Towards the Global Elimination of Brain Damage Due to Iodine Deficiency

A global program for human development with a model applicable to a variety of health, social and environmental problems
Monitoring of iodine content of salt—an important aspect of the conquest of Iodine Deficiency Disorders
To the Global Partnership
Dedicated to the Elimination of
Iodine Deficiency Disorders

An Ancient Scourge of Mankind

The People of the affected countries
The Governments of the affected countries
The Salt Producers of each country

The International Agencies-especially
The World Health Organization
The United Nations Children’s Fund
The World Bank
The Micronutrient Initiative
Kiwanis International

The International Council for Control of
Iodine Deficiency Disorders
The Global Network for the Sustained Elimination of Iodine Deficiency

The Bilateral Agencies-especially
The Australian Agency for International Development
The Canadian International Development Agency
The Netherlands Ministry for Development Cooperation
The Swedish International Development Agency
The United States Agency for International Development
Preface

This book is addressed to a broad multidisciplinary audience from the international community concerned about the global problem of brain damage due to iodine deficiency and its elimination by the consumption of iodized salt.

Iodine Deficiency is the most common preventable cause of brain damage in the world today, with in excess of 2 billion at risk from 130 countries.

This book reports the progress of the Global Program since the elimination-goal was adopted by the World Summit for Children, meeting at the United Nations, New York in 1990.

By 2000 very significant progress had been achieved with almost 70 per cent of households having access to iodized salt. This ensured protection of close to 80 million newborns with a saving of over one billion IQ points.

However, there are still 41 million newborns who are not protected. There is therefore a continuing challenge both to increase the coverage and to sustain the coverage already achieved and so achieve the new UN elimination goal, which has been accepted for 2005.

We have the necessary knowledge for this task but there is too often a failure of political will due to ignorance of the great opportunity presented to the current generation to eliminate what is an ancient scourge of mankind going back to 3000BC.

This book aims to meet this gap in knowledge and promote the necessary political will. It has been written by representatives from the remarkable Global Partnership of Agencies who are working together with the people and governments of the affected countries towards the goal

We are indebted to Barbara McNamara of the ICCIDD Secretariat in Adelaide and the staff of the ICCIDD Office, Dr Rajesh Pandav and Mr Pritam Singh Tanwar in New Delhi, for expert secretarial support, together with our colleagues at Oxford University Press in New Delhi.

We would like to thank Anne Hetzel for permission to use her drawings.

Special thanks are due to Dr Chandrakant Pandav, who has been responsible for overall coordination and production of the book.

We are also grateful for the support and the advice from our colleagues on the Advisory Board.

Basil S Hetzel
for the Editorial Board
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**Glossary**

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<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>ACC/SCN</td>
<td>Administrative Committee on Co-ordination- Subcommittee on Nutrition of the United Nations System (SCN)</td>
</tr>
<tr>
<td>AFRO</td>
<td>African Regional Office (WHO)</td>
</tr>
<tr>
<td>ASEAN</td>
<td>Association of South East Asian Nations</td>
</tr>
<tr>
<td>AusAID</td>
<td>Australian Agency for International Development</td>
</tr>
<tr>
<td>CIDA</td>
<td>Canadian International Development Agency</td>
</tr>
<tr>
<td>CIDDS</td>
<td>Country Iodine Deficiency Disorders Status</td>
</tr>
<tr>
<td>CIS</td>
<td>Commonwealth of Independent States (former USSR)</td>
</tr>
<tr>
<td>Cretin</td>
<td>A corruption of the French word ‘crestin’ or ‘Christian’-the afflicted person being referred to as ‘a pauvre chretien’ or ‘bon chretien’ because of their harmlessness or innocence.</td>
</tr>
<tr>
<td>DNA content</td>
<td>DNA is the basic material within a cell, which stores the genetic code and is responsible for cellular growth</td>
</tr>
<tr>
<td>ECO</td>
<td>European Cooperation Organization</td>
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<tr>
<td>ESA</td>
<td>East and Southern Africa</td>
</tr>
<tr>
<td>ESPA</td>
<td>European Salt Producers Association</td>
</tr>
<tr>
<td>EEC</td>
<td>European Economic Community</td>
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<tr>
<td>EMCOSAL</td>
<td>A semi-autonomous Corporation in Bolivia for building salt iodization plants</td>
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<tr>
<td>Term</td>
<td>Definition</td>
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<tr>
<td>EMRO</td>
<td>Eastern Mediterranean Regional Office (WHO) (Middle East)</td>
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<tr>
<td>Endemia</td>
<td>An area where a disease is endemic</td>
</tr>
<tr>
<td>Endemic</td>
<td>Occurrence of a disease confined to a community</td>
</tr>
<tr>
<td>Endemic Cretinism</td>
<td>Brain damage to the foetus resulting from the loss of function of the maternal thyroid gland in pregnancy characterised by varying degrees of mental defect, deaf-mutism and spastic paralysis (neurological cretinism). Brain damage due to foetal hypothyroidism also occurs as a result of iodine deficiency in pregnancy (hypothyroid cretinism).</td>
</tr>
<tr>
<td>Endocrinologists</td>
<td>People who study endocrine glands i.e. glands that secrete hormones. Thyroid gland is one such gland.</td>
</tr>
<tr>
<td>EPI 30 Cluster</td>
<td>A sampling method initially proposed under the Expanded Program of Immunisation (EPI) for estimating immunisation coverage levels in a community, now being used for other purposes including estimating the prevalence of IDD</td>
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<tr>
<td>EURO</td>
<td>European Regional Office (WHO)</td>
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<tr>
<td>FAO</td>
<td>Food and Agriculture Organisation (Rome)</td>
</tr>
<tr>
<td>GAIN</td>
<td>Global Alliance for Improved Nutrition</td>
</tr>
<tr>
<td>Goitre</td>
<td>An enlarged thyroid gland</td>
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<tr>
<td>Goitrogens</td>
<td>A chemical capable of causing goitre by inhibiting iodine uptake by thyroid</td>
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<tr>
<td>Hyperthyroidism</td>
<td>The result of excessive circulating thyroid hormone causing tremor, sweating, nervousness, loss of weight</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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<tr>
<td>Hypothyroidism</td>
<td>The result of a lowered level of circulating thyroid hormone with slowing of mental and physical functions</td>
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<td>ICCIDD</td>
<td>International Council for Control of Iodine Deficiency Disorders</td>
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<tr>
<td>IDD</td>
<td>Iodine Deficiency Disorders—the spectrum of the effects of iodine deficiency at various stages of life in a population that can be prevented by correction of the iodine deficiency</td>
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<tr>
<td>IEC</td>
<td>Information, Education and Communication</td>
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<tr>
<td>IIH</td>
<td>Iodine Induced Hyperthyroidism—a transient condition caused by increase in iodine intake to an iodine deficient population.</td>
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<tr>
<td>ILSI</td>
<td>International Life Sciences Institute</td>
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<tr>
<td>INACG</td>
<td>International Nutritional Anaemia Consultative Group</td>
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<tr>
<td>Iodization</td>
<td>The general term covering iodization programs using various agents (iodine, iodate) or technology (salt, oil, bread and water)</td>
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<tr>
<td>Iodized Oil</td>
<td>Iodine in poppy seed oil—lipiodol extensively used in radiology as a radio contrast medium. Available both by injections (Lipiodol) and by mouth (Oriodol)</td>
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<td>Iodized Salt</td>
<td>Salt to which potassium iodate or potassium iodide has been added</td>
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<tr>
<td>IVACG</td>
<td>International Vitamin A Consultative Group</td>
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<td>IWGIDD</td>
<td>International Working Group on Iodine on Iodine Deficiency Disorders (China)</td>
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<td>Kiwanis International</td>
<td>A world service group with 500,000 members who have raised US$76 million to meet the cost of country programs for the elimination of IDD, administered through UNICEF.</td>
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<tr>
<td>Median UIC</td>
<td>If the urinary iodine concentrations in a community survey of individuals are arranged in ascending order, median UIC refers to the one which occurs at the centre (i.e. equal number of observations on either side of it)</td>
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<tr>
<td>MI</td>
<td>Micronutrient Initiative</td>
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<td>MNM</td>
<td>Micronutrient Malnutrition</td>
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<tr>
<td>MT</td>
<td>Metre Tonnes</td>
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<tr>
<td>Myxedema</td>
<td>An oedema (swelling) in the face and elsewhere, which occurs due to hypothyroidism. One cause is iodine deficiency (myxedematous hypothyroid cretinism)</td>
</tr>
<tr>
<td>NCCIDD</td>
<td>National Council for Control of Iodine Deficiency Disorders</td>
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<tr>
<td>NGOs</td>
<td>Non-Government Organizations</td>
</tr>
<tr>
<td>NRDC</td>
<td>Nutrition Research Development Centre in Bogor Indonesia</td>
</tr>
<tr>
<td>OAU</td>
<td>Organization for African Unity</td>
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<tr>
<td>PAMM</td>
<td>Program against Micronutrient Malnutrition, Atlanta USA based at Emory University, Atlanta USA</td>
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<tr>
<td>PAHO</td>
<td>Pan American Health Organization (part of WHO)</td>
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<tr>
<td>Phalanx</td>
<td>Digital bone of a finger</td>
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### Glossary

<table>
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<th>Definition</th>
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<td>Prophylaxis</td>
<td>An intervention aimed at preventing the occurrence of a disease</td>
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<td>Radio-immune</td>
<td>A technique of estimating the level of a Assay (RIA) hormone in the serum by using assay of a radioactive (e.g. I^{131}) element which the hormone contains</td>
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<tr>
<td>SAARC</td>
<td>South Asian Association for Regional Cooperation</td>
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<tr>
<td>SCN</td>
<td>Subcommittee on Nutrition of the UN System</td>
</tr>
<tr>
<td>SEARO</td>
<td>South East Asian Regional Office (WHO)</td>
</tr>
<tr>
<td>SIDA</td>
<td>Swedish International Development Agency</td>
</tr>
<tr>
<td>TFNC</td>
<td>Tanzania Food and Nutrition Centre</td>
</tr>
<tr>
<td>Thiocyanate</td>
<td>Chemicals known to have goitrogenic effects</td>
</tr>
<tr>
<td>TGR</td>
<td>Total Goitre Rate</td>
</tr>
<tr>
<td>Thyroid Size</td>
<td>Measured by ultrasonography—a much more sensitive and reproducible measurement than is possible by palpation</td>
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<tr>
<td>Thyroxine</td>
<td>Thyroid Hormone (T_4) containing 4 iodine atoms on an amino acid molecule</td>
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<tr>
<td>Triiodothyronine</td>
<td>A second thyroid hormone (T_3) which contains 3 iodine atoms and is the form active at tissue level.</td>
</tr>
<tr>
<td>TSH</td>
<td>Thyroid Stimulating Hormone secreted by the pituitary gland, which controls thyroid activity</td>
</tr>
<tr>
<td>UIC</td>
<td>Urinary Iodine Concentration</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Program</td>
</tr>
<tr>
<td>UNESCO</td>
<td>United National Educational, Scientific and Cultural Organisation (Paris)</td>
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<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>UNICEF</td>
<td>United Nations Children’s Fund (New York)</td>
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<td>USAID</td>
<td>United States Agency for International Development</td>
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<tr>
<td>USI</td>
<td>Universal salt Iodization-iodization of all salt for human and animal consumption</td>
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<tr>
<td>WFP</td>
<td>World Food Program (Rome)</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization (Geneva)</td>
</tr>
<tr>
<td>WPRO</td>
<td>Western Pacific Regional Office (WHO)</td>
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Section I

Introduction: The Nature and Magnitude of the Iodine Deficiency Disorders (IDD)

Basil S Hetzel

1. Introduction

2. Iodine Deficiency and Brain Damage
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   2.2 Studies in Papua New Guinea
   2.3 Animal Models
   2.4 The Iodine Deficiency Disorders (IDD)
   2.5 The Magnitude of IDD

3. Anecdotal Reports of the Elimination of IDD at Village Level
   3.1 The Village of Sengi, Central Java, Indonesia
   3.2 The Village of Jixian, Northern China
   3.3 The Village of Padrauna (Deoria), Northern India
   3.4 The IDD Iceberg

4. A Global Program for the Elimination of Brain Damage due to Iodine Deficiency
1. Introduction

Iodine deficiency is the cause of an Ancient Scourge of mankind. This scourge includes goitre and brain damage at all ages beginning with the foetus during pregnancy.

This book describes the development of a global program for the elimination of brain damage due to iodine deficiency mainly by the use of iodized salt.

This global program dates from 1990 when the necessary political support became available through the World Summit for Children with the support of the UN System, through the World Health Organization and UNICEF. This support has led to the development of an informal global partnership of countries, UN and bilateral aid agencies, technical agencies and the salt industry.

Prior to 1990 the necessary scientific basis for the global program had been established by a large group of scientists from many countries of the world over the preceding century.

This scientific work had recently focussed on the role of iodine deficiency in causing brain damage, particularly in the developing foetus during pregnancy. It was then shown that correction of the iodine deficiency before pregnancy would prevent or eliminate this brain damage. This finding provided the basis for a global program for the elimination of brain damage caused by iodine deficiency by the use of iodized salt.

Before 1990 the translation of this knowledge into effective elimination programs had been limited and spasmodic.

The translation had been particularly hampered by inadequate communication with governments, which blocked effective implementation.

This situation was finally remedied by the 1990 World Summit for Children, which included the goal of the virtual elimination of iodine deficiency disorders (IDD) by the year 2000. This unprecedented Declaration included 27 goals for the improved health and education of children—it was signed by 71 Heads of State who attended the meeting at the United Nations, New York. They were followed by signatories from 88 other governments.

Extensive studies throughout the world over the last 20 years have revealed that 130 countries are affected by iodine deficiency, with a total population in excess of 2 billion at risk of the occurrence of varying degrees of brain damage (WHO/UNICEF/ICCIDD 1999).
Since 1990 substantial progress in the elimination of brain damage has been made with two thirds of households having access to iodized salt by 2000. However, there is still another third that does not have access and there is some evidence of ‘backsliding’ since 2000 by some countries which had already made satisfactory progress. In all countries sustainability has become the challenge.

This book reports in detail the progress of the global elimination program, which aims to cover 130 countries. It reports success and also failure in individual countries and provides an analysis of the lessons learnt from this experience.

The target set by the UN System at the UN General Assembly Special Session for Children (UNGASS) (May 2002) for Elimination of IDD, is now 2005.

The book provides an appraisal of the current situation to help in the achievement of this objective!

We have made substantial progress, we have the necessary knowledge but it is political will that is required by people and by governments to rid the world of this Ancient Scourge! This requires a continued education effort to build awareness of the great opportunity we have. All these issues are explained in detail in this book.

We begin in this Section I with a brief review of the major aspects of the effects of iodine deficiency including some of the research that has led to this great opportunity of eliminating this terrible affliction.

2. Iodine Deficiency and Brain Damage

Iodine deficiency is now considered the most common cause of preventable brain damage in the world today (WHO 1994).

The problem has arisen because people live in an environment where the soil has been leached of iodine due to flooding of river valleys or in hilly and mountainous areas by high rainfall or glaciation.

The deficiency in the soil leads to deficiency in all forms of plant life including all cereals grown in the soil (fig. 1). Hence large populations living in systems of subsistence agriculture particularly in the developing countries, as in the great river valleys of Asia, are locked into iodine deficiency (Hetzel 1989).

Iodine is an essential element for human and animal development because it is a constituent of the thyroid hormones, thyroxine (T₄) and triiodo-thyronine (T₃).
Global Elimination of Brain Damage Due to Iodine Deficiency

Fig. 1 Iodine cycle in nature: The atmosphere absorbs iodine from the sea which then returns through the rain and snow to the mountainous regions. It is then carried by rivers to the lower hills and plains, eventually returning to the sea. High rainfall, snow and flooding increase the loss of soil iodine, which has often been already denuded by past glaciation. This causes the low iodine content of food for man and animals (Hetzel 1989).

Fig. 2 A mother and child from a New Guinea village who are severely iodine deficient. The mother has a large goitre. The bigger the goitre the more likely it is that she will have a brain damaged child. This can be prevented by eliminating the iodine deficiency before the onset of pregnancy (Hetzel and Pandav 1996).
Without the thyroid hormones, metamorphosis of the tadpole into the frog will not occur. This indicates their basic significance throughout the animal kingdom.

In iodine deficiency, the thyroid gland enlarges to form a goitre (fig. 2) to maintain the level of thyroid hormones in the blood but eventually the level falls with increasing effects on the development of the brain and other organs.

The role of iodine deficiency as a cause of brain damage has been established by a combination of individual clinical studies on subjects suffering from the effects of iodine deficiency, epidemiological investigation of communities and populations and the study of animal models.

We will now briefly consider these studies.

2.1 History

The relation between iodine deficiency and brain damage was originally raised by observations of the association of goitre and mental retardation (endemic cretinism).

Goitre is most commonly caused by iodine deficiency and the term ‘endemic goitre’ refers to this condition as distinct from goitre due to other causes. Records of goitre date back to 3000BC.

The term ‘cretin’ was first used in Diderot’s Encyclopedie (1754) to refer to an ‘imbecile who is deaf, dumb with a goitre hanging down to the waist’ known at that time to be widely present is Switzerland, Southern France and Northern Italy. The term ‘endemic cretin’ is used to refer to its association with endemic goitre.

This association was known to the mediaeval world but was finally established by an epidemiological survey ordered by the King of Sardinia, which was published in 1848. At this time the King of Sardinia was also King of Savoy, which included the European Alpine Region.

After the early descriptions from the 17th to 19th Centuries the problem of cretinism was lost sight of until later in the 20th Century because these subjects were often confined to remote areas which limited access for scientific study.

It was in the 1960s that the problem was rediscovered in various parts of the world–in Latin America (Brazil); Africa (the then Zaire and now Republic of the Congo); The People’s Republic of China and Papua New Guinea (Pharaoh et al 1980).
There are two types of endemic cretinism as originally recognised by McCarrison in the Himalayan Region—a nervous type and a hypothyroid (myxedematous) type (McCarrison 1908). The condition of neurological endemic cretinism is characterised in its fully developed form by severe brain damage, deaf mutism and a spastic state of the hands and feet (fig. 3). It is the result of iodine deficiency in the first half of pregnancy.

A much less common form is hypothyroid cretinism, which occurs with severe iodine deficiency in late pregnancy. It is characterised by dwarfism, brain damage with severe hypothyroidism (fig. 4). Mixed forms also occur.

Questions were raised about the relation of iodine deficiency to cretinism in Southern Europe (Switzerland, Northern Italy and Yugoslavia) because of the apparent spontaneous disappearance of cretinism in the absence of programs for the correction of iodine deficiency with iodized salt (Costa et al 1964).

These observations raised the question as to whether iodine deficiency was the cause of cretinism.
Fig. 4 A hypothyroid cretin in Sinjiang, China who is also deaf mute. This condition is completely preventable. Right: The barefoot doctor of her village. Both are about 35 years of age (Photograph courtesy of Dr Ma Tai, China).
2.2 Studies in Papua New Guinea

This work was carried out in the Highlands of Papua New Guinea, in collaboration with the Public Health Department of the Territory (then under Australian administration) taking advantage of the availability of iodized oil (a preparation of iodine in poppyseed oil long used in radiology as a contrast medium) for the correction of iodine deficiency (McCullagh 1963).

A single injection of iodized oil was shown to correct severe iodine deficiency in subjects in the Highlands for over 4 years depending on the dosage (Buttfield & Hetzel 1967).

Subsequently the prevention of cretinism and stillbirths was demonstrated by the administration of iodized oil before pregnancy in a controlled trial in the Western Highlands of New Guinea (Pharoah et al 1971). This finding was subsequently accepted as definitive (Lancet 1972). A mass injection program with iodized oil was carried out from 1971.

Wide experience in all parts of the world supports the view that cretinism disappears in a population when iodine deficiency is corrected. The apparent spontaneous disappearance in Europe is now attributed to ‘silent’ correction of iodine deficiency by gradual dietary diversification together with the gradual use of iodine supplements associated with economic and social development (Burgi et al 1990).

2.3 Animal models

To further establish the relation between iodine deficiency and foetal brain development an animal model was developed in the sheep. A major reason for using sheep was the access provided for surgical removal of the maternal and foetal thyroid glands so that the roles of the maternal and foetal thyroid secretions could be defined. Subsequently similar models were developed in the primate marmoset monkey and in the rat (Hetzel & Mano 1989).

Significant effects of iodine deficiency in slowing foetal brain development have been shown in all three species. Further details are given in Section IV.

These studies with animal models confirmed the effect of iodine deficiency on foetal brain development as already indicated by the results of the field trial with iodized oil in Papua New Guinea. The combination of the controlled trial with the results of the studies in animal models clearly established that prevention of brain damage was possible by correction of the iodine deficiency before pregnancy.
A Review of the extensive work on the subject of iodine deficiency and brain damage has been published (Stanbury 1994).

2.4 The Iodine Deficiency Disorders (IDD)

The results of the research required a re-conceptualization of the main effect of iodine deficiency from the common lump in the neck (goitre) to a general effect on growth and development, including especially brain development.

To this end the term iodine deficiency disorders (IDD) was proposed (Hetzel 1983) and has since been generally adopted.

The term IDD refers to all the effects of iodine deficiency on growth and development in a human and animal population, which can be prevented by correction of the iodine deficiency. These include goitre, stillbirths, neonatal and other types of hypothyroidism but the most important effect is that of foetal brain damage (Table 1). The term IDD

<table>
<thead>
<tr>
<th>Table 1. The Spectrum of Iodine Deficiency Disorders (IDD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FOETUS</strong></td>
</tr>
<tr>
<td>Abortions</td>
</tr>
<tr>
<td>Stillbirths</td>
</tr>
<tr>
<td>Congenital anomalies</td>
</tr>
<tr>
<td>Neurological cretinism:</td>
</tr>
<tr>
<td>mental deficiency,</td>
</tr>
<tr>
<td>deaf mutism, spastic diplegia, squint</td>
</tr>
<tr>
<td>Hypothyroid cretinism:</td>
</tr>
<tr>
<td>mental deficiency, dwarfism, hypothyroidism</td>
</tr>
<tr>
<td>Psychomotor defects</td>
</tr>
<tr>
<td><strong>NEONATE</strong></td>
</tr>
<tr>
<td>Increased perinatal mortality</td>
</tr>
<tr>
<td>Neonatal hypothyroidism</td>
</tr>
<tr>
<td>Retarded mental and physical development</td>
</tr>
<tr>
<td><strong>CHILD &amp; ADOLESCENT</strong></td>
</tr>
<tr>
<td>Increased infant mortality</td>
</tr>
<tr>
<td>Retarded mental and physical development</td>
</tr>
<tr>
<td><strong>ADULT</strong></td>
</tr>
<tr>
<td>Goitre with its complications</td>
</tr>
<tr>
<td>Iodine-induced hyperthyroidism (IIH)</td>
</tr>
<tr>
<td><strong>ALL AGES</strong></td>
</tr>
<tr>
<td>Goitre</td>
</tr>
<tr>
<td>Hypothyroidism</td>
</tr>
<tr>
<td>Impaired mental function</td>
</tr>
<tr>
<td>Increased susceptibility to nuclear radiation</td>
</tr>
</tbody>
</table>

Global Elimination of Brain Damage Due to Iodine Deficiency

has now been adopted throughout the world, including adoption by the Chinese without translation!

Effects on brain function occur at all stages of life, from foetal damage or hypothyroidism in the neonate, child or adult (Table 1). These features are discussed in more detail in Section IV.

A meta-analysis of recent research reported a total of 18 studies in which comparison was made between iodine deficient populations and suitable control populations with a similar social and cultural background (Bleichrodt & Born 1994).

These studies revealed that the mean score for the iodine deficient group was 13.5 IQ points below that of the non-iodine deficient groups. These data further indicate the major population dimension of the effect of iodine deficiency on neuropsychological development.

Social and economic effects result from iodine deficiency in both human and animal populations. In humans there is reduced school performance in children and reduced productivity in adults and reduction in goitre.

Detailed calculations have been made of the economic costs of medical assessment and the treatment of goitre. In Germany where there is still much uncontrolled IDD, the costs of diagnosis have been estimated at US$250 million per year and the costs of treatment have been estimated at US$300 million per year. The cost of hours lost in working time for this medical care was calculated to be US$150 million. This makes a total of US$700 million. (Pfannensteil 1985).

There are also significant effects on all livestock with impaired reproduction in poultry, sheep, goats and cattle, with reduced wool growth and milk production and reduced rates of survival in offspring. Such effects indicate that correction of iodine deficiency has direct economic benefits. (Table 2). It has been calculated by the World Bank that each dollar dedicated to IDD prevention would yield a productivity gain of $28. (Levin et al 1993; Pandav and Rao 1997).

It is important to note that iodine deficiency increases the effect of exposure to nuclear radiation with increased susceptibility to cancer (Table 1).

2.5 The Magnitude of IDD

The at risk population for IDD was estimated in 1990 by WHO to be 1.6 billion including in excess of 20 million with some degree of brain
Nature and Magnitude of IDD

Table 2. Effects of Iodine Interventions and Measurements of Economic Benefits

<table>
<thead>
<tr>
<th>EFFECTS</th>
<th>BENEFITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reductions in:</td>
<td></td>
</tr>
<tr>
<td>1. Mental deficiency</td>
<td>1. Value of higher work output in household and labour market</td>
</tr>
<tr>
<td>2. Deaf mutism</td>
<td>2. Reduced costs of medical and custodial care</td>
</tr>
<tr>
<td>3. Hypothyroidism</td>
<td>3. Reduced educational costs from reduced absenteeism and grade repetition</td>
</tr>
<tr>
<td>4. Goitre</td>
<td>4. Reduced costs of investigation and treatment</td>
</tr>
</tbody>
</table>

From: Levin et al (1993)

<table>
<thead>
<tr>
<th>EFFECTS</th>
<th>BENEFITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increases in:</td>
<td></td>
</tr>
<tr>
<td>1. Live births</td>
<td>1. Value of higher output of meat and other animal products</td>
</tr>
<tr>
<td>2. Weight</td>
<td>2. Value of higher animal work output</td>
</tr>
<tr>
<td>3. Muscle mass</td>
<td>3. Increased meat production</td>
</tr>
<tr>
<td>4. Wool coat in sheep</td>
<td>4. Increased wool production</td>
</tr>
</tbody>
</table>

From: Levin et al (1993)

damage due to the effects of iodine deficiency in pregnancy. Iodine is the most common preventable cause of brain damage (WHO 1994).

More recently these estimates have been increased to 2.2 billion at risk of the effects of iodine deficiency (Table 3) with the recognition that even mild iodine deficiency in the mother has effects on the foetus.

There are now estimated to be 130 IDD affected countries including the most populous–Bangladesh, Brazil, China, India, Indonesia and, Nigeria (WHO/UNICEF/ICCIDD 1999).

There is therefore a global scourge of great magnitude, which provides one of the major challenges in international health today.
3. Anecdotal Reports of the Elimination of IDD at Village Level

The dramatic impact of the elimination of iodine efficiency at the local community level is shown by some anecdotal reports. These include the village of Sengi in Central Java, Indonesia and the village of Jixian in Northern China (Heilongjiang Province) and the village of Padrauna, district (Deoria) in Northern India.

These reports can be replicated from iodine deficient communities from the many countries where people suffer the debilitating effects of iodine deficiency.

3.1 The Village of Sengi, Central Java, Indonesia

Dr R Djokomoeljanto, Dean of Faculty of Medicine, Diponegoro University, Semarang, Indonesia tells the following story about the introduction of injections of iodized oil in the village of Sengi in Central Java.

---

**Table 3. Current Estimates of Population at risk of IDD by WHO Regions**

<table>
<thead>
<tr>
<th>WHO Region with IDD</th>
<th>Number of Countries Affected</th>
<th>Total population in IDD</th>
<th>At Risk Population**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>44</td>
<td>610</td>
<td>295</td>
</tr>
<tr>
<td>Americas</td>
<td>19</td>
<td>477</td>
<td>196</td>
</tr>
<tr>
<td>South East Asia</td>
<td>9</td>
<td>1,435</td>
<td>599</td>
</tr>
<tr>
<td>Eastern Mediterranean</td>
<td>17</td>
<td>468</td>
<td>348</td>
</tr>
<tr>
<td>Europe</td>
<td>32</td>
<td>670</td>
<td>275</td>
</tr>
<tr>
<td>Western Pacific</td>
<td>9</td>
<td>1,436</td>
<td>513</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>130</strong></td>
<td><strong>5,096</strong></td>
<td><strong>2,225</strong></td>
</tr>
</tbody>
</table>

*Based on UN population Division (UN estimates 1997)

**The at risk population is the population living in iodine deficiency areas where total goitre rate (TGR) is more than 5%

***Expressed as a percentage of the total population in the Region

“When I came to Sengi for the first time in 1973, the village was so quiet, there were no activities seen or observed by visitors, everyone looked lethargic and gave the impression of being lazy. Not a single child played in front of his or her house. Nowadays we know that this must be the consequence of hypothyroidism, since 87% of this population had low serum thyroid hormone levels. Many also showed signs of clinical or sub-clinical hypothyroidism and 9% were cretins. Nobody finished the six years of elementary school and the dropout rate was tremendously high. This was due to ‘hypothyroidism affecting the brain’-they were anergic. On April 17th 1973 all villagers received an injection of iodized oil. Dramatic changes were seen within a year. The children were now lively, playing happily in front of their houses, group activities like badminton, volleyball and chess playing were organised. All were amazed when, at the end of 1974, Sengi received the honour for the best volleyball and chess player in the sub-district competition. In subsequent years the school dropout rate fell dramatically. Many students passed primary, secondary and then high school and some of them followed with a university education. Public activities increased. Fishing and farming boomed and the community now exports fish and vegetables regularly. The socio-economic condition has improved accordingly.

Cretins improved physically but not mentally. Mr PA (B) was a hypothyroid cretin but felt himself healthy enough to marry. His wife was a neurological cretin. By that time the iodine deficiency of everyone in the village had been corrected by the injection of iodized oil. This couple had three healthy sons. They grew and developed normally, both physically and mentally. One of the three was well until he died in a vehicle accident. The other two, (fig. 5) include Rame (second from right) who ranked first when finishing the high school in Semarang and now (2001) has almost finished his BSc in Chemistry at Diponegoro University. His younger brother, Ramidi (second from left) born in 1983 ranked first of 49 pupils in his high school class. He is now also in Semarang and plans to become a physician. What a difference the iodine in a single injection made to the fate of this family!” (Djokomoeljanto 2001)

3.2 The Village of Jixian, Northern China

This study by Professor JQ Li, (Professor of Medicine Jamusi School of Medicine, Heilongjiang Province, North China) has been reported as follows (Ma and Lu 1996).
Global Elimination of Brain Damage Due to Iodine Deficiency

Fig. 5 Iodine gives Cretin Couple Normal Children. (Djokomeljanto 2001)

Fig. 6 A group of lively Indian Children from Padrauna (Deoria), Uttar Pradesh, India who had received iodized oil injections six months before this photograph was taken (Hetzel 1989).
Until recently Jixian was known as the ‘Village of Idiots’. There were 247 families in the village comprising some 1243 people, of whom 850 (65%) had a goitrous condition. There were 115 cretins, many severe due to brain damage, deaf mutism and spasticity of the legs.

Because of its reputation, no girls wanted to marry young men from Jixian and it was a very depressed community, whose income was appallingly low and with a sense of hopeless inadequacy and glum endurance. On the low hills nearby was a rock shaped like a stone monkey which was thought to be casting an evil eye on the village. The villagers smashed it, but with no effect. The elders also thought that cretinism might be a visitation because ancestors had killed cattle, but no spells or incantations had any effect. Even the dogs and cats showed the effects of iodine deficiency.

All the water came from a shallow well. In 1978 the iodized salt program began and in 1979 a deep well was put in by the Central Government at Professor Li’s instigation. He believed that the village was built on an ancient river bed—probably an earlier course of the Sung Wha Jiang River—as there was a thick layer of heavy clay, which was preventing the iodine bearing water from permeating to the surface. The deep well has penetrated this thick layer so that all the water now was found to have a much better iodine content. In addition injections of iodized oil were given to all young women of marriageable age and all children.

Since the salt program began and the water was improved, the standard of living has risen, the village has produced enough goods to begin to export and has done best of all the villages in the district. The per capita income has doubled in the last three years and by 1986 many families now had a radio, a watch or even a television.

Table 4. Effects of iodine deficiency control in Jixian village, China*

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Goitre Prevalence</td>
<td>80%</td>
<td>4.5%</td>
</tr>
<tr>
<td>Cretinism Prevalence</td>
<td>11%</td>
<td>Fall</td>
</tr>
<tr>
<td>School ranking (of 14 schools in the district)</td>
<td>14th</td>
<td>3rd</td>
</tr>
<tr>
<td>School failure rate</td>
<td>&gt;50%</td>
<td>2%</td>
</tr>
<tr>
<td>Value of farm production(Yuan)</td>
<td>19,000</td>
<td>180,000</td>
</tr>
<tr>
<td>Per capita income(Yuan)</td>
<td>43</td>
<td>550</td>
</tr>
</tbody>
</table>

*From: Ma & Lu (1996).
Forty-four girls have now come in from neighbouring villages as brides and there is a crop of healthy babies.

It is remarkable to see the improvement and hear about it from enthusiastic people, both from the village and the Medical Centre. (Table 4).

3.3 The Village of Padrauna (district, Deoria), Northern India

In Northern India, a high degree of apathy has been noted in populations living in villages in iodine deficient areas. This may even affect domestic animals such as dogs. The lethargy is so much that dogs continue to sit in the middle of road even when a four-wheel vehicle approaches them. In fact, the deficiency is so severe that enlargement of thyroid gland-goitre was seen even in birds. It is apparent that reduced mental function due to brain hypothyroidism is widely prevalent in iodine deficient communities. It is also an uncommon occurrence for children born in this area to reach professional levels—such as physicians or civil servants. This has an effect on their capacity for initiative and decision-making. People who are residents of this area are often referred as “fools”. This indicates that iodine deficiency can be a major obstacle to the human and social development of communities living in an iodine deficient environment.

As Dr CS Pandav (All India Institute of Medical Sciences, New Delhi) has found the correction of the iodine deficiency has reversed this situation as is indicated by the lively children from the village of Padrauna in Uttar Pradesh six months following an iodized oil injection (fig. 6). It has been a major contribution to community development as in the case of the village of Jixian.

These accounts describe the remarkable benefits of the elimination of iodine deficiency at village level. These observations can be duplicated in many villages in many countries throughout the world.

Both the human and economic benefits are apparent—the elimination of iodine deficiency is indeed associated with benefits on a remarkable scale. The elimination of iodine deficiency is indeed a major contribution to social and economic development.

This message needs to be much better known to promote the political will of people and governments throughout the world.
3.4 The IDD Iceberg

It is apparent that there is a gradation of the effects of iodine deficiency, which can be conveniently represented by the concept of an iceberg (fig. 7).

The visible and most serious effect of iodine deficiency is the condition of endemic cretinism which occurs with a prevalence of 1-10% in a severely iodine deficient population.

The next gradation is that of less severe brain damage which may not be apparent until specific psychological testing is carried out (as described in Section IV). This lesser effect is much more common (up to 30%) than gross cretinism. In China terms such as ‘subcretin’ or ‘cretinoid’ are used to describe these subjects.

The most common effect of iodine deficiency apart from goitre is the loss of mental and physical energy due to hypothyroidism. This condition sometimes called cerebral hypothyroidism can be reversed by correction of the iodine deficiency as described in these village populations.

This condition is associated with a reduction in the level of circulating thyroid hormone which can be shown in more than half the goitrous population in an endemic area (Buttfield and Hetzel 1967; Kochupillai et al 1973). Such decrease leads to a reduction in thyroid hormone level in the brain, which accounts for the lethargy commonly observed in endemic populations as described in these villages.

The correction of iodine deficiency produces a dramatic reversal of the condition of cerebral hypothyroidism due to restoration of brain thyroid hormone levels. This is a different effect from brain damage during pregnancy, which is not reversible but completely preventable.
4. A Global Program for the Elimination of Brain Damage to Iodine Deficiency

The reasons why the elimination of brain damage due to iodine deficiency was worthy of a global program for major commitment by governments and the major international agencies were the following:

i) The problem was of **sufficient qualitative and quantitative significance** to justify a major allocation of resources. The at risk population for brain damage, due to iodine deficiency, has been recently estimated to be 2.2 billion from 130 countries (WHO/UNICEF/ICCIDD 1999). The economic benefits have been referred to earlier in this Section.

ii) There were effective **preventive measures suitable for mass application** in the form of iodized salt and iodized oil. This had been shown for iodized salt in many developed countries and for iodized oil in a number of developing countries (Hetzel 1989, Hetzel and Pandav 1996, WHO 1994).

iii) There was an **available system for the correction of iodine deficiency through delivery of iodized salt** through the salt industry and for the delivery of iodized oil through the primary health care system. Adequate iodine supplementation can be provided with no increase or even a reduction in salt intake if necessary. Iodized salt is available and sustainable at a minimum cost (US3-5 cents per year). (see further Section V).

iv) There were **practical methods for monitoring the program so that it could be effective and sustainable**. This is achieved by checks on salt iodine at factory, retail or household level and by measurements of urine iodine excretion, which provide a measure of the dietary intake of iodine. Suitable procedures for use with large numbers of samples are available and have been used extensively throughout the world in both developed and developing countries since 1990. (see further Section IV).

These were the major considerations needed to justify a global program and led to the inclusion of the objective of the virtual elimination of IDD as one of the 27 Goals of the World Summit for Children.

An Overview of the global program is provided in the next Section (Section II).
We conclude here that the elimination of brain damage due to iodine deficiency has been established as a feasible objective with great human and economic benefits for in excess of 2 billion people.

It presents the challenge of the elimination of a major non-infectious disease, with great human and economic costs as an Ancient Scourge of mankind.

References


Global Elimination of Brain Damage Due to Iodine Deficiency
Section II

An Overview of the Global Program for the Elimination of Brain Damage due to Iodine Deficiency

Basil S Hetzel

1. Introduction

2. Bridging the gap between Research and its Application
   2.1 The ICCIDD
   2.2 The World Health Assembly
   2.3 The World Summit for Children
   2.4 The Global Partnership

3. Development and Progress of Country Programs
   3.1 Development
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4. Sustainability
   4.1 Progress of Salt Iodization
   4.2 Criteria for Monitoring Progress towards Sustainable Elimination of IDD as a Public Health Problem
   4.3 Global Network for the Sustained Elimination of Iodine Deficiency

5. Conclusion
1. Introduction

This overview of the global program for the elimination of brain damage caused by iodine deficiency will consider briefly the various aspects that are discussed in more detail in subsequent sections of the book. It aims to provide a general orientation so that the special aspects can be seen as part of the development of the whole program.

The scientific basis for the global program rests on a combination of clinical and epidemiological studies in various parts of the world, supported by studies in animal models which has established that iodine deficiency is the most common preventable cause of brain damage which can be prevented by correction of the deficiency. This evidence has already been reviewed in Section I.

The global elimination program has developed through successful application of this knowledge at country level, mainly with the use of iodized salt. This has involved the support of the United Nations System, particularly WHO and UNICEF and has been initiated in more than 100 countries with an at risk population in excess of two billion.

The program has involved the development of an informal global partnership including the people and governments of affected countries, the bilateral aid agencies, the technical agencies and special funding support from Kiwanis International, The Gates Foundation (both through UNICEF) and most importantly the salt industry. This Global Partnership is fully described in Section III.

The scientific basis for the elimination of brain damage due to iodine deficiency is presented in Section IV. The use of iodized salt for the sustained elimination of iodine deficiency is described in Section V. The role of education and communication is discussed in Section VI. National country programs are described in Section VII and VIII. Finally, the challenge of sustainability is described in Section IX including the further steps that have been taken to ensure elimination is not only achieved, but sustained by continuous monitoring of the iodine nutrition of the populations of more than 100 countries that have the problem of brain damage due to iodine deficiency.

In 2002 in order to promote sustainability a new Global Network for the Sustainable Elimination of Iodine Deficiency was established to involve the salt industry at national and international levels together with UNICEF, WHO, the ICCIDD and other technical agencies with Kiwanis International.

This network was formally launched at the time of the UN General Assembly Special Session on Children (UNGASS), in New York (May
At this time the new goal of elimination of IDD by the year 2005 was accepted by the UN System.

2. Bridging the gap between Research and its Application

There was an urgent need to bridge a great gap between research on the subject of iodine deficiency and brain damage and its application in public health programs. A beginning was made with a Symposium at the 4th Asian Congress of Nutrition in Bangkok, which indicated the need for public health action (Lancet 1983). After this in response to an invitation from the Subcommittee on Nutrition of the UN System (SCN) a proposal for a global prevention program was prepared early and submitted to the SCN in 1985. The proposal included a review of the scientific evidence, a model for a national program and then a proposal to establish the International Council for Control of Iodine Deficiency Disorders (ICCIDD) as an expert Non-Governmental Organization (NGO) available to agencies and governments to assist in the development of national programs. This proposal was accepted by the SCN in 1985 and later published (Hetzel 1988).

2.1 International Council for Control of Iodine Deficiency Disorders (ICCIDD)

The ICCIDD is an international multidisciplinary network, which aims to bridge the gap between the research and its application in national programs. The ICCIDD now comprises more than 700 professionals from over 100 countries with a majority from developing countries. The disciplines include, endocrinology, nutrition, epidemiology, laboratory technology, salt technology, education, mass media and public health administration.

In 1987 the ICCIDD was recognized as the expert group on all aspects of iodine deficiency disorders (IDD) by the UN System through the UN Subcommittee of Nutrition (SCN). In 1987 the SCN also established an IDD Working Group of multilateral and bilateral agencies involved in nutrition programs and it is to this group that the ICCIDD has reported as well as to WHO. In 1994 the ICCIDD was officially recognized by WHO as an NGO working collaboratively towards the elimination of IDD by the year 2000 (Hetzel 2002) (see further Section III).
From its foundation the ICCIDD chose technical assistance to national programs as the first priority. This led to a working relationship with the governments of IDD affected countries (usually Ministries of Health and those concerned with Iodized Salt) and with the leading international aid agencies WHO and UNICEF and more recently with the salt industry.

2.2 World Health Assembly

The 1986 World Health Assembly (WHA,) with representation from more than 160 governments, passed a Resolution sponsored by Australia, which noted this new aggressive approach to the prevention and control of IDD (WHO 1986).

This was followed by WHA Resolutions in 1990, calling for elimination of IDD by the year 2000 and later Resolutions in 1996, calling for sustainability of the program through systematic monitoring. Both included reference to the role of the ICCIDD and its availability to assist countries (WHO 1990,1996).

This massive problem of iodine deficiency has been met at the technological level with iodized salt. This measure has been shown to be effective in a number of industrialized countries. But this was much less so in developing countries where until 1990 experience had been generally not been up to the expected level. However, this has changed following recognition of the effects of iodine deficiency on brain development and the adoption of a policy of universal Salt Iodization (USI) by WHO, UNICEF and the ICCIDD followed by legislation in the IDD affected countries. This required that all salt for human and animal food grade consumption be iodized (WHO 1994).

2.3 World Summit for Children

By 1990 a Global Action Plan for the elimination of IDD by the year 2000 was proposed by the ICCIDD, which provided for actions at global, regional and national level. This plan was endorsed by the SCN in 1990 and the goal was accepted by the World Health Assembly and the Executive Board of UNICEF (SCN 1990) (WHO 1990).

The endorsement of the Global Action Plan was followed by the adoption of the goal of elimination of IDD by 2000 by the World Summit for Children on September 30th 1990 at a special meeting at the united Nations, New York. This meeting was attended by 71 Heads of State who signed a declaration providing new goals for improved health and education for all children throughout the world (World Summit for Children
This Declaration was subsequently signed by representatives of 88 other national governments. Such a Resolution was unprecedented and has provided very important political support for national IDD programs throughout the world. These and other developments since 1983 are summarized in Table 1.
Global Elimination of Brain Damage Due to Iodine Deficiency

Table 2. Global Partnership for Elimination of IDD

- People of affected countries
- Governments of affected countries
- The salt industry of affected countries and salt exporting countries
- The International Agencies: especially WHO; UNICEF; World Bank
- The Bilateral Aid Agencies: especially Australia; Canada; Netherlands;
  The International Council for Control of Iodine Deficiency Disorders
  (ICCIDD)
- The Micronutrient Initiative (MI); Program Against Micronutrient
  Malnutrition (PAMM)
- Kiwanis International
- Global Network for the Sustained Elimination of Iodine Deficiency

Table 3. Major ICCIDD/UNICEF/WHO Meetings from 1985

<table>
<thead>
<tr>
<th>Year</th>
<th>Event/Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>Birth of ICCIDD, New Delhi, India</td>
</tr>
<tr>
<td>1986</td>
<td>Inauguration, Kathmandu, Nepal</td>
</tr>
<tr>
<td>1987</td>
<td>Africa, Yaounde, Cameroon</td>
</tr>
<tr>
<td>1988</td>
<td>Scientific Meeting on Iodine and the Brain, Washington DC, USA</td>
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<tr>
<td>1989</td>
<td>Asia, New Delhi, India</td>
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<tr>
<td>1989</td>
<td>China, Tianjin, China</td>
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<tr>
<td>1990</td>
<td>Africa, Dar-es-Salaam, Tanzania</td>
</tr>
<tr>
<td>1991</td>
<td>10th ITC, The Hague, The Netherlands</td>
</tr>
<tr>
<td>1991</td>
<td>Former USSR, Tashkent, Uzbekistan</td>
</tr>
<tr>
<td>1992</td>
<td>Europe, Brussels, Belgium</td>
</tr>
<tr>
<td>1993</td>
<td>Middle East, Alexandria, Egypt</td>
</tr>
<tr>
<td>1994</td>
<td>Latin America, Quito, Ecuador</td>
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<tr>
<td>1995</td>
<td>Asia, Dhaka, Bangladesh</td>
</tr>
<tr>
<td>1996</td>
<td>Africa, Harare, Zimbabwe</td>
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<tr>
<td>1997</td>
<td>Europe, Munich, Germany</td>
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<tr>
<td>1998</td>
<td>China, Beijing, China</td>
</tr>
<tr>
<td>2000</td>
<td>China, Beijing, China</td>
</tr>
<tr>
<td>2003</td>
<td>Asia, Chiang Rai, Thailand</td>
</tr>
<tr>
<td>2004</td>
<td>Latin America, Lima, Peru</td>
</tr>
</tbody>
</table>

* Transferred from Islamabad, Pakistan, due to the Gulf War and associated with the 10th International Thyroid Congress (ITC)
2.4 The Global Partnership

An informal global partnership has now developed. The key members are listed in Table 2. This partnership includes the people and governments of the IDD affected countries, the salt industry of the affected countries; the international agencies WHO and UNICEF, the World Bank, elaborate and the technical agencies; the ICCIDD, MI, PAMM (formerly-now Emory University) and Kiwanis International. Kiwanis International is a world service club based in the USA with nearly 600,000 members from 85 countries. Kiwanis International has already contributed US$60 million to country programs in 90 countries, through UNICEF, from a total of US$76 million in cash and pledges. The Global Partnership is described in detail in Section III.

3. Development and Progress of Country Programs

3.1 Development

A significant factor in the development of these national programs, has been a series of Regional meetings held throughout the world by the ICCIDD with the support of WHO and UNICEF. These meetings have been attended by representatives from the Ministries of Health and other important sectors such as the salt industry and media in relation to the National Programs. These meetings are listed in Table 3. It is through these Regional meetings that the limited number of experts from the ICCIDD network have been able to communicate with professionals from many countries. This has been subsequently developed further with consultancies and more contacts designed to identify obstacles to progress and remove them (Hetzel 2002).

Notable progress has occurred in Africa. At the first African Regional meeting (Yaounde, Cameroon in 1987), only 22 countries were represented. In 1996, a total of 45 countries were represented including Angola, Eritrea, Mozambique and Zaire in spite of the occurrence of civil war in these countries (WHO/UNICEF/ICCIDD 1997).

At these Regional meetings a ‘wheel’ model for a National Program has been presented to show its multisectoral nature and the relation between the different elements (fig. 1).

The expertise required includes epidemiology, the establishment of laboratories (salt iodine, urine iodine) advice regarding planning, education and communication, management, iodized salt and other iodine technologies. This is why the multidisciplinary network is necessary.
Global Elimination of Brain Damage Due to Iodine Deficiency

Fig. 1 Wheel Model for IDD Elimination Program

The ‘wheel’ model shows the social process involved in a national IDD Control Program. The successful achievement of this process requires the establishment of a National IDD Control Commission, with full political and legislative authority to carry it out. (WHO/UNICEF/ICCIDD 2001).

The ‘wheel’ must keep turning to maintain an effective program. It consists of the following components.

1. **Assessment of the situation** requires baseline IDD prevalence surveys, including measurement of urinary iodine levels and an analysis of the salt economy.
2. **Communication** implies Dissemination of findings to health professionals and the public, so that there is full understanding of the IDD problem and the potential benefits of elimination of the most common preventable cause of brain damage.
3. **Development of a plan of action** includes the establishment of an intersectoral committee or commission on IDD and the formulation of a strategy document on achieving the elimination of IDD.
4. **Achieving political will** requires intensive education and lobbying of politicians and other opinion leaders. This is achieved by community education through the mass media and other means.
5. **Implementation of Program** needs the full involvement of the salt industry. Special measures, such as negotiations for monitoring and quality control of imported iodized salt, are required. It is also be necessary to ensure that iodized salt delivery systems reach all affected populations, including the neediest. In addition, the establishment of cooperatives for small producers, or restructuring to larger units of production, may be needed. Implementation will require training at all levels in management, salt technology, laboratory methods and communication.
6. **Monitoring and evaluation** require the establishment of an efficient system for the collection of relevant scientific data on salt iodine content and urinary iodine levels. This requires suitable laboratory facilities.
Overview of the Global Program

The preferred public health technology on the grounds of effectiveness and cost is universal salt iodization (USI). This means that all food industry salt for human (and animal) consumption should be iodized. This requires legislation. The recommended level is 20-40 mg iodine per kilogram of salt (WHO/UNICEF/ICCIDD 1996).

Such a measure has been adopted by many countries including the highly populous countries, Bangladesh, China, India, Indonesia and Nigeria.

3.2 Progress

The WHO/UNICEF/ICCIDD Report on Progress in the Elimination of IDD in 1999 indicated remarkable progress in that, of 130 IDD affected countries, 105 (81%) had an intersectoral national body (Committee or Commission) with responsibility for the program. Other details are shown in Table 4. Of the five billion people living in countries with IDD, 68% of them had access to iodized salt.

4. Sustainability

The next challenge in relation to the success of USI is the issue of sustainability. It is well known, that past success has been followed by failure, due to a variety of factors. In Guatemala and Colombia in South America it was due to political changes, and social upheaval, in the former USSR countries to complacency and apathy together with political changes and in China due to the Cultural Revolution when public health programs were suspended.


| · | 130 | IDD affected countries |
| · | 105 | (81%) have intersectoral body |
| · | 192 | (78%) have plan of action for IDD |
| · | 98 | (75%) have legislation in place |
| · | (9%) | have draft legislation |
| · | 95 | (73%) monitor salt quality |
| · | 84 | (65%) have laboratory facilities for monitoring |

Experience indicates that the continuing social process is essential—the ‘wheel’ must turn if sustainability is to be ensured. For this regular data collection of salt iodine and urine iodine is essential (fig. 1).

The cooperation of the salt industry in providing good quality iodized salt is very important to sustainability of the elimination of IDD. There are great opportunities for community education through the distribution of iodized salt.

Sustainability is discussed in detail in Section IX.

### 4.1 Progress of Salt Iodization

An assessment of the progress of USI has been provided by UNICEF (UNICEF/WHO 2000). Over 90% of the populations of 28 developing countries use adequately iodized salt. In an additional 36 countries more than half of the population is protected from IDD by using iodized salt.

These 64 countries include China, India, Indonesia and Nigeria as well as a number of poorer countries such as Bangladesh, Benin, Burundi and Eritrea.

There are still 36 countries where less than half the population uses iodized salt. This includes many countries in Central and Eastern Europe and the Commonwealth of Independent States (CIS) where once adequate salt iodization rates have dropped dramatically in recent years and iodine deficiency disorders, including endemic cretinism, have recurred.

### 4.2 Criteria for Monitoring Progress towards Sustainable Elimination of IDD as a Public Health Problem

This refers to the monitoring of elimination programs using internationally accepted indicators to determine whether iodine levels are sufficient within a population.

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**Table 5. Summary of criteria for monitoring progress towards sustainable elimination of IDD as a public health problem**

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Goals</th>
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<tbody>
<tr>
<td><strong>Salt Iodization</strong></td>
<td></td>
</tr>
<tr>
<td>Proportion of households using adequately iodized salt</td>
<td>&gt;90%</td>
</tr>
<tr>
<td><strong>Urinary iodine</strong></td>
<td></td>
</tr>
<tr>
<td>Proportion below 100µg/L</td>
<td>&lt;50%</td>
</tr>
<tr>
<td>Proportion below 50µg/L</td>
<td>&lt;20%</td>
</tr>
</tbody>
</table>

The criteria for monitoring progress towards sustainable elimination of IDD as a public health problem were originally determined by a Joint WHO/UNICEF/ICCIDD Working Group on Assessment and Monitoring of IDD in 1994 and further developed at a subsequent meeting in 2001 (Table 5).

4.3 Global Network for the Sustained Elimination of Iodine Deficiency

This Global Network was established following the Salt 2000 Meeting in The Hague and subsequently at a Summit of Leaders Meeting in Paris (10 January 2001).

Participants at the Summit agreed to form an international network (Subsequently designated The Global Network for the Sustained Elimination of Iodine Deficiency) to tackle tasks beyond the ongoing agendas of each particular organization. The focus of the Network is to be on global strategy, support to national coalitions, analysis of national problems, collaborative responses to national needs, monitoring of global progress, information exchange and networking among members in order to achieve the sustained elimination of iodine deficiency through USI.

Nominations for Board Membership were accepted by UNICEF, WHO, Salt Institute (USA), ESPA (European Salt Producers Association), ICCIDD, CDC, MI and Kiwanis International. The China National Salt Industry and the Program against Micronutrient Malnutrition (at Emory university) and CDC, Atlanta were later accepted as Board members. Support for the Network has been provided by a small permanent Secretariat. The Network has been particularly concerned with the issue of Universal Salt Iodization (USI) as a special challenge to ensure sustainability.

This network was formally launched at the time of the UN General Assembly Special Session for Children, in New York (May 2002). At this time the new objective of elimination of IDD by the year 2005 was accepted by the UN System.

A special fund, (US$15 million) was allocated by the Gates Foundation to UNICEF for the support of the elimination of iodine deficiency through the Global Network. These funds are now being directed to country evaluations and other special projects within the global program. The ICCIDD has been designated the lead agency for country evaluations (Hetzel 2002).

An International Meeting for Sustained Elimination of IDD under the co-sponsorship for the Global Network and the Chinese Government
took place in Beijing, 15-17 October 2003. Some 350 delegates from 30 countries including two Deputy Premiers and 20 Ministers and heads of a dozen international organizations attended the meeting.

The countries invited were mainly from the Asian Region but Ecuador, Egypt, Ethiopia, Guatemala, Iran and Nigeria were invited to share their experiences. All participating governments submitted a brief report of their national programs. The ICCIDD was well represented.

At the inaugural session in the Great Hall of the People, Mme Wu Yi, Deputy Premier and Minister of Health, Ms Carole Bellamy UNICEF Executive Director and Dr Catherine Le Gales-Camus WHO Assistant Director General spoke strongly for accelerated efforts towards the 2005 goal.

After an update on the global IDD status and a report about China’s program, the sessions focused on the five issues critical for sustained IDD elimination; policy/political commitment at various levels, the supply and distribution of iodized salt, social mobilization to generate community support for behavioral compliance, monitoring of salt quality and adequate iodine nutrition and national coalition for sustained elimination.

A closing statement on consensus that took into account the proposed action from the national reports and the discussion was then presented. A number of amendments were tabled from the floor and the consensus with specific follow-up action was adopted unanimously.

5. Conclusion

The global elimination program has made significant progress over the period since 1990. It is important to identify the reasons for this progress.

A series of factors can be cited as follows:

i) The definition of the problem of iodine deficiency as a readily transmitted concept, with an easy acronym – the concept of the iodine deficiency disorders (IDD) – referring to all the effects of iodine deficiency with special emphasis on brain damage in a population that can be totally prevented by correction of iodine deficiency.

ii) This was followed by the creation of the International Council for Control of Iodine Deficiency Disorders (ICCIDD) with the support of WHO and UNICEF committed to the assistance of national programs for the elimination of IDD.
iii) The availability of effective technology suited for mass use in large populations – iodized salt has met this requirement and the salt industry has become — an important stakeholder and a cooperative partner.

iv) The availability of simple practical methods for monitoring and surveillance – the measurement of salt iodine and urine iodine has been made effective for use on a large scale with the technical assistance of the ICCIDD.

v) The availability of a national program model, (the ‘wheel’ model), which can be readily understood and implemented and which is driven by regular data on salt iodine and urine iodine-

Political support has come through the UN System- the World Summit for Children supported by WHO, UNICEF, the World Bank and the bilateral aid agencies (AusAID, CIDA, the Netherlands, Sweden and USAID) with the participation of the governments of IDD affected countries.

Implementation has depended on national organizations-both the public and private sectors have been involved. This applies particularly to the involvement of the salt industry.

The funding support of the governments of IDD affected countries has been quantitatively most important. Funding has been provided by all these agencies but Kiwanis International through UNICEF has been particularly significant. This depends on an educated community, which understands the relation between iodine deficiency and brain damage and the opportunity of prevention. It needs to be understood that adequate dietary iodine intake is just as important as clean water as part of the general knowledge of the community.

The challenge now is sustainability, as well as implementation in the countries that have not yet developed effective programs.

The Director General of the WHO (Dr Gro Brundtland) has pointed out that the achievement of IDD elimination “will be a major and total public health triumph ranking with small-pox and polio”. It will be a major global triumph in the elimination of a non-infectious disease (WHA 1999).

This effort has involved a remarkable partnership between countries, international and bilateral aid agencies, technical organizations, the salt industry and Kiwanis International.

The strength of this Partnership and the newly established Global Network encourages confidence that elimination of IDD is a realistic goal,
although inevitably its achievement by a country will depend on continued political and social stability, as well as technical efficiency.

The progress achieved with the elimination of brain damage due to iodine deficiency provides a possible model for the successful solution of other global nutritional, as well as social and environmental problems.

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Section III

The Global Partnership
*People & Governments/Salt Industry*
*UN System/AusAID/CIDA/
Kiwanis International/Global Network/
ICCIDD/IRLI/Research Centres/MI*

1. Introduction
2. People in Countries where IDD is a Public Health Problem
3. Governments of Countries where IDD is a Public Health Problem
4. The Salt Industry
5. The Role of UNICEF and WHO in Eliminating Iodine Deficiency Disorders
6. Bilateral Aid (Development) Agencies
7. Kiwanis International First Worldwide Service Project
8. The Global Network for the Sustainable Elimination of Iodine Deficiency
9. The International Council for Control of Iodine Deficiency Disorders (ICCIDD)
10. The International Resource Laboratories for Iodine (IRLI) Network
11. Research Centres that have made major contributions to IDD research
12. The Micronutrient Initiative (MI)
Global Elimination of Brain Damage Due to Iodine Deficiency

1. Introduction

Great progress has been made in the development of IDD Elimination Programs through an informal Global Partnership that has developed following the World Summit for Children in 1990.

In this Section III the various partners describe their role which has led to the development of coordination and effective action towards the great goal of elimination.

The partnership includes the following -

2. People in countries where IDD is a public health problem.
3. Governments of countries where IDD is a public health problem.
4. Salt Industry has an important role to play in achieving effective Salt iodization.
5. The Role of the UN System particularly WHO and UNICEF, which are specifically committed to assisting countries achieve the goal of elimination of IDD. The World Bank has provided major funding support to the development of the salt industry in Indonesia and China. The United Nations Agencies FAO, WFP and UNIDO have also been involved.
6. Bilateral Aid (Development) Agencies of developed countries which have included support of national programs for IDD control in their development programs. These include Australia, Belgium, Canada, Germany, Holland, Italy, Sweden and the United States of America. The role of Australia and Canada will be described in detail.
7. Kiwanis International—an international world service club which has adopted the elimination of IDD, through UNICEF, as its First worldwide service project.
8. Global Network for the Sustainable Elimination of Iodine Deficiency, including the Salt Industry at international level.
9. International Council for Control of Iodine Deficiency Disorders (ICCIDD) which has provided an expert scientific advisory role in the establishment of effective national programs and in the monitoring of progress towards the goal of elimination of IDD at country level.
10. International Resource Laboratories for Iodine (IRLI) Network has at international and national levels been recently established to assist the development of laboratories for the determination of salt iodine/urine iodine within national elimination programs.
11. Research Centres where important IDD research has been carried out that has made possible this global program for the elimination of brain damage due to iodine deficiency. These institutions are situated in both developed countries and developing countries.

12. The Micronutrient Initiative (MI) was established in 1992 as an international secretariat by its principal sponsors: Canadian International Development Agency (CIDA), International Development Research Centre (IDRC), United Nations Children’s Fund (UNICEF), United Nations Development Program (UNDP) and the World Bank. The mission of the MI is to facilitate the achievement of the goals related to elimination of micronutrient malnutrition accepted by the World Summit for Children.
People in Countries where IDD is a Public Health Problem

The leaders in this partnership are clearly the people themselves who have the problem. It is a tragic fact that the people of many countries including both the developed and developing countries are not fully aware of the problem that they have. The deadening effects of iodine deficiency combined with the geographic isolation of so many iodine deficient communities mean that the problem is just not known to the people most affected. This is even true of Europe where there is still widespread ignorance of the effect of iodine deficiency on brain development in foetal life and early infancy.

This indicates that arousing community awareness is a major step required in country programs. This applies to the local community and to the wider regional and international community. Different methods of awareness are required at each level.

The tragic situation shown in the photograph (Section I) of the Chinese mother with four sons, three of them cretins, is reproduced over and over again throughout the large populations at risk all over the world.

The message that such situations can be totally prevented needs to be broadcast using every media resource. Now that transistor radios and television are so widely available there are new opportunities for effective media campaigns. Such campaigns are of course already operating in developing countries for the sale of aerated beverages, cigarettes, beer and other widely used products of Western civilization and are very effective!

There should be no hesitation in spelling out the personal and social dimension of the tragedies consequent on mental deficiency as the major effect of iodine deficiency on human development.

The impact of iodine deficiency on a village community and the benefits of its correction are vividly shown from the experience of the villages in Indonesia, China and India that is reported in Section I.

There are significant community groups, which could provide leadership in arousing awareness about IDD. The problem is above all one affecting women and children. The IDD problem is now being taken up by well-organised women’s movements in many countries.
Another resource would be groups of disabled persons. An example is the Chinese Disabled Persons Federation of which the Chairman is Mr. Deng Pu-fang, son of Deng Tsaioping the former paramount leader of China.

In the field of mental deficiency there is the International League against Mental Handicap composed of national groups in both developed and developing countries. These groups often include people in leadership positions.

A well informed community can apply significant political pressure for effective IDD control programs at regional and national level. This has already been noted in considering the model of a national program. The perception of IDD at community level as affecting productivity, quality of life, and the school performance of children can be very persuasive with politicians especially when accompanied by data on the economic costs of not having an IDD control program as outlined in Section I of this book.

An educated community will create demand for iodized salt and the salt industry will respond to this demand as has occurred in developed countries. The consumer organizations and social educationists play a very important role in this aspect. They communicate easily and directly with people at all levels transcending socio-economic and academic barriers.

The achievement of correction of iodine deficiency is often not sustained due to political instability affecting the public health sector, or there may be ineffective and inefficient monitoring and many other problems may occur. The only insurance in the long term is the awareness of the community at risk of the proven means by which this risk can be removed. This question of sustainability is considered fully later in this book in Section IX.

An adequate dietary intake of iodine is just as important for the maintenance of health and wellbeing as many other public health measures such as clean water, clean food and public hygiene.

In concluding this discussion of the “People” it is useful to remind ourselves of the new importance of “People Power” in causing social and political change in our world today. The collapse of the communist regimes in Eastern Europe and the former USSR, the collapse of the Marcos dictatorship in the Philippines and more recent developments in a number of countries, all indicate the “power of the people”. The influence
of the international media has undoubtedly been very important in all these developments. At their best, they indicate awareness of human values as being in the end the highest priority.

We can confidently expect an increasing momentum in the drive for improved public health including the elimination of IDD as a result of this new climate of “people power”.

Governments of Countries where IDD is a Public Health Problem

The responsibility for decision about the introduction and maintenance of an effective national IDD elimination program rests ultimately with the government of the country. Governments are sovereign and it is to governments that the case has to be made and won! Governments in their decision making are influenced by community perceptions as well as the advice of professionals, together with economic considerations.

As already pointed out one reason for the neglect of the IDD problem has been the fact that it is often found in the more remote parts of a country where people have little political influence. Another reason has been the lack of perception of the importance of the IDD problem in human, social and economic terms. This limited perception has now been revised as the evidence mounts of the personal and social and economic cost of IDD to the people of the country affected. This cost has been spelled out in detail in Section I of this book—costs are very high for developed countries as well as developing countries as the data already cited from Germany indicates. By contrast the cost of IDD control programs is indeed modest. The cost of not having a program is very very great compared to the cost of the program. Using the most conservative estimates, Pandav et al. (Pandav, 1997) calculated the cost benefit ratio of IDD Elimination Programmes implementing Universal Salt Iodization (USI) is 1:3. If benefits related to education and livestock populations are included, the ratio is likely to be 1:8. Thus, IDD Elimination Programmes provide a convincing opportunity of a worthwhile investment in improving the health and nutrition of populations. Governments need to be aware of these major advantages of the prevention of IDD.

The decision of a government to have a national IDD control program involves the setting up of a multisectoral IDD control council or commission. This involves health, education, salt industry, planning, finance, commerce, education and media sectors. The key figure is the Chairman of the Commission who should be at ministerial level if possible, with the political authority and support of the Cabinet. Similar considerations apply to other health problems as the WHO has been
pointing out for some years. Health problems require a multisectoral approach. It is not just “public health policy” but a “healthy public policy” and such policy belongs to the main stream of government body.

Of course pressures for expenditure come from areas other than health—these include defense needs—armaments of various types which consume so much of the health budgets of many developing countries. In developing countries, according to the UNDP, some 20% of central government expenditure is devoted to defense. In the mid 1980s military spending in developing countries exceeded spending on health and education combined. At a time of national budget cuts in the developing world there has been protection of the large sums provided for the military. The last decade has witnessed a further escalation in military expenditure. Arms are often a major source of external debt—military debt accounts for more than a third of the total debt in several large developing countries.

These are the realities that need to be borne in mind in relation to future health and education expenditure by developing countries. There is an urgent need for a more human approach to national budgets in many developing countries. But the same applies to developed countries!

It has been estimated by UNICEF that all child malnutrition could be ended by an additional expenditure of US$25 billion which would remove widespread illiteracy and preventable disease. Such a big figure has to be compared with other big items in the costs of development. It is slightly greater than the expenditure incurred for the new Hong Kong airport. It is about the same as the agreed support package to be provided by the group of seven (G7) for Russia alone. It is less than Europeans spend on wine and less than Americans spend on beer each year!

The control of IDD is in fact rather cheap by comparison with so many other problems! The extra cost of salt iodization is low—normally in the range of 2-7 US cents per person per year which is less than 5% of the retail price of salt in most countries (see further Section V). This means that the cost of salt iodization can sooner or later be transferred to a large extent to the salt industry and the consumer.

A major step forward in securing a higher priority for expenditure on children’s health and education was the World Summit for Children held at the United Nations on 30 September 1990. This was attended by 71 Heads of State together with senior representatives of 88 other governments. This meeting was convened by a group of six Heads of State under the chairmanship of the President of Mali and the Prime Minister of Canada.
At the World Summit the 71 Heads of State followed by 88 other governments signed a Declaration and approved a new program for the improved health and education of children throughout the world. This list of goals included the virtual elimination of IDD by the year 2000.

This was an unprecedented commitment by Heads of State to give priority to the needs of children.

The World Summit for Children in 1990 was followed by a further commitment by 55 Heads of State who nominated delegations to the Policy Conference on Micronutrient Malnutrition held in Montreal, Canada (October 1991). This was followed by the International Conference on Nutrition (Rome, December 1992) which was attended by government delegations from 160 countries. At the level of Ministers of Health of more than 160 governments, the World Health Assembly in 1990 also adopted the goal of elimination of IDD as a public health problem by the year 2000. This commitment was reaffirmed by the 1996 World Health Assembly.

This new level of political commitment at national level has led to more rapid progress towards the goal of elimination of IDD than ever before.

Examples are provided by Indonesia, the Philippines and China.

In Indonesia, President Suharto announced trebling of the expenditure on IDD control in January 1992.

In the Philippines, President Fidel V Ramos, speaking at a National Advocacy Meeting on “Ending Hidden Hunger” in June 1993, noted recent progress in ensuring no baby is born physically or mentally handicapped because of iodine deficiency and called on his government to fully support IDD elimination.

In China a National Advocacy Meeting on the Elimination of IDD was held in the Great Hall of the People with the sponsorship of the Premier Li Peng (21-24 September 1993).

All Provincial Governors with their staffs attended the meeting in addition to representatives of the international agencies including WHO, UNICEF, UNDP, World Bank and the ICCIDD. The meeting was chaired by Madame Peng Pei Yung-one of five members of the State Council. The Vice Premier, Mr Zhu Rong Ji made a commitment on behalf of the Chinese government which was followed by speeches of support from the international agency representatives including particularly UNDP and the World Bank. Mr Zhu subsequently, at a special meeting of the Provincial Governors, assured them that the central government would
provide the necessary funding to secure an effective elimination program. The remarkable progress of the National Program in China (Section VIII) followed the recognition by the Chinese Government of the major hazard of the effects of iodine deficiency on early brain development in the light of its one child family policy.

At a Regional level this commitment to the elimination of IDD has also been made by the South Asian Association for Regional Cooperation (SAARC, - 1992, 1996) including Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. It has also been made by the Organisation for African Unity (OAU) in Cairo (1993) and the Organisation of American States in Latin America (Bogota 1992).
Iodine deficiency has afflicted humanity from ancient times. Throughout the millennium behind us, iodine deficiency has been a stealthy drag on the physical, mental and social development of millions upon millions of families and their children, by sapping their cognitive performance and their productivity, and by undermining their reproduction and survival. A prompt and effective remedy, seaweed, which as we know earlier is rich in iodine was already in use over the millennia by physicians in China. We have since learned through a series of scientific studies that the solution to the global public health problem of iodine deficiency lies in the delivery of addition iodine to all members of society. This can be achieved effectively and efficiently only by Universal Salt Iodization.

At this point in time, it is important to note that salt producers everywhere are key partners of the global IDD alliance. The responsibility of salt producers is to provide iodine by adding to common salt. As a result, all people of the world can have adequately iodized salt for all times to come so as to prevent Iodine Deficiency Disorders.

Annual salt production has increased over the past century from 10 million tons to over 200 million tons today. According to US Geological Survey Mineral Commodity Summaries, January 2003, the world salt production stood at 225 million metric tons, in 2002. Nearly 100 nations have salt producing facilities ranging from primitive solar evaporation to advanced, multi-stage evaporation in salt refineries.

The formation of a working relationship between the ICCIDD and the international salt industry dates from a meeting held at the 7th International Symposium on Salt, held in Kyoto (6-9 April 1992). The Symposium brought together about 600 delegates from the salt industry and the related activities all over the world.

A special symposium was held on the iodine deficiency disorders for the information of all the delegates. An informal special meeting then took place which was attended by 16 representatives of the international salt industry who were particularly concerned about the production of iodized salt for human consumption. The representatives present agreed to remain in communication with the ICCIDD on all the technical aspects of salt iodization. A roster of consultants was established for technical
advice to the ICCIDD and to agencies. It was pointed out that the demand for iodized salt was increasing and so there was a need to increase production.

A subsequent resolution by the International Board of the ICCIDD in 1993 has recommended the iodization of all salt for human consumption which is exported to countries with an IDD problem. Letters with this recommendation have been sent to the senior executives of major international salt companies.

It is clear that the salt industry has an important role to play in achieving effective salt iodization. ICCIDD / UNICEF / WHO / CIDA workshops in Africa for the salt industry held in Botswana (April 1992) and in Senegal (October 1992) have led to an increased demand for the production of iodized salt.

The 8th World Salt Symposium was held in The Hague, the Netherlands from 7th to 11th May, 2000. Much progress has been achieved in the intervening eight years from the last symposium.

The papers at the 8th symposium dealt with all aspects of salt and show how important salt is for mankind. ‘Salt : life depends on it’ – , considered earlier as a catchphrase has now become a simple fact. The role of salt as a carrier for many micronutrients was re-emphasized.

The food supply of more than 2 billion people is lacking in adequate levels of iodine, resulting in the widespread prevalence of spectrum of iodine deficiency disorders (IDD). This public health problem can be corrected by the regular delivery of small doses of iodine to the population through commonly eaten foods or condiments. Salt is an excellent carrier for iodine and other nutrients as it is consumed at relatively constant, well-definable levels by all people within a society, independently of economic status.

Once established in a country, salt iodization is a permanent and long-term solution to the problem. It eliminates iodine deficiency and continues to provide each individual with his/her daily iodine needs and prevents recurrence. Within one year of iodized salt the required iodine being widely available and consumed in a community, there will be no further birth of cretins or children with subnormal mental and physical development attributable to iodine deficiency. Goiter in primary school children and adults will have started to shrink and even disappear altogether. Children will be more active and perform better at school.

The range and variety of scientific contributions in this salt industry-sponsored Symposium (2000) will testify to the many accomplishments
of the last decade. In summary, this decade will be remembered for the history of how UN agencies, the salt industry and its allied businesses, NGO, specialist scientists and practitioners from all sectors have collaborated in the global effort to reach the common goal of IDD elimination.

Much progress has been made since Salt-2000. The important role of industry in the stake has been acknowledged. The industry has responded in equal measure. The chapter by Mr. David P. Haxton in this Section dwells in detail on this and related aspects.

It is pertinent to remember Gro Harlem Brundtland, Director General of WHO when she said, “When elimination of IDD is achieved, it will be a major and total public health triumph, ranking with small pox and poliomyelitis”. (WHA-1999)

Table 1. World Salt Production (in million metric tons)

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<td>6.9</td>
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<td>United Kingdom</td>
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<td>6.6</td>
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<tr>
<td>All other</td>
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5

The Role of UNICEF and WHO in Eliminating Iodine Deficiency Disorders

Nita Dalmiya, Ian Darnton-Hill
Bruno de Benoist, Maria Andersson

5.1 Summary

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5.3 Recommended Strategy to Combat Iodine Deficiency

5.4 Progress Toward Eliminating IDD

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5.6 The role of UNICEF and WHO

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5.14 Conclusion
5.1 Summary

The importance of iodine deficiency disorders (IDD) to UNICEF and WHO was clearly demonstrated by the inclusion of a specific goal for IDD elimination in the World Summit for Children in 1990, the Joint WHO/FAO International Conference on Nutrition in 1992 and several resolutions of the World Health Assembly. Most recently, the UN System as a whole, at the Special Session on Children of the United Nations General Assembly in 2002, reinforced the need for continued efforts towards the elimination of iodine deficiency disorders and other micronutrient deficiencies, in ensuring a ‘World Fit for Children’.

Impressive progress has been made since 1990 towards eliminating iodine deficiency disorders. UNICEF and WHO have played a critical role in advocating for, and raising awareness of, these issues at the international, regional, and national levels among policymakers and helped to increase awareness and consumer demand among populations. Using a rights-based approach, UNICEF with the support of other UN agencies has been instrumental in elevating to the highest political level the discussion of every child’s right to adequate nutrition. This right includes that of young women to have adequate iodine status to ensure optimal neuro-intellectual development in their children, from the time of conception through to birth, and into the child’s subsequent life.

UNICEF and WHO have particularly emphasized the role of Universal Salt Iodization (USI) as the main strategy to achieve this at a public health level. UNICEF and WHO have also been very supportive at the national level in providing technical guidance to national programs, including monitoring and evaluation. UNICEF has also played a special role, reflecting its comparative advantage in terms of field presence and expertise among the partners in engaging the cooperation of other partners, including bilateral donors, non-governmental organizations, and the private sector for IDD elimination. WHO has played a key role in coordinating and mobilizing national decision-makers on the public health dimension of iodine deficiency. WHO has also coordinated technical expert groups to provide guidance to countries on the indicators to assess iodine deficiency, the criteria to track progress towards the elimination of iodine deficiency and a strategy for the prevention and control of iodine deficiency. WHO maintains a global databank on IDD and other micronutrients.

Great progress has been made over the last decade towards improving the iodine status of populations around the world which has resulted in a
reduction by half of the number of countries with iodine deficiency as a public health problem and almost 70% of households in the world using adequately iodized salt. However, iodine deficiency is still a public health problem in 54 countries, and 30% of households still do not use adequately iodized salt. This is the challenge for the coming years. As such, all agencies must continue to be heavily involved in programs to achieve the UN goal of sustainable elimination of IDD by 2005. Whereas USI will remain UNICEF’s and WHO’s key strategy over this time and in the future for sustainability, complementary approaches will be needed in the hardest to reach populations and in emergency situations.

5.2 Global Goals for Eliminating IDD

At the beginning of the 1990s, three important conferences took place to draw the attention of the international community to the public health dimension of iodine deficiency. First, the World Summit for Children (WSC) established for the first time specific global goals and targets for reducing micronutrient deficiencies and improving child nutrition (UNICEF 1990). At the WSC in New York, the single largest gathering of world leaders up to that time, government leaders representing 71 countries committed themselves to achieving several goals, three of which were directly related to the elimination of micronutrient deficiencies in women and children:

(i) reduction of iron-deficiency anaemia in women by one-third of the 1990 levels;
(ii) virtual elimination of iodine-deficiency disorders (IDD); and
(iii) virtual elimination of vitamin A deficiency and its consequences, including blindness (UNICEF 1990).

This global momentum around IDD awareness was followed in Montreal (October 1991) by another historic conference convened by the World Health Organization (WHO) and the United Nations Children’s Fund (UNICEF) on “Ending Hidden Hunger”, a policy conference on micronutrient malnutrition which brought together 300 ministers, policy leaders and scientists from all over the world (UNICEF/WHO/ICCIDD 1991). This conference encouraged many countries to initiate and reinforce efforts towards IDD prevention and control as a national priority. The World Declaration and Plan of Action for nutrition, endorsed by almost all countries at the International Conference on Nutrition organized by WHO and FAO in Rome, 1992 further emphasized the feasibility and the commitment of the global community to eliminating IDD by the year
In 2002, the Special Session on Children of the United Nations General Assembly (UNGASS) adopted a comprehensive set of goals, the World Fit for Children Goals (WFFC) that focussed on reducing malnutrition in children under 5 years of age by at least one-third through supportive strategies that include ‘achieving the sustainable elimination of iodine deficiency disorders by 2005 and accelerate progress towards the reduction of other micronutrient deficiencies, through dietary diversification, food fortification, and supplementation’ (United Nations 2002).

There are good reasons why such an ambitious agenda for improving nutrition was adopted. First, there was recognition that all children have a right to adequate nutrition. This was first articulated in the Universal Declaration of Human Rights adopted in 1948, and later expressed in the Convention on the Rights of the Child (CRC) which has been ratified by 192 countries (UNICEF 1989). Second, there was strong scientific evidence that nutrition is the foundation for survival, growth, and development of children. Well-nourished children have improved health, perform better in schools, grow into healthy adults, and have longer life expectancy. Well-nourished women face fewer risks during pregnancy and their children start life both physically and mentally healthier. In that context, iodine deficiency has been increasingly recognized as a cause for a wide spectrum of health consequences including poor pregnancy outcomes with increased rate of stillbirth, perinatal mortality, low birth weight, impaired growth and hypothyroidism all included in IDD. However, the main consequences of iodine deficiency is associated with brain damage during the fetal life resulting in disorders in neuro-intellectual and cognitive development in children (Pelletier et al 1995). Iodine deficiency is the main cause of preventable damage in children. Third, in the early 1990s, it was estimated that approximately 655 million people or 12% of the world’s population were affected by clinical disorders associated with iodine deficiency due to a lack of iodine in the diet (WHO 1993). Finally, the economic impact of micronutrient deficiencies, and more specifically of iodine deficiency on poorer countries’ development and economic wellbeing became more established and modeled, including primarily for iodine (World Bank 1994) (see Section I).
5.3 Recommended Strategy to Combat Iodine Deficiency

In 1993, the Joint WHO/UNICEF Committee on Health Policy recommended Universal Salt Iodization (USI), i.e., the iodization of all edible salt including that used in animal feed and salt used for food processing as the main strategy to prevent and control iodine deficiency (UNICEF/WHO Joint Committee 1994). This was further reinforced in 2002 at the UNGASS, which adopted the IDD elimination goal by the year 2005 with USI as the main strategy.

While other food products can also be iodized, salt is widely consumed and inexpensive to iodize. Salt has successfully been iodized in industrialized countries since the 1920s and therefore has a proven track record. Prior to 1990, few developing countries had large-scale salt iodization programs and it was estimated that less than 20% of edible salt was iodized (UNICEF 1989).

5.4 Progress Toward Eliminating IDD

Since the adoption of the USI strategy, dramatic progress has been made towards improving iodine nutrition status through the consumption of iodized salt. Household consumption of iodized salt more than tripled during the last decade. In 2002, 66% of households in the developing world were estimated to consume adequately iodized salt (fig. 1). The countries of Latin America and the Caribbean achieved the highest levels of iodized salt coverage (84%) followed closely by East Asia and the Pacific at 82%. Middle East and North Africa stood at 51%, followed by sub-Saharan Africa at 66%. South Asia lags behind at 49% mainly due to slow implementation in India and Pakistan. In central and eastern Europe/Commonwealth of Independent States, close to 40 per cent of households consume iodized salt (UNICEF 2004). The last region has shown a particularly impressive increase after falling to very low levels (from previously high ones) in the 1990s. As a result, the number of countries where iodine deficiency is a public health problem decreased by nearly half from 110 in 1993 to 54 in 2003 (WHO 1993, 2004). Despite this impressive progress worldwide, there are still 38 countries where less than half of the population uses iodized salt, and 41 million babies are still born every year unprotected from iodine deficiency and its lifelong consequences (UNICEF 2004) (fig. 2). It is critical that the gains made thus far are sustained and the availability and use of iodized salt increases in countries that have low coverage.

Furthermore, it is important to note, that while the goal includes all edible salt i.e. table and animal salt, and salt for use in processed foods,
Fig. 1 Levels of household consumption of iodized salt (1997-2000) by UNICEF region.

Fig. 2 Forty-one million newborns still unprotected from learning disabilities.
most countries are only mandating the iodization of table salt. It is increasingly recognised that a significant proportion of total salt consumed comes from other sources than table salt, mainly for processed food. Since approximately 80% of salt is consumed in processed foods such as in breads, sausages, canned and other ready-to-eat foods in western and central Europe, it is critical for these countries to start using iodized salt for food processing. However, currently only a few countries mandate the use of iodized salt in food processing including Denmark, Germany, the Netherlands, and Switzerland (WHO 2004). There has also been some reluctance on the part of the food industry to change their practices due to concerns about the negative impact of iodized salt on the taste and appearance of foods. Recognising this situation, UNICEF commissioned a literature review and studies on the use of iodized salt in pickling and meat curing in 1994, which showed that there was no significant impact of iodized salt usage on the organoleptic properties of food (UNICEF 1994). This has recently been repeated for Chinese foods (Global Network 2004). Since then, UNICEF offices have also supported small studies using local foods such as soy and fish sauce. Another issue that needs to be considered is the public health concern of the role of salt as a risk factor for cardio-vascular diseases which is resulting in a decline in the consumption of salt (WHO 2003). However, it is important to state here that a Joint WHO/FAO Expert Consultation on, “Diet Nutrition and the Prevention of Chronic Diseases” (WHO 2003) clearly stated the following with respect to salt intake while suggesting ranges of population nutrient intake goals. To quote, “Salt should be iodized appropriately. The need to adjust salt iodization depending on observed sodium intake and surveillance of iodine status of the population should be recognized.” This trend represents a real constraint for the implementation of the USI strategy. An alternative would be to increase the level of iodine fortification in salt. Lastly, there is very little information on the use of iodized salt for animals, which means that a critical opportunity of ensuring iodine through the food chain is being missed.

The task of sustaining iodine deficiency elimination necessarily requires vigilance. Experience has shown that in the absence of adequate monitoring and continued political support, iodine deficiency can resurface as witnessed in Guatemala and Bolivia (UNICEF 2002), and during times of civil strife such as Sierra Leone where coverage fell from 75% to 23%. It is therefore imperative that salt iodization is continuously monitored along with the iodine status of populations. Strong partnerships between
salt producers, governments, scientific groups, and civil society organizations at the national level will be key to ensuring that salt iodization is sustained and that iodized salt reaches everyone who needs it. Consumer demand has been an under-appreciated but critical component of sustainable USI.

5.5 Achievements and Opportunities

Past experience shows that the progress made by countries towards IDD elimination was the result of strategic programmatic shifts combined with effective advocacy and effective partnerships. The availability of low-cost and technology-driven interventions, such as iodized salt, played an important part in the progress achieved. Furthermore, the development of clear and simple messages about the importance of iodine for optimal function outcomes (e.g., brain development), and the feasibility and cost-effectiveness of these interventions made it easier to convince decision makers and donors to invest in salt iodization programs. The rapid success that followed shows that with a combination of factors—political will, availability of national and international resources, scientific leadership national and international partnerships including the private sector, capacity development and monitoring—positive results could result in a relatively short span of time. The lessons of the last decade, both the successes and failures, in addressing the goal of IDD elimination will be critical in defining how the international nutrition community, governments, and our other partners move toward sustaining the gains and further reducing the burden of iodine deficiency.

Finally, an important achievement of this decade has been the increased awareness of the role of nutrition on early child development as well as on human development and poverty alleviation. A major opportunity to make further progress in this regard is provided by the Millennium Development Goals (MDGs) and the World Fit for Children goals (WFFC).

Eliminating iodine deficiency disorders has the potential to make a significant contribution to the achievement of the MDGs, adopted at the UN General Assembly in 2000, particularly in the following five that implicate nutrition:

(i) Eradicate extreme poverty and hunger: Eliminating IDD through USI will ensure that children are able to learn better and therefore are more productive as adults. This in turn will contribute to poverty alleviation.
(ii) Achieve Universal Primary Education: Children will be able to learn better and therefore be more ready to attend schools once their iodine status is normal. School attendance will also improve when children have improved cognitive function and intellectual capacity.

(iii) Promote gender equality and empower women: While IDD affects everyone, eliminating it will ensure that women do not have children who are affected and require more care so as not to be a drain on the household resources and so allow them to take up income-generating work.

(iv) Reduce child mortality: It is a well-established fact that IDD contributes to increased infant mortality. Eliminating IDD will ensure that children are born healthier and better able to thrive.

(v) Improve maternal health: Eliminating IDD in women will surely improve their health and ability to be more productive and also affect their ability to bear healthier children.

5.6 The role of UNICEF and WHO

In reviewing the experiences of the last decade, it is clear that UNICEF and WHO played an essential role in the prevention and control of iodine deficiency disorders. However, the success is also due to the combined efforts of other international organizations such as the International Council for Control of Iodine Deficiency Disorders (ICCIDD), the Micronutrient Initiative (MI), academic institutions, donors, foundations, the World Bank, and the Regional Development Banks, Kiwanis international, and salt producer associations, all of which played a significant role in achieving the progress made so far.

UNICEF as part of the UN system has played a special role in eliminating IDD given its mandate to improve the welfare of children and women. UNICEF’s involvement with IDD dates back to about 1950 when the FAO/WHO commission advised UNICEF that ‘in areas where soil and water are deficient in iodine, iodized salt needs to be provided,’ and the use of iodized salt in school meals was recommended. UNICEF was also active in the 1960s in providing technical support and hardware to countries in Asia and Latin America, and even had an engineer with experience in such matters stationed in New York. However, it was not until 1990 at the UNICEF Executive Board that the goal of ‘eliminating IDD’ was adopted and then further endorsed at the World Health Assembly that May, and then later at the WSC.
UNICEF has been able to play a significant role in IDD elimination mainly due to its extensive field presence in 158 countries around the world. At the country level, the UNICEF Representative has both the authority and autonomy to negotiate programs of cooperation with the government based on the priority needs defined by UNICEF’s Executive Board. This structure has allowed UNICEF to play an active role in providing support to governments in terms of meeting the needs of children and women in countries everywhere. It is this very system that has enabled UNICEF to take on a significant role in supporting IDD programs in over 100 countries worldwide.

WHO’s role in relation to IDD elimination goes back to the 1960s with the publication of the first compilation of data on goitre prevalence throughout the world (WHO 1960). This review was instrumental in drawing attention to the public health dimension of iodine deficiency. Later in 1985, at a historic Joint WHO/UNICEF inter-country workshop on IDD elimination held at the WHO South East Asia Regional office in New Delhi, ICCIDD was proposed and then formally inaugurated in Kathmandu the following year. With the adoption of a resolution on the prevention and control of IDD by the World Health Assembly in 1986, IDD elimination was collectively recognised by all member states as a high priority, preventable cause of brain damage and mental impairment affecting millions worldwide (WHO 1986). In 1990, the World Health Assembly passed an historic resolution deciding that “WHO shall aim at eliminating IDD as a major public health problem in all countries by the year 2000”. This was followed the same year by the World Summit for Children, which endorsed as one of its decade goals the “virtual elimination of IDD” (see Section II).

From 1986 onwards, it would be rather invidious to talk about WHO activities without referring to the close partnership with UNICEF and ICCIDD, as partners which have done so much to reinforce and spearhead the efforts for advocacy and prevention of IDD at global, regional and national levels. By the end of the 1990s, the role of other partners in IDD control, in particular the salt industry was fully recognised.

WHO’s particular role in relation to health issues at global level including IDD has three main dimensions - its coordinating and regulatory role in international health, and in scientific aspects, and technical cooperation with Member States. With regard to its normative and regulatory role, WHO has convened expert consultations to establish nutrient requirements, in particular for iodine and then to derive the level of food
fortification with iodine, especially the level of iodine in salt that is both safe and effective for all the population group (WHO/UNICEF/ICCIDD 2001).

One of the main elements of a sustainable IDD program is an effective monitoring system, which considers both the quality of salt and the iodine status of the population. Accordingly, World Health Assembly resolutions have called upon WHO to provide guidance to member states on ways to assess the magnitude of iodine deficiency and monitor the effectiveness and the impact of the IDD control programs on the population iodine nutrition. WHO convened two major expert consultations, in collaboration with UNICEF and ICCIDD, which made recommendations on the indicators to be used to assess iodine deficiency, monitor IDD control programs and to establish criteria to define the severity of iodine deficiency as a public health problem which gives important indications to decide on an intervention, and for monitoring IDD elimination (WHO/UNICEF/ICCIDD 1996).

Moreover, WHO has established a global databank compiling country data on the three major micronutrients - iron, iodine and vitamin A, to keep countries informed on the micronutrient status of the world population, assess the effectiveness and impact on population’s micronutrient status of the strategies to control micronutrient disorders recommended by WHO, identify the emerging public health problems, track the progress made by countries towards the international goals and draw the attention of public health authorities on the public health dimension of micronutrient deficiency. The WHO global databank on IDD was established in 1990 and the latest version was published in 2004 (WHO 2004). The full database is available on WHO’s Web site (http://www3.who.int/whosis/micronutrient/).

5.7 Advocacy, Partnership and Alliance Building

The global conferences, summits and World Health assemblies held in the 1990s were significant opportunities for advocacy and alliance building around the importance of micronutrient malnutrition. They were successful in creating awareness of the global problem of iodine deficiency and its consequences and, in turn, triggering discussion at regional and national levels among policymakers in favor of eliminating iodine deficiency. It was realized early on that in order to have an impact on iodine deficiency, it would be critical to harness the technical expertise and resources of partners at all levels—international, regional, and national.
At the international level, UNICEF and Kiwanis International (KI), a leading international service organization, entered into a unique partnership to eliminate iodine deficiency. For the first time in the history of Kiwanis International, the entire Kiwanis world network rallied around a single cause and committed itself to mobilizing $75 million for IDD elimination. Furthermore, KI also made a commitment to increase public awareness of the problem and consequences of iodine deficiency and to promote the use of iodized salt. This experience with the Kiwanis International has been a striking example of the value of partnerships with civil society organizations for public health initiatives.

The Network for the Sustained Elimination of Iodine Deficiency (‘the Network’), launched at a special session of the UN general assembly in May 2002 by the Director General of WHO, is a further example of an “alliance” of organizations, including UNICEF, WHO, international non-governmental organizations, including ICCIDD, research institutions, salt producers’ associations and private foundations that are all committed to fulfilling the WFFC goal on IDD elimination. Among its various activities, the Network through its member organizations supports the formation of national IDD committees, bringing together government, international organizations, the salt industry, civil society organizations, and consumer groups in favor of sustained iodine deficiency elimination.

At the regional level, several alliances were forged and strengthened with organizations and groups, such as the South Asian Association for Regional Cooperation (SAARC), the Organization of African Unity (OAU), and the Economic Community of West African States (ECOWAS), to follow up on the commitments of the global summits and conferences. Regional technical meetings were also held to bring together key scientific groups and governments to discuss the issues of micronutrient malnutrition, often joint meetings of WHO, UNICEF and ICCIDD. Advocacy took place at the national level, bringing together scientists, civil society organizations, rights groups, government, and representatives of international organizations to galvanize public opinion around the need to tackle “hidden hunger.” This advocacy in favor of iodine deficiency created a favorable policy environment at the national level, whereby action and programs in support of eliminating iodine deficiency became possible (see Section II, VIII).

5.8 Technical Support for Implementation of National Programs

At the national level, UNICEF and WHO in close collaboration with other international organizations have supported a variety of actions, such
as national surveys to document the extent of the problem. These surveys have also played a useful advocacy role in convincing governments to take action. Consensus-building workshops involving the private sector were also organized at the national level by international organizations to agree on the problem of iodine deficiency and to decide on actions. These workshops and national debates were successful in ensuring the inclusion of nutrition and micronutrients in national policy, such as National Plans of Action (NPAs) for Nutrition that emerged from one of the recommendations of the 1992 joint FAO/WHO International Conference on Nutrition.

5.9 Support for Monitoring and Evaluation

The WSC marked the first time that there was systematic follow-up and rigorous monitoring of countries implementation of their plan of action adopted by WSC. This monitoring process is based on the indicators and the criteria also established by WHO for monitoring national progress towards sustainable elimination of iodine deficiency as a public health problem (Table 1) (WHO/UNICEF/ICCIDD 2001).

A process indicator—the proportion (%) of households consuming adequately iodized salt—was established against which to measure progress toward eliminating iodine deficiency. This process-oriented indicator allowed UNICEF and its partners a way to rapidly measure progress toward the goal at the national level. The process indicator was selected for inclusion in the large household surveys such as DHS (Demographic Health Surveys by USAID) and MICS (Multiple Indicator Cluster Surveys of UNICEF). As previously mentioned, significant attention was paid to measuring progress toward the goal of IDD elimination, resulting in significant increase in the availability of data at the national level. As a result of the end-of-decade survey activity, there are more than 70 countries reporting updated figures on the consumption of iodized salt at the household level.

All of this attention to measuring progress resulted in significant efforts towards strengthening the capacity of laboratories around the world to measure micronutrients. The establishment of clear indicators by WHO greatly assisted in this process. The US Centers for Disease Control and Prevention along with several international agencies, including UNICEF, WHO, MI, and ICCIDD, recently took the lead in creating the network of the International Resource Laboratories for Iodine (IRLI). At a conference in Thailand in May 2001, it was agreed that an international network of
### Table 1. Criteria for monitoring progress towards sustaining elimination of iodine deficiency disorders

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<td><strong>Salt Iodization coverage</strong></td>
<td></td>
</tr>
<tr>
<td>• Proportion of households consuming adequately iodized salt</td>
<td>&gt;90 %</td>
</tr>
<tr>
<td><strong>Urinary iodine</strong></td>
<td></td>
</tr>
<tr>
<td>• Proportion of population with urinary iodine levels below 100 µg/L</td>
<td>&lt;50 %</td>
</tr>
<tr>
<td>• Proportion of population with urinary iodine levels below 50 µg/L</td>
<td>&lt;20 %</td>
</tr>
<tr>
<td><strong>Programmatic indicators</strong></td>
<td>At least 8 of the 10</td>
</tr>
<tr>
<td>• National body responsible to the government for IDD elimination. It should be multidisciplinary, involving the relevant fields of nutrition, medicine, education, the salt industry, the media, and consumers, with a chairman appointed by the Minister of Health;</td>
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<tr>
<td>• Evidence of political commitment to USI and elimination of IDD;</td>
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<tr>
<td>• Appointment of a responsible executive officer for the IDD elimination program;</td>
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<tr>
<td>• Legislation or regulation of USI;</td>
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<tr>
<td>• Commitment to regular progress in IDD elimination, with access to laboratories able to provide accurate data on salt and urinary iodine;</td>
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<tr>
<td>• A program of public education and social mobilization on the importance of IDD and the consumption of iodized salt;</td>
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<tr>
<td>• Regular data on iodized salt at the factory, retail and household levels;</td>
<td></td>
</tr>
<tr>
<td>• Regular laboratory data on urinary iodine in school-aged children, with appropriate sampling for higher-risk areas;</td>
<td></td>
</tr>
<tr>
<td>• Cooperation from the salt industry in maintenance of quality control; and</td>
<td></td>
</tr>
<tr>
<td>• A database for recording results or regular monitoring procedures particularly for salt iodine, urinary iodine and, if available, neonatal thyroid stimulating hormone (TSH), with mandatory public reporting.</td>
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</table>

**Source:** ICCIDD/UNICEF/WHO, 2001
iodine resource laboratories would strengthen the capacity of individual country laboratories to accurately measure iodine in urine and salt (US Centers for Disease Control and Prevention 2003). Based on the recommendations of this meeting, 12 laboratories were selected from each of the 6 WHO regions on the basis of their laboratory performance, capacity and infrastructure, solid links to a national IDD programming body, and geopolitical representation. It is anticipated that in the future, the mandate of the IRLI groups of labs could be expanded further to include the other micronutrients.

5.10 Mobilisation of the Private Sector

Equally important was the realization that some of the solutions to the iodine deficiency problem lay outside the public-health sector and that it would therefore be crucial to work with the private sector to make a positive impact on a population’s iodine status (Dalmiya and Schultink, 2004). In country after country, UNICEF has worked to convince salt producers of their “social responsibility” to iodize salt. Several meetings of salt producers were organized to bring together salt producers on a regional basis between 1999 and 2000 in Africa (Mombassa, Accra, and Dakar), Latin America (Bogota), and in eastern and central Europe/Commonwealth of Independent States (Kiev). A mini-symposium on the benefits of iodized salt was also included at the Salt 2000 Symposium held in The Hague in May 2000.

The progress seen in salt iodization is testament to the success of this development approach, which recognizes the strategic importance of public-private alliances in addressing public health issues. Recently, in his address to the World Economic Forum in New York in 2002, UN Secretary General, Kofi Annan, encouraged the international community to look toward the Iodine Network’s model for ways to make development programs more effective: “Take the case of the world’s salt manufacturers. Working with the United Nations, they have made sure that all salt manufactured for human consumption contains iodine,” he said.

UN agencies, and in particular UNICEF have also been able to work with and to convince private companies in industrialized countries to take interest in the issue of food fortification in developing countries. UNICEF, the MI, and others have organized training workshops and study tours, provided practical assistance, and facilitated technology transfer between large companies, such as Akzo Nobel in China to the national program in Tanzania for salt iodization.
UNICEF has also worked closely with manufacturers of food premixes and fortificants such as potassium iodate. Through the supply division in Copenhagen, UNICEF has worked with suppliers to secure competitive prices for potassium iodate, which has given a big boost to salt iodization programs at the national level. The longer-term goal is to allow countries to be self-supporting and for salt iodization to be sustainably continued by absorbing costs and/or passing them onto the consumer.

5.11 Direct Fundraising and Leveraging of other Sources of Funding

In a number of countries, UNICEF has provided direct financial support for start-up costs of fortification, including equipment, fortificant, and laboratory supplies. This has been possible due to their direct fundraising efforts with a variety of donors, including bilateral donors (e.g. Australia, Canada, the Netherlands, and United States), Kiwanis International, MI, and the Bill and Melinda Gates Foundation. UNICEF has also served as a “broker” among governments, the private sector, and lending institutions (the World Bank and regional banks) to negotiate support for micronutrient programs. Innovative credit schemes and revolving funds have been set up in several countries to assist companies engaging in food fortification to cover capital and other recurrent costs, such as a premix. Through advocacy, the World Bank and regional development banks, such as the Asian Development Bank, have been convinced to invest in food fortification programs. A multi-million dollar loan from the World Bank to China helped to restructure and upgrade the salt industry there, resulting in more than 90% of Chinese households now consuming iodized salt (Chinese Centre for Disease Control & Prevention 2003). Similar success has also been achieved in Sri Lanka (Medical Research Institute 2001). Estimates indicate that private sector investments to salt iodization programs may have exceeded $1 billion in the last decade (UNICEF 1998). The conclusion is that advocacy work of international agencies and partners created a supportive climate for increased investment and commercial loans for food fortification in developing countries.

5.12 Promoting a Rights-based Approach

WHO and UNICEF have played a significant role in promoting a rights-based approach to eliminating iodine deficiency. By arguing the right of all children to adequate nutrition and including its provision in
the Convention on the Rights of the Child (UNICEF, 2002), these UN agencies have elevated the discussion to the highest political level and placed the national responsibility for ensuring that every child receives adequate nutrition on a legal footing. Furthermore, technical assistance has been provided to governments in numerous countries around the world on drafting of legislation and regulations around salt iodization and food fortification. In countries where such laws and regulations have been passed, they have served the useful purpose of creating a “level playing field” or operating standards for the food industry engaged in fortification, and have served as a method of enforcing those in the private sector who are non-compliant.

5.13 Reaching the Goal of Sustainable IDD Elimination in 2005 and beyond: A Stronger Role for UNICEF and WHO

With less than two years to go to reach the goal of IDD elimination, it is critical that UNICEF and WHO with all of the partners supporting the sustainable elimination of IDD takes stock of the progress achieved thus far, understand the gaps and constraints, and strategize on how to accelerate progress as the countdown begins towards 2005. UNICEF’s Executive Director, Carol Bellamy, expressed her commitment to reaching this goal in her New Year’s message to UNICEF staff (2004), “we need to re-energise the world to foster more effective action on young child survival and growth…and remember, the goal of Universal Salt Iodization by 2005 is well within reach–let’s make it happen!” (UNICEF 2004).

Translated into action, all countries where UNICEF supports national IDD programs are required to provide feedback to the Executive Director on proposed strategies and actions to reach the IDD goal and other goals. To support this process, WHO and UNICEF with support from the Network conducted a gap analysis using WHO indicators to determine the extent to which countries were on track to reach the goal of sustainable elimination of IDD and also understand the constraints faced (WHO/UNICEF/ICCIDD 2001).

The results of the gap analysis indicate the need for a global strategy to accelerate progress towards the 2005 goal of IDD elimination. Using the analysis as a guide, criteria are proposed for prioritising interventions using indicators such as urinary iodine levels, iodized salt coverage, and the number of children born unprotected. Based on these criteria, several strategic approaches will be used to accelerate achievement towards the goal of sustainable elimination of iodine deficiency by year 2005. Strategic
countries will be targeted using the following criteria:
- Countries with the most unprotected infants
- Major salt exporting countries
- Countries where iodized salt coverage exceeds 90%
- Countries which are close to reaching the goal but need re-energising
- Countries with special needs such as emergencies
- Countries where USI is dependent on small salt producers

Evaluation of a decade of intense support to IDD elimination programs in over 100 countries points to some valuable lessons learned. Achieving the 2005 goal will clearly require the combined energies and resources of all the partners at all levels: international, regional and country level. A model for combining the talents and strengths of all the partners is provided in the Network, which must work more efficiently to provide support to countries and ensure the full participation of the private sector as was originally intended. At the international level, there will be a need to harmonise the plans of all the individual partners to ensure that when combined, they will have the desired effect of supporting national efforts. At the national level, the formation of national coalitions comprising of all sectors of society including public and private, but also the civic sector will ensure that there is ownership and vigilance, two key ingredients for sustainability since it is impossible to eradicate IDD. China’s experience with periodic advocacy for IDD in the face of the political reality of changing leaderships is an example of how it managed to secure national resources and attention for IDD. Efforts will also need to be stepped up to ensure that populations are aware of the ongoing ‘threat’ of IDD particularly as visible signs of IDD such as goitre disappear. The initiative of some countries to include information about IDD and iodized salt in school curriculum is innovative and needs to be evaluated. Finally, salt producers need also take responsibility for informing the public about IDD and the need to consume iodized salt only.

Over the last ten years, UNICEF has allocated multi-millions of dollars towards the purchase and procurement of salt iodization equipment and potassium iodate, a trend, which continues. There are but a few countries, which have phased out support for equipment and potassium iodate. The cost of fortification including the cost of iodate must be absorbed by the industry and passed along to the consumer—and the sooner that this is done the better. UNICEF, WHO and their partners at the country level need to work more closely with salt producers to ensure that they have business plans for absorbing the cost of iodizing salt. Governments for
their part must be encouraged to waive the taxes and other tariffs imposed on so called ‘value-added’ commodities such as iodized salt as an incentive to salt producers. Considerable efforts still need to be made in some part of the world where previously made regional trade agreements on salt are not being adhered to.

Efforts need to be made to ensure that salt is effectively iodized so that people receive just the right amount of iodine required in their diets. For salt iodization to be effective, it is clear that more attention must be paid to quality assurance and control. In this respect, the formation of the IRLI laboratories is an important step forward. And lastly, given the reality of declining table salt intakes, more and more countries will be required to undertake urinary iodine surveys to determine the impact of salt iodization on the iodine status of populations, particularly on the status of pregnant women where the need for iodine is most critical.

5.14 Conclusion

The role of UNICEF and WHO and all the international NGOs has been pivotal as evidenced by the progress made toward eliminating iodine deficiency. With the commitment of the international community to the MDGs and the WFFC micronutrient goals, there is a new opportunity for UNICEF, WHO and the partners to continue making progress towards the sustained elimination of iodine deficiency and to address those most vulnerable. To do this, all the organisations dealing with IDD will need to work even more closely together for this common good.

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6

Bilateral Aid (Development Agencies):
AusAID, CIDA

Alan March, Barbara Macdonald

6.1 The Role of the Australian Agency for International Development (AusAID) in the Global Program for the Elimination of IDD

6.2 Support for the Elimination of Iodine Deficiency Disorders at the Canadian International Development Agency
6.1

The Role of the Australian Agency for International Development (AusAID) in the Global Program for the Elimination Of IDD

Alan March

6.1.1 Introduction

6.1.2 The ICCIDD
  6.1.2.1 Review 1992
  6.1.2.2 Recent developments-consolidation in Asian countries

6.1.3 China
  6.1.3.1 Monitoring Centres
  6.1.3.2 National IDD Reference Laboratory
  6.1.3.3 Tibet

6.1.4 Other Country Support
  6.1.4.1 Indonesia 1976-1981
  6.1.4.2 Vietnam 1993-1998

6.1.5 International Seminar 2000

6.1.6 Conclusion
6.1.1 Introduction

AusAID, the Australian Agency for International Development, is the Australian government’s overseas aid program. Its current budget is A$1.8 billion. Each year the Australian aid program reaches more than 58 million people living in poverty around the world, with almost 80% of its activities taking place in the Asia-Pacific region.

Australia works with other governments, the United Nations, Australian companies, non-government organisations and individual experts to design and implement projects that tackle the causes and consequences of poverty in developing counties.

In 2002, a new policy document for the aid program was launched: Australian Aid: Investing in Growth, Stability and Prosperity. It reinforces the essential overarching objective of the aid program: to assist developing countries to reduce poverty and achieve sustainable development.

The provision of health aid is an important component of the Australian aid program as investment to improve health is a key factor in reducing poverty. Australia’s health aid focuses on improving basic health for those most in need, with an emphasis on women’s’ and children’s health. Access to health care together with good nutrition, basic education, clean water and adequate sanitation are essential cost-effective investments in reducing poverty and improving economic growth. Better nutrition and improved health increases the capacity of children to learn and of adults to participate in the economic and social development of their communities.

Millions of people in the developing world suffer ill health from diseases and conditions that can be prevented or controlled with early, low-cost interventions. Iodine deficiency is recognised as the world’s greatest single cause of easily preventable mental and growth retardation. Low-cost, effective interventions such as salt iodization are key interventions supported by the Australian aid program. Australia’s support of the work of the ICCIDD is an example of a collaborative international effort to provide basic cost-effective health care to improve the health, school attendance and learning capacity of millions of vulnerable children.

Since 1986 AusAID has supported IDD activities in China, India, Indonesia, Thailand and Vietnam. AusAID’s core funding for ICCIDD has increased over the years (from A$165,000 in 1997-98 to A$470,000 in 2001-02). This support recognises the programs’ achievements and the contribution-targeted support can make to increasing global awareness of IDD. The global partnership in which Australia is involved with
ICCIDD is achieving significant results towards the elimination of iodine deficiency disorders and its work has improved the quality of many people’s lives.

6.1.2 The International Council for Control of Iodine Deficiency Disorders (ICCIDD)

AusAID support for the ICCIDD dates from 1984 when a grant was made to Dr BS Hetzel to prepare a Report of the Prevention and Control of the Iodine Deficiency Disorders, which had been commissioned by the UN Sub-Committee on Nutrition (SCN).

This Report was submitted to the SCN Secretariat in March 1985. After a global survey of the nature and magnitude of the Iodine Deficiency Disorders (IDD) it recommended the establishment of an international NGO to assist countries in the development of National Programs for the Elimination of Brain Damage due to iodine deficiency with iodized salt.

This recommendation was approved by the SCN and led to the establishment of the International Council for Control of Iodine Deficiency Disorders in 1985, with the support of AusAID, UNICEF and WHO. The Inaugural Meeting was held in Kathmandu, Nepal, in March 1986 with supporting statements from the Director General of the WHO (Dr Hafdan Mahler) and the Executive Director of UNICEF (Mr James P Grant).

The ICCIDD adopted a Constitution, appointed a Board and an Executive with a series of six Regional Coordinators for the six major WHO Regions.

Dr BS Hetzel was appointed Executive Director in 1985 and continued in this position until 1995 when he was appointed Chairman and served in this position until 2001.

AusAID (earlier known as AIDAB), continued to provide support with UNICEF and WHO, to be joined in 1991 by the World Bank and the Canadian International Development Agency and later the Dutch Government.

AusAID support increased from A$76,000 in 1987-88 to A$114,000 in 1990.

This level of support continued to 1992 providing 27% of the total ICCIDD income.
6.1.2.1 Review of ICCIDD (1992)

In 1992 a Review for AusAID was carried out by Dr Quentin Reilly, a public health specialist and former Secretary for Health in Papua New Guinea.

He found that ‘ICCIDD, with few resources, has made a significant contribution to international public health and has been given an international mandate to continue its role. Its successes reflect well on Australia and it is recommended that ICCIDD should continue to be supported, with an increased contribution as budget circumstances permit’.

6.1.2.2 Recent Developments-Consolidation in Asian Countries

Since 1995 AusAID has provided increased support for the ICCIDD to assist consolidation of programs in Asian countries with specific funding for monitoring and evaluation (verification) of country programs.

This support has been allocated for the work of the two Asian ICCIDD Regional Coordinators – Dr CS Pandav from his office in Delhi, at the All India Institute of Medical Sciences (Centre for Community Medicine) and Dr ZP Chen, from an office in the Tianjin Medical University, where he is Director of the Institute of Endocrinology.

Dr Pandav is responsible for advising countries in South East Asia and the Pacific and Dr Chen advises China and Mongolia and the Democratic Republic of North Korea. He is also Chair of the Scientific Advisory Committee for the China National Program.

The importance of monitoring and evaluation of programs was emphasised in a 1996 WHA Resolution, which was strongly supported by Australia and 26 other countries in the Assembly Debate.

From 2000 this ICCIDD support including program evaluation for Asian countries has been further increased to A$470,000.

At the request of AusAID, arrangements have now been made to direct this entire AusAID Grant to ICCIDD activities in the Asian Pacific Region.

In 2002, the additional appointment, as Regional Coordinator, of Dr Creswell Eastman (Director of the Institute of Clinical Pathology & Medical Research, Westmead Hospital Sydney and Director of the Australian Centre for Control of Iodine Deficiency Disorders) has been made to advise a group of South Asian countries-Indonesia, Thailand, Vietnam, Laos, Cambodia, Philippines and Papua New Guinea. This means that Dr Pandav can now concentrate his efforts in Bangladesh, Bhutan, India, Maldives, Myanmar, Nepal and Sri Lanka.
6.1.3 China

6.1.3.1 Monitoring Centres

A series of visits to China by Dr Basil S Hetzel in 1981, 1982 and 1984 revealed the massive problem of iodine deficiency in China with some 400 million at risk in a total population of 1 billion. A plan was developed (with AusAID support) to provide professional training for Chinese health professionals in the field of laboratory technology and in program monitoring in consultation with Dr Creswell Eastman, Director of the Institute of Clinical Pathology and Medical Research at Westmead Hospital, University of Sydney. Dr T Ma, of Tianjin Medical University, a great IDD figure in China was also consulted.

After approval by AusAID this program was directed by Dr Creswell Eastman, Director of the Australian Centre for Control of Iodine Deficiency Disorders (ACCIDD) with the assistance of Dr Glen Maberly at the Westmead Hospital, Sydney, with Dr Hetzel as Senior Advisor. It provided a grant of A$2.8 million over a 5 year period (1986-1991), with the training of some 40 Chinese laboratory technicians at Westmead Hospital. These Chinese technicians provided the staff for monitoring centres for the IDD Control Program (particularly the measurement of urine iodine and salt iodine) in Tianjin, (Central China); Harbin, (North China); Guiyang (South China) and Xining (Western China). This program was very important to the subsequent further successful development of the National China Program.

6.1.3.2 National IDD Reference Laboratory

A National IDD Reference Laboratory for China has been developed by Dr Eastman in close collaboration with the Chinese Ministry of Health. Major funding came from AusAID, with additional support from WHO and UNICEF. The laboratory was established in the Institute of Epidemiology and Microbiology within the Chinese Academy of Preventive Medicine in Beijing in 1998 and officially opened in June 1999. Staff were recruited and sent to Australia for laboratory management and technical training in Westmead Hospital, University of Sydney. The organisational structure of the laboratory was defined and implemented.

In its first 12 months, the National Reference Laboratory has established an IDD external quality control network, developed operational procedures for it and defined responsibilities and the reporting relationship with government administrative bodies and technical institutions. It has
also completed evaluations of 29 provincial surveillance laboratories, 19 UNICEF sponsored prefectural urinary iodine laboratories and 470 country level salt quality surveillance laboratories. It has also provided training for Tibet and other provinces and organised a workshop on laboratory management for provincial IDD laboratories in Fuzhou. The laboratory played an important role in the recently completed Third National IDD Surveillance Survey. It has become the central coordinating instrument for IDD surveillance in China and will continue to play this role in prevention and elimination of IDD in China for the foreseeable future (see further on China Program in Section VIII).

6.1.3.3 Tibet

In 1997, the 2nd Biennial National IDD Surveillance Survey in China revealed that the elimination program had achieved significant progress in most provinces, with the exception of Tibet, which was lagging well behind the national target and time frame for all control criteria. In June 1998, a request for support was submitted to WHO by the Tibet Department of Health. WHO responded positively, stating it would fund the activities proposed for the first year (1999) if other agencies provided evidence of continued support of the project in 2000 and beyond. UNICEF and AusAID agreed in principle to support the proposal and the Department of Disease Control in the Chinese Ministry of Health and the China National Salt Industry Corporation also made a commitment to participate and guarantee resources for the project.

WHO commissioned a Feasibility Study undertaken by a multidisciplinary team representing major stakeholders, and led by Dr Eastman. The team confirmed the magnitude and severity of the IDD problem in Tibet and further defined the support required in their report to WHO. AusAID commissioned ACCIDD, using its own resources, to develop the Project Design Document for a three-year project.

· The interim Project Design Document was submitted to AusAID in February 2000 and in March 2000 AusAID announced support of $2 million for a three-year project.

The project is being delivered by a multilateral organisational arrangement, involving AusAID, the Chinese government coordinating agency (The Ministry of Foreign Trade and Economic Cooperation) and WHO. The Institute of Clinical Pathology and Medical Research at
Westmead Hospital (Dr Eastman and Dr Mu Li) is responsible for project direction, technical support and external coordination under a Contractual Service Agreement with WHO.

Now, two years into project implementation, significant progress has been made. For example, IDD prevention, health promotion and education programs have been developed and implemented throughout Tibet. The Lhasa Salt Iodization Factory has doubled production of iodized salt. Eighteen professional personnel have been trained in Beijing, Hong Kong and Australia for health promotion, project management and laboratory management and project infrastructures have been installed. Most importantly about 75% of women of childbearing age and 60% of infants have received iodized oil supplements as part of the transitional strategy. The project is on time and on budget, but it is too early to assess the outcomes.

6.1.4 Other Country Support

6.1.4.1 Indonesia (1976-1981)

AusAID has provided support for the IDD Elimination Program since 1976. Initial projects were in Indonesia with support for an iodine laboratory in Semarang, Central Java, followed by assistance with research work (1980-1981), in collaboration with Dr R Djokomoeljanto, Dean of the Faculty of Medicine at Diponogoro University, Semarang. This study carried out by Dr Eric Dulberg, supervised by Dr Djokomoeljanto and Dr Basil Hetzel demonstrated the reduction in walking age of infants in iodine deficient mothers who had received iodized oil injection in pregnancy, compared to a control group who had not received iodized oil injections.

The AusAID contribution helped to consolidate the establishment of the village of Sengi in Central Java as the monitoring centre for the National Program. A new proposal has now been developed (2002) for the establishment of an Academic Centre for IDD at Diponogoro University in Semarang, the capital of Central Java with the leadership of Dr Djokomoeljanto.


In 1993 Vietnam had a population of 70 million with an estimate of 94% at risk of IDD both in the hills and flooded Mekong Delta. AusAID support (A$4m) was provided over 5 years (1993-1998). This support covered the monitoring of iodized salt (quality and distribution) and urine
iodine determinations. Three iodine laboratories in Hanoi, Da Nang and Ho Chi Minh City were established. In addition a communication program was focussed on women in the villages.

The Vietnamese Government adopted a Universal Salt Iodization (USI) strategy by decree of the Prime Minister and establishment of the National Committee for IDD Control (NCIDDC) in 1994. Four years later, the annual survey in 1997 showed that people in 43 out of 61 provinces in the country have median urinary iodine levels higher than 100µg/L and median household salt levels higher than 16 parts per million (ppm). Based on the experience gained in the first years of USI implementation, the National IDD Control Committee (NIDDCC) has issued a stronger government decree on USI.

6.1.5 International Seminar
An ICCIDD/AusAID Seminar was held on 3rd March 2000 in Adelaide, South Australia with an attendance of approximately 100.

This Seminar was organised by ICCIDD with support from AusAID on March 3, 2000. The plenary session was keynoted by the Honourable Alexander Downer, Minister for Foreign Affairs of Australia. He discussed the importance that the Australian government puts on its commitments to furthering health in Asia and cited the generous continuing investment by AusAID towards this objective including the control of IDD.

Dr Basil Hetzel, Chairman of ICCIDD discussed the global partnership and the role of the ICCIDD, reviewing the founding of ICCIDD 15 years ago as an expert group committed to helping countries in the initiation, monitoring and evaluation of programs. Since then, remarkable progress has been made through the intense efforts of many organisations and particularly in partnership with UNICEF and WHO. He emphasised the role of the ICCIDD in conducting independent evaluations of progress at country level, at government invitation and in collaboration with UNICEF and WHO.

The Seminar next heard short presentations from ICCIDD Board Members involved in specific country programs in Asia: Dr Zu-pei Chen (China), Dr Sangsom Sinawat (Thailand); Dr CS Pandav (India) and Dr R Djokomoeljanto (Indonesia). These experts summarised their country programs and the importance of external, including ICCIDD, assistance in fostering them. (Two of these speakers, Dr ZP Chen and Dr Sangsom Sinawat had had past graduate experience in Australia with AusAID support).
A special session was devoted to the technology of IDD Assessment-including the methods for measurement of urine iodine, (Dr John Dunn) the establishment with AusAID support of iodine laboratories in Vietnam (Dr ML Wellby) the new Hitachi Microplate Method for measurement of urine iodine (Dr M Karmarkar) and the establishment, with AusAID support, of the National Reference Laboratory in China (Dr C Eastman).

6.1.6 Conclusion

IDD is a major problem for Asian countries with more than half the global population of (2 billion) at risk.

AusAID is committed to support for IDD elimination programs as a health and development priority.

AusAID is proud of its initial and continuous support of the ICCIDD since its establishment in 1985.

In 1990 The World Summit for Children set the ambitious target of the year 2000 for the virtual elimination of IDD. Despite significant progress this was not achieved and more work needs to be done to reach approximately 1 billion people who remain unprotected by iodised salt.

Although the elimination target was not met, ICCIDD has a positive record of achievement. As a result of its work with global partners, approximately 70% of households in the 130 IDD-affected countries now consume some iodized salt, where ten years ago fewer than 20% of people at risk had access to it. 28 developing countries have achieved 90% salt iodization and 36 more countries have over 50% coverage.

As an advocate for universal salt iodization and a source of unrivalled scientific expertise for iodine deficiency elimination programs worldwide, the ICCIDD has been vital to the achievements made towards global elimination. The Council has been instrumental in translating into action the knowledge that adding iodine to salt or vegetable oil can prevent mental and physical disability. It has successfully prompted and assisted national governments to adopt the formal regulatory procedures, community education and primary health care activities that are essential to combat iodine deficiencies.

The Council would not have got off the ground without the driving force of a truly distinguished Australian - Dr Basil Hetzel. Dr Hetzel has worked tirelessly on iodine deficiency for over 35 years. He presided over the expansion of ICCIDD into a multidisciplinary force bringing together the talents of public health and nutrition professionals, planners, technicians, educators, the salt industry and professional communicators.
Although now retired, Dr Hetzel remains involved in the ICCIDD and the Council will continue to benefit from his vast experience and his scientific and administrative skills.

The Australian Government is proud to have joined UNICEF and the World Health Organization in providing financial support for the ICCIDD from its conception. The results achieved towards IDD elimination could not have been attained without the establishment of the global partnership, which ICCIDD has spearheaded. This partnership includes the people and governments of the 130 countries affected by IDD; the major international agencies - WHO, UNICEF and the World Bank; the ICCIDD in its technical role; countries like Australia, Canada, and the Netherlands providing direct aid to country programs; and the salt industry itself. What has been learned through the experience of iodine programs is that each of these partners has an indispensable role to play and the global goal of elimination will never be reached without their continued commitment.

Australia is pleased to support IDD efforts, particularly in the Asia Pacific region where the need for iodised salt is greater than anywhere else in the world. With a commitment by international partners to work closely together with ICCIDD and continued mobilisation of political will and resources, no child and no family anywhere in the world should have to suffer the terrible and entirely avoidable consequences of iodine deficiency. Australia is proud to be part of the work to achieve this important goal.
6.2

Support for the Elimination of Iodine Deficiency Disorders at the Canadian International Development Agency

Barbara Macdonald

6.2.1 Introduction

6.2.2 A Short History of Canada’s Role

6.2.3 Moving Forward
6.2.1 Introduction

Throughout the 1990s, programs to eliminate iodine deficiency disorders (IDD) formed a cornerstone of the Canadian International Development Agency’s (CIDA) strategy to combat hunger and malnutrition. CIDA has long recognized that ensuring optimal nutrition is critical for achieving the Agency’s mandate of poverty reduction. To this end, along with programs to reduce food insecurity and chronic undernutrition, CIDA has made significant contributions to efforts to eliminate micronutrient malnutrition or “hidden hunger”.

Salt iodization programs have been a particular area of focus. Spurred on by World Bank analyses demonstrating that each $1 dedicated to IDD prevention would yield productivity gains of $28, the Agency made coordinated investments across its bilateral, multilateral and partnership branches. National programs were supported in over 40 countries, and core funding was provided to the International Council for the Control of Iodine Deficiency Disorders (ICCIDD) and the Micronutrient Initiative (MI). These Ottawa-based organizations, in turn, led advocacy, technical assistance and technology development efforts. UNICEF estimates that over 7 million children have been protected from IDD as a result of this Canadian support.

6.2.2 A Short History of Canada’s Role

The Canadian Government has its own history of tackling goitre and other manifestations of iodine deficiency through salt iodization. Soils found in the prairies and surrounding the Great Lakes are long known to be low in iodine. To prevent IDD, in 1949, the Government of Canada introduced regulations under the Food and Drugs Act to mandate the iodization of salt sold for household use. Endemic goitre was virtually eliminated soon thereafter.

In the 1990s, support for this public health intervention was broadened to other countries. The Government of Canada laid the groundwork for its international efforts to reduce iodine deficiency by co-chairing along with Mali the World Summit for Children in 1990. At this historic event, 73 countries committed themselves to eliminate iodine deficiency disorders by the year 2000, a number that reached 167 countries by the year 1996.

Quick on the heels of the Summit, Canada responded with several political and financial initiatives.
Within 2 years, Canada:
- Announced new funding to achieve the micronutrient goals set at the Summit (October 16, World Food Day, 1990)
- hosted the Montreal Conference on Ending Hidden Hunger (1991)
- initiated support to the ICCIDD to ensure that the international community had strong scientific grounding
- co-founded the Micronutrient Initiative; an international secretariat focused on mobilizing action to eliminate micronutrient malnutrition (1992)

CIDA also rapidly commenced its support for UNICEF’s country programs. Over $12 million was provided to 13 Asian countries matched by an additional $12 million for 32 African countries. Countries as diverse as Indonesia, Nigeria and Chad all received CIDA support.

UNICEF generated a breadth of experience in collaborative development through these country programs. It was recognized that getting iodine to the millions of individuals affected globally would require a broad-based action-oriented partnership. Governments would need to work with industry and with consumer groups. National organizations would need to simultaneously engage their own communities and reach out across borders to address funding shortfalls and salt importation issues. All would need to coordinate their efforts to ensure that the right support reached the right people at the right time.

For donors such as CIDA, flexibility of funding at the national level would be key. Funding might be required by governments to enact legislation or to launch public health communications efforts. However, the recipient of support might equally be industry who needed seed funds for iodization equipment or potassium iodate. Examples of the varied inputs provided include Bolivia’s product labelling and massive public education campaigns and China’s salt industry training and logistics improvement. Despite the programmatic differences, both countries rapidly succeeded in their efforts. Bolivia was the first developing country to be certified for Universal Salt Iodization and iodized salt reached 94% of China’s massive population by the end of the decade. Africa also made great strides but here again, the models were distinct. At times, massive imports of salt across borders were leveraged to carry much-needed iodine to countries with limited domestic production. In other cases, small-scale producers were equipped with skills and supplies, thus ensuring a level playing field with larger industry. With such diverse strategies, Africa now protects 285 million people in over 32 countries from IDD.
An important role for the Agency’s country-level work has been the provision of *early seed funds*. In the early 1990s, the universal salt iodization campaign was at a stage where smaller investments made across several countries could test financing and partnership models preparing the ground for larger financial commitments by governments and industry (see **Fig. 1** for financing details in several Asian countries). The Agency learned that backing good ideas even with a modest amount of strategic funds could encourage confidence. As a result, UNICEF estimates that CIDA’s initial contributions of approximately US$20 million to country programs were followed by over US$1 billion invested by national governments, the World Bank, civic organizations such as The Kiwanis Clubs and perhaps most significantly, the salt industry. Salt iodization has since been celebrated as exemplifying public-private sector collaboration by United Nations Secretary General Kofi Annan at the 2002 World Economic Forum.

More recently, on the technology front, the Agency has been encouraged by innovative work conducted by the Micronutrient Initiative and the University of Toronto on the double-fortification of salt with iodine and iron. Equally committed to the sustainable elimination of anemia as to the elimination of IDD, CIDA is keen to back a program that may bring additional nutritional benefits to the most vulnerable groups.

![Fig. 1 Resources for IDD investment in Asia (1990-99) (US$ millions)]
With efficacy now established, we look forward to seeing the results of large-scale production and commercialisation trials currently underway in Indonesia, India, Nigeria and Kenya.

6.2.3 Moving Forward

Progress in advancing children’s rights was gauged in 2002 at the United Nations General Assembly Special Session (UNGASS) on Children. Iodine programs were heralded as one of the most important global achievements for children since the World Summit for Children. Canada’s Minister for International Cooperation was on hand to congratulate the international community on its success and to re-commit CIDA to help reach the remaining 40 million children born each year without access to iodized salt. We look forward to working with governments, non-governmental organizations, and the salt industry in achieving that goal.
7

Kiwanis International
First Worldwide Service Project
Juan F Torres Jr

7.1 Introduction

7.2 Kiwanis/UNICEF Worldwide Service Project Partnership

7.3 Engaging the Kiwanis membership

7.4 Kiwanis IDD Partnerships

7.5 Kiwanis Public Education and Advocacy
7.1 Introduction

Founded in 1915, Kiwanis International consists of a network of chartered local Kiwanis clubs made up of Kiwanis members. The clubs enjoy a large degree of autonomy. They are organized by the basic governance, meeting attendance, dues, and fiscal accountability prescribed by the charter, but they are free to adopt their own language and culture and to initiate any service projects chosen by their own members. Today, Kiwanis includes nearly 600,000 members in more than 85 nations around the world. The men and women of the Kiwanis family of clubs range in age from very young schoolchildren to members who are well past retirement.

Kiwanis International is governed by a Board of Trustees and supported by an International staff and the Kiwanis International Foundation. An International President, who is elected yearly, presides over the International Board. The International Office is in Indianapolis, Indiana, U.S.A. Kiwanis International is organized into regions and districts with the territorial boundaries established by the International Board, and they are governed by their own elected officers.

Through the years, Kiwanis International promoted its motto “We Build” by working in concert to address a specific service need. The International Committee on Underprivileged Children Work, for example, was organized in 1923. However, the procedures of selection often were informal, the kinds of projects varied according to perceived need with little analysis or planning, and the project duration rarely survived beyond the term of the sponsoring officer. The participation of local clubs was low and short-lived.

In subsequent years, Kiwanis launched annual service themes to unite Kiwanis clubs behind defined national and international purposes. By 1970, the themes had grown in scope and became known as Major Emphasis Programs, complete with supporting manuals and suggested activities. During the 1980s, these programs nearly always focused on children. These decades also brought other important changes. Kiwanis transformed from a North American club to a truly international organization, embracing clubs in European, Latin American, African, and Asia-Pacific countries. Kiwanis also actively recruited youth, women, and minorities as club members and leaders.

In 1990, Wil Blechman, MD was elected International President. He and other thoughtful International leaders recognized that the annual
Major Emphasis Program was neither cost efficient nor effective. On October 1, 1990, Dr. Blechman led Kiwanis International to embark on a three-year initiative, titled “Young Children: Priority One,” to promote early intervention of health and education among children: prenatal to five years old. Though the initial progress was slow, the new project led to contacts with likeminded organizations such as the Carter Center in Atlanta, Georgia, and to a recommendation for Kiwanis to be represented at two meetings starting on October 9, 1991, in Montreal, Quebec: “Protecting the World’s Children: Keeping the Promise” and “Ending Hidden Hunger.” These experiences brought to Kiwanis leadership a new vision of global service activity. Mr. James P. Grant, a visionary leader in nutritional disorders, had become the Executive Director of UNICEF. He pronounced in a 1986 address at the first ICCIDD meeting at Kathmandu, Nepal, “IDD is a good example of a major nutritional disorder for which the techniques of treatment, control, and prevention are easily available and affordable. All it takes is a strong will, wider awareness, and cooperation among those who hold a key to the solution of the problem.” He admonished his audience, “Why has progress not been broader and more effective? The most probable answer is that the policymaking bodies in many countries were not fully aware of its health and development significance. The salt industry did not have sufficient incentives to cooperate, and the public did not know the root of the problem, its health hazards, and the ease of prevention.”

It was at this time of renewed emphasis and advocacy when Kiwanis International appeared on the scene seeking a service need that Kiwanis clubs worldwide could support. At the 1993 Kiwanis International Convention in Nice, France, the House of Delegates adopted a resolution that encouraged the organization to develop a global service project.

Kiwanis and UNICEF developed a partnership and promulgated a set of goals. UNICEF prepared a list of options for potential Kiwanis participation. After extensive evaluation and discussion, including member surveys, focus groups and interviews, the Kiwanis International Board agreed to submit a proposal to the House of Delegates to join UNICEF in its effort to virtually eliminate iodine deficiency disorders (IDD) in the world by year 2000. Kiwanis chose the elimination of IDD because the science was known, the solution was extremely cost-effective, the amount of money needed was within the membership’s capability to raise funds, and the solution would permanently improve the futures of millions of children.
Borne on this momentum, the House of Delegates, convened at the 1994 Kiwanis International Convention in New Orleans, Louisiana, overwhelmingly gave its approval of a Worldwide Service Project to protect newborns and young children from IDD.

At the beginning of the project, Kiwanis’ intended role primarily was raising funds. Kiwanis International agreed to raise US$75 million to build salt-iodizing plants for the world at a unit price of US$50,000. Before long, it became clear that the needs of the national IDD-elimination programs vary. Most of the governments seek advice and assistance for public education, advocacy, and legislation. They need financial help to upgrade small, local salt producers and salt quality, as well as iodine procurement. The smaller countries in the developing world have little use of large, modern salt factories that require advance technology to operate and maintain. To meet the challenge of the Worldwide Service Project, Kiwanis International and the Kiwanis International Foundation upgraded its own systems for more efficient management of the donations. Kiwanis began to educate its officers and members about IDD as a cause of worldwide human suffering and an obstacle to social and economic development. Kiwanians began to learn about salt production, packaging, distribution, and marketing. They began to realize that a large number of players also were working to achieve universal salt iodization. Above all, they learned the important role of salt producers in eliminating IDD. The Worldwide Service Project—with its grand vision and lofty goal and the experience of all 8,000 clubs working to achieve a common goal—energized and united the members. This, perhaps, is the program’s most lasting legacy to the entire Kiwanis family.

7.2 Kiwanis/UNICEF Worldwide Service Project Partnership

As the programs moved forward, UNICEF experts worked with salt producers, various government ministries, national government officials, nongovernmental organizations, schools, and others to develop a country plan to be submitted to Kiwanis for support. The UNICEF-approved proposals included detailed budgets and timetables, which were submitted to Kiwanis International for consideration. An allocations committee was formed, made up of officers of both Kiwanis International and Kiwanis International Foundation. The allocations committee made funding recommendations after review of each proposal. Once a proposal had been approved, the requested funds were transferred to UNICEF. It
is important to note that, by agreement, all Kiwanis funds were used to support approved projects; no money was retained by UNICEF headquarters or its various country committees for administration or other uses.

Kiwanis received regular progress reports from UNICEF. In addition, Kiwanis members conducted on-site reviews with UNICEF staff members in a number of countries. Often the visiting Kiwanians met with government leaders to reinforce the value of the countries IDD-reduction efforts.

The Worldwide Service Project was immensely popular among the club members. By 2002, the Worldwide Service Project for IDD elimination had received more than US$76 million in cash and pledges, and Kiwanis had contributed more than US$60 million to the national IDD elimination programs in 90 countries through UNICEF. Along the way, Kiwanis built partnership with the salt producers, the International Council for the Control of Iodine Deficiency Disorders (ICCIDD), the World Health Organization (WHO), the Micronutrient Initiative (MI), and other organizations. These achievements firmly established Kiwanis International as an international service organization for children, and the name of Kiwanis and its contributions to promote universal salt iodization became known throughout the world.

The scale of this global effort provided Kiwanis the opportunity to monitor the effectiveness of its contributions and to report progress to Kiwanis members and Kiwanis supporters. The ability for members and their supporters to see the results being achieved by their contributions was vital to the continued success of the Kiwanis campaign.

7.3 Engaging the Kiwanis Membership

Kiwanis International is divided into regions called districts. These areas vary widely in size. In some cases, they encompass a number of countries. Other districts are defined by states or provinces—either individually or in groups. As of October 2002, Kiwanis clubs are located in 86 nations. Kiwanis International has nearly 300,000 adult members and more than 250,000 youth members.

Though Kiwanis adult and youth clubs have a long history of service to others, they never had partnered with one another internationally in a single, focused project. To gain member support for the Kiwanis campaign, Kiwanis International produced brochures and videos in a
number of languages to show members the significance of their support. Meetings were conducted at every level to educate Kiwanis members and their supporters of the problems associated with IDD, how it could be eliminated, and how Kiwanis International would lead the international effort. They were shown how Kiwanis funds, Kiwanis advocacy, and Kiwanis hands-on efforts could help change the world forever.

In addition, Kiwanis members visited countries that suffered from IDD. As the project started to show results, visits were made to countries that had benefited from Kiwanis’ support. These volunteers communicated their findings to the general membership, writing articles, taking photos, and making presentations to conventions, workshops, and meetings. In every case, they reported that the Kiwanis contributions were making a real difference in the countries visited. Often the relationships established during these visits resulted in long-term friendships between Kiwanians and the people they met.

The worldwide commitment of Kiwanis clubs to raise at least US$75 million to help eliminate IDD began a new era for Kiwanis International. It was the first time that Kiwanis members committed themselves to supporting projects outside of their communities and regions. It also was the first time that Builders Clubs (schoolchildren in middle schools), Key Clubs (high school students), Circle K clubs (college students), and Kiwanis clubs joined together to improve the lives of millions through one project. The Kiwanis Worldwide Service Project changed the definition of community for Kiwanians and unified the nearly 600,000 adult and youth members of the Kiwanis family.

The project energized the total organization. The Worldwide Service Project enabled the organization and its members to see the world as an opportunity for Kiwanis and its new partners to build a better world for children.

7.4 Kiwanis IDD Partnerships

Kiwanis money has been a catalyst for other investments, often leveraging private salt producer investments as well as supplemental aid from foundations and governments. Significant partnerships with non-Kiwanis organizations have been an important element of the progress Kiwanis has helped create.

As an example, Morton Salt, the largest salt producer in the United States, participated in the campaign in a number of ways. It produced 80 million boxes of iodized salt for sale to consumers and labeled each
container with information about the Kiwanis project. In addition, Morton made available 500,000 countertop and stand-alone collection canisters to help with fund-raising activities. One of the highlights of the Kiwanis-Morton partnership was a US$1,025,000 check presented to Kiwanis representing cash and in-kind donations made by Morton to the Kiwanis Worldwide Service Project.

Another early example of how the IDD program established important relationships was the development of its partnership with the Joseph P. Kennedy Jr. Foundation. Both groups are concerned about persons living with mental disabilities: the Kennedy Foundation through its support of Special Olympics and Kiwanis through its campaign to virtually eliminate IDD, the world’s most prevalent, preventable cause of mental retardation.

After presenting the Kiwanis story to the UN Foundation, which administers Ted Turner’s gift to the United Nations, the foundation provided Kiwanis a one-to-one $1 million matching grant. The resulting $2 million was used to fund projects in Africa’s goiter belt (Guinea, Central African Republic, Angola, Congo, and Chad).

7.5 Kiwanis Public Education and Advocacy

Kiwanis members often played a role in securing governmental financial support of UNICEF IDD programs. As an example Kiwanis members met with their elected representatives to brief them on the need for governmental support of the Kiwanis IDD effort. In addition, Kiwanis staff conducted annual meetings with US Congressional committee staff members to brief them on global progress and the need to support international aid to fund IDD projects. To reinforce the need, Kiwanis officers regularly testified at Congressional committee hearings. Each year upon congressional allocation of funds to IDD projects, Kiwanis staff and UNICEF staff meet with the US Agency for International Development (USAID) to identify countries for US funding of IDD projects. Often projects have required both USAID and Kiwanis funding for full implementation.

Similar Kiwanis advocacy took place in countries were there is a strong Kiwanis membership base. Due, in part, to Kiwanis advocacy, the governments of Canada, Belgium, Germany, Netherlands, USA, Australia, Japan, and others contributed large sums to the effort. This support has been a vital part of the global successes to date.

Kiwanis members contributed to the progress of the global effort through their advocacy and hands-on support of iodization efforts.
Kiwanis members have visited Albania, Bangladesh, Bhutan, Bolivia, China, Costa Rica, Ghana, Guatemala, Madagascar, Nepal, Pakistan, Panama, Philippines, Russia, Senegal, Sri Lanka, Thailand, Ukraine, and Vietnam.

The value of these Kiwanis visits was demonstrated during a visit to Russia. Kiwanians learned that salt-iodization equipment was being held in customs and would not be released until substantial duty had been paid. Kiwanis leaders met with leaders of the Russian government and strongly advocated the finding of a solution to the impasse. This created a strong movement in the government to the point that the chief of the Customs Committee—a position comparable to that of a vice-prime minister—announced that the committee waived for one year all excise duties providing time for UNICEF to negotiate a permanent solution.

In addition, Kiwanis members have been strong advocates of universal salt iodization in their own countries. In the Philippines, for example, Kiwanians took an active hands-on role both at the local and national levels. Kiwanis leaders meet regularly with UNICEF and others to develop strategies that will result in their people getting adequate iodine in their diets. Kiwanians have conducted meetings with government leaders and they continue to lobby for strong enforcement of a commitment for salt iodization throughout their country.

Kiwanis International is an active partner in the global coalition of agencies that are united around the elimination of IDD. Kiwanis continues its support of regular monitoring of country-level salt-iodization levels and the effort to assure iodization sustainability. The Kiwanis partnerships with health experts, salt producers, and others provides Kiwanis the opportunity learn where advocacy of its members can help ensure continued success.

Speaking as part of a United Nations panel titled “A Smart Start for Children: The Launch of the Network for the Sustained Elimination of Iodine Deficiency,” 2001-02 Kiwanis International Vice-President/Treasurer Bob Moore said: “Our task is not complete. We need to continue until we reach our goal, and then we must continue to monitor, educate, and publicize the importance of maintaining the supply of iodine. Kiwanis and our partners have made significant strides in this project in time and money. To protect that investment and maintain its important benefits for the people of the world, Kiwanis is dedicated to sustaining the elimination of iodine deficiency by continuing to work with our partners in this endeavor.”
Noting that Kiwanis believes children become the love they know, Moore emphasized that children should be given a chance to reach their full potential. “The elimination of iodine deficiency is a step in showing our love for children and giving them that chance.”
8

The Global Network for the Sustainable Elimination of Iodine Deficiency

David P Haxton

8.1 History and Rationale

8.2 Gradual Growth of the Idea

8.3 Salt 2000 and the Round Table

8.4 The Global Network
   8.4.1 National Coalitions
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8.6 International Collaboration in Laboratory Services

8.7 Conclusions
8.1 History and Rationale

*Plato is reported to have said:*

“The beginning is the most important part of the work”.

The history of national efforts to eliminate iodine deficiency disorders presents examples of progress that waned and failed. It is safe to say that the failures did not occur because of technical or scientific reasons. Rather, national vigilance declined due to little concern in political and industrial circles and limited public interest. A key underlying factor was the lack of persistent communication and education on the dangers particularly to the brain of iodine deficiency and the benefits of salt iodization in prevention.

Near the end of the last Century, it was clear that the health sector needed a success. Political and financial leaders were weary of annual appeals for illusive goals. Official development assistance was under heavy scrutiny in many Capitals. Theories of “development” itself were under analysis and early results indicated that new thinking and approaches were required to sort through the issues creating the differences between what was thought to be ‘development’ and what was called ‘foreign aid’. (Haxton, 1992)

Emerging from these discussions and analyses was the growing realization that national endeavors that had good success were those that attracted and combined the interests of all sectors of society (public, private, civil, scientific, cultural, etc). Because of this societal approach the ability to effect change was demonstrated effectively. With regard to elimination of iodine deficiency, there was no doubt that where successful nationally it was due to the active support and investment of salt producers underpinned by the national investment in oversight and foreign aid to the country.

As this realization set in, it also became evident that success would depend on public awareness of the dangers of iodine deficiency and its insistence on ensured protection from preventable brain damage.

Civil society and the sectors of education and agriculture gradually took up leadership roles. While much of this emerged as a natural consequence of program planning nationally, a good bit of the understanding of the need for collaboration between national entities arose from National Advocacy Events in many countries following the Global Summit for Children in 1990. National Advocacy Events involving political, religious, public and private sector leaders were held in China, Mongolia, Philippines, India, Pakistan, Botswana, Bolivia, Indonesia, Russia, among others.
National Advocacy Events were not the only source for the understanding for the need for national entities to blend their activities in directing the common national good. Many governments accepted, or renewed, their obligation to create national policy on iodine nutrition and establish standards. Concurrently, salt producers and traders saw the advantages to their businesses and to the nation of the need for only iodized salt for human and animal consumption. Gradually working harmony was created and collaborative actions increased. Civil society became more aware of the magnitude of the challenge to eliminate the scourge of iodine deficiency and supported the endeavor. The scientific community lent its considerable support recognizing the need for alliances to achieve the goal. Thus, gradually it came to pass that each entity added value to the national effort and steady progress in many places was recorded.

That is not to say that progress was uniform. The hesitant starts, the sluggish acceleration of the tonnage of appropriately iodized salt, the difficulty of obtaining investment funds for the vital infrastructure of laboratories and monitoring facilities and modernized packaging and improved logistics had an effect on the speed with which things got moving nationally. Delays were occasioned also by attempting to get all things into place before starting some things. But governments and others slowly realized that the private productive producers of salt held the power and facilities to provide the daily needs for iodine and to realize that good nutrition is good politics. And the producers began to see that good public nutrition is good business. The scientific and civil communities saw the advantages to nutritional progress of working together.

The gradual way in which international development agencies began to blend their roles in these efforts with others was a mirror reflection of the requirements for success nationally. The international groups held the view that progress should not be allowed to wane and fail again. In order to achieve the goal of Universal Salt Iodization (USI) and to sustain it over time it was obvious that a network of interested parties, each doing what it does best would be vital and it would assure maximum use of resources.

8.2 Gradual Growth of the Idea

At a meeting in Atlanta in spring 1999 informal discussion suggested that the international development agencies approach the organizers of Salt 2000, a gathering of salt producers and traders that takes place every seven years and seek insertion in the discussions of the recognized
value of salt producers and traders to USI, the first plateau on the road to elimination of Iodine Deficiency Disorders. Dr. van der Haar at Emory University was designated as the focal point for approaching the Salt 2000 management. This author was asked to visit with Salt 2000 leaders as they attended another convention in Ft. Lauderdale, Florida, USA. From these two interventions, the idea of ‘run up’ meetings to Salt 2000 arose and became accepted among the concerned organizations and the Salt 2000 organizers.

Two series of meetings followed. One stream involved discussions related to the substance of insertions by UNICEF, WHO, MI, ICCIDD, and KIWANIS International to the Salt 2000 meeting and the predictable follow-up consequences. The other avenue was to encourage and support regional gatherings of salt producers, traders and food processors.

These latter gatherings were seen as ways to promote effective attendance at Salt 2000 in The Hague; as ways to bring salt producers and traders and policy people from neighboring countries together; and ways in which to review progress to the goal accepted by all: USI. “Salt Producers Meetings” were held in Bogotá, Colombia; Kiev, Ukraine; Dakar, Senegal; Mombasa, Kenya; Dubai, UAE. The results of these meetings demonstrated: an interest in continued inter organization collaboration; the importance of assuring optimal iodine in the daily diet and achievement of sustained USI in each country; the value of working together to form national groups to ensure that progress will be sustained.

It became evident that a new approach to international collaboration was needed to accelerate and strengthen the organizational interests priority for:

(a) reaching the goal of Universal Salt Iodization and virtual elimination of Iodine Deficiency Disorders and

(b) assuring the placement of appropriate means to sustain these over time nationally.

It was proposed that a Global Network of interested bodies be formed. UNICEF and MI saw the advantage of this kind of approach and in collaboration with the leadership of Salt 2000 proposed that discussions be held on achieving USI and Virtual elimination of IDD

Considerable detailed information is available at www.sph.emory.edu/ PAMM/Salt2000/salt3.htm

Elimination as part of the discussions of the technical issues of Salt 2000. KIWANIS saw the potential as additional assurance of sustaining national activities undertaken in many places with grants from their resources.
Not only would this be new in international public nutrition work, it would be a significant challenge to draw together organizations with dissimilar structures, corporate objectives, and operating procedures and cultures. Simultaneously, the Salt 2000 leadership and senior officials from UNICEF, WHO, MI, ICCIDD, US CDC and Emory University, and KIWANIS formed a working group to look at the potential for a global “network” following from Salt 2000. A main purpose would be to create an instrument to assist in sustaining progress where significant and to accelerate it where flagging. The working group Walter Becky, CEO of Morton Salt of the US; Nettles Brown, former President of Kiwanis International; Frits van der Haar of Emory University; David P Haxton, Advisor to Micronutrient Initiatives, Justus du Jong of Akzo Nobel Salt, Venkatesh Mannar, President of MI and Werner Schultink of UNICEF met in The Hague, Indianapolis and New York and exchanged ideas and concepts by electronic means.

8.3 Salt 2000 and the Round Table

The 8th World Salt Symposium, “Salt 2000”, hosted by the salt industry in Europe, was held in The Hague in May 2000. At the festive opening plenary session, Mr. Floris Bierman, President of Akzo Nobel Salt, speaking for the producers present from around the world, said, “The issue of salt and health has become a central theme of this Symposium. In this respect, the attitude of the salt industry has certainly changed. Ten years ago, when our collaboration was called upon, we pointed at the respective national governments and said, ‘Let them prepare the laws and regulations, we will provide the product, and then all problems are solved’. Now, we know better. We go out and promote; we convey the message and we supply the technology.” This set the stage for subsequent discussions aimed at suggesting how this might be done by better collaboration and what might be required to achieve the goal.

A ‘Round Table’ was organized jointly by Salt 2000 and MI to take up the challenge. The Round Table concurred that the major issues for sustained USI and virtual elimination of IDD were:

i) communication and education and improved consumer information;
ii) Government support with clear and applicable policies;
iii) expansion and appropriate use of technology; and
iv) modern monitoring linked to immediate action.

At the Round Table were representatives of ESPA (the Host with Salt 2000), Salt Institute of USA, UNICEF, WHO, ICCIDD, World Bank, Canadian CIDA, Dutch Foreign Aid, KIWANIS International, Russian
Salt Corporation, Salt Commissioner of India, Micronutrient Initiative, Emory University, PAMM and USCDC.

Most organization representatives spoke in favor of the idea of forming a Partnership, but some felt that joining a network was not possible within current organizational practice. A few required further internal discussions. The Round Table suggested that an organizational meeting be held to draft a Partnership Network at an early date. A working group was formed which met in New York and Indianapolis and electronically.

The European Salt Producers Association offered to be Host at such a gathering in the Headquarters of Solvay in Paris later that year to consider proposals of the working group. All organizations represented at the Round Table were invited to send a representative to Paris. A temporary Secretariat was appointed in Emory University in Atlanta charged with preparing the Meeting and providing the necessary documentation. Some committees were formed to sort out preliminary and basic issues: organizational structure and procedures; finances; membership.

The Paris Meeting in January 2001 quickly came to grips with the immediate needs and proposed that a Partnership be formed and that it be comprised of a “Summit” of Leaders that would meet every 2 or 3 years and “The Alliance”, a Representative of each Member who would meet periodically to take up work plans, plus handle regular operating matters and report to the Summit appropriately for policy guidance. The Board would be supported by a small Secretariat with defined duties. Task Forces of Board Members…and/or other associates of a Member Organization would take on special assignments. The Summit as proposed by the organizers held only the one meeting at Salt 2000 and has not met since. However, the “Alliance”, later called the “Board”, has met periodically to look at a range of policy issues, propose actions for national consideration, arrange national evaluations and assessments, and organize international meeting on matters of particular and specific priority need.

Some basic principles were quickly agreed upon and remain the guiding ethic. Among the most important:

- To apply lessons learned, to avoid recognized past failures with a determination to avoid repetition;
- To come to grips with the delicate process of blending international assistance and national support appropriately and in so doing, reduce dependency upon international assistance judiciously and in timely fashion.
- National ownership of the endeavors is a *sine qua non* for sustained success.
- A major goal will be formation of National Coalitions in each country.
- The main thrust will be to take full advantage of the attributes of each Member and thus assure added value to collaborative effort.
- A commitment to avoid getting lost in the rhetoric of the goal.
- Agreement that for most undertakings, one Member be designated as “Lead” for the activity.
- To keep a lean and functional structure and not be a source for funding (Working group, 2000)

8.4 The Global Network

The major activities proposed by the Board of the Global Network were:

8.4.1 National Coalitions

National ownership is an evident requirement of the effort to eliminate iodine deficiency and to do so in ways that sustain optimal iodine nutrition levels. Except for modest foreign aid, which might have stimulated action, supported postponed investments and trained some personnel, most of the investment in achievement of USI is national in origin.

History in this field is replete with national efforts that reached high levels of protection for the population, sustained a plateau of success for a period, but gradually waned and allowed iodine deficiency to return to plague the population. The history of this work is recorded elsewhere, but suffice it here to note that such failures were mainly due to:

i) lack of political commitment and political will to sustain success and persistent effort to assure optimal daily iodine in the diet of all the people for all time;

ii) failure to understand elimination of iodine deficiency requires sustained and persistent effort to assure optimal daily iodine in the diet of all the people for all time;

iii) lack of those that had the knowledge of the problems and the dangers adequately to communicate with those that could act on the problem;

iv) lack of clear understanding of the need for private sector, public sector and professional sector interaction and collaborative support.

Thus, the Network pledged to direct its abilities toward these ends that would assure and sustain success. It asked each of its Members to encourage each of its national affiliates or outlets or subdivisions to seek out the equivalent units of other national entities and work out ways to form “National Watches” or “National Coalitions” where they do not exist, or to expand and strengthen such national IDD committees as may be found.
Permanence in elimination comes from a persistent regular concern for assuring quality and sufficiency. The most important is assurance of iodized salt production over time so that iodine levels in salt deliveries are always adequate; and that there is a sufficient supply for all at fair prices. Equally, there is a need for quality assured performance by the various elements of national society that support these continuous efforts: political commitment must be regularly renewed and invigorated; communications must be open, transparent and persistent over time. Finance is required for training and other support activity budgets—such as salt inspection and laboratory-based assessments. This needs constant management attention which might be called ‘an entrepreneurial approach to iodine nutrition’; even handed and transparent law enforcement including import guidelines is essential; public education must be penetrated so that all children learn of the needs for iodine and the dangers for brain cells of its deficiency; agriculture leaders need constant reminding of the value of iodine for domestic animal feeding. Finally, but vitally, there is a need for persistent and professional measurement of the progress in human iodine nutrition and the public reporting of regular monitoring through salt iodine and urine iodine measurements. All of these are national responsibilities but may benefit from support or collaboration with Members of the Global Network and from experience elsewhere.

National coalition membership will vary country by country. The essential issue is to assure that the national leadership comprises those most likely to retain interest and to keep people informed of the dangers of a lapse in iodine nutrition. Simultaneously helping to sustain quality production, quality national efforts, and quality public monitoring of human nutrition improvement. These will include sports, culture, political, religious, civic, labour, and business, commercial, professional, scientific and other national entities.

8.4.2 Public Relations and Communications

Planning and providing these services are as vital to the life of the Network as they are to national endeavors. The Board is dependent upon the Members to undertake effective communication within each organization and, as well, to support public communications on iodine nutrition regularly. The Secretariat has effectively used the Internet to communicate on a range of subjects.
8.4.3 Advocacy and Organization

A formal inauguration ceremony of the Global Network to Sustain Iodine Nutrition was held as a special event at United Nations General Assembly Special Session on Children (UNGASS) in New York in May 2002. (5)

Attended by 300 members of official delegations to the UN General Assembly Special Session, the Panel for this event included, Dr. Gro Harlem Brundtland, Director General WHO; Mr. Roger Moore, UNICEF Goodwill Ambassador; Ms. Khaleda Zia, Prime Minister of Bangladesh; Mr. Beriz Belkic, Chair of the Presidency, Bosnia and Herzegovina; Dr. Ali Mohamed Shein, Vice President of Tanzania; Mr. Dong Zhuhua, Chair, China Salt Producers’ Association; Mr. Floris Bierman, President, Akzo Nobel Salt; Mr. Walter Becky, President, Morton Salt; Mr. Robert Moore, Vice President, Kiwanis International; Ms. Susan Whelan, Minister of International Cooperation, Canada; Ms. Eveline Herfkens, Minister of Development Cooperation, the Netherlands; Mr. Tommy Thompson, Secretary, Department of Health & Human Services, USA; Mr. Anatoly Karpov, UNICEF Goodwill ambassador and former World Chess Champion; and Hilary Bowker, CNN International (panel moderator)

Under the leadership of the Salt Institute of North America, a meeting comprised mainly of senior officials of major salt producers from all the countries of the Americas was held in Miami in March 2002. (8) In addition to the Producers, senior officials of some governments and development agencies attended.

The major purposes of the meeting were:

i) to consolidate leadership for sustained elimination in the private productive sector;

ii) re-enforce the priority for establishing National Coalitions to assure continued progress in the Region; and to review what might be done collectively in the countries having difficulty in reaching the goal of USI. UNICEF agreed to take a lead in most countries to pull together a national coalition. WHO/PAHO agreed to press for any existing Ministry of Health unit to be part of the effort.

8.4.4 Tracking Progress

The Secretariat produced a “Global Scorecard” showing how each country stood in the progress toward Universal Salt Iodization. (6) The Scorecard, based on the best available data and statistics from Members, is an advocacy and management tool, not the usual statistical tabulation.
The Global Partnership

It ranks countries by the number of families with access to iodized salt, and, thus, with children protected from brain damage. A review of the Scorecard gave the Board of the Network an overview of issues commanding its attention.

Countries in the group having achieved 90% household access or more were considered virtually successful and encouraged to seek a Network sponsored assessment to confirm the status using published UNICEF/WHO/ICCIDD standards.

Countries in a group with reported access to iodized salt of between 50% of households to 90% were encouraged to review their national efforts to assure that the strategic plans in place were adequate and on track and, if thought needed, to seek collaboration from the Network to make reviews, or adjustments.

Countries in a third category (less than 50%) were noted as obviously lagging behind expectations and needs. Each requires a different review taking the range of factors in each national situation into account. UNICEF and WHO in each country are asked to encourage such requests from governments and their partners.

8.4.5 National Assessments

The Secretariat, with the aid of a subcommittee of the Board, produced a “Guideline for National Reviews” which was approved by the Board. It was based on the assumption that a Government, before seeking foreign collaboration for a review would assure that all available data had been reviewed and the conclusion reached that such a review was indicated. Taking that into account, UNICEF and WHO Representatives would, if in agreement, forward the request to the Network Chair following which the ICCIDD would take the lead to solicit from all Members of the Board suggestions for the appropriate talent to meet the revealed demands of the national situation. A team would be named by the Chair of the Network, approved by the Government, a review undertaken and a report issued. Guidelines for undertaking the assessment were prepared and adjusted as progress unfolded. National Assessments under the aegis of the Partnership/Network have been completed in: Macedonia; Panama; Peru (April 2004); Thailand (2004); and Bhutan. Assessments of or technical assistance to specific elements in national endeavors have been provided by various Members of the Network (in addition to normal comitments) to: Central Asian Republics; Kazakhstan; India; Indonesia; Myanmar; Guatemala; Haiti; Dominican Republic; Lithuania and Russia.
Further to assist national reporting on progress and to suggest a uniform method of gathering information for analysis, the Network has designed a Matrix for reporting to be used by all Members.

**8.4.6 Iodine Nutrition in Industrialized Countries**

In the global thrust virtually to eliminate IDD, actions aimed at problems in Western Europe were never seen as priorities by development agencies. However, repeated reports from the European Salt Producers Association, from ICCIDD and from WHO indicated the significance of the problem in many countries. Constant vigilance in industrialized countries is as important as it is in developing countries. The myth that only poor countries suffer from the stealthy scourge of iodine deficiency is false. Encouraged by the undisputed evidence, the European Salt Producers Association (ESPA) suggested that the Network become involved in actions in Europe to address the situation. Discussions were held in Ghent, Belgium, (2002) and more recently (end 2003), ESPA proposed a joint approach by the Network to the European Union to seek attention to the problem. It needs also to be noted that evidence shows an increasing on the problem in Australia, New Zealand and other parts of the industrialized world.

The problems of IDD in Europe are described elsewhere in this book. Suffice here to indicate that the difficulties in achieving USI in Europe include a number of issues, all of which need to be addressed more or less simultaneously for maximum result. There are different laws and rules in each country, and the European Union is expanding its membership. Some countries use potassium iodate, others potassium iodide. In many places, iodine is added to other consumable products but this undermines USI and the concept of accepting the recognized norm for appropriate delivery to all people. Many food processors do not use iodized salt in their processing of manufactured food products. Consumers have the right to choose among a variety of products which presents a danger since consumer awareness of the dangers of iodine deficiency are not widespread. Moreover, many who now buy iodized salt do not know the underlining reasons for the purchase.

Even where national average data and information seems to indicate ‘full protection’, a look at the recommended diet and intake for pregnant women reveals that iodine intake is reduced in the very group most vital to prevention.

ESPA proposed at the Beijing Meeting of the Network Board that all Members agree on a common approach to the challenge of seeking
European Union support for USI while simultaneously encouraging public support for USI in each country. This is an approach that demands widespread participation and involvement of all Members of the Network with outlets in Europe and will entail close collaboration in each country for an effective public information / consumer awareness undertaking so that approaches to the EU are supported by an informed public opinion.

8.4.7 Special Situations

By 2005, each Government in the world is asked to prepare and share a plan for improved conditions of children and women as agreed at the UN Special Session on Children. This would be an opportune time to present significant and important information to each to assure protection from brain damage for succeeding generations. National constituents of Board Members can be most influential in making this happen especially if done through a National Coalition. Not only would it be useful in each nation, but it would create the tendency to assure cohesion among and between neighboring States Members of the Regional Bodies (like EU, SAARC, ASEAN and others) which would aid in getting standards and guidelines uniform.

8.5 The Beijing Conference

The Board of the Network in 2002 proposed to meet in Beijing, PRC, sometime during 2003 to coincide with the planned gathering in China of the leaders of the national effort to achieve USI and virtually eliminate IDD. Learning from lessons of experience was agreed as a guiding principle in Network policy, and the Board felt that significant lessons could be learned and shared from the experience in China. To connect the Board Meeting with the Re-advocacy Event in Beijing involved discussions with the Government of the PRC. UNICEF was asked to take the lead in this undertaking.

As planning for the meeting became accelerated, it was quickly concluded that a wider international gathering allowing others to exchange views on progress and obstacles would produce beneficial results. It would also add impetus to the acceleration of national efforts toward the goal of USI. While a small management team prepared a list of countries that might be invited and guidelines for reports to the meeting itself, UNICEF in the name of the Board invited each to send a delegation at the Ministerial level to discuss:
Global Elimination of Brain Damage Due to Iodine Deficiency

i) achievements toward USI and
ii) lessons learned in that process and
iii) proposals to overcome hurdles identified.

Each invited Government was asked to form a team representing the major interests in the effort, to prepare a short report on progress to date, and to highlight significant lessons learned and serious bottlenecks encountered. To assure maximum attention on the issues involved in the work while respecting diplomatic requirements and protocol, an agenda was agreed upon which derived its format from the lessons learned in the successful endeavor in China. (China IDD control programme, 2000) National reports were asked to use this guideline in preparation.

The topics covered in the Beijing Meeting were:
- The need to keep public and official consciousness high.
- The need to sustain political commitment.
- Lessons regarding Multi-Sector collaboration
- Lessons on law enforcement and regulatory practice regarding USI
- Experiences from information and consumer education and from social mobilization efforts
- Experience in maintaining good monitoring and evaluation
- Practice of good scientific prevention measures.
- Priority to improve quality and productivity of IDD elimination staff in all sectors.
- Experiences in strengthening scientific research

In summary, the reports and statements confirmed that progress is rapid and durable when open and collaborative relationships exist between public and private sectors nationally. Monitoring also improves. In order to sustain progress, it seems imperative to obtain the full support of the food processing industries. In addition, the agriculture sector can be a valuable ally. Unless the education system is fully penetrated with the knowledge of the value of iodine and the dangers of its absence and the value of persistent consumption of iodized salt, knowledge will not automatically transfer from one generation to the next.

It confirmed the lesson learned that there is a need to market even the most beneficial of services since it is clear that it is not sufficient to just design a service… or a program…. and propose it to officials, public and private, and hope for active political and other support for a decade or so. Just as immunizing children against disease and illness must be
The Global Partnership

promoted as regularly as the arrival of babies and mothers who bear them….iodized salt must be marketed and the issues surrounding IDD must become market issues. Iodized salt needs to be the new norm.

Many national reports indicate major logistical challenges: need for road improvement; storage and logistics; modern packaging; reaching outlying population groups; border protection and control of entry of non-iodized salt. Unlocking the stalemate between lack of iodized salt and the need to expand markets in difficult to reach locations will require senior management and entrepreneurial attention, imaginative realignment of resource application, and improved monitoring.

A few reports tell of the formation of salt associations. Selling iodized salt to small, dispersed, nomadic, tribal or remote populations was not a feature of reports. In good part, absence of the product among such groups might relate to lack of incentive to sell it in those places. Perhaps this is a management and logistical challenge to address soon. Producers will provide the product, but they would prefer to do so at even a modest profit. (Governments might look at ways to collaborate in ways that assure that iodized salt is available in all locations in ways somewhat similar to police or army protection, mail delivery or voting activities.)

8.6 International Collaboration in Laboratory Services

Under the leadership of the Centre for Disease Control (CDC) (US Public Health Service, Atlanta), the Network assisted in expanding a global network of recognized laboratories that governments and others could use to confirm monitoring results and minimize operational costs. The International Resource Laboratories for Iodine (IRLI) sustains exchanges and contacts with 12 referral laboratories in 12 countries. (7)

The IRLI Network, although still in the embryonic stage of development has the potential to become self sustaining in 3 to 5 years and can serve as a valuable resource for other laboratories in their regions by providing the fundamentals of testing, providing knowledge of the latest developments in technology, such as the WYD Iodine checker, assuring the standardization of techniques between the countries of the region and, thus, quality assurance. The IRLI Network will provide a trusted and reliable source laboratory to which program managers in neighboring countries can periodically send urinary iodine samples for testing. The IRLI Network is promoting a paradigm shift in thinking and encouraging member labs to develop marketing plans for their services.
Such plans would emphasize the added value brought to labs in the region. In addition it is a way to set up fair and equitable cost recovery mechanisms for services rendered. CDC has furnished the Network labs with everything they need to launch this new approach and UNICEF is providing the necessary computer hardware.

8.7 Conclusions

In perspective of history, the developments in accurate understanding of the problem of iodine deficiency, the enormity of its human and economic impact, and the best ways of tackling it have undergone an extraordinary transition with an ever-contracting timetable. Iodine deficiency has been around for millennia; but it took several centuries for the conclusion to be reached that goiter, cretinism, and associated brain damage long depicted in historical paintings and statues was caused by a minute deficiency of a simple natural element in the daily diet. Realization of the unique effectiveness of the straightforward solution, universal salt iodization, took less time to take hold–a few decades only. It remains a challenge to meet the commitment within the time set by the UN to put the solution permanently in place for preventing the evil of this age-old stealthy scourge.

As development has taken hold and as old practices yield to unfolding knowledge and modern management, changes take place. In this process both the system involved and the people involved are changed both by external influence and by internal learning and application. With the push for accepting USI as the major strategy for achieving the goal of virtual elimination, rapid improvements were seen in salt iodization practices. The desire to expand and consolidate these gains, when combined with the imperative to ensure permanence, was the crucial underlying reason for close collaboration of concerned organizations and governments. This Chapter has set out to illustrate some of the more recent ideas, concepts, initiatives, agreements and events that took place during the short time of the past two decades. It now seems safe to suggest that the public sector…often in places hesitant to work directly with the private sector…has seen that the success of this venture to eliminate IDD depends upon recognition that the application of the agreed upon solution lies in private and civic hands. The private sector…equally hesitant about working on (what had been perceived as) public sector activities…sees that fair and transparent government oversight to protect public nutrition
is good and benefits all. Pulling divergent interests with different mandates into a cohesive network demands political leadership. The challenges remain of working together globally for identified goals, only achievable when national entities also pool resources for mutual benefit, and accepting each Member for what it can contribute best to the single vision. But much has been accomplished and upon that much can be built.

The resources of the combined members of the Network are available to collaborate with national efforts and in so doing will provide a wider range of assistance than heretofore available through any one entity interested in the work. For all too long there was an implicit assumption that if the technical advice provided to a program were sound the service or program would succeed. This assumption has been abundantly proven to be inadequate. There is a need to discuss operational issues; to understand the relationship between what is proposed and other priorities like poverty reduction, productivity, education; and a need to understand how things work nationally. To sustain success an entrepreneurial stance to public health nutrition will be beneficial and will help to meld the interests of the public and private sectors in this vital human endeavor.

The current Network is remarkable in its composition. There is no other operating collaboration comprising public, private, scientific, and civic and development aid entities in the field of nutrition. It is unique in this regard and it is also unique in that it does not finance national development activities but rather encourages national entities to undertake those responsibilities, perhaps with foreign development collaboration through some official channel.

(*) The text of this chapter was shared for comments with the Chair of the Network, Dr. Rainer Gross of UNICEF, the former Chair, Dr. Werner Schultink of UNICEF, and the Secretary, Dr. Frits van der Haar, of Emory University. The comments were enormously helpful but the author remains solely responsible for errors and omissions.

References

5. “Preventing Brain Damage from Iodine Deficiency Requires Partnership”, Briefing Note for UN Special General Assembly on Children.


7. Plan for International Resource Laboratories for Iodine (IRLI) and Reports on Progress, produced by USCDC, Atlanta, Georgia.


9

The International Council for Control of Iodine Deficiency Disorders (ICCIDD)

B S Hetzel & J T Dunn

9.1 Founding of the ICCIDD

9.2 The ICCIDD Network

9.3 The Activities of the ICCIDD
   9.3.1 Global
   9.3.2 Regional
   9.3.3 National

9.4 Sustainability

9.5 The Future

9.6 Conclusion
9.1 Founding of the ICCIDD

The international public health community, including the international agencies, needed to be made aware of the public health implications of the relation between iodine deficiency and brain damage. As described in Section II a beginning was made with a Symposium at the 4th Asian Congress of Nutrition in Bangkok (Lancet 1983). This aroused the interest of several prominent nutritionists. After this an invitation was extended by the UN Subcommittee on Nutrition (SCN) through the Australian Government for preparation of a Report on a proposed Global Program for the Elimination of Brain Damage due to Iodine Deficiency. This Report, which was later published (Hetzel 1988) included a review of the scientific evidence, a model for a national prevention program and then a proposal to establish the International Council for Control of Iodine Deficiency Disorders (ICCIDD) as an expert advisory group available to agencies and governments. Approval for the establishment of the ICCIDD was given in 1985 by the SCN at its meeting in Nairobi (Lancet 1986).

The ICCIDD was initiated in March 1985 at a Symposium in Delhi at the time of a WHO/UNICEF Intercountry Meeting. A group of 12 thyroid scientists and public health professionals, including WHO and UNICEF representatives, agreed to go forward with initial support from the Australian Aid Program (AusAID), UNICEF and WHO. The ICCIDD was formally inaugurated in Kathmandu, Nepal (March 1986) with messages of support from the Director-General of WHO (Dr Hafdan Mahler) and the Executive Director of UNICEF (Mr James Grant) (Lancet 1986).

In 1987 the ICCIDD was recognised as the expert group on all aspects of the iodine deficiency disorders (IDD) by the UN System through the UN Subcommittee of Nutrition (SCN). In 1994 the ICCIDD was officially recognised by WHO as an NGO working collaboratively towards the elimination of IDD by the year 2000 (Hetzel and Pandav 1996).

From its foundation the ICCIDD accepted technical assistance to national programs as the first priority. This led to a close working relationship with governments of countries with severe IDD (usually Ministries of Health) and with the leading international agencies WHO and UNICEF. The 1986 World Health Assembly (WHA) passed a Resolution sponsored by Australia, which noted this new aggressive approach to the prevention and control of IDD (WHO 1986).

This was followed by WHA Resolutions in 1990, calling for elimination of IDD by the year 2000 and a Resolution in 1996, calling for
sustainability of the program through systematic monitoring. Both included reference to the role of the ICCIDD and its availability to assist countries.

In 1990 the World Summit for Children accepted the goal of the virtual elimination of IDD by the year 2000, which provided major political support for country programs (see further Section II, VI and VII).

9.2 The ICCIDD Network

The ICCIDD now consists of a multidisciplinary global expert network of over 700 professionals from about 100 countries. This network includes scientists, public health administrators, technologists, communicators, economists, salt producers and other experts, who are committed to assisting national governments and international agencies in the development of national programs for the elimination of IDD. More than half, are from developing countries. Membership is free and open to qualified professionals with an interest in IDD.

The ICCIDD logo is shown in fig 1. It emphasises the relevance of the brain to its work.

The Inaugural Meeting took place in Kathmandu, Nepal in March 1986.

A review of all aspects of IDD public health programs was carried out, which led to the subsequent publication of a book entitled: “The Prevention and Control of Iodine deficiency Disorders” (Hetzel et al 1987).

A Constitution was adopted with subsequent registration of the ICCIDD as a Non-Government Organization (NGO) in Australia.

In accordance with the Constitution, an Executive Committee was elected which included a Chairman, Vice Chairman, Executive Director and Secretary.

The ICCIDD Founding Office Bearers and Board Members are listed in Table 1.

The ICCIDD was very fortunate to have Dr JB Stanbury and Dr V Ramalingaswami as Chairman and Vice Chairman respectively. Their international reputations for pioneering research on iodine deficiency provided an immediate boost to the scientific status of the organization, in both developed and developing countries.

The ICCIDD has been able to attract the support of a substantial group of scientists and public health professionals with experience of IDD over the nearly 20 years since its birth in 1985.
Table 1. The ICCIDD Founding Office Bearers and Board Members (1986)

The initial “Office Bearers” were:

<table>
<thead>
<tr>
<th>Role</th>
<th>Name and Nationality</th>
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<tbody>
<tr>
<td>Chairman</td>
<td>JB Stanbury (USA)</td>
</tr>
<tr>
<td>Vice Chairman</td>
<td>V Ramalingaswami (India)</td>
</tr>
<tr>
<td>Executive Director</td>
<td>BS Hetzel (Australia)</td>
</tr>
<tr>
<td>Secretary</td>
<td>JT Dunn (USA)</td>
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The following were appointed as Regional Coordinators (following the WHO Regions):

<table>
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<tr>
<th>Region</th>
<th>Coordinator and Nationality</th>
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<tbody>
<tr>
<td>African Region</td>
<td>OL Ekpechi (Nigeria)</td>
</tr>
<tr>
<td>SE Asian Region</td>
<td>CS Pandav (India)</td>
</tr>
<tr>
<td>American Region</td>
<td>E Pretell (Peru)</td>
</tr>
<tr>
<td>European Region</td>
<td>F Delange (Belgium)</td>
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<tr>
<td>Western Pacific Region</td>
<td>T Ma (China)</td>
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In addition Founding Board Members included the following:

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<tr>
<th>Name</th>
<th>Nationality</th>
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<tbody>
<tr>
<td>M Benmiloud</td>
<td>Algeria</td>
</tr>
<tr>
<td>R Carriere</td>
<td>(UNICEF, Delhi)</td>
</tr>
<tr>
<td>N Chawla</td>
<td>(Consultant to UNICEF, India)</td>
</tr>
<tr>
<td>G Clugston</td>
<td>(WHO Delhi)</td>
</tr>
<tr>
<td>MC de Blanco</td>
<td>(Venezuela)</td>
</tr>
<tr>
<td>R DeLong</td>
<td>(USA)</td>
</tr>
<tr>
<td>E De Maeyer</td>
<td>(WHO Geneva)</td>
</tr>
<tr>
<td>R Djokomoejanto</td>
<td>(Indonesia)</td>
</tr>
<tr>
<td>MH Gabr</td>
<td>(Egypt)</td>
</tr>
<tr>
<td>FP Kavishe</td>
<td>(Tanzania)</td>
</tr>
<tr>
<td>N Kochupillai</td>
<td>(India)</td>
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<tr>
<td>D Lantum</td>
<td>(Cameroon)</td>
</tr>
<tr>
<td>TZ Lu</td>
<td>(China)</td>
</tr>
<tr>
<td>MGV Mannar</td>
<td>(UNICEF Consultant, India)</td>
</tr>
<tr>
<td>R Manoff</td>
<td>(USA)</td>
</tr>
<tr>
<td>G Medeiros-Neto</td>
<td>(Brazil)</td>
</tr>
<tr>
<td>C Thilly</td>
<td>(Belgium)</td>
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<tr>
<td>F Van der Haar</td>
<td>(The Netherlands)</td>
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</table>
The ICCIDD has also enjoyed a close working relationship with the World Health Organization and UNICEF. This was initially established with Dr Graeme Clugston, Director of Nutrition and Development for WHO and Dr Peter Greaves, Senior Advisor on Micronutrients at UNICEF.

Notable contributions have been made by former senior UNICEF officers, Mr David Haxton and Professor Jack Ling.

The Executive Director’s position has been full-time, the others being part time.

From 1986 to 2001 the ICCIDD Administrative Office was that of Dr Basil S Hetzel in Adelaide, South Australia who served as the Executive Director (1986-1995) and then Chairman (1995-2001). He also served as Treasurer for this period, assisted by an annual audit by Mr Peter Kirk of Deloitte Touche Tohmatsu, Adelaide.

In 1995 Dr Francois Delange (Belgium) became Executive Director and served until 2001.

In 2001 the office was transferred to Ottawa with the appointment as Treasurer of Dr Peter Walker, Dean of the Faculty of Medicine at the University of Ottawa, Ottawa, Canada. The ICCIDD Constitution was originally drawn up to meet the requirements of an Australian NGO. It has now been modified to meet the requirements of a Canadian NGO with the appointment of Directors instead of Board Members. The ICCIDD is now registered as a Canadian NGO with (in addition) approval as a Charitable Organization in Canada. The ICCIDD was indebted to Mr Robin Ritchie QC of Ottawa for the necessary legal advice to make this transfer.

The ICCIDD now has a Governing Board of Directors of 40 members, half from developing countries and the international agencies. The Board of Directors meets annually, usually in conjunction with a Regional meeting or a Special Workshop. The current Board of Directors is listed in Table 2 with a photograph (April 2001) and brief biographies in ICCIDD Appendix 1.

In March 2001 Professor Jack Ling (USA) succeeded Dr Hetzel as Chairman and Dr John Dunn (USA) succeeded Dr Francois Delange as Executive Director.
Table 2. ICCIDD Board of Directors (2001-2004)

Executive Committee
- Prof. J Ling (Chair) (USA)
- Dr GN Burrow (Vice Chair) (USA)
- D JT Dunn (Executive Director) (USA)
- Dr PL Jooste (Secretary) (South Africa)
- Dr P Walker (Treasurer) (Canada)
- Mr MG Venkatesh Mannar (Canada)
- Ms J Mutamba (Zimbabwe)
- Dr S Sinawat (Thailand)

Chairman Emeritus
- Dr BS Hetzel (Australia)

Committee Chairs
- Dr H Burgi (Science/Technology) (Switzerland)
- Dr GN Burrow (Development)
- Mr R Hanneman (Salt) (USA)
- Mr D Haxton (Liaison) (USA)
- Prof J Ling (Communication)

Regional Coordinators
Africa
- Dr D Lantum (RC) (Central Africa and Madagascar Subregion) (Cameroon)
- Dr J Egbuta (West Africa Subregion) (Anglophone) (Nigeria)
- Ms J Mutamba (South/East Subregion)
- Dr T Ntambwe (West Subregion) (Francophone) (Republic of Congo)

Americas
- Dr E Pretell (RC) (Peru)
- Dr E Boy (Central American/Caribbean Subregion) (Guatemala)

Asia Pacific
- Dr C Eastman (RC) (Australia)

China-East Asia
- Dr Zu-pei Chen (RC) (China)
Table 2. ICCIDD Board of Directors (2001-2004) (Contd.)

<table>
<thead>
<tr>
<th>Region</th>
<th>Directors</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Europe/Central Asia</td>
<td>Dr G Gerasimov (RC) (Russia)</td>
</tr>
<tr>
<td>South East Asia</td>
<td>Dr CS Pandav (RC) (India)</td>
</tr>
<tr>
<td>Middle East</td>
<td>Dr F Azizi (RC) (Iran)</td>
</tr>
<tr>
<td>West/Central Europe</td>
<td>Dr A Pinchera (RC) (Italy)</td>
</tr>
<tr>
<td>Other Directors</td>
<td></td>
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<tr>
<td></td>
<td>Dr E Asibey-Berko (Ghana)</td>
</tr>
<tr>
<td></td>
<td>Dr F Delange (Belgium)</td>
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<tr>
<td></td>
<td>Dr GR DeLong (USA)</td>
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<td></td>
<td>Mr Z Dong (China)</td>
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<td></td>
<td>Ms AM Higa (Peru)</td>
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<td></td>
<td>Dr IS Hussein (Oman)</td>
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<td></td>
<td>Dr L Ivanova (Bulgaria)</td>
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<td></td>
<td>Mr L Locatelli-Rossi (Zambia)</td>
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<td></td>
<td>Dr G Maberly (USA)</td>
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<td></td>
<td>Mr RL McCurley (USA)</td>
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<td></td>
<td>Mr B Moinier (France)</td>
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<td></td>
<td>Dr CS Pittman (USA)</td>
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<tr>
<td></td>
<td>Dr R Sheikholeslam (Iran)</td>
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<td></td>
<td>Dr C Thilly (Belgium)</td>
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<td></td>
<td>Dr C Todd (Belgium)</td>
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<td></td>
<td>Dr P Vitti (Italy)</td>
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<tr>
<td></td>
<td>Dr Yan Yuqin (China)</td>
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<td>Dr M Zimmerman (Switzerland)</td>
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</table>
9.3 The Activities of the ICCIDD

The work of the ICCIDD has developed at 3 different levels:
9.3.1 Global
9.3.2 Regional
9.3.3 National

9.3.1 Global Activities
These are listed in Table 3.

At the global level the ICCIDD has been successful in greatly increasing the awareness of IDD as an international health problem of major importance within the UN System and beyond. It is now recognised by WHO that iodine deficiency is the single most important preventable cause of mental defect in the world today.

The ICCIDD has participated fully in a series of meetings with WHO and UNICEF concerned with different technical aspects of control programs such as the Methods of Assessment and the Criteria for Elimination (WHO/UNICEF/ICCIDD 2001). The ICCIDD plays a special role in adapting scientific information for public health recommendations.

Applied research has been another important activity including the determination of the optimal dosage level (duration and effectiveness) for iodized oil when given by mouth and a simplified method for the
determination of urinary iodine. These and other such studies have provided important guides for future public health practice.

The ICCIDD has collaborated closely with WHO and UNICEF in short term training programs for country program managers in technical procedures such as ultrasonography, the measurement of thyroid size, laboratory methods for the measurement of urinary iodine excretion and blood TSH. Multidisciplinary training for a longer term (up to six months) has been carried out by the Program Against Micronutrient Malnutrition (PAMM) jointly organised by the Centre for Disease Control (CDC) and the School of Public Health, Emory University in Atlanta, USA.

The ICCIDD maintains a databank on Country Programs, which is continuously updated. It provides monitoring details on progress towards the goal of elimination.

Current data are shown in the tables in Appendix 1 of this book and in the global map on iodine nutrition for each country.

Finally, publications have been very important to the creation of an informed group of professionals throughout the world. These include the IDD Newsletter published by the ICCIDD quarterly since 1985 (edited by Dr JT Dunn) with a circulation of 4400. The IDD Newsletter has since 1985 provided a unique series of Reports on IDD at country level as well as scientific and technical developments.

9.3.2 Regional Activities

The ICCIDD has Regional Co-ordinators for Africa, America, Asia Pacific, South East Asia, China-East Asia, West and Central Europe, Eastern Europe and Central Asia and the Middle East (Table 2). In Africa four Subregional Coordinators are responsible for countries in the West (one each) for Anglophone and Francophone, Central and Southern Eastern Regions. Each Regional and Subregional Coordinator is a member of the Board of Directors and makes an annual report on IDD activities in the region and also takes appropriate initiatives including consultancies to individual countries to promote national programs.

A significant factor in the development of national programs has been a series of Regional meetings held since 1986 throughout the world by the ICCIDD with the support of WHO and UNICEF. These meetings have been attended by country representatives, from the Ministries of Health and other important sectors, such as the salt industry and media in relation to National Programs. These meetings took place Yaounde (Cameroon) 1987, in Delhi (India) 1989, in Dar es Salaam (Tanzania)
1990, in Tashkent (Former USSR) 1991, in Brussels (Belgium) 1992, Alexandria (Egypt) 1993, Quito (Ecuador) 1994, Dhaka (Bangladesh) 1995, Harare (Zimbabwe) 1996, Munich (Germany) 1997 and Beijing (China) 1998. More recently a Regional Meeting was held in Chiang-Rai (Thailand 2003) and in 2004 will be held in Lima, Peru.

It is through these Regional meetings that the experts within the ICCIDD network have been able to communicate with professionals from many countries. This has subsequently developed further with consultancies and further contacts designed to identify obstacles to progress and remove them.

Progress has been notable in Africa. At the first African Regional meeting (Yaounde, Cameroon in 1987), only 22 countries were represented. In 1996, 45 countries were represented including Zaire, Angola, Mozambique and Eritrea in spite of the occurrence of civil war in these countries (WHO/UNICEF/ICCIDD 1997).

At these Regional meetings a model for a National Program (the 'wheel' model) has been presented to show its multisectoral nature and the relation between the different elements (see Sections II, VII, VIII)

The expertise required includes nutrition, endocrinology, epidemiology, laboratories (salt iodine, urine iodine) advice regarding planning, education, communication, management, iodized salt and other iodine technologies relevant to National Programs. This is met by the ICCIDD multidisciplinary network.

9.3.3 National Activities

National activities have followed from the Regional Activities already described. In the last two years ICCIDD members have been appointed as National Representatives to provide advice and support for National Programs in their countries and to promote the formation of National Coalitions for sustainable optimal iodine nutrition. Such appointments have progressed in all Regions.

9.4 Sustainability

The next challenge being faced by the ICCIDD and its partners in relation to the success of universal salt iodization (USI) is the issue of sustainability. It is well known that past success has been followed by failure due to a variety of factors. In Guatemala and Colombia in South America, it was due to political changes and social upheaval, and in the former USSR countries, to complacency and apathy following initial
success. In China it was the Cultural Revolution. More recently in Brazil
the federal government has relinquished responsibility for salt iodization
to the salt industry as part of a policy of decentralization, which poses a
threat to sustainability.

The list of the requirements for sustainability, are laid out in a recent
Report (WHO/UNICEF/ICCIDD 2001) and they are fully discussed in
Section IX.

The cooperation of the salt industry in providing good quality iodized
salt is very important to the sustainability of the elimination of IDD. The
Global Salt 2000 Symposium at The Hague, following an earlier ICCIDD
Seminar at the previous Salt Symposium in Kyoto in 1992, resolved to
support the elimination of IDD. Subsequently a Global Network for the
Sustainable Elimination of Iodine Deficiency’ has been established with
the support of UNICEF, WHO, the Salt Institute (USA), ESPA (European
Salt Producers Association), ICCIDD, CDC, MI and Kiwanis
International. This Network was formally launched at the time of the
UN General Assembly, Special Session on Children (UNGASS), New
York (May 2002). Special efforts are now being made by the salt industry
to ensure quality control and other measures (see further Section III Global
Network).

The need for an independent evaluation of progress at country level
was first raised by the ICCIDD with WHO and UNICEF in 1993. A
Resolution was passed by the 1996 World Health Assembly pointing out
the need for monitoring and evaluation in order to ensure sustainability
of programs and the availability of the ICCIDD to assist. Since 2000 a
series of country evaluations have been led by the ICCIDD including for
the Global Network since 2002.

Reports on the Regions and Countries and Regions by ICCIDD
Regional Coordinators are included in Section VIII. These indicate some
successful programs but there is still some considerable distance to go
before global elimination can be achieved.

A Conference of National ICCIDD Representatives from countries
in Western and Central Europe held in Goteborg, Sweden (Vitti et al
2002) indicated that more than half the population in the Region is at risk
of iodine deficiency. The Conference pointed out ‘that most countries
have weak to non-existent government programs to address the problem.
Consequently much of the responsibility is shouldered by others especially
thyroidologists, the health sector, academic institutions and the salt
industry. National Coalitions of these groups can and should play a major
part in achieving and sustaining optimum iodine nutrition in the continent'. Similar considerations apply to the other regions, especially in Africa (see further Section VIII).

9.5 The Future

The need for an international non-government organization with relevant scientific expertise is indicated by the importance of the ICCIDD in the establishment of country programs throughout the world since 1986. Continued monitoring in order to ensure sustainability often requires international assistance—including that of WHO, UNICEF and the ICCIDD. It is not possible for WHO and UNICEF to provide IDD specialist staff in view of many other pressing needs. So the ICCIDD network plays an important complementary role to these major Agencies.

The role of the ICCIDD in the global partnership has been discussed in a recent Round Table in the Bulletin of the WHO (Hetzel 2002). Emphasis was laid on the role of the ICCIDD in communication, advocacy, implementation and sustainability of country programs with UNICEF and WHO in the global partnership.

The ICCIDD has provided stability of personnel and purpose in contrast to national government and agencies where changes are more frequent.

An updated ICCIDD Mandate was adopted in April 2001, following a special Board of Directors consultation (ICCIDD Appendix 2).

The maintenance of effective national programs for the elimination of IDD as a cause of brain damage is the responsibility of national governments. This emphasises the political aspect, which has been highlighted by the current situation in India. At the Federal Government level there has been a recent reversal of the ban on the sale of non-iodized salt, which had previously been approved in 22 States and 6 Union Territories. The ICCIDD Regional Coordinator for South-East Asia, with ICCIDD colleagues in Delhi, continues to maintain an active scientific advocacy dialogue with peoples representatives, policy makers and the media (see further Section VIII) A Public Interest Litigation (PIL) has been filed in the Supreme Court of India. An action to reinstate the ban awaits decision by the Supreme Court of India.

The ICCIDD expertise needs to continue to be available to governments and agencies, with continuity of existing funding sources or alternative sources of support.
The ICCIDD budget is modest—approximately $1 million per year of which $500,000 to 600,000 is core—this is provided now mainly by the bilateral donors, Australia, Canada, Holland, with past support by the World Bank, UNICEF and WHO. In recent years UNICEF and WHO support has been provided to assist the attendance of country program staff at meetings. UNICEF provides support for the *IDD Newsletter*. The ICCIDD also receives support for Special Projects. This modest support needs to continue for the ICCIDD itself to be sustainable!

There is a need for the continuing recruitment of new ICCIDD members. New members with relevant expertise in nutrition, epidemiology, endocrinology, salt technology, public health administration, education and communication are needed to continue the availability of the multidisciplinary expertise, which has been the great strength of the ICCIDD. To this end the ICCIDD has participated in a variety of international specialist meetings.

IDD Symposia have been provided by the ICCIDD at successive International Union of Nutrition Scientists (IUNS) Congresses since 1985 (Brighton, UK); in 1989 (Seoul, South Korea); in 1993 (Adelaide, Australia); in 1997 (Montreal, Canada); in 2001 (Vienna, Austria).

The ICCIDD contributed to the International Salt Symposium held in Kyoto (Japan) (1993) and in The Hague (2000). It also contributed to Regional Salt Meetings in Bogota, Colombia; Kiev, Ukraine; Dakar, Senegal; Dubai, UAE; Mombasa, Kenya before the 2000 meeting; and with the Western African Health Organization (WAHO) in Conakry, Guinea in 2003.

Contact with thyroid scientists has been continued through Satellite Meetings held with successive International Thyroid Congresses (The Hague 1991; Toronto 1995; Kyoto 2000). In addition more recently satellite meetings have been held with Regional Thyroid Associations, the European Thyroid Association (ETA) (Krakow 2002, Goteborg 2003); the Asia & Oceania Thyroid Association (AOTA) (Singapore 2003); and the Latin American Thyroid Society (LATS) (Cordoba 2003).

### 9.6 Conclusion

Our experience indicates that the NGO model can indeed be effective in assisting a global program, in making it initially effective and in making it sustainable. We hope this experience will assist the establishment of other NGO’s in order to assist other global programs in collaboration with the UN Agencies in other areas of public health.
References


ICCIDD Appendix 1

ICCIDD Board of Directors 2001-2004
Brief Biographical Data

Margaret N Asuquo (Nigeria)-Quality control expert, Union Dicon Salt PLC, Nigeria. Background in production and management of iodized salt in the private sector.

Fereidoun Azizi (Iran)-Professor of Medicine and Director of Endocrinology, Shaheed Beheshti University, Tehran; Chairman, National Advisory Committee on iodine nutrition; frequent consultant on iodine nutrition in the Middle East; background as academic thyroidologist; Regional Coordinator for the Middle East (2001), ICCIDD.

Erick Boy (Guatemala)-Currently Program Officer, Micronutrient Initiative, Ottawa; formerly staff member, INCAP, Guatemala; training and background in nutrition, especially micronutrients; Subregional Coordinator for Central America and the Caribbean (1999-), ICCIDD.

Hans Burgi (Switzerland)-Associate Professor of Medicine (Emeritus), Chief of Department of Medicine, Burgespital Solothurn, Switzerland (retired); Chairman, Swiss Iodine-Fluorine Commission; background in clinical thyroidology; long-term interest and research in iodine deficiency.

Gerard Burrow (USA/Canada)-Special Advisor to the President of Yale for Health Affairs, David Paige Smith Professor of Medicine, professor of Obstetrics and Gynaecology, and recent Dean, Yale University School of Medicine; background in academic thyroidology with a particular interest in the thyroid gland in pregnancy; Director of Development, Vice Chair 2001-), ICCIDD.

Zu-pei Chen (China)-Professor of Medicine, Director of Institute of Endocrinology, Tianjin Medical University, Tianjin, China; Chairman of National IDD Advisory Committee to the Ministry of Health; frequent consultant on IDD in China and other countries; background in thyroidology and pathophysiology, especially IDD; Regional Coordinator for China and Eastern Asia, ICCIDD.

Francois Delange (Belgium)-Consultant in Pediatric Thyroidology, Honorary Head of Clinics and Professor, department of Pediatrics, University of Brussels; full time activity at the Department of Pediatrics, Saint-Pierre Hospital, University of Brussels, 1960-1996; ICCIDD Executive Director (1995-2001) and Regional Coordinator for Europe (1985-2001).
Robert DeLong (USA)-Professor of Pediatric Neurology, Duke University Medical Center; formerly Chief of Pediatric Neurology, Massachusetts General Hospital and Duke University; Co-director, Xinjiang, China, Project on Timing of Brain Vulnerability to Iodine Deficiency during Development, and of Project on IDD Treatment by Iodination of Irrigation Water.

Zhihua Dong (China)-Manager, China National Salt Industry Corporation; leader in China’s national implementation of salt iodization for correction of IDD; background in salt iodization management.

John T Dunn (USA)-Professor of Medicine, Divisions of Endocrinology and International Health, University of Virginia; background in laboratory work on iodine chemistry and metabolism and in clinical thyroidology, frequent contributor to scientific and other literature on thyroid and iodine and consultant to international agencies and individual countries on all aspects of IDD; Secretary (1985-2001); Executive Director (2001-); Editor, IDD Newsletter (1985-), ICCIDD.

Creswell J Eastman (Australia)-Professor of Medicine and Pathology, University of Sydney, Director of the Institute of Clinical Pathology and Medical Research at Westmead Hospital and Director of the NSW State Analytical Laboratories. Principal International Consultant in IDD to the Chinese Ministry of Health and consultant to WHO, Western Pacific Region. Director of the Australian Government-funded “Australia-China Technical Cooperation Project on IDD” from 1985-1991; Chairman and Project Director of the AusAID/WHO funded “IDD Elimination Project in Tibet”. Regional Coordinator for Asia Pacific Region.

John Egbuta (Nigeria)-Formerly Senior Research Fellow, Department of Chemical Pathology, Faculty of Medical Sciences, University of Jos, Nigeria; Program Officer with UNICEF on the Elimination of Micronutrient Deficiencies (IDD, VAD and IDA) in Nigeria. Sub-regional Coordinator for Anglophone West Africa, ICCIDD

Gregory Gerasimov (Russia)-Professor of Medicine, recent Head of Thyroid Division of Endocrinology Research Centre, Moscow; independent public health consultant (micronutrients) for international agencies an countries of Eastern/Central Europe and Central Asia. Sub-regional Coordinator, later Regional Coordinator for Eastern Europe and Central Asia, ICCIDD.

Richard Hanneman (USA)-President and CEO, Salt Institute, the global association of salt manufacturers; for the past 15 years, involved in planning worldwide salt symposia in Kyoto (1992) and The Hague (2000). Chair, Salt Iodization Committee (2001-), ICCIDD.
David Haxton (USA)-Economist, former Regional Director of UNICEF; work in UNICEF to elevate priority for iodine nutrition and national efforts to eliminate IDD in Peru, Bolivia, Ecuador, Colombia, Paraguay and Brazil while serving in those countries; in Indonesia as UNICEF representative and as Regional Director in South Asia, collaborated with national efforts to accelerate progress in Nepal, Bhutan, India, Sir Lanka, Mongolia and China; advisor to Executive Director of MI on policy and programming and advisor to PAMM on Policy; Chair. Liaison Committee, ICCIDD.

Basil Hetzel (Australia)-Formerly Professor of Medicine, University of Adelaide; Professor of Social and Preventive Medicine, Monash University, Melbourne; Director, National Institute of Nutrition, Adelaide, Australia; background in public health, nutrition and epidemiology; author, editor or co-editor of 6 books on iodine nutrition; Chairman (1995-2001) and Executive Director (1985-1995); Treasurer (1985-2001) ICCIDD.

AnnaMaria Higa (Peru)-Nutritionist, former Director, National IDD Program, also UNICEF Consultant, Ministry of Health, Peru; background in management and surveillance of IDD programs, social marketing and communication.

Izzeldin S Hussein (Oman)-Secretary, Regional Association for Iodized Salt Producers in Middle East and North Africa, frequent consultant and temporary advisor, WHO/EMRO. Degrees in pharmacognosy and management (MBA); developed the salt industry of Oman in 1990, and partnerships between industry and health authorities in Middle East countries; frequent consultant on iodized salt situations and marketing.

Ludmila Ivanova (Bulgaria)-Associate Professor of Nutrition, National Centre of Hygiene, Medical Ecology and Nutrition, Sofia, Bulgaria; Head Laboratory Nutrition, Laboratory Manager, National IDD Elimination Program, Ministry of Health, Bulgaria.

Pieter Jooste (South Africa)-Nutrition Intervention Research Unit, Medical Research Council of South Africa. Work in laboratory assessment of nutritional disorders, including iodine deficiency, investigation into distribution and features of IDD in South Africa and frequent consultant to countries and international agencies on laboratory and epidemiologic assessment of IDD; Secretary (2001-), ICCIDD.

Daniel Lantum (Cameroon)-Professor of Public Health and Community Medicine, formerly Vice-Dean and Head of Department of Public Health Unit, Faculty of Medicine and Biomedical Sciences,
The Global Partnership

University of Yaounde; long time focal point for IDD in Cameroon. Chairman, Micronutrient Task Force for Africa; Sub-regional Coordinator for Central Africa and Madagascar (1987-present); Regional Coordinator for Africa (2000-), ICCIDD.

Jack Ling (USA)-Clinical Professor of Public Health and Director of International Communication Enhancement Centre, Department of International Health and Development, School of Public Health and Tropical Medicine, Tulane University, New Orleans. Previously Visiting Professor of Communication at the University of Louisiana at Lafayette and adjunct Professor at Columbia University and City University of New York. Worked as journalist, then 30 years with UN, including terms as Director, Division of Communication, UNICEF HQ (1972-1982) and Director, Division of Information and Education, WHO HQ (1982-1986). Chair, Communication and Education Committee (1995-) and Chair, Board of Directors (2001-), ICCIDD.

Lorenzo Locatelli-Rossi (Zambia/South Africa)-Background, through family, in the salt industry as international private producer and holder of several patents for salt refining; personally worked in several countries on salt production, sales and marketing of salt and has consulted in over 30 countries on the Universal Salt Iodization/IDD Project.

Glen Maberly (USA/Australia)-Executive Director, PAMM; Professor of International Health, Emory University School of Public Health; frequent consultant to international agencies on IDD and fortification; background in academic endocrinology in Australia.

MG Venkatesh Mannar (Canada/India)-Executive Director (now President), Micronutrient Initiation (MI) Ottawa; background in chemical engineering and salt production in India; extensive consultancies with UNICEF, CIDA and other agencies on salt fortification.

L Meftah (Algeria)-Frequent consultant in Middle East on salt iodization; background in engineering and salt production.

Bernard Moinier (France)-Secretary, European Salt Producers Association and Comite des Salines de France; background in management of trade associations; author of papers on dietary salt and its supplementation with iodine and fluoride.

Judith Mutamba (Zimbabwe)-Deputy Director (Principal Dietician), National Nutrition Unit, Ministry of Health and Child Welfare, Zimbabwe, Sub-regional Coordinator for Southern and Eastern Africa (1994-) and Executive Committee, ICCIDD.

Theo Ntambwe (DR Congo)-Director of National Nutrition Program, DR Congo; background in nutrition, especially control of iodine and other
micronutrient deficiencies, assessment of thyroid volume by ultrasonography. IDD initial evaluation and action plan elaboration in African Countries. Sub-regional Coordinator for Congo and Francophone West Africa, ICCIDD.

Chandrakant S Pandav (India)-Professor, Department of Community Medicine, All India Institute for Medical Sciences, New Delhi; postgraduate training in medical economics; extensive experience in India and other countries of Southeast Asia as consultant and advisor; also, consultant to IDD programs in Africa, Middle East, participant, editor and author for many publications on IDD and health economics; Regional Coordinator for Southeast Asia (1985-), ICCIDD.

Aldo Pinchera (Italy)-Professor and Director, Institute of Endocrinology, University of Pisa; a leader in thyroidology for Italy and internationally; extensive research, especially in autoimmune thyroid disease and effects of iodine on the thyroid. Regional Coordinator for Europe (2001-), ICCIDD.

Constance Pittman (USA)-Professor Emerita of Medicine at the University of Alabama at Birmingham; long experience in clinical and research thyroidology, with special emphasis on metabolism and activation of thyroid hormones; active in many professional and research organizations; member and consultant on IDD, Kiwanis International.

Eduardo Pretell (Peru)-Professor of Medicine, Faculty of Medicine, Head of Unit of Endocrinology and Metabolism, High Altitude Research Institute, Cayetano Heredia Peruvian University. Founding Director of the Peruvian IDD Control Program in 1983; Minister of Health, Peru 2000-2001; background in academic thyroidology, iodine chemistry, fieldwork on IDD. Regional Coordinator for the Americas (1985-), ICCIDD.

E Sigurdsson (Iceland)-Past President of Kiwanis International; leader in Kiwanis World Service Project to elimination IDD.

Sangsom Sinawat (Thailand)-Director, Division of Nutrition, Ministry of Public health; background as paediatrician and nutritionist; frequent consultant on micronutrient issues in Thailand and globally.

Soekirman (Indonesia)-Professor of Nutrition, Jakarta; long experience with micronutrients, especially iodine and Vitamin A.

S Sundaesan (India)-Deputy Salt Commissioner, Government of India; long experience with production and management of salt, including iodization.

Claude Thilly (Belgium)-Professor of Public health, Free University of Brussels; wide experience in epidemiology and management of iodine deficiency, especially in Africa and Vietnam.
Charles Todd (Zimbabwe)-Regional Health Advisor, European Commission, Harare, Zimbabwe; Associate Professor, University of Zimbabwe Medical School; medical general practitioner; background in operational research in IDD; consultant for WHO and UNICEF on implementation of IDD programs; formerly Africa Regional Coordinator ICCIDD.

Peter Walker (Canada)-Dean, Professor and former Chair of Medicine, University of Ottawa School of Medicine; background in endocrinology, internal medicine and medical school administration; Treasurer (2001-), ICCIDD.

Yan Yuqin (China)-Professor of Medicine, focusing on basic and applied research on iodine nutrition and in charge of Iodine Laboratory in Division of IDD Research, Institute of Endocrinology of Tianjin Medical University, Tianjin; member of National Advisory Committee on IDD of Ministry of Health; background in pathology, endocrinology, epidemiology and iodine chemistry.
Fig. 1 Members of the Board present at the 2001 meeting near Ottawa: in front, Egbuta, Izzeldin; first row standing, Anne Hetzel, Pittman, Pandav, Higa, Dunn, Pretell, Ling, Chen, Yan; second row, Lantum, Burrow, Ntambwe, Haxton, Gerasimov, Mutamba, Hanneman, Hetzel, Walker, Azizi; last row, Burgi, Mannar, Jooste, Maberly, Thilly.
ICCIDD Appendix 2

ICCIDD MANDATE

THE VISION OF ICCIDD IS A WORLD VIRTUALLY FREE FROM IODINE DEFICIENCY DISORDERS WITH NATIONAL ENDEAVORS IN EACH COUNTRY TO MAINTAIN OPTIMAL IODINE NUTRITION, PRIMARILY THROUGH UNIVERSAL CONSUMPTION OF IODIZED SALT.

THE MISSION OF ICCIDD IS TO ADVOCATE TO GOVERNMENTS, CITIZENS, AND DEVELOPMENT AGENCIES A PRIORITY COMMITMENT TO IODINE NUTRITION THROUGH A MULTIDISCIPLINARY APPROACH THAT INVOLVES ALL RELEVANT PARTNERS.

ICCIDD BELIEVES THAT COUNTRY PROGRAMS MUST BE FULLY SUPPORTED NATIONALLY FOR SUSTAINED SUCCESS, AND WILL WORK WITH ALL PARTNERS AND NATIONAL ENTITIES TOWARDS THAT END.
The global goal to achieve sustainable elimination of iodine deficiency disorders (IDD) by 2005 requires verification that a population is receiving adequately iodized salt and its iodine status is adequate. However, several factors complicate proper monitoring of the salt situation and a population’s iodine status:

i) use of various methods for determining both salt iodine (SI) and urinary iodine (UI),

ii) significant differences in the proficiency and capacity of laboratories throughout the world,

iii) lack of organized SI and UI external quality assurance programs, and

iv) limited access to resource laboratories for necessary technical and analytical assistance.

In response to these challenges, the International Resource Laboratories for Iodine (IRLI) Network was established.

The initial structure and early goals of the IRLI Network were determined at an international conference in Bangkok, Thailand (May 2001), hosted by Dr Emorn Wasantwisut and her colleagues of the Institute of Nutrition at Mahidol University. Nearly 100 researchers, policymakers, and public health professionals from 31 countries attended this meeting. The conference enabled participants to review and discuss country experiences and to address the technical and practical barriers to the analyses of UI and SI. The participants agreed that an international network of iodine resource laboratories would strengthen the capacity of individual country laboratories to accurately measure iodine in urine and salt.

Conference participants developed a plan of action for the IRLI Network. One or two laboratories from each of the six World Health Organization (WHO) regions were selected on the basis of laboratory performance, capacity and infrastructure, solid links to a national IDD programming body, and geopolitical representation. The Bangkok conference participants nominated the regional resource laboratories.
From these nominations, the IRLI coordinating body, which includes representatives from the Centers for Disease Control and Prevention (CDC), International Council for Control of Iodine Deficiency Disorders (ICCIDD), Micronutrient Initiative (MI), United Nations Children’s Fund (UNICEF), and WHO, then selected 12 laboratories as resource laboratories of the initial IRLI Network (September 2002).

The initial IRLI Network included laboratories from 12 countries: Australia, Belgium, Bulgaria, Cameroon, China, Guatemala, India, Indonesia, Kazakhstan, Peru, Russia, and South Africa. Merely 2 months after the announcement of the initial IRLI Network, at least two IRLI Network laboratories received additional resources from their governments as recognition and reinforcement of their new regional function. These early successes validated the approval and support for the IRLI Network, which provided a positive platform for the IRLI Network’s future success.

The 12 IRLI Network laboratories provide technical and analytical support and training to national and sub-national laboratories in their regions for the analyses of iodine in urine and salt. The IRLI Network laboratories also participate in the Ensuring the Quality of Iodine Procedures (EQUIP) program, an international external quality assurance program for UI measurements managed by CDC. Ultimately, the IRLI Network laboratories will establish their own regional networks of laboratories and will work to secure resources for their networks. Additional responsibilities of the IRLI Network laboratories include communication with the salt industry to ensure production and distribution of adequately iodized salt and advocacy to national and international partners to garner political support and raise awareness of IRLI Network activities.

To better prepare the IRLI Network laboratories for these roles and responsibilities, 28 representatives from the 12 IRLI Network laboratories and from the IRLI Network coordinating body convened for the IRLI Harmonization Workshop in Cape Town, South Africa, during November 10-14, 2002. CDC, ICCIDD, MI, UNICEF, and WHO co-sponsored the workshop, and Dr. Pieter Jooste and his colleagues of the Medical Research Council, Tygerberg, South Africa, hosted it. The goals of the workshop were to standardize the operating procedures among IRLI Network laboratories, equip those laboratories for their role as resource laboratories, improve communication among laboratories and with the coordinating body, plan next steps to implement network activities at the regional level, and develop long-range plans of action for the six regions.
Technical and operational considerations affecting the acceptance, viability, and sustainability of the IRLI Network were discussed openly throughout the workshop sessions. The workshop allowed the representatives to work together with other IRLI Network laboratories in their regions to brainstorm and develop early plans for the establishment and acceptability of regional networks. To gain acceptance in their respective regions, the IRLI Network laboratories recognized the need to develop marketing plans emphasizing the added value of their laboratories. The regional marketing plans will be used to gain support both from other laboratories in the region and also government to strengthen collaboration among multiple sectors.

A second major outcome of the workshop was acknowledgement that the IRLI Network laboratories must develop creative strategies resulting in financial sustainability within 3-5 years. These strategies are based on the notion that seed money from multilateral agencies will be available only for a limited time, so regional financial plans using the sliding scale model must be developed. Financial plans must emphasize a return on investment, and conference participants suggested exploration of a fee-for-service approach. The fee-for-service approach is one way for the laboratories to recover material, personnel, and overhead costs—progress toward financial sustainability.

From the discussions during the Cape Town workshop, CDC developed an *IRLI Network Operation Manual* as the basis for interactions among Network members and the technical development of the Network. Furthermore, the *Operation Manual* addressed the financial model for the IRLI Network laboratories and provided a framework and strategies—such as the development of marketing plans and establishment of regional networks—for other IRLI Network components.

To gain acceptance and raise awareness of the Network, the IRLI Network coordinating body distributed two advocacy letters. One letter to over 40 laboratories participating in CDC’s EQUIP program introduced the IRLI Network laboratories, explained selection of the initial IRLI Network laboratories, and outlined the IRLI laboratories’ roles and responsibilities. A second letter, sent to WHO and UNICEF country offices, also introduced the initial IRLI Network and advocated endorsement of efforts to strengthen political and agency support for the IRLI Network.

To standardize the training and technical assistance material used by IRLI Network laboratories, the *Laboratory Guide for the Measurement
Fig. 1 Relational Model for the International Resource Laboratories for Iodine (IRLI) Network

Fig. 2 In utero and postnatal protection of children’s brains from losses in learning ability — improved economic and social development of nations
of Iodine in Urine and Salt was developed. The ~300-page guide focuses on the preanalytical, analytical, postanalytical, and total quality management issues related to UI and SI measurements. IRLI Network laboratories assisted with the development of the Laboratory Guide and are encouraged to use the guide as a resource when conducting training and technical assistance to other laboratories.

All IRLI Network laboratories provide some form of technical or analytical support and training to other laboratories in their regions. The IRLI-Indonesia laboratory was chosen as the primary resource laboratory for the “Evaluation of Intensified Iodine Deficiency Control” project, which will collect ~17,000 UI samples from people in 28 provinces in Indonesia. IRLI representative Dr. Rachmawati Banundari was also selected as the National Laboratory Coordinator for the project, so she will conduct a standardization program for the three labs involved in the project.

The IRLI-Kazakhstan laboratory also serves as a technical resource for a large-scale project, entitled “Improving Nutrition for Poor Mothers and Children in Asian Countries in Transition.” The project involves six countries: Azerbaijan, Kazakhstan, Kyrgyz Republic, Mongolia, Tajikistan, and Uzbekistan. IRLI representative Dr. Feruza Ospanova serves as the regional specialist on IDD and Universal Salt Iodization for the project.

Additional examples of the significant role of IRLI Network laboratories as technical resources include the IRLI-Australia laboratory assisting with a research study conducted by the Western Sydney Area Health Services on the iodine status of a large population in Australia and the IRLI-South Africa laboratory’s involvement with a doctoral student from Lesotho. The IRLI-South Africa laboratory worked with the student to evaluate the IDD control program in Lesotho and analyzed the SI and UI samples from Lesotho in its lab. The collaboration increased knowledge about the IDD situation in Lesotho and strengthened the capacity in Lesotho to eliminate IDD.

With support from UNICEF and Bulgaria’s Ministry of Health, the IRLI-Bulgaria laboratory analyzed UI samples from schoolchildren and pregnant women for a national survey evaluating the IDD status in Bulgaria. The IRLI-Guatemala laboratory provided analytical support to Nicaragua and Dominican Republic. The IRLI-Guatemala laboratory conducted training courses on SI and UI methodologies to laboratory representatives from Dominican Republic and Belize.
IRLI-China provided international training to laboratory representatives from Vietnam. The Vietnamese representatives participated in a 3-week training program funded by UNICEF-Vietnam. The training covered topics such as laboratory methods, IDD programming, establishment of a national network, and cooperation with the salt industry.

In addition to the IRLI Network laboratories’ role as technical and analytical resources, some IRLI Network laboratories are working to establish or maintain regional networks. The IRLI-Belgium laboratory has submitted a proposal to the European Commission for funding for the “Iodine Validation for the European Laboratories” project, an interlaboratory comparison program for laboratories across Europe. The IRLI-Russia laboratory has identified five laboratories in Russia that are equipped for UI analysis, and IRLI-Russia plans to establish a regional external quality assurance program with these labs. Lastly, the IRLI-Peru laboratory plays a key role in coordinating the “Interlaboratories Assay for Urinary Iodine” program, an external quality control program for UI analysis comprising 19 laboratories in the Latin American region.

Communication with the salt industry to ensure production and distribution of adequately iodized salt is another important responsibility of IRLI laboratories. IRLI-South Africa prepared and distributed educational materials to all salt producers iodizing salt in South Africa; the laboratory conducted salt sampling and testing to investigate the loss of iodine from packaged salt under different climactic conditions. Representatives from the IRLI-Cameroon laboratory visited three major salt producers and a major salt importer in Cameroon to evaluate their quality control and quality assurance programs. The IRLI-Cameroon representatives reported much improvement in the programs from the previous year; the salt producers and importer agreed to send their laboratory technicians for training at the IRLI-Cameroon laboratory.

IRLI Network laboratories are also involved in advocacy efforts to national and international partners to build political support and raise awareness of the IRLI Network activities. The IRLI-India laboratory demonstrated this role by ensuring wide coverage of the IRLI Network at the WHO Bi-Regional Consultation to Promote Sustainable IDD Control Programmes in the South East Asian and Eastern Mediterranean regions. IRLI-India also presented information about the IRLI Network at the Second Inter-Country Workshop on Iodine Monitoring, Laboratory Procedures, and National IDD Elimination Programs, which WHO and ICCIDD organized.
Therefore, in the 1½ years since its formal inception, IRLI Network laboratories have embraced their roles and responsibilities as resource laboratories and have strengthened the capacity of laboratories to accurately measure iodine in urine and salt. As the first global network of iodine resource laboratories in support of national public health and industry monitoring, the IRLI Network is built on a strong foundation, backed by well-defined guidelines and goals, and comprising hard-working, committed representatives. The IRLI Network is an integral monitoring component that contributes to sustaining progress toward optimal iodine nutrition and Universal Salt Iodization.
Research Centres contributing significant research on IDD since 1950

The Global Program for the Elimination of Iodine Deficiency as a Cause of Brain Damage has rested on a strong foundation of international research extending throughout the world. A number of leading IDD Research Centres are listed in Table 1. A notable feature of this research is the amount of work being carried out in various academic centres in Asia, Africa and Latin America.

Many investigators from these centres have become members of the ICCIDD, a number have served on the Board of the ICCIDD and others have become ICCIDD Senior Advisors to assist IDD elimination programs in their regions and elsewhere.

It is appropriate to record here the pioneering role of Dr John B Stanbury, former Chief of the Thyroid Clinic, Harvard Medical School and former Professor of Experimental Medicine, Massachusetts Institute of Technology, Boston.

Dr John Stanbury was the first Chairman of the ICCIDD and served for a period of 10 years.

In addition to his own contributions he has been an inspiration of many young scientists throughout the world.

A similar inspirational role for the developing world has been provided by the late Professor V. Ramalingaswami.

There are many research workers all over the world now exploring different aspects of the Iodine Deficiency Disorders.
<table>
<thead>
<tr>
<th>Region</th>
<th>Country</th>
<th>Research Centres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>Cameroon</td>
<td>University Centre for Health Sciences, Yaounde, Cameroon</td>
</tr>
<tr>
<td></td>
<td>Nigeria</td>
<td>University of Nigeria, Enugu, Nigeria, Jos, Nigeria</td>
</tr>
<tr>
<td></td>
<td>South Africa</td>
<td>Medical Research Council, Tygerberg, South Africa</td>
</tr>
<tr>
<td></td>
<td>Zimbabwe</td>
<td>University of Zimbabwe, Harare, Zimbabwe</td>
</tr>
<tr>
<td>Asia</td>
<td>China</td>
<td>Tianjin Medical University, Tianjin, China</td>
</tr>
<tr>
<td></td>
<td>India</td>
<td>All India Institute of Medical Sciences, Ansari Nagar, New Delhi - India</td>
</tr>
<tr>
<td></td>
<td>Indonesia</td>
<td>Diponegoro University, Semarang, Indonesia</td>
</tr>
<tr>
<td></td>
<td>Japan</td>
<td>Toho University, Tokyo, Japan</td>
</tr>
<tr>
<td></td>
<td>Thailand</td>
<td>Siriraj Hospital, Bangkok, Thailand</td>
</tr>
<tr>
<td>Europe</td>
<td>Belgium</td>
<td>Hospital St Pierre, University of Brussels, Brussels, Belgium</td>
</tr>
<tr>
<td></td>
<td>Italy</td>
<td>Institute of Endocrinologia, Aetologia Clinica E Medicina, De Lavoro, Pisa, Italy</td>
</tr>
<tr>
<td></td>
<td>Spain</td>
<td>Institute of Endocrinologia, Biomedicas del CSIC, Madrid, Spain</td>
</tr>
<tr>
<td></td>
<td>Switzerland</td>
<td>Swiss Federal Institute of Technology, Zurich, Switzerland</td>
</tr>
<tr>
<td></td>
<td>The Netherlands</td>
<td>University of Leiden, Leiden, The Netherlands</td>
</tr>
<tr>
<td>Region</td>
<td>Country</td>
<td>Institution</td>
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<td>----------------------------------------------------------------------------</td>
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<tr>
<td>Middle East</td>
<td>Iran</td>
<td>University of Tehran</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eveen, Tehran, Iran</td>
</tr>
<tr>
<td>Oceania</td>
<td>Australia</td>
<td>The Queen Elizabeth Hospital</td>
</tr>
<tr>
<td></td>
<td></td>
<td>University of Adelaide, Adelaide, Australia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CSIRO Health Sciences and Nutrition Institute</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adelaide, Australia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Australian Centre for Control of IDD (ACCIDD), Westmead Hospital</td>
</tr>
<tr>
<td></td>
<td></td>
<td>University of Sydney, Sydney Australia</td>
</tr>
<tr>
<td></td>
<td>New Guinea</td>
<td>Institute of Medical Research</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Goroka, New Guinea</td>
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<tr>
<td></td>
<td>New Zealand</td>
<td>MRC Unit</td>
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<tr>
<td></td>
<td></td>
<td>Medical School</td>
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<tr>
<td></td>
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<td>Canada</td>
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<td>University of Toronto</td>
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<tr>
<td>Brazil</td>
<td></td>
<td>Hospital das Clínicas</td>
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<td></td>
<td></td>
<td>University of Sao Paulo</td>
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<td></td>
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<td>The Americas</td>
<td>Ecuador</td>
<td>Central University Medical School</td>
</tr>
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<td></td>
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<td>Quito, Ecuador</td>
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<tr>
<td></td>
<td>Peru</td>
<td>Universidad Peruana</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Cayetano Heredia”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lima, Peru</td>
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<tr>
<td></td>
<td>USA</td>
<td>Harvard Medical School</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Massachusetts Institute of Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Boston, Mass, USA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Program Against Micronutrient Malnutrition</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Emory University</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Atlanta Georgia, USA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>University of Virginia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Charlottesville, Virginia, USA</td>
</tr>
</tbody>
</table>
The Micronutrient Initiative
Venkatesh Mannar

The Micronutrient Initiative (MI) was established in 1992 as an international secretariat by its principal sponsors. International Development Research Centre (IDRC), Canadian International Development Agency (CIDA), United Nations Children’s Fund (UNICEF), United Nations Development Program (UNDP) and the World Bank.

The Mission of the MI then was to facilitate the achievement of the following goals related to the elimination of micronutrient malnutrition by supporting effective and sustainable programmatic actions:
• virtual elimination of iodine deficiency disorders
• virtual elimination of vitamin A deficiency and its consequences, including blindness
• reduction of iron deficiency anemia in women by one-third of the 1990 levels

In March 2001 the MI changed its status from secretariat to an independent not-for-profit organization. MI is governed by an international Board of Directors. Presently MI is based in Ottawa, Canada and maintains regional offices in New Delhi, India and Johannesburg, South Africa. MI supports and promotes food fortification and supplementation programs in Asia, Africa and Latin America and provides technical and operational support in those countries where micronutrient malnutrition is most prevalent. MI carries out its work in partnership with other international agencies, governments and industry.

The Micronutrient Initiative’s mission is to stimulate and support national actions to eliminate micronutrient malnutrition, assuring universal coverage and sustained impact on people’s health and well-being.

Over the years, MI has grown. It began as an international commitment to remedy the widespread problems caused by micronutrient deficiencies. Today MI is an effective, robust organization that provides technical and financial assistance, secures services, develops solutions, and advocates on behalf of vulnerable populations, particularly the poor, women, and children.
Over the past decade, the Micronutrient Initiative (MI) and its many partners have devoted significant resources and effort to bring worldwide attention to micronutrient malnutrition, its consequences and solutions. These efforts have resulted in strong progress towards controlling widespread micronutrient malnutrition. With respect to virtual elimination of IDD, a campaign to iodize all of the world’s edible salt, coverage has been expanded and now more than 70 percent of the global population have access to iodized salt; the Universal Salt Iodization (USI) effort has turned out to be one of the most impressive public health success stories of the latter half of the century.

Along with UNICEF, WHO, ICCIDD, the MI also played an important role at the United Nations General Assembly Special Session on Children convened in May 2002 where world leaders set the following targets:

- The sustainable elimination of iodine deficiency disorders by 2005;
- The sustainable elimination of vitamin A deficiency by 2010;
- Reducing anemia prevalence, including iron deficiency by a third by 2010;
- Accelerating progress towards the reduction of other micronutrient deficiencies through dietary diversification, food fortification and supplementation.

The MI has laid the foundation for major expansion in food fortification in the early years of the twenty-first century. MI has contributed to this progress by raising awareness and political commitment, initiating action, providing the tools for action, building consensus and networks, leveraging resources and transferring ownership, and working with its many partners to support programs in developing countries.
Section IV
The Scientific Basis for the Elimination of Brain Damage due to Iodine Deficiency
F Delange and BS Hetzel

1. Introduction

2. The Iodine Deficiency Disorders in the Life Cycle
   2.1 Iodine Deficiency in the Foetus
   2.2 Iodine Deficiency in the Neonate
   2.3 Iodine Deficiency in the Child
   2.4 Iodine Deficiency in the Adult

3. Specific Iodine Deficiency Disorders
   3.1 Endemic Goitre
   3.2 Endemic Cretinism

4. Assessment of the IDD Status of the Population
   4.1 Urinary Iodine
   4.2 Prevalence of Goitre
   4.3 Measurement of Serum TSH, Thyroid Hormones and Thyroglobulin (Tg)

5. Technology of Iodine Supplementation
   5.1 Iodized Salt
   5.2 Iodized Oil
   5.3 Other Methods

6. Control of IDD
   6.1 Current Status of IDD Control Programs
   6.2 Monitoring and Impact of the Programs of Salt Iodization
   6.3 Side Effects of Iodine Supplementation

7. Conclusion
1. Introduction

As indicated in Section I of this volume, the term Iodine Deficiency Disorders (IDD) refers to all the ill effects of iodine deficiency in a population that can be prevented by ensuring that the population has an adequate intake of iodine (Hetzel 1983, WHO/UNICEF/ICCIDD 2001). These effects are listed in Table 1. The presently recommended daily intake of iodine is shown in Table 2.

Brain damage and irreversible mental retardation are the most important disorders induced by iodine deficiency. Extensive studies throughout the world over the last 20 years have revealed that 130 countries are affected by iodine deficiency, with a total population of 2.2 billion at risk of the occurrence of varying degrees of brain damage (WHO/UNICEF/ICCIDD 1999). Iodine deficiency is the leading cause of preventable mental retardation (WHO 1994).

Table 1. Spectrum of Iodine Deficiency Disorders (IDD)

<table>
<thead>
<tr>
<th>Foetus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abortions</td>
</tr>
<tr>
<td>Stillbirths</td>
</tr>
<tr>
<td>Congenital anomalies</td>
</tr>
<tr>
<td>Neurological cretinism:</td>
</tr>
<tr>
<td>mental deficiency</td>
</tr>
<tr>
<td>deaf mutism, spastic diplegia, squint</td>
</tr>
<tr>
<td>Hypothyroid cretinism:</td>
</tr>
<tr>
<td>mental deficiency, dwarfism, hypothyroidism</td>
</tr>
<tr>
<td>Psychomotor defects</td>
</tr>
<tr>
<td>Neonate</td>
</tr>
<tr>
<td>Increased perinatal mortality</td>
</tr>
<tr>
<td>Neonatal hypothyroidism</td>
</tr>
<tr>
<td>Retarded mental and physical development</td>
</tr>
<tr>
<td>Child and Adolescent</td>
</tr>
<tr>
<td>Increased infant mortality</td>
</tr>
<tr>
<td>Retarded mental and physical development</td>
</tr>
<tr>
<td>Adult</td>
</tr>
<tr>
<td>Goitre with its complications</td>
</tr>
<tr>
<td>Iodine induced hyperthyroidism (IIH)</td>
</tr>
<tr>
<td>All Ages</td>
</tr>
<tr>
<td>Goitre</td>
</tr>
<tr>
<td>Hypothyroidism</td>
</tr>
<tr>
<td>Impaired mental function</td>
</tr>
<tr>
<td>Increased susceptibility to nuclear radiation</td>
</tr>
</tbody>
</table>

This Section IV will provide a global overview of the disorders induced by iodine deficiency. Special emphasis will be put on recent developments in the concept of IDD such as the role of iodine deficiency in the development of brain damage and mental retardation; goitre seen as a sign of maladaptation to iodine deficiency rather than as the adaptative process to the deficiency; assessment of the iodine status of a population; and control of IDD including present achievements, monitoring and side effects.

Extensive and recent global reviews of the different aspects of IDD are available elsewhere (Stanbury and Hetzel 1980; Hetzel et al 1990; Delange 1994; Hetzel and Pandav 1996; Hollowell and Hannon 1997 and Hetzel 1999).

2. The Iodine Deficiency Disorders in the Life Cycle

The effects of iodine deficiency on growth and development can be considered at the various stages of life as follows:

2.1 Iodine Deficiency in the Foetus

Iodine deficiency in the foetus is the result of iodine deficiency in the mother. The consequence of iodine deficiency during pregnancy is impaired synthesis of thyroid hormones by the mother and the foetus. The reduction of blood thyroid hormones is associated with a greater incidence of abortions, still births, and congenital anomalies, which can be reduced by correction of the iodine deficiency. The effects are similar to those observed in maternal hypothyroidism, which can be reduced by thyroid hormone replacement therapy (McMichael et al 1980).

An insufficient supply of thyroid hormones to the developing foetal brain results in mental retardation (Pharoah et al 1971; Hetzel et al 1990; Stanbury 1994; Bernal and Nunez 1995; Chan and Kilby 2000; Glinoer and Delange 2000). This vulnerability extends to the end of the second year of life by which time the brain has achieved an adult weight. There

<table>
<thead>
<tr>
<th>Table 2. Recommended daily intake of iodine</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 µg for pre-school children (0 to 59 months);</td>
</tr>
<tr>
<td>120 µg for schoolchildren (6 to 12 years);</td>
</tr>
<tr>
<td>150 µg for adults (above 12 years); and</td>
</tr>
<tr>
<td>200 µg for pregnant and lactating women</td>
</tr>
</tbody>
</table>

From WHO/UNICEF/ICCIDD (2001)
Global Elimination of Brain Damage Due to Iodine Deficiency

is therefore a very rapid period of growth during pregnancy and the first 
two years of life during which time the brain is very vulnerable to thyroid 
hormone deprivation with the likelihood of irreversible damage. For this 
reason a check of thyroxine levels is made at the fourth day of life as a 
routine screening procedure carried out in most industrialised countries 
with the aim of detecting congenital abnormalities of the thyroid. So that 
immediate correction with thyroid hormone replacement can be initiated. 
Congenital abnormalities occur in approximately 1 in 4000 births. In 
areas of severe iodine deficiency such neonatal hypothyroidism may occur 
in up to 10% of births. So there is a very large increase in iodine deficient 
populations, which indicates the massive dimension of the problem (Hetzel 
and Pandav 1996) and the urgency for correction of the iodine deficiency.

2.1.1 Brain development in humans

Brain growth is characterized by two periods of maximal growth 
velocity (Dobbing and Sands 1973). The first one occurs during the first 
and second trimesters between the third and the fifth months of gestation. 
This phase corresponds to neuronal multiplication, migration and 
organization. The second phase takes place from the third trimester 
onwards up to the second and third years postnatally. It corresponds to 
glial cell multiplication, migration and myelination. The first phase occurs 
before the foetal thyroid has reached its functional capacity. It is now 
agreed that during this phase, the supply of thyroid hormones to the 
growing foetus is almost exclusively of maternal origin while during the 
second phase, the supply of thyroid hormones to the foetus is essentially 
of foetal origin (Vulsma et al 1989; Morreale de Escobar et al 2000).

2.1.2 Experimental studies in animals

Studies of the effects of iodine deficiency in animals have confirmed 
the morphological and biochemical modifications seen in the hyperplastic 
goitre of man (Bernal and Pekonen 1984; Pandav and Rao 1997). More 
recently the effects of iodine deficiency on development, particularly those 
relating to the foetus have been investigated. These studies on the sheep, 
marmoset (Callithrix jacchus jacchus) and the rat have been particularly 
concerned with foetal brain development because of its relevance to the 
human problem of endemic cretinism and brain damage resulting from 
foetal iodine deficiency.
i) Iodine Deficiency and the Sheep

Severe iodine deficiency has been produced in sheep (Potter et al 1982) with a low iodine diet of crushed maize and pelleted pea pollard (8-15µg iodine/kg) which provided 5-8µg iodine per day for sheep weighing 40-50 kg. The iodine deficient foetuses at 140 days were grossly different in physical appearance in comparison to the control foetuses. There was reduced weight, absence of wool growth, goitre, varying degrees of subluxation of the foot joints, and deformation of the skull (fig. 1). There was also delayed bone maturation as indicated by delayed appearance of epiphyses in the limbs. Goitre was evident from 70 days in the iodine deficient foetuses and thyroid histology revealed hyperplasia from 56 days gestation associated with a great reduction in foetal thyroid iodine content and reduced plasma T4 values. There was a lowered brain weight and DNA content as early as 70 days, indicating a reduction in cell number probably due to delayed neuroblast multiplication, which normally occurs from 40-80 days in the sheep. Findings in the cerebellum indicated arrested development (Potter et al 1982).

A single intramuscular injection of iodized oil (1 ml = 480 mg iodine) given to the iodine deficient mother at 100 days gestation was followed by partial restoration of the lamb brain weight and body weight with restoration of maternal and foetal plasma T4 values to normal (Potter et al 1984).

Studies of the mechanisms involved in the sheep revealed significant effects of foetal thyroidectomy in late gestation and a significant effect of maternal thyroidectomy on brain development at mid-gestation. The combination of maternal thyroidectomy (carried out 6 weeks before pregnancy) and foetal thyroidectomy produced more severe effects on the brain than that of iodine deficiency associated with greater reduction in both maternal and foetal thyroid hormone levels (McIntosh et al 1983; Hetzel 1999). These findings confirm the importance of both maternal and foetal thyroid hormones in foetal brain development.

ii) Iodine Deficiency in the Marmoset

Severe iodine deficiency has been produced in the marmoset (Callithrix jacchus jacchus) with a mixed diet of maize (60%), peas (15%), torula yeast (10%) and dried iodine deficient mutton (10%) derived from the iodine deficient sheep already described above. The newborn iodine deficient marmosets showed some sparsity of hair growth (Mano et al 1987). The thyroid gland was enlarged with gross reduction in plasma T3
Fig. 1  Effect of severe iodine deficiency during pregnancy on lamb development. A 140 day old lamb foetus (normal gestation period 150 days) was subjected to severe iodine deficiency through feeding the mother an iodine deficient diet (5-8µg per day) for 6 months prior to and during pregnancy, compared to a control lamb of the same age fed the same diet with the addition of an iodine supplement. The iodine deficient lamb shows absence of wool coat, subluxation of the leg joints and a dome-like appearance of the head due to skeletal retardation. The brain was smaller and contained a reduced number of cells, compared to the control. From: Potter et al (1982)
in both mothers and newborns, greater in the second pregnancy than in the first, suggesting a greater severity of iodine deficiency. There was a significant reduction in brain weight in the newborns from the second pregnancy but not from the first. The findings were more striking in the cerebellum with reduction in weight and cell number evident and histological changes indicating as in the sheep, impaired cell maturation. These findings demonstrate the significant effects of iodine deficiency on the primate brain.

iii) Iodine Deficiency in the Rat

Studies in rats have been carried out using the diet consumed by the people of Jixian village in China (Li et al 1985) (see Section I). This village was severely iodine deficient with 11% endemic cretinism. The diet included available main crops (maize, wheat), vegetables, and water from the area with an iodine content of 4.5µg/kg. After the rats had received the diet for 4 months, the newborn showed obvious goitre, foetal serum T4 was 3.6µg% compared to controls of 10.4µg% and they had higher I125 uptake and reduced brain weight. The density of brain cells was increased in the cerebral hemispheres. The cerebellum showed delayed maturation as in the other species.

2.1.3 Epidemiological and clinical aspects of brain damage and mental retardation in iodine deficiency

These aspects are developed in the section “Specific Iodine Deficiency Disorders”.

2.2 Iodine Deficiency in the Neonate

An increased perinatal mortality due to iodine deficiency has been shown in Zaire (Zaire now the Republic of the Congo) from the results of a controlled trial of iodized oil injections alternating with a control injection both given in the latter half of pregnancy (Thilly et al 1980). There was a substantial fall in infant mortality with improved birth weight following the iodized oil injection. Low birth weight of any cause is generally associated with a higher rate of congenital anomalies and higher risk through childhood. This has been demonstrated in the longer term follow up of the controlled trial in Papua New Guinea in children up to the age of 12 years (Pharoah et al 1971; Pharoah and Connolly 1987) and in Indonesia (Cobra et al 1997).
A reduction of infant mortality has also been reported from China following iodine supplementation of irrigation water in areas of severe iodine deficiency. Iodine replacement has probably been an important factor in the national decrease in infant mortality in this country (Delong et al 1997).

Apart from mortality, the importance of the state of thyroid function in the neonate relates to the fact that the brain of the human infant at birth has only reached about one third of its full size and continues to grow rapidly until the end of the second year (Dobbing 1974). The thyroid hormone, dependent on an adequate supply of iodine, is essential for normal brain development as has been confirmed by the animal studies already cited.

Studies on iodine nutrition and neonatal thyroid function in Europe confirm the continuing presence of iodine deficiency affecting neonatal thyroid function and hence a threat to early brain development (Delange et al 1986). A series of 1076 urine samples were collected from 16 centres from 10 different countries in Europe along with an additional series from Toronto, Canada and analyzed for their iodine content. The results of these determinations are shown in Table 3. The distribution was skewed so that arithmetic means were not used, but the results were expressed in percentiles. Some very high values were seen which could be attributed to the use of iodinated contrast media for radiological investigation of the mother during pregnancy. There was a marked difference in the results from the various cities. The high levels in Rotterdam, Helsinki and Stockholm differed from the low levels in Gottingen, Heidelberg, Freiburg and Jena by a factor of more than 10. Intermediate levels were seen in Catania, Zurich and Lille.

Data on neonatal thyroid function was analysed for four cities where enough newborns (30,000-102,000) had been tested. The incidence of permanent congenital hypothyroidism was very similar in the four cities but the rate of transient hypothyroidism was much greater in Freiburg, associated with the lowest level of urine iodine excretion, than in Stockholm, with intermediate findings from Rome and Brussels. These data confirm the significance of iodine intake for neonatal thyroid function.

In developing countries with more severe iodine deficiency, observations have now been made using blood taken from the umbilical vein just after birth. Neonatal chemical hypothyroidism was defined by serum levels of T₄ less than 3µg/dL and TSH greater than 100µU/ml. In the most severely iodine deficient environments in Northern India, where
Table 3. Frequency distributions of urinary iodine concentrations in healthy full-term infants in 14 cities in Europe and Toronto, Canada

<table>
<thead>
<tr>
<th>City</th>
<th>Number of Infants</th>
<th>10th Percentile</th>
<th>50th Percentile</th>
<th>90th Percentile</th>
<th>Frequency (% of values Below 5µg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toronto</td>
<td>81</td>
<td>4.3</td>
<td>14.8</td>
<td>37.5</td>
<td>11.9</td>
</tr>
<tr>
<td>Rotterdam</td>
<td>64</td>
<td>4.5</td>
<td>16.2</td>
<td>33.2</td>
<td>15.3</td>
</tr>
<tr>
<td>Helsinki</td>
<td>39</td>
<td>4.8</td>
<td>11.2</td>
<td>31.8</td>
<td>12.8</td>
</tr>
<tr>
<td>Stockholm</td>
<td>52</td>
<td>5.1</td>
<td>11.0</td>
<td>25.3</td>
<td>5.9</td>
</tr>
<tr>
<td>Catania</td>
<td>14</td>
<td>2.2</td>
<td>7.1</td>
<td>11.0</td>
<td>38.4</td>
</tr>
<tr>
<td>Zurich</td>
<td>62</td>
<td>2.6</td>
<td>6.2</td>
<td>12.9</td>
<td>34.4</td>
</tr>
<tr>
<td>Lille</td>
<td>82</td>
<td>2.0</td>
<td>5.8</td>
<td>15.2</td>
<td>37.2</td>
</tr>
<tr>
<td>Brussels</td>
<td>196</td>
<td>1.7</td>
<td>4.8</td>
<td>16.7</td>
<td>53.2</td>
</tr>
<tr>
<td>Rome</td>
<td>114</td>
<td>1.5</td>
<td>4.7</td>
<td>13.8</td>
<td>53.5</td>
</tr>
<tr>
<td>Toulouse</td>
<td>37</td>
<td>1.2</td>
<td>2.9</td>
<td>9.4</td>
<td>69.4</td>
</tr>
<tr>
<td>Berlin</td>
<td>87</td>
<td>1.3</td>
<td>2.8</td>
<td>13.6</td>
<td>69.7</td>
</tr>
<tr>
<td>Gottingen</td>
<td>81</td>
<td>0.9</td>
<td>1.5</td>
<td>4.7</td>
<td>91.3</td>
</tr>
<tr>
<td>Heidelberg</td>
<td>39</td>
<td>1.1</td>
<td>1.3</td>
<td>4.0</td>
<td>89.8</td>
</tr>
<tr>
<td>Freiburg</td>
<td>41</td>
<td>1.1</td>
<td>1.2</td>
<td>2.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Jena</td>
<td>54</td>
<td>0.4</td>
<td>0.8</td>
<td>2.2</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The European cities are listed according to decreasing values (50th percentile)
From: Delange et al (1986)
more than 50% of the population has urinary iodine levels below 25ug per gram creatinine, the incidence of neonatal hypothyroidism was 75 to 115 per thousand births (Kochupillai and Pandav 1987). By contrast in Delhi, where only mild iodine deficiency is present with low prevalence of goitre and no cretinism, the incidence drops to 6 per thousand. In control areas without goitre the level was only one per thousand.

There is similar evidence from neonatal observations in neonates in the Congo in Africa where a rate of 10% of chemical hypothyroidism has been found (Delange et al 1982). This hypothyroidism persists into infancy and childhood if the deficiency is not corrected, and results in retardation of physical and mental development (Vanderpas et al 1984). These observations indicate a much greater risk of mental defect in severely iodine deficient populations than is indicated by the presence of cretinism. They provide strong evidence for the need to correct the iodine deficiency in Europe as well as in developing countries.

Another important aspect of iodine deficiency in the neonate and child is an increased susceptibility of the thyroid gland to radioactive fallout. Delange (1990) has shown that the thyroidal uptake of radioiodine reaches its maximum value in the earliest years of life and then declines progressively into adult life. The apparent thyroidal iodine turnover rate was much higher in young infants than in adults and decreased progressively with age. In order to provide the normal rate of T4 secretion, Delange has estimated that the turnover rate for intra-thyroidal iodine must be 25-30 times higher in young infants than in adolescents and adults. In iodine deficiency a further increase in turnover rate is required to maintain normal thyroid hormone levels. This is the reason for the greatly increased susceptibility of the neonate and foetus to iodine deficiency. Iodine deficiency also causes an increased uptake of radioiodide, resulting from exposure to nuclear radiation. Protection against this increased uptake can only be provided by correction of iodine deficiency, which constitutes a further urgent indicator for the correction of iodine deficiency in Europe as well as in developing countries.

2.3 Iodine Deficiency in the Child

Recent work has demonstrated the effects of mild and moderate iodine deficiency on brain function. Aghini-Lombardi et al (1995) reported that in children aged 6-10 years in an area in Tuscany who had mild iodine deficiency (64µg iodine/day), the reaction time was delayed compared
with matched controls from an iodine sufficient area (142µg iodine/day). The cognitive abilities of the children were not affected.

Additional investigations conducted in areas with moderate iodine deficiency have also demonstrated the presence of definite abnormalities in the psycho-neuromotor and intellectual development of children and adults who are clinically euthyroid but who do not exhibit the other signs and symptoms of endemic cretinism, that is the most severe form of brain damage caused by iodine deficiency. These studies are summarized in Table 4.

The impairment of intellectual development in these conditions represents the long-term consequence of transient neonatal hypothyroidism (Calaciura et al 1995).

In more severe iodine deficiency, the anomalies found in the population are of the same type, although more frequent and more severe than those found in moderate iodine deficiency. The frequency distribution of IQ in apparently normal children in such conditions is shifted towards low values as compared to matched controls who were not exposed to iodine deficiency during the critical period of brain development because of correction of the deficiency in the mothers before or during early gestation (Fierro-Benitez et al 1974; Kochupillai et al 1986; Huda et al 1999). More globally, in their meta-analysis of 18 studies on neuromotor and cognitive functions in conditions of moderate to severe iodine deficiency, Bleichrodt and Born (1994) concluded that iodine deficiency resulted in a mean loss of 13.5 IQ points in the total population.

2.4 Iodine Deficiency in the Adult

A high degree of apathy has been noted in populations living in severely iodine deficient areas. This may even affect domestic animals such as, dogs (Pandav and Rao 1997). It is apparent that reduced mental function due to cerebral hypothyroidism (reduced brain T₃) is widely prevalent in iodine deficient communities with effects on their capacity for initiative and decision making. This indicates that iodine deficiency can be a major block to the human and social development of communities living in an iodine deficient environment which can be reversed by correction of the iodine deficiency. This is particularly striking following iodized oil injections as in Sengi village in Indonesia (see Section I).

In addition to this impact on brain and neurological intellectual development, iodine deficiency at any period in life, including during adulthood can induce the development of goitre with mechanical complications and/or thyroid insufficiency.
**Table 4. Neuropsychointellectual Deficits in Infants and Children in conditions of Mild to Moderate Iodine Deficiency**

<table>
<thead>
<tr>
<th>Regions</th>
<th>Tests</th>
<th>Findings</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain</td>
<td>Locally adapted Bayley Mccarthy Cattell</td>
<td>Lower psychomotor and mental development than controls</td>
<td>Bleichrodt et al 1989</td>
</tr>
<tr>
<td>Italy</td>
<td>Bender-Gestalt</td>
<td>Low perceptual integrative motor ability. Neuromuscular and neurosensorial abnormalities</td>
<td>Vermigilio et al 1990</td>
</tr>
<tr>
<td>Sicily</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuscany</td>
<td>Wechsler Raven</td>
<td>Low verbal IQ, perception, motor and attentive functions</td>
<td>Fenzi et al 1990</td>
</tr>
<tr>
<td>Tuscany</td>
<td>Wisc</td>
<td>Lower velocity of motor response to visual stimuli</td>
<td>Vitti et al 1992</td>
</tr>
<tr>
<td></td>
<td>Reaction time</td>
<td></td>
<td>Aghini-Lombardi et al 1995</td>
</tr>
<tr>
<td>India</td>
<td>Verbal, pictorial Learning tests Tests of motivation</td>
<td>Lower learning capacities</td>
<td>Tiwari et al 1996</td>
</tr>
<tr>
<td>Iran</td>
<td>Bender-Gestalt Raven</td>
<td>Retardation in psychomotor development</td>
<td>Azizi et al 1993</td>
</tr>
<tr>
<td>Malawi</td>
<td>Psychometric tests including verbal fluency</td>
<td>Loss of 10 IQ points as compared to iodine-supplemented controls</td>
<td>Shrestha 1994</td>
</tr>
<tr>
<td>Benin</td>
<td>Battery of 8 non verbal tests exploring fluid intelligence and 2 psychomotor tests</td>
<td>Loss of 5 IQ points as compared to controls supplemented with iodine for one year</td>
<td>Van den Briel et al 2000</td>
</tr>
</tbody>
</table>
Another consequence of longstanding iodine deficiency is the development of hyperthyroidism in the adult (Vanderpump et al. 1995; Aghini-Lombardi et al. 1999) but also in the child (Garcia-Mayor et al. 1999). This is accompanied by multinodular goitres with autonomous nodules. The pathogenesis of this syndrome is discussed later in this chapter (side effects of iodine supplementation). It is now accepted that such hyperthyroidism is one of the disorders induced by iodine deficiency.

3. Specific Iodine Deficiency Disorders

3.1 Endemic Goitre

3.1.1 Epidemiology

The term endemic goitre is a descriptive diagnosis and reserved for a disorder characterised by enlargement of the thyroid gland in a significantly large fraction of a population group, and is generally considered to be due to insufficient iodine in the daily diet. Since nontoxic goitre also exists when there is abundant iodine in the diet, the distinction between endemic and non-endemic goitre is necessarily arbitrary. Endemic goitre may be said to exist in a population when more than 5% of the preadolescent (aged 6-12) school age children have enlarged thyroid glands, as assessed by the clinical criterion of the thyroid lobes being each larger than the distal phalanx of the subject’s thumb (WHO/UNICEF/ICCIDD 2001). Detailed criteria are discussed further below.

Most of the mountainous districts in the world have been or still are endemic goitre regions. The disease may be seen throughout the Andes, in the whole sweep of the Himalayas, in the European Alps where iodide prophylaxis has not yet reached the entire population, in Greece and the Middle Eastern countries, in many foci in the People’s Republic of China, and in the highlands of New Guinea. There are or were also important endemias in non-mountainous regions, as for example, the belt extending from the Cameroon grasslands across northern Zaire and the Central African Republic to the borders of Uganda and Rwanda, Central Europe and the interior of Brazil. An endemic existed in the Great Lakes region in North America two generations ago. Measurements have indicated that these regions have in common a low concentration of environmental iodine. The iodine content of cereals and the drinking water is low, as is the quantity of iodide excreted each day by residents of these districts.
Goitre maps of various countries have been repeatedly drawn, requiring modification as successful prophylactic measures have been introduced. Although goitre was an important problem in many regions of the United States of America in the past (Clesen 1929), more recent USA surveys have shown it in no more than 4-11% of schoolchildren, and with almost no evidence of iodine deficiency (Hollowell et al 1998). This finding is a testimony to the effectiveness of iodine prophylaxis in preventing endemic goitre.

The great arc of the Himalayas from West Pakistan across India and Nepal, into Northern Thailand and Vietnam and into Indonesia, is one of the most highly endemic regions of the world. The disease used to be a major problem throughout the Andes. It has been reported from Australia and New Zealand and from different places in Europe. The world and regional distribution of goitre was exhaustively reviewed by Kelly and Snedden in 1960 and subsequently by others (Stanbury and Hetzel 1980); (Delange et al 1993); (Hetzel and Pandav 1996); (Delange et al 1998) and (WHO/UNICEF/ICCIDD 1999).

These surveys reveal striking differences in the rate of goitre in different endemic regions and even in adjacent districts. The geographic unevenness of an endemic undoubtedly has much to do with the habits of the population and their economic resources for the importation of foods. In attempting to account for the variability in the expression of endemic goitre from one locality to the next, the availability of iodine should be investigated before searching for some other subtle dietary or genetic factor. The key to the problem almost always lies in the availability of iodine. One must also consider the possibility that an observed goitre rate may not reflect current conditions, but rather may be a legacy of pre-existing iodine deficiency that has not yet been entirely resolved by an improvement in the supply of iodine. The assessment of goitre in a population is further discussed below in the section on assessment of the IDD status of the population.

3.1.2 Causes

i) Iodine Deficiency

The arguments supporting iodine deficiency as the cause of endemic goitre are four:

a) the close association between a low iodine content in food and water and the appearance of the disease in the population;

b) the sharp reduction in incidence when iodine is added to the diet;
c) the demonstration that the metabolism of iodine by patients with endemic goitre fits the pattern that would be expected from iodine deficiency and is reversed by iodine repletion.;

d) finally, iodine deficiency causes changes in the thyroid glands of animals that are similar to those seen in humans (Hetzel and Pandav 1996; Delange and Hetzel 1998).

Almost invariably, careful assessment of the iodine intake of a goitrous population reveals levels considerably below the average in regions where the disease does not exist. Most reports place the mean intake between 10 and 50µg/24 hour. Severe iodine deficiency is still encountered up to the present. From two endemic goitre areas of Zimbabwe mean iodine urinary excretion from adults was reported to vary between 10µg/L and 20µg/L (Todd and Bourdoux 1991). In Senegal a mean iodine excretion of 17µg/g creatinine (roughly equivalent to 24-hour) was also reported in 1992 (Lazarus et al 1992). In the Eastern part of Germany, a 24-hour iodine excretion of 16µg has been reported in 1989 (Delange and Burgi 1989). This is only a small sample of many reports indicating that iodine deficiency, even in its severe form, is still present in many parts of the world.

ii) Goitrogenic factors

Although the relation of iodine deficiency to endemic goitre is well established, other factors may be involved. A whole variety of naturally occurring agents has been identified that might be goitrogenic in man (Gaitan 1980; 1989). Most of these have only been tested in animals and/or have been shown to possess anti-thyroid effects in vitro. These compounds belong to the following chemical groups: Sulfurated organics (like thiocyanate, isothiocyanate, goitrin and disulphides), flavonoids (polyphenols), polyhydroxyphenols and phenol derivatives, pyridines, phalate esters and metabolites, polychlorinated (PCB) and polybrominated (PBB) biphenyls, other organochlorines (like DDT), polycyclic aromatic hydrocarbons (PAH), inorganic iodine (in excess), and lithium. Gaitan (1980) divides goitrogens into agents acting directly on the thyroid gland and those causing goitre by indirect action. The former group is subdivided into those inhibiting transport of iodide into the thyroid (like thiocyanate and isothiocyanate), those acting on the intrathyroidal oxidation and organic binding process of iodide and/or the coupling reaction (like phenolic compounds) some phalate derivatives (disulfides
and goitrin) and those interfering with proteolysis, dehalogenation and hormone release (like iodide and lithium).

Indirect goitrogens increase the rate of thyroid hormone metabolism (like 2,4 dinitrophenol, PCB’s and PBB’s). Soyabean, an important protein source in many third world countries interrupts the enterohepatic cycle of thyroid hormone (Van Wyk et al 1959) and may cause goitre when iodine intake is limited. It should be recognized that goitrogens are usually active only if iodine supply is limited and/or goitrogen intake is of long duration.

Goitre and especially large colloid goitres in endemic iodine deficiency represents maladaptation to iodine deficiency because it leads to a vicious cycle of iodine loss and defective thyroid hormone synthesis (Dumont et al 1995).

3.2 Endemic Cretinism

3.2.1 Epidemiology

When Sir Robert McCarrison described cretinism in north western India during the first decade of this century (McCarrison 1908) he delineated a neurologic form, with predominantly neuromotor defects, including strabismus, deaf mutism, spastic diplegia, and other disorders of gait and coordination. The other form, which he called the myxedematous form, showed evidence of severe hypothyroidism, short stature, and markedly delayed bone and sexual maturation.

3.2.2 Neurological Cretinism

The three characteristic features of neurological endemic cretinism in its fully developed form are extremely severe mental deficiency together with squint, deaf mutism and motor spasticity with disorders of the arms and legs of a characteristic nature. (fig. 2). As would be expected with a deficiency disease there is a wide range in the severity of the clinical features in the population affected. Recent studies by De Long et al (1985), Boyages et al. (1988) and by Halpern et al (1991) have provided new observations and insights.

i) The three characteristic features of neurological endemic cretinism are:

a) Mental deficiency is characterised by a marked impairment of the capacity for abstract thought but vision is unaffected. Autonomic, vegetative, personal, social functions and memory appear to be relatively well preserved except in the most severe cases.
Fig. 2  Male from Ecuador about 40 years old, deaf-mute, unable to stand or walk. Use of the hands was strikingly spared, despite proximal upper-extremity spasticity.
From: Delong et al (1985)
b) **Deafness** is the striking feature. This may be complete in as many as 50% cretins. It has been confirmed by auditory brain stem evoked potential studies, which showed no cochlear or brain stem responses even at the highest sound frequencies. These findings suggest a cochlear lesion. In subjects with reduced hearing a high tone defect is apparent. Deafness is sometimes absent in subjects with other signs of cretinism. All totally deaf cretins were mute and many with some hearing were found to have no intelligible speech.

c) **The motor disorder** shows a characteristic proximal rigidity of both lower and upper extremities and the trunk. There is a corresponding proximal spasticity with markedly exaggerated deep tendon reflexes at the knees, adductors and biceps. Spastic involvement of the feet and hands is unusual or, if present, is much milder than that of the proximal limbs. Function of the hands and feet is characteristically preserved so that most cretins can walk. This observation is very useful in differentiating cretinism from other forms of cerebral palsy commonly encountered in endemic areas, such as cerebral palsy from birth injury or meningitis.

In addition to frank cretinism, a larger proportion of the population (estimated to be 3-5 times as great) suffers from some degree of mental retardation and coordination defect. Comparative population based neuropsychological assessments of children in areas of iodine deficiency compared with areas with adequate iodine intake confirm a shift of the intelligence curve to the left in the iodine deficient areas. Careful examination of affected individuals in such areas, reveals a pattern of neurological involvement similar to that seen in frank cretins, although of milder degree. In assessing these less severe defects, nonverbal tests are most helpful and school progress is a good indicator. After the age of 3 years drawings are very useful, indicating a defect in visual motor integration (Delong et al 1985).

On the basis of his clinical observations, De Long (1987) suggests that the neuropathological basis of the clinical picture includes underdevelopment of the cochlea for deafness; maldevelopment of the cerebral neocortex for mental retardation; and maldevelopment of the corpus striatum (especially putamen and globus pallidus) for the motor disorder. The cerebellum, hypothalamus, visual system, and hippocampus are relatively spared. Studies of human cretin brains by modern techniques would provide further insight.

The frequency of goitre and thyroid dysfunction in these defectives is similar to the ones observed in the general population.
ii) Pathophysiology of neurological cretinism

Developmental neuropathology and available epidemiologic data suggest that the period from about 12-14 weeks until 20-30 weeks of gestation may be the critical period during which damage occurs. Cochlear development occurs at the same time. These data correlate well with the data from the Papua New Guinea trial, which indicated that iodine repletion, must occur before pregnancy to prevent cretinism (Pharoah et al 1971; Pharoah and Connolly 1987).

Studies already cited above on the effect of iodine deficiency on brain cell development in the newborn rat, sheep and marmoset suggest that iodine deficiency has an early effect on neuroblast multiplication. Brain weight is reduced with a reduced number of cells as indicated by lowered DNA, a greater density of cells in the cerebral cortex and reduced cell maturation in the cerebellum. In the light of the evidence summarized above that maternal thyroxine crosses the placenta, it is now concluded that neurological cretinism is caused by maternal hypothyroidism due to iodine deficiency in view of the fact that correction of maternal iodine deficiency before pregnancy will prevent cretinism in the infant (Pharoah et al 1971).

3.2.3 Hypothyroid (Myxedematous) Cretinism

The typical hypothyroid cretin (fig. 3) has a less severe degree of mental retardation than the neurological cretin. All the features of severe hypothyroidism are present from early life. As occurs with sporadic congenital hypothyroidism (Dumont et al 1963; Delange et al 1972) there is severe growth retardation, incomplete maturation of the features including the naso-orbital configuration, atrophy of the mandibles, puffy features, myxedematous, thickened and dry skin, dry and sparse hair, eyelashes and eyebrows and much delayed sexual maturation.

Contrasting with the general population and with neurological cretinism, goitre is usually absent and the thyroid is often not palpable, suggesting thyroid atrophy. This diagnosis is confirmed by thyroid scans which show thyroids in normal location but of small volume with a very heterogeneous and patchy distribution of the tracer (Delange 1974). Thyroidal uptake of radioiodine is much lower than in the general population. The serum levels of $T_4$ and $T_3$ are extremely low, often undetectable and TSH is dramatically high. Markedly enlarged sella turcicae have been demonstrated, suggesting pituitary adenomas (Melot et al 1962).
Hypothyroid cretinism used to be particularly common in Zaire. The early reports by the Belgian teams indicated limited neurological abnormalities in the cretins in this country (Delange et al 1972). The movements are slow and the reflex relaxation is usually much prolonged. However hyperreflexia and Babinski signs were occasionally reported while knocked knees, flat feet were obvious from the photographs of these patients reported in the literature. However, subsequent neurological examination of some of these patients (De Long et al 1985) revealed in some of them the neurological signs reported in the neurological type of cretinism, partly obscured by the features of severe hypothyroidism.

Iodine deficiency is, as for the neurologic type, a prerequisite for hypothyroid (myxedematous) cretinism. Its role is demonstrated by:

- the correlation between the degree of iodine deficiency and the frequency of the condition,
- the reemergence of cases in previously affected populations following cessation of salt iodization programs as recently reported from Central Asia. (Delange et al 1998).
4. Assessment of the IDD Status of the Population

The assessment of the status of iodine nutrition constitutes the basis for the development of a national IDD control program. Three major components are required for the assessment and, later, monitoring of IDD in an iodine deficient population. They are in order of importance from a public health point of view:

- the determination of the excretion of iodine in the urine;
- the determination of thyroid size and the estimation of the prevalence of goitre;
- the determination of the serum levels of TSH, thyroid hormones and thyroglobulin.

Updated recommendations regarding these three variables have been recently published in a WHO/UNICEF/ICCIDD Handbook (2001).

Apart from the techniques involved in these procedures, selection and sampling of the population has to be carried out using accepted criteria to provide valid indicators of the status of the population being studied. In general, observations have often been made on school children as one of the most vulnerable groups. A total sample of 200 children in the age range 10-14 years will suffice. Randomization is required to cover the variable distribution of goitre, which is related to hilly or mountainous terrain. This and other epidemiological aspects are discussed more fully elsewhere (WHO/UNICEF/ICCIDD 2001).

4.1 Urinary Iodine

Urinary iodine excretion is a good marker of the very recent dietary intake of iodine and, therefore, is the index of choice for evaluating the degree of iodine deficiency and of its correction. Iodine concentrations in casual urine specimens of children or adults provide an adequate assessment of the population iodine nutrition, provided a sufficient number of specimens is collected. Twenty four hours samples are difficult to obtain and are not necessary. Relating urinary iodine to creatinine is expensive and unnecessary.

Several methods of determination of urinary iodine have been reported (Dunn et al 1993; Rendl et al 1998; Ohashi et al 2000). The most commonly used is called Method A (WHO/UNICEF/ICCIDD 2001). Small samples of urine are digested with ammonium persulfate at 90-110°C. The iodine content is then determined with the sensitive colorimetry of the Sandell-Kolthoff reaction in which iodine is determined from its catalytic reduction
Global Elimination of Brain Damage Due to Iodine Deficiency

of cerium ammonium sulfate in the presence of arsenious acid. This method detects urinary iodine concentration in the range 0-100µg/L (0-1.19µmol/L).

For epidemiological studies, the population distribution of urinary iodine is required rather than individual levels. Because the frequency distribution of urinary iodine is usually skewed towards elevated values, the median is used instead of the mean as indicating the status of iodine nutrition. Table 5 shows the epidemiological criteria presently recommended for assessing iodine nutrition based on median urinary iodine concentrations.

The need for samples to be taken from pregnant women has become apparent in the light of recent studies (Glinoer and Delange 2000). Casual urine samples from school children can be collected at the same time as the goitre is assessed.

The values of urinary iodine can be most conveniently expressed as a range with a median or by the proportions at a series of cut off points, <20µg per litre, <50µg per litre and <100µg per litre.

Table 5. Epidemiological criteria for assessing iodine nutrition based on median urinary iodine concentrations in school-aged children

<table>
<thead>
<tr>
<th>Median urinary iodine (µg/L)</th>
<th>Iodine Intake</th>
<th>Iodine Nutrition</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 20</td>
<td>Insufficient</td>
<td>Severe Iodine Deficiency</td>
</tr>
<tr>
<td>20-49</td>
<td>Insufficient</td>
<td>Moderate Iodine Deficiency</td>
</tr>
<tr>
<td>50-90</td>
<td>Insufficient</td>
<td>Mild Iodine Deficiency</td>
</tr>
<tr>
<td>100-199</td>
<td>Adequate</td>
<td>Optimal</td>
</tr>
<tr>
<td>200-299</td>
<td>More than adequate</td>
<td>Risk of iodine-induced Hyperthyroidism within 5-10 years following introduction of iodized salt in susceptible groups</td>
</tr>
<tr>
<td>&gt;300</td>
<td>Excessive</td>
<td>Risk of adverse health consequences (iodine-induced hyperthyroidism, autoimmune thyroid disease)</td>
</tr>
</tbody>
</table>

From WHO/UNICEF/ICCIDD (2001)
4.2 Prevalence of Goitre

The size of the thyroid gland changes inversely in response to alterations in iodine intake, with a lag interval that varies from a few months to several years. The prevalence of goitre is an index of the degree of longstanding iodine deficiency and, therefore, is less sensitive than urinary iodine in the evaluation of a recent change in the status of iodine nutrition (WHO/UNICEF/ICCIDD 2001).

Thyroid size is traditionally determined by inspection and palpation but ultrasonography of the thyroid provides a more precise and objective method. Table 6 shows the revised and simplified classification of goitre.

Table 6. Revised classification of goitre

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 0</td>
<td>No palpable or visible goitre</td>
</tr>
<tr>
<td>Grade 1</td>
<td>A goitre that is palpable but not visible when the neck is in the normal position (ie the thyroid is not visibly enlarged). Thyroid nodules in a thyroid which is otherwise not enlarged fall into this category</td>
</tr>
<tr>
<td>Grade 2</td>
<td>A swelling in the neck that is visible when the neck is in a normal position and is consistent with an enlarged thyroid when the neck is palpated</td>
</tr>
</tbody>
</table>

From WHO/UNICEF/ICCIDD (2001)

However, the evaluation of the prevalence of goitre based on palpation has been questioned because the reproducibility of assessment by palpation is low, especially with the size estimation of smaller glands, particularly in children (WHO/UNICEF/ICCIDD 1994).

Therefore, the method of choice is now ultrasonography which is reproducible with a maximum deviation of 10%. Normative values for thyroid volume measured by ultrasonography as a function of age, sex and body surface area have been proposed (Delange et al 1997). However, these normative values might have been overevaluated by some 30% due to interobserver variability in thyroid ultrasonography (Zimmermann et al 2001). Updated normative values are presently being reevaluated. By definition, a thyroid is considered as goitrous when its volume is above the percentile 97 established for sex, age and body surface area in iodine replete populations (WHO/ICCIDD 1997).
As already stated the prevalence of goitre in iodine replete populations is below 5 percent.

4.3 Measurement of the Serum Concentrations of TSH, Thyroid Hormones and Thyroglobulin

The serum thyroid hormone levels are a further index of the effects of iodine deficiency.

However, difficulties are often encountered in obtaining venous blood samples in populations due to apprehension about blood collection and operational difficulties. Therefore, these measurements are not recommended in routine assessment and monitoring (WHO/UNICEF/ICCIDD 2001).

5. Technology of Iodine Supplementation

5.1 Iodized Salt

Iodized salt is considered as the most appropriate measure for iodine supplementation (WHO/UNICEF/ICCIDD 2001).

The advantage of supplementing with iodized salt is that it is used by all sections of a community irrespective of social and economic status. It is consumed as a condiment at roughly the same level throughout the year. Its production is often confined to a few centres, which means that processing can occur on a larger scale and with better controlled conditions. However, this is often not the case in developing countries.

There are two forms of iodine, which can be used to iodize salt: “iodide” and “iodate” usually as the potassium salt. Iodate is less soluble and more stable than iodide and is therefore preferred for tropical moist conditions. Both are generally referred to as “iodized” salt.

The daily requirement of iodine is 150µg per person for adults as already mentioned. The level of iodination of salt has to be sufficient to cover this requirement together with losses from the point of production to the point of consumption including the expected shelf life. It also has to take into account the per capita salt consumption in an area. Previously, generally accepted levels of salt consumption in the range 10-15g per day are now regarded as excessive because of the increased liability to hypertension. However, it is important to state here that a Joint WHO/FAO Expert Consultation on, “Diet Nutrition and the Prevention of Chronic Diseases” (WHO Technical Report Series, 916, 2003) Clearly stated the following with respect to salt intake while suggesting ranges of population nutrient intake goals. To quote, “Salt should be iodized
appropriately. The need to adjust salt iodization depending on observed sodium intake and surveillance of iodine status of the population should be recognized. Iodized salt is also needed as a feed supplement for cattle and other livestock in iodine deficient areas. Allowing for these factors, the level of iodine as iodate being used at present to provide 150µg of iodine by day is in the range of 20-40mg per kg (WHO/UNICEF/ICCIDD 1996). If salt intake falls, the level of iodine supplementation can readily be increased to maintain the required intake of 150µg per day.

The other aspects of the use of iodized salt in the prevention of IDD, including the implementation and monitoring of programs of universal salt iodization (USI) are discussed in Section V.

5.2 Iodized Oil

Iodized oil ("lipiodol") was first used for the correction of iodine deficiency in Papua New Guinea. In a controlled trial in the Boana area of the Huon Peninsula of New Guinea, McCullagh carried out a double blind follow-up over 3 years which revealed successful prevention of goitre (McCullagh 1963). In subsequent laboratory studies on the same population, Buttfield and Hetzel (1967) demonstrated both severe iodine...
deficiency and the effectiveness of the single iodized oil injection (4ml) in correcting iodine deficiency for a period of up to 4 1/2 years. A further controlled trial in the Western Highlands of Papua New Guinea revealed the prevention of endemic cretinism provided the injection was given before pregnancy. There was also a reduction in recorded foetal and neonatal deaths in the treated group (Pharoah et al 1971; Pharoah and Connolly 1987).

A further advantage of iodized oil has been the subsidence of established goitre within one to three months of the injection. (fig. 4) This is much appreciated by the goitrous subjects. When coupled with increased energy and well being consequent on the correction of hypothyroidism, there has been continued demand for the measure, originally in Papua New Guinea, and in many other countries since.

Extensive additional studies on the use of iodized oil in the correction and prevention of IDD have subsequently been conducted in Latin America, Africa, Asia and Eastern Europe (Dunn 1996).

The physiology and pharmacology of iodized oil in goitre prophylaxis has recently been extensively reviewed (Wolff 2001).

In excess of 100 million injections of iodized oil have been given since 1974 with very little in the way of side effects apart from a rare abscess at the site of injection. Refrigeration is not required, which is a great advantage. Iodized oil is certainly an effective means for the correction of iodine deficiency and has opened up the possibility of elimination of IDD as a public health problem in the next decade. However the necessity for an injection has been questioned, in view of the costs of the syringe and needles and the necessity to have specially trained staff to give the injections. If the staff are readily available through the primary health care system, then the costs are comparable to those of iodated salt: 5-10 US cents per person per year. On the other hand, if the oil can be given orally it would be possible to use village health volunteers to supervise the administration of the oil. This would make it much more readily available to village communities with severe IDD problems. Another advantage of the oral preparation is the freedom from the risk of AIDS or Hepatitis B infection from contaminated syringes, although this should be eliminated by proper sterilisation of needles or by using disposable syringes. Recent experience has confirmed the convenience of the oral administration of iodized oil at yearly intervals through the primary health care system at a village level. In general the effect of oral administration lasts half the time of the same dose given by injection (Delange 1994).
5.2.1 Target Groups

An iodized oil supplementation program is necessary when other methods have been found ineffective or can be considered to be inapplicable. Iodized oil can be regarded as an emergency measure for the control of severe IDD until an effective iodinated salt program can be introduced. The spectacular and rapid effects of iodized oil in reducing goitre can be important in demonstrating the benefits of iodization, which can lead to community demand for iodized salt. In general iodized oil administration should be avoided over the age of 45 because of the possibility of precipitating hyperthyroidism in subjects with longstanding goitre (see further below). Pregnancy is not regarded as a contra-indication (WHO 1996; Delange 1996). There is a considerable variation in the costs in various parts of the world as might be expected. One important factor is the availability of primary health care staff for the administration of the oil whether by mouth or by injection. The important feature of iodized oil administration is that it can be carried out without the legislation required for iodized salt.

The possibility of linking up an iodized oil program with other preventive programs including the Child Immunization Program, has been investigated (WHO 1987). Great progress has been made with child immunization programs in Africa and Asia. A series of injections are given covering diphtheria, tetanus toxoid and whooping cough (3 injections), polio (usually double oral administration) and measles (single injection). The target group is young children (0-2 years). Tetanus toxoid is recommended for pregnant women as a preventive measure against tetanus in the neonate.

To this series of measures, iodized oil administration (by injection or by mouth) could readily be added to cover young children over the first 2-5 years of life, the second most important target group. Women of reproductive age would require separate coverage through the primary health care system, especially the family planning health care system or in antenatal services at the same time as with tetanus toxoid. These measures have now been recommended by the World Health Organization.

5.3 Other Methods

Iodized bread was used in Tasmania in preference to both iodized salt and iodide tablets distributed through the schools, and shown to be effective (Clements et al 1970). Its use was discontinued because of the availability of other sources of iodine, notably from milk consequent to
the use of iodophors in the dairy industry. It is for this reason that milk has become a major adventitious source of iodine in many Western countries such as the USA, the United Kingdom, and in Northern Europe. A change in dairy practice has now reversed the situation and increased the likelihood of iodine deficiency in the population. Successful use of iodized bread has been reported from Russia when bread became a staple (Gerasimov et al 1997).

Iodized water has been used in several countries. Reduction in goitre rate from 61 per cent to 30 per cent with 79 per cent of goitres showing visible reduction has been demonstrated following iodation of the water supply in Sarawak. Significant rises in serum T₄ and falls in TSH were also shown. Measurement of urinary iodine excretion indicated iodine repletion (Maberly et al 1981).

Similar results have been obtained from further studies in Thailand, in Sicily, Mali, Central African Republic and China. They have been recently reviewed (ICCIDD 1997).

6. Control of IDD

6.1 Current Status of IDD Control Programs

Seaweed has been used to prevent goitre in China for centuries but it is only in the years 1910 to 1920 that systematic programs of salt fortification with iodine were introduced as a strategy for the elimination of IDD in Switzerland (Burgi et al 1990) and in the United States of America (Marine and Kimball 1920).

Starting in the late 1950s with pioneering studies in New Guinea (McCullagh 1963; Buttfield and Hetzel 1967), supplementation with iodized oil was introduced in severely affected populations in Asia, Africa and Latin America. Initially, iodized oil was administered intramuscularly, more recently by the oral route. Follow-up studies of these programs are reported and summarized elsewhere (Dunn 1996). As indicated earlier in this chapter, iodized oil appeared as a particularly effective procedure for the elimination of IDD: goitre prevalence decreased rapidly and thyroid function reverted to normal and remained normal up to 5 years after injection of iodized oil and for 1 to 2 years after oral administration (Buttfield and Hetzel 1967). A further controlled trial in the Western Highlands of Papua New Guinea revealed the prevention of endemic cretinism provided the injection was given before pregnancy (Pharoah et al 1971). The trial also revealed a reduction in recorded foetal and neonatal
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deaths in the treated group. As indicated earlier, mental development was markedly improved and the frequency of stillbirths and the perinatal mortality decreased while the birthweight increased (Pharoah et al 1971; Pharoah and Connolly 1987).

In summary, the studies using iodized oil unquestionably demonstrated that correction of iodine deficiency, greatly reduced or eliminated its consequences: brain damage, mental retardation, goitre, impaired thyroid function and perinatal morbidity.

Similar but less dramatic effects occur with iodized salt depending on the rapidity of the correction of iodine deficiency.

The justification, technology and organization of programs of universal salt iodization are described in Section V.

As described in Section II following the World Summit for Children of 1990 to assist the joint efforts and action of the 130 IDD affected countries and their governments, there has now developed an informal Global Partnership. This Partnership includes major agencies of the United Nations, namely UNICEF, WHO, and the World Bank; the bilateral aid agencies, especially Australia, Canada and the Netherlands; international technical NGOs such as ICCIDD and the Micronutrient Initiative (MI); The Program Against Micronutrient Malnutrition (PAMM), funding by Kiwanis International through UNICEF and the salt industry. Great progress has been achieved during the last decade in ensuring access to iodized salt for iodine deficient populations (see further Sections II and V).

6.2 Monitoring and Impact of the Programs of Salt Iodization

The social process for successful implementation a national IDD control program includes the following components (see Section II): situation assessment; communication of results to health professionals, political authorities and the public; development of an action plan; implementation of the plan and finally, evaluation of its impact at population level. This last phase, monitoring, is often neglected not only because it is the last phase in the process but because it may be over shadowed by other components of the program such as implementation, which is considered as the main or occasionally even the single component to be considered. In addition, many countries affected by IDD belong to the group of countries with low income that therefore do not have the financial or technical resources for the laboratory facilities necessary to
Global Elimination of Brain Damage Due to Iodine Deficiency

carry out proper monitoring of salt quality and iodine status. And yet, monitoring is crucial because IDD is a disease and its prevention and therapy require trained professionals to supervise the program and verify its effects.

As indicated in Section V the most cost-effective way to achieve the virtual elimination of IDD is through Universal Salt Iodization, (USI). Therefore, the indicators used in monitoring and evaluating IDD control programs include:

- Indicators to monitor and evaluate the salt iodization process (Process indicators);
- Indicators to monitor the impact of salt iodization on the target populations (Impact indicators).

The process indicators are discussed in detail in Section V.

The impact indicators have been recently reevaluated and discussed (WHO/UNICEF/ICCIDD 2001). They are described in detail earlier in this Chapter. As indicated, they include especially the determination of urine iodine.

It is now considered that iodine deficiency has been eliminated from a particular country when the access to iodized salt at household level is at least 90%, together with a median urinary iodine of at least 100µg/L and with less than 20% of the samples below 50µg/L.

Currently, we have much less information about the impact of the salt iodization programs on IDD than on the implementation of the programs themselves. The monitoring data of all countries affected by IDD with a program of iodine supplementation are summarized country by country on the websites of ICCIDD (http://www.iccidd.org) and WHO (http://www.who.int.nut) (See Section VIII, IX and Appendix I).

As assessed by measurements of urinary iodine, many countries have achieved the elimination of iodine deficiency, e.g. Algeria, Kenya, Cameroon, Tanzania (Africa), Iran, Lebanon, Tunisia (Eastern Mediterranean), Bhutan, China, Indonesia, India, Thailand (Asia), Venezuela, Peru, Ecuador (Latin America) and Switzerland, Austria, Great Britain, Finland, Norway, Sweden, Poland, Macedonia and Serbia in Europe.

So far few longitudinal or case control studies address the influence of USI on the other main disorders induced by iodine deficiency, such as impairment of thyroid function, low birth weight, perinatal mortality and morbidity and the prevention of mental retardation. The statement that correction of iodine deficiency protects 85 million neonates from the risk of brain damage and mental retardation annually is politically attractive.
but scientifically questionable as it results simply from a multiplication of the birth rate of the affected countries by the percentage of access to iodized salt at household level. Both figures lack precision.

Finally, partnership evaluation of country programs using for example the ThyroMobil model (Delange et al 1997) indicated that in some countries, poorly monitored programs of salt iodization resulted in excessive iodine intake associated with risks of adverse health consequences such as iodine-induced hyperthyroidism (IIH).

6.3 Side Effects of Iodine Supplementation

As discussed so far in this chapter, iodine deficiency is associated with the development of thyroid function abnormalities. Similarly, iodine excess, including following overcorrection of a previous state of iodine deficiency, can also impair thyroid function. The effect of iodine on the thyroid gland is complex with a U shaped relation between iodine intake and risk of thyroid diseases as both low and high iodine intake are associated with an increased risk. It is stated that normal adults can tolerate up to about 1000µg iodine/day without any side effects (WHO 1994). However this upper limit of normal is much lower in a population which was exposed to iodine deficiency in the past. The optimal level of iodine intake to prevent any thyroid disease may be a relatively narrow range around the recommended daily intake at 150µg (Knudsen et al 2000).

The possible side effects of iodine excess are as follows:

6.3.1 Iodide goitre and iodine-induced hypothyroidism

When the iodine intake is chronically high, as for example in coastal areas of Japan (Suzuki et al 1965) and China (Ma et al 1982) due to the chronic intake of seaweeds rich in iodine such as laminaria or in Eastern China because of the high iodine content of the drinking water from shallow wells (Zhao et al 2000), the prevalence of thyroid enlargement and goitre is high as compared to normal populations and the prevalence of subclinical hypothyroidism is elevated. The mechanisms behind this impairment of thyroid function are probably both iodine enhancement of thyroid autoimmunity and reversible inhibition of thyroid function by excess iodine (Wolff-Chaikoff effect) in susceptible subjects (Roti and Vagenakis 2000). However, this type of thyroid failure has not been observed after correction of iodine deficiency, including in neonates after the administration of huge doses of iodized oil to their mothers during pregnancy (Delange 1996).
6.3.2 Iodine-induced hyperthyroidism (IIH)

Iodine-induced hyperthyroidism (IIH) is the main complication of iodine prophylaxis. It has been reported in almost all iodine supplementation programs (Stanbury et al 1998). The outbreak most extensively investigated occurred in Tasmania in the late 1960s following iodine supplementation simultaneously by iodized bread and the use of iodophors by the milk industry (Connolly et al 1970; Stewart et al 1971). The incidence of hyperthyroidism increased from 24 per 100,000 in 1963 to 125 per 100,000 in 1967. The disease occurred most frequently in individuals over 40 years of age with multinodular goitres (Vidor et al 1973). The most severe manifestations were cardiovascular and were occasionally fatal. The epidemic lasted for some 10 to 12 years and was followed by an incidence of hyperthyroidism somewhat below that existing prior to the epidemic.

The problem of IIH was recently reactivated when it was reported that the introduction of iodized salt in Zimbabwe resulted in a sharp increase in the incidence of IIH from 3/100,000 to 7/100,000 over 18 months (Todd et al 1995). A high risk of IIH was also reported from Eastern Congo following the introduction of iodized salt (Bourdoux et al 1996). A multicentre study conducted in seven African countries, including Zimbabwe and Congo (WHO/UNICEF/ICCIDD 1997) showed that the occurrence of IIH in the last two countries was due to the sudden introduction of poorly monitored and excessively iodized salt in populations which had been severely iodine deficient for very long periods in the past. The conclusion of the multicentre study was that the risk of IIH was related to a rapid increment of iodine intake resulting in a state of acute iodine overload. On the contrary as already mentioned an increased incidence of hyperthyroidism was not reported in populations which could adjust their thyroid function and regulation to a chronically high iodine intake.

IIH following iodine supplementation cannot be entirely avoided even when supplementation uses only physiological amounts of iodine. In a well controlled longitudinal study in Switzerland the incidence of hyperthyroidism increased by 27% during the year after the iodine supply was increased from 90µg/day to the recommended value of 150µg/day (Baltisberger et al 1995). Subsequently there was a steady decrease in the incidence of the disorder.

The reason for the development of iodine-induced hyperthyroidism after iodine supplementation has now been explained (Dremier et al 1996). Iodine deficiency increases thyroid cell proliferation and mutation rates
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which, in turn, trigger the development of multifocal autonomous growth with scattered cell clones harbouring activated mutations of the TSH receptors. Measurement of total intrathyroidal iodine by means of X-ray fluorescence scanning showed that only some nodules keep their capacity to store iodine, others become autonomous and can cause hyperthyroidism after iodine supplementation (Jonckheer et al 1992).

It thus appears that IIH is one of the Iodine Deficiency Disorders. It appears to be inevitable in the early phase of iodine supplementation. It is important that clinical facilities are available for diagnosis and treatment of these patients. They are usually over the age of 40 so that radioactive iodine is the treatment of choice.

6.3.3 Iodine-induced thyroiditis

Another possibility is the aggravation or even the induction of autoimmune thyroiditis by iodine supplementation. In experimental conditions, excessive iodine intake can precipitate spontaneous thyroiditis in genetically predisposed strains of beagles, rats or chickens. The mechanism involved in iodine-induced thyroiditis in animal models could be that elevated dietary iodine triggers thyroid autoimmune reactivity by increasing the immunogenecity of thyroglobulin or by inducing damage of the thyroid by cell injury by free radicals.

Attention was drawn to the possibility of iodine-induced thyroiditis in humans when studies conducted in the United States of America following the implementation of salt iodization showed an increased frequency of Hashimoto’s thyroiditis seen in goitres removed by surgery (McConahey et al 1962).

However, to the best of our knowledge, although cross sectional studies have associated endemic goitre with the presence of thyroid autoantibodies for example in Sri Lanka (Premawardhana et al 2000) no large epidemiological metabolic or clinical surveys have been performed which have analyzed the impact of large scale programs of iodine supplementation on the occurrence of clinically significant iodine-induced thyroiditis with public health consequences on thyroid function. The longterm prospective study presently organized in Denmark (Laurberg et al 1998) could provide an adequate answer to the question as to whether correction of iodine deficiency results in clinically significant development of thyroid autoantibodies and thyroid failure. For the Danish authors, thyroid autoantibodies appear as markers but not inducers of thyroid disease, i.e. they are the consequence of the goitre rather than its cause.
6.3.4 Thyroid cancer

In animals, the chronic stimulation of the thyroid by TSH is known to produce thyroid neoplasms (Money and Rawson 1950). There is a tendency for higher incidence rates of thyroid cancers in autopsy material from endemic goitre areas although the relationship of thyroid cancer and endemic goitre has often been debated without agreement being reached on many aspects, including causal relationship (Harach et al 1985).

Iodine supplementation is accompanied by a change in the epidemiological pattern of thyroid cancer with an increased prevalence of papillary cancer discovered at autopsy (Vigneri et al 1998). However, the prognosis of thyroid cancer is significantly improved following iodine supplementation due to a shift towards differentiated forms of thyroid cancer that are diagnosed at earlier stages.

Moreover, careful monitoring of the incidence of thyroid cancer in Switzerland following iodine supplementation showed that the incidence of thyroid cancers steadily decreased from 2 to 3 per 100,000 in 1950 to 1 to 2 per 100,000 in 1988, i.e. during a period when iodine intake increased and reached an optimal value (Levi et al 1991).

Finally, fine-needle aspiration biopsies were performed in Poland between 1985 and 1999 in 3,572 patients treated by thyroidectomy and were compared to the results of postoperative histopathological examinations. The particular interest of this study is that Poland used to be an endemic goitre area and that iodine deficiency was progressively corrected during the study period 1985-1999. The frequency of neoplastic lesions significantly decreased throughout the examined period and the ratio of the papillary/follicular carcinomas increased. However, the frequency of cytologically diagnosed chronic thyroiditis increased from 1.5 to 5.7% (Slowinska-Klencka et al 2002).

7. Conclusion

In conclusion, it appears that the benefits of correcting iodine deficiency far outweigh its risks (Braverman 1998; Delange 1998). Iodine-induced hyperthyroidism and other adverse effects can be almost entirely avoided by adequate and sustained quality assurance and monitoring of iodine supplementation which should also confirm adequate iodine intake.

We conclude that the progress towards correction of iodine deficiency globally in the past decade is a public health success unprecedented with a non-infectious disease and that sustainable elimination of this Ancient Scourge is within reach.
References


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Section V

Iodized Salt for the Elimination of Iodine Deficiency Disorders

M. G. Venkatesh Mannar

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8. A Continuing Partnership
1. Introduction

The importance of addressing iodine deficiency disorders (IDD) on a global basis was first recognized at the World Summit for Children in 1990. Seventy one (71) Heads of State met in New York and approved a plan to promote the welfare of children (World Summit for Children 1990) that included seven major goals and 26 supporting/sectoral goals of which three related to micronutrient malnutrition—one specifically to eliminate IDD. Although the micronutrient goals seemingly constituted only a fraction of all the goals they were the cutting edge, they were amenable to fulfillment in the shortest possible time and their cost benefit ratio was highly favourable. They also underscored the unique opportunity we had to provide nutritional well being as fundamental to sustainable human development on a scale not witnessed before. The summit goals became a mission for the entire UN family—for the aid agencies, for governments and non-governmental organizations. Following the summit, governments working with the salt industry and supported by international agencies and expert groups then set to develop programs that would enable this measure.

The inadequacy of iodine in the diets of many populations is caused by the lack of iodine in the food that people eat owing to a deficiency in the soil and water where the food is grown. This can be corrected through provision of small doses of iodine through commonly eaten foods or condiments. Salt iodization has been identified as the main intervention to deliver iodine on a continuous and self-sustaining basis to populations around the world. Salt has been demonstrated to be an excellent carrier for iodine and other nutrients as it is consumed at relatively constant and well-defined levels by most people within a country or region. Intake is largely independent of economic status. Iodization of salt therefore needs to be instituted as on a sustained basis. Salt iodization is a remarkably cost effective public health goal. On average, the one-time increase in cost is only 3-5 cents per person per year, a price so low that even consumers in least developed countries would barely notice it.

Once established in a country, salt iodization is a permanent and long-term solution to the problem. It eliminates iodine deficiency and continues to give each individual his/her daily iodine needs and prevents recurrence. Within one year of a community regularly consuming iodized salt containing the required iodine, there will be no further birth of cretins or children with subnormal mental and physical development attributable
to iodine deficiency. Goitres in primary school children and adults will have started to shrink and even disappear altogether. Children will be more active and perform better at school. Conversely, if there is a slippage in iodization programs and people do not receive their daily requirement of iodine on a regular basis, iodine deficiency disorders and Goitres will resurface very quickly (Sections II, IV).

2. Achievements

By the year 2003 many developing countries had taken steps to ensure that they iodize all salt produced for human and livestock consumption. Nearly 70% of the world’s human and livestock salt is iodized today. But the problem is not eliminated and further efforts are needed to complete the task and sustain the achievement. In 2002 world leaders re-convened at the UN General Assembly Special Summit for Children (UNGASS). They reaffirmed their commitment to “….achieve sustainable elimination of iodine deficiency disorders by 2005 (A World Fit for Children, United Nations 2002).

Policy makers realize that in the wider picture technological problems are not nearly as serious as operational ones related to making programs work in communities where deficient people live. Issues of supply and logistics, communications and community participation, partnership building across a wide spectrum of players-public and private-are recognized as equally important to ensure the success and sustainability of efforts to eliminate micronutrient deficiencies in large populations.

The following achievements in IDD elimination over the past decade are noteworthy (Gross 2003).

- By 2002, more than 170 countries had committed themselves to universal iodization of salt. Many countries have provided resources for IDD elimination in their national financial budgets and are progressing toward the goal of Universal Salt Iodization.
- Salt iodization has witnessed a remarkable growth in application. According to UNICEF reports in 2002, most of the populations in more than 87 countries-at least 65% of the world’s population-already have access to iodized salt. (fig. 1) Forty-five countries have achieved more than 75% coverage.
- Most countries already have all, or most, of the necessary program components in place. Producers are clearly supporting increased production and sale of iodized salt. In most countries, iodized salt is
already available, public awareness and knowledge is high and they are monitoring IDD rates. Regulations or laws are in place or being developed.

- Investment (Public & Private) in the iodized salt industry over the past decade exceeds one billion dollars and continues to grow.
- Large populations are no longer iodine deficient. (China is one of the great success stories in salt iodization, having gone from 50 percent coverage just ten years ago to more than 95 percent coverage today (see further below).
- There is significant reduction in total Goitre rate in several countries with maximum impact in regions where household level consumption of iodized salt is high (fig. 2). We are preventing more than 12 million cases of mental retardation in infants annually (UNICEF 1998). Human function and development will benefit enormously. Intellectual capacity of a significant number of the next generations born into the world will increase.
- There is now potential for eliminating the ancient scourge of iodine deficiency disorders. Success with salt iodization has given governments a new confidence to address other more complex micronutrient problems through food fortification to deliver essential micronutrients to their populations.

By any yardstick this is a major global public health achievement. In many developing countries, salt iodization is the first large-scale experience in national fortification of a commodity to eliminate a public health problem. It has taught valuable lessons in collaboration between government, industry, non-governmental organizations, the media, the community at large and other sectors. It has also offered insights into building and sustaining an intervention politically, technically, managerially, financially and culturally.

Universal Salt Iodization (USI) may be in reach, yet we are not yet there. In as many as 50 countries less than 50% use iodized salt. Further a disturbing sign of “backsliding” has been recently noted in some regions. With less than two years remaining to achieve this goal, there is an urgent need to reinvigorate the global effort and to accelerate country level action. Countries need to identify constraints and weaknesses and develop corrective actions. Monitoring is key since time and again, we have seen the re-emergence of IDD when monitoring slackens. Countries require a well-designed monitoring system to provide information for decision-making, targeting, focusing attention, raising awareness and garnering resources.
Fig. 1 Consumption of Iodized Salt (by Geographic Region)

Fig. 2 Trends in Total Goitre Rate with Increasing Household Consumption of Iodized Salt
3. Key Partners in the Global Effort

Salt iodization represents the first effort to advocate and institute national fortification programs to deliver essential nutrients. Effective and sustainable iodization is possible only when the public sector (that has the mandate and responsibility to improve the health of the population), the private sector (that has experience and expertise in food production and marketing), and the social sector (that has the grassroots contact with the consumer) collaborate to develop, produce, and promote the fortification of a basic food commodity such as salt.

The rapid promotion and realization of the goal of USI has been the outcome of a growing international dialogue on micronutrient malnutrition to develop this new coalition between governments, private food companies, scientific expert groups, multilateral and bilateral development assistance agencies and other stakeholders to discuss collaborative approaches to eliminate micronutrient malnutrition. This effort is a new kind of partnership—a partnership at different levels. At the global level, it links the international agencies and groups (each with their own plans to pursue) to ensure that key issues and needs are addressed. At the national level—where the war really needs to be won—it brings together public and private sectors, profit, and non-profit sectors. At the regional level the initiative needs to be supported with agreement on issues of inter-country food movement, standards, and regulation.

Following the international commitment at the World Summit for Children in 1990 these linkages and partnerships got steadily established (UNICEF 1990). They were supported at the international level by several agencies including UNICEF, the World Health Organization and The World Bank. The International Council for Control of Iodine Deficiency Disorders provided the scientific leadership and consensus for intervention and surveillance. Other groups such as the Micronutrient Initiative provided technical and financial support to expand and refine salt iodization practices and monitoring. Bilateral donor agencies (primarily, Australia, Canada, Japan, the Netherlands, Sweden and the USA) provided initial financial support. More significant funding followed through a global service project undertaken by Kiwanis International to raise and provide resources to support national programs.

At the World Salt Symposium held in The Hague, The Netherlands in May 2000, salt iodization became one of the main themes and priorities for the salt industry (Mannar 2000). During the Symposium executives of
the salt industry met with leaders of governments and NGOs and directors of international organizations to look at how they could better collaborate to accelerate global progress towards ending iodine deficiency forever. An agreement was reached to form the Network for Sustained Elimination of Iodine Deficiency, a collaborative coalition of public, private, international and civic organizations (see further Section III).

The IDD elimination goal was re-affirmed by multi-sector national delegations during the UN Special Session for Children (UNGASS) in New York, May 2002 and a timetable was set for global elimination by 2005. The Network for Sustained Elimination of Iodine Deficiency (IDD Network) was formally launched by the Director General of WHO at a side event during UNGASS which included contributions of high-level global leaders, including the Ministers from Canada, Netherlands and the United States of America. Today the Network includes key actors: UN agencies, salt producers, major salt industry associations, scientific bodies, non-government interests and civil society. The Network has organized regional meetings in Europe (Ghent 2001) and Latin America (Miami, March 2002) and Asia (Beijing, October 2003), to bring together the important stakeholders to assess the status of IDD prevalence and progress towards USI and develop strategies to accelerate progress towards the goal.

The Network’s mandate is to support national efforts to eliminate iodine deficiency—and to sustain elimination—by promoting collaboration among public, private and civic organizations. These partner organizations are committed to ensuring that universal salt iodization is sustained in all countries, and that recurrence of brain damage from iodine deficiency will be prevented. The Network is unique in bringing together such a broad range of partners—especially the salt industry.

4. Integrating Iodization within Salt Production and Distribution Systems

The specific objective is to dovetail iodization into the prevailing salt production and distribution system in a country at minimum cost and disruption. The salt industry has obviously been a key player in enabling this major public health achievement. However the production process and scale vary over a wide range in this most ancient of industries. Salt manufacturing techniques and product quality vary over a wide range from cottage scale units producing a few hundred tons a year to very
large fully automated plants producing several million tons. Some countries depend entirely on mining of underground rock salt deposits. Others on the extraction of salt from sea water or saline lake/underground brine by solar drying. In a few countries they produce both forms. For units with production of more than 10,000 tons per year that are well organized with quality control systems, the integration of iodization has been easy. Such large producers account for nearly 75% of all salt for edible consumption in these countries.

However, many small units along coastlines or lake shores produce some of the salt as a semi-agricultural operation. These units often operate with a minimum of organization and almost no quality control. They are scattered along the coast or lake shores and do not lend themselves to regulation by the government. Very often precise figures regarding even their location, extent of holdings and production statistics are not available. The producers have limited financial means and lack access to technical or financial assistance to begin quality iodization processes and to monitor quality. As a result the salt produced in these units is of poor quality. This has complicated USI programs. Additionally they have poor packaging practices or do not package the salt at all. Yet they are often the main salt supplies to the communities most at risk of IDD.

As USI implementation enters the critical final phase in many countries, support needs to be provided to small producers. The producers often have to first be convinced that they have a role to play in the USI program and that they are capable of doing it. Benefits to them, including economic returns, have to be illustrated. Their limitations and constraints need to be recognized. They cannot and should not be expected to participate for the good of the country, although this should be developed as a motivating factor. At the end of the day, the production of iodized salt must benefit them economically in order for their contribution to be sustainable. As a long-term aim, they should also be supported to upgrade their facilities in general. In order to remain economically viable, small salt producers will have to change with the times. The trend will inevitably be towards better quality, iodized salt. To work towards this they may need to form cooperatives with other producers. A shared iodization machine may be the starting point for such a cooperative. The next step may be a packing machine. Alternatively they could be facilitated to supply their salt to larger producers, who undertake the task of iodization and packaging and perhaps purification. Technical training and assistance is often needed, for example in establishing production, quality control sampling and analytical procedures. In some cases, appropriate
technology for salt purification needs to be provided. Simpler quality control and analytical techniques, such as test kits, may also be needed.

A further problem experienced in some countries, is multiple levels of iodization and packaging. In this situation, raw salt producers supply their un-iodized salt to multiple small re-packagers who take on the task of iodization and packaging the salt into consumer-size bags. As with small salt producers, these facilities often do not have the capacity to consistently produce good quality iodized salt and to monitor its quality. Where this practice occurs, governments should encourage raw salt producers, especially if they are large, to iodize the salt at source. These raw salt producers can thereafter supply large sacks of iodized salt to re-packers for packing into small bags. By encouraging iodization at source, the number of facilities that need to be monitored is reduced and large producers can take advantage of economies of scale to implement more dependable and uniform iodization techniques.

The stability of iodine in salt and levels of iodization are questions of crucial importance to national planners and salt producers as they have implications for program effectiveness, safety and cost. High humidity results in rapid loss of iodine from iodized salt, ranging anywhere from 30 to 98% of the original iodine content. By refining and packaging salt in a good moisture barrier, such as low density polyethylene bags, iodine losses can be significantly reduced, during storage periods of over six months (Mannar 2000). Over the past decade there have been significant investments in salt refining capacity in several countries. In India, refining capacity has increased from less than 5% to nearly 50% over the past 15 years. China has undergone a major modernization of refining iodization and packaging facilities over the past six years. This augurs well for iodization since refined salt in watertight packing retains up to 80% of iodine for 12 months.

5. Achieving and Sustaining Universal Salt Iodization

As significant as the progress over the past decades has been and as promising as their potential might be, there is still much to be done. There is evidence of declining IDD prevalence but the goal of elimination has not yet been achieved. Experience over the past decade has provided several valuable lessons, which point to future strategies to expand and sustain the universal iodization of salt.
5.1 Sustaining Political Commitment at the National and Sub-National Level

The Goal of IDD elimination and USI is a national obligation. Continued and strong government commitment and industry motivation are essential to eliminate IDD. Senior political leaders should strongly support the cause. Political commitment to IDD elimination needs constant renewal through periodic advocacy events. We therefore need to ensure advocacy for long term sustained commitment from all collaborating partners. Programs should continue after external inputs are withdrawn with more national resources in firm and permanent budgets to sustain progress. National plans must commit resources for sustained elimination of IDD.

Multi-sectoral national and sub-national coalitions are practical and effective means to sustain IDD elimination. Coalitions should have clearly defined goals, authority and definition of roles and responsibilities. They should use monitoring information for strategic planning and decision making. Coalitions should promote collaboration between government departments and between government and other partners in particular the salt industry. The economics of the salt industry and the food processing industry need to be more fully understood by the health and scientific community in order that recommendation for national consideration makes good business sense as well as good public policy. Elimination of IDD will reduce preventable mental retardation but this must be made into a socially positive political good. Periodic external evaluations could be invited to provide an independent perspective and insights.

5.2 Ensuring the Supply of Iodized Salt

The production and marketing of adequately iodized salt needs to be accelerated until all households and individuals have access. While voluntary iodization is a good step, only mandatory iodization will ensure universal compliance. It is important to ensure that all salt for human and animal consumption including salt for food processing is iodized. The salt industry should have the mandate and resources to ensure effective iodization including mechanisms to secure regular and efficient supply of raw materials including salt, bags, potassium iodate and laboratory supplies. Refining and moisture-resistant packaging are essential to retain iodine. Producer compliance, quality assurance, logistic problems and
bottlenecks need to be addressed through effective advocacy and social communications.

Associations of salt producers should be strengthened to build capacity to produce and distribute adequately iodized salt. Salt producers should be provided with the infrastructure and financial assistance through innovative mechanisms such as revolving funds where necessary. They should be provided with sustained management inputs to ensure quality assurance of product, process and progress.

The flow of non-iodized salt into the market should be actively discouraged. Technical assistance and other support should be made available to small salt producers to be able to produce adequately iodized salt or to pool their salt to enable iodization.

5.3 Quality Assurance of the Product, the Process and the Progress is Key

An effective and ongoing monitoring system to check iodine levels in salt from production to consumption is essential for the success of an iodization program. Once national standards for iodization are in place and understood by producers and processors alike, the issue becomes their application universally and over time persistently to assure the public health-public nutrition benefit desired. Nationally monitoring implies regular oversight of:

i) The Product (clean products, quality standards, appropriate iodine levels, fair prices),

ii) The Process (access to raw materials, iodate, packaging, labeling, quality assurance mechanisms in place, systematic and regular training, public communication, social marketing, management, accountability).

iii) The Progress (impact measurement in humans and animals to confirm success and shows its positive consequences in health, well-being, productivity and progress of the nation)

There should be a sustained commitment by all parties—government, industry and trade and the consumer to ensure effective monitoring of iodized salt. Monitoring of salt at all levels particularly at the production level is key. Private producers of iodized salt should accept the responsibility for quality production of iodized salt at competitive and fair prices universally. Monitoring systems should ensure specified salt iodine levels and coordinated with effective regulation and enforcement.
They need to be supported with administrative and lab infrastructure and be functional to enable corrective action when required. They should help identify problem areas. The use of salt testing kits should be expanded especially at consumer level in markets and households. To support monitoring we need to look at ways in which modern technology can be more rapidly applied to essentials of programs in IDD elimination. Some immediate ways are through rapid field test and assessment techniques, electronic communications tools and reporting techniques, management information systems, training, orientation and motivation.

5.4 Reaching the Unreached

Reaching iodized salt in rural terrain and difficult geography-mountainous or coastal-presents a challenge. Access to iodized salt by rural populations requires special strategies to meet situations that are unique and varied. The focus should be on improving marketing to difficult locations and transient, remote, isolated populations and/or island groups. However in so doing we must avoid the danger of thinking of IDD as a problem mainly for rural or mountain populations. It is a major urban problem, as well. Countries with limited resources or smaller problems need more help; others need support to accelerate existing plans.

5.5 Social Mobilization, Demand Creation and Community Participation

The consumption of adequately iodized salt should be the norm for all. The rationale should be that children have the right to reach their genetic potential and people have the right to demand fortified products like salt at convenient locations, in appropriate packages, at fair prices…and forever. Towards this end a clear communications strategy should be implemented to expand and sustain consumer awareness and demand for iodized salt. This should include education on the health, economic and social value of iodine in the daily diet through school curricula, media and other channels. Communications and monitoring of USI and IDD elimination should be integrated within existing health/education/agricultural extension structures and procedures in imaginative ways. Demand for iodized salt could be increased through consumer education, a national logo for easy identification and social mobilization. Innovative ways of building awareness amongst stakeholders through religious leaders or well-known personalities could be used. Salt testing
kits could be used as a social mobilization tool in schools and communities and also by traders and dealers (see further Section VI).

5.6 Salt Iodization Strategies and Programs need to Keep Adjusting to a Changing Environment

Globalization and free trade are having significant impacts on salt production, import, refining and distribution patterns and need to be monitored. Adequate inputs (material, financial, trained human resources) need to be ensured. Public demand for a balanced iodine intake should be expanded and sustained. While gearing up for USI, the salt industry needs to build strong regional networks. Iodine levels in salt should be harmonized across regions. Process and impact monitoring could be included in household surveys, census, and other ancillary information-gathering efforts on a permanent basis.

5.7 Capacity Building

This is a vital and continuing component. The need in every country is for constant vigilance to assure that (i) the producers are fully up-to-date and have good personnel in packaging, monitoring, reporting and analysis (ii) the country is inserting knowledge through iodine courses, public communication and schools; (iii) the responsible agents like Ministries of Health have adequate trained personnel for their vital role of surveillance and assessment of progress in human nutrition, including laboratories and other support measures. In addition National training schemes in micronutrient malnutrition are priority needs. The need for constant attention to this aspect cannot be over stated. These need to be multi disciplinary in composition and scope. All stakeholders in success must be kept up to date.

5.8 Impact Evaluation

The final proof of impact and successful elimination of iodine deficiency is reflected in the reduction in prevalence of Iodine Deficiency Disorders. These need to be monitored and tracked at periodic intervals. The ICCIDD/WHO/UNICEF/ 2001 Report recommends indicators and a standard protocol for assessment including the ‘wheel’ model (Section II). Countries should request periodic external evaluations to provide independent feedback and timely recommendations and support high level advocacy. The results of national and regional progress made
toward optimal iodine nutrition should be widely shared. A permanent network of reference labs around the world has been established using standardized procedures for salt-iodine and UIE estimation (International Resource Laboratories for Iodine (IRLI) Network 2002).

6. **What made Salt Iodization in the People’s Republic of China Successful**

In China, the coverage of iodized salt has increased from 54% (of which 39.9% met standards) in 1995 to 95.2% (of which 88.8% met standards) in 2002. The Total Goitre Rate in children has been reduced from 20.4% in 1995 to 5.8% in 2002. Essentially, China has reached the goal of Universal Salt Iodization (USI). This has been achieved since 1991 when Premier Li Peng, in response to the World Summit for Children, signed the *Declaration and Plan of Action of the Peoples Republic of China (PRC)* which included the goal of eliminating IDD by the year 2002 *(fig. 3)*. National goals were set for reducing the number of children with an enlarged thyroid to under 5% and providing more than 90% of all households with adequately iodized salt.

The Government of China Salt Iodization Program was launched during a high-level Advocacy Meeting convened by the State Council in 1993. The program focuses on increasing the production of iodized salt through strengthening of the salt industry and providing quality assurance and monitoring over the salt distribution system. Currently, there are 1,300 producers and distributors employing more than 400,000 personnel. The industry produces more than 28 million tons of salt annually, of which approximately 7 million tons are for human consumption or food use. Components of the Salt Iodization Project include legislation, management, process production, facilities upgrading, marketing, social mobilization and quality assurance monitoring. The China National Salt Industry Corporation is designated as the lead agency in this effort with the support from a number of key partners including the Ministry of Health, Ministry of Railways, Ministry of Transportation, industrial and commercial sectors, quality and technical sectors, and international organizations. To assure iodized salt supply and quality, three state laws decreed by the State Council together with 34 provincial regulations enabled the Government of China to strengthen the centralized management of the food salt monopoly from national and provincial to prefecture and county levels. Beyond controlled production through the
state monopoly mechanism the program developed a number of strategies. This includes:

- Nationwide licensing for wholesale and transport sectors to ensure adequate distribution;
- An enforcement team of 25,000 assures that only legally produced salt reaches the market; and
- Direct cooperation among salt producers and local governments supplies iodized salt directly to consumers.

A key factor has been the upgrade of production and packaging facilities at 120 large-scale plants at a cost of US$100 million, including a US$27 million loan from the World Bank. As a result, production of iodized salt at these facilities more than doubled since 1995.

While the nation as a whole has reached the goal of 90% iodized salt coverage, a number of areas are far below that goal. The challenge will be to achieve Universal Salt Iodization (USI) in poor and remote areas such as Sinjiang and Tibet. Moreover, attention must be focused on controlling the flow of non-iodized salt in specific areas where there is over production or easy access to raw salt. This includes the southern coastal provinces with sea salt production and the western provinces with large lake deposits. China’s goal for the future is to assure that these provinces that remain at high risk of IDD also achieve USI (see further Section VIII).

![Fig. 3 Progress with Salt Iodization in China](image-url)
7. New Frontiers

Over the past decade there has been a worldwide movement by consumer groups to raise private sector consciousness to participate in tackling social and environmental problems. Viewed from this angle, IDD control presents an opportunity for the salt industry to derive economic and social benefit for itself while simultaneously providing a social benefit to the community by fortifying the salt they produce and sell.

Salt enjoys unique advantages as a carrier of nutrients in most parts of the world in terms of universal coverage, uniformity of consumption and low cost of fortification. Encouraged by the progress made in several countries in implementing successful salt iodization programs, efforts have been directed at examining the feasibility of fortifying salt with iron and other nutrients such as fluorine along with iodine. With production, surveillance and monitoring infrastructure for iodization programs already in place, such as integration and coordination would enable resource savings and maximum efficiency. The commercial application of large-scale multiple fortification programs would be a major breakthrough in establishing a cost effective delivery system for these nutrients to cover large populations (Diosady et al 1997).

8. A Continuing Partnership

The public-private-civic partnership to achieve and sustain USI needs to continue with each of the partners playing an important role:
- Salt Producers must assure supply and access. They should always reach all customers with a quality (iodized) product and progress toward self-monitoring
- Governments (especially the health, industry, food and drug administration and standards departments) must provide permanent support to universal salt iodization and monitor the situation; there should be a strategy to cover populations not reached by iodized salt
- The Social Sector must remain supportive and insist on national supervision. It should oversee progress and guard against reversal
- The Public must understand and demand its right to iodized salt
- UN and Other Agencies - continue to focus attention at a national and global level
Such coalitions should be multi-sectoral and have clearly defined roles and responsibilities and oversight authority. They must be cohesive and well coordinated with the partners working with a spirit of transparency, openness with each other and sharing experiences that will help achievement of the common goal. Only through such a coordinated effort and vigil at the global, regional and country level in terms of social advocacy and providing the vitally needed technical and financial inputs can we eliminate iodine and other nutrient deficiencies from the face of the earth.

References


Section VI

The Role of Education and Communication

Jack Ling

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1. Introduction

Lest we forget, Iodine Deficiency Disorders (IDD) is a story of human suffering—cretinism with its tragic and brutal impact, visible goitre and its deformities, and above all the vast invisible, silent and life-long mental and physical impairment that are its consequences. Fighting IDD and preventing this suffering, however, is an inspirational story of unprecedented multidisciplinary societal effort.

In terms of its impact on humanity, IDD threatens and harms more people than many of the most feared scourges. An estimated two billion people in 130 countries are at risk. Yet, prevention is today well understood and achievable: regular use of the right kind of salt, an indispensable and low-cost food for everyone.

1.1 Aim: A Behavioral Norm

Communication is at the heart of the effort to combat this devastating micronutrient deficiency. At the beginning of the last decade, even as world leaders were gathering in New York to take up the issue of fighting iodine deficiency, one of the goals of the World Summit for Children (1990) there was widespread ignorance about the magnitude of its harmful effects among policy and decision makers, development agencies, and the mass media. The role of communication thus ranges from disseminating data about impact on brain development in fetuses and infants to positioning iodine deficiency not only as a social and health issue but also as a development and economic issue, from launching over a hundred national programs to the mobilization of the salt industry as a principal player, from spreading the word about the benefits of iodized salt to tailoring messages for specific audiences, and finally from involving civil society to making the use of iodized salt as the behavioral norm.

Communication, the sharing of meaning for a common understanding, does not stand-alone. It is an integral part of virtually every step in the global campaign against IDD and a critical element of any national IDD program. Other chapters may cover various aspects of the communication story directly or indirectly. This chapter focuses on planned and purposeful communication in advocacy for policy support as well as on educating the public about the daily necessity of ingesting iodine from iodized salt or other conveyors.

The chapter covers some of the issues crucial to the challenge—the first of its kind in the age of globalization—of changing a choice of
condiment in the highly competitive environment of commercial food products.

1.2 National Responsibility

Fighting IDD is, first and foremost, the responsibility of sovereign states. International development organizations - multilateral, bilateral or non governmental – may provide technical or financial assistance, but all IDD programs are national. First credit for the phenomenal progress in some countries must go to national efforts, including those in communication. Countless critical face-to-face encounters, meetings and events involving media outreach were involved. It would be impossible to acknowledge, even to list, all the efforts. It is possible, however, to sketch some of the communication issues encountered.

2. Mobilizing Political Will

Many seminars, meetings and conferences on health and development, including the decisions by countries in South Asia and Africa at regional assemblies, helped to mobilize the political will to tackle IDD. None played a greater role than the historic 1990 UN Children’s Summit, a groundbreaker in the annals of development in general and in social development in particular. It was at the 1990 Summit that the political leaders of the world committed their countries to the virtual elimination of this ancient scourge as one of the goals of the Summit.

The communication benefit of the Summit cannot be overstated. The extensive series of national and regional meetings that preceded it attracted massive media coverage in developing countries and enlivened discussion among development professionals. This resulted in a strengthening of political will so essential to any major development progress. Scores of magazine covers, special weekly supplements, public affairs television programs, daily newscasts as well as roundtable discussions generated interest in IDD among international development circles hitherto unaware of the issue. Media coverage of the Summit itself was unprecedented. For instance, Time magazine, the popular international news weekly, devoted two cover stories to the Summit. Television networks in all regions of the world provided extensive coverage of the event. The Summit Declaration and the goals adopted by the leaders were widely publicized. Credit must be given to those involved in
the communication aspects of the Summit at the country, regional and international levels.

2.1 The Goal of Virtual Elimination

The Summit went beyond the adoption of goals. National Plans of Action, an immediate follow-up of the Summit, and UNICEF’s annual Progress of Nations reports that measured progress towards the goals all helped to keep the focus on the global program.

As a prelude to the Summit, the UN Sub-Committee on Nutrition in February 1990 and the World Health Assembly in May took up the issue of iodine deficiency. Following the Summit, the 1991 Ending Hidden Hunger conference in Montreal, the 1992 Rome International Conference on Nutrition and the 1992, 1996 & 1999 World Health Assembly and other international development meetings further consolidated the political will (see further Section II).

3. Disseminating IDD Information

Visible goitre had made its appearances very early in art and sculpture. And for a long time, word of mouth was the main means of spreading IDD information in many developing countries. The invention of printing facilitated the mass distribution of texts, which spread the word about visible goitre to the literate with access to printed material. For a long time, IDD information was not disseminated beyond the scientific community.

In modern times, once salt was identified as a convenient vehicle for delivering iodine, salt companies began iodizing table salt in the 1920s. Mass media began to play a role in IDD communication as pamphlets, posters, magazine, newspaper, radio, and television were used in marketing iodized salt. Iodized salt was first used in Switzerland, but the Morton Salt Co. of the USA led the way in IDD information dissemination in countries where its products were sold. It asserted that children who used iodized salt lived healthier and happier lives and performed better in school.

There has been an understandable reluctance among some cardiologists that the promotion of iodized salt might lead to the overuse of salt. This however, has not been a serious impediment to the general dissemination of IDD information. In point of fact, Joint WHO/FAO Expert Consultation on, “Diet Nutrition and the Prevention of Chronic Diseases”
(WHO Technical Report Series, 916, 2003). Clearly stated the following with respect to salt intake while suggesting ranges of population nutrient intake goals. To quote, “Salt should be iodized appropriately. The need to adjust salt iodization depending on observed sodium intake and surveillance of iodine status of the population should be recognized”.

The deeply imbedded association of visible goitre with a lack of iodine in the diet has impeded popular recognition of the invisible brain damage even mild iodine deficiency can inflict on the fetuses and infants who will form future generations. The image of an enlarged neck or an endemic cretin makes a graphic impression, but a lesser degree of mental impairment is visually hard to portray. It is indeed one of the communication issues that hamper many national efforts in public education. These days, visual goitre is rarely seen in most of the countries. In order for the public to maintain vigilance against IDD, the menace of invisible brain damage must replace visible goitre as the symbol of IDD.

3.1 Broadened Scope

Dr Basil Hetzel introduced the term Iodine Deficiency Disorders (IDD) in 1983, which refers to all the effects of iodine deficiency on growth and development in a population including particularly brain development (Section I). The term has broadened the scope of the fight and made it easier for the lay public to appreciate the scale of the impact of this ancient scourge.

The fact that loss of up to 10 to 13 IQ points even from a mild form of iodine deficiency disorders will reduce learning capacity and result in lower productivity of communities and even nations has ignited the interest of development economists. Such economic arguments have played a crucial role in persuading policy makers to support sustained global IDD elimination. This approach was certainly a key factor in the decision of Premier Zhu Rongji of China to give iodized salt a special state controlled status, even though China was going through a wave of privatization preceding its membership in WTO. The more recent recognition by development economists that the impact of micronutrient deficiencies can account for a reduction of 5% of GDP of a country (World Bank 1994) has further strengthened this IDD message.

In attaining sustained IDD elimination, however, the proof of the pudding is in the eating! In terms of communication and education of the public, it means convincing people to use iodized salt without increase in salt intake as a daily health routine. Working with salt producers in
advertising, promotion and marketing did not feature in early IDD programs and only in recent years have some program planners taken up efforts aiming at behavioral compliance.

4. Behavioral change and Social Mobilization—
a Communication Model

Combating IDD requires changes in policy and behavior. Sustained change requires the involvement of many societal segments and an application of strategies for behavioral change. It calls for an enabling environment and the mobilization of stakeholders.

Much of the first decade of IDD work focused on the production and distribution of iodized salt and setting up of laboratory services, including the training of technical personnel. Getting people to make the informed choice of using iodized salt and to sustain the practice did not get its due attention until the second half of the 1990s.

IDD work is often viewed as a quintessential development program involving multidisciplinary inputs and the behavioral compliance of the entire society. Young and old all need iodine for their optimum mental and physical functions. There is a clear need for advocacy for sustained political/policy support, and for cooperation between the private/commercial sector and public/governmental sectors. The communication-oriented model of development, Social Mobilization (SOCMOB), offers the ideal approach. SOCMOB calls for the involvement of all relevant sectors of society for a common development objective. Decision makers, medical scientists and public health professionals, development bureaucrats, salt producers and traders, marketing and media specialists, educators, international and national non-governmental organizations and community groups, and families and individuals all find their respective stakes in the fight against IDD.

The SOCMOB approach can best be illustrated in the following figures (fig. 1 & fig. 2).

4.1 The Norm of Using Iodized Salt

Unless and until another convenient and practical formula to deliver the needed iodine for the public at large is discovered, the battle against IDD comes down to the establishment of the norm of using iodized salt in what we eat, including iodized salt in processed foods. No increase in salt intake is necessary. The use of iodized oil has an instant effect (and
Although circumstances differ from country to country and often from one part of a country to another, this chart illustrates the framework under which different societal elements may have a stake in IDD elimination. The social mobilization strategy calls for partnership with all stakeholders.
Fig. 2 The five illustrated segments of society in Fig. 1, representing National Partners, provide inputs. The Partners are supported by international development agencies. Process, which includes various elements of mobilization, leads to outputs. The ultimate end of development is improved economic and social status.
can do wonders) in severe cases, but its broad application or general public health has not been an option. It is worth reiterating that using iodized salt is not for a period but for all time and for all generations to come. In other words, the success or failure depends on the continuous consumption of such salt and the facilitation of a common practice, or new social norm.

It may be argued that no successful attempt has ever been made to make everybody to learn about, accept and act upon a given piece of new information. There is not an acceptable benchmark for the knowledge base for a behavioral norm. The minimum percentage of public awareness needed for such a norm is also not known. However, the measure of urinary iodine as a marker for iodized salt consumption provides a scientifically based instrument to ensure such behavioral compliance has been developed (see further Section II for ‘Wheel’ model).

4.2 Brain Damage not Widely Known

The hard fact remains that an unacceptable proportion of medical and health professionals are still unaware of the brain damage aspects of IDD. In many countries visible goitre continues to overshadow discussion of the topic. As the brain damage issue was not confirmed until the latter part of the 20th century, many medical and health texts still do not include this finding.

Another fact is that the very deliberate and successful advocacy of the endocrinologists and development specialists that was brought to bear on the decision to fight IDD by world leaders in 1990 leapfrogged ahead of the usual route a public health problem travels to the attention of policy leaders. In effect, the political decision to virtually eliminate IDD in 1990 raced ahead of the time required for the new scientific facts to reach the rank and file of the medical and health professionals.

4.3 Silent Sufferers

Moreover, unlike in the case of other ailments where pain and other manifestations are present and sufferers take their problems to the health professionals, children suffering IDD with a lower level of IQ do not know they have been short changed. They do not speak for themselves and bear the burden of impairment for the rest of their life.

Given the state of IDD information, purposeful communication and education activities must be incorporated into the strategy of sustained
IDD elimination that aims at facilitation of the new salt usage norm. Otherwise, those who are persuaded to take up iodized salt as a result of the enthusiastic fanfare of the launch of Universal Salt Iodization (USI) may well drop the habit and bring about the return of IDD. For, it is clear that there isn’t yet a solid base of public knowledge of the real impact of IDD for sustained behavior compliance.

4.4 Harder Challenges Ahead

For the almost a third of the world’s population not yet using iodized salt, the tasks ahead require much more understanding of the specific obstacles of different audiences. The old adage, “The easier parts get done first, the harder jobs remain to be tackled”, rings true. The harder jobs are often in the more remote areas, involving the least educated and the most economically disadvantaged.

Moreover, the global program against IDD must not stop at 90% of the household usage of iodized salt, the current benchmark for success. In fact, it must continue its march toward universality. Stopping short of total coverage could further marginalize the poorest segment of society. IDD work will help improve the intellectual development of the children of the poor and with it will come stronger learning capacity, increased economic productivity and better social well being. IDD work, in effect, is a useful instrument to help break the vicious cycle of poverty.

One must also accept that in promoting iodized salt one must face the realities of the commercial market. Salt is not a medicine but a commercially available commodity. This means that IDD programs should recognize the competitive nature of the food market, where a hundred flowers compete for attention. Scores of food products ranging from sports drinks to tonics, even from fast foods to fortified cereals, are crowding the airwaves and electronic arena with hammer-and-tong attention-getting messages. These often feature credible personalities in the sports, artistic, and even political circles. IDD messages face heavy competition from friendly and unfriendly fire.

4.5 The Commercial Food Market

Getting the word out to the last third of the world not yet consuming iodized salt on a regular basis poses a tremendous communication challenge. The multiplication of channels of communication brought on by the ever-changing methods of information dissemination and exchange
has presented both opportunities and difficulties in getting the correct messages to specific audiences. Internet and cyber technologies offer powerful means of communication. But an overload of messages creates even fiercer competition for attention. Countries in the throes of reform taking up the various elements of market economy have added a new dimension to the communication challenges. Effective IDD messages need to be professionally prepared and more focused for specific audiences. This will entail greater investment in communication and education activities that aim at behavioral compliance on a sustained basis.

The ultimate payoff of the global campaign is optimal iodine nutrition for all by ensuring universal access to iodized salt and establishing the practice of using iodized salt as a norm. For this behavioral change on a sustained basis, the careful application of the SOCMOB approach is necessary for the remaining job of eliminating IDD.

5. The Pivotal Role of the Salt Sector

Long before the global effort against IDD, salt companies recognized the value of iodized salt in fighting visible goitre and had introduced their products in the market place. With USI, major salt manufacturers including Morton of the USA, Akzo Nobel of the Netherlands, and salt associations such as the Salt Institute, the European Salt Association and China National Industry Association readily assumed the role of principal stakeholders. However, the majority of the world’s people do not depend on products of major salt producers and multinational companies for their daily intake of salt. Some get their salt from convenient lake salt deposits; others help themselves with rock salt wherever they can find it. Still others use inexpensive sea salt, which contrary to popular belief contains little iodine. Most of their salt supply is deficient in iodine, as initially shown in Switzerland. Marketing and advertising activities of the big salt producers do not reach the most remote areas, where impoverished communities have greater need for the protection of iodized salt.

In many countries, salt production was a government monopoly and salt bureaucrats were mostly unacquainted with the realities of competitive marketing in the modern media environment. This was particularly acute in countries undergoing the transition from the centrally planned economy
to market-oriented economy. There are also landlocked countries without salt and other areas that depend on imported salt.

5.1 Iodized Salt Messages

The salt sector, or the salt chain, ranging from top management to retailers, has a special responsibility in disseminating IDD messages. As suppliers and contact points of information for the consumers, they are a natural source of information for the public. Moreover, they can be conveyers of correct or incorrect information. A random enquiry in a number of countries showed that many retailers did not have a sound knowledge of the IDD threat and the value of iodized salt. One retailer was certain that without iodine one would lose all one’s teeth. Another insisted that iodized salt increased one’s IQ, which if taken literally can lead to overdose of salt or of iodine by parents intent on helping their children to become smarter!

As the retailers are in frequent contact with housewives and chefs who use salt for their daily activities, they are in the position to short cut the route of public health or the education channels and get directly to the people who buy and use salt. Indeed, IDD consumer education is a vital part of the marketing strategy of salt producers. In a number of countries, notably China, such point-of-sale education is being carried out.

6. Support from International Partners

It is axiomatic that all planned and purposeful communication inputs ultimately aim at national sustained IDD elimination. Some national programs have not included communication as an integral part of the strategies and thus failed to achieve the progress envisaged and indeed a few have suffered “backsliding” from initial progress. Nevertheless, the percentage of iodized salt users has doubled since the global program began in 1990, thanks to many notable national communication efforts. While it is not possible to record all the worthy national activities, some examples may be found in the country reports (see Section VIII).

Many multilateral and bilateral governmental and non-governmental organizations dedicated to development have helped national IDD programs in advocacy and public education, for which no record has been made. However, here are some notes about the support of some of the international partners:
6.1 UNICEF

In IDD communication, UNICEF has been the principal international player. Its extensive network of country offices provides critical support to national governments in designing and implementing IDD programs with communication components. UNICEF’s effective advocacy efforts for IDD, especially in relation to the 1990 UN Summit for Children, have already been described. Following the Summit, under the vigorous and goal-oriented direction of James Grant, (Executive Director) the child advocate extraordinaire, the network of 130 UNICEF offices in IDD-affected countries moved swiftly into action. Through media and interpersonal communication, UNICEF made its case.

USI, A Battle Cry-Jim Grant personally met many world leaders; with the prop of a thimble of iodine needed for a lifetime and a test kit. At official or private dinners he never missed an opportunity to ask his hosts, including presidents and prime ministers, to pass the salt, and test it there and then on his own plate to see if it was iodized. He was successful in persuading leaders to commit national resources in fighting this devastating deficiency. He initiated and launched with fanfare via media-oriented events the global movement of Universal Salt Iodization (USI), which soon became a battle cry for all UNICEF field offices from Afghanistan to Zimbabwe.

As the IDD damaging effect on brain development was not widely recognized, in a number of key countries, UNICEF offices helped organize “advocacy” events, involving political leaders to make the case for IDD in social as well as economic development. UNICEF also initiated the discussion of IDD in the Joint UNICEF/WHO Health Policy committee, which led to the launch of Universal Salt Iodization (USI). In China, where economic issues reigned supreme with 40% of the population at risk of IDD, efforts to reach the State Council were undertaken. Effective interpersonal communication resulted in a major Advocacy Conference in the Great Hall of the People in Beijing in September 1993 where the Premier’s full support was sealed.

In reaching leaders as well as the public, few have done more than UNICEF’s Goodwill Ambassador, Sir Roger Moore of James Bond fame, who is concurrently Honorary Chair of Kiwanis International’s global campaign to raise funds for UNICEF. He has been a remarkably effective advocate at special events and via the mass media. In 2002, UNICEF also recruited Anatoly Karpov, the world chess champion as the spokesperson to promote USI in Central and Eastern Europe and Central Asia.
6.2 Kiwanis International

Kiwanis International (KI) has been the leader in civil society in fighting IDD. In 1992, KI adopted the virtual elimination of IDD as its first global program for children and has raised $75 million in cash and pledges to support community programs through UNICEF. Fundraising and participatory activities ranged from personal pledges to radio and television appeals, from music and sports events to car washes. These activities in addition to bringing in money also generated media coverage that spread the word about the threat of IDD to children’s mental and physical development. Many Kiwanians occupy prominent positions in their communities and are effective advocates for IDD work in industrialized countries as well as in a growing number of developing countries. The 2002-2003 President of KI is a nuclear physician in Manila, Philippines, who has access to the health establishment (see further Section III).

6.3 ICCIDD

From the outset, ICCIDD included communication and education as a key component in the fight against IDD, as defined by Dr Basil Hetzel (see Section II, Section III). It publishes a quarterly Newsletter and has organized a series of regional meetings to advocate IDD work. ICCIDD maintains two websites—the home site at the University of Virginia and the communication focal point website at Tulane University. The communication focal point published a communication guide, available in English, French, Spanish, Russian, Chinese and Portuguese, which provides suggestions for communication inputs ranging from advocacy for the needed political will to community education for behavioral change. ICCIDD in partnership with UNICEF introduced the international IDD Day in 1995 and produced the popular IDD fact card for public education.

6.4 WHO, MI and Other International Agencies

As the principal international health authority, WHO is in the unique position of mobilizing Ministers of Health who congregated annually at the World Health Assembly to review common issues. WHO publications, press notices and documents spread the word about IDD, especially among public health professionals. Other UN agencies, including the World Bank and UNIDO, joined the fight with their special inputs and thus reached their respective professional milieus (see further Section III).
Micronutrient Initiative (MI) has provided support in communication activities for a number of national IDD programs. It helped ICCIDD and UNICEF in launching the IDD Day, and reached out for international media support on the occasion of the 2000 Salt Symposium as well as during the official launch of the Global Network in 2002. Training programs, such as the Program against Micronutrient Malnutrition (PAMM) included orientation for advocacy and communication strategies.

7. Partnership/Network/Alliance

After a decade of encouraging progress, the critical role the salt industry played was spotty and uneven and in many countries under-appreciated. On the occasion of the Fourth International Salt Symposium at The Hague in May 2000 at a summit of leaders of organizations involved in IDD work a partnership of key international stakeholders was proposed. The salt industry was invited to take its rightful place in the partnership.

The Global Network for Sustained Elimination of Iodine Deficiency was established in 2001 after almost a year of negotiation to rationalize the different cultures of the various institutions involved. Founding members of the Network are: WHO, UNICEF, Salt Institute USA, European Salt Association, China National Salt Industry Corp., ICCIDD, CDC, MI and Emory University. The official launch of the Network took place during the UN General Assembly Special Session on Children in May 2002, with the Director General of WHO, the Deputy Executive Director of UNICEF, Prime Minister of Bangladesh, and an array of health and development ministers from donor and developing countries officiating at the ceremony. The launch of the Network was an event of considerable advocacy and communication impact at the official level as well as at the general public.

Other Network activities that contribute to the advocacy and communication aspects of the IDD fight include the inclusion of communication requirements in the evaluation of IDD progress and the holding of a second IDD Network summit in China to reinvigorate the IDD fight. The Network also encourages the establishment of multi-disciplinary national watchdog bodies to ensure the universal sustained use of iodized salt with communication and education a key indicator.

In October 2003 the Network and the Chinese government jointly sponsored the International Meeting for Sustained Elimination of IDD in
Beijing to exchange experience on ‘lessons learnt’ about several issues critical for sustained IDD elimination. The meeting adopted a consensus statement calling for specific actions by countries and for the reinvigoration of the global effort to reach the 2005 goal adopted by the UN General Assembly Special Session on Children in 2002. Some 350 participants from 27 countries, including two deputy prime ministers, 20 ministers and heads of a dozen international organizations attended the meeting, the largest assembly of leaders concerned with IDD since the 1990 UN Summit for Children.

8. Annual IDD Day

Though there is a certain degree of fatigue attached to special days and years, in the case of IDD such observances are important for sustaining the campaign. The goal is still some distance away and the nature of fighting deficiency demands continuous surveillance even after having scored impressive progress. The remaining tasks are far more complicated and challenging than what has been achieved. Any slackening of public attention could wipe out previous gains.

By the mid 1990s in a number of countries communication activities were organized on a specific day to engage the attention of the public. In the absence of an international day, UNICEF and ICCIDD in 1995 joined forces to introduce an October IDD Day to coincide with the fundraising season in the industrialized countries. With support from Micronutrient Initiative, UNICEF and ICCIDD produced a basic booklet, *A Grain of Salt*, with suggestions for a variety of activities to create awareness and to promote USI. Many countries chose to observe IDD Day in different months, however.

8.1 Regular Review

This annual event should serve as an occasion to review progress, tackle emerging problems and facilitate a broad base public participation. As everyone needs iodine, civil societal involvement and public participation rallying around a special day are *sine qua non* for success.

IDD Day should not be an isolated event but should form an integral part of the strategy for sustained virtual elimination. It should be taken up as part of a comprehensive public education effort, along with other
communication activities aiming at behavioral change such as health promotion and education as well as school health education programs. It should be employed by the IDD national coalitions being formed to engage in communication and education work to review progress, identify problems and feature themes, e.g. the value of iodine in the diet or the danger of its absence.

9. Lessons learned

9.1 Re-advocacy or Periodic Advocacy

When the Director General of Health Services of an Asian country was asked by the nutrition chief to give support to the two-year-old IDD program, he responded: “Why IDD again? We did it last year!” This is indicative of the lack of understanding among policy leaders of the nature of fighting a nutritional deficiency. Indeed fighting IDD requires behavioral compliance (using iodized salt for food) by all, all the time and for all generations to come. The concept of “re-advocacy” which has been adopted by the Chinese government calls for periodic advocacy activities to maintain the political will and to focus attention on the need for sustained IDD virtual elimination strategies.

9.2 Advocacy at all Levels: National, Local and Cultural

In public health programs that require behavioral change, especially food habits, complex cultural, economic and political factors must be taken into account. These factors must be tackled at various levels of society ranging from the policy to the community, and from the commercial sector to the household. A favorable policy promulgated at the capital, even in a country with highly centralized government, does not mean compliance at the provincial, country or village level. Advocacy is needed at every level of society. Local units often ignore edicts from the central governments. Cultural practices are not uniformly observed even in a given locality.

9.3 Communication an Integral Part of Strategy

Communication activities should not be isolated efforts but should form an integral part of the program strategy. The lack of appreciation of comprehensive communication inputs could lead to scattered activities
that stand alone and without clear objectives against which such work can be evaluated. Communication inputs should be taken up at the earliest stages of planning through various phases of implementation to evaluation for any food fortification programs and should have their roots in national capacity and ownership.

9.4 Maintaining Standards of Communication Competence

As everyone communicates in her/his daily life, communication for public health efforts often falls prey to the assumption that “we can do it” and that, “no specialists are needed for such work”. While some are naturally gifted in communication, most need professional inputs and at least guidance. Effective communication with groups and the public requires thoughtful planning and rigorous implementation.

9.5 Sharing Communication Responsibilities

There is still reluctance on the part of some in the health/medical sector, particularly the scientific element, to recognize that public health ventures involve a wide range of stakeholders, whose roles can sometimes be more critical than the health professionals. In the case of IDD elimination, iodized salt, the principal instrument, is produced by state enterprises and private industries. It is important that the health sector share responsibility with the salt sector in communication efforts. In many countries, health officers in charge of IDD work treat salt producers as suppliers or vendors. The Global Network for Sustained Iodine Nutrition sets the example where salt producers are key members of the coalition.

9.6 The Critical Role of the Salt Chain

When the salt producers are given their due recognition as the party that furnishes the weapons to fight IDD, efforts are necessary to ensure that the entire salt chain from top salt management to the retailers is conversant with the key IDD issues. The example of the enthusiastic salt plant manager who told a crowd that iodized salt increases IQ of children is worth repeating. Such statements could mislead parents increasing the amount of salt used for their children’s food. Some retailers gave erroneous information about IDD, which can inflict damage to the credibility of IDD programs.
9.7 The Need for the Education Sector to be a Full Partner

The education sector, which prepares oncoming generations, should constitute a main stakeholder of all IDD efforts. Educators must be concerned with the learning capacity of students and should not sit on the sideline making only occasional efforts to help. The Ministry of Education should take up its rightful responsibility for IDD work because of IDD impact on intellectual development and learning capacity. Indeed, the education sector holds one of the principal keys for sustained behavioral change.

9.8 The Commercial Food Market Challenge

Iodized salt is marketed commercially and its promotion must often fight for attention in the market place. Communication strategies should take into account the competition of friendly fire from other commercially available products that claim to be good for children’s development as well as unfriendly fire from food products that do not contribute to children’s physical and mental development.

9.9 One Message does not fit all

In a highly competitive communication environment, IDD programs must try to reach specific audiences with appropriate messages. Audience segmentation is necessary as the global program enters the stage of reaching the last third of the population not using iodized salt. Generally positive messages about iodized salt’s benefit to children’s mental and physical well-being is no longer enough. For expectant mothers, the message should refer to the rapid brain development of the fetuses they are carrying. For those not yet persuaded that iodized salt is worth the extra cost, however small that extra cost may be, messages about the cost difference versus the economic benefit of better learning capacity leading to greater productivity should be made. For those unlikely to have heard at all about the brain damage aspects of IDD, a direct focus on the issue may be as effective as a more elaborate explanation of IDD threat to child development.

9.10 Verbal Compliance Versus Actual Behavioral Practice

Qualitative data collecting interviews need to be carefully screened for accuracy. In some cultural settings, respect for authority and plain
politeness to visitors are so deeply ingrained that respondents do not give answers they think may be unwelcome. Some Chinese villagers kept two types of salt, one iodized, to show official visitors, and one non-iodized for their regular use!

9.11 Communication for Animal Iodine Deficiency

In areas where animal husbandry may not be a main economic activity, iodine deficiency for animals is not understood. Non-iodized salt is often used for cattle; IDD is also a cause for morbidity and mortality among animals; and animals with IDD produce less economic return. Moreover, non-iodized salt for animals often finds its way to the kitchen, for economic reasons or convenience.

9.12 The Economic Argument

As economics reigns supreme in the highest council of decision-makers, the economic argument should be an integral part of advocacy strategy. Moreover, even when political support is firm at the central level, there is still need to advance the economic argument at local and district levels, where officials responsible for setting priorities often view IDD work as social services that take a back seat behind economic development.

9.13 The Limitation of Legislation

Legislation cannot stand-alone. It must be supported by education, for it is impossible to enforce such law at the household level. Administrative fiat for mandatory use of iodized salt can be counterproductive when there is not a parallel effort to ensure an adequate supply of iodized salt and to undertake public education. A Pakistani district officer was so committed to IDD work that he prematurely banned non-iodized salt from the market before enough iodized salt was made available. The result was a black market for both iodized and non-iodized salt!

9.14 Avoid the use of “Victory”

In any public announcement about success, it is imperative that the word “victory” be avoided. As the nature of the fight against micronutrient
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deficiencies demands a never-ending effort, victory conveys the notion of finality and the idea that the fight is over. Victory in this sense will surely stymie further progress and may even sow the seeds of failure.

9.15 The Importance of Communication in Relation to Monitoring and Assessment

Monitoring is generally recognized as a key step in identifying problems and assessing progress, including the urinary iodine level. What is not always understood is the importance of communicating the results of assessment to public awareness of the problems and how monitoring is an effective tool to forestall backsliding of progress.

10. Remaining Tasks and Prospects

Following the end of the cold war in the later 1980s, the failure of the “peace dividend” to materialize disappointed the development community. No transfer of military expenditure to economic and social development took place. On the contrary, international social development aid received a smaller slice of the GDP of the wealthy countries, and national resources available for social projects in the developing nations also declined. Of the goals set by the World Summit for Children only a few made substantial progress. IDD was one of them, though the goal of virtual elimination per se, was not reached. Ironically, IDD initial success has created a sense of

Fig. 3 ‘The Executive Director of UNICEF (Ms Carol Bellamy) meets the Chair of the ICCIDD, Professor Jack Ling at the opening of the Summit Meeting in Beijing, October 15, 2003.’
complacency. Many even thought the IDD problem was about to be eliminated for good.

The 2002 UN General Assembly Special Session on Children, which measured progress towards the Summit targets and adopted new development goals, acknowledged IDD progress and set the new virtual elimination goal for 2005. Given the very challenging tasks in reaching the remaining third of the world’s population with iodized salt, the IDD Network and the Government of China co-sponsored an international meeting to accelerate the global program in Beijing in October 2003.

10.1 The Beijing Event, October 2003

At the Beijing event, involving 25 ministers from two dozen countries, the concept of periodic advocacy initiated by China was introduced, useful experiences were shared, and a number of issues germane to sustained IDD elimination were discussed. A Beijing Commitment for Action was adopted and the countries and international organizations represented all pledged to take specific country-level action in the next two years in a concerted drive towards the 2005 goal.

The review of the global situation showed that quite a few large countries, including Pakistan and Ethiopia lagged behind. India, Indonesia and Bangladesh move forward but slowly. The countries in the former Soviet Union, especially a few of the Central Asian countries and Russia, need urgent action.

A few countries, which had done well, are showing signs of retrogression in the absence of an appropriate strategy for sustained elimination. Communication for resource mobilization for accelerated programs is called for. The creation of national coalitions must pick up momentum. IDD messages about brain damage must be given priority. More professional communication input and targeted efforts at specific audiences are needed. Iodized salt as an equalizer for social and economic development should be stressed and be a constant argument at the policy level.

10.2 Towards the 2005 Goal

If the resolve demonstrated at the Special UN General Assembly Session is maintained and carried out, and the commitments made at the Beijing event are realized, sufficient progress can be made by 2005 to claim a measure of success in reaching the goal. Specific efforts to include communication in the strategies for sustained IDD elimination must be made.
Progress in the fight against IDD has been impressive. But the international community cannot allow the fight against IDD to falter while a third of the population remains unprotected. Steps to introduce comprehensive communication inputs should be taken to safeguard against backsliding. If the political will is sustained and all the necessary steps are taken at the international and national levels, the new millennium will herald a new dawn for the fulfillment of humanity’s natural potential. If not, future generations will face the same insidious assault on mental and physical development with the same cruel social and economic consequences that IDD has wreaked since time immemorial.

If the world community cannot succeed in sustained IDD elimination, a low cost and relatively simple development objective, one wonders what prospects are there for the more costly and complex development issues?

References


Section VII

The National Program for the Elimination of IDD

CS Pandav and BS Hetzel

With special contributions by
G Gerasimov
CS Pandav
D Lantum

1. Introduction

2. The Social Process Model

3. Report on Progress in National Programs

4. Specific Country Programs in Different Political Situations

   4.1 Russian Federation
   4.2 Bhutan
   4.3 Madagascar

5. Summary and Conclusion
1. Introduction

This section describes the National Program, which is the basic operational unit for the global program. As already indicated there are 130 IDD affected countries. In this Section we review the status of these programs. In addition detailed reports are provided for three different Country Programs.

Since 1990 through the World Summit for Children there has been unprecedented political support at Heads of State level for National Programs for the elimination of brain damage caused by iodine deficiency.

This political support has been a major factor in the progress that has been made since 1990 as described in the Joint ICCIDD/WHO/UNICEF Report (1999).

Political support depends on community awareness and understanding of the problem. Without this awareness politicians are unlikely either to be aware or willing to act. Political support is essential for the passage of laws or regulations on salt iodization through the legislature and also for timely economic incentives.

The process of communication in building community awareness has been fully described in Section VI.

In this Section VII we are concerned with the whole social process required for a successful national program. This can be understood through a social process model as recommended in the Joint ICCIDD/WHO/UNICEF 2001 Report and outlined in Section II.

2. The Social Process Model

The social process model can be usefully presented in the form of a ‘wheel’ as described in the Joint Report.

The model shows the diversity of functions that have to be linked together to achieve an integrated successful national IDD elimination program. This model is being followed in a number of countries. The wheel must keep turning to maintain the vitality of the program! The wheel is driven by the availability of data on urine iodine and salt iodine levels.

The ‘wheel’ model involves six components clockwise in the hub of the wheel (fig. 1).

The multidisciplinary orientation required for a successful program, poses special difficulties in implementation. Experience indicates that
Fig. 1 Wheel Model for IDD Elimination Program

The ‘wheel’ model shows the social process involved in a national IDD Control Program. The successful achievement of this process requires the establishment of a National IDD Control Commission, with full political and legislative authority to carry it out. (WHO/UNICEF/ICCIDD 2001).

The ‘wheel’ must keep turning to maintain an effective program. It consists of the following components.

1. Assessment of the situation requires baseline IDD prevalence surveys, including measurement of urinary iodine levels and an analysis of the salt economy.
2. Communication implies Dissemination of findings to health professionals and the public, so that there is full understanding of the IDD problem and the potential benefits of elimination of the most common preventable cause of brain damage.
3. Development of a plan of action includes the establishment of an intersectoral committee or commission on IDD and the formulation of a strategy document on achieving the elimination of IDD.
4. Achieving political will requires intensive education and lobbying of politicians and other opinion leaders. This is achieved by community education through the mass media and other means.
5. Implementation needs the full involvement of the salt industry. Special measures, such as negotiations for monitoring and quality control of imported iodized salt, are required. It is also be necessary to ensure that iodized salt delivery systems reach all affected populations, including the neediest. In addition, the establishment of cooperatives for small producers, or restructuring to larger units of production, may be needed. Implementation will require training at all levels in management, salt technology, laboratory methods and communication.

In addition a community education campaign is required to educate all age groups about the effects of iodine deficiency with particular emphasis on the brain.
6. Monitoring and evaluation require the establishment of an efficient system for the collection of relevant scientific data on salt iodine content and urinary iodine levels. This requires suitable laboratory facilities.
Global Elimination of Brain Damage Due to Iodine Deficiency

Communication problems often arise between health professionals and the salt industry—with their different professional orientations. There is need for mutual education about the health and development problems of IDD and about the problems encountered by the salt industry in the continued production of high quality iodized salt. Such teamwork is required for sustainability to be achieved.

The additional cost of iodine fortification in the process of salt production (less than 5US cents per person per year in 1999) should eventually be borne by an educated community. This will greatly assist sustainability.

The ‘wheel’ model is driven by the ‘marker’ of salt iodine consumption and urine iodine excretion of the community or population. It is fortunate that the urine iodine excretion provides an excellent indication of dietary iodine intake as described in Section IV.

These markers provide the essential elements for monitoring the program to assess whether iodine deficiency is being eliminated. Determinations must be carried out regularly using procedures described in Section IV and Section IX. If there is evidence of inadequacy of iodine intake through iodized salt then appropriate remedial measures can be taken at factory, retail or household level.

Measurements of urinary iodine are usually carried out in school children aged 8-12 years taking advantage of their availability in the school setting. However, if school attendance is reduced due to inadequate access (foreseeable through distance or poverty) then this must be followed up by sampling at household level.

Another community group of great importance to the elimination program, are women of reproductive age including particularly pregnant and lactating women. These groups should receive special attention, as for example, in China where comprehensive data are now being collected (see China Report Section VIII).

These groups are very important to foetal and child health. An adequate amount of iodine must be provided for the mother during pregnancy so that she can produce the necessary extra thyroid hormone required, particularly in the first half of pregnancy before the foetal thyroid secretes thyroid hormone. Even at the end of pregnancy there is a significant proportion of foetal thyroid hormone derived from the mother.

This means that effective and reliable laboratories need to be available at country and regional level for salt iodine (by titration) and urine iodine (by chemical determination). Regional Reference Laboratories are important for external quality control at country level by exchange of
samples as in the recently established International Resource Laboratories for Iodine (IRLI) Network (Section III).

The availability of the salt iodine and urine iodine determinations suitable for large-scale use is a great strength for the National IDD Elimination Program. The effectiveness of the social process can be reliably and readily assessed through these determinations for which adequate resources must be provided by funding trained manpower, equipment and materials.

3. Report on Progress in National Programs

In 1999 WHO in collaboration with UNICEF and ICCIDD reviewed the IDD global situation with reference to National Programs.

Three key elements in the Social Process Model are a national intersectoral coordinating body or commission, a plan of action for the elimination of IDD and legislation on salt iodization. The findings are shown in Table 1 regarding the status of the global program for 130 IDD affected countries.

Of the 130 countries with IDD, 98 (75%) had legislation on salt iodization in place and a further 12 have it in draft form.

Table 1. Current status of key elements of IDD control programs

<table>
<thead>
<tr>
<th>WHO Region</th>
<th>Number of countries</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Affected by IDD</td>
<td>National Intersectoral Coordinating Body</td>
<td>Plan of Action for IDD Control</td>
<td>Legislation in place</td>
</tr>
<tr>
<td>Africa</td>
<td>44</td>
<td>35</td>
<td>36</td>
<td>34 (6*)</td>
</tr>
<tr>
<td>Americas</td>
<td>19</td>
<td>18</td>
<td>18</td>
<td>17</td>
</tr>
<tr>
<td>SE Asia</td>
<td>9</td>
<td>9</td>
<td>8</td>
<td>7 (1*)</td>
</tr>
<tr>
<td>Eastern Mediterranean</td>
<td>17</td>
<td>15</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Europe</td>
<td>32</td>
<td>20</td>
<td>18</td>
<td>20 (3*)</td>
</tr>
<tr>
<td>Western Pacific</td>
<td>9</td>
<td>8</td>
<td>8</td>
<td>6 (2*)</td>
</tr>
<tr>
<td>Total</td>
<td>130</td>
<td>105</td>
<td>102</td>
<td>98 (*12)</td>
</tr>
<tr>
<td>Percent</td>
<td>100%</td>
<td>81%</td>
<td>78%</td>
<td>75% (9*)</td>
</tr>
</tbody>
</table>

*The figure in brackets refers to the number of additional countries, which have legislation in draft form. (From WHO/UNICEF/ICCIDD 1999).
Table 2. Current Status of household consumption of iodized salt

<table>
<thead>
<tr>
<th>WHO Region</th>
<th>Number of Countries with IDD</th>
<th>Percentage of household consumption of iodized salt</th>
<th>Overall*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No data</td>
<td>&lt;10%</td>
</tr>
<tr>
<td>Africa</td>
<td>44</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Americas</td>
<td>19</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SE Asia</td>
<td>9</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Eastern Mediterranean</td>
<td>17</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Europe</td>
<td>32</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Western Pacific</td>
<td>9</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

*Total population of each country multiplied by the % of households consuming iodized salt. Numbers then totalled for each Region and divided by the total Regional population. (From WHO/UNICEF/ICCIDD (1999)
Table 3: Current status of monitoring activities and laboratory facilities in IDD affected country (1999)

<table>
<thead>
<tr>
<th>WHO Regions</th>
<th>Number of IDD affected Countries</th>
<th>Number of IDD affected Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Monitoring salt quality</td>
</tr>
<tr>
<td>Africa</td>
<td>44</td>
<td>29</td>
</tr>
<tr>
<td>Americas</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>South-East Asia</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Europe</td>
<td>32</td>
<td>17</td>
</tr>
<tr>
<td>Eastern Mediterranean</td>
<td>17</td>
<td>14</td>
</tr>
<tr>
<td>Western Pacific</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>130</td>
<td>95</td>
</tr>
<tr>
<td>Percent</td>
<td>100%</td>
<td>73%</td>
</tr>
</tbody>
</table>

*These figures reflect countries with the capacity for both, urinary iodine and/or salt iodine level analyses. Standard of laboratories and expertise for each of these, however, is very different. (from WHO/UNICEF/ICCIDD (1999).
Following the promulgation of legislation on salt and the sensitization of the salt industry, there has been a big increase in the consumption of iodized salt. The latest data for each of WHO’s Regions are summarised in Table 2.

Table 2 shows the uneven progress by Region. Europe has achieved only 27% coverage whereas the other Regions have achieved 60% or more.

This report emphasises the importance of monitoring for ensuring the sustainability of IDD control programs. The latest data from the same report, concerning the status of monitoring programs in the various WHO Regions are summarised in Table 3.

The poor achievement of Europe shown in Table 2 with only 27% coverage is reflected in the inadequate facilities for the monitoring of salt iodine and urine iodine (Table 3) with only 13 out of 32 countries with functioning iodine laboratories. This situation in Europe is attributable largely to political and government failure as discussed further in the Regional Report (Section VIII).

4. Specific Country Programs in Different Political Situations

A series of three examples of successful country programs are now presented with reference to the Social Process Model. Each illustrates the development of national programs in three different situations. They are:

4.1 The Russian Federation - a large Federation of States
(population 145 million)

4.2 Bhutan - a small Himalayan Kingdom (population 2.1 million)

4.3 Madagascar - an Island Nation (population 16 million)
4.1

IDD In The Russian Federation
Gregory Gerasimov

4.1.1 Introduction

4.1.2 Assessment

4.1.3 Planning

4.1.4 Implementation

4.1.5 Monitoring

4.1.6 Challenges ahead
4.1.1 Introduction

There is ample evidence to show that from 1955-1970 IDD in the Russian Federation, as well as in other republics of the former USSR, were put under relatively strict control. As a result, there was a significant reduction of endemic goitre (EG) incidence and prevalence. Data from the 1969 national survey revealed the prevalence of total goitre to be less than 5%, i.e. almost at sporadic level. This was accomplished by a mix of technologies including a significant increase in iodized salt production and use (up to 1 million tons annually, or 4.5-5kg per capita of population); the distribution of iodine tablets to specific target populations, principally women and children in severe deficient areas; and careful monitoring. To a certain extent therefore it can be concluded that during the period of 1950-1970, IDD/EG in the USSR were put under strict control (Dedov et al 1992, Gerasimov et al 1993, Gerasimov 2003). However, two decades later, with the availability of urinary iodine estimation and ultrasonography methods for measuring thyroid volumes for IDD assessment, it has become clear that IDD can and do occur in many areas, where they have been considered to have been eliminated. In all probability this consideration applies to progress reached in the Soviet Union: IDD were not fully eliminated, but significantly ameliorated, while the most severe manifestations of iodine deficiency (cretinism, large goitres) were eradicated.

The main shortcoming of IDD/EG control in the USSR was its limitation to “endemic goitre” areas only. There was no legislation for universal salt iodization (USI) in Russia, and IDD prevention was regulated by the administrative mechanisms of a fully centralized economy. Iodized salt was supplied to endemic goitre areas as identified on the list provided by the Ministry of Health. However, iodization of all edible salt was not mandated for the salt industry. In the 1970s and 1980s iodine deficiency gradually returned as supervision waned and regular effective monitoring was reduced. Because of broader economic and political problems, the system of IDD/EG control started deteriorating and finally collapsed with the break up of the USSR in 1991.

In the meantime, an International Symposium on the Elimination of IDD with special reference to the USSR, was held at Tashkent in November 1991. It was sponsored by UNICEF, ICCIDD and WHO, became an important milestone in the development of the IDD control program in Russia. Many Soviet colleagues presented data from their own republics and areas, information that had not been previously available to the
international world, G.Gerasimov and R.Gutekunst, both of the ICCIDD Board, arranged and collated the presentations, and edited them for publication. The proceedings of the meeting were published in Russian and in English, and the main presentations were summarised in the IDD Newsletter (IDD Newsletter 1992). A number of international speakers discussed various general aspects of IDD, including B.Hetzel, J.Stanbury, J.Dunn, R. Gutekunst, C. Thilly, R. Delong, H.Burgi, D. Haxton and others from the ICCIDD.

In the resolution, which concluded the meeting, the participants called for emergency measures to fight IDD in the USSR. They also recommended conducting more surveys and using advanced techniques such as urinary iodine determination to assess the current status of IDD in different regions of the country. Unfortunately, the break down of the USSR and the subsequent turmoil significantly delayed the implementation of these recommendations. At the same time, the significance of this meeting can not be overestimated.

4.1.2 Assessment

Reinstitution of an IDD program in Russia required high level advocacy based on scientific evidence of a significant iodine deficiency nationwide. In 2001, the National IDD Centre under the Russian Ministry of Health published data from epidemiological studies performed to date in different areas of Russia from 1991 to 2000 (Table 1). These surveys covered at least 28 of the 89 administrative districts of Russia, but in terms of population and size of territory these studies covered more than

Fig. 1 Map of the Russian Federation
half of the territory of the Russian Federation (fig. 1) (Russian Ministry of Health 2001).

Results of these surveys provided clear information that all populations in the currently surveyed territory of Russia is exposed to some degree of iodine deficiency. In some remote regions extremely severe manifestations of iodine deficiency (cretinism) were found (Osokina and Manchuk 1998). Iodine deficiency is present in big cities (Moscow, St. Petersburg and others) and in coastal areas, and is generally more prevalent in rural than in urban regions. It is also prevalent in districts that have not been earlier considered as “endemic for goitre”. Iodine deficiency is more prevalent in the Eastern (Asian) districts of the country than in the Western (European) part. The results of these surveys have provided a solid background for high level advocacy, on the part of international as well as bilateral organisations and donors.

When iodine deficiency is eliminated goitre prevalence among schoolchildren decreases to less than 5%. Optimal median UI levels are between 100 to 200µg/L.

### 4.1.3 Planning

As mentioned above, the whole concept of IDD prevention in the Soviet Union was designed for a centralized state management system for iodized salt production and distribution. The country’s disintegration and subsequent economic reform in Russia put an end to the centralized and distributive system in the economy. At the beginning of the 1990s, many enterprises of the salt industry and almost the entire wholesale and retail trade system were privatized. After the collapse of the Soviet Union, there was no legislative framework in the Russian Federation for conducting an IDD prevention program under the conditions of a market economy. As a result, this program was practically curtailed, production of iodized salt ceased between 1993 and 1996, and less than 20,000 tons of iodized salt were produced in Russia in 1997.

Moreover, the former National Industrial Standard for “Common table salt”, adopted in 1991, actually hindered the mass manufacture of iodized salt: only relatively unstable potassium iodide (KI) was permitted as an iodizing fortifier, it was forbidden (!) to iodize fine grade evaporated salt, and shelf-life of iodized salt was limited to three months. There were significant difficulties in providing the salt industry with iodizing fortifiers, production of which had essentially ceased in Russia and other CIS countries. The price of these fortifiers was also often unjustifiably high.
Table 1. Iodine deficiency in various regions of Russia: cumulative results of regional surveys performed in 1991-2000 (Russian Ministry of Health 2001)

<table>
<thead>
<tr>
<th>Regions Of the Russian Federation</th>
<th>Goitre prevalence in school-children</th>
<th>Range of UI median values (µg/L)</th>
<th>IDD severity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>*mild to *moderate to **severe</td>
<td></td>
</tr>
<tr>
<td>European part of the Russian Federation</td>
<td></td>
<td>*mild to **moderate to ***severe</td>
<td></td>
</tr>
</tbody>
</table>

- Moscow (city) 10-12 44-87 *
- Moscow region 12-29 25-83 * to **
- Tambov region 19-30 52-59 **
- Voronezh region 16-40 30-58 **
- Tula region 15-30 51-64 **
- Orel region 20-45 40-84 * to **
- Bryansk region 12-30 69-84 *
- Kaluga region 10-30 54-89 * to **
- Tver region 12-23 57 * to **
- Belgorod region 16-28 48-80 * to **
- Orenburgsk region 15-30 42-58 * to **
- St.Petersburg (city) 9-21 69-75 *
- Arkhangelsk region 11-98 30-74 * to ***
- Kirov region 14-28 56-78 * to **
- Komi Republic 10-15 52-102 *
- North Ossetia Republic - 68-74 *
- Yaroslavl region 13-34 30-68 * to **
- Lipetsk region 14-28 82 *
- Udmurtia republic 16-48 64-86 * to **
- Krasnodar region 10-23 48-57 *
- Kalmykia republic 14-50 51-100 * to **
- Bashkiria republic 27-31 16-42 **

Asian part of the Russian Federation

- Khany-Mansiysk region 37-39 28-67 **
- Tuva republic (1997) 68-88 16-18 ***
- Tuva republic (2000) 5-50 91-186 Generally *
- Sakha-Yakutia republic 16-39 16-53 ** to ***
- Tyumen region 12-37 28-67 **
- Sakhalin region 3-12 51-117 *
- Krasnoyarsk region 14-32 44-69 * to **
- Novosibirsk region 16-34 68-85 * to **

Iodine deficiency is considered to be eliminated when goitre prevalence among schoolchildren decreases to less than 5%. Optimal median UI levels are 100-200 µg/L.
Global Elimination of Brain Damage Due to Iodine Deficiency

St. Basil’s Cathedral
Consumer demand for iodized salt was extremely low, since clients and customers were poorly informed about the benefits of iodized salt. Another reason for this low demand included the very short storage time (3 months), which restricted sales, and the relatively low quality of iodization.

4.1.4. Implementation

The situation began to improve gradually after 1997 when owing to the joint efforts of national salt manufacturers, the Russian government and the Ministry of Health, with the active participation and financial support from international organisations, primarily UNICEF, the problem of eliminating iodine deficiency began to receive priority attention again. On the first meeting of salt producers of Russia, Ukraine and Belarus held in Moscow in November 1997 an agreement was reached on raising the weight proportion of iodine in salt to $40 \pm 15$ mg/kg (from previous $23 \pm 11$ mg/kg) and gradually transferring to the use of potassium iodate. In contrast to the former standard, the stipulated shelf life for iodized salt has been noticeably extended and constitutes the following: using potassium iodide – 6 months, using potassium iodate – 9 months, for vacuum salt – 12 months. Later the shelf life of iodized salt has been further extended.

By 2002 Russian salt producers had built up sufficient production capacities, refurbished their production facilities, drawn up and introduced new advanced quality standards based on international experience, led to improved iodization, quality assurance and the packaging of iodized salt. It is now safe to state that there are no longer any real obstacles preventing the Russian salt industry from fully meeting the country’s demand for iodized salt (Apanasenko et al 2002).

The six main Russian salt enterprises now have the technological potential to produce 671,000 tons of iodized salt annually. Estimated demand for iodized salt in Russia is approximately 500,000 tons (based on 3.5 kg of salt per capita a year, and a population size of 145 million). Iodized salt production in Russia in 2000-2001 reached 82-90,000 tons, and an additional 35-40,000 tons were imported from Ukraine and Belarus and processed in small repackaging enterprises belonging to major salt dealers. Thus, the annual supply of iodized salt to Russia has increased dramatically from 20,000 tons in 1997 to almost 140,000 tons in 2002 (fig. 2). However, this amount covers no more than 25-30% of potential demand for iodized salt in Russia (Apanasenko et al 2002).
Problems concerning the supply of iodizing fortifiers (potassium iodate) to salt production enterprises have also been completely resolved over the past three years. The existing capacities of two Russian chemical enterprises are sufficient to supply the salt industry with the necessary amounts of potassium iodate at reasonable prices.

The price of nationally produced iodized salt is only slightly higher (5-15%) than the price of ordinary salt, mainly due to the cost of the iodizing fortifier. Iodized salt is the cheapest way of meeting the population’s requirement for this essential micronutrient and is affordable to all social groups. However, the production of iodized salt is still hindered by insufficient consumer demand for this product (Apanasenko et al 2002).

### 4.1.5 Monitoring

In response to several resolutions of the Head of State Sanitary Physician of the Russian Federation, the system of IDD monitoring has been restored after thirty years of non-existence at the national level. It now includes production monitoring (data on production, sale and quality of iodized salt) as well as impact monitoring. Iodized salt is tested in more than 1,500 food control laboratories and the results are reported to the Ministry of Health. In the first nine months of 2002 almost 50,000 samples of iodized salt were checked nationwide. The data show that the quality of iodized salt is further improving and that the number of samples with inadequate iodine content decreased from 16% in 2000 to 11% in 2001. However, there is still room for further improvement of iodized salt quality (Gerasimov 2003).

![Fig. 2](Image)
The biological monitoring system of IDD is gradually becoming stronger. From 1994 to 2000, seven laboratories for UI measurement were organised in different regions of Russia with the central resource laboratory based in Moscow. This laboratory is participating in the CDC-led EQUIP network, and provides technical support to sister laboratories in Russia and in Central Asia.

Policies of IDD prevention are currently stipulated by a Resolution of the Russian Government (1999), setting a voluntary model of IDD prophylaxis. In the absence of mandatory legislation, the supply of iodized salt to both households and the food industry depends on demand from the retail trade, and hence, large and small consumers. Efforts to increase “public demand” are unlikely to achieve the aim of 90% of households consuming iodized salt within the next few years. A comprehensive legislative framework, with a strong enforcement system, that requires mandatory iodization of all food-grade salt (table salt and salt for food processing) is therefore necessary. This requires high level advocacy, including concerted efforts from international (FAO, UNICEF, WHO) and bilateral organisations and donors.

4.1.6 Challenges ahead

In spite of significant progress achieved in Russia over the past 5 years, there are still more challenges ahead. On several occasions the Russian Ministry of Health supported the position that a mandatory model of IDD prevention though USI in Russia could be implemented through federal legislation. This it would require the adoption of a special act (law) on IDD prevention, or the amendment of existing laws (for example, the Food Safety Law) by the Federal Legislative Assembly of the Russian Federation. In 2003 such draft legislation has been developed and submitted to this national legislative body. However, this draft legislation needs further advocacy and active lobbying in the parliament. With the adoption and full enforcement of national legislation of IDD prevention by mandatory and universal salt iodization, Russia acquires a great chance to reach the goal of IDD elimination by 2005.
4.2

Bhutan

CS Pandav

4.2.1 Introduction
4.2.2 Assessment
4.2.3 Planning
4.2.4 Political Decision
4.2.5 Monitoring
4.2.6 Evaluation
4.2.1 Introduction

Bhutan is located in the eastern Himalayas bordered by India in the south, east and west and by the Tibetan Autonomous Region of China in the north. A population of 2.1 million lives in an area of 47,000 square kilometers. The Royal Government of Bhutan has worked with the International Agencies to achieve good progress with Community Development and public health program programs (Table 1).

Infant mortality rate (IMR) has declined from the 1983 figure of 102.8 to 70.7/1000 live births in 1994. With the more recent strides made in salt iodization, the IMR is bound to have declined further. Similarly, the under-five mortality rate has decreased from 162.4 to 96.9 per 1000 live births (Bhutan Health Statistics). These rates can also be correlated with a decrease in the total goitre rates and the cretinism rates.

Iodine deficiency disorders (IDD) have long been a major public health problem in Bhutan. Over the past three decades several studies have been conducted on the prevalence of IDD in Bhutan. The first published report was by two English doctors who spent five weeks in Bhutan in 1964. While these doctors did not conduct an empirical study to specifically investigate goitre, they reported that goitre among the population was “so prevalent as to be taken for granted”.

A nationwide study in 1983 (UNICEF/WHO, 1983) reported a total goitre prevalence of 60 per cent, a high prevalence of cretinism and low urinary iodine concentration in the majority of the population. Based on the results of the study, UNICEF commissioned a study to assess the salt distribution in the country and form a broad outline of a feasible salt iodization program in the country (UNICEF/ROSCA, 1983). The study demonstrated the technical, organizational and economic feasibility of iodization of all salt consumed in Bhutan (Table 2).

Table 1. Key Events in Community Development in Bhutan

<table>
<thead>
<tr>
<th>Event</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colombo Plan</td>
<td>1962</td>
</tr>
<tr>
<td>Joining of United Nations</td>
<td>1971</td>
</tr>
<tr>
<td>Joining of South Asia Association for</td>
<td>1985</td>
</tr>
<tr>
<td>Regional Cooperation</td>
<td></td>
</tr>
<tr>
<td>Signing of Convention of the Rights of the Child</td>
<td>1991</td>
</tr>
<tr>
<td>Achievement of Universal Coverage of Immunization</td>
<td>1991</td>
</tr>
<tr>
<td>Preparation of National Plan of Action for Children</td>
<td>1992</td>
</tr>
</tbody>
</table>
Table 2. Key Events in Bhutan’s IDD Control Program

<table>
<thead>
<tr>
<th>Event</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iodine Deficiency Disorders in Bhutan: Extent and Severity: First nationwide IDD study</td>
<td>1983</td>
</tr>
<tr>
<td>Production and Distribution of iodized salt to Control Iodine Deficiency Disorders in Bhutan</td>
<td>1983</td>
</tr>
<tr>
<td>National Policy, Strategy and Plan of Action to Control Iodine Deficiency Disorders in Bhutan: The National IDD Control Program in Bhutan</td>
<td>1985</td>
</tr>
<tr>
<td>Situational analysis of the salt iodization Program in Bhutan</td>
<td>1986</td>
</tr>
<tr>
<td>A nationwide internal program evaluation of IDDCP</td>
<td>1992</td>
</tr>
<tr>
<td>Iodine Deficiency Disorders in Bhutan: Extent and severity - External evaluation</td>
<td>1996</td>
</tr>
<tr>
<td>Statement signed by His Holiness the Je Khenpo</td>
<td>1997</td>
</tr>
<tr>
<td>Introduction of annual cyclic monitoring</td>
<td>1998</td>
</tr>
<tr>
<td>Sustainable elimination of IDD</td>
<td>2002</td>
</tr>
</tbody>
</table>
The Royal Government of Bhutan formulated and introduced a coordinated multi-sectoral Iodine Deficiency Disorders Control Program (IDDCP) in 1985 (RGB/UNICEF, 1985). The main components of IDDCP were salt iodization and distribution (introduced in April 1985 by the establishment of a salt iodization plant in Phuentsholing); iodized oil injections in high risk areas; monitoring iodine content of salt; evaluation of the Program and community level education.

4.2.2 Assessment

A situational analysis of the salt iodization Program in Bhutan was carried out in 1983. The study identified issues in implementation and made suggestions to improve its efficiency. A nationwide Program evaluation of IDDCP was carried out in 1991-1992 (DHS, 1992). The results showed that as compared to 1983, there was a considerable reduction in the prevalence of goitre and cretinism and improvement in the urinary iodine status of the population. This was attributed to the successful salt iodization Program as reflected in over 95 per cent salt samples at household level having an adequate amount of iodine.

In mid-1996, a national assessment was undertaken to track progress towards the sustainable elimination of iodine deficiency disorders in Bhutan. The assessment was conducted jointly by Nutrition Section, Division of Health, Royal Government of Bhutan, the International Council for Control of Iodine Deficiency Disorders (ICCIDD), New Delhi (India), UNICEF, WHO, and The Micronutrient Initiative, Ottawa (Canada) (RGB/ICCIDD/AIIMS/UNICEF/WHO/MI, 1996). The study found that 82 per cent of salt samples at household level had adequate iodine as compared to 95 per cent to 96.5 per cent of salt samples in the 1991-92 study. The low levels of iodine in salt at household level in the study could also explain the observation that 24 per cent of school children had urinary iodine excretion less than 100 µg/L as compared to only 13 per cent to 16 per cent in 1991-92 study.

The report indicated that since 1994 there was a breakdown in monitoring of the iodine content of salt at the production level at the Salt Iodization Plant (SIP), Phuentsholing. In addition, the salt crusher was also not functioning properly. Moreover, since 1994, there had also been consistent problems in the regular procurement of common salt by Bhutan Salt Enterprise (BSE), Phuentsholing. These resulted in retailers buying salt from across the Indo-Bhutan border directly, with consequent loss of control over the iodine content of salt.
Together these factors probably resulted in salt having inadequate and non-uniform iodine content as observed in the community. There was also a breakdown in the monitoring of iodized salt at the community level. The total number of salt samples analyzed per district was less than the recommended targets. The quarterly salt monitoring reports sent from the district to the Public Health Laboratory (PHL), Thimphu were incomplete and irregular. There was no system of providing feedback on salt monitoring to the District Administration, Health Department, Bhutan Salt Enterprise (BSE), Phuentsholing and other stakeholders for any corrective action.

The Royal Government of Bhutan reviewed the report of this study in September 1996. The recommendations emerging out of the findings of the assessment provided a framework for future action to maintain progress towards the sustainable elimination of IDD in Bhutan by and beyond the year 2000.

4.2.3 Planning

Based on the findings and the recommendations, the Royal Government of Bhutan reviewed its plan of action to reach the year 2000 goal of elimination of iodine deficiency disorders. The monitoring system has been strengthened. The district hospitals are being provided with laboratory equipment in order to do the salt analysis for iodine content by the titration method at the district level. School children have been included in the regular monitoring, to ensure a multi-sectoral approach. A revised strategy for training health staff was adopted.

4.2.4 Political Decision

On 30 August 1997, a policy statement was signed by His Holiness the Je Khenpo (spiritual head in Bhutan) at a ceremony attended by most of the senior officials of ministerial rank and by heads of UN agencies (Kuensel, 1997). The key component of the statement was “Children in Bhutan are at high risk of being affected by iodine deficiency since Bhutan falls in the iodine deficient belt of the Himalayas. Every one of us has the responsibility to ensure that our children get iodized salt to be able to grow into healthy adults.” The statement signing was followed by a function at one of the larger High Schools in the capital where school children and teachers from many schools gathered to receive blessings from His Holiness the Je Khenpo and to get information on IDD.
4.2.5 Monitoring

Bhutan may be one of the first countries in the region to have begun annual cyclic monitoring in addition to the regular monitoring system. The recommendation of the 1996 study was to divide the country into five zones of four districts each and one zone per year to be covered. In each zone, 30 clusters or Community/Primary schools are to be randomly selected and 40 school children between 6-11 years of age will be examined for goitre grading. Urine and salt samples will be randomly collected from 25 per cent of the examined children per zone. Per year 1200 children will be examined for goitre grading and laboratory analysis of 300 urine and salt samples respectively will be done for iodine content. The whole country would thus be covered in a phased manner in five years. The cycle can be repeated after five years so that each zone is surveyed once in five years.

In late April 1998, the first cyclic monitoring exercise was conducted. The study team comprised local health workers, staff of the central Nutrition Section and one member of the administration staff.

4.2.6 Evaluation

In 1998, total goitre rate was 17%, the percentage of people with urinary iodine greater than 100 µg/L was 88%, median urinary iodine was 277 µg/L and iodized salt coverage was 96%. Since then regular monitoring has ensured that coverage of iodized salt remains above 90%, (total goitre rate was 12%, the percentage of people with urinary iodine greater than 100 µg/L was 77%, median urinary iodine 170 µg/L and iodized salt coverage was 71%). In spite of the set back Bhutan now has a total goitre rate less than 5%, median urinary iodine 298 µg/L and iodized salt coverage was 95%. More recently, an external evaluation was carried out in 2002 which confirmed elimination of IDD in Bhutan.

The WHO/UNICEF/ICCIDD guidelines (2001) have specified ten program indicators of which eight criteria have to be fulfilled for a country to be declared as having completely eliminated IDD as a public health problem.

1. An effective, functional national body (council or committee) responsible to the government for the national program for the elimination of IDD. This council should be multidisciplinary, including the relevant fields of nutrition, medicine, salt industry, education, the media and consumers, with a chairman appointed by the Minister of Health.
2. Evidence of political commitment to universal salt iodization and the elimination of IDD
3. Appointment of a responsible executive officer for the IDD elimination program
4. Legislation or regulations on universal salt iodization. (While ideally regulations should cover both human and agricultural salt, if the latter is not covered this does not necessarily preclude a country from being certified as IDD-free.)
5. Commitment to assessment and re-assessment of progress in the elimination of IDD, with access to laboratories able to provide accurate data on salt and urine iodine
6. A program of public education and social mobilisation on the importance of IDD and the consumption of iodized salt
7. Regular data on salt iodine at factory, retail and household levels
8. Regular laboratory data on urine iodine in school aged children with appropriate sampling for higher risk areas
9. Co-operation from the Salt Industry in maintenance of quality control
10. Database with recording of results or regular monitoring procedures, particularly for salt iodine, urine iodine and, if available, neonatal TSH, with mandatory public reporting

In point of fact, the Royal Government of Bhutan has fulfilled all the ten criteria.

Through the exemplary efforts of the Royal Government of Bhutan, the program has achieved elimination of Iodine Deficiency Disorders in Bhutan. The processes are in place so as to ensure that the elimination of iodine deficiency will be a sustainable achievement. The introduction of cyclic monitoring as part of the monitoring process for the first time in the world has worked to the country’s advantage. Bhutan has shown that, with the political commitment and leadership in place, with adequate infrastructure, scientific leadership, and the notable contribution from Bhutan Salt Enterprises the program to eliminate IDD has achieved its objective. The challenge is now is to ensure sustainability!
4.3
Prevention and Control of Iodine Deficiency in Madagascar 1990-2003
Daniel N Lantum

4.3.1 Introduction

4.3.2 Assessment

4.3.3 Recommendations

4.3.4 Dissemination

4.3.5 Planning

4.3.6 Implementation-Plan of Action 1992-99

4.3.7 Monitoring and Epidemiological Surveillance
   4.3.7.1 Progressive Impact Assessment
   4.3.7.2 Household Coverage with Iodized Salt
   4.3.7.3 New Endemic Cretins
   4.3.7.4 Impact on Intellectual Function
   4.3.7.5 Iodine Induced Hyperthyroidism (IIH)
   4.3.7.6 Integration of IDD into other micronutrient malnutrition programs
   4.3.7.7 IDD Program Investment

4.3.8 Summary of IDD Program Impact

4.3.9 Sustainability Strategy for 1998-2005 and beyond

4.3.10 Conclusion
4.3.1 Introduction
The review of the fight against iodine deficiency and its consequences commonly referred to as “Iodine Deficiency Disorders” (IDD), for Madagascar is of special interest because it paints a vivid picture of the importance of IDD as a great contributory factor to abject poverty as well as the effectiveness of the work of a determined coalition of partners to radically change the situation within less than a decade (1992-2002). The population of Madagascar was estimated at 16 million in 2000 with an annual growth rate of 3%.

This evidently poor developing country had been known to have vast regions with visible goitres for several decades, but assessment was yet to be carried out.

4.3.2 Assessment
i) Preliminary studies of goitre
Although several researchers had done some limited goitre surveys in some regions, the national reference study was that of R Lala conducted between 1988 and 1992, involving a large sample of 20,832 school children of 10-14 years.

The results of goitre prevalence are presented by province and by altitude in (Table 1).

Table 1. Average Goitre Prevalence Rate by Province and Altitude for Madagascar, 1991.

<table>
<thead>
<tr>
<th>Province</th>
<th>Altitude</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-100m</td>
</tr>
<tr>
<td>Antananarivo</td>
<td>5042</td>
</tr>
<tr>
<td>Fianarantsoa</td>
<td>3708</td>
</tr>
<tr>
<td>Toamasina</td>
<td>3198</td>
</tr>
<tr>
<td>Antsiranana</td>
<td>2600</td>
</tr>
<tr>
<td>Mahajanga</td>
<td>3203</td>
</tr>
<tr>
<td>Toliary</td>
<td>3007</td>
</tr>
</tbody>
</table>

The above table shows that the severity of goitre endemicity correlated well with altitude in all the provinces of Madagascar, besides indicating that goitre prevalence was of moderate to severe endemicity.
These findings were presented at a National Seminar Workshop in Antananarivo, Madagascar, on 14-16 October 1992 to which, an ICCIDD/UNICEF consultant was invited. At this meeting a convincing community diagnosis was established and this led to the organization of a national IDD program.

Apart from the effectiveness of the Information, Education and Communication (IEC) political will and government commitment was attained for the program. The following policy recommendations were made:

“The participants in the National Seminar-workshop on IDD held at Antananarivo, 14-16 October 1992; thank and congratulate the Ministry of Scientific Research, the Ministry of Public Health, UNICEF and WHO for organising this workshop which led to:

· the exchange of information on the problems of iodine deficiency,
· the derivation of principal strategies with the aim of virtual elimination of IDD from Madagascar by the year 2000.”

4.3.3 Recommendations

· the elaboration of a program for the fight against IDD, adapted to the realities of the country, and integrated into the activities of the government of Madagascar;
· the creation of a multidisciplinary and multisectoral National Committee which will coordinate all the nutritional activities, directed to IDD elimination;
· the nomination of a National Coordinator for the control of IDD within the Ministry of Health, charged with the application, management, follow-up and evaluation of the program, and with the convening of meetings of the national committee;
· the obligatory iodization of food grade salt in Madagascar;
· the putting in place of the necessary regulations for the production and quality control of iodized salt in Madagascar;
· as needs arise, utilize other methods of delivering iodine to the population such as iodized oil;
· the mobilisation of resources for the prevention and control, and for research on IDD in Madagascar;
· the introduction of some modules on IDD into the curricula of primary, secondary and professional schools (Faculty of Medicine, Nurses, Health Technicians);
the introduction of some indicators of IDD among the indicators for the sectoral policies of government in the domains of health, nutrition, education, population, from WHO (HFA 2000) and UNICEF (National Program for the Survival, Protection and Development of the Child);

### 4.3.4 Dissemination

· the creation within the National Committee of an IEC component charged with the conception, planning, elaboration and dissemination of the necessary material for implementation; and to evaluate the impact of the messages on awareness-building and education;
· the promotion of the best methods of circulation of the messages on IDD among the different ministries, researchers, scientists and physicians;
· the creation of a Scientific bulletin for networking supported by researchers, physicians, nutritionists and sociologists concerning nutrition and nutritional deficiencies (This bulletin will equally favour the exchange of information between Madagascar and other countries interested in the progress of research on IDD);
· the strengthening of training in epidemiology and in management of IDD;
· the fixing of a National Day for the fight against all deficiency disorders in a manner as to raise the awareness each year of the public and decision-makers on the progress achieved in the implementation of the different programs;
· the association more closely of the national mass media (the press, radio, television) with the program for the fight against IDD with the special favour of the free diffusion of messages;
· the research and collaboration of the multilateral bodies (UNICEF, WHO, FAO, WBK (SECALINE) and NGOs with the government for the technical and financial support to the IDD program.

### 4.3.5 Planning

Within four weeks of these recommendations, a lot of activities took place, indicating the high level of political will and commitment gained:

· The ICCIDD consultant developed an IDD training program, which was adopted and used for the training of 36 medical doctors and scientists on IDD and the conduct of IDD surveys and interpretation of the findings.
Global Elimination of Brain Damage Due to Iodine Deficiency

- These 36 trainees were divided into 7 groups and proceeded to carry out IDD surveys in the 6 provinces and to create Sentinel Zones for eventual IDD program monitoring and evaluation.
- The Ministry of Health was restructured, creating a service for IDD control followed by the nomination of a National Coordinator.
- The drafting of the project for legislation was completed.
- A nucleus of the national committee of salt producers was created and it began to meet to discuss prospects of iodizing all food grade salt in Madagascar.
- While strengthening the Micronutrient Laboratory of the Faculty of Medicine, a new iodine laboratory was proposed under the direct control in the Ministry of Health.
- The urine, blood and salt samples collected from the sentinel sites were shipped to Yaounde (Cameroon) for analysis.
- The creation of an IDD data bank was initiated for the Nutrition service.

During the same period a National Seven-Year Action Plan 1992-1999 was elaborated to guide all actions as adopted in the resolutions while awaiting the results of the urine, blood and salt analyses.

From the above actions there was good evidence that the Plan was now well understood to be a major contribution to the alternative of the great poverty and slow socio-economic and cultural development that characterised the nation. Hence, IDD control became the long-awaited opportunity and entry point for the international partners who took part in the workshop. A national coalition was soon established consisting of:

- Ministry of Public Health
- Ministry of Scientific Research
- The Faculty of Medicine University of Antananarivo
- The Ministry of National Education
- The Ministry Of Justice
- Salt Producers
- UNICEF
- World Bank–SECALINE Project I And II
- WHO
- USAID (OMNI)
- Kiwanis International, and
- ICCIDD

Other partners joined later.
4.3.6 Implementation


The multidisciplinary and intersectoral committee set up for the plan adopted all the resolutions of the historic National IDD seminar of October 1992 and worked out details to cover seven years in three major but overlapping phases, namely, Resources Mobilisation, Implementation, Monitoring and Evaluation.

Considering the resources, they were seen as consisting of Financial, Manpower, Material, Administrative and management capacity, space and structures, woven into overlapping and supportive programs integrated into other on-going activities. Implementation and monitoring had already begun from the baseline surveys and the creation of sentinel zones, and a major evaluation was planned to take place after 5 years of progress, that is, by 1998. The plan was carefully costed and a budget prepared. It is convenient for this presentation to separate the elements and present each in order to highlight the IDD program process, progress and success, as each phase rolled by.

ii) Financial Resources

The budgetary estimate of US$ 1.2 million for the period 1992-1997 was prepared. By the year 1999, the estimated requirement was expected to be US$ 1.6 million. That time, the cost for potassium iodate was US$ 30 per kg.

The World Bank project (SECALINE) saw the National IDD program as an antipoverty opportunity and proposed US$ 1 million immediately while UNICEF committed US$ 400,000 out of the total of US$ 1.6 million. The Kiwanis International joined in later for 1996/97 budgetary year with US$ 148,000 and with US$ 150,000 for 1998/99. UNICEF was to be the administrator of these funds.

iii) Administration of Lipiodol (Ultra-fluide Guerbet Capsules 1993-1995)

The administration of iodized oil in the form of capsules was an emergency measure based on the severity of IDD in parts of the country. Therefore the capsules were targeted to high-risk groups to prevent brain damage. The groups consisted of pregnant women and children of 1-14 years in hyper-endemic regions. As this strategy is relatively more expensive, universal salt iodization and consumption was accelerated to take over as soon as possible by December 1995.
Reports from all sources confirm that 1 million capsules of Lipiodol (ultra-fluide Guerbet) capsules were purchased and administered in high-risk endemic zones. According to the UNICEF Progress Report, April 1997, “Iodized oil capsules distribution was monitored through monthly utilisation reports sent in by Health Centres. 98% of 206 health centres submitted their reports accounting for 100% of first supplies and 93% of second supplies of iodized oil capsules. The beneficiaries totalled 8,86000, of whom more than 80% were pregnant women, children 0-14 years, and women 15-45 years, in accordance with the Ministry of Health protocol for iodized oil supplementation.

It was also reported that there was a stampede for iodized oil capsules once goitres were observed to be regressing after 6 months and some parents of school children whose goitres rapidly shrunk came up to thank the medical officer in charge of the School Health Service. Formal evaluation of iodized oil impact took place in 1995 in the sentinel zone only, as operationally directed from the central coordinating office; and the results were quite positive and encouraging - a concrete proof of the efficacy and effectiveness of iodized oil.

iv) Salt Iodization Activities (1994-1996)
These consisted specifically of:
- Formulation of legislation
- Contact and training of all salt producers
- The arrival of a salt Engineer as ICCIDD/UNICEF consultant– (Mr Meftah Lamine)
- Organisation of salt producers into cooperatives in Tuleary
- Purchase and supply of iodization equipment by SECALINE;
- Technical training of salt producers and installation of equipment, and training of mechanics for maintenance; in collaboration with UNIDO.
- Purchase and supply of Potassium Iodate by UNICEF.

v) Legislation
- The principal regulatory texts guiding the National IDD program included:
- Inter-ministerial Order # 413/94/MPCA/MINSAN/MRAD of 2nd June 1994 defining and stipulating the accepted norms for food grade salt and iodized salt.
Decree No. 95-587 of September 1995 lays down the National policy for the control of IDD, states the regulatory measures and creates the National IDD committee (multisectoral body).

Inter-ministerial order #0409/96/MINSAN/MINA/MINEC/MINCT of 6 February 1996 defines the modalities of application of Decree No. 95-587 of 5 September 1995.

Decree No. 97-212 of 25 March 1997 reorganises the Ministry of Health to facilitate the functioning of the IDD program in an integrated Micronutrient Malnutrition control system which is described in detail in the “program de cooperation Madagascar UNICEF 1996-2000.”

In general the regulatory texts were well-applied and necessary revisions made to include sanctions for failure to comply. A complex chain of control and certification of salt products has been invented and updated to minimise fraud.

vi) Information, Education and Communication (IEC)

A sustained Information, Education and Communication component kept up the dynamics of the national IDD control program. This consisted of:

- Periodic National seminar/workshops,
- Documents: IDD booklets and pamphlets;
- Posters, stickers, slogans, iodized salt LOGO;
- Mass media: press, television, radio;
- House to house education during iodized salt surveys;
- Health talks on the prevention of IDD given in maternal and child health clinics;
- Celebration of IDD days and of Health weeks–big event for social mobilisation
- Special visits of the Minister of Health to IDD endemic zones;
- Teaching of IDD modules in school curricula at all levels;
- Wide distribution of rapid test kits to the elite of the population to involve them in quality control.

All these were confirmed in the UNICEF Progress Report of April 1997.

Apart from the IEC activities, an extensive program for training included 1500 workers on IDD control, 30 laboratory technicians and mechanics for 23 small salt-works and 15 more laboratory technicians for the Ministry of Health regional laboratories.
4.3.7 Monitoring and Epidemiological Surveillance

The creation of seven sentinel zones and the establishment of several baseline indicators constituted a very strong base for the Madagascar IDD prevention and control program.

i) Progressive Impact Assessment

Thanks to existing baseline information from the pre-Universal Salt Iodization (USI) period 1989-1992 and the confirmatory baseline survey of 1992. It was, therefore, possible to assess the progressive impact of the intervention with iodized oil (1993-1995) and USI (1995-1998). This was so because the same techniques of measurement and parameters were strictly followed in the evaluations of 1995, 1996, 1997 and 1998. The study population remained that of children aged 6-12 years.

Table 2. Comparison of Goitre Prevalence for 1992 and 1997

<table>
<thead>
<tr>
<th>Sentinel Zone</th>
<th>1992</th>
<th>1997</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambohidratrimo</td>
<td>38%</td>
<td>4.9%</td>
</tr>
<tr>
<td>Belazao/Antsirabe II</td>
<td>32.8%</td>
<td>14.6%</td>
</tr>
<tr>
<td>Betroka</td>
<td>16.8%</td>
<td>12.4%</td>
</tr>
<tr>
<td>Bealanana</td>
<td>18.0%</td>
<td>17.0%</td>
</tr>
<tr>
<td>Maroambitry</td>
<td>38.6%</td>
<td>23.0%</td>
</tr>
<tr>
<td>Ranomafana – East</td>
<td>28.8%</td>
<td>16.5%</td>
</tr>
<tr>
<td><strong>Total Average</strong></td>
<td><strong>28.7%</strong></td>
<td><strong>14.8%</strong></td>
</tr>
</tbody>
</table>

a) Goitre Prevalence

The dramatic reduction was well recorded for sentinel zones (Table 2).

b) Urinary Iodine Excretion 1992-1997

By 1995, it was reported that for children 6-12 years in the seven sentinel zones, the relative proportion of 16% with levels below 20µg/L had dropped to 5%; by 1996, it was 0.9%; and by 1997 it was 2.4%. Similarly the proportions of children excreting iodine at 100µg/L and above had risen from 0% in 1992 to 25.3% by 1995; to 78.7% by 1996 and was 45.7% by November 1997. The drop from 78.8% for 1996 to 45.7% was attributed to transfer from iodized oil to the consumption of
iodized salt which was not yet universal in all the sentinel zones such as Bealanana in Mahajanga rural Province.

In 1992 the median value for urinary iodine excretion was only 39µg/L. The median values for urine samples randomly taken from school children in May 1997 to January 1998 had a range from 90µg/L to 180µg/L with the average or mean of medians being 124.9µg/L. This showed definite improvement in the correction of iodine deficiency.

ii) Household Coverage with Iodized Salt

Although iodized salt had reached every health district by November 1997 thus achieving 100% territorial coverage, not all the salt samples tested positive for iodine. Hence for Balazoa 88.3% tested positive while for Diego in Antsiranana it was 100%. Thus, progress had occurred but there were still problems in some places. In Betroka 93% and in Ranomafana East 96.1% tested positive for iodine. The UNICEF indicator of 90% was already achieved in Madagascar by 1998.


<table>
<thead>
<tr>
<th>Class</th>
<th>Pass Rate in 1994</th>
<th>Pass Rate in 1997</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 – 10</td>
<td>40%</td>
<td>64%</td>
</tr>
<tr>
<td>10 – 9</td>
<td>66%</td>
<td>65%</td>
</tr>
<tr>
<td>9 – 8</td>
<td>56%</td>
<td>68%</td>
</tr>
<tr>
<td>8 – 7</td>
<td>38%</td>
<td>69%</td>
</tr>
</tbody>
</table>

Table 4 Proportion of Pupils Repeating by 1994 and 1997

<table>
<thead>
<tr>
<th>Class</th>
<th>Repeat Rate 1994</th>
<th>Repeat Rate 1997</th>
</tr>
</thead>
<tbody>
<tr>
<td>11th grade</td>
<td>40%</td>
<td>36%</td>
</tr>
<tr>
<td>10th grade</td>
<td>30%</td>
<td>17%</td>
</tr>
<tr>
<td>9th grade</td>
<td>29%</td>
<td>26%</td>
</tr>
<tr>
<td>8th grade</td>
<td>31%</td>
<td>13%</td>
</tr>
<tr>
<td>7th grade</td>
<td>43%</td>
<td>21%</td>
</tr>
</tbody>
</table>
iii) New Endemic Cretins

In the severe IDD endemic areas where cretins were quite frequent in 1992, no new cretins were reported. Unfortunately, as this indicator had not been provided for in the national epidemiologic surveillance form, none could be recorded. However in the Pediatric Ward of the Regional Hospital for Fianarontsoa, Dr R Nielle and his Chief Nursing Officer who had been running the unit for 27 years volunteered the information that new endemic cretins were no longer seen in their unit since the introduction of iodized oil followed by iodized salt in the community. At the Centre for Mentally Handicapped children “Orchide Blanche” in Antananarivo, it was reported that new cases had not been reported.

iv) Impact on Intellectual Function

From as early as 1994 the University and research sector had already launched ongoing operations research projects. The results were presented at the seminar held in August 1998. They demonstrated that the pass-rate in First School Leaving Certificate had greatly improved between 1994 and 1997. In addition the proportion of repeaters considerably reduced in Belazao-Antsirabe.

It is pertinent to mention that the iodized salt consumed in Belazao comes from Morondava, Tuleara and Antananarivo (reconditioned). Thus better results could be expected in Antsiranana enjoying higher quality salt.

Another parallel study in another school in Antsirabe showed the following results: (Table 5)

<table>
<thead>
<tr>
<th>Year</th>
<th>Enrolled</th>
<th>Pass</th>
<th>Pass – Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>63</td>
<td>16</td>
<td>25%</td>
</tr>
<tr>
<td>1995</td>
<td>55</td>
<td>26</td>
<td>65%</td>
</tr>
<tr>
<td>1996</td>
<td>73</td>
<td>39</td>
<td>53%</td>
</tr>
<tr>
<td>1997</td>
<td>71</td>
<td>50</td>
<td>70%</td>
</tr>
</tbody>
</table>

We observed a positive correlation between continued iodine consumption in time and the success in intellectual performance during the period 1994-1997.
v) Iodine Induced Hyperthyroidism (IIH)

As was expected, the transient epidemic of iodine-induced hyperthyroidism (IIH) was already setting in by the year 1998, that is, two years after the introduction of iodized salt into this severely iodine deficient community. Six cases of IIH were reported at the Central Reference Hospital, Befelatana. During the IDD National seminar of August 1998, the subject of IIH was extensively discussed and medical specialists (Cardiologists, Endocrinologists and Psychiatrists) were advised to be more vigilant and to diagnose and treat new cases of IIH promptly or refer suspicious cases for early diagnosis and therapy.

vi) Integration of IDD into other Micronutrient Malnutrition Control Programs

Textually and structurally, there are provisions for integrating IDD control into the general program for control of other micronutrients, such as vitamin A, iron and calcium deficiency. The Prime Minister’s decree No 97-212 of 25 March 1997 fixing the attributions of the Ministry of Health provides for it, and “The Cooperation program Madagascar / UNICEF 1996-2000, Part II, NUTRITION” had already worked out the details for such integration.

vii) IDD Program Investment

We have already stated the World Bank (Secaline) and UNICEF commitments. The April 1997 Report on the IDD Elimination Project prepared by UNICEF detailed the budget and actual expenses. The Kiwanis International had donated US$148,000, for the 1996/97 Budgetary year, and US$ 150,000 were received as supplementary funds by 1998, totalling US$ 298,000 of Kiwanis support by January 1998. The government of Madagascar provided enthusiastic and maximum cooperation in space, manpower and coordination. Other support (unspecified) was provided by USAID/OMNI.

4.3.8 Summary IDD Program Impact

The impact of iodized oil and salt on the Madagascar population is summarised in the Table 6.

4.3.9 Sustainability Strategy for 1998-2005 and Beyond

i). The political will and commitment remains high and has been translated into policy and programs, which are perennial.
a) The present organic structure of the Ministry of Health stipulated in Decree No 97-212 of 25/3/97 permitted easy coordination of relevant service units.

b) Appropriate legislation and regulatory texts on salt iodization have been enacted and are being applied and updated to meet program challenges.

c) The integration of IDD in the Community Health Care delivery system at District level with community participation has been implemented.

d) The creation of a central IDD committee, which carries out regular monitoring and periodic evaluation in addition to the National Epidemiology Surveillance system, which produces yearly reports in health activities and diseases including the IDD spectrum.

ii) The fact that all food grade salt is produced and iodized in Madagascar is a strong and favourable sustainability factor

iii) The formation and commitment of the National Association of Iodized Salt producers of Madagascar is indicative of continued civic engagement.

iv) The highly organized system of social mobilization and IEC through social structures using printed messages promises to be sustainable.

v) The integration of IDD modules in school curricula for permanent teaching promises to sustain the control program.

vi) As iodized salt is a principal and lucrative business industry in Madagascar, it will sustain IDD control.

vii) The involvement of the Ministry and University in operations research to improve the program and its outcomes is important.

viii) The formation of partnerships with agencies of the United Nations such as UNICEF, WHO, FAO, the World Bank, UNIDO will foster sustainability of the fight against brain damage and poverty in favour of child survival and development for decades to come.

ix) ICCIDD is available to advise and facilitate.

4.3.10 Conclusion

The National Madagascar IDD program has been an exemplary and successful program in that the logical social model for eliminating an endemic disease was well followed, namely: problem estimation, securing of political will and commitment, elaboration of a Plan of Action, formation
### Table 6. Summary of Health Impact Indicators of National IDD Program

<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>SITUATION 1992</th>
<th>SITUATION 1997</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goitre Prevalence</td>
<td>Range 28%–68%</td>
<td>15% March 1997</td>
</tr>
<tr>
<td></td>
<td>Mean 45%</td>
<td>15% December 1997</td>
</tr>
<tr>
<td>Urinary Iodine</td>
<td>Median = 39µg/L</td>
<td>125µg/L</td>
</tr>
<tr>
<td></td>
<td>Mean = 42 µg/L</td>
<td>150µg/L December 1997</td>
</tr>
<tr>
<td></td>
<td>Proportion less 20 µg/L, 16%</td>
<td>2%</td>
</tr>
<tr>
<td></td>
<td>Proportion &gt; 100 µg/L</td>
<td>46% March 1997</td>
</tr>
<tr>
<td></td>
<td></td>
<td>87% December 1997</td>
</tr>
<tr>
<td>Coverage by universal salt iodization</td>
<td>0%</td>
<td>80% by November 1997</td>
</tr>
<tr>
<td></td>
<td></td>
<td>90% by March 1998</td>
</tr>
<tr>
<td>Endemic Cretins</td>
<td>Ambohidratimo++</td>
<td>No New cases</td>
</tr>
<tr>
<td></td>
<td>Belazao-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Antsirabe++</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Fandriana+++</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Tananarive+</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Pediatric ward</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Fianarantsoa+++</td>
<td>NIL</td>
</tr>
<tr>
<td>Juvenile Hypothyroidism</td>
<td>Raised TSH: 30%</td>
<td>Not assessed</td>
</tr>
<tr>
<td></td>
<td>Low T4: 54.1%</td>
<td></td>
</tr>
<tr>
<td>Intellectual Performance</td>
<td>High school failure rate</td>
<td>Improved pass rate</td>
</tr>
<tr>
<td></td>
<td>High drop-out rate</td>
<td>Reduced dropout rate</td>
</tr>
<tr>
<td></td>
<td>High repeat rate</td>
<td>Reduced repeaters</td>
</tr>
<tr>
<td>Jod-Basedow</td>
<td>Unknown</td>
<td>6 cases reported, Emergence of minor epidemic</td>
</tr>
<tr>
<td>Incidence of Operated Goitre cases</td>
<td>Very high+++</td>
<td>Relatively few cases+</td>
</tr>
<tr>
<td>Population growth</td>
<td>3.0% (estimates)</td>
<td>3.3% (estimates)</td>
</tr>
<tr>
<td>Knowledge of IDD spectrum control measures</td>
<td>Goitre-was known.</td>
<td>Increased++++</td>
</tr>
<tr>
<td></td>
<td>NIL for control measures</td>
<td>Good knowledge of iodized oil and salt</td>
</tr>
<tr>
<td>Salt production</td>
<td>Indivudual</td>
<td>Cooperative groups with improved production</td>
</tr>
<tr>
<td></td>
<td>Dirty, non iodized</td>
<td>Clean iodized salt</td>
</tr>
<tr>
<td>Pediatric morbidity &amp; mortality</td>
<td>Generally High rates</td>
<td>To be assessed by Demographic surveys</td>
</tr>
</tbody>
</table>
of partnership for resources mobilisation and development, implementation, monitoring and periodic evaluation, continuing IEC component, Operations Research and feedback for re-planning. Hence it has been possible to assess the health impact along several indicators. In the domain of partnership formation, the promotion and catalysing role of ICCIDD in collaboration with UNICEF and WHO has been central.

Thanks to the major financiers namely, the World Bank (SECALINE) and Kiwanis International, the program never faltered. The timely arrival of USAID/OMNI to support a post-five year evaluation through an ICCIDD consultant highlighted the spectacular success of the IDD program of this big island nation whose development energy and know-how had long been sapped by severe iodine deficiency and its consequences of general low intellectual and economic performance. All along, we have also discovered a motivated developing nation geared up to fight underdevelopment, poverty and to improve their quality of life. Certainly, the promising elimination of iodine deficiency and the assurance of sustained optimal iodine nutrition by 2002, was a worthy goal and great mission for the ICCIDD—the principal leader.

5. Summary and Conclusions

5.1 Russian Federation

As pointed out by Dr. Gerasimov an international meeting held in Tashkent in January 1991 with the joint sponsorship of UNICEF/ICCIDD/WHO was very important in initiating new momentum into the IDD control program in Russia (IDD Newsletter 1992). The subsequent breakdown of the USSR delayed the implementation of the recommendations from this meeting.

Surveys carried out over the period 1991-2000 demonstrated a significant problem with IDD as indicated by elevated goitre rate and reduced urine iodine excretion throughout the population (145 million) of the Russian Federation.

Implementation of an iodized salt program did not occur until after 1997 with significant progress achieved by 2002 so that there is now confidence that the demand can be met. Monitoring of iodized salt indicates better quality but there is still room for improvement. Laboratories for the measurement of urine iodine have been established.
with the recent assistance of the International Resource Laboratories for Iodine (IRLI) Network.

However, there is a lack of demand for iodized salt. Legislation has not been passed. Universal Salt Iodization is necessary but requires ‘high level advocacy’ including international organizations from the UN System (FAO, UNICEF, WHO).

5.1.1 Comment

It is clear that a major communication and education campaign is required to promote the use of iodized salt immediately without USI legislation. But an effective education program should assist the future passage of legislation, eventually for USI.

5.2 Bhutan

This small Himalayan Kingdom (population 2.1 million) had severe IDD. A Plan of Action was drawn up in 1985 with implementation of the IDD Control Plan (IDDCP) by the establishment of a salt iodization plant on the border with India at Phuentsholing, iodized oil injections in high risk areas, salt monitoring, evaluation and community level education.

However, a Joint Report in 1996 to the government by the ICCIDD indicated inadequate monitoring of iodized salt. This was corrected with acceptance by the government of the objective of sustainable elimination of IDD in Bhutan by 2000. Urine iodine laboratories were established.

Political support was provided by His Holiness the Je Khenho at a special ceremony on 30th August 1997, attended by Ministers and Heads of UN Agencies. This ceremony was followed by the signing of a Statement of Commitment to ‘ensure that the children of Bhutan get iodized salt to be able to grow into healthy adults’.

In 1998 the TGR was 17%, median urine iodine was 277µg/L and iodized salt coverage was 96%. By 2002 the TGR was less than 5% with median urinary iodine of 298µg/L. An external evaluation carried out in 2002 confirmed the elimination of IDD.

The WHO/UNICEF/ICCIDD (2001) Guidelines for sustainability have now been met by the Royal Government of Bhutan. A normal cyclic regular monitoring system has been established with the division of the country into five zones of four districts each. Each year 1200 children are checked for goitre grading and analysis of 300 urine samples and salt samples for iodine levels.
5.2.1 Comment
External assistance (ICCIDD/UNICEF/WHO/MI) with the initial assessment led to the IDD Control Program. This Bhutan experience indicates the need for sustainability measures, particularly by the monitoring of salt iodine and urine iodine and the role of the ICCIDD in ensuring this.

5.3 Madagascar
This national program in an island nation of 16 million has been most successful.

As reported by Dr D Lantum the social process for a national program was adopted. The sequence of Assessment, Dissemination, Planning, Political Decision, Implementation and Evaluation was followed. Necessary funding support was provided by US$1 million from the World Bank (anti-poverty program) with additional support by UNICEF and Kiwanis International.

Legislation has been passed for norms for iodized salt and the creation of a National IDD Multisectoral Committee.

A sustained Information, Education and Communication (IEC) Program has been established with the use of mass media, IDD booklets and pamphlets. An extensive staff training program included 1500 workers on IDD control, 30 laboratory technicians and mechanics for 23 small salt works and 15 more laboratory technicians from the Ministry of Health Regional Laboratories.

Progressive Impact Assessment was carried out showing fall in TGR. Improved household coverage with iodized salt, rise in urine iodine and improved school performances. Full details are given in Table 6 in Dr Lantum’s Report.

5.3.1 Comment
The Madagascar program presents an excellent example of the fully developed social process for a national program. The island situation has the advantages of a clearly defined population, conscious of its identity in accepting the challenge of the elimination of IDD as a factor in the reduction of the widespread poverty.

The success of the program has been greatly assisted by the leadership provided by the ICCIDD through Dr Dan Lantum.
Conclusion

Each of these three programs demonstrates a significant role for external assistance through the UN System-UNICEF, WHO and the ICCIDD. This is also illustrated in the experience with a number of national programs reported in Section VIII.

It would seem essential that some external assistance through the UN System will need to continue to sustain national programs from time to time.

The technical role of the ICCIDD is unique. It needs to be continued to promote sustainability.

The good progress made with national programs reflects the strength of the informal global partnership of WHO, UNICEF, and the ICCIDD with the governments of IDD affected countries.

This global partnership is further strengthened by the support of the salt industry through the recently established Global Network for Sustainable Elimination of Iodine Deficiency (see Section III).

Sustainability is now the challenge (see Section IX).

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Ranaivaharisoa Ravaorinjanahary Lala (1992), Goitre et Carence En Iode A Madagascar; Aspects Biochimique Epidemiologique, These de Doctorat Es Sciences Naturelles, Université d’Antananarivo.


Section VIII

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1.2 World Map showing Iodine Nutrition by Country

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2.1 Overview
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   8.1 **Western and Central Europe**—F Delange
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I

Introduction

Basil S Hetzel

1.1 Classification of Countries by Iodine Nutrition

The Regions follow those established by the World Health Organization. An Overview of the programs in each of the Regions is given with an Introductory Section on ‘Lessons Learnt’.

Detailed data on the status of the program in each country by region is given in Appendix 1.

A classification of the iodine nutrition of countries by Regions is shown in the following Tables, which provide a background to the discussion in this Section. These data are provided from the ICCIDD Data Base. They have been compiled by Dr John Dunn, Executive Director of the ICCIDD and refer to the situation as of early 2003.

1.2 World Map Showing Iodine Nutrition by Country

These data are also shown in the World Map (in between page 294 and 295).

In addition detailed data on the status of each country program is given in Appendix 1.
**Table 1. Classification of African Countries by Iodine Nutrition**

<table>
<thead>
<tr>
<th>Severe</th>
<th>Moderate</th>
<th>Mild</th>
<th>Deficient</th>
<th>Likely</th>
<th>Sufficient</th>
<th>Likely</th>
<th>Excess</th>
<th>Status</th>
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<tr>
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<td></td>
<td>Algeria</td>
<td>Benin</td>
<td>Cameroon</td>
<td>Kenya</td>
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</table>

288 Global Elimination of Brain Damage Due to Iodine Deficiency
Table 2. *Classification of South East Asian Countries by Iodine Nutrition*

<table>
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<tr>
<th>Severe</th>
<th>Moderate</th>
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<td>Bangladesh</td>
<td>Bhutan</td>
<td>Myanmar</td>
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<td>Brazil</td>
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<td>Sri Lanka</td>
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Table 3. Classification of China/East Asian Countries by Iodine Nutrition

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<th>Likely</th>
<th>Status</th>
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<tbody>
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<td>Moderate</td>
<td>Mild</td>
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<tr>
<td>Mongolia</td>
<td>North Korea</td>
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Table 4. Classification of Asia/Pacific Countries by Iodine Nutrition

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<td>Moderate</td>
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<td>Papua New Guinea</td>
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### Table 5. Classification of Middle East Countries by Iodine Nutrition

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Reports from the Regions and the Countries
## Table 6. Classification of Americas by Iodine Nutrition

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### Table 7. Classification of West/Central European Countries by Iodine Nutrition

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<td>(Montenegro)</td>
<td>Yugoslavia (Serbia)</td>
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Table 8. *Classification of East Europe/Central Asian Countries by Iodine Nutrition*

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<th>Status</th>
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<tbody>
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<td>Severe</td>
<td>Moderate</td>
<td>Mild</td>
<td>Deficient</td>
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<tr>
<td>Armenia</td>
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</tbody>
</table>
2

African Region

D Lantum, J Egbuta
J Mutamba, T Ntambue

2.1 Overview

2.2 Cameroon

2.3 Nigeria

2.4 East & Southern Africa
2.1

Overview

John T Dunn, D Lantum, J Egbuta
J Mutamba, T Ntambue

In collaboration with other
Senior ICCIDD Members from Africa*

2.1.1 Summary and Lessons Learnt

2.1.2 Introduction

2.1.3 Urinary Iodine

2.1.4 Legislation

2.1.5 Iodized Salt

2.1.6 National Programs

2.1.7 Overall Status

2.1.8 Recommendations

* M Benmiloud, OL Ekpechi, C Todd, P Jooste
2.1.1 Summary and Lessons Learnt

Africa has made great strides towards iodine sufficiency in the past 15 years. Approximately 23 of the 50 countries considered here, representing 59% of its population, appear to be iodine sufficient. The major push for iodized salt, currently used by about 62% of households, is chiefly responsible for this improvement. By comparison, the WHO/UNICEF/ICCIDD Conference concluded that virtually every African country had some iodine deficiency.

Much remains to be done. Over half the countries still harbour iodine deficiency, putting at least 330 million people at continuing risk for its consequences. The continent is only about halfway to its goal of virtual elimination of iodine deficiency by 2005, as pledged by the UN General Assembly Special Session (UNGASS) on children in May 2002. Strong efforts must be made towards more effective implementation of iodized salt, through stronger government programs, education, monitoring, and information gathering.

2.1.2 Introduction

Africa has over 800 million people, about 15% of the world’s population. Virtually all of its countries have had iodine deficiency in the past. ICCIDD has periodically summarised overall progress, with frequent additional reports on individual countries or subregions (Ekpechi 1987; IDD Newsletter (1997, 1999). The present article offers an update, drawn principally from ICCIDD sources but in addition from UNICEF Country Offices (especially on iodized salt) and WHO as well as communication from various national and other commentators.

The data are presented in three tables and a map. They include all of geographical Africa, although North Africa is also grouped with ICCIDD’s Middle East/North Africa region, and the ICCIDD regions differ slightly from those of WHO and UNICEF. However, information is frequently fragmentary or not available at all.

Table 1 presents a classification of countries by iodine nutrition status and Table 2, an overall summary. The entries reflect our best judgement from what is available. Still, information on many items, especially monitoring and education, cannot be readily found. Often data on the same subject conflict; for example, different surveys may report different levels of iodine in the salt or urine, and choosing the more reliable figure has been arbitrary. More details appear in the pages for individual countries in ICCIDD’s CIDDS database (www.iccidd.org).
2.1.3 Urinary iodine
In accordance with WHO/UNICEF/ICCIDD (2001) recommendations, urinary iodine concentration is the major indicator of iodine nutrition. Deficiency is defined as either severe (median UI <20µg/L), moderate (20-49µg/L), or mild (50-99µg/L); sufficiency is 100µg/L or higher, and excess is >300µg/L. Several countries have had recent careful representative national surveys, but these are the exceptions. Often only regional surveys are available. Generally, information from urinary iodine concentrations correlates with that from goitre surveys when both are available. Almost no country has information about neonatal screening with TSH, a useful marker for iodine nutrition in more developed countries.

2.1.4 Legislation
Some type of legislation for salt iodization and IDD exists in 38 of the 50 countries, and is pending in another. Eight countries do not have relevant laws, and the situation is uncertain in Comoros, Somalia, and Sierra Leone. Potassium iodate (KIO₃) is the iodine compound used by all African countries, although it is frequently not clear whether the levels specified are for iodine per se or for KIO₃, of which only 58% is iodine. Wide variation exists in the specifications for iodine content of salt, ranging from 20-100ppm. Some countries specify a range, others a minimum, and still others prescribe different levels at production, retail, and household.

2.1.5 Iodized salt
Salt production is uneven across the continent; some countries import it, others export. Countries that import all of their salt (e.g., Congo, Nigeria, Zimbabwe, and Rwanda) have led the continent in implementation of iodized salt. For them, the major strategy has been effective control measures and inspection at the borders. Other countries may have many small salt producers scattered over a wide area, presenting a much greater challenge to effective iodization of their product.

Another important variable is the distribution of salt production between large and small operations. Large producers usually have more sophisticated technology that allows iodization to be introduced easily, and the management is more accessible to regulatory agencies and more compliant in observing quality control and the laws. Small producers are often spread over large areas and consist of single individuals or families; introducing iodization into their operations requires intensive education, technical support, and logistic arrangements.
The data on household use of iodized salt come principally from the UNICEF global database on IDD, compiled in 2000 (www.childinfo.org), occasionally supplemented by additional or more recent information. These surveys use different definitions for adequately iodized salt, but usually require at least 15ppm at the household level. Wide variation across the continent is evident, from virtually no iodized salt in Mauritania, Sudan, and Gambia to over 90% in Benin, Cameroon, DR Congo, Kenya, Libya, Namibia, Nigeria, Sao Tome, Togo, Tunisia, and Zimbabwe. By population, about 62% of households are covered with adequately iodized salt.

2.1.6 National programs
Most governments accept some responsibility for IDD control. The degree of involvement ranges from none in several countries to active programs with a designated government unit and a national coalition in others. Over time, many programs fluctuate in their activities, peaking with a survey and enthusiasm about salt iodization and enforcing national laws, and then ebbing with changes in personnel, financing, and advocacy.

Our knowledge about monitoring and quality assurance of salt is limited. A few countries, especially those that import salt, have good systems of quality control and monitoring. In most of the others, monitoring is uneven at best, and often there is no information.

Similarly, only a few countries have programs that actively monitor iodine nutrition. The surveys that have taken place from time to time are usually limited geographically and technically, relying on unrepresentative sampling of locales and only neck palpation. The more careful studies, such as done with the ThyroMobil, provide a uniform reliable technology, but are limited in the number of sites they can reach, particularly neglecting the distant rural poorer sites that typically harbour the most resistant iodine deficiency.

Information is also sparse about sustained education activities within countries. Many have proposed commendable plans for education at all levels, from politicians through the health sector to the community. The degree of penetration of such messages and their long-term effects are generally unknown.

2.1.7 Overall status
Table 1 places each country in a category ranging from severe iodine deficiency to excess. Significant, are the large numbers of countries in the “likely deficient” categories (17 countries, 120 million people) and “likely
sufficient” (12 countries, 151 million people) as well as one without enough information to categorise. Thus, over half the countries lack enough information to allow a proper conclusion about their iodine nutritional status.

This analysis presents information by individual country, because programs and epidemiologic data are national. The largest of the countries considered here has a population nearly 1,000 times greater than that of the smallest. Even small and medium-sized countries have considerable diversity of geography, wealth, and nutritional status, and significant pockets of persisting iodine nutrition can easily be lost when averaged with the iodine sufficiency of other zones of the country. For example, Nigeria, Kenya, and South Africa appear sufficient, but need attention to possible continuing iodine deficiency in parts of their national territory.

ICCIDD has summarised Africa’s iodine nutrition before (Table 3) although the previous tallies were not prepared in the same way. In 1987 few countries had data on urinary iodine, and conclusions were based on goitre prevalence by palpation. Many countries had virtually no information about iodine nutrition. Technology had improved somewhat by 1996, and urinary iodine measurement was coming into greater use. The summary in 1999 did not provide information on a number of countries, so its totals are smaller.

Despite these limitations, the data of Table 3 show several trends. First, the number of countries that are sufficient, or likely sufficient, has increased steadily. Secondly, we have more and better information than before, although data are still incomplete. Even the countries that remain deficient show evidence of lesser degrees of deficiency over time. Examination of individual countries show some with striking improvement, such as Algeria, Benin, Cameroon, DR Congo, Kenya, Madagascar, Malawi, Nigeria, Rwanda, and Togo. In a few, the iodine deficiency has probably worsened, such as Sierra Leone and Ethiopia.

2.1.8 Recommendations

Many general recommendations can be made for African countries, including more effective implementation of iodized salt, more vigorous educational efforts, stronger program organization, and national coalitions for advocacy. Additionally, the present review emphasises three activities for urgent attention:

1. More information – This compilation clearly demonstrates how limited the data are for many countries. Missing information certainly
exists and needs to be found. ICCIDD through its Subregional Coordinators
and National Representatives, and together with partners in WHO,
UNICEF, and other organizations, will increase its efforts to gain a more
complete picture of the current situation in countries, and thus improve
planning for a more effective strategy.

2. Adjustment of salt iodine levels – The range of iodine concentrations
for fortifying salt in Africa is quite wide. The amounts in some countries
(e.g., Kenya, Eritrea, Niger, Uganda and Zambia) are very high and are
likely to increase the risk of iodine-induced hyperthyroidism, as happened
in Zimbabwe in the early 1990s. Salt moves across many national borders
in Africa, and a fairly uniform standard for iodine content makes good
public health and economic sense. Regional health and economic groups
should convene to reach such a standard; previous workshops, particularly
in Eastern Africa, have considered the issue, but with little follow-up.

3. Monitoring – Most countries in Africa have inadequate monitoring
of both salt and iodine nutrition. Data on both indicators are essential for
correcting delays in progress and for advancing sustainability. All programs
should build a component for monitoring nutrition and salt into their overall
strategy and dedicate some of their resources to it.

References

Ekpechi OL (1987) Iodine deficiency disorders in Africa. In Hetzel BS, Dunn
JT, Stanbury JB (eds). The Prevention and Control of Iodine Deficiency Disorders,
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2.2

Cameroon
Dr. Daniel N Lantum

2.2.1 Summary and Lessons Learnt

2.2.2 Introduction

2.2.3 Community Diagnosis of IDD Endemicity

2.2.4 Program Evolution

2.2.5 IDD Survey of 1999

2.2.6 Results of 2002

2.2.7 Other Impacts

2.2.8 Merited Acknowledgements
2.2.1 Summary and Lessons Learnt
1. The sustained leadership role of International community (WHO/UNICEF/ICCIDD) was vital, and the continuing catalytic and teaching role of the ICCIDD Focal Point was central to the progress achieved.
2. A committed national multidisciplinary scientist capable of establishing partnership and networking was the driving force.
3. As iodine laboratories are scarcely used, there is no need for one in every country but the titration of iodine in salt should be done at industrial level or at national quality control points by the local University Faculties of Science and Medicine.
4. Rapid turnover of trained personnel is injurious to the program.
5. Iodized salt producers must be supervised to sustain regular and adequate levels of iodization as well as supply information on progress of the national program of which they are the principal movers.
6. With the liberation of the salt trade, the control of salt marketing is imperative, as smart smugglers of non-iodized salt are a serious threat and could ruin the program in isolated districts.
7. Adequate coverage of the country with iodized salt reduces the effect of goitrogens (cassava, etc) consumed as food staples.
8. No national IDD program can be successful without extensive partnerships and networking. It is a serious error to confide programs to junior health technicians as leaders.
9. National coalitions are necessary to promote social mobilisation and sustained information, education and communication at the grassroots.
10. There were many individuals who joined the program primarily as business ventures with no commitment to IDD elimination, and when resources were scarce, they withdrew.
11. Access to mass media of communication is an essential program component to raise population awareness.
12. Regular program monitoring and publication of progress reports is necessary to win public interest and support, but resources were always scarce to do regular monitoring.
13. New scientific updates through 1986-2002 did alter program aspects including methods of data collection, types of data collected, units of measurement, interpretation of endemicity and cut-off levels for total goitre rates and urinary iodine excretion levels. This proved the importance of operational research done by ICCIDD and national scientists.
14. The ICCIDD Newsletter did help greatly to enlighten local leaders on what others were doing in other countries and thus encouraged us to keep up our effort.

15. Continuous human resource development and capacity building are a sine qua non for a national program that has no foreseeable end. The ICCIDD TASK FORCE, which later became the AFRICAN Micronutrient TASK FORCE did a lot in this domain through yearly workshops.

2.2.2 Introduction

The idea of conceiving the National Iodine Deficiency Disorders (IDD) Program in Cameroon and for most countries of Africa must be accredited to the WHO/UNICEF/ICCIDD IDD Regional Conference held in Yaounde, 21-24 March 1987. At this conference the concept of goitre, endemic cretinism and other IDD manifestations as being one continuum of diseases with a common cause, namely, iodine deficiency was well elucidated, the six phases of the social model of controlling an endemic disease well described, the patchy endemicity of IDD in Africa summarised and the different strategies for control of IDD well discussed, with universal salt iodization emerging as the choicest hope in the long run. Some of the outcomes of the meeting were the creation of an IDD African Task Force to help create country programs and the appointment of Professor Daniel Lantum as the ICCIDD Subregional Coordinator for Central Africa and Madagascar. In 1989 the WHO/ICCIDD sent out Mr. Venkatesh Mannar, a Salt Consultant to Cameroon and he and Professor Dan Lantum carried out a study of the salt trade in Cameroon, with particular reference to possibilities of iodization of all food grade salt at Douala, the principal Port-town of Central Africa. It was then that the Sel du Cameroun Preparation for the Cameroon National IDD Program began with the sponsorship in 1989 by WHO/ICCIDD of Dr. Jeanne Ngogang-a Biochemist Lecturer, to the All Indian Institute of Health Sciences, New Delhi, India, to learn the management of an Iodine Laboratory under Professor MGV Karmkar. This was followed by support for the creation of an Iodine laboratory at the Faculty of Medicine and Biomedical Sciences (then CUSS/UCHS) to facilitate the community diagnosis of IDD and eventually to assure program monitoring. Eventually a laboratory technician was trained in CDC Atlanta by the Program against Micronutrient Malnutrition (PAMM). The CUSS team further extended their base to the National Centre for Food and Nutrition Research (CNRAN)
and trained laboratory technicians for Democratic Republic of Congo, Tchad, Central African Republic and Gabon. They have also carried out urinary iodine analysis for these countries as well as Madagascar, but their commonest activity over the years has consisted of support for studies by medical students doing their Doctorate degrees on IDD, periodic monitoring of the national program, quality assessment and quality control for the many salt producers in Douala.

2.2.3 Community Diagnosis of IDD Endemicity

The endemicity of Iodine Deficiency Disorders (IDD) as a public health problem in Cameroon was established by Lantum and collaborators of the University Centre for Health Sciences of the University of Yaounde in 1990/1991 after a quasi-national survey and review of fragmentary information reported by isolated researchers between 1954 and 1990. It is worth mentioning that the German colonial records do mention that pockets of goitre were seen in parts of Cameroon by 1906; but it was Masseyeff of the French Organisation for Scientific and Technical Research (ORSTOM) who investigated large communities in the Batouri region of the East Province in 1954 and described it as hyper-endemic for goitre with Total Goitre Prevalence of 58%. He was soon followed in 1967 by Pele who worked at Akonolinga; then by Lowenstein (1968) under the auspices of the World Health Organization; Stephany and collaborators in Kadey division (1970). Robert Aquaron and others (1972–1977) carried out urinary iodine surveys in several communities in East and West Provinces, thanks to his home base laboratory in Marseilles.

Our medical students then joined the battle under our supervision to carry out studies on IDD for their MD theses. They were Pierre Nguessi (1976), Latch Ben Ena (1981), Tembon Ardi Chi (1984), Verla Siysi (1989), John Ngum (1990) and Tchakounte (1991), and others. It was at this point that Lantum and others completed the quasi-national survey to compile evidence to establish the national Community diagnosis of a moderate IDD endemicity with average Total Goitre Prevalence of 29.4% based on data from 26 sentinel sites. The population at risk was estimated to be 5,654,044 out of 10.5 million population (1990), that is 53.8%. Clinically and biologically we found severe iodine deficiency, endemic goitre, hyperthyroidism, endemic cretinism, neonatal hypothyroidism, juvenile hypothyroidism, high infant and perinatal mortality and other indirect consequences of IDD (fig. 1).
Fig. 1 A cretin, 50 years old from North West Province, Cameroon with Dr. Kamga Fotso, August 1993.
With the above convincing evidence, the Minister of Public Health decided to set up a national IDD control program by signing Ministerial Order: N° 0133/A/MSP/SG/DSFM/SDSF/SDSF/SN of 29 May 1991 which was formally launched on 21st June 1991 at a Press Conference. By this legislative instrument, the strategy of Universal Salt Iodization and consumption was adopted, as it was quite feasible.

2.2.4 Program Evolution

We are grateful to the Private Salt Sector—the SELCAM Refinery—that agreed to iodize all their food-grade salt according to the standing legislation. They increased their production progressively and adequately covering the estimated annual national need of 33,000 tons till 1994 when other salt producers joined in when the salt trade was liberalised. In addition to production, this company carried out the marketing and distribution to all the corners of the national territory. The Faculty of Medicine and Biomedical Sciences (FMBS) undertook to do monitoring in the field using the rapid test kits, supported by titration of sub-samples, as well as carry out urinary iodine analysis periodically for urine samples collected from school children in selected sentinel sites. Thus they assessed iodized salt coverage, carried out goitre surveys in school children to establish current prevalence and compare with baseline levels in order to establish program impact according to eight convenient indicators: namely, Total Goitre Prevalence (TGP); presence of new cretins; Household coverage; iodine content in salt at production and at the periphery; consumer awareness of the program; increase in urinary iodine excretion levels; and population satisfaction.

The thyroid hormones T4 and T3 plus TSH were assayed in the Hormone laboratory of the Institute for Medical Research and Medicinal Plants (IMPM) to determine the prevalence of neonatal hypothyroidism.

In 1992 and 1993 national follow-up surveys were conducted to assess the extent of the availability of salt in the market chain (principal depots, retailers in rural districts, and at the household) as well as the yearly quantity and quality of iodized salt produced. Special detailed evaluations were carried out in selected sentinel sites to assess progressive impacts. UNICEF supported the Faculty to do an extensive impact evaluation in 1995 before the External Evaluation team visited in October 1995 to carry out their Seven African Country Study organised by WHO/UNICEF/ICCIDD. Soon after, since 1996 the Ministry of Public
Health joined in to do a yearly iodized salt coverage assessment at consumer level, which they have kept up till 2002.

The Inputs and Impacts of the Program between 1990/1991 and 1995 are presented in the following tables:

Table 1: Progress in Production of Iodized Salt 1991 - 2002

Table 2: Qualitative Household Coverage with Iodized Salt 10-100ppm (1992 – 1999)

Table 3: Progress Impact of Total Goitre Prevalence (TGR) for selected Sentinel Sites (by palpation method)

Table 4: Impact on Urinary Iodine excretion levels 1990-1995.

Table 1. Progress in Production of Iodized Salt 1991 - 2002

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Producer</th>
<th>Quantity (tons)</th>
<th>Total (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991-1992</td>
<td>SELCAM</td>
<td>41,000</td>
<td>41,000</td>
</tr>
<tr>
<td>1992-1993</td>
<td>SELCAM</td>
<td>46,975</td>
<td>46,975</td>
</tr>
<tr>
<td>1993-1994</td>
<td>SELCAM</td>
<td>50,105</td>
<td>50,105</td>
</tr>
<tr>
<td>1994-1995</td>
<td>SELCAM</td>
<td>41,944</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Imported salt-Senegal (SSS)</td>
<td>4,300</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Imported salt Via Geneva (PRADIS)</td>
<td>9,000</td>
<td>13,304</td>
</tr>
<tr>
<td>2001-2002</td>
<td>SELCAM</td>
<td>40,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SOTRASEL</td>
<td>30,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SOCAPURSEL</td>
<td>50,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Imported</td>
<td>21,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SOREPCO/SS</td>
<td>141,000</td>
<td></td>
</tr>
</tbody>
</table>

SSS: Sel de Sine Saloum from Koalack, Senegal
PRADIS: Salt from Geneva PRADIS Communities
+ Other brands from Nigeria and Europe are also present in small quantities.
Table 2. Qualitative household coverage of salt of 10-100ppm (1992-1999)

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>62.5%</td>
</tr>
<tr>
<td>1993</td>
<td>65.80%</td>
</tr>
<tr>
<td>1994</td>
<td>82.70%</td>
</tr>
<tr>
<td>1995</td>
<td>89.50%</td>
</tr>
<tr>
<td>1998</td>
<td>95%</td>
</tr>
<tr>
<td>1999</td>
<td>96%-100%</td>
</tr>
<tr>
<td>2001</td>
<td>97%</td>
</tr>
<tr>
<td>2002</td>
<td>95.4%-98.5%</td>
</tr>
</tbody>
</table>

Table 3. Progress impact on total goitre prevalence (TGR) for selected sentinel sites (by palpation method)

<table>
<thead>
<tr>
<th>Site</th>
<th>1990</th>
<th>1993</th>
<th>1995</th>
<th>1999</th>
<th>2002*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foumban</td>
<td>65%</td>
<td></td>
<td>7.5%</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Doukoula</td>
<td>75%</td>
<td></td>
<td>45.3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oshie</td>
<td>64%</td>
<td>38.8%</td>
<td>21.1%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Mokolo</td>
<td>36.70%</td>
<td></td>
<td>2.8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jakiri/Wvem</td>
<td>58.8%</td>
<td></td>
<td>18.22%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pitoa</td>
<td>30.5%</td>
<td></td>
<td>11.8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vina (Sassa-Mbersi)</td>
<td>45%</td>
<td></td>
<td>7%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bangoua</td>
<td>36.77%</td>
<td></td>
<td>1.58%</td>
<td>6%</td>
<td></td>
</tr>
<tr>
<td>Ndoungue</td>
<td>14.11%</td>
<td></td>
<td>3.22%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bertoua</td>
<td>14.4%</td>
<td></td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Mean</td>
<td>29.4%</td>
<td>10.26%</td>
<td>5.80%</td>
<td>5.4%</td>
<td></td>
</tr>
</tbody>
</table>

*(n=2481)

*(Note: 2002 National Survey used 30 Cluster Method-not corresponding to many sentinel sites)
Table 4. Impact on Urinary Iodine Excretion in some sentinel sites 1990-1999

<table>
<thead>
<tr>
<th>Site</th>
<th>Year</th>
<th>Urinary Iodine Excretion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batouri-Betare-Oya</td>
<td>1990/91</td>
<td>81.5µg/L (n=46)</td>
</tr>
<tr>
<td></td>
<td>1993</td>
<td>24µg/L (N=47)</td>
</tr>
<tr>
<td></td>
<td>1995</td>
<td>121.5µg/L -140µg/L</td>
</tr>
<tr>
<td></td>
<td>1999</td>
<td>Bertoua 425µg/L (n=25)</td>
</tr>
<tr>
<td>Foumban</td>
<td>1990</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1993</td>
<td>84µg/L (n=41)</td>
</tr>
<tr>
<td></td>
<td>1995</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1999</td>
<td>191µg/L (n=24)</td>
</tr>
<tr>
<td>Oshie</td>
<td>1990/91</td>
<td>67µg/L (n=60)</td>
</tr>
<tr>
<td></td>
<td>1993</td>
<td>68µg/L (n=49)</td>
</tr>
<tr>
<td></td>
<td>1995</td>
<td>104µg/L -129µg/L</td>
</tr>
<tr>
<td></td>
<td>1999</td>
<td>418µg/L (n=26)</td>
</tr>
<tr>
<td>Jakiri/Wven</td>
<td>1990/01</td>
<td>37.6µg/L (n=76)</td>
</tr>
<tr>
<td></td>
<td>1993</td>
<td>20µg/L (n=49)</td>
</tr>
<tr>
<td></td>
<td>1995</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1999</td>
<td>291µg/L (n=22)</td>
</tr>
<tr>
<td>Vina/Sassa Mbersi</td>
<td>1990/91</td>
<td>45µg/L (n=87)</td>
</tr>
<tr>
<td></td>
<td>1993</td>
<td>54µg/L (n=48)</td>
</tr>
<tr>
<td></td>
<td>1995</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1999</td>
<td>77µg/L (n=24)</td>
</tr>
<tr>
<td>Bangoua</td>
<td>1999/91</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1993</td>
<td>49µg/L (n=48)</td>
</tr>
<tr>
<td></td>
<td>1995</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1999</td>
<td>403µg/L (n=23)</td>
</tr>
</tbody>
</table>

(NB: Iodized salt with iodized oil injections were used in some health centres in Batouri/Betare/Oya before USI began in 1991/92).


<table>
<thead>
<tr>
<th>Province</th>
<th>Sentinel Site</th>
<th>Median (1999)</th>
<th>Mean 2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>North West</td>
<td>1. Oshie</td>
<td>418µg/L</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Djottin/Oku</td>
<td>291µg/L</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>3. Bangoua</td>
<td>403µg/L</td>
<td>Thirty</td>
</tr>
<tr>
<td></td>
<td>4. Foumbam</td>
<td>191µg/L</td>
<td></td>
</tr>
<tr>
<td>Littoral</td>
<td>5. Sakhayemi</td>
<td>283µg/L</td>
<td>Clusters</td>
</tr>
<tr>
<td>South West</td>
<td>6. Tiko</td>
<td>114µg/L</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7. Akwaya</td>
<td>123µg/L</td>
<td></td>
</tr>
<tr>
<td>South</td>
<td>8. Ebolowa</td>
<td>110µg/L</td>
<td></td>
</tr>
<tr>
<td>Adamoua</td>
<td>9. Sassa Mbersi</td>
<td>77 µg/L</td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>10. Bertoua</td>
<td>425µg/L</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>283µg/L</td>
<td>190µg/L</td>
</tr>
</tbody>
</table>
2.2.5 IDD Survey of 1999

This evaluation took place in January 1999 in 7 out of 10 provinces due to problems of logistic support, and 10 Sentinel zones were studied. It was coordinated by the ICCIDD Regional Coordinator for Africa to confirm the evidence of virtual elimination of iodine deficiency found in two peripheral zones by the Seven African Country study conducted by WHO/ICCIDD in November 1995. The parameters studied were: Total Goitre Prevalence in school children 6–12 years, Urinary Iodine Excretion level and the presence of new cases of endemic cretinism. The TGR had dropped to less than 5% in 6 zones but we registered 6% for Bangoua, 7% for Sassa Mbiersi, 8% for Sakkayemi and 11.9% for Djottin-Oku—the total averaging less than 5% since the TGR was 0% in 3 zones. No cases of Grade 2 (Visible Goitres) were seen—only palpable goitres.

The urinary iodine excretion median levels ranged from 77-425 µg/L, with a mean of Medians equal to 283µg/L which is above the optimal cut-off level indicating correction of Iodine Deficiency. (Table 5). Thus it was concluded that Cameroon had now attained sustainable adequate iodine nutrition status, especially given the fact that two new Iodized Salt Producers had been established at the port-city of Douala, namely SOTRASEL, SOREPCO. In 2002, a third producer called SOCAPURSEL, with a giant ultra-modern plant, joined the salt market, thus strengthening our hope for the future of sustainable IDD elimination.

2.2.6 Results of 2002

Between the months of July and September 2002, the Ministry of Public Health conducted a national survey to evaluate the impact of the USI operating since 1991 and to confirm or refute the evidence of the January 1999 evaluation. They used the standard research methodology of 30 randomly selected clusters of the population recommended by WHO/UNICEF/ICCIDD in 2001. Only children 6-12 years were studied. Preliminary report findings were as follows:

- The Total Goitre Prevalence (obtained by palpation technique) was 5.4%.
- The national median value of urinary iodine was 190 µg/L.
- No newcretins have been born since 1991; the only one seen was born that year in a rural village in the Bafang outskirts.
- The national coverage with iodized salt of 15ppm and above was 97% having been 81% in 1995; 95.6% in 1998; 95% in 1999 and 94% in 2002.
<table>
<thead>
<tr>
<th>Recommended Input</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. National IDD Committee</td>
<td>Present and active</td>
</tr>
<tr>
<td>4. Salt Monitoring System.</td>
<td>Present and integrated in National Epidemiologic System at Health District level. Reports Yearly</td>
</tr>
<tr>
<td>5. Iodine Laboratories</td>
<td>· Yaounde Centre for Food Nutrition is part of IRLI Network, inter-calibrating with CDC Atlanta, etc</td>
</tr>
<tr>
<td></td>
<td>· Centre Pasteur Laboratory is functional.</td>
</tr>
<tr>
<td>6. Internal Quality Control by Producers</td>
<td>SOCAPURSEL has a laboratory in the factory and also uses Rapid Test Kit. Other producers use Rapid Test Kits only.</td>
</tr>
<tr>
<td>7. Systematic Quality Assessment at Port of Entry</td>
<td>Vigilant mixed team of Health and Customs, and periodic control by Public Health Delegation</td>
</tr>
<tr>
<td>8. IEC on IDD control</td>
<td>· National Radio and Television is periodic</td>
</tr>
<tr>
<td></td>
<td>· ICCIDD has published 30,000 booklets</td>
</tr>
<tr>
<td>9. Social Marketing of Iodized Salt</td>
<td>Producers carry out a lot of Advertising of their products by Bill Boards, T-shirts, package labelling, etc</td>
</tr>
<tr>
<td>10. National Coalition for IDD Elimination</td>
<td>Extension includes WHO, UNICEF, FAO, WFP, MPH, Faculty of Medicine, Ministry of Education, the Church, Scouts and others.</td>
</tr>
<tr>
<td>11. School Curricula and Nutrition Book</td>
<td>IDD control is already in School Textbooks.</td>
</tr>
<tr>
<td>12. Social Mobilisation</td>
<td>Periodic IDD and other Micronutrient Malnutrition Days take place around October periodically.</td>
</tr>
<tr>
<td>13. Capacity Building</td>
<td>Periodic Seminars in Health Ministry, Training of Laboratory Technicians.</td>
</tr>
<tr>
<td>14. Operational Research and Reporting</td>
<td>Cardiologists and Endocrinologists are compiling Statistics on Toxic goitres possibly Iodine-Induced Hyperthyroidism; Medical Students work on IDD for MD Theses.</td>
</tr>
<tr>
<td>15. Participation of ICCIDD Focal Point</td>
<td>IDD Focal Point is Regional in ICCIDD Board Meetings for Update Coordinator for Central Africa 1987—To date</td>
</tr>
</tbody>
</table>
The total iodized salt production by Cameroon major Refineries (SELCAM, SOTRASEL and SOCAPUERSEL) plus the imported salt from Senegal (Sel de Sine Saloum) and Nigeria (DICON and DANGOTE) far exceeds the national annual need of about 45,000 tons. Indeed these producers supply to the Sub-Regional Market which covers Cameroon, Tchad, Central African Republic, Congo (Brazzaville), Gabon, Equatorial Guinea, Islands of Sao Tome and Principe, and probably beyond.

The reliability of the above information stands to be generally acceptable for most indicators since external experts from the International Council for the Control of Iodine Disorders (ICCIDD) and Helen Keller International (HKI) were involved as consulting Scientific Advisers in the survey design and reporting, though some ecologic definitions are questionable. It is to be remembered that it was because many countries of the world had not yet attained “virtual IDD elimination” by the target year 2000, that the World Health General Assembly extended the date line to 2005. Thus Cameroon had already met the goal by 1999 and has since been involved with sustainability, which has so far, been quite successful.

2.2.7 Other Impacts

The national intellectual gains made by the improvement of the children’s Intelligence Quotients (IQ) by 10-15 points and the quantitative and qualitative value gained by the prevention of Brain Damage for almost all the children now being born and yet unborn is obviously enormous. Indeed the quality of life of the present and future generations has been tremendously improved by this successful national IDD program.

Other inestimable impacts could be expected in the:
- decrease of the frequencies of spontaneous abortions;
- decrease in prenatal and neonatal, that is peri-natal mortality rates;
- decrease in still–birth rates;
- decrease in bizarre neurological disorders of children attributable to iodine deficiency;
- decrease in the proportions of underweight babies at birth; and
- decrease in the neo-natal hypothyroidism.

However, it has not been possible to demonstrate this improvement by the use of specific tests because these tests were not available.

We would expect an improvement in the educability of our children (other factors ignored) given their improved intelligence quotients. Also a decrease in school “drop-out” rates attributable to iodine deficiency and juvenile hypothyroidism.
In general, the socio-economic productivity of the nation is expected to improve and who doubts that the prowess of the Indomitable Lions (the Cameroon National Football team) during the last 12 years has not been at least partially attributable to adequate iodine nutrition assured by our successful national IDD program!

All along the Cameroon IDD program has cumulated several sustainability measures.

2.2.8 Merited Acknowledgements

For this remarkable and historic success, thanks are due to extensive Partnerships and Inter-Sectoral Collaboration, which in this instance include:

- Ministry of Public Health (MPH)
- World Health Organization (WHO)
- United Nations Children’s Fund (UNICEF)
- International Council for Control of Iodine Deficiency Disorders (ICCIDD)
- Ministry of National Education
- Ministry of Industrial Development and Commerce (MINDIC)
- Faculty of Medicine and Biomedical Sciences of University of Yaounde I (FMBS) (formerly CUSS)
- National Centre for Research in Food and Nutrition (CNRAN)/IMPM and especially its iodine laboratory.
- Institut/ Centre Pasteur de Yaounde
- Centre for Hormone Analysis of IMPM/MINREST of Dr Manguelle Dicoum Biyong
- Helen Keller International (HKI)
- The Private salt producers (SELCAM, SOTRASEL, SOCAPURSEL) and major salt Importers (Soudanese, SOREPCO)
- Ministry of National Education and Schools
- The Cameroonian people
- And many more helpers- direct and indirect.
References


2.3

Nigeria

Dr. John Egbuta

2.3.1 Summary and Lessons Learnt

2.3.2 Introduction

2.3.3 Methodology and Results

2.3.4 Discussions and Conclusions
2.3.1 Summary and Lessons Learnt

- Advocacy and social mobilisation as a strategy has been effective in the effort to achieve USI in Nigeria. Not only did it succeed in enlisting the support of the major partners and stakeholders, it also enhanced the cordial relationship between the salt industries, government regulatory agencies and UNICEF.
- The legislation on Universal Salt Iodization (USI) was successfully passed at the early stages of the program in Nigeria. This singular act served as a catalyst for achieving the high coverage in the household consumption of iodized salt in Nigeria as far back as 1995.
- Capacity building through training and workshops helped to build bridges between the private sector, government agencies, and non-governmental agencies. This strategy contributed greatly to the success of the IDD elimination program in Nigeria. It was possible even for school children and housewives to develop simple skills to perform the testing of iodized salt in their homes using locally made soluble starch. Equipment and kits for regular measurements and continuous monitoring of salt were made available to regulatory agencies and relevant government ministries and parastatals.
- The media in general (electronic, print, and popular drama) was sufficiently well-informed about the sustained elimination of IDD and the promotion and monitoring of salt at the household level; to become strategic allies in the effort to bring about a behavioural change towards the control of IDD in the Nigerian population.
- It has become customary to celebrate the IDD week in the third week of October each year. This activity now features in the annual calendar of the Ministry of Health and is celebrated by the Ministry every year with little or no support from UNICEF or WHO.
- The commitment of key members of the National IDD Committee coupled with the sustained interest of the major agencies (UNICEF, WHO, and ICCIDD) has been and will continue to be very important to the IDD elimination program in Nigeria.

2.3.2 Introduction

The resolution to virtually eliminate Iodine Deficiency Disorders (IDD) by the year 2000 was made in 1990 on the strength of available evidence that iodine deficiency was a major cause of retardation in children and was one the contributing factors to high infant mortality (Hetzel 1983). Lack of iodine from conception is the most dramatic consequence of
iodine lack with economic implications as pointed out elsewhere in this book (Levin 1987). Nigerians are beginning to understand that goitre, an enlargement of the thyroid gland is the result of a lack of iodine in the body. Many people believed that goitre resulted from witchcraft activities and in other communities a woman without goitre was not considered beautiful since the roundness of the neck was perceived as a mark of feminine beauty. However, the effects of iodine deficiency on brain development are not generally understood.

Awareness of IDD and its control through salt iodization was slow to arrive in Sub-Saharan Africa, and introduction of the program has been less than 10 years old. WHO, UNICEF and ICCIDD have been in the forefront for the eradication of IDD in Africa. Progress in the field started in 1985 with mobilization of WHO interest on IDD in Africa followed by the WHO/UNICEF/ICCIDD sponsored IDD Seminar in Yaounde Cameroon (Ekpechi 1987). Subsequent to this, were the appointment of an IDD Task Force for Africa, the appointment of 3 sub-regional coordinators and the creation of a Special Trust for IDD in Africa. In 1986 the Afro Committee in Bamako Mali sponsored by Cameroon and Nigeria adopted a similar resolution. The resolution urged WHO and UNICEF to take further active official action to promote control of IDD.

The entire landscape of Nigeria predisposes the country to iodine deficiency disorders because of its proximity to the Equator and the long months of rainfall spreading from April to November. The risk of IDD is quite high in Nigeria, a country that has a well demarcated goitre belt, where almost all the inhabitants within the belt live on cassava based food staple (Egbuta and Hettiaratchy 1996). At least 60 million Nigerians (from a total population of 140 million) are at risk of IDD. As early as 1965, Ekpechi had alerted the Federal Ministry of Health Nigeria on the IDD problem in the country and 1974 formed a Ministerial Committee on Iodization of Salt. This committee wound up in 1976 due to poor funding but again Ekpechi’s untiring advocacy resulted in the meeting of a Ministerial Expert Committee on IDD in Enugu in 1988. This committee recommended advocacy at all levels, setting up of a National Committee on Control of IDD. The committee again went into abeyance, due to administrative and funding problems.

The early studies of (Ekpechi 1967, 1973; Nwokolo and Ekpechi 1996) that IDD was a public health problem in Nigeria. More data were reported by Isichei, Das and Egbuta (1987) that led to the production of the first goitre map for Nigeria. The World Summit for Children in 1990 called for
the virtual elimination of Iodine deficiency disorders (IDD) and in response to this call an IDD baseline study was carried out as a prelude to the introduction of universal salt iodization program (Egbuta 1993). This study was very extensive in scope covering all the 30 States of Nigeria with emphasis on the previously surveyed hyper-endemic Local Government Areas in 8 States of the country (fig 1). The prevalence of IDD was established by the measurement of total goitre rate (TGR) but lacked the measurement of median urinary iodine in the surveyed populations. Following this study the total goitre rate for Nigeria was put at 20%.

The Standards Organization of Nigeria (SON) instituted mandatory iodization of salt in January 1994 and within 12 months it was possible for 95% of Nigerian households to have access to adequately iodized salt.

It has been 5 years since universal salt iodization started in Nigeria following a long period of advocacy with medium and high policy makers, regulatory agencies, and the salt industry. In those years, monitoring of salt in the industries and ports of entry by the National Agency for Food, Drug Administration and Control (NAFDAC) and the Standards Organization of Nigeria (SON), by titrimetric analysis, and at the household level by the Nutrition officers across the country, using the semi-quantitative rapid field test kits, has been fairly regular. The objective of the present review is to assess the impact of universal salt iodization in Nigeria in the last five years, and with reference to some of the sentinel sites studied previously during the 1995 multi-centre study.

2.3.3 Methodology and Results

In this study a total of 2372 school children in 11 Local Government Areas in 10 States were examined. The school children were distributed into 1420 males and 952 females (Onyenekwe et al 1999). School children aged between 8-12 years were used for the goitre survey and the estimation of urinary excretion of iodine (UEI). Goitres are easily detectable in this age group and the changes associated with improved iodine supply are more likely to occur earlier in them than adults. The method of goitre classification by palpation was employed using the new internationally accepted method in which the classifications are simply graded as 0, 1, or 2. A total of 537 samples were analyzed for urinary excretion of iodine (UEI)

The multistage random sampling method was used as later described elsewhere (WHO/UNICEF/ICCIDD 2001).
Fig. 1 Percent Prevalence of Endemic Goitre in Nigeria, by State, 1993
Most significant in Table 1 are the changes observed in Uzo-Uwani, Obudu and Okpokwu Local Government Areas (LGAs) where total goitre rates in each of the local government areas was above 60% in 1993. In each of these LGAs located in the Southeastern part of Nigeria, the rate of decrease over a period of five years is greater than 75%. The same rate of decrease is observed in Bakori, Anka, Gwarzo, and Bassa LGAs, all in Northern Nigeria. This assertion correlates very well with the measurement of urinary iodine excretion rates in these local government areas (Table 2). All the subjects examined in Uzo-Uwani and Bassa had adequate urinary iodine excretion (above 10µg/dL). In Okpokwu, Obudu, Obanliku, Bakori, and Anka LGAs more than 70 % of the subjects had urinary iodine excretion more than the threshold value of 10µg/dL.

2.3.4 Discussions and Conclusions

The World Summit for Children (WSC) resolution was quite an ambitious one, declaring the year 2000 as a target for the virtual elimination of IDD globally. The IDD landscape in Nigeria has changed significantly between 1993 and 1998, using as indicators, total goitre rate measurement and urinary iodine excretion. The prevalence of goitre gives an idea of the past history of iodine nutrition at the population level. Palpation is the simplest method for measuring thyroid size. However palpation becomes imprecise as the majority of goitres in a population diminish in size, i.e., following implementation of a national salt iodization scheme. In this case measurement of thyroid volume is more accurately performed by ultrasound (Delange 1994)). Much of the recent IDD assessment work done in Europe was accomplished by ultrasonography transported across countries and borders by van (Delange et al 1995). In West Africa a similar exercise has just been concluded in Benin, Togo, Burkina Faso, and Niger.

It is not clear why the decrease in the goitre rates observed in Akoko-Edo, Ekiti East and Ifedapo LGAs are not as dramatic as the others observed in this study. These LGAs are located within the same geographical and cultural zone in Western Nigeria, which may imply the involvement of a common factor such as food pattern. The disparity in the dietary patterns of the various ecological zones in Nigeria could be responsible for the observed differential reduction rates between Western Nigeria and other parts of Nigeria. The progress towards elimination of IDD in the south eastern part of Nigeria is very remarkable particularly in Uzo Uwani Local Government Area where prevalence was 67% in 1993 but had fallen to 9.8% in 1998. The 1995 multi-centre study had put goitre prevalence in that LGA at 40%.
Table 1. TGR for selected LGAS for 1993, 1995 and 1998

Table 1 shows trend in the reduction of goitre rates over the years in schoolchildren, based on different surveys, in the previously hyperendemic local government areas.

<table>
<thead>
<tr>
<th>Location</th>
<th>LGA</th>
<th>TGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>State</td>
<td></td>
<td>1993</td>
</tr>
<tr>
<td>Enugu</td>
<td>Uzo-Uwani</td>
<td>67</td>
</tr>
<tr>
<td>Cross River</td>
<td>Obudu/Obanliku</td>
<td>62</td>
</tr>
<tr>
<td>Benue</td>
<td>Okpokwu</td>
<td>60</td>
</tr>
<tr>
<td>Edo</td>
<td>Akoko-Edo</td>
<td>32</td>
</tr>
<tr>
<td>Ekiti</td>
<td>Ekiti East</td>
<td>38</td>
</tr>
<tr>
<td>Oyo</td>
<td>Saki (Ifedapo)</td>
<td>36</td>
</tr>
<tr>
<td>Katsina</td>
<td>Bakori</td>
<td>11</td>
</tr>
<tr>
<td>Kebbi</td>
<td>Anka</td>
<td>22</td>
</tr>
<tr>
<td>Kano</td>
<td>Gwarzo</td>
<td>13</td>
</tr>
<tr>
<td>Plateau</td>
<td>Bassa</td>
<td>26</td>
</tr>
</tbody>
</table>

Table 2. Values of Urinary Excretion of Iodine (UEI)

Shows the urinary excretion rates of iodine in the previously hyperendemic local government areas as well as the selected non-IDD endemic local government areas such as Gwarzo and Bakori.

<table>
<thead>
<tr>
<th>State</th>
<th>LGA</th>
<th>NO</th>
<th>Range (mg/dl)</th>
<th>Median (mg/dl)</th>
<th>MEAN (mg/dl)</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enugu</td>
<td>Uzo-Uwani</td>
<td>46</td>
<td>10.6–20.0</td>
<td>15.65</td>
<td>15.72</td>
<td>2.75</td>
</tr>
<tr>
<td>Cross River</td>
<td>Obudu/Obanliku</td>
<td>80</td>
<td>6.4–20.0</td>
<td>14.70</td>
<td>14.75</td>
<td>3.88</td>
</tr>
<tr>
<td>Benue</td>
<td>Okpokwu</td>
<td>94</td>
<td>1.0–19.8</td>
<td>14.80</td>
<td>14.03</td>
<td>4.75</td>
</tr>
<tr>
<td>Edo</td>
<td>Akoko-Edo</td>
<td>41</td>
<td>1.0–19.4</td>
<td>14.00</td>
<td>13.96</td>
<td>4.11</td>
</tr>
<tr>
<td>Ekiti</td>
<td>Ekiti East</td>
<td>42</td>
<td>5.8–19.8</td>
<td>14.60</td>
<td>13.56</td>
<td>3.81</td>
</tr>
<tr>
<td>Oyo</td>
<td>Saki (Ifedapo)</td>
<td>56</td>
<td>1.6–20.0</td>
<td>9.20</td>
<td>9.15</td>
<td>5.17</td>
</tr>
<tr>
<td>Katsina</td>
<td>Bakori</td>
<td>29</td>
<td>5.2–16.8</td>
<td>10.60</td>
<td>11.35</td>
<td>3.77</td>
</tr>
<tr>
<td>Kebbi</td>
<td>Anka</td>
<td>62</td>
<td>6.5–20.0</td>
<td>15.55</td>
<td>14.59</td>
<td>4.20</td>
</tr>
<tr>
<td>Kano</td>
<td>Gwarzo</td>
<td>37</td>
<td>3.0–20.0</td>
<td>12.60</td>
<td>11.45</td>
<td>5.08</td>
</tr>
<tr>
<td>Plateau</td>
<td>Bassa</td>
<td>50</td>
<td>10.0–9.4</td>
<td>15.50</td>
<td>15.06</td>
<td>2.83</td>
</tr>
</tbody>
</table>

TOTAL     | 537                  | 1.0–20.0 | 14.65 | 13.39 | 4.04 |
Also, it is not clear why the 1998 total goitre rate in Akokoedo LGA is as high as 30.4% after the level had been noted by an international team in 1995 to be 26% down from 32% in 1993. However, it should be noted TGR as a measure of IDD is fraught with unavoidable human errors and personal bias and, for this reason, is gradually becoming obsolete, particularly in the developed world.

Iodine deficiency is not the sole cause of endemic goitre. There are some goitrogenic factors in the diet or environment, other than iodine deficiency, may play a critical role in the aetiology of the disease (Gaitan 1989; Delange et al 1982). Natural goitrogens were first found in vegetables of the genus Brassica (Podoba and Langer 1964) (the Cruciferae family), which possesses goitrogenic properties in animals. Their antithyroid action is related to the presence of thioglucosides, which after digestion, release thiocyanate and isothiocyanate. Another important group of naturally occurring goitrogens is the cyanoglucosides, which have been found in several staples (cassava, maize, bamboo shoots, sweet potatoes, lima beans) (Ermans et al 1980; Langer and Greer 1977). After ingestion, these glucosides release cyanide, which is detoxified by conversion to thiocyanate, a powerful goitrogenic agent that inhibits thyroid iodide transport and, at higher doses, competes with iodide in organification processes (Ermans et al 1980). In Akokoedo and Ekiti-east LGAs which are contiguously located in western Nigeria the major food staple is cassava, a noted goitrogen whose presence in the diet could explain why the rate of decline in total goitre rate in those two LGAs located in Western Nigeria including Ifedapo, is not as sharp as those observed in the Eastern part of the country.

The use of urinary iodine excretion rates as a measure of IDD status provides a more vivid indication of the virtual elimination of IDD in previously endemic sites (Table 2). A median urinary iodine excretion rate in excess of 10µg/dL in a given population is indicative of iodine sufficiency in that population. In all the LGAs, except one (Ifedapo, with 9.20µg/dL), assayed in this study the median excretion of urinary iodine exceeded 10µg/dL. Urinary iodine excretion measurements are indicative of the current dietary intake of iodine and, although the previous multi-centre study determined urinary iodine excretion rates in only Uzo-Uwani and Akokoedo, it is evident from this study that the populations in these LGAs were iodine-sufficient. The slightly low urinary iodine excretion rates in Ifedapo (Saki) and Gwarzo LGAs may be connected with the reported inundation of the areas with non-iodized industrial salt by some unscrupulous traders.
There is strong evidence emerging from the two urinary iodine studies in Nigeria that the country is generally iodine sufficient. As can be seen in Table 2 the median urinary iodine excretion for the sampled population, drawn mostly from IDD-endemic areas is 146.5µg/L with a mean value of 133.9µg/L. If this picture holds true for the rest of the country, Nigeria would rank among the countries where the universal salt iodization scheme has achieved the desired impact. For the communities sampled the health and socio-economic burden of IDD has been lessened, which translates into improved child survival, improved educability, independence and productivity and improved earning power.

The regular and routine measurement of iodized salt using the field test kit over the last three years has consistently indicated the availability of adequately iodized salt to about 96% of Nigeria households. The survey conducted in 1998 showed that 98.7% of Nigerian households have access to adequately iodized salt at 30ppm. This finding would suggest that Nigeria, in general terms, has achieved the goal of Universal Salt Iodization (USI) and should now focus its attention on constant monitoring in order to sustain this level of iodization. Some of these data have been published elsewhere (Egbuta et al 2003).

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2.4

East and Southern Africa

*Judith Rudo Mutamba*

2.4.1 Introduction

2.4.2 Summary of Country Situations and Experiences

- 2.4.2.1 Angola
- 2.4.2.2 Botswana
- 2.4.2.3 Kenya
- 2.4.2.4 Lesotho
- 2.4.2.5 Mauritius
- 2.4.2.6 Mozambique
- 2.4.2.7 Namibia
- 2.4.2.8 South Africa
- 2.4.2.9 Swaziland
- 2.4.2.10 Tanzania
- 2.4.2.11 Uganda
- 2.4.2.12 Zambia
- 2.4.2.13 Zimbabwe

2.4.3 Discussion

2.4.4 Conclusion
2.4.1 Introduction

Iodine deficiency is a major nutritional problem, which affects both the developed and developing countries. It is due to limited intake of iodine and in some cases exacerbated by goitrogens such as cassava. The presence of endemic goitre, enlargement of the thyroid gland reflects significant iodine deficiency in a population. Iodine deficiency affects all stages from foetal life to adulthood. Physical and mental development including intellectual capacity is impaired (Hetzel & Pandav 1994). Iodine deficiency disorders (IDD) are internationally a common cause of ill health. In Africa IDD exacerbates the burden of disease, which is heavier due to poverty and lack of access to basic social services as reflected by high infant, child and maternal mortality rates. Millions of children in East and Southern Africa die of preventable diseases and malnutrition. The dramatic effects and low cost of iodine prophylaxis makes elimination of IDD a key public health program to implement especially in Africa due to the expected high returns. Sustainable elimination of IDD will help reduce the infant and under-five mortality rate.

Iodine deficiency (ID) has been documented as a major public health problem in the East and Southern African countries since the early 1900’s. National goitre surveys indicated prevalence ranging from 20% to above 60% in almost all the countries. Biochemical indicators of urine iodine (UI), thyroid stimulating hormone (TSH) and iodine in drinking water substantiated the severity of the ID. Policy makers in the sub-region did not immediately act to address the iodine deficiencies. The first recognition of IDD as a public health problem was in 1987 during the meeting jointly convened by WHO, UNICEF and the International Council on the Control of Iodine Deficiency Disorders (ICCIDD) in Yaounde, Cameroon. The impetus for the elimination of IDD was at the World Summit for Children when world leaders endorsed the goals of virtual elimination of IDD and that of vitamin A deficiency and the reduction of the prevalence of iron-deficiency anaemia in pregnant women by one third, by the year 2000. By the year 2000 many countries had made progress in tackling IDD through universal salt iodation (USI). More than 60% of households in Africa had access to iodized salt. Iodine nutrition status improved rapidly as reported at the WHO Intercountry workshop for National program managers (WHO/UNICEF/ICCIDD 1998).

IDD were of public health significance in all countries in East and Southern Africa i.e. Angola, Botswana, Eritrea, Ethiopia, Kenya, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Tanzania, Seychelles, South
Africa, Swaziland, Uganda, Zambia and Zimbabwe except in Mauritius and Seychelles. Cretinism, the worst condition, with irreparable brain damage, was reported in Angola and Tanzania.

The IDD situation was unique for each of the countries and so were the challenges faced in addressing the problem. A summary presentation of the IDD situation is given below. The experience and progress of each country has systematically advanced the cause of IDD elimination in the sub-region.

2.4.2 Summary of Country IDD Situations and Experiences

2.4.2.1 Angola

Partial surveys conducted in 1994 indicated that total goitre rate was 50% in Hwambo and ranged from 67–73% in Vie. Cretinism was also recorded. Legislation on salt iodization was approved in 1996 requiring 60–100 parts per million (ppm) iodine at production level. By 1996, only 17% iodized salt coverage was reported (WHO 1998).

2.4.2.2 Botswana

Goitre prevalence in 1989 was 17% and median urine iodine ranged from 68µg/L in Southwest to 310µg/L in the East (WHO 1998). Salt surveys in 1998 showed that 98% of households had iodated salt. Legislation was delayed pending discussions to lower the level of iodization.

As a salt net exporter Botswana plays a vital role in IDD elimination in the sub-region. In 1990 the ICCIDD/UNICEF/WHO Task Force on IDD in Africa, at the fourth meeting held in Dar-es-Salaam resolved to urge SUA PAN (Botswana Ash) to install facilities for salt iodation (WHO 1990) Botswana Ash (Pty) Ltd (Botash) started producing salt in 1991 (Stewart 2003) It iodates coarse and fine salt for human and animal consumption with potassium iodate. A pan mixture is used to ensure effective blending to lessen iodine variation in any given batch. Botash implements a quality management system and has the ISO 90001:2000 accreditation, which assures us that Botash complies fully with international quality management systems standards. An on-site laboratory maintains Quality Assurance (QA) prior to the dispatch of the product (Stewart 2003). Botash has made significant contributions to the measurable success in the elimination of IDD in Southern Africa.
2.4.2.3 Kenya

Goitre surveys conducted in Mombasa, Nairobi and the Rift Valley between 1962 and 1964, indicated total goitre rate of 15–74 % with highest prevalence in the west of the Rift Valley in central Nyanza and in Western province (WHO 1997).

Kenya started the IDD control in 1970. Kenya is a major salt producer with 85% of the salt coming from the sea and the lakes. There are many salt manufacturers but 83% of all salt comes from only five manufacturers in Malindi and Mombasa. One company provides 70% of the salt consumed in the country. Salt iodation was enacted in 1970 at 20 ppm modified in 1973, 1978 and 1990 to 30 ppm and finally to 100 ppm. The Task Force for the Prevention and Control of Iodine Deficiency Disorders in Africa recommended the modification to 100ppm (WHO 1990). The high levels were to cover for anticipated iodine losses during transportation and storage.

A national Micronutrient Survey conducted in 1994 in 45 districts showed goitre prevalence of 16.3% and urinary iodine excretion of 62µg/L in children 8–10 years indicating improved iodine nutrition status (WHO 1998). A follow up study in 1995 in Kericho and Kiambu districts and Nairobi, showed lowered goitre prevalence of 10%. Iodine contents of samples analyzed in 1995 averaged 60 ppm at household levels. Median urinary iodine concentration ranged from 12.5µg/dL to 58µg/dL. Excessive iodation by some companies was noted. (WHO 1998).

Monitoring surveys indicated more than 90% iodized salt coverage by 2000. This success was mainly through collaboration between the salt industry, other business groups, the government, the scientific groups, development partners and the communities in all regions. Advocacy

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Table 1. Salt Iodation Customer Requirements

<table>
<thead>
<tr>
<th>Country</th>
<th>Potassium iodate as I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botswana</td>
<td>30 – 90 ppm</td>
</tr>
<tr>
<td>Malawi</td>
<td>47 – 59 ppm</td>
</tr>
<tr>
<td>South Africa</td>
<td>40 – 60 ppm</td>
</tr>
<tr>
<td>Zambia</td>
<td>50 – 90 ppm</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>25 – 55 ppm</td>
</tr>
<tr>
<td>Namibia</td>
<td>50 – 80 ppm</td>
</tr>
</tbody>
</table>

*Source: Botswana Ash (Pty) Ltd*
campaigns on USI were considered key in the program. October each year has been observed as the Micronutrients Month. IDD Days have been observed. The Scouts Association of Kenya assisted by the Kenya Salt Manufacturers, Ministry of Health, Kenya Bureau of Standards and members of the National Council on Micronutrient Control take an active role in sensitizing communities on IDD. The Scouts participate to ensure sustainable elimination of IDD in Kenya working closely with school children (Personal communication, UNICEF Nairobi 2002).

2.4.2.4 Lesotho

A 1968 national study indicated total goitre rate of 41% and visible goitre rate of 14% in school children aged 6-13 years. A second national study confirmed iodine deficiency in Lesotho. Total goitre rate was 42% in women of child-bearing age and 21% in school children, 6 to 13 years. The median urinary iodine concentration in mountains and lowland were 35µg/L and 55µg/L respectively (WHO 1998[a]). A 1993 national micronutrient survey revealed TGR of 42.5% and VGR of 15.3% in children between 6 and 16 years (Jooste 1997).

Iodized oil capsules were distributed from 1995 to 1998. Legislation on universal salt iodation was promulgated in March 2000 at 40-60ppm (WHO 1998[b]). Awareness campaigns were arranged through community gatherings, media, local newspapers, posters and pamphlets. An IDD Control Task Force was formed to ensure enforcement of legislation. In 1999 a qualitative study indicated 81.8% use of adequately iodized salt. Only 5.25% used non-iodized salt.

A recent study (Sebotsa, 2003) showed median urinary excretion of 214.7µg/L in children. The median urinary iodine concentration was higher in the Lowlands (329.9µg/L) than in the Mountains (182.6µg/L). Prevalence of goitre in children was 10.7% and 19.4% in women. Household coverage of iodized salt was 98.4% and 86.9% households used adequately iodized salt. The study revealed that IDD had been eliminated but effective regular monitoring of salt iodine levels was needed at point of entry.

2.4.2.5 Mauritius

In a national survey conducted in 1995, 10% of children between 3–6 years had urine iodine <50µg/L. However, 95.6% adults had urine iodine levels >100µg/L and 80.8% of pregnant women had urine iodine levels more than 100µg/L (WHO 1998[b]). The findings indicated no IDD and hence the strategy used is to get iodine from the diet.
2.4.2.6 Mozambique

Isolated small surveys conducted in 1989 and 1992 in Niassa demonstrated that TGR was 76% and VGR was 13.5%. Median urine iodine concentration (MUIC) was 28µg/L. Forty-nine percent (49%) of the urine samples had iodine concentration <20µg/L. In Tete province TGR was observed to be 50%. In a follow up survey in Niassa in 1995 TGR was 71%, VGR was 0.9%. In Cabo Delgado TGR was 35% and MUIC was 29µg/L. Manica province had TGR of 18% and urine iodine of 51µg/L. Gaza had TGR 8.1% and MUIC of 74µg/L. In Maputo TGR was at 9.4% and MUIC was 104µg/L (WHO 1998b). Though salt iodization program was inducted in 1995, it has not been legislated yet.

In 1999 of 53 registered salt producers, 41% did not have iodization plants. Twelve iodization plants installed with UNICEF funds, could only meet 70% of production capacity. A 1998 salt survey indicated iodization in: Maputo, 41%, Gaza, 26%, Manica, 51%, and Cabo Delgado, 28%. In November 1998 iodized salt household coverage was 39% as submitted by school children (WHO 1998b).

The salt producers need support to enable them iodate their salt. A monitoring system should be developed and the laboratory strengthened to enable urine iodine analysis.

2.4.2.7 Namibia

In the 1990-91 survey in the Caprivi region, in school children 6–18 years, TGR was 35% in boys and 38% in girls. In the 1992 national survey of 1830 children aged 8-12yrs TGR ranged from 0–7%, UI=77-137 µg/L in South and central areas. In the North, TGR was 15–25% UI was 46µg/L and in the Caprivi TGR was 55% and UI = 25µg/L. National TGR was 24% and urine iodine levels were 53µg/L (WHO 1998a). In sentinel surveillance in 1994, TGR was 14% and urine iodine levels were 113µg/L. The 2000 country update indicated the level of salt iodation ranging from 0–80ppm. Ninety percent of households consumed iodized salt. Total goitre prevalence has gone down to ranges of 0-20% and urinary iodine levels raised to 216.3µg/L. Virtual elimination of IDD is expected to be soon.

2.4.2.8 South Africa

Endemic goitre was reported in South Africa in 1927. A goitre research committee appointed in 1948 recommended iodized salt to all endemic goitre areas in South Africa, the Caprivi Strip and Swaziland. Voluntary
iodization of salt was introduced in 1954 at 10 to 20 parts per million (ppm) to prevent and control the endemic (Jooste 2000).

A 1955 survey identified goitre endemic areas from East Cape to Eastern Transvaal including Lesotho and Swaziland. Isolated studies conducted in 1994 and 1995 confirmed the endemic. A survey conducted in Cape Province found TGR of 26% and median urinary iodine level of 22 µg/L.

Whilst there were no national data on the IDD situation in South Africa, direct and indirect evidence suggested that IDD was endemic in some regions in the country. On that weight an Iodine Deficiency Disorders Control Program Committee was formed with members from the public sector, industry, consumer groups and UNICEF. It advocated for compulsory salt iodation from December 1995. The legislation increased the iodine level from 10–20mg/kg to 40–60mg/kg (Jooste 2000).

In 1998 the South African Institute for Medical Research conducted a national survey, which confirmed that South Africa had a national IDD problem. Goitre rate was 40.9% in 2377 boys and girls of 7–11 years. Iodized salt coverage increased from 30% to 62% in two years after the introduction of mandatory iodization. The mean household salt iodine concentration was 27mg/kg. The median iodine concentration ranged from 6mg/kg to 42mg/kg. The national median was 30mg/kg. The study indicated that 13.6% of households used non-iodated salt, 21.1% inadequately iodized, and 1.8% households used salt with excess iodine. Nationally 62.4% households used adequately iodized salt (Jooste 2001).

Urine iodine survey of 8524 urine samples from 179 schools in the 9 provinces indicated median urine iodine of 177µg/L (range 156–259µg/L) mean range from 172-250µg/L (SAIMR 2000). Just under 90% of schools had on average an adequate iodine intake whilst 10.6% of sample had median urinary iodine concentration of less than 100 microgram, indicating a degree of dietary iodine deficiency.

South Africa made major progress in the elimination of IDD through USI in only seven years. Virtual and sustainable elimination of iodine deficiency in South Africa is assured.

The key elements to the South African achievements include the following:

· Dedication of a core group of individuals.
· The establishment of the South African IDD network or National Coalition.
· Monitoring and surveillance of the IDD Control Program on both process and impact indicators.
Major concerns raised were:

- Salt for agriculture is not iodated and this leaks into human consumption. Livestock iodine nutrition status remains un-addressed.
- Salt is not available in households of the very poor in some of the rural areas.

2.4.2.9 Swaziland

In a survey of school children in four endemic areas (1993) TGR ranged from 6–38%, median urine iodine concentration ranged from 12–35µg/L. Legislation if USI was in 1997. In a follow up survey in 1998 TGR reduced from a range of 1.6 – 11% and median urine iodine concentration ranged from 101–234µg/L (WHO 1998b).

In the 2000 Multiple Indicator Cluster Survey, 5.8% population had no salt, with the poorest being the most affected (8%). Only 54% of households had adequately iodized salt. More households in rural areas (44.1%) had inadequate iodine salt levels compared with those in the urban areas (34.2%) (Jooste 2000). Swaziland was far from eliminating IDD. Since it imports all its salt Swaziland needs to enforce legislation on USI and import only iodized salt.

2.4.2.10 Tanzania

Iodine deficiency disorders were noted in Tanzania in 1923. Surveys conducted in 1953, 1958 and 1963 showed goitre prevalence of 75.8 percent. Despite the high levels intervention was not instituted due to uncertainties on dealing with non-goitre areas. There were fears of toxicity since hyperthyroidism had been reported.

The Tanzania Food and Nutrition Centre (TFNC) conducted goitre surveys in 20 regions between 1980 and 1998 with financial support from the Swedish International Development Agency (SIDA). It was estimated that 5.61 million people had IDD, 160 000 were cretins and 450 000 cretinoids. Many areas were identified to be highly endemic with total TGR above 60 percent. Mbeya and Mbozi districts had TGR above 80 percent (WHO 1998b).

In 1985, the National Council for the Control of Iodine Deficiency Disorders (NCCIDD), a multi-sectoral policy body was mandated to co-ordinate the implementation of the IDD Control Program.

Iodized oil was administered to everybody aged 1–45 years in 27 severely IDD affected districts. By 1999 Tanzania had distributed a total
Global Elimination of Brain Damage Due to Iodine Deficiency

of 16.1 million capsules to more than 6.0 million people. The short-term intervention was mainly financed by SIDA, Japanese International Cooperation Agency (JICA) and UNICEF.

Tanzania has a complex salt iodation program. It is a net producer of salt and has large, medium and small-scale salt producers, a situation similar to Angola, Eritrea and Mozambique. Small-scale salt producers are a challenge in implementing universal salt iodation.

The Tanzania Salt Iodation program started in 1988 with support from the Netherlands Government, UNICEF and the International Labour Organisation. There were 197 registered large and medium-scale salt producers with salt production capacity of 267,000 metric tonnes (MT) per annum. The national demand for salt was only 96,000 MT, which meant Tanzania could meet all its salt needs.

Eight iodation machines with mixers were procured and installed. A total of 106,000 metric tonnes of iodated salt per year was expected with machines fully operational. By December 1995, 46 salt iodation machines had been procured and distributed to sites in Kigoma, Tanga, Coast, Dar-es-Salam, Mtwara, Lindi and Dodoma regions. UNICEF supplied an additional 25 small machines for small-scale salt producers.

By 1997, a total of 72 iodation machines had been procured including accessory equipment. Potassium iodate, test kits and packaging materials were also supplied free of charge. Training of salt producers on quality control, storage and handling of iodated salt was provided with installation of iodation machines.

The salt iodation regulations were instituted as early as 1978 but implementation only started in January 1995. Iodation at factory level was set at 75–100 parts per million.

The Tanzania Salt Producers Association (TSPA) was set up in 1994 supported by government to coordinate all the country’s salt producers. The association is involved in conducting training and distribution of requirements for salt iodation.

i) IDD Status

Surveys carried out in Tanzania mainland, showed that goitre prevalence had decreased from 67.6 percent (in 1980s) to 23.5 percent (in 1999). Visible goitre rate was 6.3 percent. Median urine iodine concentration (UIC) was 235µg/L (N=2089). Only 9.1 percent individuals had UIC below 50µg/L.

Iodated salt coverage at household level was 83.3 percent (range 52.9–97.2 percent (N=21,1153)). Non-iodated salt came mainly from small-
scale salt producers. Awareness of the IDD problem and its control was poor among the general public and community participation in the program was low.

In the 27 endemic districts, salt iodine content varied. A few samples exceeded 100ppm. A 56 percent population had urine iodine concentration above 200µg/L. A reduction of iodization levels from 75–100 parts per million (ppm) to 50–70 ppm was recommended.

The Islands of Zanzibar are part of Tanzania. A situation analysis carried out in March/April 2001 revealed that IDD exists in Zanzibar and worse in Pemba Island (Table 2).

ii) Small-Scale Salt producers

A study conducted in 2002/2003 on Small-scale Salt Producers identified 4 461 in Tanzania (TFNC 2003). Almost half (49.2 percent) of the producers had never iodated their salt mainly due to lack of awareness of the salt regulations. Producers did not know where to get potassium iodate and had no knowledge and skills on salt production and iodation.

This study highlighted priority areas to be considered for assistance to small-scale salt producers if virtually elimination of IDD is to be achieved.

2.4.2.11 Uganda

IDD was reported as early as the 1960’s. In 1991 a survey carried out in nine districts amongst school children 6–12 years, reported overall TGR of 74%. A few cases of cretinism were reported in Kabale villages. In 1999 IDD monitoring survey was conducted in six districts among 2860 schoolchildren. The overall TRG had dropped to 16% and overall median iodine concentration was above 100µg/L and only 5% had a median concentration below 50µg/L. Sixty four percent of salt samples had iodine levels above 50ppm. The remarkable improvement in IDD was attributed to enforcement of the legislation on salt iodation at 100ppm (Bachou 2000).

2.4.2.12 Zambia

A 1971 national prevalence survey of the general population in 37 districts showed TGR of 50.5% and VGR of 13%. A National IDD Task Force was formed in 1990. A National baseline survey conducted in 1993 showed TGR of 31.6% and mean UI excretion of 60µg/L. The 1996 Multicentre Study showed decreases in TGR since 1993: Livingstone, 82% to 4.3%; Choma, 59% to 16% and Katete, 31% to 4% (WHO 1998b).
Most salt comes from Botswana and Namibia. Legislation on salt iodation was enacted in 1978 and revised in July 1994 requiring salt iodation of 80–00ppm at factory level, 50-80ppm at point of entry and 30-50ppm at retail level. In 1999, households ranging from 37% to 93% had adequately iodized salt.

A 2002 survey indicated TGR of 31.8% in pupils from 25 schools. Median urinary iodine concentration (MUIC) was 246.5µg/L. Only 4% of the pupils were in the range of 50–100µg/L, 20% were between 100–200µg/L and 76% between 200–500µg/L. The results showed that 93.5% of the salt had adequate iodine and 85% households had access to iodated salt (Zambia National Food & Nutrition Commission, 2002). The survey indicated that Zambia had eliminated IDD.

The need for databases for recording urine, salt and goitre results was articulated. There was also a recommendation to revisit the salt legislation to lower the iodine levels and include iodated salt for animal consumption.

2.4.2.13 Zimbabwe

Surveys conducted between 1968 and 1988 established the prevalence of IDD. The Ministry of Health with support from the Swedish International Development Agency and UNICEF conducted a national goitre survey in August 1988 amongst 164,096 primary school children in 53 districts. The survey indicated TGR ranging from 10.8% in the capital city Harare to 78.7% in Murehwa district. More than a third of the districts had TGR above 50%. The national TGR was 44% and VGR was 4% (Mutamba 1993). The survey revealed that Zimbabwe was at risk of IDD. The severity of the endemia was confirmed by urinary iodine levels, which ranged from 14–24µg/L (Mutamba 1993).

An intersectoral committee established in 1989 developed a plan of action to address IDD. Iodized oil capsules were distributed in Murewa district. By 1992 iodized salt was available throughout Zimbabwe. The 1973 Food regulations were amended in 1994 making salt iodation mandatory at 30–90ppm.

Before 1993 little iodized salt was available. By 1993 significant iodized salt was available countrywide and by late 1994 the median salt iodine levels were below 30mg/kg. By 1998 the median had reached 60mg/kg. Assays were conducted at the Government Analyst Laboratory and at the University of Zimbabwe. A monitoring program was established. Urine iodine in schoolchildren and household salt iodine levels were recorded
from established sentinel sites. Salt collected countrywide was analyzed for iodine by titration. The results of the salt monitoring revealed great variability in iodine levels. In 1997 salt data found that 31% of samples had iodine levels outside the permitted range. This variability explained the wide variability in urinary iodine levels. Some individuals had values in excess of 1200µg/L. Between 1991 and 1995, UI levels increased more than ten fold.

In 1995 the overall median UI from 6 districts was 430µg/L (range of medians: 290-560µg/L) and mean 490µg/L. Of 966 samples analyzed 16 (1.7%) had values below 50µg/L and 48 (5.0%) below 10µg/L. In 1998, median UI rose to 417µg/L in 11 districts. In Nkayi and Shurugwi districts the median urine iodine levels were well above 600µg/L. The high levels of iodine was reason of concern. Whilst most people had no difficulty in dealing with high iodine intakes, some susceptible individuals developed hyperthyroidism (Todd et al 1995, 2000).

Zimbabwe faced the challenge of iodine-induced hyperthyroidism (IIH), which increased three-fold. IIH occurred due to the rapid improvement of iodine status in a population, which had been severely deficient. This transient IIH was observed in other countries in association with iodine excess where there had been severe iodine deficiency (WHO/UNICEF/ICCIDD 1997). It is important that clinical facilities are available for diagnosis and treatment of these patients. They are usually over the age of 40 so that radioactive iodine is the treatment of choice (Section IV).

In Zimbabwe the problem was identified and quickly addressed because of an established monitoring system. This led to a recommendation of reduction of iodation levels to 25-55ppm in 1999. Despite all hurdles, universal salt iodization has been a great success in Zimbabwe (Todd et al 2000).

The 1999 National Micronutrient survey indicated median UI concentration of 245µg/L, which was above the recommended 100-200µg/L. Only 5% samples were below 50µg/L. More than 97% households were consuming iodized salt.

2.4.3 Discussion

East and Southern Africa had a major public health problem of iodine deficiency as reflected by goitre levels, which ranged up to 60% or more in some areas. The severity of the endemic was verified by more than half of the populations in the various countries showing urine iodine levels below 50µg/L. Even though the goal of eliminating iodine deficiency disorders
by the year 2000 was not met the East and Southern African countries made major strides towards the elimination of the scourge as reflected by the process and impact indicators. Most countries passed legislation on salt iodation and through universal salt iodization, East and Southern Africa have made good progress towards the elimination of IDD. Most countries have however been observing high urine iodine levels indicating high levels of salt iodation. The excessively high iodine levels led to IIH in Zimbabwe. These can be addressed by careful monitoring of salt and urine iodine levels to avoid excess intake (WHO/UNICEF/ICCIDD 1997).

Through national and sub-regional support with collaboration from bilateral, international agencies and non-governmental organizations capacity was built within countries to deal with IDD. Courses offered under the PEG program, PAMM, ICCIDD and by TFNC created in-country core teams with interest and expertise to deal with IDD.

Harmonisation of Iodized Salt Regulations for the Countries in Southern Africa is proceeding (Nyamandi & Mutamba 2000).

Technical and financial support from international program implementation has led to the development of iodine laboratories to deal with the in-country analyses. Recently the designation of South Africa as part of the International Resource Laboratories for Iodine (IRLI) Network will assist in sustained country program monitoring. The IRLI Network was formed to strengthen the basic monitoring component of universal salt iodization worldwide.

Challenges for the next decade in the sub-region include the following:

- Facilitation of small-scale producers to enable production and supply of quality iodated salt.
- Mainstreaming training on IDD to enable continuation of expertise in the area since the experienced old group might fade away.
- Need to form active National Coalitions inclusive of all disciplines, with the salt industry taking a central role.
- Strengthen the monitoring and evaluation system to avoid pitfalls where non-iodized salt continues to be delivered or where excess iodine is supplied leading to IIH.
- Legislation for iodization of salt for animal consumption should be adopted.
- Applying some of the successes of the program to address other micronutrient deficiencies.
These challenges can be met with continued advocacy and monitoring with allocation of resources.

2.4.4 Conclusion

In conclusion major steps have been made in the last decade to eliminate IDD in East and Southern Africa through Universal Salt Iodization. Momentum should be maintained through continued monitoring to address the remaining challenges, to ensure virtual and sustainable IDD elimination in all countries then maintain the iodine nutrition.

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Global Elimination of Brain Damage Due to Iodine Deficiency


3

South-East Asian Region
Chandrakant Pandav
Denish Moorthy

3.1 Lessons Learnt

3.2 Tracking Progress in the Region

3.3 India
3.1

Summary and Lessons Learnt

Iodine Deficiency Disorders (IDD) have been a major public health problem in all the 10 countries in the WHO-South East Asia Region (WHO-SEAR). It is estimated that a total of 599 million people from this region alone are affected by IDD, thereby constituting the highest number of population from a single region.

The proportion of households consuming adequately iodized salt varies between 1.7% in DPR Korea and 8% in Maldives to 75% in Thailand and 82% in Bhutan. While in the remaining countries it varies from 50% to 65%. An external evaluation was co-ordinated by the Global Network for Sustainable elimination of iodine deficiency in 2002 which confirmed elimination of IDD in Bhutan.

Efforts are in place to increase the availability of adequately iodized salt at the household level, and most importantly to sustain the coverage over 90% and to introduce a system of cyclic monitoring using IDD indicators.
3.2

Tracking Progress in the Region

Iodine Deficiency Disorders (IDD) have been a major public health problem in all the 10 countries in the WHO-South East Asia Region (WHO-SEAR). It is estimated that a total of 599 million people from this region alone are affected by IDD, thereby constituting the highest number of population from a single region (WHO 2002). A summary of IDD prevalence and progress in its elimination in the countries from this region is presented in Tables 1, 2 and 3.

Bangladesh has reduced IDD with a fall in the Total Goitre Rate (TGR) from 47.1% in 1993 (Dhaka University/ICCIDD/UNICEF 1993) to 17.8% in 1999 (Salamatullah 2001). In Bhutan, it has been reduced to 14% in 1996 (ICCIDD/UNICEF/MI 1996) from 60% in 1983 (AIIMS/UNICEF/WHO 1983). Bangladesh and Bhutan have achieved near universal supply of iodized salt, but they have not been able to achieve universal availability of iodized salt at the household level due to various reasons. In April

<table>
<thead>
<tr>
<th>WHO SEAR Country</th>
<th>Year</th>
<th>Total Goitre Rate %</th>
<th>Urinary Iodine Median µg/L %</th>
<th>&lt;100 µg/L %</th>
<th>Endemic Cretinism Prevalence %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>1999</td>
<td>17.8</td>
<td>Hilly Zone 63.8</td>
<td>43.1</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Flood-prone -139.3 Plane Zone 147.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bhutan</td>
<td>1996</td>
<td>14</td>
<td>230</td>
<td>24</td>
<td>0.4– 0.9</td>
</tr>
<tr>
<td>India</td>
<td>2000</td>
<td>16.6</td>
<td>123.3</td>
<td>32.5</td>
<td>**</td>
</tr>
<tr>
<td>Kerala State</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>1998</td>
<td>9</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Maldives</td>
<td>1995</td>
<td>23.6</td>
<td>67</td>
<td>65.5</td>
<td>**</td>
</tr>
<tr>
<td>Myanmar</td>
<td>1997</td>
<td>28</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Nepal</td>
<td>1998</td>
<td>Children-50 67</td>
<td>Children-143.8</td>
<td>35.1</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Women-40 145.3</td>
<td>Women-114.1</td>
<td>43.6</td>
<td></td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>2001</td>
<td>20.9</td>
<td>145.3</td>
<td>30.6</td>
<td>**</td>
</tr>
<tr>
<td>Thailand</td>
<td>1998</td>
<td>2.6</td>
<td>153</td>
<td>23</td>
<td>**</td>
</tr>
</tbody>
</table>

** Information awaited/No data available
**Table 2. IDD Elimination Strategies in the WHO-SEAR Countries**

<table>
<thead>
<tr>
<th>WHO SEAR Country</th>
<th>Current Intervention Strategy</th>
<th>Legislation Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>USI</td>
<td>Legislation In place</td>
</tr>
<tr>
<td>Bhutan</td>
<td>USI</td>
<td>Legislation in place</td>
</tr>
<tr>
<td>India</td>
<td>USI</td>
<td>Legislation in place at State Levels</td>
</tr>
<tr>
<td>Indonesia</td>
<td>USI Iodized Oil</td>
<td>Legislation in place</td>
</tr>
<tr>
<td>Maldives</td>
<td>USI</td>
<td>Legislation Awaited</td>
</tr>
<tr>
<td>Myanmar</td>
<td>USI, Iodized Oil capsule</td>
<td>Legislation Awaited</td>
</tr>
<tr>
<td>Nepal</td>
<td>USI, Iodized Oil capsule</td>
<td>Legislation Awaited</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>USI</td>
<td>Legislation in place</td>
</tr>
<tr>
<td>Thailand</td>
<td>USI, Iodized Oil capsule &amp; Water</td>
<td>Legislation in place</td>
</tr>
</tbody>
</table>

**Table 3. Status of IDD Elimination Programs in the WHO-SEAR Countries**

<table>
<thead>
<tr>
<th>WHO SEAR Country</th>
<th>Recommended iodine content in salt (PPM)</th>
<th>Production / availability of iodized salt (proportion to the total requirements)</th>
<th>Proportion of households consuming adequately iodized salt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>50</td>
<td>99.7% (1999)</td>
<td>57% (1999)</td>
</tr>
<tr>
<td>Bhutan</td>
<td>60</td>
<td>100% (1996)</td>
<td>82% (1996)</td>
</tr>
<tr>
<td>DPR Korea</td>
<td>**</td>
<td>**</td>
<td>1.7% (2000)</td>
</tr>
<tr>
<td>India</td>
<td>30</td>
<td>92% (2000)</td>
<td>71% (1998)</td>
</tr>
<tr>
<td>Maldives</td>
<td>Yet to be decided</td>
<td>**</td>
<td>8%</td>
</tr>
<tr>
<td>Myanmar</td>
<td>40-60</td>
<td>66% (1997)</td>
<td>50%-60% (1997)</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>50</td>
<td>63% (2001)</td>
<td>49.5% (2001)</td>
</tr>
<tr>
<td>Thailand</td>
<td>50</td>
<td>75% (1998)</td>
<td>75% (1998)</td>
</tr>
</tbody>
</table>

** Informaiton awaited
1958, Bhutan begun Annual Cyclic monitoring in addition to regular monitoring system. As a result, Bhutan now has a total goitre rate less than 5% median urinary iodine 298 µg/L and iodized salt coverage of 95%. More recently an external evaluation was co-ordinated by the Global Network for Sustainable elimination of iodine deficiency in 2002 which confirmed elimination of IDD in Bhutan. Details of success stay of Bhutan are covered in Section VII The National Program for the Elimination of IDD Indonesia has a low TGR (9%), a significant improvement since 1993 when the goitre prevalence was 27.3% (WHO 1997). The prevalence of IDD is reduced from 9.3% in 1989 (WHO 1997) to 2.6% in 1998 (EAPRO/ROSA/MI 1999) in Thailand, and it continues to show further reduction in the TGR. Thailand also introduced Annual Cyclic Monitoring. Currently (April, 2004) external evaluation co-ordinated by the Global Network for Sustainable Elimination of Iodine Deficiency is in progress in Thailand. Sri Lanka (TGR 20.9%) now plans to monitor salt and urine iodine levels in all districts at least once in three years. All these countries have adopted Universal Salt Iodization (USI) through legislation to combat IDD.

There has been significant progress towards the control of IDD in Nepal. The median urinary iodine excretion (UIE) values were 114.1µg/L among women and 143.8µg/L among school-aged children, indicating that at national median UIE is just above the WHO cut-off point for a significant public health problem. The proportion of low UIE values (<100µg/L) has declined from 52% (general population) in 1985 to 39.1% (adult women and school-aged children) in the current survey. The prevalence of low UIE is highest among women and children living in rural areas and in the Terai zone. High prevalence in this region is reported from Nepal where goitre prevalence ranges from 40% to 50%. The virtual absence of visible goitre among the population, 1.3% among women and 0% among school-aged children, in the survey is also an indication of success. However, in spite of the improved UIE status, high rates of palpable goitre were seen, which may reflect past goitre rather than current iodine deficiency. The finding that most of the salt samples tested contained some iodine (82.8%) indicates that efforts towards the universal iodization of salt in Nepal is on track, and confirms the feasibility of universal salt iodization as the sole strategy for the elimination of IDD. Maldives (TGR 24%) has stepped up efforts to eliminate IDD through the “Maldives National Nutrition Strategy, 2001”. Myanmar (TGR 28%) has started with the monitoring of salt and urinary iodine status. However, in all these three countries, i.e. Nepal, Maldives and Myanmar, the USI legislation is still awaited. There is insufficient data on the prevalence of
IDD and its elimination efforts from DPR Korea. India, being a vast country with hyper endemic pockets, IDD prevalence shows a wide range from 2.3% to 68% based on country-wide surveys, and from different States and Union Territories (WHO 1997). A recent household based study from the Kerala state covering school age children showed 16.6% goitre prevalence. Similar studies are being undertaken in the states of Tamil Nadu, Orissa, Goa and Bihar. In India, the Central Government has lifted the ban status in September 2000. However, the legislation is in place in the state level and union territories. The details are covered in (3.3) India.

It is to be noted that 70% of households (average) consume adequately iodized salt (WHO/UNICEF/ICCIDD 1999). Universal Salt Iodization (USI) legislation is also in place in 6 countries in this region. Salt monitoring for iodine content is done in 8 countries on a regular basis, while 7 countries monitor urinary iodine status (ICCIDD/WHO/UNICEF 2001). With one-sixth of the world population residing in this region, all these are laudable achievements.

Efforts are in place to increase the availability of adequately iodized salt at the household level, and most importantly to sustain the coverage over 90% and to introduce a system of cyclic monitoring using IDD indicators. The concept of cyclic monitoring has basically evolved as in most developing countries the evaluation of IDD control program is done countrywide once in 4 to 5 years either by national or International team. Thus there is no scope to know any pitfalls or midterm corrections in the control program. The cyclic monitoring concept envisages division of the country or area with IDD into five zones. Each year one district or area should be chosen for evaluation of IDD control program. The evaluation should be carried out using 30 cluster sampling technique (proportionate to size) from each cluster 40 children age group 6-11 should be examined for goitre grading and out of these 40 children, 10 urine samples and 10 salt samples should be collected on random basis. Thus, from 30 clusters, total of 1200 children should be examined for goitre grading, 300 urine and salt samples for analysis of iodine need to be done. In the second year another 5 districts or areas should be covered. Thus in 5 years the whole country will be covered and then the cycle can be repeated.

The advantages of cyclic monitoring are:

1) every year information on IDD will be available. Thus will help in knowing pitfalls in the program so that current action can be taken
2) children aged 6 to 11 years are examined for goitre grading. In the next cycle the children examined would be from the next generation and hence the IDD control effect on the next generation would be visible.
History teaches us that the sustained elimination of IDD requires constant vigilance of a range of professional and public interests. It is particularly important to understand this as we have crossed that target of universal iodization of edible salt by the end of 1995. Too many of us may diminish our efforts when we reach the plateau. The long climb to eliminate the stealthy scourge of IDD from the globe begins with the achievement of universal iodization of salt (Pandav 1995).

Basil Hetzel, in his inaugural address at the South Asian Country meeting on “Partnership to Hidden Hunger–Collaboration of stakeholders in sustaining elimination of Iodine Deficiency Disorders in Bangladesh”, held at Dhaka, Bangladesh in April 1995 stated, that “the elimination of IDD will be a great triumph in the field of public health comparable to the eradication of smallpox”. This is eminently possible. For, there are few moments in time when there is a clear fork in the path of major human endeavour. As we battle against the ancient and pervasive scourge of iodine deficiency, we are certainly at a turning point. Never before has the way to our goal been so clear or so near. Never before have we been able to see so clearly or so far.

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3.3

India

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C. S. Pandav

3.3.1 Summary and Lessons Learnt

3.3.2 Introduction

3.3.3 The Beginning: The Kangra Valley Project (1956-1972)

3.3.4 The Turning Point: Meeting with Mrs Indira Gandhi, Prime Minister of India in 1983 - Acceleration of the National Goitre Control Program

3.3.5 Progress Since 1984

3.3.6 National Family Health Survey – 2 (1998-1999)

3.3.7 Year 2000 and Beyond

3.3.8 The Production of Iodized Salt

3.3.9 Data for Decision Makers and Sustained Political Commitment
3.3.1 Summary and Lessons Learnt

An analysis of iodine deficiency disorders (IDD) elimination programs all over the world show that four elements contribute to their success: political commitment, administrative infrastructure, scientific leadership and monitoring and evaluation. India’s experience with the four essential elements can be summed up as follows:

i) Political commitment

For the first 20 years of its existence, the National Goitre Control Program (NGCP), launched in 1962, iodized salt was a low priority. It was renamed as the National Iodine Deficiency Disorders Control Program (NIDDCP). The turning point was in 1983, when Prime Minister Indira Gandhi was briefed by top scientists on the consequences of IDD and the availability of a cheap and cost-effective solution. She decided that this was not only a health problem but a national development problem. Almost overnight, the program underwent a sea change and the strategy of Universal Salt Iodization (USI) was adopted. Goitre control was on the Prime Minister’s 20 Point Program and the private sector was invited to produce iodized salt. In June, 1992 the NGCP was renamed as the National Iodine Deficiency Disorders Control Program (NIDDCP) recognizing the spectrum of disorders due to iodine deficiency. Members of the ICCIDD have helped to make the authorities aware on a regular basis of the need for iodization.

ii) Administrative infrastructure

For proper administration, it is essential to have a nodal point for the program. For India this is the Adviser (Nutrition) and Deputy Assistant Director General (Goitre). Each state also has an IDD cell to act as its nodal point.

iii) Scientific leadership

ICCIDDD members have been involved in conducting research on different aspects of IDD for the last 40 years. The formation of an NGO in India as the National Chapter of ICCIDD has facilitated the creation of a ‘home base’ located in the country’s premier health institute, the All India Institute of Medical Sciences. This serves as the training and resource centre for field surveys, training in measuring iodine levels in salt and urine (to track progress towards IDD elimination), information dissemination, technical expertise and monitoring and evaluation of activities. State level workshops for IDD workers have been conducted.
from time to time to review progress, identify bottlenecks, learn from their own and others’ experience and modify programs accordingly.

iv) Monitoring and evaluation

India has a system in which food inspectors collect salt samples and send them to laboratories for analysis. In New Delhi, ICCIDD has established a system for regularly enlisting the schools in monitoring the program:

ICCIDD has also forged collaborative partnerships with a network of NGOs such as the Voluntary Health Association of India and the Bharat Scouts and Guides, which carry out activities all over the country. In addition to providing technical support, ICCIDD has conducted independent evaluations of the Universal Salt Iodization Program in New Delhi, Madhya Pradesh, Sikkim, Kerala, Tamil Nadu, Orissa, Bihar and Goa.

There has been a tremendous increase in iodized salt production from 0.2 million tons in 1983 to 4.6 million tons in 2001. Coverage with adequate iodized salt is now 49%, according to a survey completed in 1999. But that means the glass is only half full. To reach and sustain 100% coverage is necessary and possible but only when civil society is determined to make the effort.

3.3.2 Introduction

India is the second most populous country in the world with a population of 1.027 billion (2001 census). High prevalence of goitre and cretinism exists in Himalayan and sub-Himalayan goitre belt, from Jammu and Kashmir in the west, to Arunachal Pradesh in the east and, along this entire length, extending at least 500 kms south of the Himalayas into the flat sub-Himalayan terai (plains).

In addition to the well-known “Himalayan endemic belt”, iodine deficiency has been reported from many other states in the country. In 1984-86, the Indian Council of Medical Research (ICMR) carried out a multicentric IDD prevalence study. Nine states outside the traditional “Himalayan goitre belt” were studied for the prevalence of goitre and cretinism. A total of 409,923 individuals were examined. Overall goitre prevalence observed was 21.1 percent and the overall cretinism prevalence was 0.7 percent.

In India, it is estimated that 200 million people are at risk. While the number of persons suffering from goitre and other iodine deficiency disorders is above 70 million. Results of sample surveys conducted by different agencies in 312 districts of 28 states and 5 union territories have
shown a high prevalence of IDD in 254 districts. No state and Union Territory in the country is free from IDD as a public health problem.

This places India among the major endemic iodine deficiency countries of the world. Immediate steps are therefore required to ensure that iodine adequate iodized salt, reaches all the afflicted populations, at the earliest.

3.3.3 The Beginning: The Kangra Valley Project (1956-1972)

The importance of IDD elimination as a public health problem in India began in 1956 with a pioneering effort by Professor Ramalingaswami and his team from the All India Institute of Medical Sciences (AIIMS) Indian Council of Medical Research (ICMR) and the state government of Punjab. The team instituted a field trial to test the effectiveness of iodine-fortified salt in the reduction of goitre prevalence. The study was a community based prospective controlled trial conducted in over 100,000 people in the Kangra District of Himachal Pradesh in North India. The duration of the study was from 16 years from 1956-1972 (Sooch et al 1973).

It was concluded from this study that adequately iodized salt on a regular and continuous basis reduces goitre prevalence. The study also demonstrated that iodine deficiency was the most important cause of goitre.

On the basis of this study, the Government of India launched the National Goitre Control Program (NGCP) in 1962, at the end of the Second Five Year Plan (Pandav et al 1988). In the beginning, the NGCP was proposed to be an area specific or targeted program, providing iodine supplementation in the form of iodized salt to only those districts where goitre was in endemic proportions, i.e., total goitre prevalence of 10% or more in the general population.

3.3.4 The Turning Point: Meeting with Mrs Indira Gandhi, Prime Minister of India in 1983-Acceleration of the National Goitre Control Program

The National Goitre Control Program, from its inception in 1962, remained a low priority health program since goitre was mainly considered a cosmetic problem. The turning point in the program implementation in India came about with a meeting with the then Prime Minister of India, Mrs. Indira Gandhi. Researchers and academicians, concerned about the brain damage that iodine deficiency was inflicting on the population, made a presentation. The Indian Council of Medical Research made a film
on iodine deficiency and human resource development, titled “Will The Salt Reach Padrauna?” Padrauna is a severely iodine deficient area in northeastern Uttar Pradesh. Here, the serious effects of iodine deficiency including cretinism were widely prevalent. Iodine deficiency was so severe that even birds and animals had goitre. The film was shown to Mrs. Gandhi. The Prime Minister was also briefed that endemic goitre was a public health problem in all the states and union territories. In addition, Indian scientists demonstrated the serious effects of iodine deficiency on brain development as measured by IQ in school children living in iodine deficient and iodine sufficient areas. The scientists also carried out studies in Uttar Pradesh and Bihar by adapting modern methods of investigations i.e. by estimating thyroid hormones in cord blood samples collected on filter paper (Kochipillai, Karmarkar, Godbole, Pandav). They reported a high incidence of neonatal hypothyroidism, almost 80 to 300 times more than in iodine sufficient areas. This was a study where 20,000 newborns were screened from different areas of India, Nepal, Bhutan (Kochupillai & Pandav 1987). The incidence of neonatal hypothyroidism was correlated with the severity of iodine deficiency as assessed by a) the pattern of urinary iodine excretion b) the prevalence of goitre c) the prevalence of cretinism. In areas where the population could be classified as Follis Group V (>50% have urinary iodines of <25µg/g of creatinine) the incidence of neonatal chemical hypothyroidism (NCH) varied from 75 to 133 per thousand births—this included Bhutan with an incidence of 115 per thousand births, Deoria, Gorakhpur and Gonda in Uttar Pradesh state of India with incidences of 133, 85, and 74, respectively, per thousand births. In areas of milder degree, like Delhi, which falls into Follis Group II (No proportion have urinary iodine <25µg/g of creatinine), with no cretinism, the incidence of NCH was 6 per thousand live births. It was evident, from this data and from other concurrent studies on the impact of high NCH on the endemic areas, to the Prime Minister that in seriously iodine deficient environments, in addition to the few clinically obvious cretins, a large number of individuals suffer from varying degrees of impairment of brain function due to intrauterine and neonatal hypothyroidism due to iodine deficiency.

The Prime Minister was also apprised of the scientific fact as reported by the World Health Organization (WHO) that iodine deficiency is the single most important cause of mental handicap in the world. Children who live in iodine deficient environment on an average have 13 IQ points less than those who live iodine sufficient environment. In order to fulfill the commitment of “Education for All” and consequent human resource
development, the need to address the problem of iodine deficiency as early as possible was highlighted.

The response from the Prime Minister was immediate and definitive. IDD was redefined as a National Development problem, with far reaching consequences. Universal Salt Iodization was accepted as the strategy for IDD elimination. As compared to the area specific salt iodization that had been carried out under the activities of the NGCP till then, this move underlined the earnest commitment of the Prime Minister in addressing this issue.

The most farsighted decision that was made by Mrs. Gandhi was the liberalization of the production of iodized salt. The private sector was permitted and encouraged to produce iodized salt. A package of incentives was given and the private sector responded overwhelmingly. Within a period of two years, the capacity of production went up eight times from 0.2 million tons per year to 1.6 million tons per year (Prakash et al 2000) with actual production from 0.2 million tons to 0.7 million tons.

The Prime Minister also made it a point to include the elimination of goitre (the term IDD had not been used widely then) as “Point eight” in the Prime Minister’s “20-point National Development Program, thus giving it a high priority. This inclusion also ensured regular monitoring of the program at the highest level.

Soon after the meeting with the Prime Minister, the Central Council of Health, the highest health policymaking body, met in 1984. One of the points of discussion was the National Goitre Control Program.

Keeping in mind the priority given to the Program by the Prime Minister, in view of the serious consequences related to mental and physical development of the children, the widespread prevalence of IDD as a public health problem in all the States and Union Territories and the availability of a physiological, low-cost affordable and acceptable intervention in the form of iodized salt, it was decided that iodization of all edible salt in the country by 1990 would be a desirable goal. The priority would be given to the endemic zones. The resource allocation to attain this goal was increased to Rs.200 million in the Seventh Five Year Plan (1985-1990).

3.3.5 Progress Since 1984

Since its inception in 1962, the NGCP had been languishing. With the boost given in 1984, the program activities accelerated. The installed capacity of iodized salt production increased from 1.6 million tons in 1986
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...to 14 million tons in 2000, an almost 9-fold increase! The actual production of iodized salt, which was close to 0.2 million tons in 1986, increased to 4.6 million tons in 2001. (Report to Government of India 2001).

In keeping with the new scientific evidence being discovered the National Goitre Control Program (NGCP) was renamed as the National Iodine Deficiency Disorders Control Program (NIDDCP) in 1992. The government had perceived the importance of eliminating the whole spectrum of disorders that is caused by iodine deficiency and not just goitre - which is only the tip of the iceberg.

The International Council for Control of Iodine Deficiency Disorders (ICCIDD), in close partnership with the All India Institute of Medical Sciences, New Delhi, UNICEF Micronutrient Initiative (MI) and WHO. India has played a significant role in strengthening IDD elimination efforts made by the State Governments, Salt Commissioner’s Office and iodized salt producers.

Apart from the technical assistance given to the Government of India and other agencies, ICCIDD has also conducted independent survey evaluation of the Universal Salt Iodization Program in New Delhi (Pandav et al 1980, 1997); Madhya Pradesh (ICCIDD 1996), Sikkim (Sankar et al 1994, 1997) Kerala, Tamil Nadu, Orissa, Bihar and Goa. In New Delhi,
ICCIDD has a system in place, where the schools are being enlisted regularly for monitoring of the program (Pandav et al 1999). The ICCIDD has also forged collaborative partnerships with a network NGOs like Voluntary Health Association of India, Bharat Scouts and Guides, among others, all over the country.

3.3.6 National Family Health Survey – 2 (1998-1999)

The National Family Health Survey–2 was the second in the series of all India surveys carried out to monitor the maternal and child health indicators in the country, using a representative sample (IIPS Survey 1998-99). In the second edition of the survey, the consumption of iodized salt at the household level was included as one of the parameters. The salt at the household level was tested with the use of the rapid Salt Testing Kits (STK). The results showed that 49% of the households in the country were using adequately iodized salt, iodine content \( \geq 15 \) parts per million (ppm), as measured by the salt testing kits. A total of 28% of the households were found to be using non-iodized salt. Another 22% were using salt that had iodine less than the recommended levels of 15 parts per million. The encouraging aspect of the results was that 71% of the population is consuming salt with some amount of iodine in it. Now the focus would be to sustain these achievements, improve the quality assurance and focus on the remaining 28% of the population, which is yet to be covered. Efforts are directed to make the consumption adequately iodized salt universal and sustain it thereafter.

3.3.7 Year 2000 and Beyond

In 1997, in a move to increase the sale and consumption of iodized salt, the Government of India banned the storage and sale of common salt for human consumption. This move, though well intentioned may well have been the cause for the protesting voices raised against Universal Salt Iodization, as the implementation of this order by the government raised the question of choice by the consumers.

On September 13, 2000, the Government of India lifted the ban at the national level on the sale of non-iodized salt (India Gazette 2000). However, except for two states (Gujarat and Orissa) the remaining states did not lift the Ban. (Later on Orissa introduced the ban again) The reason given was that, “When the question was of individual choice, compulsion is undesirable”.

Some of the factors that may have been responsible for the government taking this drastic move were:
1) Price difference between iodized and common salt
2) Difficulties faced by the salt producers under the Prevention of Food Adulteration (PFA) Act, 1954.
3) Politics and economics of Liberalization
4) Principle of Choice

The two main reasons may possibly be the price difference between packaged refined free flowing iodized salt and the common salt available and the difficulties faced by the small scale salt producers under the PFA Act, which had stringent penalties for not conforming to the standards set by the government.

The price of the packaged refined free flowing iodized salt is two to three times more than the price of the common salt. But, invariably, the price of this high quality branded product is compared to the price of the non-packaged common salt available in the market. Some groups highlight the price difference, but this is true for all the products. In the absence of price control mechanisms, the market forces govern the sale of the salt, slightly tilting towards the product, which has added value—be it in terms of appearance, packaging, labelling and other sales promotion strategies. But the fact remains that more than 80% of the salt that is sold in the country is in the crystal or powdered form. Another widespread misconception of the people is that the packaged refined salt is the only salt in the market that is iodized. In point of fact, even crystal and powdered salt can be effectively iodized.

The second objection was raised to the interpretation given by the government officials to the Prevention of Food Adulteration Act, under which iodized salt sale was governed. Under this Act, if the salt sample did not have 30 parts per million of iodine at the production level or 15 parts per million of iodine at the consumption level, then the salt manufacturer could be taken to Court in the area or state where the salt sample was collected and analysed, regardless of the place of origin of the salt and the salt manufacturer. This was treated akin to a criminal offence, punishable with a monetary fine and a jail sentence. The PFA inspectors, in their efforts to rigidly implement the rule, ignored some of the genuine problems that the salt producers were facing, where the salt produced by someone else had their address on its cover and they were being summoned in court for someone else’s negligence. The salt producers, who had actively gone out of their way to support this program from the very beginning, were unhappy with the treatment and consequent harassment being meted out to them. These social issues are not easily tackled by quantitative scientific methods and the concept of qualitative
research methodology plays an important part in understanding the
process related to legislation and enforcement.

The Government policy of promotion of production of good quality
iodized salt is in place and remains unchanged. The status with respect
to lifting the ban on sale of common salt situation remains very fluid. So
far, two states, Orissa and Gujarat out of 35 administrative regions have
lifted the ban following the Central Governments order lifting the ban at
the national level. Later on Orissa reintroduced the Ban again. It is
important to note here that in India, health is a state issue. Therefore, it is
the state ban that decides the implementation of legislation with respect
to iodized salt.

3.3.8 The Production of Iodized Salt

The Salt producers and the various associations of the salt producers
in the different salt producing states have performed a great enormous
service to make India self sufficient in the production of common salt.
India has more than required capacity to produce iodized salt. The salt
producers and the salt traders are spurred by three main factors:

i) Economic incentives

ii) Technical support

iii) Social incentives

i) Economic incentives

All iodized salt in the country is produced mainly in three states:
Gujarat in west India, Rajasthan in northwest India and Tamil Nadu in
South India. The salt is then transported from these production centers
to the rest of the country by road and rail transport. For distances beyond
500 kilometers, it is economical to transport the salt by the rail route. In an
effort to induce the salt producers to manufacture only iodized salt, the
Government of India and the Ministry of Railways have introduced iodized
salt under the Category B priority. This ensures that it is placed behind
Defence in terms of the priority given to its transport. If the turnover of
the iodized salt is good and the transport of the product is assured at a
lesser rate (as compared to road transport), then it makes good business
sense to invest in the manufacture of iodized salt.

ii) Technical Support

The salt producers have been receiving support from the government
in that a separate department, the Salt Commissioners office, under the
Ministry of Industry provides technical assistance to monitor the quality
of iodized salt at the production level. Bilateral and international agencies like UNICEF, MI, WHO and ICCIDD have been regularly contributing their time, resources and expertise in ensuring that the salt production is of the highest quality.

iii) Social Incentive

The salt producers have also fulfilled their commitment to the children of India. By ensuring the supply of iodized salt to all areas in the country, they are giving each and every growing fetus and child an opportunity for optimum mental and physical development. The economic development of a society alone is not sufficient for overall improvement of the health status of a community; there has also to be a social change bringing about equity and equality of distribution of development in the community.

The creation of a demand for iodized salt or the provision of an adequate supply of iodized salt is necessary but not sufficient for the IDD Elimination Program to run independently. This has to be bolstered by regular, reliable, representative, state level scientific data and data for decision-makers.

3.3.9 Data for Decision Makers and Sustained Political Commitment

With the varying geopolitical and socio-economic zones in India, it is very difficult to consider the whole country as a study unit. As a result, there have been no country evaluations on IDD in India. The only study that can be considered a countrywide study is the ICMR study conducted in 1984-86 (ICMR 1989). Other than the ICMR study, the data is mainly at the district level in the various states, from studies conducted by the National IDD Control Program and also by independent investigators. There is also a large variation in the methodology of the studies, which do not lend them to inter-study comparisons. There exists paucity in regular, reliable, representative, state level scientific data, which can be presented to the policy makers as an index of tracking progress towards sustainable elimination of IDD.

Continuing political support and commitment to sustain the progress that India has displayed in 15 years of Universal Salt Iodization, and over 50 years of research on IDD, is very important. There have been instances from Thailand, Ecuador, Guatemala, Peru and Brazil, to cite a few case studies, where IDD has reappeared as a public health problem, after a let-up in the sustenance of the IDD elimination efforts (IDD Newsletter 1992, 1994, 2000).
In summary, the foremost task is the collection of regular, reliable, representative, state level scientific data to convince the policy makers of the seriousness of the problem. In India, Public Interest Litigations (PIL) has been filed in the Supreme Court, (the highest judicial body of the country) questioning the Government’s decision to lift the ban. Be that as it may, the communication focus now should be towards the role of iodine and iodized salt in the optimum physical and mental development of the children of India.

IDD is an ecological problem, a disease of the soil causing a nutritional imbalance in human beings. Since the vehicle chosen to deliver iodine is salt, the solution of providing adequately iodized salt to people cuts across many disciplines besides health sciences. Technical support by a body of scientists and professionals is the core effort, and substantial inputs from professionals in other fields like sociology, qualitative research methodology and anthropology are also essential. The salt industry should have the mandate and the access to resources to ensure effective iodization. Producer compliance, quality assurance, logistical problems and bottlenecks need to be addressed through effective advocacy and social communications. Monitoring systems should be in place to ensure specified salt iodine content and to coordinate effective regulation and enforcement. The solution lies in understanding the social scenario and the community’s perception of the problem. Also essential to the efforts is the establishment of various partnerships between the stakeholders to ensure sustainability.

References


4

China and East Asia Region
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4.2 Tibet

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People’s Republic of China
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4.1.1 Summary of the China experience

The experience of China in rapidly achieving IDD elimination with continuing effort to sustain the achievement can be summarized as follows:

- Effective initial advocacy to the senior leaders resulted in the strong policy support for IDD Elimination—a model of international cooperation resulted in high level commitment
  - Sound argument based on IDD damage to child intelligence with clear implications on human resource and economic development
  - A feasible solution based on improving the function of the existing salt industry
- The primary instrument for IDD elimination is the reform and centralized management of the salt industry to assure only iodized salt is used for human consumption based on the historic and current economic framework of China
  - Limit salt production and distribution to selected large producers and provide assistance to improve their production quality
  - Regulated salt price to assure profit for the producer of iodized salt
  - Effective salt administrative system to stop the flow of non-iodized salt which is funded by the profit of the salt industry
- Adequate IDD surveillance and salt quality assurance - sustained IDD and salt monitoring has become the major tool of the National IDD elimination program
  - Ability to monitor progress by measurement of salt and urine iodine
  - Ability to detect small areas where USI has relapsed
  - Proven to be a useful as an evidence-based tool for advocacy
- Periodic re-advocacy and remobilization to sustain the national and local interest in IDD elimination-keeping the IDD issue alive
- The use of health promotion strategically—targeting those areas where there is significant competition between iodized and non-iodized salt
  - A clear role for the health sector in addition to IDD surveillance
  - Consumer marketing by the salt industry—beyond salt distribution alone
- Targeting remaining non-USI areas as part of the overall strategy to sustain the IDD elimination effort—keep the IDD elimination effort ongoing by intensified action helps to keep the IDD issue alive at national level.
- The National IDD Advisory Committee plays an important role in technical support by coordination of different technical bodies for the implementation of the National IDD Program
4.1.2 Introduction

Iodine Deficiency was recorded, as goitre, in the ancient Chinese medical literature as early as 3,000BC. It was one of the very significant public health problems and has continued to threaten the quality of life, human potential and socio economic development in China. Prior to the national effort to eliminate iodine deficiency disorders (IDD), in the 1990s, 700 million people, were estimated to live in iodine deficient areas and therefore were at risk of its impact. Epidemiological surveys revealed there were 35 million IDD affected individuals based on the presence of goitre, 250,000 with typical cretinism (fig. 1). In addition mild mental retardation (IQ 50-69) occurred in 5-15% of the children in many IDD endemic areas (Ma & Lu 1996).

The most important epidemiological survey, clinical investigation and intervention study in Chengde, Hebei Province in 1960, was led by Prof Xianyi Zhu (HI Chu) and Dr T Ma and their endocrine research group from the Tianjin Medical College (Ma et al 1982). This study demonstrated that iodine deficiency was the main etiology for endemic goitre and endemic cretinism and demonstrated that iodized salt was the most effective intervention for correction of iodine deficiency in the whole population. (Ma et al 1998)

Later, their effort was assisted by several Australian IDD experts–Professors Basil Hetzel, Creswell Eastman, and Glen Maberly. This early work provided the scientific basis for the start-up effort for IDD elimination in China in the 1980s. One important outcome of the research and investigation of Dr T Ma was the documentation that children who had grown up in IDD endemic areas had significantly lower intelligence in contrast to children who had grown up in areas not significantly affected by iodine deficiency (IDD Newsletter 14: 1998). The IQ distribution curves of children have a general tendency to shift to the left with an average IQ deficit of 10 points for populations living in known IDD endemic areas. Most of the mild mental retardation in IDD areas was attributed to iodine deficiency and because of the sub-clinical nature of mental retardation, these subjects have been called “sub-cretins” in China (Liu Cheng-Shan et al, 1987).

In the 1950s and 1960s, health authorities tried to improve the supply of iodized salt to control goitre but the measures were limited to highly endemic areas. With the new findings of the impact of IDD, the government soon adopted the iodized salt program (KI 10-30ppm at production level) as the main strategy for all IDD endemic areas. Although goitre rate was
Fig. 1 Brain and Cretins
decreased and very few cretins were born, IDD was not under control due to a lack of strong political will, irregular salt iodization and no effective monitoring system. This period is well covered in a previous Report (Ma and Lu 1996).

The strength of the evidence from Prof Ma Tai’s work that iodine deficiency was later associated with significantly reduced IQ was further supported by the consistent findings of multiple studies of similar design coming from different parts of China. A meta-analysis of 36 such studies conducted in China found the average reduction in IQ was 11 points (Qiang et al 2000). The recognition of a general damage of cognitive performance with impaired child development elevated the concern for IDD from an endocrine problem of thyroid dysfunction resulting in goitre to that of reduction in human resources and constrained economic development. The damage of iodine deficiency used to be seen as being limited to very few unfortunate children who were cretins, whereas the newer evidence showed that all children in affected areas were shortchanged, indicating a much higher burden. The findings on reduced cognitive performance and lower intelligence in China led to a serious national commitment and effort to eliminate IDD.

4.1.3 1993 Advocacy Meeting

In 1990, the historic UN Summit for Children adopted a series of goals, one of which was the virtual elimination of IDD. Premier Li Peng signed the Summit declaration on behalf of China (fig 2). The late Minister of Health, Dr. Chen Mingzhang, brought the issue to the attention of State Council through Madam Peng Peiyun. A consortium of international agencies, including WHO, UNICEF, World Bank, UNIDO, UNDP, ICCIDD, and bilateral donors such as AusAID and CIDA, was ready to provide assistance to a national effort. The State Council’s Madam Peng hosted a high-level advocacy meeting in September 1993, involving national leaders from various sectors and provincial governors. It was a defining event for the national IDD program (Ministry of Health 2003).

The meeting resulted in the establishment of the multi-sectoral State Council Leading Group for IDD Elimination headed by Madam Peng herself (fig 3). The commitment at the UN Summit became an action program involving all provincial leadership. The Department of Endemic Diseases of the Ministry of Health assumed the leadership of the technical work of the Leading Group. A training and coordination unit, the National Training and Technical Service (NTTS), was subsequently created to service the national program (Ministry of Health 2003).
The State Council approved a new National IDD Control Program with mandatory salt iodization. USI was accepted as the major intervention. Health Education and the IDD Day would play an important role in social mobilisation. National Monitoring was planned to be implemented every two years by using WHO/UNICEF/ICCIDD criteria for monitoring progress towards eliminating IDD as a significant public health problem (WHO/UNICEF/ICCIDD 2001).

4.1.4 State Council Decision

The decision to launch the national program, to a large extent, was made by the then Vice-Premier, Mr. Zhu Rongji, who was impressed by the fact that the principal damage of IDD concerned children of lower intelligence, as it was presented to him during a small gathering of senior national and international experts on IDD. As an economist, Vice-Premier Zhu understood the implication of IDD for human and economic development, and he inquired about the solution to the problem. The experts present made it clear that, if all the salt could be properly iodized, IDD could be eliminated. Mr. Zhu who had attended the advocacy meeting indicated to all those present, “I will make sure it is done” (Chen 1993).
essence, the high-level advocacy event was able to create the opportunity for the most senior leader in charge of economic development to make an on-the-spot decision.

For the enhanced IDD surveillance system, each province is considered as a basic unit for epidemiological survey. The PPS cluster method was accepted for assessing IDD prevalence. Schoolchildren aged 8-10 years old were chosen as the target population. The National and Provincial Monitoring System on iodized salt was also set up to monitor the consumption pattern of iodised salt.

4.1.5 Progress against IDD

Throughout the second half of the 1990s China made a remarkable effort in IDD elimination—it increased the iodized salt supply for human consumption from less than 40% to 90% to reach the goal of Universal Salt Iodization (USI) in 2000. To a large extent, this was the result of the concerted efforts of the national IDD elimination program supported at the highest level by government leaders who achieved the revitalization of the salt industry. This effort, which was started in the early 1990s with resulting USI by 2000, has been regarded as the first major phase of the IDD elimination program.
Currently, the government of China is in the Second Phase of the IDD elimination effort focusing on the remaining 10% of the population still under IDD threat, while also striving to sustain an IDD free status in the areas, which had already achieved USI.

This chapter will describe the process by which China made rapid progress towards USI in a relatively short period of time (First Phase of IDD elimination), and the current challenge and strategy required to assure that all areas can reach USI (the Second Phase of IDD elimination).

4.1.5.1 The IDD and salt industry situation before 1990

About 60% of the land of China is low in iodine content. The distribution of iodine deficient soil follows an east to west gradient—virtually most of the western part of China, which is at higher elevation, is at risk for IDD. Many communities in western China are known to be severely affected areas with a high prevalence of goitre and cretinism. Many parts of China were defined as IDD endemic areas based on various local IDD surveys, mainly based on the observation of a significant level of goitre. By the end of the 1980s about 480 million people or close to half of the national population was living in the recognised IDD endemic areas. To a large extent, IDD intervention by salt iodization and distribution of iodine capsules was based on the presence of goitre. The use of non-standardized goitre surveys resulted in many IDD affected areas failing to be recognised due to either lack of surveys or perceived low goitre prevalence.

In 1995 when the first National Survey on IDD status was conducted as part of the National Program for IDD Elimination, only 39% of households were found to be consuming iodized salt (Ma et al 1982). This targeted distribution of iodized salt by area was later abandoned, and switched to the current model of universal protection with iodized salt.

The salt production and salt trade in China has been well documented over the last two thousand years. Throughout history, even after the founding of the People’s Republic of China in 1949, the salt trade has been tightly controlled by the central government. Throughout the dynasties, income drawn from salt was a major source of revenue for the ruling family, and the senior official who was in charge of the Bureau of Salt Affairs was comparable in importance to the current day Minister of Finance. After the founding of the People’s Republic of China in 1949, the Salt Administration Bureau was maintained under the supervision of
the Ministry of Finance; then in 1956 the responsibility was switched to the Ministry of Light Industry (Ding and Tong 1997).

4.1.5.2 State Salt Monopoly

The monopoly of the salt trade was maintained in part because all industries were managed by a centrally planned mechanism resulting in a limited number of production facilities often with inefficient operation. Prior to the liberation of salt industry control, all salt manufacturers were state-owned enterprises, and only salt for IDD endemic areas was iodized, which was a practice started in the 1960s. The overall capacity for production of processed salt of 3 million tons by state owned producers in 1980s, iodized or not, was below the needed national consumption of nearly 5 million tons. This meant that non-processed raw salt made up a substantial part of the salt for household consumption. The liberalization of the salt industry and trade took place as part of the overall economic reform. When the deregulation of the salt industry and market occurred, within ten years, a few thousand small producers owned by local governments sprang into action resulting in an oversupply of edible salt with varying quality. Fierce competition kept salt industry as a whole non-profitable. In such circumstances, it was not feasible to improve production facilities and to assure the quality of the salt.

4.1.6 First Phase of National IDD Elimination Program (1990-2000)

4.1.6.1 Advocacy—the key to the program

The key lessons from the 1993 landmark advocacy effort were that:

i) the argument presented must be strong—the cost of lower intelligence due to IDD is more persuasive to policy makers in contrast to high rates of goitre.

ii) a clear and feasible solution had to be defined (in contrast to “more research will tell us what to do”); and most importantly

iii) the need to influence the person who can truly make the decision. It is fair to conclude that strong and effective advocacy was the starting point leading to an effective National Program for IDD elimination.

4.1.6.2 Scope of the First Phase of the National IDD Elimination Program

After the high-level IDD advocacy event in 1993 which defined the need for a National Program for IDD elimination, the program started
in 1994 with a series of activities focused on assuring the supply of iodized salt to all households through reforming and re-strengthening the operation of the salt industry. The goal of this national program was to reach the goal of Universal Salt Iodization (>90% iodized salt consumption for all households), as required by the World Summit for Children by the year 2000.

The key components of the National IDD elimination program were:

· Legislation and regulation to limit salt production to 118 authorized producers
· Upgrade the salt production capacity and quality of authorized producers
· Central planned production quota and distribution of iodized salt
· Improve the epidemiological and laboratory capacity for monitoring of IDD and iodized salt
· Health education to promote the use of iodized salt and the concept of IDD elimination.

It is the successful and coordinated implementation of these key activities, which has enabled China to make rapid progress towards the USI goal of 2000.

4.1.6.3 Legislation and Regulation for Salt Industry and market reform

One of the key decisions of the State Council to ensure that all edible salt was properly iodized was to reverse the course toward the free-market approach (started in the mid 1980s), and re-centralize the management of the salt industry as a quasi-monopoly, similar to the arrangement prior to the deregulation. Under a planned economy management, only authorized producers can produce and sell salt while the national and provincial salt bureaus determine the quota each producer can produce, and where they can distribute the salt. Such a measure has the net effect of eliminating much of the excess production, and concentrating the salt production in a smaller number of larger producers. The overall conceptual framework of the National IDD Elimination Program was issued in 1994 as a decree of the State Council signed by Premier Li Peng (State Council 1994). The key legislation, which was put into place by this decree (Ministry of Health 1994), is summarized below.

i) The management guideline for Salt Iodization for the Elimination of IDD

A guideline was issued in August 1994 as a decree of the State Council. This was an umbrella legislation, which specified that salt
producers be under the direct management of provincial and municipal government, as part of the salt bureau system as of Oct 1, 1994. The key elements of this new law were:

- Provincial government was to regain the control of salt production, or re-monopolize the salt industry.
- Production quality and locations for distribution for each salt production unit were defined by national-level and provincial level salt cooperation—a centrally planned mechanism.
- Allowance for the increase of salt price to assure proper iodization and packaging
- The quality of the salt and iodine content must be defined as required

There were several specific regulations developed under the principle of this umbrella legislation, which define the specific elements of salt industry reform, and the requirement for proper monitoring.

4.1.6.4 Salt Industry Reform and Development

Re-centralization of the salt industry, using a centrally planned mechanism in the management of salt production and distribution. The policy and legislation for the resumption of the salt industry in a centrally planned fashion provided the framework for a highly regulated salt market where it was easier to assure quality production and iodization. Based on this reform plan, a total of 118 large salt producers across China were licensed to produce salt for human consumption, and this resulted in a rapid phasing out of most small to medium size producers. For the most part, this phasing-out process did not meet any resistance, because most of the smaller salt production facilities were government owned enterprises, and most local governments observed the orders coming from the central government. The remaining large-scale salt producers were managed by the provincial-level Salt Corporation, which is the enterprise arm of the provincial Salt Bureau. On the national level, the China National Salt Industry Corporation under the Ministry of Light Industry was re-established to provide guidance and supervision for the provincial level salt corporation.

The most important function of the China National Salt Industry Corporation is to define the production quota for each salt production facility and allocate the geographic areas for distribution. This resumption of the centrally planned production and distribution had the net result of assuring salt distribution to most areas (but not all remote areas), and
eliminating the competition in areas where salt supply was plentiful. This anti-market competition measure coupled with price fixing, as commonly done with many commodities in China, actually allowed most of the remaining salt producers to operate with some profit, and the provincial salt cooperation to be very profitable because of the large differential in price paid to producers and the wholesale price. Most of the remaining salt producers and provincial salt corporations well understood that the favorable policy that created this semi-monopoly system was the principal instrument for IDD elimination which indicated that the proper iodization of salt was regarded as an important task.

**Upgrade the production facility of salt producers—assure the quality of salt and proper iodization.**

Coupled with this new policy was the allocation of government funds to support the capital improvement of the salt production facilities. As part of the United Nations support system for the National IDD Elimination Program of China, the World Bank was able to fast track a loan of US$27 million dollars in 1995 together with funds authorized by the government to support the upgrade of physical infrastructure of the authorized salt production facilities (World Bank Report 2001). By 2002, near the conclusion of this physical facility upgrade project, the government of China had invested US$110 million, in addition to the World Bank loan. The net result was that, the majority of the 118 large-scale salt production facilities which were defined as authorized producers have been fully modernized and a number of these producers were able to provide effective iodization, starting in 1996. A logo for quality iodine salt was introduced in 1997 for inclusion on the retail salt package from the qualified producers, which also symbolized the role of iodine and human intelligence (fig. 4).

It is clear that the combination of the reform policy to re-centralize the salt industry coupled with the physical upgrade were the two critical and complementary measures leading to the rapid progress of USI in China. At the time when the World Bank Loan was planned, there was a controversy among the key government agencies concerning the use of the loan for the IDD elimination effort. Traditionally, it is the health authority that takes the lead in all the IDD elimination effort, as was the case in China. It was viewed as unusual for a major international loan not to be executed by the lead agency; instead it was assigned to the salt industry with the China National Salt Industry Corporation as the executing agency. This break of tradition of having a project aimed at the elimination of a health problem managed by non-health partners did meet resistance
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from some of the health managers. The fact that this project was able to address the central issue of IDD elimination—assure the supply of iodized salt—resulting in USI by 2000 demonstrated the soundness of the investment strategy (World Bank Report 2002).

4.1.6.5 Dual function of the Salt Administrative Bureau—regulators and enterprise

One of the outcomes of the re-centralization of China’s salt trade was that the provincial Salt Administrative Bureaus suddenly became responsible for the production, distribution and wholesaler of salt, beyond their previous administrative role of market inspection of salt from all sources. The combination of the role of enterprise and regulator was viewed by many as a clear conflict of interest. From a historic point of view, prior to the deregulation of the salt trade in the early 1980s, the Salt Bureau had always enjoyed the dual role for centuries—monopoly of salt trade. Given the newly defined rules for salt industry and trade reform, only authorized government owned large-scale facilities can produce salt, which is overseen by the provincial Salt Administrative Bureaus. Any salt produced by unauthorized producers is classified as illegal salt, subject to confiscation by the inspectors of Salt Administrative Bureau.

Fig. 4 The official logo for quality iodized salt produced by all authorized salt producers. The Chinese character on the person means “Iodine”, and the overall symbol implies that iodine is good for intelligence or smartness. This logo is now incorporated in the anti-counterfeit label affixed to all retail salt packages sold in China.
The Salt Administrative Bureau for sometime was a sub-agency under the Ministry of Light Industry even after the salt industry reform took place. In 1998, with the government reorganization, this particular Ministry was disbanded, and supervisory responsibility was transferred to the Commission for Industry and Trade. The Commission assumed the direct management role of the Salt Administrative Bureau at national level in 2001, but at provincial level and below, the work force for the Salt Administrative Bureau was still managed and financed by the provincial salt company. In 2003, the Commission for Industry and Trade became a division of the highest planning body of China, the Development and Reform Commission, which also supervised the operation of the National Salt Industry Cooperation. This latest supervisory arrangement will probably assure the dual function for the near future.

**Enforcement measures against the trade of illegal salt by the Salt Administrative Bureau**

The inspectors of the Salt Administrative Bureau are called the “salt police”. By 2000, there was a total of 25,000 salt police in service across China. To a large extent, they played a major role in eliminating the trade of non-iodized salt for human consumption by stopping the transport and sales of “illegal salt”–salt not produced by authorized facilities, or even out-of-quota production from the authorized facilities. Most of the illegal salt produced outside the government-sanctioned facility was lower quality salt and non-iodized salt mostly intended for the black market as edible salt. Also, the production of lower quality and much lower priced salt for industrial use was often diverted as black market edible salt. Stopping the flow of this salt had the net effect in reducing the trade and use of non-iodized salt.

In essence, the Salt Administrative Bureau had the legal mandate to put any competitor of edible salt out of business. Hence it is a form of monopoly. The cost for maintaining the salt police force is funded by the profit from sale of the “legal salt”. This unusual arrangement turned out to be an effective mechanism in assuring the rapid implementation of USI. The dual function of the salt bureau was able to stop the flow of non-iodized salt in many parts of China within the first few years of this new arrangement. Prior to the new reform rule, the inspector of the Salt Bureau was supposed to inspect and stop the trading of salt that did not meet the quality standard. Because of under funding of the Salt Bureau function, and no incentive in carrying out the task, non-iodized or low-quality salt had flowed freely in most markets. It is clear that, the re-vitalization of the
<table>
<thead>
<tr>
<th>Systems</th>
<th>Indicators</th>
<th>Operational Feature</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>The National IDD Survey (MOH)</td>
<td>Iodized/non-iodized salt Goitre rate - school age Urinary iodine-school age TSH - newborn</td>
<td>- Epidemiologic survey using population proportion sampling method allows the characterization of whole country and each province - Every 2 years - First one 1995</td>
<td>- requires special fund for each round of survey - proven to be the most useful system for IDD monitoring due to ability to compare IDD and salt consumption status</td>
</tr>
<tr>
<td>The routine iodized salt monitoring by the Anti-Epidemic Stations (MOH)</td>
<td>Iodized salt - at production sites</td>
<td>- Quarterly measurements - Sample of salt from each of four levels using titration method - There is charge to salt production facility for the testing - Other levels no charge</td>
<td>- For those countries with salt factories the tasks are carried out and some even increase the frequency to monthly - Most provinces not able to carry out the routine function at household and retail level because of lack of funding support for such operation</td>
</tr>
<tr>
<td>The Salt Industry Quality Monitoring Program (CNSIC)</td>
<td>Salt quality Iodized salt</td>
<td>- Routine monitoring of iodine content at production site-multiple samples a day (internal quality control) - Monthly collection of 25 samples different lost at each production facility for all salt quality indicators</td>
<td>- The daily routine iodine content monitoring results are not reported but a record is kept at each facility - The result of monthly measurements are reported to the Quality Monitoring Unit of the CNSIC through computer network</td>
</tr>
</tbody>
</table>
traditional Salt Administrative Bureau system by giving them back the role as the sole legal salt distributor has greatly enhanced the effort to bring iodized salt to all households.

The effective enforcement mechanism of the salt police of the Salt Administrative Bureau system does not cover all parts of China. Only about two-thirds of the counties have a Salt Administrative Bureau station. Further extension of this system will enable better distribution of iodized salt, and enforcement to stop the flow of non-iodized salt.

However, this dual function of the Salt Administrative Bureau system is under review. Starting in 2001, the Commission of Internal Trade started to question this practice of dual role of enterprise and regulator, in part because the national economic development policy is to move all industry from state-owned management to a free-market based. In anticipation that such a breakup of the semi-monopoly practice may take place, the China National Salt Industry Corporation took the lead in forming a conglomerate called the China Salt Group with most of the Provincial Salt Corporations as members of this group. In the event of deregulation of the salt trade, the conglomerate members are in a better position to compete based on the scale of economy, and market dominance.

### Table 2: Monitoring China National Program 1995-2002

<table>
<thead>
<tr>
<th>INDICATORS</th>
<th>1995</th>
<th>1997</th>
<th>1999</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>The proportion of households consuming iodized salt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20mg/kg (%)</td>
<td>39.9</td>
<td>81.1</td>
<td>88.9</td>
<td>95.2</td>
</tr>
<tr>
<td>20-50mg/kg</td>
<td>29.7</td>
<td>69.0</td>
<td>80.6</td>
<td>88.9</td>
</tr>
<tr>
<td>median iodine level</td>
<td>16.2</td>
<td>37.0</td>
<td>42.3</td>
<td>31.4</td>
</tr>
<tr>
<td>Urinary Iodine level in Children</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (µg/l)</td>
<td>164.8</td>
<td>330.2</td>
<td>306.0</td>
<td>241.2</td>
</tr>
<tr>
<td>&lt;50µg/L (%)</td>
<td>13.3</td>
<td>3.5</td>
<td>3.3</td>
<td>5.8</td>
</tr>
<tr>
<td>Number of Provinces</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With Median &lt;100µg/l</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total Goitre Rate (TGR) (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palpation</td>
<td>20.4</td>
<td>10.9</td>
<td>8.8</td>
<td>5.8</td>
</tr>
<tr>
<td>Ultrasonography</td>
<td>---</td>
<td>9.6</td>
<td>8.0</td>
<td>5.6</td>
</tr>
<tr>
<td>Grade II</td>
<td>2.1</td>
<td>0.5</td>
<td>0.33</td>
<td>0.28</td>
</tr>
<tr>
<td>The production of iodized salt (10,000 tons)</td>
<td>---</td>
<td>539</td>
<td>620</td>
<td>753</td>
</tr>
</tbody>
</table>
Iodized Salt Coverage at Household Level 1995

Note: Salt with iodine level $\geq 15$ ppm; Range is 32.4% and 98.7%
Source: China National IDD Surveillance, 1999, MoH

Fig. 5. 1995 Surveys. The result of 1995 National IDD survey on iodized salt consumption level by province. Only Shanxi province had a consumption level higher than 80% and the overall national consumption level was 39% - which was the baseline at the start-up of the National IDD Elimination Program.
4.1.7 IDD Monitoring and Iodized Salt Quality Assurance

At the start of the National IDD Elimination Program in 1994, one important component put into action parallel with the salt industry reform effort was the development of a mechanism for the monitoring or surveillance of IDD status including the consumption of iodized salt. To support the implementation of the monitoring and surveillance systems through the Ministry of Health system, a special unit called the National Support Team for Elimination of IDD, within the current China Centers for Disease Control (CCDC) was established. Starting in 1995, a total of three separate surveillance systems was put into operation—two managed by the National IDD Support Team on behalf of the Ministry of Health, and one by the China National Salt Industry Corporation (CNSIC). Table 1 summarizes the key features of each system.


The National IDD survey was the base line survey in 1995, prior to all major measures to improve the supply of iodized salt. In this survey the overall household iodized salt consumption rate was 39% based on iodine content greater than 15ppm (Table 2) (Ministry of Health 1996) (fig. 5).

Among the 31 provinces and municipalities only one province (Shanxi) had an iodized salt coverage rate over 80%. The median urinary iodine level was 165µg/dl.

So far, the national survey has been carried out four times (1995, 1997, 1999, and 2002) using a comparable design allowing for comparison over time. This system has proven to be the most valuable and credible monitoring system for IDD status and iodized salt coverage down to provincial level. By 1999, the overall national household iodized salt consumption reached 90%, to provide the evidence of USI by 2000. Table 2 illustrates the rapid improvement of the iodized salt consumption level based on the 1997 and 1999 National Surveys (fig. 6).

Clearly, the most useful aspect of the survey-based IDD surveillance system is the proper monitoring of the principal process indicator for IDD elimination—the iodized salt. The system also demonstrated other uses. The finding of a relatively high median urinary iodine level in 1997 and 1999 (greater than 300µg/dl in a majority of the provinces) indicated that the iodine level of salt based on the requirement of 20-60ppm was higher than necessary. The finding of iodine content of salt from the survey’s average 50ppm confirmed the urinary finding. Based on these findings, the national standard for iodized salt was changed to 35ppm±15ppm.
Fig. 6. 1999 Surveys The result of 1999 National IDD survey found 21 provinces reached USI–iodized salt consumption level greater than 90%, and there were 10 provinces with very uneven level of consumption below 90%. The overall national consumption level reached the goal of 90% set for 2000. This survey was the principal evidence for China to declare USI at national level in 2000. This same map of iodized salt consumption also became the main tool to target the remaining areas for further intervention during the Second Phase of the National IDD Elimination Program.
Global Elimination of Brain Damage Due to Iodine Deficiency

This resulted in a fall in urine iodine (Table 2) due to a reduction of one third in the use of potassium iodate by the salt producers. The only key indicator, which was not found to be useful, was TSH in newborns. This had to do with variation in methods used across provinces, which renders the results difficult to compare across the country, and over time. For the 2002 survey, TSH was discontinued as one of the required measurements.

4.1.7.2 The routine monitoring of salt by the Anti Epidemic Stations

This county-based system was designed for regular monitoring at production, wholesale and household level. In principle this is a mechanism that would be most useful in defining areas needing attention and action based on the nature of the problem such as excess raw salt production, or lack of iodized salt distribution. To complement this need, a network of IDD laboratories was set up as part of the National IDD

Table 3. The laboratory system for the monitoring of IDD status

<table>
<thead>
<tr>
<th>System</th>
<th>Key Indicators</th>
<th>Role and Function</th>
</tr>
</thead>
</table>
| **Central – The National IDD Reference Laboratory, China CDC (Centres for Disease Control and Prevention)** | Iodine salt by titration, Urinary iodine, TSH | - Provide reference (QC) for laboratories of the network  
- Training support for provincial laboratories  
- Quality assurance program for the National Survey samples |
| Total 31 laboratories          |                         |                                                        |
| **Provincial - Provincial Endemic Disease Laboratory, Provincial CDC** | Iodine salt by titration, Urinary iodine, TSH | - Supervise and support the prefecture and country level laboratories  
- Analysis of samples of the National Survey |
| Total 330 laboratories         |                         |                                                        |
| **Prefecture - prefecture level Anti-epidemic station** | Iodine salt by titration, Urinary iodine | - Salt testing for the routine monitoring of salt by the Disease Control System  
- Support the function of the Country level laboratories |
| Total 2450 laboratories        |                         |                                                        |
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Elimination Project through the support of AusAID, UNICEF and WHO in the late 1990s. Evaluation found the system functioning well in selected provinces where there was provincial funding and management input to this system. Unfortunately, most of the provinces, which are more affected by IDD, are also poor provinces where provincial governments are not able to provide the basic input to assure the system operation. The only functioning part of this routine monitoring system is the periodic check of iodine content of salt at the production facility, for those few counties where there were production facilities. The main reason this aspect of the system is working is that the cost of this operation is offset by the charge to salt producers for “inspection” as well as a fine levied if the salt inspected is found to contain iodine less than 20ppm. This provided a useful function of external monitoring of iodized salt at production level.

However, one side effect of this external inspection of salt at production level led the producer to push the higher average level of iodine content above 50ppm in order to avoid any lot of salt falling below 20ppm of iodine. This resulted in the high median urinary content in the range of 300µg/l based on the National Survey of 1999. Beyond the production level monitoring, the information reported from household or wholesale level has not been found to be as useful as the findings of the National Survey System, which has better assured quality.

4.1.7.3 The Salt Industry Quality Monitoring System

As part of the salt industry reform plan of the National IDD Elimination Program started in 1995, a quality assurance system was introduced for those facilities, which were licensed to produce salt for human consumption. This system required the monthly measurement of multiple salt quality indicators including iodine by qualified laboratories, which forwarded the report to the Production Monitoring Department of the China National Salt Industry Corporation.

The implementation of this system has been slow. By 1999, only half of the 118 production facilities were able to report the monthly results through the electronic network set up for this purpose. If this system is fully functional, it is an adequate internal monitoring mechanism for the salt industry system. At most production facilities, there is a local quality control mechanism to assure proper iodination by conducting daily iodine content measurement using the titration method for multiple samples. There is no requirement to report these results but there is an opportunity...
to make it a reportable system to strengthen the overall internal monitoring mechanism for the salt industry.

4.1.7.4 The IDD laboratory system

As part of the effort to establish the long-term monitoring capacity for IDD and iodized salt, a National IDD Reference Laboratory Network was developed through the support of AusAID and UNICEF starting in 1997 (Chinese Academy of Preventive Medicine 2001). Table 3 summarizes the system and functional capacity.

The National IDD Reference Laboratory was established in 1997 and gradually emerged as a major laboratory support for staff training and the monitoring of IDD by the IDD laboratory network. The National IDD Reference Laboratory provides a proficiency-testing program for all laboratories in the China network—twice a year sending salt and urine samples for all laboratories to measure (Chinese Academy of Preventive Medicine 2001). Based on the reported results of proficiency testing, those laboratories with quality problems are followed up for remedial action. Another major service of the laboratory in recent years is to

Fig. 7. IDD Day in Gansu Province (2000)
assist other countries in training of personnel and the establishment of their national IDD laboratory capacity.

The most notable function of the Provincial Laboratory is the sample analysis from the biannual national IDD survey. Some provinces are able to carry out special studies in between the surveys, but for most provinces, other functions are limited due to funding constraints. To a large extent, under utilization is also an issue for the prefecture and local level laboratories. The notable exception is for those counties or prefectures where there are large scale salt production facilities. These laboratories are able to conduct monitoring testing monthly and can charge the facility for the inspection service.

4.1.8 The Communication and Health Promotion Effort to Support IDD Elimination

At the start-up of the National IDD Elimination Program in 1995, the health education and promotion component was planned as a major component of the program. The actual implementation of communication activities was limited during the First Phase of the national effort (1995-2000) mainly because the aim was to assure the supply of iodized salt through the reform and upgrade of the salt industry.

The primary task for IDD-based communication was managed by the Endemic Disease Department of the Ministry of Health (in 1998 it became a division of the Disease Control Department). The most notable effort, which brings national attention, is the annual IDD day on May 5 (Ministry...
Global Elimination of Brain Damage Due to Iodine Deficiency

During this day, there are media and community-based events sponsored and supported by the public health agency throughout the country (fig. 7).

Each year there is also a mobilization event held on the IDD day in one selected province where there was still significant IDD. The event is headed by a senior inter-agency team (health and salt industry) with international agency representatives to assure the participation of senior provincial officials.

The net result of replacing the non-iodized salt in the market with iodized salt through the re-establishment of a salt trade monopoly making only iodized salt available, in the short run, does not require a strong promotion effort directed to consumers. However, for those remaining areas where there is low use of iodized salt due to the abundance and lower price of non-iodized salt, the role of communication is critical—consumers must be convinced the more expensive iodized salt offers health protection and is better for the brain development of children.

4.1.9 Second Phase of IDD Elimination-2001 to Present

The achievement of the national goal of Universal Salt Iodization by 2000 for the entire country, as defined by the World Summit for Children, based on the major effort of the National IDD Elimination Program initiated in 1994 is now recognized as the First Phase of China’s IDD elimination effort.

A high-level National IDD Advocacy Meeting took place in October 2000 where USI for the country as a whole was proclaimed and commitment was made to continue the IDD elimination effort for all provinces to reach USI by 2005 (fig. 8).

This meeting became the defining event for the Second Phase of the IDD Elimination Program with a clear strategy, which required different input and effort from that for the First Phase.

The major goals for the Second Phase of National IDD Elimination Program were to assure:
1) the sustainability of the USI accomplishment of the First Phase; and
2) achieve USI for those provinces, which did not reach USI during the First Phase.

The rationale of having a strategy to sustain USI is based on other countries experience, which demonstrated that once the USI goal reached, further effort for IDD elimination or effort to assure the production and distribution of iodized salt begins to falter, and within a few years the
iodized salt consumption level has dropped significantly. (see further Section VIII)

Even though at the national level, China was able to achieve 90% level of household salt consumption level this achievement was very uneven. Based on the 1999 National IDD survey, there were several provinces still far short from the USI goal, and it is apparent that each of these areas requires very specific action, aimed at the local situation, in order to achieve USI. These areas have not responded to the key intervention strategy of the First Phase—rapid scale-up of production and assured distribution of iodized salt through the reform of the salt industry.

4.1.9.1 Focus for the Phase 2 intervention—Characteristic of remaining IDD or non-USI areas of China

The remaining areas of China yet to reach USI have several features in common. These features can be summarized as the combination of two major factors:
1) excess local salt resource and supply resulting in lower cost salt available; and
2) the lack of an adequate iodized salt distribution mechanism and absence of a Salt Administrative Bureau to control the flow of non-iodized salt. The First Phase of the national program was able to establish an effective salt distribution and administrative mechanism in most parts of China, particularly in coastal and Central Provinces. But these systems are still far from complete in provinces in the remote Western Region.

Excess salt resource—the eastern coastal situation.

This problem is not uncommon across China because the richness of the salt resource far exceeds the annual salt requirement for human consumption and industry need. The centralized regulation of the salt trade, to a large extent, was able to stop the excess production and distribution of excess of non-iodized salt in most non-salt producing provinces. Hence the rapid achievement of USI in most provinces.

The major exception are coastal areas where there are excess salt fields with many small producers under local government protection because the salt fields are leased from local government and classified as township enterprises. In such cases, advocacy and communication to
gain the interest of local government in supporting the IDD elimination task is important. This includes the removal of protection of those producing raw salt for human consumption and the assistance to salt farmers to transform the sea salt operation to other enterprises such as fishery or harvesting of seaweed.

Several provinces have already made great progress in this regard. The Jiangsu province has already eliminated 90% of excess salt fields and was still able to achieve USI status for the entire province by 2000. Fujian province has eliminated over 20,000 hectares or two-thirds of the excess salt fields since 2000 and reached the USI status in 2002. The experience of Fujian demonstrated the important role of a provincial governor in “influencing” the county authorities to support the IDD elimination effort by abandoning their protection of excess raw salt protection.

Hainan province is the only coastal province that does not have an active program to eliminate or to transform the excess salt fields. This in part reflects the lack of understanding of the provincial leader of the significance of IDD, and in part due to a weak salt administrative system and provincial salt company only willing to focus on salt distribution to areas which have higher profit margins. For the most part, in the coastal areas the primary problem is excess raw salt, which is cheaper than the iodized salt. There is no shortage of iodized salt supply. In such a scenario, the successful experience of eliminating excess salt production capacity through gaining the support of local government is the key. Consumer education and health promotion is critical in accelerating this effort.

_Excess salt resource coupled with lack of access to iodized salt—the Western inland situation._

In the western inland of China, there are also abundant salt resources, and to a large extent harvest by local salt traders. Because of low population density and vast distances from government sanctioned large salt producers, the distribution network for iodized salt is incomplete and lacking in the vast areas of western China, especially Tibet, Qinghai, and Southern Xinjiang. This combination creates the greatest challenge of IDD elimination.

The general strategy in such a setting is to establish iodized salt distribution first. This can be accomplished by subsidizing such higher cost operation with profits from urban areas. The Xinjiang Salt Corporation
is a good example of such effort. It set up local salt distribution centers in Southern Xinjiang, which previously had no history of iodized salt use. Once the access point for iodized salt was established, the second step was to promote the importance of iodized salt through various channels—education, religious, and mass media. To a large extent, this effort has been supported by international agencies, such as UNICEF.

The only major challenge remaining is that the difference in cost of locally collected raw salt and the processed iodized salt can often be great. In most remote areas where income level is far lower than the urban areas, a significant cost differential still presents a barrier to access to iodized salt. Without some form of short-term subsidy in the form of a government poverty alleviation fund or below-cost support on the part of the overall profitable salt company system, it will be difficult to achieve the USI goal in some of the remote areas. The role of enforcement of the Salt Administrative Bureaus in these western remote areas is limited because they are only useful in stopping large-scale illegal production and distribution. In remote areas, most of the salt collection and distribution is done by very small-scale traders or through self-collection at the local salt deposit. A feasibility study in a large part of Western China, on how best to achieve access to iodized salt, by making it affordable, is clearly indicated.

4.1.9.2 The role of advocacy and communication

During the Second Phase of the China IDD Elimination Program, the role of adequate communication and health promotion is far more important than during the First Phase. The major challenge of the Second Phase is the remaining areas, which did not reach USI, and these are areas where there is significant competition between iodized salt and the often-cheaper

<table>
<thead>
<tr>
<th>Target groups</th>
<th>Urinary Iodine</th>
</tr>
</thead>
<tbody>
<tr>
<td>School Children (8-10 years)</td>
<td>229.1</td>
</tr>
<tr>
<td>Women at child bearing age (20-40 years)</td>
<td>220.2</td>
</tr>
<tr>
<td>Pregnant women</td>
<td>178.8</td>
</tr>
<tr>
<td>Lactating women</td>
<td>191.3</td>
</tr>
<tr>
<td>Babies (0-2 years)</td>
<td>240.4</td>
</tr>
<tr>
<td>Milk</td>
<td>145</td>
</tr>
</tbody>
</table>

Table 4. Median Urinary iodine in target groups (µg/L)
Global Elimination of Brain Damage Due to Iodine Deficiency

For consumers to choose a more expensive salt, they must perceive the added value for health and protection of children’s intelligence worth the extra cost. Hence it is essential to market the added value of iodized salt.

Historically, this has been the role of the health education and promotion specialist in China. The salt industry or provincial salt company has played little role in this regard because of the monopolistic nature of the salt company in each province where due to the lack of a major competitor, and a remote market makes a profit unlikely. Given the monopoly status of the Salt system of China is mandated as an instrument for IDD elimination, it is essential for the now profitable salt industry to assure not only distribution of iodized salt to remote areas, but also to market the iodized salt to promote the choice over non-iodized salt. In this connection, the network of 750,000 licensed salt retailers will be mobilized to undertake IDD education with consumers, since they are in direct contact with the users of salt on a regular basis. Without a marketing effort, it will not be possible for rural and poor consumers to purchase the more expensive iodized salt over the raw salt. Since 2001, through the support of the China National Salt Industry Corporation and UNICEF, there is increasing effort by some of the Provincial Salt

Fig. 9 The logo selected from a national competition intended for application with communication material for marketing of iodized salt to consumers through the salt companies. The Chinese Characters state “Iodized salt protects the intelligence of Children”. The symbol of ‘tree’ has special meaning in China; it implies raising children is like growing a tree, which requires special care to assure good development.
Corporations to invest in marketing of iodized salt to consumers. In 2002, a competition was set up to develop a logo, which can be used in future communication and promotion efforts on the importance of iodized salt to consumers (fig 9).

Beyond the health promotion effort to consumers, advocacy effort to assure local government support to support and to sustain IDD elimination is also part of the Second Phase of the National Program. High-level remobilization events were held in September 2001 and in October 2003. The later event was organized as a joint national and international meeting with high-level participation from 20 countries and senior officials from all provinces in China yet to reach the USI goal. The focus of this event was to showcase the feasibility of IDD elimination in difficult areas to stimulate greater action and political support.

In essence, continuing advocacy will help achieve IDD elimination in remaining non-USI areas, and equally important, to help sustain the USI in areas already achieved.

4.1.9.3 The Role of monitoring and surveillance

The well-established National IDD Survey mechanism during the First Phase of the National IDD Elimination Program continues to be of great value for the Second Phase in order to monitor progress in areas yet to reach USI. Additionally, it has become a quality assurance tool for those areas, which have already achieved USI— for the detection of relapse. In fact this later function has proven of be useful in the 2002 National IDD survey where there were several areas, such as Beijing and Yunnan province as a whole that were found to fall below the previously achieved level of 90% iodized salt coverage defined for USI. The same survey mechanism was also able to identify the pockets within these two provinces where there was significant use of non-iodized salt. As a result, in-depth assessment and IDD elimination action has been put into action with the support of UNICEF.

One major adaptation of the National IDD survey system during the Second Phase is the expansion to measure iodized salt coverage from province level to that of sub-province level (prefectures). In doing so, it eliminated the need for a secondary survey to determine the problematic areas with below 90% coverage within a given province.

Fig. 10 illustrates the iodized salt consumption level of Beijing based on the 2002 National Survey. This not only detected that Beijing had a significant relapse from its previous level of 95% in 1999 to 89% in 2002. With this finding, the Beijing Salt Corporation was able to determine that
Fig. 10. Beijing-data The 2002 National IDD survey found the Municipality of Beijing which had previously reached 95% iodized salt consumption level had declined to 89%; hence no longer meeting the USI definition. The 2002 survey was able to provide below province monitoring, and so was able to determine that three of the northern Beijing counties now have very high levels of non-iodized salt use. This became the focus of further investigation and intervention by both salt and health authorities. This is an example of the value of long-term monitoring.
there was a major loophole in the wholesale system with penetration into the rural areas of the Beijing municipality of non-iodized salt as well as unauthorized salt. Remedial action was initiated in the summer of 2003.

The 2002 National Survey was able to demonstrate that, most of the remaining non-USI provinces in the First Phase of the National Program, based on the 1999 National survey had made significant progress, except for Tibet. Fujian and Ningxia provinces reached provincial USI since last survey. The value of this system for both problem detection and monitoring of progress is clearly established. The most valuable aspect of this system is the fact that it has become the main management tool of the National IDD Elimination Program where the findings are used to determine program action and funding priorities. For sustained action, including the maintenance of already achieved USI, the China National IDD Survey demonstrated the usefulness and cost effectiveness of investment in a quality surveillance system.


An important project concentrated on the iodine nutritional status of the major target population (women of childbearing age, pregnant and lactating women) jointly supported by MOH, Salt Industry and ICCIDD. ICCIDD Focal point, Prof. Yan Yuqin organised 12 teams to implement this project for understanding the iodine nutritional status in the target population after USI. 26 clusters of populations in urban and rural areas from 12 provinces were selected for this survey. Schoolchildren at age of 8-10, women of child bearing age (20-40 years old), pregnant women, lactating women and their infants or babies at age of 0-2 years old were regarded as target groups.

The mean iodine concentration in drinking water was 3.7µg/L (n=1290), which indicates the environmental iodine deficiency. The coverage rate of USI was around 97%. Table 4 shows the urinary iodine concentration in target groups with data on milk iodine.

The survey also demonstrated that UI in pregnant and lactating women in some of rural or urban areas was below 150 or even 100µg/L, which reveals mild iodine deficiency is still present even though they have adequately iodized salt.

The results reveal the following facts:

- There is adequate iodine nutrition in all the special target groups and there is no iodine excess.
The newborns are completely protected by sufficient iodine intake. Recommendations were:

- The iodine nutrition in pregnant and lactating women should be given special attention to ensure the urinary iodine of young children is over 100 but below 150 µg/L after the intervention of USI.
- Urinary iodine in schoolchildren should not be below 150 µg/l.

References

Chen, ZP. (1993) Oral history provided at Tianjin Medical College, Tianjin, China.


4.2

Tibet

_Creswell J Eastman and Mu Li_

4.2.1 Introduction

4.2.2 Definitions and Demographic Data

4.2.3 Major Health Problems in Tibet

4.2.4 IDD in the People’s Republic of China (PRC)

4.2.5 The IDD Situation in Tibet

4.2.6 IDD Elimination Efforts

4.2.7 IDD Elimination Project in Tibet

4.2.8 Outcomes of the IDD Elimination Project

4.2.9 Discussion

4.2.10 Conclusion
4.2.1 Introduction
The very mention of the word Tibet conjures up visions of mountains, mysticism, religion and spirituality and provokes strong rhetoric and robust debate about human rights and independence. Because of its geographic and political isolation, Tibet remains a land wrapped in obscurity and controversy, about which facts and reliable information are sparse, but propaganda is plentiful and opinions abound. In the masses of material published in the international press dealing with the plight of the Tibetan people, we have been struck by the scarcity of any reliable information on the health status of the people living in Tibet. The purpose of our report is to bring to the attention of the international medical community, the widespread prevalence of iodine deficiency disorders (IDD) in Tibet and the devastating consequences IDD has had on the physical and intellectual development of the population. We provide previously unpublished information on preliminary outcome data from an ongoing Australian-funded and WHO-supported intervention, designed to eliminate this scourge from future generations of Tibetan children (Li & Eastman 2003).

4.2.2 Definitions and Demographic Data
By Tibet, we mean the Tibet Autonomous Region (TAR), a province of the Peoples Republic of China (PRC). The TAR is a high altitude plateau, averaging 4000 metres above sea level, encircled by the highest mountain ranges on earth and covering a huge landmass in excess of 1.2 million square kilometres. It is a sparsely populated environment, subjected year round to harsh extremes of climate. Basic infrastructure is very limited, particularly in roads and transport. There are no internal rail or air services. The TAR comprises 7 prefectures that are further subdivided into 73 counties. The total population is approximately 2.5 million, with 70% living in rural and remote areas. Official statistics claim that 90% of the permanent population is ethnically Tibetan, the remainder being Han Chinese and some minority ethnic groups. Large numbers of ethnic Tibetans live in the surrounding provinces of Qinghai, Gansu, Sichuan, Yunnan and Xinjiang where IDD continues to be a significant problem.

The TAR economy is heavily subsidized from Beijing and domestically relies mainly on agriculture and herding or animal husbandry, with the majority of the population being engaged in agriculture. The nomadic people, who reside in the more remote areas of the country, largely undertake herding of yaks, sheep and goats. The average per capita income of
approximately US$120 indicates a severe level of poverty. More than 50% of the adult population is illiterate, with the highest rates being in the older rural populations (Zhang Tianlu 1997). One can only speculate that this high level of illiteracy is a consequence of multiple factors including lack of educational opportunity and minimal educational resources, combined with the effects of IDD and other micronutrient deficiencies on intellectual development.

4.2.3 Major health problems in Tibet

Life expectancy is lower and infant mortality is higher in Tibet compared with the rest of China (Hayes et al 2001). Infectious diseases and endemic nutritional disorders dominate the health profile. IDD and Kashin-Beck disease (KBD) are the two highly prevalent non-communicable endemic diseases. KBD, also known as “big bone disease”, is characterised by a deforming osteoarthropathy resulting in decreased limb length, shortness of stature and severe disability. The aetiology of KBD remains obscure. Putative causes include dietary selenium deficiency and mycotoxin poisoning by fungal contamination of stored barley (Chasseur et al 1997). It is interesting that IDD and KBD coexist in many regions in Tibet such that iodine deficiency has also been implicated in the pathogenesis of KBD (Moreno-Reyes et al 1998).

In a recent multicultural and comprehensive study of nutritional and health status of Tibetan children from 0 to 7 years of age, Hayes and colleagues reported that 51% of the children were stunted in growth (Hayes et al 2001). Undoubtedly IDD is a major contributory factor to growth retardation.

4.2.4 IDD in the Peoples Republic of China (PRC)

Endemic environmental iodine deficiency occurs in most, if not all, of the 31 provinces and autonomous regions of the PRC and it is estimated that over 500 million people live in areas of moderate to severe iodine deficiency. The history of IDD in the PRC and the successful national IDD elimination program have been well described elsewhere (Wang et al 1997; Eastman 1997) and Section VIII of this book. Universal Salt Iodization (USI), underpinned by legislation that all salt destined for human and animal consumption must be iodized, was the vehicle chosen to deliver iodine to the human and animal populations. A countrywide public health promotion and education campaign has succeeded in creating a high level of awareness of IDD in the population and this has driven the demand for iodized salt. A World Bank review of the NIDDEP in 1998 concluded “there
has been excellent progress and quite remarkable achievements in the efforts to eliminate IDD in China through implementation of the NIDDEP’ (World Bank 1998). The report found that an effective, nationwide, program management and operational structure was in place for social mobilisation, health education and surveillance, from county through provincial to national level, and was functioning well with some notable exceptions in some of the poorer more remote provinces. Tibet was the most notable outlier.

4.2.5 IDD situation in Tibet

Information discussed in this communication has been derived from the Tibet Department of Health (TDOH) through surveys performed by the Tibet Institute of Endemic Diseases Prevention and Control (TIEDPC), the biennial National Surveillance Studies conducted in 1997,1999, 2001 and field studies performed in Tibet by the authors (Eastman et al 1999). In the 1997 survey, conducted in all seven prefectures, only 22% of the population surveyed had urinary iodine excretion concentrations (UIE) above the cut-off level of 100µg/L, that is consistent with adequate iodine nutrition (Table 1). More importantly, 35% of the population exhibited severe iodine deficiency (UIE <25µg/L) and 43% exhibited moderate to mild iodine deficiency (UIE of 25-100µg/L). Data obtained during the 1997
Fig. 2 Cretin with Kashin-Beck disease
Fig. 3 Stunting of growth
Table 1. Distribution of Urinary Iodine levels in the Tibetan population prior to commencement of Tibet IDD Elimination Project*

<table>
<thead>
<tr>
<th>Prefecture</th>
<th>0–25µg/L</th>
<th>25–100 µg/L</th>
<th>&gt;100µg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lhasa</td>
<td>14.4</td>
<td>48.1</td>
<td>37.5</td>
</tr>
<tr>
<td>Changdu</td>
<td>47.5</td>
<td>38.3</td>
<td>14.2</td>
</tr>
<tr>
<td>Shannan</td>
<td>16.5</td>
<td>58.2</td>
<td>25.3</td>
</tr>
<tr>
<td>Rikazi</td>
<td>64.5</td>
<td>28.3</td>
<td>7.2</td>
</tr>
<tr>
<td>Nakchu</td>
<td>28.1</td>
<td>37.2</td>
<td>34.7</td>
</tr>
<tr>
<td>Ali</td>
<td>5.1</td>
<td>74.4</td>
<td>20.5</td>
</tr>
<tr>
<td>Linzhi</td>
<td>12.0</td>
<td>58.9</td>
<td>29.1</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>34.8</strong></td>
<td><strong>43.3</strong></td>
<td><strong>21.9</strong></td>
</tr>
</tbody>
</table>


Table 2. 1995, 1997 and 1999 China National IDD Surveillance Survey data

<table>
<thead>
<tr>
<th></th>
<th>Tibet</th>
<th>National</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1997</td>
<td>1999</td>
</tr>
<tr>
<td>Households qualified</td>
<td>6.2</td>
<td>27.5</td>
</tr>
<tr>
<td>Iodized Salt coverage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8-10 y-o TGR (by palpation)</td>
<td>29.0</td>
<td>22.8</td>
</tr>
<tr>
<td>8-10 y-o median UIE</td>
<td>55.4</td>
<td>58.8</td>
</tr>
</tbody>
</table>

*Data is presented as % of the population sample studied

TGR: Total goitre rate
and 1999 National Surveillance Studies for goitre rates, median urinary iodine levels, household iodized salt rates (aggregated for the whole of Tibet) are shown in Table 2. There is data from IQ studies of a sample of approximately 4500 children showing an average IQ of 85. Cretin rates quoted by the Tibet Department of Health in 1999 ranged from 2.0% to 13% in rural villages where iodine deficiency was known to be severe. There is no independent data available to corroborate these IQ figures and cretin rates.

We do not have any original data relating to physical growth and development of Tibetan children. Recently, Hayes and her colleagues studied 2078 Tibetan children, 0 to 84 months of age and found 51% had moderately or severely stunted growth (Hayes et al 2001).

4.2.6 IDD Elimination Efforts

Measures to control endemic goiter in Tibet were first initiated in the 1970s. At that time the causal link between endemic goiter and neurological impairment was not understood, consequently these preventative efforts were not very successful. Iodized oil capsules have been distributed sporadically among the population since 1993. In addition there was an initiative undertaken to fortify “brick tea” with iodine, but this was not successful.

An iodizing salt production facility was established in Lhasa in 1998 and in the first year produced 2500 tonnes of iodized salt. The major obstacle to USI is the wide availability of cheap, raw salt harvested from the mountain lakes and bartered for barley and other foodstuffs.

4.2.7 IDD Elimination Project in Tibet

In 1999, with support from WHO, AusAID and UNICEF, we undertook a feasibility study for the development of a whole of Tibet IDD elimination program (Eastman et al 1999). The recommendations from the Feasibility Study were accepted and implemented with financial support from AusAID and WHO. The program comprised support for the development of an iodized salt industry, health education and communication, training, capacity building, management support and the implementation of a short-term iodized oil capsule supplementation campaign. The goals and components of this project have been described in detail elsewhere in 2003 (Li & Eastman 2003). The iodized oil capsule distribution program was implemented as a short-term or interim solution to prevent brain damage and growth retardation in the newborns and infants while USI was being phased in.
Fig. 4 Changes in median Urinary Iodine Excretion (UIE) since commencement of the Tibet IDD Elimination Project in 1999-2000.

WCBA: women of childbearing age
Fig. 5 Changes in goitre rate in Tibetan children since commencement of the Tibet IDD Elimination Project in 1999-2000 (year 1)
4.2.8 Outcomes of the IDD Elimination Project

The Lhasa salt factory has increased production of iodized salt to 5500 tonnes in 2003. This represents approximately 40% of the iodized salt required for human consumption for the population of Tibet indicating that there is a long way to go to achieve USI in Tibet. Nonetheless, dramatic progress has been made since 1999 as median UIE in both children and women of childbearing age have now increased to 143µg/l and 82µg/l, respectively (fig. 4). There has been a concomitant decline in the goiter rate in children from 29% to 11% (fig. 5). The challenge is how to sustain this great gain in the fight to eliminate IDD in Tibet.

4.2.9 Discussion

IDD is endemic throughout the whole of the TAR and there is unequivocal evidence for widespread physical and intellectual impairment among the children of Tibet. While we suggest that iodine deficiency is the major determinant in this process, many other factors may be incriminated in stunting the physical and mental development of these children (Maberly & Sullivan 2001). Notwithstanding these various possible contributory causes, severe iodine deficiency is universal throughout rural Tibet and is associated with a high prevalence of goiter, endemic cretinism, diminished IQ and growth retardation. The TDOH quotes prevalence rates from 2% to 13% in rural villages surveyed. While we have no means of verifying these figures our impressions from visiting and surveying the population of eastern and southern Tibet are that endemic cretinism is very common, as is KBD (Li & Eastman 2003; Eastman et al 1999). In the recent study of children and adolescents with KBD, performed in villages around Lhasa, approximately 1% of these children had classical signs of endemic cretinism (Moreno-Reyes 1998). In this study 66% of the population were severely iodine deficient with a urinary iodine excretion level less than 20µg/l and a goitre prevalence of 46%.

4.2.10 Conclusion

The IDD elimination project commenced in year 2000 has demonstrated great gains in educating the population about the human damage caused by iodine deficiency and the need to supplement the population with iodine. All efforts are now being directed towards ensuring these initiatives will be sustainable.
Acknowledgements

We thank AusAID officers in Canberra and Beijing, WHO/WPRO staff in Manila, ACCIDD personnel, health officials in the Ministry of Health in Beijing and our Tibetan colleagues for their great efforts and support.

References


4.3

Mongolia

ZP Chen

Mongolia is located in the north of China with a population of 2.2 million, an area of 604,000 square miles and average altitude of 1600 meters. There are 21 provinces and the city of Ulaanbaatar is the capital with a population of 600,000. IDD is a public health problem, with goitre prevalent in most of the country. Cretinism is only found in Bulgan in Central Mongolia with the incidence of 0.4% and the hypothyroid type is predominant. The investigation indicated environmental iodine deficiency, i.e. iodine concentration in water is only 0.24-4g/L. An iodized oil program was carried out in most of provinces, which was supported by UNICEF. A National Advocacy Meeting was held in 1995. A National IDD Control Program was established and USI became the major strategy for IDD elimination. The Public Health Institute of Mongolia was appointed as the executive technical body for the implementation of National IDD Control Program.

There are 12 salt companies for the production of iodized salt, of which half are state-owned. Iodine concentration at production level is 50ppm with 20-30ppm at consumer level. However, a large amount of the salt in Mongolia is imported from abroad of which 25-37% is iodized salt with the concentration of 40ppm for human consumption. Potassium iodate will have been supported by (Japanese International Cooperation Agency (JICA) by the year 2000 through a cooperation project. Up to now there is no report on Iodine Induced Hyperthyroidism.

The price difference between iodized salt and crude salt is great (crude salt 75 Tuclic/kg; iodized salt 200-500 Tuclic/kg). Only 42% of the population is covered by iodized salt, therefore, IDD is still prevalent in Mongolia. A JICA Project helped to set up a laboratory for urinary iodine determination in Ulanbaator with support for training and monitoring. There is no strict monitoring system for iodized salt and only the rapid kit has been used for random monitoring. Another problem is there is no effective ban on non-iodized salt in the market. Further progress can be anticipated with the continued support of JICA.

Reference

4.4

Democratic People’s Republic of Korea

ZP Chen

IDD in DPR Korea is a significant public health problem. However, the severity of IDD is not so severe as in other parts of Asia, because Koreans have seafood as a traditional dietary habit for thousands of years. In particular, seaweed is quite common as table food for pregnant and childbearing aged women. Endemic goitre is found in some places, especially in mountainous areas.

Iodized salt is the main strategy for IDD elimination and relative sectors of the government have adopted salt iodization and promote the consumption of iodized salt. The total need of salt for human consumption is 40,000 tons/year, but only one-fourth is iodized. Since the floods the economic situation has been getting worse and salt pans were severely damaged. Some salt was then imported from China with the support of UNICEF to meet the urgent need.

Mr. Lorenzo Locatelli-Rossi (ICCIDD) visited DPR Korea in 1998 and two training workshops on “Universal Salt Iodization in DPR Korea” were organised. He suggested a plan of action focused on rehabilitation of salt works to increase the production of iodized salt.
5

IDD in the Asia Pacific Region: Progress and Problems
Creswell J Eastman

5.1 Summary and Lessons Learnt
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5.1

Summary and Lessons Learnt

Creswell J Eastman

The goal of achieving USI and virtual elimination of IDD, within the Asia Pacific region by 2005 remains a formidable challenge for many countries. Unless IDD efforts and programs can be reinvigorated in a number of countries, where there has been little or no progress in recent years, the goal is not attainable. The commitment and achievements in countries such as Thailand, Indonesia, and more recently Vietnam, provide inspiration to others that sustainable IDD elimination can be realised throughout the Asia Pacific region.
5.2

History and Background

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Iodine deficiency still exists as a major public health problem in a large number of countries in the Asia-Pacific region. The vast geographical expanse of the Asia-Pacific region, covering approximately 40 countries, from tiny Pacific Islands nations to some of the most populous nations on earth, such as Indonesia, poses a challenge in identifying and addressing the problems of IDD in this part of the world. Because many of these countries are island states with large expanses of coastline, and presumably with access to seafood, it has erroneously been assumed that iodine deficiency was not a significant endemic problem. As a consequence, there is little or no data on IDD in many of the smaller nations and a disregard for the crucial role of iodine nutrition in some of the more affluent nations such as Australia and New Zealand. ICCIDD has shown a commitment to address this issue by establishing a new region and appointing a new regional coordinator for the Asia-Pacific region in 2002.

The best source of information on IDD prevalence data comes from the WHO Western Pacific Regional Office (WPRO) in Manila (WHO 2004). In the Western Pacific Region nine countries (Cambodia, China, Mongolia Laos, Malaysia, Papua New Guinea, Philippines, Vietnam and Fiji) have IDD as a significant public health problem. Hong Kong has also been recently recognised as having mild iodine deficiency. There have been reports of goitre being prevalent in New Caledonia, Fiji and some of the other smaller Pacific Islands. However, survey data is limited and these reports will need to be investigated. It is likely that IDD is a significant public health problem in East Timor, as there are many anecdotal reports of endemic goitre in adults and children in the hinterland of this emerging island state. Of major concern are recent reports of the re-emergence of iodine deficiency in Australia and New Zealand (Li et al 2001; McDonnell et al 2003). On the other hand, there are some shining examples of success in controlling IDD within the region, most notably Thailand and Indonesia whose stories will be recounted elsewhere in this book. The available data on household coverage with adequately iodized salt, on a country-by-country basis, indicate that Cambodia and the Philippines are lagging well behind other countries in the region (fig. 1). Data provided by UNICEF. It should be emphasised that data is not available for many countries in the region.
Fig. 1. Household coverage with adequately iodized salt in countries in Asia Pacific region. This data has been collected from 2000 to 2003 and is provided by courtesy of Karen Codling, EAPRO, UNICEF.
5.3

Regional Activities
Creswell J Eastman

5.3.1 Australia and New Zealand

5.3.2 Cambodia

5.3.3 Laos

5.3.4 Malaysia

5.3.5 Papua New Guinea

5.3.6 Philippines

5.3.7 Vietnam


5.3.1 Australia and New Zealand

Several recent surveys have confirmed the re-emergence of mild iodine deficiency in Australia (Li et al. 2001; McDonnell et al. 2003). Median urinary iodine excretion (UIE) levels have decreased from over 100 ug/l, in surveys conducted before 1990, to levels around 80ug/l, in surveys conducted a decade later. This dramatic decline in iodine intake in the Australian population has been attributed to the major decrease in iodine concentrations in dairy milk (Eastman 1999). For several decades the major source of iodine in the Australian diet has been from contamination of milk by iodophores used as sanitising agents in the dairy industry. These chemicals have gradually being phased out and replaced by chlorine-based disinfectants. Because Australia has not had an ongoing monitoring program the problem only came to light through the efforts of researchers interested in IDD. While iodized salt is readily available in most grocery stores and supermarkets, sales of iodized table salt represent less than 10% of the edible salt market in the country. There is no legislation compelling the use of iodized salt in the food industry and there is little awareness among the public of the problems of IDD. The situation in New Zealand is very similar to that in Australia. Both countries share a common food standards authority so any changes to legislation regarding salt iodization will need to be agreed between them before we can expect change.

A National Iodine Nutrition Study is presently underway in Australia to obtain a snapshot of urinary iodine levels and thyroid size in 8 to 10 year old schoolchildren to provide data for the development of a sustainable, comprehensive program for optimal iodine nutrition.

5.3.2 Cambodia

Cambodia still has a major problem with IDD. Iodine deficiency is quite severe throughout the country. A national subcommittee for control of IDD was formed in 1997 and at that time a national goitre survey was undertaken. The national goitre rate has been reported as 12 percent but in some provinces it is as high as 39 percent (UNICEF 1997). Legislation for USI was introduced in 1998 and salt iodization commenced in 1999 with assistance from WHO and UNICEF. There are a number of local salt producing and iodization plants, but in the eastern border areas most salt comes from Vietnam. Much of this appears to be non-iodized salt. Recent data on household coverage with adequately iodized salt indicate that the program to provide USI has stalled (fig. 1). The Ministry of Health in
Cambodia continues to provide iodized oil capsules to people living in remote areas. There are many ongoing community activities for education and social mobilisation promoting the use of iodized salt. Many problems still persist and there is an urgent need to provide Cambodia with more assistance to achieve sustainable IDD elimination.

5.3.3 Laos

IDD has long been recognised as a major public health problem in Laos and was confirmed by the national iodine survey in 1993 that revealed iodine deficiency was almost universal throughout the whole country. 65% of children examined were classified as having severe iodine deficiency. The legislation for USI was introduced in 1995. With financial support from UNICEF local salt producers commenced iodizing salt. Most of the 26,000 tonnes of edible salt produced annually in Laos is now iodized. A goitre survey undertaken in 2000 confirmed that the goitre rate in children had declined from over 50% to only 10%. Despite this great improvement a recent review of the salt industry in Laos commissioned by UNICEF (Locatelli Rossi 2003) unearthed major faults in the production of iodized salt that may explain why iodized salt tested at the household level is frequently inadequately iodized. Resources from WHO, UNICEF and ICCIDD have been mobilised to assist Lao government authorities address the deficiencies in their IDD elimination program.

5.3.4 Malaysia

IDD has been identified as a significant public health problem in various geographic regions of Malaysia, particularly in interior population groups in Sarawak and Sabah (Goek Lin Khor). While there has been legislation since the 1980s that all imported salt be iodized it is not known if this has eliminated IDD from Malaysia.

5.3.5 Papua New Guinea

Severe iodine deficiency was identified in PNG in the 1950s and it was the site of the pioneering clinical research of Pharaoh and Hetzel and their colleagues demonstrating that neurological cretinism could be prevented by the administration of iodine early in pregnancy. While legislation was enacted in 1995 banning the importation, sale and distribution of non-iodized salt the lack of a national monitoring program means there are no recent data to indicate the current status of IDD in PNG.
5.3.6 Philippines

Iodine deficiency continues to be a significant public health problem in the Philippines and iodized salt utilization remains very low. Approximately two-thirds of the children recently surveyed in 1998 and 2001, by means of urinary iodine excretion, in the Philippines had significant iodine deficiency as shown in (IDD Newsletter Feb 2004 page 17). Despite all of the efforts that have gone into eliminating IDD from the Philippines, commencing in the early 1980s and continuing up until now, iodine deficiency remains highly prevalent throughout the whole country.

Table 1. Prevalence of iodine deficiency by urinary iodine excretion levels in the Philippines: data provided courtesy of Karen Codling, UNICEF

<table>
<thead>
<tr>
<th>Prevalence of IDD in the Philippines</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1998 Survey - urinary iodine levels</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>- Median UIE = 71µg/L</td>
</tr>
<tr>
<td>- 34.7% = &gt;100µg/L (no IDD)</td>
</tr>
<tr>
<td>- 29.6% = 50 -99µg/L (mild IDD)</td>
</tr>
<tr>
<td>- 23.5% = 20-49µg/L (moderate IDD)</td>
</tr>
<tr>
<td>- 12.3% = &lt;20µg/L (severe IDD)</td>
</tr>
<tr>
<td><strong>Comparison : UIE &lt; 100µg/L (Children with IDD)</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>- Philippines: 65.4%</td>
</tr>
<tr>
<td>- Vietnam: 39.2%</td>
</tr>
<tr>
<td>- Laos: 27.45%</td>
</tr>
</tbody>
</table>
Explanation for lack of success for USI in the Philippines

Fig. 2 The reasons for the Philippines not succeeding in eliminating IDD are multiple and are summarised.
We need to accelerate progress in order to achieve the goal of at least 90% coverage by 2005.

Fig. 3. Shows the progress Vietnam has made towards achieving the target of USI
In 2003, new initiatives were developed and instituted to accelerate progress to achieve the goal of USI. These efforts have been spearheaded by the Department of Health and supported by UNICEF, Kiwanis and ICCIDD. There is renewed optimism that strengthening and enforcing the law on salt iodization will see progress in the effort to eliminate IDD. The reasons for the Philippines not succeeding in eliminating IDD are multiple and are summarised (fig. 2).

5.3.7 Vietnam

The first IDD control programs in Vietnam were established in the early 1970s. The initial focus was on the mountainous provinces in the North where goitre rates were as high as 55%. A nationwide survey was undertaken in 1993 and the average goitre rate in children was 22% and the median urinary iodine excretion was only 32µg/L. The government of Vietnam responded by establishing a national IDD control committee and developed a nationwide network of salt iodization plants. AusAID provided technical and other assistance to assist in establishing this program. In 1999 the government issued a decree relating to the production and supply of iodized salt for human consumption. Currently, the rate of coverage for adequately iodized salt in Vietnam has risen to 82.5% and 31 of the 61 provinces in Vietnam have coverage rates above 90 percent (fig. 3). The Vietnamese government has a policy for subsidising iodized salt for some 12 million ethnic minorities in mountainous areas of the country. There is a very well organized and efficient national IDD committee that oversees monitoring of the IDD elimination program. Provincial IDD committees undertake monitoring surveys three times a year and there is a national survey every second year. There is a central laboratory in the Hospital for Endocrinology in Hanoi that oversees all laboratories monitoring for urinary and salt iodine levels. IEC activities are well developed but are focused more on the elimination of endemic goitre rather than prevention of brain damage from iodine deficiency.

To ensure sustainability of the IDD elimination program it will be necessary for the government of Vietnam to strengthen the legislation to achieve USI and eliminate non-iodized salt from the marketplace. Vietnam expects to achieve the USI goal of over 90% coverage of the population and reduction of goitre rates to less than 10% by end of the year 2005.
References


5.4

IDD Control in Indonesia
R. Djokomoeljanto, Satoto, Rachimi Untoro

5.4.1 Introduction

5.4.2 Intervention Programs
   5.4.2.1 Iodized Salt
   5.4.2.2 Iodinated Oil Capsules

5.4.3 Monitoring and Evaluation

5.4.4 Strength and Weaknesses of the Indonesia IDD Control Program

5.4.5 Recommendations

5.4.6 Salt Situation Analysis in Indonesia

5.4.7 Further Comments

5.4.8 Conclusion
5.4.1 Introduction

IDD has been known in Indonesia for many years. The oldest information about Goitre comes from Javanese copper inscriptions found at Bangli in Bali. A national survey in 1980-1982 of primary school children in 26 provinces described a >10% goitre prevalence in 68% of sub-districts and a >30% prevalence in 40% of sub-districts, reaching >80% in some villages. That same survey estimated that the country had 75,000 cretins (comprising 10-15% of the population in some areas), 3.5 million people with goitre, and 35 million living in endemic areas. By 1988 the total goitre prevalence (TGR) had decreased to 25%, and further to 19.9% in 1990.

The latest survey, in 1998, covered 27 provinces and found the distribution of the population among areas, according to goitre prevalence, was: non-endemic, 142.5 million; mild endemic, 36.8 million; moderate endemic, 8.2 million; and severe endemic, 8.8 million people. The TGR in schoolchildren had declined to 9.8%, better than the country’s target of 18%, but the TGR of pregnant women in the same villages was 16.0%. The median UEI (urinary excretion of iodine) of pregnant women showed that 72% were $\geq 100$ µg/L, and 13% were 50-99 µg/L. The median TSH in pregnant women was 4.0 µU/ml, and 30% were $\geq 5.0$ µU/ml. Only 64% of households consumed adequately iodized salt (>30 ppm). The proportion of salt samples that met the requirement for fortification correlated well ($r=0.8$) with the median UEI of pregnant women.

It was estimated that the country lost 130,800,000 IQ points from iodine deficiency (Muhilal, 1998). Minimal brain dysfunction occurred even in formerly deficient areas that were now replete, despite normal UEI in schoolchildren and no increase in goitre prevalence (Bambang-Hartono 1996). Neonatal TSH values closely correlated with those of mothers (Yasin 1989). Furthermore, in iodine replete areas, some mothers with TSH of $\geq 5$µU/ml give birth to children with abnormal neurological development noted at 0-2 years of age. Other serious problems were smaller birth weight, prematurity, and spontaneous abortion (Bambang Hartono 2001). The administration of iodized oil capsules improved infant survival (Cobra 1997).

5.4.2 Intervention programs

The intervention program in Indonesia followed the social process model put forward by Hetzel at the First Seminar on Endemic Goitre and Cretinism in Indonesia, held at Semarang in 1978. It was based on epidemiological studies showing IDD on virtually every island, and an
appreciation of the damaging effects of iodine deficiency on the population, especially in the severely affected areas. In 1976 a goitre prevention component was adopted as part of Indonesia’s community nutrition program. At a seminar in Semarang it was decided to classify endemic goitre by its prevalence as mild (10-19%), moderate (20-29%) and severe (>30%); this latter category also included the presence of endemic cretins in the population.

The country adopted the goal that no cretin would be born after the year 2000 (later changed to 2010). In 1990 a Ministry of Health decree established a National IDD Committee, which developed three strategies: (1) iodized salt for human consumption as the permanent long-term strategy; (2) iodinated oil injection or capsules for severely endemic areas, as a short term measure; and (3) iodized water as an appropriate technology in special high risk areas. (Benny Kodyat 1991)

5.4.2.1 Iodized salt

Salt Iodization began under Dutch rule in 1927, but stopped in 1945 when the salt monopoly was disbanded. A well established infrastructure is needed to provide and distribute good quality iodized salt throughout Indonesia, an archipelago with more than 13,000 islands. To simplify the problem, a blanket approach with 40 ppm KIO3 (+ 25%) was adopted. A preliminary intervention trial in Central Java proved that this salt was effective in reducing goitre and increasing urinary iodine (Djokomoeljanto 1976, unpublished). The campaign against IDD started in 1976, with UNICEF support. Initially, responsibility and accountability for enforcement were not clear within the government, and no mechanism for coordination among involved ministries and the private sector existed.

In 1990, the Indonesian Government (GoI) resumed a nationwide IDD control programme with the assistance of the World Bank, UNICEF and other agencies. Its goal was to reduce the prevalence of IDD by monitoring the iodine status of the community and increasing the supply of iodized salt and its consumption, while improving intersectoral coordination.

The GoI started its Intensified IDD Control (IIDC) Project in 1997, with support from the World Bank. Progress has been slower than expected because of unresolved problems with poor accountability and weak enforcement. National consumption of iodized salt at the household level increased from 78.2% in 1995 to 81.5% in 1999. However, the adequacy of iodized salt (i.e., containing > 30 ppm) rose only from 50% in 1996 to 65.5%,
Table 1. Percentage of households using adequately iodized salt (≥30ppm), by province and some districts.

<table>
<thead>
<tr>
<th></th>
<th>WSm</th>
<th>Wjv</th>
<th>Cjv</th>
<th>Pati</th>
<th>Rbg</th>
<th>Ejv</th>
<th>Pb</th>
<th>NTB</th>
<th>NTT</th>
<th>SS</th>
<th>SES</th>
<th>Mlk</th>
<th>Mgl</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>93.7</td>
<td>59.2</td>
<td>61.9</td>
<td>55.7</td>
<td>31.5</td>
<td>60.5</td>
<td>35.5</td>
<td>12.1</td>
<td>15.4</td>
<td>27.3</td>
<td>58.7</td>
<td>33.4</td>
<td>65.8</td>
</tr>
<tr>
<td>1999</td>
<td>90.3</td>
<td>54.3</td>
<td>55.7</td>
<td>49.1</td>
<td>31.9</td>
<td>63.6</td>
<td>28.4</td>
<td>12.5</td>
<td>23.0</td>
<td>36.6</td>
<td>52.9</td>
<td>34.9</td>
<td>57.8</td>
</tr>
<tr>
<td>2000</td>
<td>90.5</td>
<td>57.7</td>
<td>51.8</td>
<td>57.5</td>
<td>30.1</td>
<td>63.3</td>
<td>26.4</td>
<td>13.7</td>
<td>29.2</td>
<td>43.4</td>
<td>59.0</td>
<td>60.5</td>
<td>47.9</td>
</tr>
<tr>
<td>2001</td>
<td>86.1</td>
<td>62.7</td>
<td>55.7</td>
<td>53.9</td>
<td>22.9</td>
<td>63.2</td>
<td>35.8</td>
<td>18.8</td>
<td>32.4</td>
<td>54.7</td>
<td>60.7</td>
<td>--</td>
<td>73.8</td>
</tr>
<tr>
<td>2002</td>
<td>92.9</td>
<td>67.8</td>
<td>54.6</td>
<td>44.0</td>
<td>36.1</td>
<td>67.8</td>
<td>35.4</td>
<td>18.0</td>
<td>32.6</td>
<td>59.9</td>
<td>58.7</td>
<td>--</td>
<td>63.8</td>
</tr>
</tbody>
</table>

Source: Technical Monitoring Mid Term Evaluation, Pati & Rbg, Pb are subdistricts with huge production of people’s salt.
**Table 2.** Storage modes for household iodized salt and their iodine contents

<table>
<thead>
<tr>
<th>Method</th>
<th>Satisfactory (S)</th>
<th>Unsatisfactory (US)</th>
<th>Nil (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed</td>
<td>75.2%</td>
<td>12.5%</td>
<td>12.2%</td>
</tr>
<tr>
<td>Open</td>
<td>49.9%</td>
<td>23.5%</td>
<td>26.6%</td>
</tr>
<tr>
<td>Near oven/stove</td>
<td>59.6%</td>
<td>19.3%</td>
<td>21.2%</td>
</tr>
<tr>
<td>In the cupboard</td>
<td>81.7%</td>
<td>11.1%</td>
<td>7.2%</td>
</tr>
<tr>
<td>On the rack</td>
<td>70.1%</td>
<td>14.8%</td>
<td>15.1%</td>
</tr>
</tbody>
</table>

*BPS 2002, 5=>30 ppm, US < 30 ppm*

**Table 3.** Number of iodinated oil injections (lipiodol) distributed and its coverage (Benny Kodyat, 1991)

<table>
<thead>
<tr>
<th>Plan (years)</th>
<th>Target</th>
<th>Total injections</th>
<th>% coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>II (1974-1979)</td>
<td>1,036,828</td>
<td>1,036,828</td>
<td>100%</td>
</tr>
<tr>
<td>III (1979-1984)</td>
<td>6,484,262</td>
<td>5,928,915</td>
<td>91.0%</td>
</tr>
<tr>
<td>IV (1984-1989)</td>
<td>5,672,365</td>
<td>4,496,359</td>
<td>79.0%</td>
</tr>
<tr>
<td>Total</td>
<td>13,193,455</td>
<td>11,462,192</td>
<td>86.7%</td>
</tr>
</tbody>
</table>
Table 4. Coverage of iodinated oil capsules (Yodiol®) in the year 2000.

<table>
<thead>
<tr>
<th></th>
<th>Women of Child Bearing Age</th>
<th>Pregnant women</th>
<th>Nursing Mothers</th>
<th>Primary School Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target</td>
<td>7,177,519</td>
<td>870,273</td>
<td>914,470</td>
<td>678,661</td>
</tr>
<tr>
<td>Distributed</td>
<td>4,365,509</td>
<td>756,693</td>
<td>560,720</td>
<td>569,444</td>
</tr>
<tr>
<td>Coverage (%)</td>
<td>60.8%</td>
<td>86.9%</td>
<td>61.3%</td>
<td>83.9%</td>
</tr>
</tbody>
</table>

Source: Directorate of Nutrition, MoH, Nov, 2001

Table 5. Urinary iodine concentrations from different sources in Central Java, 2003

<table>
<thead>
<tr>
<th></th>
<th>&lt;100µg/L</th>
<th>100-300µg/L</th>
<th>&gt;300µg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private outpatients</td>
<td>11.9%</td>
<td>66.7%</td>
<td>21.4%</td>
</tr>
<tr>
<td>(n=126)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private St Elisabeth Hospital (n=75)</td>
<td>2.7%</td>
<td>94.5%</td>
<td>21.0%</td>
</tr>
</tbody>
</table>


63.5%, 64.6%, 65.5% and 68.6% in 1998, 1999, 2000, 2001 and 2002, respectively.

According to the assessment of Susenas (the National Health Survey), only 4 of 27 provinces reached the target of >90% of households consuming iodized salt. Provinces in Java and Bali were still at the level of 40 – 70%, two provinces did not change. Based on comparisons within districts between 1998 and 2002, 57.5% of districts stayed at the same level, 14.6% were worse, and 19.6% improved their iodized salt consumption.

The salt industry relies on more than 25,000 small salt farmers to produce about 80% of the country’s salt (called people’s salt), with the remaining 20% provided by PT Garam, a government enterprise. The salt farmers are concentrated along the north coast of Java, and in Madura, Bali, South Sulawesi and East Nusa Tenggara. Java and Madura have the greatest capacity for salt production, and it is very low elsewhere. Small farmers use primitive traditional technology, producing low quality salt that is not suitable for Iodization. Their product is cheaper and has its own channel in the salt market, being sold to traders who then resell it to processors for Iodization and packaging. Monitoring of iodine levels in salt is the responsibility of the Ministry of Trade and Industry and the Institute for Drug and Food Control (Badan POM), depending on whether it is checked at production, retail or household level. Information sharing is needed but is not always smooth.

The report of the Mid-Term Evaluation of the IIDC Project (2000) showed that USI coverage for households is far from satisfactory (Table 1). Two issues may arise. In Java, the districts with many producers of people’s salt (Indramayu, Cirebon, Pati, Rembang, Probolingga) have a low consumption of iodized salt, perhaps due to infiltration of non-iodized salt and lack of public awareness. The other problems are logistic, in NTT, NTB and Maluku. For both issues law enforcement is the key to success.

Other observations from BPS showed that the concentration of iodine in salt is influenced by the storage method in homes (Table 2).

5.4.2.2 Iodinated oil capsules

When severe and mild IDD were simultaneously found in the early stage of intervention, both the blanket approach with 40 ppm iodized salt and iodinated oil injection (‘lipiodol,’ containing 480 mg iodine per ml) were introduced. The latter was directed to remote areas and those with moderate to severe IDD, as judged by the TGR of school children and national survey results. Injection was given every 4 years: 0.2-0.4 ml
lipiodol for children age 0-6 months, 0.3-0.6 ml for age 6-12 months, 0.5-1.0 ml for age 6mo-6 years, and 1-2 ml for age 6-45 years (Hetzel 1978).

Tables 3 summarizes targets and actual implementation of the injection program in 25 provinces from 1974-1989 (Five Year Development Plan II through IV). Overall, 11,462,192 of the 13,193,455 targeted injections (86.8%) were administered (Country Report, New Delhi 1989). Evaluation showed that this approach was not efficient as a national program, although effective for special circumstances. The GoI stopped it for several reasons, including failure to reach the same persons each 4 years, concerns about the risk of hepatitis from injections, the need to import the iodized oil, and high delivery costs.

PT Kimia Farma, with the help of Australia’s CSIRO (endorsed by Dr. Hetzel), produces yodiol® capsules (‘iodized-peanut-oil’ Kimia Farma Indonesia), which were then used in the national intervention program to overcome the above mentioned problems. This capsule was effective in preventing and treating IDD when given once a year. Subsequent field studies showed that iodized peanut oil was more efficacious in controlling iodine deficiency than was poppyseed oil containing the same amount of iodine (Untoro 1999). The capsule can be distributed through the channel already existing for vitamin A. Again, the criterion for receiving yodiol is the TGR of community schoolchildren and that of the rest of the population (r=0.93) (Tarwotjo 1982) which was also confirmed by the latest survey (Muhilal 1998). The 1995/96 – 1997/98 surveys revealed that the coverage of yodiol capsule distribution was good in pregnant women in areas with a high TGR, but not in those with a low TGR (Muhilal 1998). Each yodiol capsule contains 200 mg I/ml (±12 drops). The dose depends on the age and gender and is given once a year: infant (<1yr) 100 mg (6 drops), preschool children (1-5yrs) 1 capsule, and males 6-20 yrs 2 capsules. (Dept Health 1992)

In the year 2000 the iodinated capsule target was 7,177,519 for CBW (women of child bearing age), 870,273 for pregnant women, 914,640 for nursing women and 676,661 for primary school children. However, the actual coverage achieved only 60.84% target for CBW, 86.9% for pregnant women, 61.3% for nursing women, and 83.9% for schoolchildren (Directorate of Nutrition, 2001).

5.4.3 Monitoring and evaluation

The last survey determined goitre rate by palpation, which is known to have both inter-observer and even intra-observer variation. To investigate this, we applied the ThyroMobil model, initiated by Delange in
Europe, in 5 provinces in Indonesia. Our aim was to evaluate the present IDD status, using the internationally standardized methods of ultrasonography with estimates of size by palpation.

We found that IDD had been eliminated in large parts of Indonesia, but in many places it was replaced by iodine excess. In Java and Sumatra the median UEI was 195 µg/L. Only 17.2% of samples were below 100 µg/L, but 18.2% were above 300 µg/L, and 0.7% were even above 1000 µg/L! An extremely high value (>3000 µg/L) was only found in Central Java, in the district of Sukohardjo. We have not yet checked for iodine-induced hyperthyroidism. With the exception of Bali, results from the other studied provinces (West Sumatra, West Java, Central Java, Yogyakarta) were good (Djokomoeljanto 2001). These data supported those of the 1998 national survey indicating that IDD had been eliminated from most of Indonesia. Furthermore, the correlation between prevalence by palpation (9%) and ultrasonography (8.6% by age, 6.8% by body surface area) was very good (Djokomoeljanto 2001).

The program and its impact are now being evaluated, results to be ready early in 2004. Preliminary data from Central Java are encouraging as to iodine sufficiency, but many urine samples have excessive iodine (> 300 mg/L). The informal experience of one of us (RD) with urinary iodine determinations from private patients in Central Java, consulted for other thyroid diseases, suggested that their iodine status was good, but around 20% had elevated urinary iodine concentrations, raising the question of whether the amount of iodine in salt–40 ppm– should be lowered. Data of 2003 show schoolchildren from Sukohardjo still have very high UEIs (also noted in the ThyroMobil study) and their urinary iodine concentrations should be checked regularly.

5.4.4 Strength and weaknesses of the Indonesian IDD Control Program

Strengths – These include a political commitment to continue the IDD-CP, the existing updated regional goitre map, the Presidential Decree and Inter-Ministerial Decrees and Commitments on iodized salt regulation, and the good collaboration between the Dept. of Health and researchers in universities.

Weaknesses – Prominent among these are the geography of an archipelago like Indonesia, the diverse cultural pattern that dictates various preferences for types of food and salt, inadequate public awareness about IDD, the existence of much local salt of differing quality produced by poor farmers with their own socioeconomic problems, and the early stages of
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decentralization, which makes it difficult to develop and disseminate a standardized strategy for IDD elimination.

In order to have an Indonesian referral center for IDD and the IDD Control Program, the IDD Center (Pusat GAKY) was established in 2001 in Semarang, site of an internationally recognized IDD Laboratory. The mission of the Center is to develop expertise and support facilities in all IDD-related issues, to promote national IDD control in Indonesia, and to collaborate with all stakeholders in Indonesia and other countries towards IDD elimination. The Board of the Center consists of experts and interested scientists in IDD from the country’s universities and research centers. A scientific journal on IDD and other information and communication systems are developed to advance the mission, and an IDD seminar is organized annually. The Center together with the IDD laboratory has a significant role in the latest final evaluation of the country’s IIDDC Project (Intensified Iodine Deficiency Disorders Control Project).

5.4.5 Recommendations

The implementation of USI should have priority, especially in prominent salt producing provinces. Enforcement and control should be intensified to guarantee that only iodized salt is distributed in non-producing provinces, especially those that still have pockets of IDD. Imported or inter-island salt for consumption should be iodized at the focal point or earlier before distribution. The program and its impact on iodine nutrition must be monitored regularly. From our study, urinary iodine excretion is the most appropriate outcome indicator for efforts against iodine deficiency under field conditions at the district level (Pardede 1998), and the IDD Center with its IDD lab can support this program.

Appropriate iodized salt production technology should be available to the poor farmers or to groups (cooperatives) to enable them to produce better salt for iodization and to improve its selling price. The Ministry of Industry and Commerce has a heavy task to cope with these problems and attain the goal in 2010. Law enforcement must be endorsed, and social marketing should be strengthened.

Iodinated oil is still needed in the IDD control program to cover pregnant and nursing women, as well as women of childbearing age. In the meantime, people’s awareness about IDD and the means for its correction should be enhanced through all available communication channels.
5.4.6 Salt Situation Analysis in Indonesia

In August, 2003, UNICEF sponsored a mission by a team, headed by Dr. Frits van der Haar, to review progress towards sustained IDD elimination in Indonesia through iodized salt. The report offers a detailed analysis of iodized salt and its utilization in the country.

Salt is produced in the country by evaporation of seawater, and this accounts for about one-third of the market, the other two-thirds coming from imports. Demand estimates in 2003 were household salt 700,000 MT (200,000 to be imported) and 55,000 MT in the food industry (35,000 MT from imports). East Java is the largest producing area (65%) followed by Central Java (14%), West Java, and South Sulawesi.

The country has about 20,000 small farmers, and 376 registered producers licensed to process iodized salt. Of these, about 80 produce adequately iodized salt. PT Garam is a state-owned entity that both produces and purchases people’s salt. Non-iodized salt reaches consumers by direct sales from farmers or traders. Salt importation is relatively new, since 1998. The main sources are Australia and India. Efforts at improvement of quality have been only modestly successful. A considerable discrepancy in the market exists when non-iodized salt is available. Thus, the use of iodized salt is lower in the salt-producing provinces than elsewhere in the country. Monitoring of salt and enforcement of the regulations are not vigorous. Producers have little incentive to iodize salt. Indonesia produces its own iodine, under a monopoly by the state-owned company, Kamiah Farm.

The report offers detailed data from 2002 on iodized salt utilization, by province. In about one-third of the districts, household iodized salt consumption was less than 40%. The remaining 56% of districts had household iodine consumption in the 40-89% range. The lowest consumption of iodized salt was in salt-producing regions.

The mission commented on advocacy and communication. A division of responsibility within the central government has limited enforcement of regulations for salt iodization. With decentralization, recent efforts have been directed at district legislation. Nationally, knowledge about the importance of iodized salt is about 72%. Communication measures have included TV and radio spots, public service announcements, pamphlets, brochures, and health promotion material from the Ministry of Health. Various women’s groups have been recruited for advocacy.

The national legislation requires that household salt must be iodized and contain 30 ppm iodine, but the wording in the various decrees makes
it possible to sell non-iodized salt directly to consumers. Several districts have passed laws that forbid this.

The mission made a number of recommendations, mostly for the Ministry of Industry and Trade, which is responsible for salt. These included: (1) addressing the problem of non-iodized salt reaching households; (2) assuring that iodized salt is actually being used throughout the food processing industry; (3) supporting district legislation prohibiting the sale of non-iodized salt; (4) advocacy; (5) permanent funding for annual monitoring of household iodized salt use in districts; (6) strengthening the message in health education by emphasizing protection of the developing brain; (7) involving religious leaders in delivering the IDD message; (8) assessing salt flow at the district level, and developing strategies to see that it is iodized; (9) encouraging community monitoring of iodized salt; (10) using partners for advocacy; and (11) offering assistance at the district level in developing annual plans for IDD elimination.

5.4.7 Further Comments

Several coordinating committees exist. One is chaired by the Director General of the Ministry of Community Health, and the Head of Nutrition is its Secretary; a main task for it has been handling the large World Bank-funded project for salt iodization, which ends in 2004. A fortification coalition also exists, to consider applying for GAIN funding, but iodine is not a prominent focus for it.

A meeting in December 2003, chaired by Dr. Rachmi Untoro, Director of Nutrition in the Ministry of Community Health, included about 20 participants, from various branches of the government, salt producers, the IDD Center, UNICEF, Kamiah Farm, and the IDD control program. The group noted that the results of the 2003 survey with urinary iodine determinations will be available shortly; initial data show that the urinary iodine levels in most places are in the iodine-sufficient range, and some trend towards excess. There was much discussion about small producers who sell non-iodized salt of low quality locally at prices considerably less than that for the iodized product.

The law requires 30-80 ppm and applies to animals as well as humans, but it is not strongly enforced. As elsewhere, most of the price difference comes from a simultaneous upgrading of salt quality, and efforts to iodize the community without upgrading salt quality were suggested. There was general agreement that because of decentralization, most efforts must be
through local governments and should emphasize education, support from local leaders, acceptable prices for iodized salt, and then enforcement. Currently, about 73% of households use adequately iodized salt (at least 30 ppm), and another 12% have some iodine, but <30 ppm; thus 85% are receiving some iodized salt. The urinary iodine data suggest that some iodine may be consumed from other sources, but these have not been identified.

Dr. Djokomoeljanto described several initiatives towards coalitions. One is a working group of colleagues from different universities who are interested in IDD. These are being consulted along with public health officials in their communities to develop approaches to local coalitions. In his area of Semarang, he has formed a coalition for central java, which includes endocrinologists, the IDD Center, nutritionists, public health workers, the Department of Industry, experts in salt engineering, salt producers, representatives of local governments, NGO’s, and the media. This group meets every month at different sites to promote activities aimed at IDD elimination, investigation, and universal salt iodization. He has also developed a national network of academics concerned with IDD, and is responsible for IDD in the Indonesian Endocrine Society.

5.4.8 Conclusion

Indonesia has made great progress against IDD with salt iodization. The key problem is the availability of non-iodized salt in many areas, especially those that produce salt. With decentralization, much of the effort is now shifting to district level, to develop locally appropriate laws prohibiting the use of non-iodized salt. Meanwhile, several coalitions of groups involved at various levels with IDD elimination are being established. Much has been accomplished in the past two decades, but much more remains to be done.

Acknowledgements

We thank Drs. Andries Querido (deceased), Basil S. Hetzel, Francoise Delange, John T. Dunn, and many others for their interest and support in stimulating the work of IDD eradication in Indonesia. Thanks are also due to the former officials of the Dept. of Health, Republic of Indonesia, who were responsible for the IDD prevention project, friends, members of the Indonesian IDD Group and the IDD Workgroup, the Diponegoro Medical Faculty, and the NGO’s who have worked hard in this national effort.
Reference


6

Middle Eastern and North African Region

F Azizi

6.1 Summary and Lessons Learnt

6.2 Background and History

6.3 Islamic Republic of Iran

6.4 Other Countries
6.1 Summary and Lessons Learnt

Summary of IDD characteristics (prevalence, areas of endemicity, control measures, iodized salt production and consumption and urinary iodine levels, total raw and iodized salt production) in countries of the Middle East and Eastern Mediterranean Region are described.

In general this region could be considered as one of the problem regions of the world, with many areas of moderate to severe iodine deficiency. The efforts of international organizations such as WHO, UNICEF and ICCIDD have helped the countries of ME & EMR Region to evaluate IDD in almost all countries, implement control programs including salt iodization in many and sustainable control of IDD elimination program in some countries.

The I.R. Iran conducts an optimal program for control of IDD. A sustainable and well-managed iodization program is functioning in the I.R. Iran with the following programmatic indicators:

a) From 1989, an effective and functional national body, the IDD National Committee, responsible to the government for the elimination of IDD has been active. This council is multidisciplinary involving the relevant fields of nutrition, medicine, industry, education etc.

b) Political commitment to universal salt iodization and the elimination of IDD has been formed in 1989 and is ongoing.

c) A responsible executive officer has been appointed for the IDD elimination program since 1990.

d) Legislation on universal salt iodization has been applied since 1992. Ministry of Industry announced that salt factories should produce only iodized salt for household use.

e) The country has been committed to assessment and re-assessment of progress in the elimination of IDD, with unlimited accesses to laboratories able to provide data on salt and urinary iodine.

f) A program of public education and social mobilization on the importance of IDD and the consumption of iodized salt have been vigorously followed in the last 11 years. The program has been integrated into the health network, with full participation of Behvarzes (rural health workers) in education and monitoring.

g) Regular data on salt iodine at factory (daily), retail (monthly) and household levels (yearly), are collected in each province and analyzed by the National Committee.
h) Regular laboratory data on urinary iodine in school-aged children with appropriate sampling for higher risk areas is in process in each province on yearly basis and nationally every 5 years.

i) Excellent co-operation from the salt industry in maintenance of quality control, supervised by the IDD executive officer.

j) Database with recording of results and regular monitoring procedures, particularly for salt iodine and urinary iodine, now available in the Ministry of Health. Neonatal TSH has been measured in Tehran in 1989 and 1997-1999. This shows significant decrease in transient hyperthyrotopicemia and recall rate.

The I.R. Iran therefore fulfills all 10 programmatic indicators set by (WHO/UNICEF/ICCIDD 2001; Azizi 2002). According to these criteria, I.R. Iran appears to have reached sustainable IDD control program since 1996, an achievement that has been recognized by WHO-EMRO in the year 2000. Monitoring of IDD control program is planned every 5 years to evaluate the sustainability of the program. It is concluded that implementation of an adequate and sustainable program of IDD control requires many effective programmatic steps, in particular its integration in the health network and mandatory iodized salt consumption.

6.2 Background and History

High prevalence of endemic goitre and findings of severe iodine deficiency in Chitral and Gilgit regions of Pakistan was reported in the Lancet in the early years of the 20th Century (McCarrison 1908). Regardless of the high rates in many regions of many other countries in EMR (e.g., Mosul province in Iraq, Shahriar in the I.R. Iran, and in most regions of Lebanon), goitre was regarded as being strictly restricted to certain geographical areas and, thus, not considered as public health problem of national importance (Baghchi, Rejeb 1987). Therefore, surveys in EMR countries had been limited to one or two endemic areas. The Islamic Republic of Iran began to study the prevalence of goitre and other iodine deficiency disorders in 1983 and conducted a national IDD survey in 1989, which revealed hyperendemic and endemic goitre in all provinces of Iran (Azizi et al 1990). A major landmark in IDD control in the EMR was the review of the prevalence and control measures of iodine deficiency disorders in EMR Member States in 1987 (Baghchi, Rejeb 1987). For the first time, it brought to the Member States’ attention, the fact that in a
number of countries of this region, IDD was a major public health problem merits serious consideration and urgent action. Table 1 summarizes major activities related to IDD in the Region in the last 13 years.

In order to respond to the growing interest of member states, EMRO convened an inter-country consultation of experts in December 1987 to collect more information, exchange experiences and develop guidelines that would assist countries to define the problem and mount national control programs. These guidelines were published (in Arabic and English) in 1988 as EMRO Technical Publication No12, entitled “Guidelines for a National program for the control of Iodine Deficiency Disorders in the EMR”

Table 1. Major IDD Activities in the ME & EMR since 1987

<table>
<thead>
<tr>
<th>Year</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987</td>
<td>Review of IDD in EMR Member States</td>
</tr>
<tr>
<td>1987</td>
<td>Inter-country consultation</td>
</tr>
<tr>
<td>1989</td>
<td>IDD survey in I.R. Iran and IDD control program</td>
</tr>
<tr>
<td>1990</td>
<td>Inter-country workshop in Tehran, I.R. Iran</td>
</tr>
<tr>
<td>1990</td>
<td>IDD discussion- 37th session of WHO-EMRO</td>
</tr>
<tr>
<td>1992</td>
<td>Training workshop for laboratory staff, Damascus, Syria</td>
</tr>
<tr>
<td>1994</td>
<td>MENA, regional IDD workshop, Tehran, I.R. Iran</td>
</tr>
<tr>
<td>1995</td>
<td>The first regional meeting of salt producers in Jordan</td>
</tr>
<tr>
<td>1996</td>
<td>Iodine sufficiency in I.R. Iran</td>
</tr>
<tr>
<td>1999</td>
<td>Symposium-workshop on assessment &amp; monitoring, Tehran I.R.Iran</td>
</tr>
<tr>
<td>2000</td>
<td>Regional meeting for promotion of iodized salt, Dubai, UAE</td>
</tr>
<tr>
<td>2000</td>
<td>IDD free countries: I.R. Iran, Tunisia. Salt iodization started in 17 countries, USI achieved in 6 countries</td>
</tr>
<tr>
<td>2001 &amp; 2002</td>
<td>First and second IDD Regional Training Course: Monitoring and evaluation of IDD elimination program, Tehran, I.R. Iran</td>
</tr>
</tbody>
</table>
In 1990, an inter-country workshop on IDD was held in Tehran, I.R. Iran, to exchange experiences and to develop approaches. Subsequently, a technical paper was presented to the thirty-seventh session of the WHO Regional Committee for the Eastern Mediterranean, alerting the ministers of health of all countries of the region to the devastating effect of IDD on brain development and cognitive function. Since then WHO, often jointly with UNICEF and ICCIDD, has made great efforts to support countries in their efforts to deal with this very important deficiency, holding a number of important workshops and training courses. A tri-regional traveling seminar organized in collaboration with the WHO-EMRO, South East Asia and Western Pacific region in India and Nepal in 1991 to observe salt iodization and iodize oil in practice; the first meeting on universal salt iodization for salt producers in the Region was held in Jordan in 1995 and a number of technical consultancies were conducted. Of these, the MENA regional IDD workshop was held in December 1994 in Tehran, I.R. Iran by UNICEF and a symposium workshop on assessment and monitoring of IDD in countries of EMR was held by WHO, September 1999 in Tehran.

In 1988, the I.R. Iran carried out the first national IDD survey in the Region, which revealed a high prevalence of IDD (Azizi et al 1990). According to the latest report of EMRO in 1999, Egypt, Jordan, Lebanon, Morocco, Oman and the Syrian Arab Republic also carried out surveys. The Islamic Republic of Iran and the Syrian Arab Republic were the first countries in the region to start iodizing salt. The first regional meeting of salt producers in the Eastern Mediterranean Region, held in 1995, led to the establishment of a regional association of iodized salt producers.

6.2.1 Present State

By late 1998, 13 countries and in 2000, 16 countries had initiated salt-iodization and 6 countries had reached the goal of universal salt iodization (USI) by demonstrating that at least 90% of households consume adequately iodized salt (fig.1)

I.R. Iran had been declared as an “IDD free” country by showing that more than 95% of households consumed adequately iodized salt and the median urinary iodine is above 100µg/L in each of the 26 provinces (Regional Meeting, Dubai 2000). More recently, Tunisia has also achieved satisfactory iodine status and both countries have been accorded IDD-free status by WHO-EMRO in the year 2000 (Regional Meeting Dubai 2000). In 2001 the Endocrine Research Center and the Ministry of Health
of I.R. Iran were appointed by WHO/EMRO to hold an annual training course on monitoring and evaluation of IDD elimination programs; the two initial courses were offered in 2001 and 2002 with participation of 12 countries (2001) and 21 countries (2002) of the region together with countries of Central Asia and Eastern Europe, respectively.

In the year 2001, the status of IDD in the ME & EMR countries was:

- **Mild IDD**: Bahrain, Egypt, Kuwait; Libya, Oman, Palestine, Qatar, and UAE.
- **Moderate IDD**: Morocco, Saudi Arabia, Sudan, and Yemen;
- **Severe IDD**: Afghanistan, Iraq, Pakistan; and

### Table 2. The status of IDD in the Middle East and Eastern Mediterranean Region, 2001

<table>
<thead>
<tr>
<th>Name of Countries</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.R. Iran, Tunisia</td>
<td>IDD eliminated</td>
</tr>
<tr>
<td>Jordan, Syria, Lebanon, Yemen</td>
<td>IDD almost controlled</td>
</tr>
<tr>
<td>Sudan, Pakistan, Egypt, Libya, Oman, Morocco, Iraq</td>
<td>USI begun, data is needed</td>
</tr>
<tr>
<td>Bahrain, Kuwait, UAE, Qatar, Palestine</td>
<td>Mild IDD or data unavailable</td>
</tr>
<tr>
<td>Afghanistan</td>
<td>Severe IDD, difficult to study</td>
</tr>
</tbody>
</table>
IDD under control: I.R. Iran and Tunisia.

Most recent information on the status of control of IDD in the countries of this region is summarized in Table 2.

6.3 Islamic Republic of Iran

The first documented report of goitre in 1968 reported goitre prevalence of 10 to 60% in Iran. However, no comprehensive studies were carried out to examine the extent of iodine deficiency disorders, nor was any long-term preventive measure taken. In 1983-84, after a gap of 15 years, Azizi et al reported hyperendemia of goitre in Shahriar, Tehran, south-central province of Kohkloyeh-BoyerAhmad and many villages located in north of Tehran City (Azizi et al 1993, 1995) with low urinary iodine excretion in many subjects. Schoolchildren of these villages had, both physical and mental growth retardation, low T4, high TSH, abnormal neurological findings, psychomotor disturbance and hearing deficits (Azizi et al 1995).

These findings prompted the Ministry of Health and Medical Education to form an Iranian National Committee for Control of IDD (INCCI) in 1988. A nation-wide survey, performed under the supervision of INCCI, Table 3. Urinary iodine concentration in selected endemic and hyperendemic regions before iodized salt distribution

<table>
<thead>
<tr>
<th>Location</th>
<th>Province</th>
<th>Urinary iodine (µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kiga</td>
<td>Tehran (rural)</td>
<td>20±11</td>
</tr>
<tr>
<td>Randan</td>
<td>Tehran (rural)</td>
<td>12±5</td>
</tr>
<tr>
<td>Zagoon</td>
<td>Tehran (rural)</td>
<td>18±10</td>
</tr>
<tr>
<td>Keshar</td>
<td>Tehran (rural)</td>
<td>19±10</td>
</tr>
<tr>
<td>Tehran City</td>
<td>Tehran (urban)</td>
<td>39±19</td>
</tr>
<tr>
<td>Shahriar</td>
<td>Tehran (urban &amp; rural)</td>
<td>71±39</td>
</tr>
<tr>
<td>Hanna</td>
<td>Esfahan (rural)</td>
<td>40±21</td>
</tr>
<tr>
<td>Yasuj</td>
<td>Boyer-Ahmad (urban)</td>
<td>34±39</td>
</tr>
<tr>
<td>Doruhan</td>
<td>Boyer-Ahmad (urban)</td>
<td>24±17</td>
</tr>
</tbody>
</table>
showed goitre as being endemic in all and hyperendemic in the capital cities of 5 provinces (Azizi et al 1990). Mean urinary iodine excretion was below 100µg/L in all and <20µg/L in many localities examined (Table 3) (Azizi et al 1990, 1993, 1995).

The INCCI prepared a national plan, which detailed objectives and strategies for IDD control. Salt iodization began in 1990. Although the production, distribution and consumption of iodized salt increased gradually, a nation-wide survey in 1993 showed that less than 50% of the households were using iodized salt. INCCI announced universal salt iodization (USI) and all salt factories were obliged by law to produce only iodized salt for household use. National surveys in 1994, 1996 and 1998 have shown that more than 95% of the households were consuming iodized salt.

In 1996, the second national survey was conducted 7 years after the initiation of iodized salt production and 2 years after the implementation of the new law for mandatory consumption of iodized salt by households (Azizi et al 1995). The total number of surveyed schoolchildren was 36178 of which 2917 had urinary iodine determination. In 16 of 26 provinces, total goitre rate was more than 40% in boys and over 50% in girls. However, the majority of schoolchildren had small goitres of grade 1 (fig.2). There was no significant difference in goitre prevalence between boys and girls or schoolchildren of rural and urban regions.

![Fig.2 Schoolchildren with visible goitre in 26 provinces (I.R. Iran, 1996)](image-url)
In all 2917 schoolchildren, the median urinary iodine excretion was 20.5µg/dl. Two thirds of schoolchildren had urinary iodine between 10 to 30µg/dl. 85.1% of children had urinary iodine equal to or in excess of 10µg/dl. 9%, 2.3% and 3.6% had mild, moderate and severe iodine deficiency, respectively. Fig. 3 shows median urinary iodine excretion in schoolchildren of 26 provinces. The highest and lowest values are from Guilan (North) and West-Azarbayjan (Northwest) provinces, 65 and 13µg/dl, respectively. There was no correlation between the prevalence or severity of goitre and urinary iodine excretion.

It is evident that the prevalence of goitre was still high in many provinces in 1996. Since the study was performed when the majority of people had used iodized salt only for 2 years, it was too early to expect that the consumption of iodide should result in reduction of goitre prevalence; since the majority of 8 to 10 year old children had, at the time, passed most of their life without adequate iodine supplementation.

It has been shown that thyroid size in children exposed to iodine deficiency in the first years of life might fail to regress completely following consumption of iodized salt, and children born prior to iodine prophylaxis, 10 years after intervention, still have larger thyroid volume than children from iodine sufficient area.

The most sensitive method for the monitoring and evaluation of an IDD control program is the determination of urinary iodine excretion.
Findings of 1996 national survey showed that the median urinary iodine excretion in schoolchildren in Iran (20.5µg/dl) was at the top of the optimal range, i.e. 10 to 20µg/dl, recommended by WHO/UNICEF/ICCIDD (2001). In 20 of 26 provinces the median urinary iodine was between 13 to 30µg/dl and in 6 provinces, it was in a range that might be considered to be accompanied by the increased risk of iodine-induced hyperthyroidism (WHO/UNICEF/ICCIDD 2001; Azizi 2002). The reason for the increase in urinary iodine has been studied in the Guilan province and it was attributed to an increase in consumption of salted food in the dietary habits of the population of this province (Rahmani et al 2001). Guilan and 5 other provinces have been among hyperendemic regions, where in 1993 and 1994, iodine supplementation in the form of iodized oil injection had been offered. A repeat survey in one of these provinces, Ilam, has shown a decrease in mean urinary iodine to 20.5µg/dL. The latest National IDD survey performed in 2001-2002 revealed total goitre rate of 13.9% and median urinary iodine of 16.5µg/dL. 5.8% of the schoolchildren had urinary iodine excretion below 5µg/dL.

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6.4 Other Countries

In Tunisia (Kharabsheh et al 2000) national survey in 1995 revealed TGR of 0.58% and median UI<50µg/L in 8% of school children aged 8-10 years. A throughout IDD control program was implemented in 1996. The country was announced to be “IDD free” by WHO/EMRO in the year 2000. East south region had low iodized salt consumption (77.9%).

In Jordan (Kharabsheh et al 2000) national survey in 1993 was indicative of moderate to severe IDD (TGR=37.7%, MUI=4.0µg/dL). Jordan has been successful in implementation of a baseline assessment of IDD in 1993, has adopted an IDD Control Program since 1995 and completed a monitoring and evaluation program since 2000. National survey in 2001 showed a significant increased in MUI in all governorates (MUI=15.4µg/dL, TGR=32.1%).

Yemen (Azizi 2001; Zein et al 2000) had been known as a country with severe IDD problem. The National IDD Control Program was been launched
Global Elimination of Brain Damage Due to Iodine Deficiency
in 1995. National survey in 1999 revealed TGR of 16.8% and MUI of 17.3µg/dL. Severe, moderate and mild IDD was found in 7.3%, 8.7% and 18.5% respectively. Household consumption of iodized salt increased from 22% in 1995 to 54% in 1999 and now reaches to 60%. Since the introduction of universal salt iodization in 1996 both the prevalence and severity of IDD were reduced markedly and Yemen can now be classified as a country with a mild IDD problem. However, the low level of households consuming iodized salt may hamper the goal of IDD elimination.

In Syria (Mohan 1999) salt iodization program has been launched since 1994. IDD is almost under control. A survey in 2001 revealed an increment in MUI. The results are not available. Household consumption of iodized salt increased from 24% in 1995 to 90% at the present.

In Lebanon (Matovinovic 1961) salt iodization started in 1992 and was implemented in a uniform manner by 1995. In 1994 National Committee for IDD Control was formed.

In Egypt (Cable Y 1968) salt iodization program began in 1993 and the government has successfully upgraded salt production plants to meet country’s iodized salt needs. Major activities for national IDD control program have started in 2001 in 5 governorates and continue to cover all governorates within 2 years.

In Morocco USI was officially endorsed in 1995. National survey in 1993 revealed MUI<5µg/dL and <10µg/dL in 20% and 63% of the population, respectively. The next step is the launching of national strategy to increase iodized salt consumption and implementation of monitoring system.

Iraq (Caughey, Follis 1965) has begun salt iodization since 1990. National IDD committee was formed in 1993. High prevalence of goitre was reported in Northern and Western provinces. Household consumption of iodized salt increased from 51% in 1997 to 90% in 2000.

In United Arab Emirates (Demarchi 1969). The national committee was established in 2000. Salt iodization is planned for 2001. National screening program for neonatal hypothyroidism have been implemented since 1998.

In Afghanistan the next five-year plan is due to be implemented in three stages (assessment, salt iodization and monitoring) from 2002-2006.

National survey in 1995 in Saudi Arabia (Al-Nuaim et al 1997) revealed the presence of mild IDD (Lowest MUI (11µg/dL): Southern province, highest goitre rate: Asir region). There is need to launch an IDD control program especially in the southern province.
**Table 4. Summary of IDD Status**

<table>
<thead>
<tr>
<th>Countries</th>
<th>Endemic region of the country</th>
<th>Prevalence (before intervention)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afghanistan</td>
<td>Northeast and Southwest regions</td>
<td>High prevalence in these regions about 80% 30% in Nanghadr Province</td>
</tr>
<tr>
<td>Egypt</td>
<td>Oases in southwest Egypt</td>
<td>26% in these areas</td>
</tr>
<tr>
<td>I.R. Iran</td>
<td>Highly endemic in southwest of Tehran (Shaahriar)</td>
<td>17-100% among schoolchildren in various regions</td>
</tr>
<tr>
<td>Iraq</td>
<td>Northern mountain region bordering Turkey (Mosul), Areas around Baghdad</td>
<td>60-85% in hyperendemic northern area, about 30% around Baghdad</td>
</tr>
<tr>
<td>Jordan</td>
<td>Northern region</td>
<td>37.7 (18-76%)</td>
</tr>
<tr>
<td>Lebanon</td>
<td>Throughout</td>
<td>40-75% in mountain and hilly region and about 12% in coastal areas</td>
</tr>
<tr>
<td>Libya</td>
<td>Endemicity in Fezzan province</td>
<td>20-55% in most areas of Fezzan</td>
</tr>
<tr>
<td>Morocco</td>
<td>Azilal region, Atlas mountains</td>
<td>65% Azilal; 29% Atlas Mountains; TGR 22%</td>
</tr>
<tr>
<td>Oman</td>
<td>Only mild</td>
<td>TGR 10%</td>
</tr>
<tr>
<td>Pakistan</td>
<td>Alarming prevalence in Gilgit and Chitral, high level in Multan</td>
<td>80-90% in Gilgit and Chitral, high endemicity in Multan</td>
</tr>
<tr>
<td>Palestine</td>
<td>Not available</td>
<td>14.9% in schoolchildren</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>Southern province</td>
<td>30% in Asir region</td>
</tr>
<tr>
<td>Sudan</td>
<td>Dafur in western Sudan, patches in other areas</td>
<td>40-65%</td>
</tr>
<tr>
<td>Syria</td>
<td>Mountainous region</td>
<td>TGR 70%</td>
</tr>
<tr>
<td>Tunisia</td>
<td>Northwest mountainous regions</td>
<td>14-51%</td>
</tr>
<tr>
<td>Yemen</td>
<td>Highlands regions</td>
<td>60-100%; TGR 32% in northern part</td>
</tr>
<tr>
<td>UAE</td>
<td>Desert and mountainous areas</td>
<td>1.5-20%</td>
</tr>
</tbody>
</table>
Base line surveys showed that no part of **Sudan** (Baghchi, Rejeb 1987; Benmiloud 1987; Eltom, Abdul Rahman 1984) is exempted from the IDD problem. A technical committee was formed in 1991. USI was implemented in 1997.

National survey in 1997 revealed severe IDD in Western Zone and moderate IDD in Upper Nile and Kordofan. In the year 2000, 2.5-12.5% of households used iodized salt, 5-12.5% used both iodized and non-iodized salt and the majority (80-95%) used non-iodized salt.

56 million people (40%) in **Pakistan** (Baghchi, Rejeb 1987; Mahmud, Siraj-UL-Haq 1986) are at risk of IDD and 72% of 8-11 year old children have mild to moderate iodine deficiency. Legislation on USI and national IDD control programs doesn’t exist.

*Fig. 4* Comparison of IDD status in countries of ME & EMR in 1993 and 2000
**Libya** (Azzizi 1993) had enacted legislation and implemented universal salt iodization in 1980.

National survey is being planned to evaluate impact of salt iodization.

In **Oman** there is mild IDD according to national survey in 1993. Legislation on salt iodization was passed in 1995. Household consumption of iodized salt increased from 35% in 1996 to 68.5% in 2000. There is no national IDD control program.

In **Palestine** the national committee has been established recently. Committee strategy focused on adoption of salt iodization along with the intensive nutrition education.

Comparison of IDD status in countries of the region in 1993 and 2000 is shown in (fig.4).

**Acknowledgment**

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**References**


Regional Meeting for the Promotion of Iodized Salt in the Eastern Mediterranean, Middle East and North Africa Region. Dubai, United Arab Emirates, 10-12 April 2000.


The Elimination of IDD in the Americas
Eduardo A Pretell

7.1 Summary and Lessons Learnt from the Region

7.2 Introduction

7.3 Global and Regional Activities

7.4 Summary of Regional Experience

7.5 The Peru Country Program

7.6 Conclusions
Summary and Lessons Learnt from the Region

Many experiences in the American Region underscore the importance and deleterious effects of iodine deficiency on human development and the urgent need for its elimination through an effective comprehensive strategy. Some of these ‘lessons learned’ are listed below:

1. Although iodized salt was recognised as a means to correct iodine deficiency, and salt iodization was implemented in most countries in the 1960s and 1970s, the actual impact was poor, so more than 30 years were lost in the battle against IDD. The main reasons for this delay were dim comprehension of the problem and its magnitude, inadequate governmental support, absent educational efforts, and failure to involve all sectors in addressing the problem.

2. This negative experience emphasises sustainability as a very important goal in national control programs, and it should be considered from the outset in developing a strategy.

3. Pioneering studies in the Region during pregnancy pointed to lack of iodine as a major cause of irreversible brain damage in the fetus, and this, rather than goitre, emerged as the gravest consequence of iodine deficiency. Concern about this finding, confirmed by others around the world, led the World Summit for Children to declare the elimination of IDD as a priority goal to be met by the year 2000.

4. Research studies on iodized oil for correcting and preventing iodine deficiency paved the way for rapid control of the problem in Peru and its widespread use around the world, while awaiting the more slowly paced implementation of USI.

5. The regular measurement of iodine in salt and urine and surveys of iodized salt consumption have been validated in the Region as appropriate indicators for the diagnosis and monitoring of iodine nutrition in populations.

6. Wide ranges in the amount of iodine added to salt, both mandated and actually found, carry the risks of insufficient or excess iodine supply, and should be adjusted to more constant and appropriate levels.
7.2

Introduction

7.2.1 Background

7.2.2 Recent Progress in the Americas

7.2.3 Iodized Salt: supply, consumption and quality

7.2.4 Iodine Nutrition
7.2

Introduction

The American countries have a rich history of iodine deficiency. Statues in the Andes and Mexico show that endemic goitre existed long before Columbus arrived. The severity of iodine deficiency followed geologic patterns similar to those elsewhere in the world. The worst endemias were in isolated mountain communities. The Andean Regions and Central Mexico were the most afflicted, but many other parts of the hemisphere were also severely involved, and virtually no country in mainland Latin America was free of iodine deficiency. (Kelly and Snedden 1960, Dunn, Pretell et al 1986; Pretell and Dunn 1987).

Modern surveys for goitre within individual counties began in the 1930s. Almost all had at least some regions where the goitre prevalence was more than 50%, and several counties, such as Bolivia, Brazil, Ecuador, Peru, Mexico and Guatemala, had iodine deficiency in most of their territory. During the 1950s and 1960s virtually every country passed a law mandating iodized salt and establishing arbitrarily a wide range of iodization levels. Some programs of prophylaxis with iodized salt were transiently successful, but most were not (Schaefer 1974, Noguera and Gueri 1994). Those that were successful initially later relapsed e.g., Guatemala, Colombia and Mexico, mainly because several common problems emerged. First, laws were not enforced and did not fix responsibility for absorbing the cost of salt iodization. No Latin America country addressed these issues satisfactorily. Secondly, monitoring was either absent or inadequate. Thus, after initial enthusiasm from the government and producers for regular checks on iodine levels in salt, interest waned, monitoring lapsed, and the iodine content salt either disappeared or greatly diminished. Thirdly, the importance of iodine deficiency and its correction was not adequately communicated to the relevant sectors, such as different branches of the government, the health establishment, industry, and most importantly, consumers.

By the 1980s and 1990s, after laws mandating iodized salt had existed for 30 years, only a few countries were nearing iodine sufficiency, and the overall goitre prevalence had not significantly changed (Pretell and Dunn 2002). In 1999, despite significant progress compared to other regions in the world, iodine deficiency as a public health problem was still present in
19 countries (WHO, 1999). This general failure in Latin America provides a valuable lesson of what can happen, as efforts for iodine prophylaxis are renewed in this region or initiated in countries elsewhere in the world.

The present article summarizes some recent information collected principally by the ICCIDD Regional Coordinator and the Subregional Coordinator for Central America and the Caribbean, from their reports, consultancies in individual countries (IDD Newsletter, 2001), and experience with the ICCIDD/Merck ThyroMobil project, which visited 13 countries in the region in 1998-2000 (Prettell et al 2000). The information on Peru reflects the author’s experience as investigator at the Cayetano Heredia University and as Director of the National IDD Program and Minister of Health.

7.2.1 Implementation of IDD Control Programs

i) Background

A renewed interest in IDD arose in the late 1970s and early 1980s, and gained strength during the 1990s. The approach to its control has varied widely among different countries in the region, reflecting the diversity of their cultural, political, and geographical situations. This effort has had two different periods, one during the early 1980s, when only 3 countries approached the problem, and a later one during the 1990s that involved the majority of countries, as described below.

In the period 1983 to 1985, three Andean countries, Bolivia, Ecuador and Peru, were the first to reassess their iodine nutrition and to implement effective IDD control programs. They share the rugged mountainous terrain of the Andes and the Amazon jungle as dominant features of their geography. In the early 1980s, their goitre prevalences were 71% for Bolivia, 80% for Ecuador and 36% for Peru. All three have scattered inland salt deposits, in addition to sea salt in Ecuador and Peru.

With strong external economic support, Bolivia and Ecuador began implementing IDD control programs in 1983, mainly by monitoring the production and consumption of iodized salt. This process required adjustment to the unique features of each country. In Bolivia little iodized salt was available to the poor part of the population, so the government developed a semi-autonomous corporation that built salt iodization plants for co-operatives of small producers located throughout the country; this approach involved enormous logistic difficulties for introducing iodization into salt production and distribution. In contrast, most of Ecuador’s salt comes from the sea and its producers are located in a small
coastal area. About half the country’s population lives along the coast, and is iodine sufficient; the remainder resides in the mountains and jungles, where iodine deficiency is severe. Peru began implementing its program in 1985, relying mainly on governmental support, and also instituted monitoring with urinary iodine. The Peru program has been recognized as a successful model for the sustained elimination of IDD and is described in more detail later in this chapter. The three countries simultaneously devoted major efforts to education, communication and information at all levels - government, salt producers and the general population in the affected areas.

These control programs have been evaluated by international teams of experts and the three countries declared virtually free of iodine deficiency as a public health problem, Bolivia in 1996, Peru in 1996 and 1998 Ecuador in 1999. However, the evolution and outcome of these control programs have been different. Ecuador and Peru have succeeded in sustaining the elimination of IDD, while Bolivia, after achieving iodine sufficiency, is now deficient again, because of lack of governmental support, a weak salt industry, and a decline in communication and monitoring activities, among other factors.

During the last 15 years almost all other Latin American countries have reassessed their iodine status and implemented programs for the control of IDD. The commitment undertaken by governments at the World Summit for Children and the support offered by ICCIDD, UNICEF, and PAHO/WHO, together with other international organizations, have been instrumental in the success of these programs. Still, some countries need to set up a more effective structure for handling programs, monitoring, education, social mobilization, and collaboration with the salt industry. Governmental support and IEC have significantly increased in the majority of countries.

ii) Recent progress in the Americas

Since 1985 great progress has been made in the fight against iodine deficiency, particularly from an aggressive push for iodized salt use. Almost all the countries have programs for the control of IDD. The achievements to date have been remarkable and indicate that the American Region should be among the first to attain the 2005 goal of sustained elimination of iodine deficiency, as set by the United Nations General Assembly in May, 2002. In addition to Bolivia, Ecuador and Peru, external evaluations have declared three other countries to have achieved the
Fig. 1  Percentage of household with access to iodized salt (WHO 1999)

Fig. 2  Relationship between urinary iodine and iodine in salt
Iodine in salt, mean, mg/kg
virtual elimination of IDD-Colombia in 1998, Venezuela in 1999, and Panama in 2002. Nevertheless, problems remain that prevent the effective and sustained elimination of IDD in the whole region. Of the 22 largest countries, at least 90% of households use adequately iodized salt (WHO 1999). Seventeen had a median urinary iodine concentration of at least 100µg/L (i.e., iodine sufficient). However, some countries have regressed during the past five years, and others never achieved iodine sufficiency. Still other countries have been incompletely assessed, and the risk of iodine excess has risen in more than one.

Information on the quality of iodized salt and on urinary iodine concentrations has been recently collected in collaboration with the National Representatives of ICCIDD and the officials in charge of the IDD control programs in countries (IDD Newsletter 2001). These data confirm considerable progress towards optimal iodine nutrition in the Region. At the same time, the available information is limited because it is not updated or is not reported in a uniform fashion, and the personnel responsible for it turn over frequently.

iii) Iodized salt: supply, consumption and quality

A landmark meeting in Quito, Ecuador, in April 1994, attended by high-ranking officials from UNICEF, PAHO/WHO, ICCIDD, and governments, issued a declaration, signed by representatives from 23 countries in the region, stating their commitment to universal salt iodization in the Region by the year 1995 as the mid-decade goal, to be followed by the final goal of eliminating iodine deficiency as a public health problem by the year 2000.

Currently, all countries in the region have accelerated their activities to reach the main goal of universal iodization of salt for human consumption. The legislation concerning the level of iodization of the salt has been adjusted during the last decade in seven countries where it was formerly very low or very high (Brazil, Chile, Ecuador, Mexico, Panama, Paraguay, and Venezuela), and in Uruguay, where iodized salt was required in only half the country (Pretell 2002).

Almost all the countries monitor iodized salt. Although more than 80% of salt in the majority of countries contains more than 15ppm of iodine at retail, the recommended figure of more than 90% has not been met or sustained in many. Guatemala, Dominican Republic, El Salvador, and Haiti are of particular concern. Among global regions the Americas have shown the most significant progress in iodized salt consumption.
Reports from the Regions and the Countries

iv) Iodine nutrition

Urinary iodine is the most important indicator of iodine nutrition, but regular monitoring is carried out in only a few countries. For some the only data are those collected in the ThyroMobil campaign or another investigation. As presented elsewhere in this book, a median of at least 100µg/L designates iodine sufficiency in a population. While not all the countries provide top-quality iodized salt for human consumption, the median urinary iodine concentration is 100µg/L in 17 of the 22 countries, and fewer than 20% of samples have a concentration <50µg/L. Four countries have a median <100µg/L, with the Dominican Republic and Guatemala showing the lowest values. Eight countries have median values above 200µg/L, and four (Chile, Brazil, Colombia, and Venezuela) are above 300µg/L, signaling the risk of iodine excess.

The median iodine content in urine correlates with iodine levels in the country’s salt (fig 2) reflecting variations in the level of fortification mandated by different governments (Pretell and Dunn 2002). Ecuador recently lowered the level of iodine in its salt, with a subsequent decrease in median urinary iodine concentration. A similar result occurred in Panama,

Table 1. Iodine nutrition status

<table>
<thead>
<tr>
<th>DEFICIENT</th>
<th>LIKELY SUFFICIENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>Argentina</td>
</tr>
<tr>
<td>Haiti</td>
<td>Belice</td>
</tr>
<tr>
<td>Mild:</td>
<td>Brazil</td>
</tr>
<tr>
<td>Bolivia</td>
<td>Canada</td>
</tr>
<tr>
<td>Guatemala</td>
<td>Colombia</td>
</tr>
<tr>
<td>Cuba</td>
<td>Costa Rica</td>
</tr>
<tr>
<td>Dominican Rep</td>
<td>El Salvador</td>
</tr>
<tr>
<td>Honduras</td>
<td></td>
</tr>
</tbody>
</table>

CI LIKELY DEFICIENT |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Guyana</td>
<td>Nicaragua</td>
</tr>
<tr>
<td>Surinam</td>
<td></td>
</tr>
</tbody>
</table>

SUFFICIENT |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecuador</td>
<td>Uruguay</td>
</tr>
<tr>
<td>Panama</td>
<td>EXCESS</td>
</tr>
<tr>
<td>Paraguay</td>
<td>Chile</td>
</tr>
<tr>
<td>Peru</td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>UNKNOWN</td>
</tr>
<tr>
<td>Venezuela</td>
<td>Barbados</td>
</tr>
</tbody>
</table>
but not in Chile, where the urinary iodine concentration remains high. This last situation requires further investigation.

Less emphasis is now placed on assessing the prevalence of goitre than in the past, because the palpation method is less reliable with small goitres and ultrasonography is not available in many countries. Recently, the ThyroMobil Project evaluated thyroid size in children from 13 countries of Latin America and found the goitre prevalence still above 5% in the majority of countries (Pretell et al to be published). Similar results have been found in other countries, and show that regression of goitre, even in children, may take a long time.

The American Region has progressed more towards the normalization of iodine nutrition in the majority of its countries than have most other regions of the world. The ICCIDD’s last report, from data collected in 2002, estimated that 91% of the regional population (757 million) is currently iodine sufficient, but 6% (49 million) are still deficient, and another 3% (29 million) have iodine excess (IDD Newsletter 2003). According to ICCIDD’s CIDDS database classification, 6 countries are already iodine sufficient and 12 are likely sufficient, but 5 have some degree of iodine deficiency, one has iodine excess, and the situation in another is unknown (Table 1).
7.3

Global and Regional Activities

7.3.1 ICCIDD
7.3.2 Andean Sub-regional Program for IDD Control
7.3.3 IRLI
7.3.4 Regional Meeting, Quito 1994
7.3.5 Salt 2000 Regional Meeting Bogota, Colombia
7.3.6 Thyromobil Project in Latin America
7.3.7 International Reference Values for Thyroid Volume by Ultrasound
7.3.8 National ICCIDD Representatives
Several global and regional activities, the initiatives of various organizations, and some projects and meetings have significantly contributed to the development and progress of national IDD control programs. The following paragraphs briefly describe some of these.

7.3.1 The International Council for the Control of Iodine Deficiency Disorders (ICCIDD)

The foundation of the ICCIDD in March 1986 provided an important and decisive push for countries to abandon the neglect of iodine deficiency that had developed over decades. Even for the three countries that had already implemented IDD control programs, the emergence of the ICCIDD provided essential technical backing for their accelerated progress. Moreover, ICCIDD played a key role in developing the resolutions for IDD elimination that were eventually adopted by the World Health Assembly and the UN World Summit for Children in 1990, and these strengthened the commitments of national governments against IDD. At the regional level, ICCIDD has worked closely with PAHO/WHO, UNICEF, other partners, and governments to present a united front towards optimal iodine nutrition and effectively iodized salt.

7.3.2 The Andean Sub-Regional Program for IDD Control

This venture was founded by UNICEF with the collaboration of PAHO/WHO and ICCIDD and financial support from the Belgian Government. The original members were Bolivia, Colombia, Ecuador, Peru and Venezuela, joined later by Paraguay. Its objective has been to assist the country members to reach the goal of the World Summit for Children. Its main activity has been to promote the exchanges of methodology and experiences among countries in IEC, social marketing, salt iodization technology, epidemiology, and monitoring. It proved effective in strengthening the IDD control programs of individual countries, as is demonstrated by the success of five of them in reaching the goal of iodine sufficiency.

7.3.3 Interlaboratory Program for Urinary and Salt Iodine Assay, and the IRLI Network

Because urinary iodine is the most important indicator of iodine nutrition, the reliability of involved laboratories is important. To this end, the Andean Sub-regional Program for Control of IDD initiated a trial in 1998 that currently continues through a partnership with the Regional
Huchingui Village
High Sierra
Ecuador

Old woman carrying load of peas.
Global Elimination of Brain Damage Due to Iodine Deficiency

ICCIDD office. Originally, the network included only laboratories of the five Andean countries, but now it comprises a total of 20 laboratories in the Latin American countries, most of them collaborating with the national IDD control programs, but having no previous external quality control. This activity has become a very important way to improve the capacity for monitoring the impact of strategies for IDD elimination, and the Regional ICCIDD laboratory has continued to offer training and consultation to labs throughout the hemisphere.

Most recently, the participation of ICCIDD in the new International Resource Laboratories for Iodine (IRLI) Network offers further opportunity to contribute to the quality and efficiency of these other laboratories. Two laboratories in the region have been selected to integrate the IRLI Network, one in Guatemala, at the Food Safety and Fortification Area, INCAP, and the other in Peru, at the Endocrinology and Metabolism Unit, High Altitude Research Institute, Cayetano Heredia Peruvian University.

7.3.4 Regional Meeting on Universal Salt Iodization for the Elimination of Iodine Deficiency Disorders in the Americas

This meeting in Quito Ecuador, April 9-11, 1994 gathered senior representatives of countries, international organizations (especially UNICEF, PAHO, and ICCIDD), and various sectors relevant to IDD, particularly the salt industry. All pledged to work together in the Region to achieve universal salt iodization and IDD elimination. The meeting culminated with the Quito Declaration on Universal Salt Iodization, signed by the representatives of 23 countries. This provided added impetus for the regional salt iodization effort.

7.3.5 Salt 2000 Regional Meeting, Bogotá, Colombia

Representatives of the salt industry, the national IDD control programs from 22 countries, and the international agencies (including PAHO, UNICEF, ICCIDD, Kiwanis, MI, PAMM) gathered to recognize the leading role of the governments through their IDD control programs for the success achieved so far in the elimination of IDD, as well as the important role played by the private sector, the salt industry. While acknowledging the significant progress achieved towards USI and the consumption of iodized salt in the majority of countries, the group noted a widespread weakness in sustainability. It recommended that the salt industry must secure QA not only among the large-scale producers but also the medium and small ones, and that legislation and regulations must be updated to provide a daily intake of 150µg of iodine. Governments were urged to
renew their commitments to sustain elimination of IDD by implementing and/or maintaining effective IDD control programs and taking a more effective role in the inspection and enforcement of the legislation for salt iodization.

A Declaration was drafted at the end of the meeting. Its key recommendations were to:

1) Encourage the industry to produce and distribute high quality iodized salt at a reasonable price;
2) Pursue permanent political will for supporting IDD programs;
3) Maintain regular monitoring of iodized salt quality and its effects in human nutrition;
4) Develop social mobilization programs to encourage consumption of iodized salt;
5) Create a trust fund for implementing regional communication programs on iodized salt consumption; and
6) Include instruction on iodine deficiency and iodized salt use in the educational system.

7.3.6 The ThyroMobil Project in Latin America

The collaboration between ICCIDD and private industry (Merck) has provided standardized rapidly available data on iodine nutrition in 13 Latin American countries. It has charted the progress of USI, showing that areas of deficiency and excess persist, as does wide variation in the level of salt iodization from heterogeneity in the relevant legislation. But also, very importantly, the project has also helped to reinforce commitments towards the sustainable elimination of IDD, to increase awareness of IDD, to promote the implementation of monitoring systems and to encourage the active participation of health authorities, academic, medical, and scientific institutions, and the mass media for the common goal. In some countries where the support of Merck was not available, the project received financial support from the local UNICEF offices and health authorities.

7.3.7 International reference values for thyroid volume by ultrasound

Under the sponsorship of WHO the Regional ICCIDD Office has participated in a multinational project to develop reference values for thyroid gland volume by ultrasound in school-age children from areas of long-standing iodine sufficiency. These criteria can now be used to define goitre for IDD surveillance. The study was carried out in collaboration with other ICCIDD colleagues at 6 sites selected from the
Americas, Europe and Western Pacific: Manama, Bahrain; Tokyo, Japan; Lima, Peru; Zurich, Switzerland; Boston, USA; and Cape Town, South Africa.

7.3.8 National ICCIDD Representatives

Since 1995, ICCIDD has appointed National Representatives to work with their governments and promote awareness of iodine nutrition and iodized salt in their countries. Currently there are representatives in 10 Latin American countries and others are being recruited. ICCIDD regards these nationals as key players in the drive to create National Coalitions for Optimal Iodine Nutrition and to promote sustainability that will outlast changing personnel and priorities in governments and agencies.
7.4

Summary of Regional Experience

1. Most of the Western Hemisphere’s previously severe iodine deficiency has been corrected. At least 80% of salt at retail is adequately iodized, and only 4 countries (Guatemala, Dominican Republic, Haiti, and Bolivia) have median urinary iodine concentrations in the deficient range.

2. The achievements so far reflect effective collaboration among many partners, both national (governments, especially Ministries of Health, Education, and Commerce, the salt industry, the health sector, consumers, and advocacy groups) and international (ICCIDD, UNICEF, PAHO/WHO, Kiwanis, bilateral donors, private foundations, and others). This collaboration offers a useful model for tackling other health issues.

3. Some countries need watching for iodine excess from unnecessarily high levels of iodine in salt.

4. Monitoring of iodine in people and in salt is still non-existent, fragile, or inadequate in many countries.

5. The great challenge now is sustaining the progress. The failures after previous success in the past decades in Latin America emphasise the perils of relaxed vigilance. For example, recent data from Bolivia show a decline in salt iodization and the threat of returning iodine deficiency, after previously achieving sufficiency.

6. Key elements for sustainability are national coalitions and effective education at all levels. Each country must take long-range responsibility for its own program to achieve permanent optimal iodine nutrition.
7.5

The Peru Country Program

7.5.1 Background
7.5.2 Public Health Action
7.5.3 Baseline IDD Situation
7.5.4 Plan of Action
7.5.5 Political and Economic Support
7.5.6 External Evaluation of the Program
7.5.7 Guarantee of Sustainability
7.5.1 Background

The elimination of iodine deficiency as a public health problem in Peru took place in three well differentiated stages over more than a half a century, since a law mandating the iodization of salt was approved in 1940.

Severe endemic goitre and cretinism were recognized in the sierra and jungle regions during colonial times but they must have existed there long before because iodine deficiency, its main cause, is a permanent natural phenomenon there. Many early explorers described the frequent occurrence of goitre, and its presence before and during the Incan rule of 1150-1533 has been documented; the Quechua natives had the words coto and opa to describe goitre and cretin, respectively. The disease was clearly prevalent during colonial times (1533-1821), when a Papal Bull of Pope Paul III (1534-1549) ordered missionaries to consider goitrous and cretinous people as beings with souls and worthy of conversion to Christianity. After Independence and during the first half of the 20th Century, many studies, chiefly epidemiological, confirmed the severity and magnitude of the endemia and its relation to low environmental iodine, but the problem received little attention (Lastress 1954, Pretell 1989).

A renewed interest in IDD emerged in the late 1940s and 1950s. Iodization of salt was legislated, the Unit of Endemic Goitre was created in the MOH, and six iodization plants were started in different Departments affected by iodine deficiency. Unfortunately this effort did not have the necessary economic and governmental support, and vanished within a decade, leaving no impact.

The 1950s brought new knowledge on thyroid patho-physiology and the effects of iodine deficiency in Latin America, pioneered by Dr. John Stanbury, later the founding Chair of ICCIDD. Under his influence, we started, in 1966 at the Cayetano Heredia Peruvian University in Lima, to reinvestigate the problem of iodine deficiency in the country. Along with epidemiological investigations that confirmed the persistence and severity of endemic goitre and cretinism in the country, three studies were particularly important because they demonstrated the deleterious effect of iodine deficiency on the quality of life, the urgent need for its elimination, and the availability of new methods for prophylaxis, treatment, diagnosis, and monitoring.

a) Effect of iodine deficiency on the maternal-fetal unit—This study clearly demonstrated that iodine deficiency caused a high rate of maternal hypothyroidism, strongly suggesting a low placental transfer
Fig. 1  A family group of five brothers and sisters all goitrous

Fig. 2  A group of neurologic and myxedematous cretins from the same village
of iodine and thyroid hormones to the fetus, and also an increased abortion rate and low iodine concentration in maternal milk, and on the fetal side, the occurrence of about 15% congenital hypothyroidism, impaired mental and neurofunctional development, and increased perinatal mortality (Pretell and Stanbury 1971, Pretell 1973, Pretell et al 1974; Pretell and Caceres 1994).

b) Use of iodized oil in the prophylaxis and treatment of IDD - The fate and effects on thyroid function of various doses of intramuscular iodized oil injections, as well as its oral administration, were investigated over a five year period (1966-1972). This new method proved of great benefit for its immediate and long lasting effect - 3 to 5 years intramuscularly and 6 to 12 months orally. It was safe in pregnant women, effective in preventing fetal brain damage, and easy to administer (Pretell et al 1969). Complementary experimental studies demonstrated storage in fat tissue independent of the thyroid (Pretell 1972, Hubner and Pretell 1981). The method has been recommended in high-risk populations (Pretell et al 1974, Stanbury et al 1987).

c) Urinary iodine as an indicator of iodine nutrition - The iodine concentration in casual urine samples was investigated and extensively validated as the most important indicator for defining the degree of iodine deficiency in a given area, as well as for monitoring the results of control programs (Medina 1989).

7.5.2 Public health action

The above results argued strongly for public health action. We convinced the authorities at the MOH of the urgent need to fight IDD, and in 1983 a Supreme Decree created the Endemic Goitre Office, which later became the National Program for the Control of Endemic Goitre and Cretinism (Pretell 1987, Pretell 1989) with support from the MOH and the Joint PAHO/WHO-UNICEF Nutritional Support Program, funded by the government of Italy.

7.5.3 Baseline IDD Situation

The Program reached full implementation in 1985. Its first task was to carry out a national survey to evaluate the actual IDD situation and its relevant features. When the survey was completed in 1986, the country's total population was 19.9 million, with 9.5 million in the sierra and jungle regions.
Fig. 3 Monitoring changes in iodized salt production, quality and consumption, and in urinary iodine.
Table 1. Components of Peru’s strategic plan of action

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<td>Network Organization &amp; training</td>
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<td>Coverage of pop at high risk with iodized oil</td>
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<td>Progressive USI</td>
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<td>Monitoring and surveillance system</td>
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<td>IEC</td>
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<td>Social Marketing</td>
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<td>Advocacy</td>
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The survey covered 136 of the country’s 184 provinces in 23 Departments, and included 775 villages. The results showed that goitre was endemic in 87% of the villages, with a total goitre rate of 36.4%. The median urinary iodine was 71µg/L with 36.8% of the values <50µg/L. The impact of the severity of the iodine deficiency on the affected population is illustrated in figures 1 and 2. The production and marketing of iodized salt was being carried out by the government mainly in two factories near Lima, the capital city on the coast. The annual production of iodized salt covered only 57% of the country’s need, and was mainly distributed to the coastal region; only 30.8% of salt at the retail level contained >15ppm iodine. An additional complicating factor was the ignorance of the population, including the health and education personnel, about the cause and the importance of IDD; only 40% of household leaders recognized goitre and cretinism as diseases, and less than 10% related them to iodine deficiency.

The extensive use of urinary iodine as the main indicator permitted a more precise assessment of the degree of deficiency, and also showed that the northern and southern sierra were the more severely affected, with median UIs of 57µg/L and 56µg/L, respectively. The population at risk was estimated at about 6 million.

7.5.4 Plan of action

The survey results led to a new plan of action (Table 1). This strategic model has proven highly successful in that it initially achieved the immediate protection of the population at risk of severe and high IDD by iodized oil administration, and at the same time moved progressively towards universal iodized salt fortification while building the bases for its sustainability. Some of the major features are described in the following paragraphs.

a) IDD network - This key component of the Program was created at the very beginning to have both a central management unit and a field organization that includes 29 Regional and Sub-regional Coordinators as well as 156 Local Coordinators at primary health care establishments. The regional health workers are motivated and well trained. All personnel undergo frequent retraining and hold annual meetings to review progress, difficulties, new guidelines, and updated scientific knowledge on IDD. The Program’s work is also
Table 2. Urinary iodine and goitre prevalence in Peru

<table>
<thead>
<tr>
<th>Year</th>
<th>Median µg/L</th>
<th>Frequency of medians %</th>
<th>Goitre Prevalence %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;100</td>
<td>100-200</td>
<td>201-300</td>
</tr>
<tr>
<td>1986</td>
<td>72</td>
<td>66.9</td>
<td>20.8</td>
</tr>
<tr>
<td>1993</td>
<td>92</td>
<td>51.4</td>
<td>32.4</td>
</tr>
<tr>
<td>1995</td>
<td>139</td>
<td>26.1</td>
<td>52.2</td>
</tr>
<tr>
<td>1996</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td>250</td>
<td>6.0</td>
<td>23.9</td>
</tr>
<tr>
<td>1998</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td>230</td>
<td>4.4</td>
<td>36.7</td>
</tr>
<tr>
<td>2001</td>
<td>180</td>
<td>10.4</td>
<td>46.3</td>
</tr>
</tbody>
</table>

(P) palpation - (US) ultrasound

Fig. 4 Location of Salt Plants
supported by other government agencies, such as the Ministries of Education, Industry and Agriculture, and local governments.

b) Protection of the high risk population—Since it would take time to provide enough iodized salt to cover the whole population, as well as to achieve acceptance of its consumption, the Program decided to protect the population at higher risk immediately with iodized oil, and about 2 million people in 83 provinces were injected during the period 1986-1987. During the following years this protection (by injection or orally) was administered to progressively fewer people in places still not reached by iodized salt, until it could be discontinued in 1996.

c) Salt iodine.—At the same time, a strong effort was made to increase the production and the consumption of iodized salt and to improve its quality by the following steps (fig. 3):

i) Production and coverage to meet population demand—During the first six years, while the salt industry was still a governmental monopoly, the production of iodized salt increased steadily, but slowly. It was only after 1992, when the industry became private, that a significant and sustained increase occurred. Since 1995 the supply of iodized salt in the market has surpassed the population demand. Currently there are 52 salt plants including the 2 previously existing large producers on the coast, and 50 small producers mainly located along the northern coastal area and in the southern sierra (fig. 4). About 75% of the iodized salt for internal consumption is covered by the large plants. The small producers receive continuous technical assistance provided by the MOH.

ii) Quality of iodized salt—In addition to providing enough iodized salt, the quality of the salt has improved, and for the past 6 years more than 90% of the salt at retail contains at least 15mg/kilo of iodine. Monitoring of salt quality at the production level has been necessary only at the small plants. Monitoring at retail level is constant and systematic, collecting a large number of representative salt samples for analysis of iodine at 15 laboratories distributed throughout the country.

iii) Household consumption—Surveys on the consumption of iodized salt have been carried out yearly since 1994, either through home visits or by asking school children to bring salt samples from their homes to the school, where the iodine content is tested with certified
Fig. 5 Changes in urinary iodine concentration in Peru by Department
semi-quantitative kits produced in the country. The results reveal an important change in the population’s attitude, so that iodized salt is no longer rejected, with the result that during the last five years adequately iodized salt is consumed by more than 90% of households.  

iv) **Urinary iodine**—The median iodine concentration in the urine has been the main indicator for the Program to monitor iodine nutrition. Its results clearly demonstrate the progress achieved in all areas of the country. The national median has stayed above 100ug/L since 1995 (fig. 5), and a breakdown of the results by Department clearly shows normal iodine nutrition in all of them (fig. 6). At the beginning the medians showed a transitory risk of iodine excess, but this situation is now normalizing (Table 2).

Representative urine samples are collected every two years and analyzed for iodine content in the laboratory of the Metabolic and Endocrine Unit, High Altitude Research Institute of Cayetano Heredia University, a designated referral lab of the IRLI Network.

v) **Information, education, communication, and advocacy**—These activities are considered highly important for strengthening knowledge about IDD and actively engaging the community in preventive measures. Most of the educational material is produced by local teams to encompass the cultural background of the target population. An extensive social marketing strategy was applied in the Program from 1993 to 1999 and significantly improved the consumption of iodized salt. It was addressed particularly to the salt production and marketing chain, the health, education, agricultural and industry sectors, the media, local authorities, police, opinion leaders, and mothers’ clubs.

### 7.5.5 Political and Economic Support

From the beginning, the political and economic support of the government has been a key factor in the Program’s success. In accordance with the commitment made by the country at the 1990 World Summit for Children, IDD was first included in the 1992-1995 National Plan of Action for Children, and its sustained elimination is now part of the Political Plan of the MOH for the period 2002-2012. The government covered approximately 50% of the Program’s budget until 1995 and about 90% since 1997. UNICEF, ICCIDD and PAHO/WHO have also provided economic and technical support.
7.5.6 External Evaluation of the Program

At its request, the Program has been evaluated twice by international teams of experts from PAHO/WHO, ICCIDD, UNICEF and PAMM. The first evaluation took place in 1996 and reported that the goal of universal salt iodization had been achieved (Ministerio de Salud 1996). The second evaluation, in 1998, confirmed the sustained virtual elimination of IDD in Peru, and the country then received a joint PAHO/WHO-UNICEF-ICCIDD Recognition Award for this achievement (Ministerio de Salud 1998).

7.5.7 Guarantee of Sustainability

The sustainability of IDD elimination in Peru is based on the following existing conditions:
1. Organization and infrastructure of the Control Program.
2. A highly qualified central team at the MOH and a national network in 34 Regional Health Directorates.
3. Political and financial backing from the government, and multisectoral support.
4. Integration of all the Program’s activities within the MOH’s national plan.
5. An active monitoring and surveillance system for iodized salt, urinary iodine and goitre prevalence.
6. Qualified laboratory facilities, including 15 decentralized regional labs for iodized salt control.
7. Full cooperation and support from the salt industry.
8. Technical support from PAHO/WHO, UNICEF, and ICCIDD
Conclusions

1. The IDD Control Program of Peru began in 1986 in the sierra and jungle regions, where severe iodine deficiency had been demonstrated previously.
2. The Program’s strategic plan of action included the immediate protection of the population at high risk with iodized oil and a progressive increase in the production and consumption of iodized salt. At the same time a well-trained and highly motivated national network was developed, and its work was amplified by intensive IEC, advocacy and marketing support.
3. Since 1995 the supply of iodized salt has exceeded the population demand, and adequately iodized salt has been consumed by more than 90% of households for the past five years.
4. The median urinary iodine concentration, the best impact indicator of iodine nutrition, has stayed above 100µg/L since 1995.
5. The prevalence of goitre has significantly decreased; it is still above normal, but its persistence is typical of areas that have once had iodine deficiency.
6. Important factors in the program’s success are the systematic monitoring of iodine in salt and in the population, and the political and economic support of the MOH.
7. Peru has succeeded in the sustained elimination of IDD with a control program that can serve as a model for other countries.

References

IDD Newsletter 27:1.


8

European Region
F Delange, G. Gerasimov

8.1 Western and Central Europe

8.2 Eastern Europe and Central Asia
8.1

Iodine Deficiency Disorders (IDD) in Western and Central Europe

F. Delange, H. Bürgi and B. Moinier

8.1.1 Summary and Lessons Learnt

8.1.2 Epidemiology

8.1.3 Public health consequences of iodine deficiency in Europe

8.1.4 Prevention and therapy of IDD in Europe
8.1.1 Summary and Lessons Learnt

The national representatives from the West and Central European Region of the International Council for Control of Iodine Deficiency Disorders (ICCIDD) met on 7th September 2002, in Goteborg, Sweden and designated 15 countries iodine sufficient, 13 deficient, 4 likely sufficient and 1 likely deficient (Table 1). Overall, more than 60% of the nearly 600 million people in the region live in countries that harbour iodine deficiency (Vitti et al 2003).

The national representatives went on to state that “national responsibility for iodine nutrition and its prophylaxis is weaker in most European countries than elsewhere in the world. Awareness of the importance of iodine deficiency can be underestimated in countries without assessment and monitoring programs and unrecognised pockets of deficiency might exist in remote areas. Laws with respect to iodized salt vary widely in Europe, as do the types and amounts of iodine compound used for fortification.

Several actions should be implemented to eradicate iodine deficiency in Europe. Methods for effective monitoring programs should be standardised. If Voluntary use of iodized salt does not result in iodine

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**Table 1. Iodine nutrition status by country, based on median urinary iodine excretion (µg/L)**

<table>
<thead>
<tr>
<th>Sufficient (&gt;100µg/L)</th>
<th>Likely Sufficient</th>
<th>Deficient (&lt;100µg/L)</th>
<th>Likely Deficient</th>
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<tbody>
<tr>
<td>Austria</td>
<td>Iceland</td>
<td>Belgium</td>
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<td>Bosnia</td>
<td>Luxembourg</td>
<td>Denmark</td>
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<td>Bulgaria</td>
<td>Norway</td>
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<td>Croatia</td>
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<td>Germany</td>
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<td>Cyprus</td>
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<td>Czech Rep</td>
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<td>Finland</td>
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<td>Macedonia</td>
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<td>Ireland</td>
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<td>Netherlands</td>
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<td>Portugal</td>
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<td>Slovak Rep</td>
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Reports from the Regions and the Countries

sufficiency strong consideration should be given to making supplementation compulsory. The high costs of iodized salt in some countries, together with low public awareness of its importance, are causes of poor acceptance by consumers and should be corrected.

ICCIDD and its partners can help countries achieve iodine sufficiency by:

- Providing models of successful legislation already in place in a few countries (such as Austria).
- Assisting the formation of national coalitions to address iodine nutrition
- Offering guidelines for Europe-wide standardised programs for monitoring both iodine nutrition and the quality of iodized salt and
- Recommending a uniform content of iodine for salt fortification.

Many of these issues should be addressed together with WHO and UNICEF through the European Union and in cooperation with groups such as the European Thyroid Association, National Endocrine Societies and the European Salt Producers Association. Countries without a national committee for iodine nutrition should be encouraged to form one that includes representatives from the national health authority, nutritionists, endocrinologists, paediatricians, epidemiologists and salt producers.

More than half of the population in Western and Central Europe is at risk of iodine deficiency and most nations have weak or non-existent governmental programs to address this problem. Consequently, much of the responsibility is shouldered by others, especially thyroidologists, the health sector, academic institutions and the salt industry. National coalitions of these groups can and should play a major part in achieving the sustaining optimum iodine nutrition in the continent. It is remarkable that Europe donates substantial funds towards the elimination of iodine deficiency in the developing world, but has not yet corrected its own.”

Reference


8.1.2 Epidemiology

Endemic goitre, frequently complicated by endemic cretinism, has been reported from Europe for centuries, especially from isolated and mountainous areas, for example from Switzerland, Austria, Italy, France, Bulgaria and Croatia (Merke 1984). IDD has been entirely eradicated in
Switzerland thanks to the implementation and sustained monitoring of a program of salt iodization (Burgi 1990). Probably because of the impact of this remarkable program on the medical world and also because legislations on iodized salt had become available in many additional countries, IDD seem no longer to have been considered an important public health problem in Europe during the next decades.

In 1960, the WHO published an exhaustive review on IDD in the world entitled ‘Endemic goitre’ (Kelly and Snedden 1960). Although this document included preliminary reports on Western countries, the information was scanty for the former USSR and especially for the Central Asia Republics, which are presently recognized as severely affected (Delange et al 1998).

It is only in the late 1980s that the European Thyroid Association, in its reevaluation of the problem, clearly indicated that, with the exception of the Scandinavian countries, Austria and Switzerland, most of the European countries or at least certain areas of these countries were still affected, especially in the Southern part of the continent (Gutekunst and Scriba 1988). This survey confirmed a lack of information on IDD from countries of the eastern part of the continent. Shortly thereafter, it was appreciated that the foetus, neonate and young infant were the most susceptible targets for iodine deficiency and the term ‘endemic goitre’ evolved into the broader concept of ‘iodine deficiency disorders’ (Hetzel 1983). Studies conducted in Europe revealed that iodine deficiency in adults was accompanied by a similar and certainly more damaging degree of iodine deficiency in the neonates and in their mothers, especially during breast-feeding (Delange et al 1986).

As indicated earlier in this volume (see Section II), a series of major decisive meetings took place in the early 1990s, including the World Health Assembly (Geneva 1990) the World Summit for Children (New York 1990), the Policy Conference on Ending Hunger (Montreal 1991) and the International Conference on Nutrition (Rome 1992). At these meetings, WHO and UNICEF committed themselves to the virtual elimination of iodine deficiency disorders in the world, including Europe, by the year 2000. In 1994, WHO, UNICEF and ICCIDD jointly published (and later updated) a technical document entitled Indicators for assessing iodine deficiency disorders and their control through salt iodization. It has become the reference document for members of the health system, salt industry and national and international organizations and agencies in charge of the elimination of the disorders (WHO/UNICEF/ICCIDD 1994, 2001).
The next crucial evaluation of IDD in Europe took place in 1992 when, thanks to recent changes in the political situation, the status of iodine nutrition could be reevaluated in all European countries including the Eastern part of the continent (Delange et al 1993). An international workshop entitled ‘Iodine deficiency in Europe: a continuing concern’ organized by one of the authors of this chapter (FD) and his colleagues under the sponsorship of the European Commission, the ICCIDD and the Belgian Foundation for Medical Research was organized in Brussels. One representative from each European country summarized the latest IDD data from his country including the preventive measures.

Fig. 1 summarises the results reported during the workshop on iodine supply in Europe as at 1992. Iodine deficiency was under control in only 5 countries, namely Austria, Finland, Norway, Sweden and Switzerland. Iodine deficiency was marginal or present mainly in pockets in Belgium, the Czech and Slovak Republics, Denmark, France, Hungary, Ireland, Portugal and the United Kingdom. IDD had recurred after transitory resolution in Croatia, The Netherlands and possibly some Eastern European countries including Russia. Finally, iodine deficiency persisted and varied from moderate to severe in all the other European countries.

In 1997, a follow-up meeting entitled ‘Elimination of iodine deficiency disorders (IDD) in Central and Eastern Europe, the Commonwealth of Independent States, and the Baltic States’ was organised in Munich under the auspices of ICCIDD, UNICEF and WHO (Delange et al 1998). It provided an overview of IDD status, control programs and salt supplementation in the 28 countries of this region. It emphasised the severity of the problem in many parts of Eastern Europe, including recurrence of goitre and occasionally of endemic cretinism in some countries such as Russia after interruption of former programs of salt iodization. The governments of the affected countries, their national delegates, the regions and sub-regions, agencies and non-governmental organisations all received appropriate recommendations. This meeting triggered massive efforts in the implementation or restitution of iodized salt programs, mainly by UNICEF with the financial support of Kiwanis International.

Since these two reports, an increasing number of publications has become available on various aspects of IDD and its control in European countries based on local or regional surveys, for example in Austria, Germany, Hungary, Italy, Portugal (The Euro-Growth Study) (Manz et al 2000), the Netherlands (Brussaard et al 1997), Ireland (Smyth et al 1997), Spain (Garcia-Mayor et al 1999).
Fig. 1 Evaluation of iodine intake in Europe (µg/day) in 1992. Range of the values observed during regional or national surveys. The figures correspond to the measurement of the daily urinary excretion of iodine or to the extrapolation to 1 L of urine per day when the results were expressed as iodine concentrations or iodine/creatinine ratios. N: Norway; S: Sweden; SF: Finland; DK: Denmark; IRL: Ireland; UK: United Kingdom; B: Belgium; NL: The Netherlands; G: Germany; PL: Poland; CS: former Czechoslovakia; CIS: Commonwealth of Independent States; F: France; CH: Switzerland; A: Austria; H: Hungary; RO: Romania; P: Portugal; E: Spain; I: Italy; CRO: Croatia; BG: Bulgaria; GR: Greece; AL: Albania; TR: Turkey (Delange et al. 1993).
A limited number of countries have re-assessed IDD on a national basis. An interesting case is Denmark, the only country in which iodized salt was prohibited until 1999 (Burgi et al 1993). Paradoxically, it was the high incidence of hyperthyroidism in the elderly (due to autonomous nodules in multinodular iodine deficiency goitres) that constituted the starting point for a very cautiously monitored program of salt iodization (Laurberg et al 1998) (See further below in this chapter). Germany was the first country to use a method of standardised evaluation of thyroid volume and prevalence of goitre by ultrasound (Hampel et al 1995). A van with sonographic equipment visited 32 regions all around the country and examined almost 6,000 individuals aged 1-90 years. This ‘ThyroMobil model’ was further fitted for systematic collection of urine samples for iodine determination. It turned out to be one of the most efficient instruments for monitoring progress towards the elimination of IDD (Delange et al 2001; Dunn 2001). The Netherlands reached adequate iodine nutrition after phases of iodization of water and salt, especially for the bakery industry (Brussaard et al 1997; Wiersinga et al 2001), Belgium (Delange et al 2000) and France (Valeix et al 1999) are among the very few European countries with no enforced programs of salt iodization so far and which remain similarly affected by mild iodine deficiency, while Poland has achieved remarkable progress (Szybinski et al 2001). Croatia (Kuzic et al 1997), Macedonia (Karanfilski et al 1998) and Turkey (Erdogan et al 2001) recorded substantial progress, especially after salt iodization was declared mandatory.

The key point is that of these European countries which were deficient in 1992, only The Netherlands, Bulgaria and Macedonia seem to have reached iodine sufficiency by 1999.

Based on these different technical and scientific contributions, WHO Euro adopted the elimination of IDD as one of its targets in its nutrition plan in 1999 (WHO Europe 2000). This was specified in an action plan for sustainable elimination of IDD introduced by one of the authors of this chapter (Delange 2000). This plan has the following components:

- Maintain and develop advocacy, training, communication, and operational research on IDD.
- Perform an ongoing detailed evaluation of the extent of IDD in Europe.
- Implement Universal Salt Iodization if not yet achieved wherever IDD is documented ensure and control its availability, technique, legislation and quality control.
- In the meantime, organise the administration of iodized oil in areas hard to reach with severe IDD.
Global Elimination of Brain Damage Due to Iodine Deficiency

- Implement iodine supplementation during the perinatal period and up to three years of age in areas with mild and moderate IDD.
- Ensure quality control and monitoring of the programs of iodine supplementation from the producer to the consumer: implement and/or control the indicators, through reference laboratories, of the iodine and salt intake of the populations. The promotion of iodized salt should not result in an increase of salt intake. The necessary monitoring of iodine intake through salt iodization is a unique opportunity to evaluate and monitor salt intake and to respect the WHO recommendation to maintain or decrease the salt intake at healthy levels.

In 1999, WHO, with the support of UNICEF and ICCIDD, published a world report on Progress Towards the Elimination of Iodine Deficiency Disorders. The document reviewed the remarkable progress achieved on a world scale. It summarized for each affected country presently available information on legislation, control and market share of iodized salt, as well as monitoring the iodine status of the populations. Based on this document, 18 of the 31 countries of Western and Central Europe are affected by IDD. At least 3 additional countries should be added to the list, namely Denmark, Ireland and France. Thus, only a limited number of European countries affected by IDD are able to report access to iodized salt at household level of at least 90% of the population, which is one of the criteria required for being allowed to declare IDD under control. Europe is now the last continent to provide iodized salt to its iodine deficient populations (WHO/UNICEF/ICCIDD 1999).

Recent updates giving full details of country programs have been provided in the IDD Newsletter (November 2002). Reference to this source is recommended for more detailed information.

8.1.3 Public health consequences of iodine deficiency in Europe

The state of mild to severe iodine deficiency persisting in many European countries or regions has important public health consequences, including on the intellectual development of infants and children. As an example, Table 2 summarizes the situation in Belgium where the consequences of mild IDD on the main target groups, i.e. pregnant and nursing women, neonates and young infants, have been extensively investigated.
More generally speaking, the consequences of iodine deficiency in Europe can be summarised as follows:

**In adults:** the frequency of simple goitre is elevated in many countries and the cost of therapy of thyroid problems resulting from iodine deficiency in the adult population is enormous. For example, the cost for the diagnosis and treatment of goitre due to iodine deficiency in Germany for the year 1986, was estimated at 900 million DM (approximately $500 million, or $8 per inhabitant per day) (Pfannenstiel 1985), while prevention

### Table 2. Functional consequences of mild iodine deficiency in Europe. The case of Belgium

<table>
<thead>
<tr>
<th>Age Groups</th>
<th>Recommended Iodine intake (µg/day)</th>
<th>Recommended Urinary iodine Concentration (µg/L)</th>
<th>Actual urinary iodine concentration (µg/L)</th>
<th>Functional consequences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pregnant Women</td>
<td>200</td>
<td>200-300</td>
<td>&lt;100 in 90% of the cases</td>
<td>Increased thyroid stimulation Goitre</td>
</tr>
<tr>
<td>Adults</td>
<td>150</td>
<td>100-200</td>
<td>51-60</td>
<td>Elevated thyroidal uptake of radioiodine</td>
</tr>
<tr>
<td>Adolescents</td>
<td>150</td>
<td>100-200</td>
<td>30-50</td>
<td>Puberty Goitre</td>
</tr>
<tr>
<td>Children 6-12 years</td>
<td>120</td>
<td>100-200</td>
<td>55-80</td>
<td>Goitre (by ultrasounds 6-11% (18.4% in girls ages 12 years</td>
</tr>
<tr>
<td>Infants 6-36 months</td>
<td>90</td>
<td>180-220</td>
<td>101 in 81% of the cases</td>
<td>Risk for future intellectual development</td>
</tr>
<tr>
<td>Neonates</td>
<td>90</td>
<td>150</td>
<td>48-86 in 68% of the cases</td>
<td>Elevated serum TSH and Tg on cord blood</td>
</tr>
</tbody>
</table>
by iodized salt would cost only 2-8 US cents per inhabitant and per year. Thyroidal uptake of radioiodine varies markedly from one European country to another and is inversely related to the iodine intake. Elevated thyroidal uptake due to iodine deficiency aggravates the risk of thyroid irradiation and development of thyroid cancer in case of a nuclear accident (Delange 1990). The best prophylaxis of nuclear hazards in case of radioiodine fallout is to increase the basal intake of iodine of the population (Ermans 1993).

Thyroid function is usually normal in adults in European countries with borderline or low iodine supply. By contrast, it is frequently altered in pregnancy (Glinoer 1997).

At least under conditions of borderline iodine intake such as in Belgium (urinary iodine 50-70µg/day), pregnancy is accompanied by a progressive decrease of serum free $T_4$ and consequently by an increase of serum TSH. This state of chronic TSH hyper-stimulation results in the development of goitre in about 10% of the pregnant women and in a progressive increase in the serum concentration of thyroglobulin. Goitre can persist after pregnancy in a significant number of women. Pregnancy, especially in conditions of borderline iodine intake, at least partly explains the higher frequency of thyroid problems in women than in men.

The consequences of marginal iodine deficiency during pregnancy in Belgium on the thyroid function of the neonate include even more elevated serum levels of TSH and thyroglobulin in cord blood than in the mothers and a slight enlargement of the thyroid gland. The role played by iodine deficiency in these changes is demonstrated by the fact that they are prevented by iodine supplementation of the mothers during pregnancy (Glinoer et al 1995) and that they do not occur in iodine replete areas in Europe such as some parts of The Netherlands (Berghout et al 1994).

In adolescents and children: Euthyroid pubertal goitre is especially frequent in adolescents and occasionally requires substitutive therapy by $T_4$ or iodide. Iodine metabolism is accelerated during this period of life.

A very important issue is that even today, clinically deficient regions of Europe exhibit subtle or even overt euthyroid schoolchildren born and raised in moderately neuro-psycho-intellectual deficits when compared to iodine-sufficient controls living an otherwise identical ethnic, demographic, nutritional and socio-economic population (Table 3). These deficits (already listed in Section IV Table 4) are of the same nature,
although less marked, than those found in schoolchildren in areas with severe iodine deficiency and endemic mental retardation (Delange 2001). As demonstrated in severe iodine deficiency, these deficits most probably result from transient thyroid failure occurring during foetal or early postnatal life, i.e. during the critical period of brain development (Delange et al 1993).

In neonates: The most important and frequent alterations of thyroid function due to iodine deficiency in Europe occur in neonates and young infants:

The frequency of transient primary hypothyroidism is almost 8 times higher in Europe than in North America (Delange 1997). This syndrome is characterised by postnatally acquired severe primary hypothyroidism lasting for a few weeks and requiring substitutive therapy (Delange et al 1983). The risk of transient hypothyroidism in the neonates increases with the degree of prematurity (Delange et al 1984). The specific role played by iodine deficiency in the aetiology of this type of hypothyroidism is demonstrated by the disappearance of neonatal transient thyroid failure in Belgian pre-terms since they were systematically supplemented with 30µg potassium iodide/day (Delange 1994).

8.1.4 Prevention and therapy of IDD in Europe

It is hard to accept that iodine deficiency, the most common preventable cause of mental deficiency in the world today (WHO/UNICEF/ICCIDD 2001), is still so prevalent in Europe. The main cause of this dire state is the lack of awareness of the health authorities, doctors and the public at large.

The strategy for the elimination of iodine deficiency in Europe must start with information and health education through appropriate channels, not only of the public, but also of the health professionals. Consumption of seafood may be encouraged, but is of limited value.

The major measure for the prevention of IDD in Europe clearly is through Universal Salt Iodization (USI), i.e. the fortification of all salt for human and animal consumption and for the food industry. Possible side effects should be openly addressed, but without causing undue concern. Also, programs should clearly avoid the impression that they advocate a higher salt intake.

In 1992, iodized salt was available in most European countries, usually nation-wide, with the exception of Denmark where it was prohibited. It was compulsory in 8 countries, including Austria and voluntary in all the
Global Elimination of Brain Damage Due to Iodine Deficiency

others, including Switzerland. The price was usually barely higher than non-iodized salt; it was even lower in France.

From 1992 onwards, and especially following the endorsement by WHO Euro of the recommendations resulting from the Brussels meeting that national iodine committees in all countries be appointed to promote the use of iodized salt, quite significant progress has been achieved in many European countries (Szybinski et al; 2001). National programs have been organised, which could result, as for example in Poland, in an exhaustive re-evaluation of the situation and in practical measures aiming at the implementation of USI.

The level of iodization of salt must be adapted at regular intervals to compensate for changing salt intake. For example, in Switzerland, because of the progressive decline in salt intake, the iodine intake slightly decreased in the seventies. In 1980, the level of salt iodization was therefore increased from 7.5 to 15ppm. This resulted in an increase of iodine intake from a borderline value of 90µg/day to a perfectly adequate value of 150µg/day. Rather unexpectedly, this change was not accompanied by any significant increase in the incidence of iodine-induced hyperthyroidism but rather, by a steady decline in the incidence of both toxic nodular goitre and Graves’ disease (Burgi et al 1998). European countries which are actually in a state of moderate iodine deficiency thus may expect to make the transition to iodine sufficiency not only with no ill effects, but with the unexpected large benefit of a marked decrease of the incidence of hyperthyroidism in the elderly in addition to the disappearance of euthyroid goitre. Incidentally, the salt iodine content in Switzerland had again to be increased in 1998, again with full normalisation of urinary iodine excretion (Burgi et al 1998).

In their report published in 1999, WHO/UNICEF/ICCIDD indicated that iodized salt was now available in all 18 iodine deficient countries in Europe and that legislation on iodized salt were available in 12 of them.

Table 3 summarises the latest information we have available on the use and legal status of iodized salt in Western and Central European countries. Most countries have created a legal basis or even established a monitoring and/or promotional program. In 10 countries the sale of iodized salt is compulsory, in 17 it is voluntary, and in 3 the status of enforcement is unknown. 15 countries require iodide, 5 countries iodate, and 10 countries allow both iodide and iodate. The level of salt iodization ranges from 5 to 85ppm. The figures for the market share of iodized household salt must be considered with great caution, since salt producers
Table 3. Regulations governing iodized salt in Western and Central Europe and market shares of iodized household salt

<table>
<thead>
<tr>
<th>Country</th>
<th>Latest review date</th>
<th>Legal Status</th>
<th>Compound Iodine Status</th>
<th>Iodine amount (ppm)</th>
<th>Market share of household salt (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albania</td>
<td>1999</td>
<td>(iodide)</td>
<td></td>
<td>(25)</td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>1999</td>
<td>C</td>
<td>both</td>
<td>15-20</td>
<td>95</td>
</tr>
<tr>
<td>Belgium</td>
<td>1992</td>
<td>V</td>
<td>both</td>
<td>6-45</td>
<td>(10)</td>
</tr>
<tr>
<td>Bosnia</td>
<td>1998</td>
<td>I(odonide)</td>
<td></td>
<td>(20-30)</td>
<td>(50)</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>1997</td>
<td>C</td>
<td>iodate</td>
<td>22-58</td>
<td></td>
</tr>
<tr>
<td>Croatia</td>
<td>1999</td>
<td>C</td>
<td>iodide</td>
<td>25</td>
<td>53</td>
</tr>
<tr>
<td>Czech Rep</td>
<td>1999</td>
<td>C</td>
<td>Both</td>
<td>20 – 34</td>
<td></td>
</tr>
<tr>
<td>Denmark</td>
<td>1999</td>
<td>V</td>
<td>iodide</td>
<td>8-12</td>
<td></td>
</tr>
<tr>
<td>Finland</td>
<td>1998</td>
<td>V</td>
<td>iodide</td>
<td>25</td>
<td>&gt;90</td>
</tr>
<tr>
<td>France</td>
<td>1997</td>
<td>V</td>
<td>iodide</td>
<td>10-15</td>
<td>55</td>
</tr>
<tr>
<td>Germany</td>
<td>2001</td>
<td>V</td>
<td>iodate</td>
<td>15-20</td>
<td>(74)</td>
</tr>
<tr>
<td>Greece</td>
<td>2000</td>
<td>V</td>
<td>iodide</td>
<td>40-60</td>
<td>18</td>
</tr>
<tr>
<td>Hungary</td>
<td>1999</td>
<td>C</td>
<td>both</td>
<td>10-20</td>
<td></td>
</tr>
<tr>
<td>Ireland</td>
<td>1992</td>
<td>V</td>
<td>iodide</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>1997</td>
<td>V</td>
<td>both</td>
<td>24 - 42</td>
<td>3</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>2000</td>
<td>No law</td>
<td>both</td>
<td>10 -25</td>
<td></td>
</tr>
<tr>
<td>Macedonia</td>
<td>2000</td>
<td>C</td>
<td>iodate</td>
<td>20 - 30</td>
<td></td>
</tr>
<tr>
<td>Netherlands</td>
<td>1999</td>
<td>V</td>
<td>both</td>
<td>30-40 household</td>
<td>(60)</td>
</tr>
<tr>
<td>Norway</td>
<td>1992</td>
<td>V</td>
<td>iodide</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Poland</td>
<td>1999</td>
<td>C</td>
<td>iodide</td>
<td>20 - 40</td>
<td>(90)</td>
</tr>
<tr>
<td>Portugal</td>
<td>1996</td>
<td>V</td>
<td>iodate</td>
<td>25-35</td>
<td>1</td>
</tr>
<tr>
<td>Romania</td>
<td>1999</td>
<td></td>
<td>iodate</td>
<td>40-50</td>
<td>25</td>
</tr>
<tr>
<td>Slovakia</td>
<td>1999</td>
<td>V</td>
<td>iodide</td>
<td>15 - 35</td>
<td>85</td>
</tr>
<tr>
<td>Slovenia</td>
<td>1998</td>
<td>C</td>
<td>iodide</td>
<td>5 - 15</td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td>2000</td>
<td>V</td>
<td>both</td>
<td>51 - 69</td>
<td>(16)</td>
</tr>
<tr>
<td>Sweden</td>
<td>1999</td>
<td>V</td>
<td>iodide</td>
<td>40-70</td>
<td></td>
</tr>
<tr>
<td>Switzerland</td>
<td>2002</td>
<td>V</td>
<td>both</td>
<td>20-30</td>
<td>94</td>
</tr>
<tr>
<td>Turkey</td>
<td>1999</td>
<td>V</td>
<td>both</td>
<td>25 - 70</td>
<td>20- 30</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>1992</td>
<td>V</td>
<td>iodide</td>
<td>10 - 22</td>
<td>2</td>
</tr>
<tr>
<td>Yugoslavia</td>
<td>2000</td>
<td>C</td>
<td>iodide</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

V: voluntary.
C: compulsory.
Information in brackets is tentative.
Void cases: no information available.
Data from IDD Newsletters 1998- 2002; from Arbeitskreis Jodmangel and from personal communications.
unwillingly divulge sales figures, and regular household surveys are
tedious to perform. Even when iodized salt is enforced by law, its market
share may remain low, because of instability of iodine, non-compliance of
producers or (cheaper) contraband imports. Market shares for the salt
for food industry are even more difficult to estimate. We have therefore
not included them in Table 3.

The staggering diversity of legal arrangements shown in Table 3
results from several factors:

- Enforced use of iodized salt facilitates the management of a program,
  but in many countries it is unacceptable on constitutional grounds.
- Even though iodate is preferable because of its greater stability,
  many countries have had no problem with iodide and prefer it, because
  it is cheaper, and because the long-term safety of iodate is not
  established according to actual standards.
- Iodine intake may vary from one country to another, depending on
dietary habits. In highly industrialised countries the share of
household salt is smaller, because most salt comes from pre-processed
food bought in the supermarket.
- It is clearly preferable to have all salt for human consumption (i.e.
  household and food industry) iodized, but some countries find it
difficult to enforce iodized salt on the food industry.

Clearly then, international legislation would be of great help. The
European Union has issued for consultation the draft Guideline on the
Harmonisation of Legal Requirements in the Member States on Nutritional
Supplements (KOM 2001 159 final 2000/080 COD). This guideline would
allow direct supplementation (i.e. not via salt) of food with iodine. This
would not allow the judicious dosing and necessary control of iodine
supplementation that iodized salt affords. If enacted, this guideline would
be a disaster for iodized salt programs.

The FAO/WHO Food Standards Program and the Codex Alimentarius
Commission have established standards for food grade salt. These
standards allow the addition of iodate or iodide, but leave the amount to
be added up to the discretion of national health authorities. Thus the
Codex standard will not eliminate the diversity, which will therefore remain
an appreciable handicap for salt producers.

As long as USI is not systematically implemented in Europe, special
attention has to be devoted to the protection of the two main target
groups, i.e. pregnant and nursing mothers and young infants. If iodine
deficient, these age groups should be supplemented with physiological
quantities of iodine, for example by adding iodine to the polyvitamins administered to these two age groups. Moreover, the iodine content of formula milk should be increased in Europe above the classical recommendation of 5µg/dL. The present recommendations, endorsed by WHO Euro and by ICCIDD, are 10µg/dL milk for fullterms and 20µg/dL for preterms (Delange et al 1993).

In addition, in some European areas affected in the past by overt endemic cretinism, the iodine deficiency was and remains severe, for example in parts of Turkey (Erdogan et al 2001) and Romania (unpublished), with impairment of neonatal thyroid function and, consequently, with potentially harmful consequences for brain development. In such situations, emergency and transient more rapid measures can be justified from a public health point of view, such as the oral administration of iodized oil.

It is now demonstrated that in many industrialised countries such as the United States, Great Britain and Northern European countries, the main source of dietary iodine is neither salt nor seafood but dairy milk. This results either from the use of iodophors in the industrial processing of milk or from iodine supplemented diets for the animals, or from both. European rules for monitoring the iodine content of milk and a precise evaluation of the possible role of milk as a substrate for iodine supplementation in Europe are desirable (Phillips 1997).

Iodinated water has proved to be efficient in the control of iodine deficiency in developing countries, in situations where the access to water is well localised, for example by wells, and where most of the water is used for human and animal consumption. These conditions are probably rarely met in European countries.

Finally, it is conceivable that in exceptional circumstances where iodide or iodate are not accepted as sources of iodine for salt iodization for personal reasons, the use of natural seaweed as a source of iodine could be considered.

In summary, iodine deficiency still affected some 150 million people in Europe in 1992 and 97 million had a goitre. Substantial but insufficient progress has been achieved during the last few years.

More precise evaluation of some national situations, dissemination of the information, health education, universal salt iodization and adequate monitoring are the priorities in order to reach the goal of elimination of IDD in Europe.
References


8.2

Iodine Deficiency Disorders (IDD)
in Eastern Europe and Central Asia

Gregory Gerasimov

8.2.1 Summary and Lessons Learnt

8.2.2 Introduction

8.2.3 IDD Assessment and Surveillance

8.2.4 Iodized Salt Production, Supply and Consumption

8.2.5 Legislation

8.2.6 Monitoring
8.2.1 Summary and lessons learnt

During 1955-1970 iodine deficiency in the former Soviet Union was virtually eliminated (as evidenced by significant reduction of EG prevalence and elimination of most severe manifestations of IDD). This was accomplished by a mix of measures including significant production of iodized salt (up to 1 million tones annually), iodine tablets distributed in specific target populations, principally women and children in critical areas; and careful monitoring.

The main shortcoming of IDD/EG control in the USSR was its limitation only to “endemic goitre” areas. There was no legislation for universal salt iodization and IDD prevention was regulated by administrative mechanisms of the fully centralized economy. Iodized salt was supplied mainly to endemic goitre areas as identified on the list provided by the Ministry of Health. However, iodization of all edible salt was not mandated for the salt industry. In 1970s-1980s iodine deficiency gradually returned when supervision waned, and when regular effective monitoring reduced. Because of broader economic and political problems, the system of IDD/EG control started deteriorating and finally collapsed with the break up of the country in 1991.

After dissolution of the Soviet Union each newly independent state had to create its own system of IDD control and prevention. Results of extensive epidemiological studies carried out in all post-Soviet states in 1991-2002 revealed that the population is exposed to different degrees of iodine deficiency. Most severe IDD were found in Central Asian Republics, Kazakhstan and some regions of Russia. These surveys provided a solid background for high level advocacy, with international and bilateral organizations and donors aimed to initiate programs for IDD elimination in the region. Due to severe economic and political problems after the break up of the Soviet Union, major activities aimed at IDD control and elimination in the Newly Independent States started only in 1995-1997, much later than in other regions of the world.

The monitoring system for iodized salt (production and quality control) has been introduced over the past 5 years in all countries of the Region. Biological monitoring system is gradually strengthening with a network of urinary iodine laboratories established in most of the countries in the Region. Recent surveys showed that with introduction of iodized salt iodine deficiency in some countries has been eliminated or reduced.

Introduction of USI requires revision of existing legislation and strengthening of its enforcement. Laws or Presidential Decrees requiring USI and prohibiting production, import and trade of non-iodized salt for
human and animal consumption were adopted only in 5 countries of the region. In other countries policies of IDD prevention are currently stipulated by the government (or health ministries) by resolutions that set a voluntary model of IDD prophylaxis. In the absence of mandatory legislation, the supply of iodized salt to households and food industry depends on demand by the retail traders, and hence, large and small consumers. A comprehensive legislative framework with a strong enforcement system is needed that requires mandatory iodization of all food-grade salt (table salt and salt for food processing).

Thus, compared to 1997, the countries of the region have made substantial progress in evaluation of IDD status and in expanded production, supply and use of iodized salt. In fig. 1 the countries of the region are grouped according to the stages they had reached in relation to the "wheel" model. Some countries (Armenia, Turkmenistan) are very close to virtual elimination of iodine deficiency. However, the goal of IDD elimination has not been reached and additional efforts are needed to combat iodine deficiency in the region.

8.2.2 Introduction

This chapter provides information on the IDD status, control programs and salt iodization in 15 countries of Eastern Europe and Central Asia. Full details are available from ICCIDD’s CIDDS database and in the IDD Newsletter Vol 18 No 3, August 2002.

Since endemic goitre (EG) in the Soviet Union had been considered to be under control, or eliminated, until recent time IDD attracted little attention from medical doctors and scientists. In 1986, the European Thyroid Association Committee on IDD failed to receive any information on IDD in the USSR (Gutekunst and Scriba 1988).

In November 1991 an International Symposium “Elimination of IDD”, with special reference to the USSR, was held in Tashkent, Uzbekistan, sponsored by UNICEF, WHO and ICCIDD. Many Soviet colleagues presented data from their own republics and areas, information that was previously not available to the international world. The Proceedings of the meeting were published in Russian and in English and the main presentations were summarized in IDD Newsletter (1992, vol. 8, No.1).

In September 1997 the three international agencies charged with leading the fight against IDD (WHO, UNICEF and ICCIDD) organised a Regional Conference “Elimination of Iodine Deficiency Disorders (IDD) in Central and Eastern Europe, the Commonwealth of Independent States and the Baltic States” in Munich, Germany. The Conference was
successful in identifying the extent of iodine deficiency, and the status of salt iodization measures taken in each country. An Overview of IDD and control programs in the Region provided updated information on the subject (Gerasimov and Delange 1997).

8.2.3 IDD Assessment and Surveillance

In the past 5 years (1997-2002) significant information has been collected on the extent of iodine deficiency in countries of the region. National and sub-national IDD surveys were conducted in Armenia (Branca et al 1998), Azerbaijan (Markou et al 2001), Belarus (Arinchin et al 2000) and Uzbekistan (Ismailov 2001). In Armenia, a national IDD survey
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has shown adequate iodine nutrition in the population and an effective program of USI that is controlling iodine deficiency (Branca et al 1998).

Development of an IDD control program in Latvia was constrained by the results of the 1995 IDD survey, reporting an almost normal median urinary iodine level, 98µg/L. A small-scale survey (in the year 2000) of about 600 children in 20 schools from all districts of the country clarified the current status of iodine nutrition in Latvia, showing generally mild iodine deficiency (median urinary iodine level 50µg/l). These results helped advocacy for a national IDD control program with USI in Latvia that is in the process of development (Selga et al 2000).

Russia has never had a national IDD survey, but numerous regional IDD assessments covering central, northern and southern regions of European Russia, West and East Siberia and the Far East were conducted in 1998-2001 and showed that iodine deficiency persists in most of its administrative regions with the exception of the Korean minority group in the south of Sakhalin Island (Sviridenko 2001). An effective regional program of salt iodization and iodine supplementation for risk groups has improved the critical situation described in Tyva republic in 1997 (Osokina et al 1998).

Regional surveys in Kazakhstan, Kyrgyzstan and Turkmenistan show various degrees of iodine deficiency (WHO CAR News 2000). Ukraine performed a national baseline IDD in 2002 with the assistance of UNICEF and CDC. Surveys in the northern area (close to Chernobyl nuclear station) and western mountainous regions of Ukraine in 1992-1998 revealed significant iodine deficiency. A 2000 IDD survey found iodine deficiency also prevalent in eastern and southern regions that were previously considered free of IDD, and it is now accepted that iodine deficiency in Ukraine is nation wide, not merely regional (Kravchenko 2002).

No national IDD surveys have been conducted in Lithuania and Estonia over past 5 years. However, recent studies reported that 17.7% of all newborns in Estonia (Mikelsaar 1998) and 20% in Lithuania (Kucinskas) screened for neonatal hypothyroidism have TSH levels above 5 microunits/l, suggesting the persistence of mild iodine deficiency.

8.2.4 Iodized salt production, supply and consumption

Iodized salt is currently being produced in 9 out of 15 countries in the Region. Some countries (Estonia, Latvia, Lithuania, Moldova, Georgia and Kyrgyzstan) do not have their own salt industry and import iodized salt from neighbouring countries; some salt in these countries is also iodized locally.
Iodized salt production was extremely limited in almost all countries of the region until 1997 (Gerasimov and Delange 1997). Since then significant efforts by the salt industry, with international support, have made iodized salt available in all countries, and production is scaling up. All edible salt in Armenia and Turkmenistan is currently iodized. Marked increase of iodized salt production is reported from Belarus (45,000 tones in 2000), Ukraine (68,000 tones in 2001), Tajikistan (21,000 tones in 1999), Uzbekistan and Kazakhstan. All these countries had virtually no iodized salt production in 1997.

In 1997-2002 most countries in the region adopted harmonised levels of salt iodization (40 +/- 15ppm) and shifted from potassium iodide to the more stable potassium iodate (Russia, Ukraine, Belarus, Kazakhstan, Armenia, Turkmenistan, Tajikistan and Azerbaijan). Local production of potassium iodate (and iodide) has been recovered in Russia, Turkmenistan and Ukraine. These countries can cover the requirements of the salt industry in the region in quality potassium iodate.

In 1997-2002, Russian salt producers have built up sufficient production capacities for iodized salt (up to 700,000 tones annually) and the supply of iodized salt to the Russian population increased from less than 20,000 tones in 1997 to nearly 140,000 in 2001. It is safe to state now that there are no longer any real obstacles in the Russian salt industry fully meeting the country’s demand for iodized salt (Apanasenko et al 2002).

Overall production of iodized salt in Ukraine increased from 40,000 tones in 2000 to 68,000 in 2001; and is expected to reach 90,000 in 2002. The supply of iodized salt for the domestic market increased in 2002, covering up to 30% of the potential demand for iodized salt. The export of iodized salt from Ukraine to CIS countries grew from 17,752 tons in 2000 to 46,018 tons in 2001, a 259% increase (Ermakov and Galushko 2002).

In 1997 no information on households (HH) consumption of iodized salt in countries of the region was available, but the Multi-Indicator Cluster Surveys (MICS) and Demographic Health Surveys (DHS) conducted in 1998-2000 offered new data. In Armenia 84% of households consume quality-iodized salt, leading to adequate iodized supply for the population. Consumption in Turkmenistan is lower (75%), most likely from losses of iodine from salt after production. Increase of iodine level in salt from 23 to 40ppm (effective from January 1, 2003) will help to improve iodine nutrition in that country. In Azerbaijan iodized salt consumption jumped
from almost zero in 1998 to 41% in 2000, but the proportion of households consuming iodized salt in other countries of the region is one of the lowest in the world, only 4.5% in Ukraine and 8% in Georgia. Information is lacking for Belarus and Russia.

8.2.5 Legislation

Laws requiring USI and prohibiting production, import and trade of non-iodized salt for human and animal consumption were adopted in Georgia (1997), Kyrgyzstan (2000), Azerbaijan (2001) and Tajikistan (2002). In Turkmenistan USI was introduced by Presidential Decree (1994). A Government decree in Belarus (2001) requires exclusive use of iodized salt for processed food, except sea fish, and for public catering. Other countries regulate salt iodization and IDD prevention by government resolutions (Russia, Ukraine, Moldova, Lithuania) and/or decrees of health ministries. For example, in Lithuania a government resolution exempts iodized salt from 18% Value Added Tax (VAT). Legislation on IDD prevention requiring USI is currently pending in Armenia, Russia, Ukraine, Belarus, Kazakhstan, and Uzbekistan.

The Prime Ministers of all (except Turkmenistan) countries of the CIS in May 2001 signed an Agreement on IDD Prevention in the member states. In 1997-2001 CIS countries updated their salt standard based on Interstate CIS salt standard 13830-97.

8.2.6 Monitoring

Process monitoring (e.g. monitoring of iodized salt quality) has been re-insti-tuted in all countries of the region once iodized salt appeared in the market. Several salt producers (in Russia and Belarus) introduced strict quality assurance of their products and were certified by the ISO. Many countries have introduced biological monitoring of the impact of salt iodization, and 11 of the 125 established urinary iodine laboratories, some of which serve regional as well as domestic needs and are participating in international quality control network.

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Section IX

Sustaining Optimal Iodine Nutrition

John T Dunn

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9. Summary
1. Introduction

Optimal iodine nutrition everywhere is the overall goal of the efforts described in this book. The initial attainment of iodine sufficiency is a satisfying milepost, but its value is greatly diluted if the achievement is not maintained. This lesson is underscored by the many countries that at some point made outstanding initial progress against iodine deficiency, only to have it re-emerge later.

Other chapters have focussed on the consequences of iodine deficiency, its extent, and current efforts to correct it. Here we address sustainability, including the criteria for assessing it (especially monitoring), country examples, national activities needed to achieve it, and the contributions of international partners. The chapter closes with a summary of current iodine nutrition in countries and future prospects.

2. Criteria for Monitoring Progress towards Sustainable Elimination

First, we need to assess whether a country has achieved iodine sufficiency, and then gauge its likely sustainability. The ICCIDD/UNICEF/WHO Report (2001) offered definitions and guidelines. The three key features are satisfactory iodine nutrition, availability of adequately iodized salt, and evidence for their sustainability.

Nutritional iodine deficiency is defined principally by the median urinary iodine concentration in the population. Section IV, Table 2, lists levels of daily iodine intake recommended by the 2001 Joint Report. These are close to those of the Food and Nutrition Board (FNB), US National Academy of Sciences, and of other national and international expert groups (Thomson, 2002). The recommended tolerable upper limit of iodine ingestion has been put at 1100µg per day by the FNB, and 1000µg by WHO. Many people consume higher amounts without apparent ill effect.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Goals</th>
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<tr>
<td>Urinary Iodine</td>
<td></td>
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<tr>
<td>Proportion below 100µg/L</td>
<td>&lt; 50%</td>
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<tr>
<td>Proportion below 50µg/L</td>
<td>&lt; 20%</td>
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Salt Iodization

| Proportion of households using adequately iodized salt | > 90% |

Programmatic indicators (see Table 2) at least 8 of the 10
Means for assessing iodine nutrition also appear in Section IV. Briefly, the median urinary iodine concentration in a representative segment of the population is currently the most practical assessment tool. Goitre palpation is occasionally useful especially with large thyroids, but is too crude for first-line evaluation. Field ultrasonography for thyroid size is precise, reliable, and recently standardized, so it is an acceptable alternative to urinary iodine concentration under some circumstances. Also, neonatal screening with TSH provides valuable information when collected as part of universal screening of newborns in a population. For most countries,
however, the urinary iodine concentration is the best marker, and has the added advantage of recognizing iodine excess as well as deficiency. (see Table 3 in Section IV for a classification of iodine nutrition status by median urinary iodine concentration).

2.1 Satisfactory use of Iodized Salt

The ICCIDD/UNICEF/WHO Report (2001) offers four 'preconditions:'

i) local production and/or importation of iodized salt in a quantity that is sufficient to satisfy the potential human demand (about 4-5kg/person/year);

ii) 95% of salt for human consumption must be iodized according to government standards for iodine content, at the production or importation levels;

iii) at least 90% of food-grade salt from a representative sample of households should have an iodine content of at least 15mg/kg; and

iv) iodine estimation at the point of production or importation, and at the wholesale and retail levels, must be determined by titration; at the household level, it may be determined by either titration or certified kits.

These are, of course, general guidelines and need to be adapted to specific conditions. The recommendations about following the government standards imply that these standards are optimal, while, in fact, they are occasionally too high or too low. The figure of at least 15mg/kg at the household level will be inadequate for some people who consume low amounts of salt. The emphasis on titration as the better method for assessing the iodine content of salt is sound, but the kits as a qualitative indicator still have a place, specially in small production units.

Despite their necessarily arbitrary nature, these preconditions emphasize that the successful application of iodized salt requires adequate supplies and regular monitoring at production and consumption levels.

3. Programmatic Indicators for Sustainability

The 2001 Report listed 10 factors (Table 2) and suggested that at least 8 should be present to conclude that adequate iodine nutrition was sustainable. Not all will be applicable to each country, but they provide a useful checklist. The requirement of 8 is arbitrary and some can be waived if found inappropriate for a specific country. We discuss these below.
Global Elimination of Brain Damage Due to Iodine Deficiency

3.1 An Effective National Multidisciplinary Body Responsible for the IDD Elimination Program

The 2001 Report envisioned chiefly a group responsible to the government, and its chair appointed by the Minister of Health. Such a group exists in many countries, with varying degrees of effectiveness. Recently there has been considerable interest in an alternative model, a coalition or alliance of concerned citizens that exist independent (partly or completely) of the government. Several examples are given later in this chapter. They illustrate how unique features in each country determine a structure that will be successful. The overriding effort should be to have a multisectoral group that will provide permanent oversight and advocacy for optimal iodine nutrition.

3.2 Political Commitment to Elimination of Iodine Deficiency and USI

Because iodine nutrition, like other issues of public health, is ultimately its responsibility, the government must be involved. This requires not only endorsement of the goals of iodine sufficiency, but provision of the resources to support it. Unfortunately, the initial enthusiasm in many successful programs is followed by complacency and then neglect (Dunn 2000). Numerous examples attest to this statement (see later in this chapter). A national coalition can be invaluable in constantly urging the government and its oft-changing political leaders to keep iodine nutrition in constant view.

3.3 Appointment of a Responsible Executive Officer for the Iodine Nutrition Program

Someone in the government needs to be held accountable. A great danger is the diffusion of responsibility among several individuals or departments, until no one has it as a major concern. The frequent reorganizations within governments, especially in Ministries of Health, often cannibalize individual units and leave the IDD Program as a lifeless and quickly forgotten cipher. This is less likely with an appointed executive whose career is judged by his performance with the IDD Program.

3.4 Legislation and Regulations on USI

Most countries have laws and regulations for iodized salt, and many have additional legal instruments for other aspects of the IDD program.
and its monitoring. Often they stem from existing food or product regulations covering additives or industry standards, and their application is not smoothly tailored to iodization. Laws for salt iodization should not be too narrow, such as in designating a particular level of iodine in salt, because they may make adjustments on technical issues more cumbersome. Better to have a broad law mandating iodized salt for human and animal consumption, and leave technical details to later enabling regulations by the Minister of Health or other functionary, without a new Parliamentary act. The legislation should designate responsibility for the program and require periodic reporting of its status. The law should also provide means for its enforcement.

3.5 Commitment to Assessment and Reassessment of Progress, with Access to Appropriate Laboratories

Like the previous three Indicators, this guideline demands governmental commitment, here to monitoring. As such, it is an extension to Indicator #3.2 above. Assessment requires access to adequate technical means for measuring iodine in salt and urine, and periodic surveys and analyses of their data.

3.6 A program of Public Education

Section VI has described the importance of education and communication in successful campaigns against iodine deficiency. Several countries, e.g., the United States, Japan, and Great Britain, have achieved iodine sufficiency through “silent prophylaxis,” chiefly from the unregulated content of iodine in dairy products, meat, and other sources. For many other countries, iodized salt is the major source of iodine, and strong consistent measures must be taken to ensure its acceptance and use. Target groups for education include governmental policy makers, the health sector, the salt industry, educational authorities, and members of the community at large. Sustainability is best achieved if all these sectors understand the consequences of iodine deficiency and the importance of its correction with iodized salt. The communication messages should be tailored to the particular target and be appropriate for the culture. Periodic assessment for level of understanding helps refine the message and re-invigorate its application.
3.7 Regular Data on Salt Iodine at Various Levels

This indicator deals further with monitoring, here of iodine in salt. Two techniques are available. The “titration method” is the standard for quantitative assessment. Details of the technique differ depending on whether iodate or iodide is used for salt iodization. In either, free iodine is liberated from the salt, and its reaction with starch produces a blue color. On titration with thiosulfate, the blue color disappears, and the amount of iodine in salt can be calculated from the amount of thiosulfate required to produce the color change. This method requires only chemicals, no special instruments, and provides a quantitative number. Each sample must be treated individually.

A simpler alternative is the use of qualitative kits. These also rely on the blue color produced by the reaction of iodine with starch, by treating a small amount of salt with several drops of a testing solution of starch and other reagents. Many versions of these kits have been used around the world. Some provide semi-quantitation, but most are reliable only for indicating the presence or absence of iodine in salt. This information is satisfactory for many applications, but should be backed up by titration. In salt plants and testing laboratories, the titration method should be used. For advocacy purposes, such as children bringing salt samples in from home, the kits are effective.

The iodine content of salt should be monitored at several levels, most importantly at production and at consumption. Producers should regularly check the iodine content of their salt as an ongoing quality assurance measure during processing. This is routine with large producers but more difficult for small producing units, frequently only a single family on a small farm. Results should be recorded and available to inspectors.

The government should also monitor the levels of iodine in salt. Typically salt inspectors visit plants, review records of internal quality control, take random samples and send them for analysis by titration in a government laboratory. Inspectors can also carry the qualitative kits for on-the-spot checks.

Salt inspectors should also routinely collect samples in the market place, and if possible, in homes. Collection should be regular and random, and samples submitted promptly for analysis. The government program responsible for iodine nutrition should oversee the analysis of samples and review the findings, inform producers of the results, and investigate any deviations from the prescribed standards for iodine content. Many countries have penalties for samples that do not meet specifications, and these should be enforced.
Countries that import iodized salt should check its iodine content at their borders, and refuse entry to batches that do not meet specification. Strong enforcement of these regulations has proven highly effective.

3.8 Regular Laboratory Data on Urinary Iodine Levels in School-Aged Children, Pregnant Women and Infants

The median urinary iodine concentration is the most valuable indicator of iodine nutrition. Current methods require less than 1 ml of urine, and samples are stable in tightly sealed tubes for couple of months, even at ambient temperature. Techniques for measurement vary from sophisticated research instruments to simple manual and semiautomatic methods that can be carried out in routine chemistry laboratories.

Surveys should use the simplest and most practical means to obtain enough information to delineate the current status and make appropriate decisions. School children have usually been studied (see Section IV). Recent work suggests that urinary iodine data from school children may underestimate the iodine nutrition of pregnant women in the same community. Because iodine deficiency produces its gravest impact during pregnancy, this possibility is of great concern. In the NHANES study from the United States (Soldin 2003) the mean urinary iodine concentration in pregnant women was about 50µg/L lower than that in 6-11 year olds and a large survey from China showed a similar difference (Yan Yuqin, personal communication). Iodine nutrition in pregnancy is complicated by the increased needs of both mother and foetus, a lower renal threshold for iodine (Smyth 1997) and occasional medical restriction of salt intake, so the minimal median values for urinary iodine of 100µg/L for iodine-sufficiency in adults should be increased to at least 150µg/L for pregnancy. In addition to these measures, data on urine iodine in breastfed infants, as well as on the iodine content of breast milk, would also provide information during the further period of brain vulnerability in the first year of life.

Occasionally, survey teams visit households to obtain data for several health and socioeconomic conditions. When these take place, urine and salt samples can easily be collected and used for assessing iodine nutrition as well.

The selection of schools or households to visit requires careful attention to ensure that those surveyed represent the population being studied. Epidemiologic techniques for proper selection are available and
Global Elimination of Brain Damage Due to Iodine Deficiency

should be carefully considered. Iodine deficiency is typically more prevalent in females in poor rural remote communities and they must be adequately represented in surveys. Children from such communities may have lower school attendance and thus may be overlooked. Pockets of iodine deficiency may also be obscured if surrounded by large areas of relative iodine sufficiency. A standard technique is cluster sampling, often applied to other health surveys. It typically includes 30 clusters, selected by appropriate statistical conditions of randomness, to be representative of the community (see further 2001 Joint Report).

An additional approach is designation of sentinel sites, to be followed serially for changes in iodine nutrition. These should be chosen to be representative of the area or situation being monitored.

3.9 Cooperation from the Salt Industry in Maintenance of Quality Control

The business of the industry is to make and sell salt. Public health issues such as salt iodization are not its primary responsibility. However, most salt producers are quite willing, and often eager, to advance a national goal like elimination of iodine deficiency, as long as it does not damage their business. Common problems, real or potential are:

i) increased cost for the producer, especially in technology upgrade and cost of iodine;
ii) unfair competition from non-iodized salt;
iii) onerous inspections and regulations; and
iv) lack of consumer support. These concerns must be recognized and dealt with.

The added cost of iodization varies greatly. Iodine itself is fairly cheap. The major expenses occur with upgrading the quality of salt as part of the iodization step, and with changes in distribution networks. Some countries have only a few producers, with sophisticated technology at large sites, or import all their salt; for them, insertion of an iodization step is simple and inexpensive, and their product can be sold with minimum increase in price.

Other countries have many small salt production sites, occasionally with only one or a few workers, where the technology is primitive and the crude product is sold locally at low cost. Introducing iodization is a major challenge in such an industry, and predictably, these countries have the most difficulty in implementing the use of iodized salt. The government
and international donors can help by providing training, forming cooperatives for iodization, and offering upgraded technology.

Salt producers feel penalized if they obey an iodization law while their competitors provide less expensive non-iodized salt. The government must enforce its iodization laws for all producers, to make the playing field level. The law should stipulate iodization of salt for domestic animals as well as for humans, both because the animals also need adequate iodine and because the presence of cheaper non-iodized salt in the market, ostensibly for animals, offers a tempting alternative for inappropriate human use.

The national regulations must be reasonable and not burdensome for the producers. The government should patiently explain the purpose and procedures of the program, address their concerns, and work with them towards a true partnership that will be mutually satisfactory. Many programs have failed because the government imposed laws without considering the interests of the producers, who then resisted and made the program ineffective.

Industries, including the salt trade, respond to the demands of consumers. If the consumer wants iodized salt, the producer will supply it, or else his competitor will. Thus, a key component of a governmental program is to educate the consumer and create a market for iodized salt. This follows from Indicator # 3.6 above.

Obtaining the cooperation of the industry, as is now being facilitated by the recently established Network for the Sustainable Elimination of Iodine Deficiency, is important (Section III). It is also necessary to see that the product meets quality control standards, as already discussed with Indicator #3.7 above.

### 3.10 Databases for Monitoring, and Mandatory Public Reporting

This topic follows from Indicators #3.7 (iodized salt) and #3.8 (urinary iodine) discussed above. A regular system of data gathering and analysis is critical for any public health issue, including iodine nutrition. The data on salt can be gathered from producers as part of their quality control procedure and from sampling by health inspectors. Routine analysis will enable early recognition of products that deviate from the accepted standards of iodine content, and lead to prompt remedial action. Often working with the producer to solve technical issues will be satisfactory; otherwise enforcement measures may be necessary.
Data on urinary iodine concentrations should be collected as detailed above, at least every several years from representative groups of the population, with special attention to those from poor, remote, and rural regions, where iodine deficiency is most likely to persist. If neonatal TSH screening is already being used nationally to detect congenital hypothyroidism, analysis of its data for the appearance of transient hypothyroidism can provide valuable information about iodine nutrition, with little added cost (see further Section IV).

Mandatory public reporting of these data is extremely important. Statistics moldering in a government office have no value unless they assist evaluation of programs. Public release of information reminds the government and citizens about iodine nutrition and how their country is progressing. National coalitions should constantly demand these reports to keep the issue in view. The ‘wheel model’ is fully discussed in Sections II, VII and in the ICCIDD/UNICEF/WHO Report (2001).

4. National Coalitions: Some Examples

We have mentioned National Coalitions above under Programmatic Indicator #1 of the Joint 2001 Report (Table 2). Their formation is one of the best ways to achieve sustainability. This importance and the many ways, in which they can evolve, justifies further discussion and some examples.

Health issues such as iodine nutrition are the responsibility of the individual country, so success in dealing with them depends on local factors. International agencies and aid organizations can offer advice and seed money, but maintaining optimal iodine nutrition must ultimately be overseen by the country and its government. However, governments and their personnel change, occasionally violently, and these conditions make it easy for a country’s iodine nutrition to sink out of sight and thus severely threaten its sustainability.

National coalitions can direct continued attention to iodine nutrition and the means for making it optimal, usually iodized salt. The structure of coalitions can vary to complement the individual circumstances of a particular country. The principal point of variation will be the level of government involvement. Because public health (and therefore iodine nutrition) is its responsibility, the government must be involved to some extent. However, the government has many other issues and priorities to face, with the inherent danger that iodine nutrition may be lost to official view unless some group keeps it constantly in focus.
In one format, the national coalition consists of prominent citizens from involved sectors who have sustainable optimal iodine nutrition as their major goal. Ideally, the coalition should include all relevant sectors—health, industry, education, the media, the affected communities, mothers, human rights advocates, civic organizations, and others. The specific make-up depends on the strengths and interests of the various available groups. The most important element is the commitment and concern of coalition members. In some countries, it works most effectively as an independent adviser to the government. In this form, it can withstand the inevitable changes in governments and their policies. Such a coalition must work with the government, because the government has the ultimate responsibility.

In another format, the government is a principal member of the coalition, and may even take the lead. This is acceptable as long as changes in governmental policy and personnel do not bring the work of the coalition to an abrupt halt.

Examples of national coalitions are as varied as the countries they represent.  

**South Africa** developed a Network with representatives of the Directorate of Nutrition and the Directorate of Food Control of the National Department of Health, UNICEF South Africa, and the Nutritional Intervention Research Unit of the Medical Research Council (Jooste 2002). While other members, such as salt producers and the general public, may soon be included, their interest in the IDD problem must first be gained. The South African network is coordinating IDD activities and mutual exchange of information among members to jointly strengthen the national salt iodization program. It has developed a plan of action, and its activities are particularly focused on supporting the salt industry towards optimal iodization of salt, by developing training activities, education, and information.

**Switzerland** has a Fluorine-Iodine Commission of the Swiss Academy of Medical Sciences, a nongovernmental body whose ten members represent a wide spectrum of prominent public health officials, dentists, thyroidologists, food chemists, pharmacologists, and salt manufacturers (Delange et al 2002). The Commission meets regularly, reviews new data on developments in iodine nutrition and iodized salt production, and makes proposals to the Federal Commission of Nutrition (a government entity), which in turn writes a Swiss Nutrition Report about every four years, including a section on iodine. From this, proposals are made to the government with recommendations for any necessary legislation.
The Russian Federation held a large national conference of iodized salt producers and distributors late in 2002, organized by the National Salt Producers Association in collaboration with the Ministry of Health, and the Russian Academy of Medical Sciences, with support from UNICEF, and attended by salt producers, distributors, and representatives of government ministries, academia, NGO's, and the media (Gerasimov 2002). One outcome was a public council consisting of representatives of the salt industry, government agencies, and public organizations, to coordinate joint efforts towards IDD elimination.

In Croatia, the Ministry of Health in 1992 established a National Committee for Eradication of Goitre and Control of Iodine Prophylaxis (Kusic 2003). The Committee is chaired by a leading thyroidologist, who directs the Department of Nuclear Medicine at the University Hospital in Zagreb. Other members are the Head of the Department of Sanitary Inspection at the Ministry of Health, a legal assistant from the Ministry of Health, a representative of the Public Health Institute, a representative of the veterinary faculty, and a director of the largest salt plant in the country. The Committee’s charge was to “control iodine prophylaxis in the territory of the Republic of Croatia, propose necessary measures to eradicate goitre, issue recommendations for health workers and other involved professionals, and participate in the preparation of relevant regulations.” The Committee has conducted surveys resulting in new compulsory regulations for salt iodization at 25mg/kg for both human and animal consumption.

An interesting historical example comes from Uruguay, where a National Committee, composed of four professors (Pediatrics, Endocrinology, Preventive Medicine, and Epidemiology) was appointed in 1953 (Salveraglio 1974). Its formation sprang from a visit by the Health Minister to the country’s north, where he noted goitres in schoolchildren as they sang the national anthem. This experience led him to create the Committee, whose members donated their time. They conducted surveys, developed a program for use of potassium iodide pills and iodized salt, and organized explanatory meetings for health authorities, teachers, civic groups, religious leaders, industrial organizations, salt dealers, service organizations, the press, and other media. The Committee members also noted other health problems including poor environmental hygiene, inadequate housing, lack of milk, poor child nutrition, and avoidable dental caries. They urged that these problems be addressed by epidemiologic, medical, and social measures, and by establishing additional health centers throughout the country to obtain public health action and gain
cooperation of communities interested in solving their own problems. Their efforts led to a bill passed in 1963 on compulsory iodization of salt, which was easily accepted by the public because the Committee had provided proper health education for the community.

In Argentina, the Federated Endocrine Societies, a professional organization of clinicians and academicians interested in the thyroid and other endocrine organs, has formed a Committee for IDD Control that has systematically evaluated the status of iodine nutrition in the country’s provinces (Niepomniszcze 2003). This organization operates entirely independently of the government, but publishes its findings and discusses them with national and provincial health authorities. The Committee also plans education for students and the general public, and is exploring neonatal screening to monitor iodine nutrition. Some support for its activities comes from a manufacturer of thyroid medicines.

A common feature of these various forms of national coalitions is the dedication and commitment of important citizens. The ICCIDD seeks out such individuals, appoints them as National Representatives, and encourages them to form national alliances with appropriate partners. This approach re-enforces the primary responsibility of the country for its optimal iodine nutrition rather than depending on international agencies, and offers the best hope for long-range success.

5. Country Examples of Sustainability Issues

Each country is unique, and so, too, are the conditions that affect its attainment of permanent optimal iodine nutrition. Here are examples that show some of the issues involved and offer lessons for other countries.

5.1 Guatemala

The country had longstanding severe iodine deficiency, especially in the mountains, with a national goitre prevalence of 38% in 1952 (Dunn 2002). A highly effective salt iodization program initiated in the 1950s brought the prevalence down to 5% by 1965. By 1973, the country declared that goitre (i.e. iodine deficiency) had been eliminated. Monitoring relaxed, and by 1987 the goitre prevalence rose to 21% and the urinary iodine fell to 42µg/L. The government regained interest, salt iodization improved, and by 1995, the median urinary iodine range was back at an acceptable level, 220µg/L. However, control of salt iodization once more became lax in the late 1990s, and by 1999, the median urinary iodine was 72µg/L, and cretinism re-appeared.
5.2 China

As described in Section VIII of this book, many parts of the country had severe iodine deficiency (Delange et al 2002). Several surveys in the early 1990s showed its extent, leading to a National Advocacy Meeting organized by the State Council in 1993, attended by top leaders, governors, and different sectors from the national and provincial levels as well as by international organizations. Next, the Chinese government and all provinces pledged the elimination of IDD by the year 2000. It established a Central Coordination and Leading Group, with a National IDD Advisory Committee for technical support and scientific consultation. The National IDD Advisory Committee and the Chinese Center for Endemic Diseases Control led efforts for technical training and scientific consultation. Each year they conduct a national re-advocacy meeting, reviewing survey data and making any necessary adjustments. Guidelines for the next decade are developed at these meetings.

5.3 Bolivia

The entire country had severe iodine deficiency with goitre prevalence in the 60% range and frequent cretinism. An impressive program with iodized salt and iodized oil led to iodine sufficiency by 1996, with median urinary iodine of 252µg/L and household consumption of iodized salt reached 92%. An external review committee then concluded that the country was iodine sufficient. Subsequently the situation deteriorated. Changes in government and personnel led to decreased monitoring and a general loss of interest. By 2000, household use of iodized salt was down to 62%, and the median urinary iodine was in the deficient range (ICCIDD 2001).

5.4 Iran

Iodine deficiency was severe in many parts of the country (Azizi 2001). Surveys by university groups and the government in the 1980’s led to a decision in 1989 to accept IDD as a priority health problem, and salt iodization began in 1990. National surveys have taken place regularly; the most recent in 2001, showed a median urinary iodine of 165µg/L and more than 95% of households consuming adequately iodized salt. The program meets all the indicators for sustainability set by ICCIDD/UNICEF/WHO Report 2001. It has an effective and functional national body that
is responsible to the government for the elimination of IDD. This multidisciplinary council involves the fields of nutrition, medicine, industry, education, and others. The government’s political commitment continues. A responsible executive officer is in charge, legislation on salt iodization has been enforced, and an active education program is integrated into the health network with full participation of rural health workers. Data on iodized salt are collected regularly at the factory, retail, and household levels in each province and analyzed by the National Committee. Surveys of urinary iodine concentration are conducted in each province yearly and every five years nationally. All results are kept in a database in the Ministry of Health. A major feature of this highly successful program has been the longstanding collaboration between dedicated leaders in the Ministry of Health and a University Endocrine Unit in Teheran (see Section VIII).

5.5 United States of America

Iodine deficiency was probably never severe, but endemic goitre was frequent in inner parts of the country, especially the Midwest and Northern Pacific region (ICCIDD 2001). Goitre among adolescent girls and during pregnancy was common enough to be considered normal. Goitre from iodine deficiency was reportedly the most frequent cause for military service rejection in the First World War among young men in northern Michigan. Iodized salt was introduced on a voluntary basis in the 1920s, while it became mandatory in neighboring Canada. In the 1950s, iodate was introduced as a bread conditioner in the baking industry and the mean daily iodine intake in the country rose (this practice has since been largely discontinued). A large national survey in the 1970s showed the median urinary iodine concentration to be 321µg/L, but a repeat study in the early 1990s showed a decrease, to 145µg/L (Hollowell et al 1998). The most recent data, from 2001, report a median urinary iodine of 162µg/L. About 70% of table salt is iodized, but the bulk of daily salt intake comes from prepared foods, which are typically not iodized. Most ingested iodine comes from dairy products and other sources, and is unrecognized and unregulated. The country is currently iodine sufficient, but the contribution of iodized salt is minor. There is no national program, although regular monitoring is currently being done by the Center for Disease Control, a government unit.
5.6 Comments on Examples

The program in Iran is one of the world’s most successful at this time, and has provided optimal iodine nutrition for over five years. Its cardinal feature is the commitment of the government and dedicated individuals to keep it effective. China is another success story that has emphasized the role of monitoring, with regular review of the results and appropriate action taken afterwards. Guatemala and Bolivia are developing countries that created impressive initial successes in achieving iodine sufficiency, only to slip backwards later, due in part to absence of monitoring and political will. The United States has achieved iodine sufficiency but by “silent prophylaxis”; its iodine nutrition is unregulated and largely unknown. No national program exists and occasionally medical and other groups comment on iodine nutrition, but there is no national coalition, nor much interest in the issue. The dramatic changes in iodine nutrition over two decades show the effects of market and cultural forces, and emphasize the need for regular monitoring to avoid return of deficiency.

6. What is needed for Sustainability? : Country, Regional and Global

6.1 At the Country Level

The key elements are described above. Iodine nutrition is essentially a country issue, and must be solved at the national level.

6.2 At the Regional Level

Factors beyond a country’s borders influence its iodine nutrition. Salt is traded extensively across national and provincial boundaries, and its regulation, especially its iodization, profoundly affects iodine nutrition. If salt is iodized before importation, the levels must comply with national laws, which may be different from those in the country of origin. Thus, a major regional goal is agreement among neighboring countries on the amounts of iodine to be added to salt, so that uniformly iodized salt can move freely across national borders. At the present time, the iodine levels in salt specified by various countries range from 0 to 100mg/kg. Europe is a hodgepodge of national regulations governing the amount and type of iodine added to salt. Some countries in East Africa iodize at 100mg/kg iodine, while most others are around 30mg/kg. As trade barriers
lower, the regulations among neighboring countries should be harmonized. For most purposes, iodization at 30mg/kilo is reasonable and can be taken as a baseline for further refinement.

Another variable is the salt used for food processing. It is not typically iodized in most countries in North America and Western Europe, but is in many countries in Eastern Europe. In countries such as the United States, most daily salt intake comes from processed foods, not from what is added in the kitchen or at the table, so harmonization of practices regarding iodized salt in food processing should also be addressed. Economic partnerships such as the European Union and ECOWAS are appropriate bodies to address consistency of these regulations.

Regions can also pool resources for monitoring and other cooperative activities. Full-scale national iodine monitoring laboratories are not always practical for many countries, especially smaller ones. The International Resource Laboratory for Iodine (IRLI) Network, created by the US Center for Disease Control, WHO, UNICEF, the Micronutrient Initiative, and ICCIDD, has designated 12 regional laboratories for measuring iodine in urine and salt. These can provide service and training for countries in their regions and form the basis for a network for quality control in monitoring. Countries can also share educational material in specific languages and exploit other common opportunities to promote effective iodine control programs.

6.3 At the Global Level

Activities at the global level should support countries in their efforts to achieve optimal iodine nutrition. Areas include monitoring, advocacy, education, communication, and research.

6.3.1 Monitoring

Global databases of progress in countries keep track of where the overall effort stands, identify countries that need more help, and track progress towards the stated goals of the UN on the virtual elimination of iodine deficiency. ICCIDD has one such database on its website, with individual listing for each country (www.iccidd.org). Both WHO and the Micronutrient Initiative are also developing databases to appear on their respective websites. UNICEF has collected data on iodized salt use, also available on the web. The ICCIDD website includes summaries of the
current status of each country with frequent updates. Its tables and maps summarize current knowledge of global iodine nutrition from currently available information, and emphasize gaps in knowledge about many countries. The global community including ICCIDD, WHO and UNICEF can urge countries to implement effective monitoring systems, and can support their development.

6.3.2 Advocacy

Country programs need advocacy both nationally and internationally. The global community can urge governments to give proper emphasis to iodine nutrition and iodized salt, and ask international donors and NGO’s to encourage country efforts.

6.3.3 Research

The fields of iodine nutrition and its implementation are advanced, relative to many other health issues, but much remains to be learned and improved. Examples are simpler, less expensive ways to assess iodine nutrition, additional means for iodine supplementation, association of iodine nutrition with other health issues, such as HIV, and documentation of socioeconomic consequences. Research on issues such as these can advance knowledge and improve program efficiency, and also foster valuable investigative experience in developing countries.

6.3.4 Education

Iodine deficiency and its correction need to be understood in order to motivate people towards effective programs. Targets should include all who may be involved—high government officials, government technical people, health workers, agriculturists, schoolteachers, students in schools, the media, and the general public. Education must be individualized to suit the characteristics of a particular country, but common principles, materials, and support can be provided by the global community. Education can also be directed at the international community itself, to improve understanding of iodine nutrition and its correction and to make it more supportive of efforts in affected countries.

6.3.5 Communication

Members of the global community should communicate with each other, to improve efficiency and promote effective collaborations. As this book shows, many international organizations are involved in the
global effort to promote optimal iodine nutrition. These include UN agencies, especially WHO, UNICEF, and the World Bank; bilateral donors, especially CIDA, AusAID, the Dutch Foreign Ministry, USAID; non-government organizations, like ICCIDD, the Micronutrient Initiative, Kiwanis International, and the Network for Sustained Elimination of Iodine Deficiency; and professional groups, such as salt producers, medical associations, and various others. Each of these organizations has its own mandates, areas of interest, and priorities. Communication among them is essential to avoid duplication and to apply resources in the most effective way. Several fora for communication exist, such as the UN Standing Committee on Nutrition and the Global Network. Linkages among organizational websites and publications such as the IDD Newsletter also promote coordination. These efforts should be institutional in nature, because personnel and priorities change.

7. Role of International Partners in Sustainability

Section III details activities of major members of the global partnership for iodine sufficiency. More can be found on their websites. Here we emphasize their role in promoting sustainability.

7.1 United Nations and Bilateral Aid Agencies

The major UN partners have been UNICEF, WHO, and the World Bank. The United Nations and member governments have pledged the virtual elimination of iodine deficiency by the year 2005. UNICEF has been charged with taking the lead in this for the UN. Both UNICEF and WHO have representatives and staff in each country, with units that cover health and nutrition, and both have made correction of iodine deficiency a high priority. It will be important that they sustain their efforts by promoting appropriate monitoring and encouraging national coalitions, so that the impressive achievements so far will not be lost.

The aid programs of many countries have contributed to various phases of the IDD elimination effort, especially Australia, Canada, Japan, the Netherlands, Sweden, and the United States. Aid has taken different forms, such as fortification projects, training, publications, and support for implementing organizations, like UNICEF, WHO, the Micronutrient Initiative, and ICCIDD. Support from some (e.g., AusAID, CIDA, the Netherlands) has been consistent for more than a decade. International aid agencies are subject to the policies of the governments they represent, and their resources, priorities, and personnel change over time.
Donors prefer to support projects for fixed periods. As they look for new areas to support, iodine nutrition runs the danger of being downgraded in importance. Donors also like to support projects that become self-sustaining. While some foreign aid will continue to be available, countries must adopt approaches that will eventually support themselves. For example, to be sustainable, a salt iodization program must be acceptable to producers and consumers, and have appropriate enforcement and monitoring. A program may reasonably receive external support for its initiation, but it must eventually run by itself without dependence on foreign aid. This requires the development of practical policies and attitudes that ingrain iodized salt use into the national way of life.

7.2 Nongovernmental Organizations

7.2.1 ICCIDD
Consisting largely of volunteers from many different disciplines and counties, ICCIDD has the single purpose of achieving optimal iodine nutrition for the world. Its goal and personnel have been fairly stable since 1985. With national representatives and members in most countries, ICCIDD has a flexibility and singleness of purpose not found in the larger organizations. However, its resources are limited and its major activities will be to offer technical advice, advocacy, and information, and to encourage countries and larger agencies to remain vigilant against iodine deficiency. Its databases and publications should help to keep iodine nutrition in constant view.

7.2.2 Micronutrient Initiative
It has made major contributions in the fight against iodine deficiency, especially in the area of fortification, which continues to be an important priority. Current efforts are directed more towards vitamin A and iron, but iodine is still an interest. It also maintains databases, and these should help draw attention to countries where the IDD control program becomes threatened.

7.2.3 Kiwanis International
IDD elimination was its first worldwide service project, for which it raised over $75 million, mostly channeled through UNICEF. While the major part of that fundraising project is now completed, Kiwanis will retain an interest in the impact of its donations, and its continued involvement should be strongly encouraged.
7.3 Professional Groups

7.3.1 Salt producer

Associations of salt producers, both national and international, have been strong partners in efforts so far. At the 8th World Salt Symposium in 2000, industry leaders recognized their responsibility for delivering the product and services necessary for achieving and sustaining the elimination of iodine deficiency. That meeting led to the formation of the Network for the Sustained Elimination of Iodine Deficiency, whose members include three groups of salt producers (the European Salt Producers Association, the Salt Institute, USA, and the China Salt Company) as well as other partners like UNICEF, WHO, ICCIDD, the Micronutrient Initiative, Kiwanis, Emory University, and the US Centers for Disease Control. This interest on the part of the salt industry must be strengthened and maintained in order to assure sustainability. The importance of iodized salt should appear regularly at meetings of producers to keep the issue constantly in view.

7.3.2 Medical associations

Endocrinologists and thyroid specialists have had a longstanding interest in iodine nutrition, because they see its effects on the thyroid daily in their clinical practice. In many countries, physicians have been among the first to point out the presence and severity of iodine nutrition and to call for its correction. Some international meetings, such as the International Thyroid Congresses, have noted the continuing presence of IDD and called on their members to encourage governments and others to work towards its elimination. ICCIDD and its partners have sponsored symposia at regional and international thyroid meetings to review IDD status and urge further corrective measures. Efforts are being made within some of the Regional Thyroid Associations to embed iodine nutrition as a routine agenda item requiring regular review and reporting. Continued awareness in this professional group is key to recognizing and correcting deviant iodine nutrition in countries and regions.

Other medical groups should also remain aware of iodine nutrition and consider ways they can improve it. Examples are nutritionists, public health workers, maternal and child health professionals and primary care physicians. Iodine deficiency affects individuals seen in all of these specialties and an awareness of it and of the necessary corrective measures can contribute greatly to the overall effort.
7.4 Networks

Several alliances of organizations dealing with iodine nutrition exist, for example, the Network for the Sustained Elimination of Iodine Deficiency, the International Resource Laboratories for Iodine (IRLI) Network, and the UN Standing Committee on Nutrition. Each of these provides a forum for reviewing current progress and problems in combating iodine deficiency, and they need to remain vigorous to advance sustainability.

8. Current Status and Prospects for Sustainability

The world has made great inroads against its iodine deficiency in the past two decades. For example, a 1987 review of Africa found that the status was unknown in 15 countries and that 97% of the rest were deficient. Fifteen years later, 53% were still deficient, but now 45% were sufficient and the status of only one was uncertain.

Table 3 summarize, available information on the world’s iodine nutrition (details by geographical area at www.iccidd.org). It classifies countries following the scheme recommended by ICCIDD/UNICEF/WHO (2001), based on median urinary iodine concentration. Countries are labeled “deficient” when a substantial fraction (not necessarily a majority) of the population lives in areas of iodine deficiency and risks its consequences. Correspondingly, a country is called “sufficient” if most people are getting enough iodine, although certain areas may still be deficient. Data for many countries are incomplete and occasionally absent; among other things, this table emphasizes the need for more detailed information.

Table 3. Global Iodine Nutrition

<table>
<thead>
<tr>
<th></th>
<th>Population (in millions)</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deficient</td>
<td>3,034 (50%)</td>
<td>84 (53%)</td>
</tr>
<tr>
<td>Sufficient</td>
<td>2,839 (47%)</td>
<td>72 (45%)</td>
</tr>
<tr>
<td>Excess</td>
<td>210 (3%)</td>
<td>3 (2%)</td>
</tr>
<tr>
<td>Unknown</td>
<td>6 (&lt;1%)</td>
<td>1 (&lt;1%)</td>
</tr>
</tbody>
</table>

Countries and their population are assigned to specific categories if a substantial segment (not necessarily a majority) have, or are likely to have, deficient or excessive iodine nutrition, usually based on UI data.

Source: ICCIDD, 2003; www.iccidd.org
Sustaining Optimal Iodine Nutrition

The table suggests that about one-half of the world’s population still lives in countries that have a substantial degree of iodine deficiency. Most countries do not have effective monitoring systems, and educational efforts have been insufficient. As stated earlier, monitoring and education are two of the crucial elements for sustainability, so the world needs to greatly accelerate its efforts. This becomes a race against time, both to meet the goal of 2005 as pledged by the United Nations General Assembly, and also to develop mechanisms for sustainability in countries while iodine nutrition still has the attention of governments and international agencies.

Successes in some countries, e.g., Iran, China, Cameroon, Peru, show that sustainable optimal iodine nutrition is possible. The three greatest threats to sustainability are inadequate monitoring, changing personnel and priorities, and failure to embed IDD control (usually through iodized salt) into the country’s way of life. These challenges can be met, as shown by these examples, but they demand accelerated efforts on the part of all, especially the countries themselves.

9. Summary

Once iodine sufficiency is obtained, its sustainability depends on monitoring of iodine nutrition and iodized salt, education, national coalitions, designated responsibility, and reporting of data. The urinary iodine concentration is the most useful monitoring tool. Country examples of sustainability issues include Guatemala and Bolivia, where initially impressive achievements subsequently declined, China, which has periodic re-advocacy meetings and a strong national committee, Iran, where an effective partnership between academic endocrinologists and the Ministry of Health has produced a carefully monitored and highly successful program, and the United States, whose silent prophylaxis is largely uncontrolled. In addition to the key elements listed above at the country level, sustainability at the regional level needs harmonization of iodized salt regulations, and pooling of resources for monitoring and education. Important activities at the global level are country databases, advocacy, research, education, and communication. Partners include UN agencies, bilateral donors, non-governmental organizations, professional groups such as salt producers and health associations, and networks.

Currently, about one-half of the world’s countries have significant degrees of iodine deficiency, although the majority within each country
may not be deficient. For these countries, the first priority is to achieve iodine sufficiency. In addition, all countries should look to the sustainability of their efforts so that the achievements are not lost in the future. Recurrence of iodine deficiency has occurred in many countries in the past. It is avoidable, but only if countries and their partners take the necessary measures to ensure sustained iodine sufficiency.

References

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Section X

Conclusion

Looking Forward
Kul Gautam (UNICEF)
Catherine Le Gales Camus (WHO)
Jack Ling (ICCIDD)

With the UN goal of reaching sustained elimination of iodine deficiency disorders (IDD) only 18 months away, there is a clear and urgent need for continued, and enhanced, vigorous, disciplined, and persistent efforts by countries. The road ahead requires firm policy commitment at all levels, as well as diligent field level program implementation.

As seen in earlier chapters, the record of progress since the historic 1990 UN Global Summit for Children is nothing short of phenomenal. In a little over a decade, there has been a tripling of the number of households using iodized salt in the world, from less than a fifth of all households to over two-thirds in IDD affected countries. This means that two billion more people are now protected by the use of iodized salt. Within the same period, the number of countries where iodine deficiency is a public health problem decreased by 41%. However, the remaining difficulties and challenges to reaching the 2005 goal should not be underestimated. And, at the same time, countries and their multi-sectoral partners must be planning to make the existing achievements sustainable into the foreseeable future.

Newborns protected in 2003 : 80 Million

In the year 2003, close to 80 million infants born were protected from this scourge, as their mothers consumed iodized salt. This amounted to a saving of over a billion IQ points. The impact on infants and children, and the societies in which they live, being able to reach their genetic potential with improved learning capacity, physical well being and productivity has yet to be calculated. The World Bank has identified micronutrient malnutrition as the cause for an approximate 5% decrease in the Gross National Product (GNP) of countries with vitamin and mineral deficiencies at a public health problem level. Certainly correcting such
deficiencies will lead to an aggregate economic and social benefit, representing many-fold the return from the relatively modest investment needed for the elimination in IDD.

To paraphrase a well-known refrain from World War II:

*Never has so much has been achieved for so many for so little in such a short time.*

The credit of course goes to the national efforts in the developing regions of the world. In many of the countries, the health sector and the salt industry have joined hands; the international development agencies have provided technical support, and the civil society has responded to the challenges in bringing about this historic achievement. The global iodine program has been called a quintessential economic and social development effort involving all segments of society and benefiting all—rural and urban, male or female, young and old, poor and rich. It is a program that addresses the heart of human development and attacks not only poverty’s symptom but also one of its causes. Nevertheless, as was seen in earlier Sections of this book, rural and poorer segments of societies are not yet receiving the full benefits.

Nevertheless, UN Secretary-General Kofi Annan has singled out iodine deficiency work as a model of public/private partnership for development.

Lest we forget, however, a third of the people in the world, especially those in the developing countries but also in the industrialized nations, are not using iodized salt. Some of them do not have access to iodized salt. Many face geographic, economic, cultural and other barriers. Most people do not yet know enough, or have forgotten, about the harmful effects of iodine deficiency. Future action must be led by consumer demand.

**Newborns Not Protected in 2003 : 41 Million**

The best estimates show that of the 110 national programmes, 27 countries have over 90% household usage of iodized salt, and 48 countries below 50%, with 35 in-between. An estimated 41 million annual newborns still come into the world unprotected from brain damage as a result of iodine deficiency while an estimated 2 billion people have inadequate iodine nutrition.
The challenges to reach the remaining third of the people before the end of 2005, the goal set by the UN General Assembly Special Session on Children, are considerable and cannot be over-emphasized. The truism that “the easy gets done first and the difficult remains to be done” aptly applies to iodine deficiency work. The urban, the more educated and more affluent tend to accept change more readily as they feel they have the power to make changes in their lives, once they are presented with evidence of harm inflicted on brain development by the lack of iodine and the benefit of iodized salt. It is those who have less power because they are poor, uneducated, in remote areas, or in conflict zones, who are the hard-to-reach, but they are precisely the people who need the protection of iodized salt most. For, they desperately need to have their children protected from brain damage in their effort to break the cycle of poverty-low productivity-low learning ability.

Backsliding Trends

A worrying trend has emerged in the last two or three years. In a number of countries, where progress was impressive, the number of households using iodized salt has declined. Some went down drastically, as much as 50%. This has been as true in the industrialized countries such as Australia, Canada, some European Countries and the USA, as well as developing countries.

A major challenge in IDD work is the need for continuing “advocacy” at the policy level to avoid the mistaken notion that fighting IDD was a one-time effort. The deficiency will return as surely as the sun rises, once people stop getting enough iodine into their body via the consumption of iodized salt. Lack of effective public education and demand creation for iodized salt may well be one of the reasons for “backsliding.” The lack of clarity and the confusion between visible goitre, which has long been recognized in history, and the invisible brain damage, associated with other health consequences, which was largely unrecognized as a public health issue before the 1970s, is another somewhat unique challenge in IDD elimination. The legacy of successful work in controlling visible goitre in years past has ironically created a perception problem in some circles. A sharp focus on brain damage, surprisingly, is still missing in some of the national programs. The fact that iodized salt is a commercially available product also poses the problem of competition from friendly or unfriendly fire of other commercially available products, some of which,
we are aware, possess vast resources for promotion and message delivery to the public. This issue is not yet fully recognised and taken up in many of the national programs.

The Tasks Ahead

In order to reach the 2005 goal, what are the tasks ahead of the international community?

Strategically, first of all, accelerated efforts must be made in the countries lagging far behind, especially those with unprotected annual newborns in the millions. Many of them are in South Asia but Africa has its share and so does the region of Eastern Europe and Central Asia. Then, there is a need to also:

(i) sustain the progress already made;
(ii) tackle the problems of countries backsliding in their iodised salt coverage;
(iii) energize those getting close to the goal;
(iv) address salt-producing countries so that all their exported, and imported salt, is iodized; and
(v) finally, address the challenge of the small salt producers who account for up to a quarter of salt consumed in some countries.

An important International Meeting for the Sustained Elimination of IDD that took place in Beijing in October 2003 has emphasized a number of crucial issues for the challenges of sustained elimination. The consensus statement adopted in Beijing has pointed the way for IDD work in the period ahead. It spells out five specific areas that need urgent attention in the pursuance of the goal:

Five Issues for Sustained Elimination

1. *Securing and sustaining political commitment.* This is a continuing effort at all levels from central government to village council. Iodizing edible salt may involve a decision by the government but using salt is also a decision by those preparing and processing food. In many countries, most of the salt consumed is in a ready-to-eat form from processed foods so that salt used in its preparation, must also be iodized. Even with a 93% household iodized salt coverage, China has set an example of holding a periodic advocacy meeting every three years.

2. *Ensuring the supply of adequately iodized salt.* While the technology of iodizing salt is not complicated, producing and marketing
iodized salt to ensure access to all households and at affordable prices requires strategic planning and logistic support. Stopping the flow of non-iodized salt into the market is very important. Helping small producers to come to terms with iodization will entail both incentives and appropriate legislation and there are encouraging examples available (Section V).

3. Social mobilization that leads to community participation and demand creation. Consumer education, school health education and media coverage of IDD issues are needed to foster the behavioral norm of using iodized salt, the lynchpin for sustained IDD elimination. More focused messages for specific audiences are needed to bring about behavioral change. Economic, social and cultural barriers need to be identified and overcome (Section VI).

4. Monitoring the quality of iodized salt and ensuring adequate iodine nutrition. Surveillance of the iodine nutrition status including urine iodine determinations and the monitoring of the quality of salt is needed to provide the basis for continuing IDD work. Results from such efforts are vital for policy and program management decision and for continuing and renewing commitment (Sections IV, VII, VIII).

5. Building national coalitions for sustained elimination. Fighting IDD is a societal effort involving efforts across all sectors. In order to achieve and maintain effective prevention and control of the iodine status of populations, each country should have a multidisciplinary group to keep a constant watch over the iodine status, identifying areas for action, promoting collaboration among sectors, especially between health professionals and salt producers, and activating civil society involvement to facilitate and maintain the behavioral norm of using iodized salt (see Section IX).

Complementing USI

All public health measures aim at the overwhelming majority of the people; this invariably leaves out minority groups with specific circumstances. The global effort to eliminate iodine deficiency via the use of iodized salt is no exception. Universal Salt Iodization (USI) is the overarching goal. Where this is fully achieved, IDD will be eliminated. However, many countries, especially industrialized countries, are iodizing only the table salt. This will be insufficient, especially as the consumption of table salt is reduced, in response to advice to reduce hypertension, and will be particularly insufficient for the unborn infants of pregnant women.
But the iodine concentration in salt can be readily increased to allow for a reduction in salt intake as pointed out in Section III and IV.

In geographic areas devoid of salt and with little physical infrastructure it may take months and years before suitable vehicle for delivering iodine could be made available and affordable. In parts of Xinjiang Autonomous Region, China, for instance, an inexpensive device costing the equivalent of 25 cents that releases iodine gradually over a period of 12 months in salty liquid melted from rock salt for cooking, has been used as a temporary measure to protect newborns with demonstrable benefits. For specific vulnerable groups, such as seriously deficient expectant mothers, oral iodized vegetable oil is available to provide adequate iodine for a year. Intramuscular injection of such oil is effective for 3 to 5 years. In areas with high iodine intake, residents should not use iodized salt. And in areas where there are severe food shortages, emergency food rations may be the best channel for the population for periods. In times of conflict, and in refugee camps, iodized salt is not necessarily the immediate solution. As a human right, these mothers will need supplementation.

Nevertheless, USI is the long-term solution to sustained optimal iodine nutrition. In evaluating iodine status, a 90% household coverage has been used as the benchmark for success. In affluent urban areas, even a lower percentage may be sufficient as residents have access to a variety of foods with iodine content, e.g. sea foods, meat, vegetables and dairy products. On the other hand, in remote rural areas the same percentage means the poorest segment of the population who needs iodine most may have been left out altogether. Although a national coverage of 90% is the current marker of success, in some countries the last 10% may be concentrated in certain areas of the country, and a drive towards universality is needed in those circumstances, with specific targeting.

Salt an Equalizer

While the social and economic arguments for IDD work have been used at advocacy level, salt as an equalizer should be viewed as an effective entry point to breach the gender barrier in male-dominated societies. With considerable investment being made in female education, the education sector should take up the IDD cause so that the girls entering school would have the capacity to learn. There is little point in improving access to education, if young children enter the schooling system with impaired neuro-intellectual potential.
For the elimination of IDD to be successful and sustainable, this must be an effort of all society in each country: the consumer, the salt industry, public health authorities, governments, the media, academia, and civil society. In the UN system, IDD work occupies an important place in health and nutrition development. WHO’s nutrition department takes a technical lead in this work. UNICEF’s nutrition staff has played the major role in supporting country programs. But IDD transcends the nutrition and health units. It is a reproductive health issue for those in population work, as it can cause still birth, miscarriages and even maternal fatalities, in addition to giving birth to cretins. It is a mental health issue, as iodine deficiency is the major, preventable, cause for mental retardation. It is certainly an early child development issue as well.

The World Bank, the Asian Development Bank and the UN Industrial Development Organization have played a vital role in helping the salt sector in training and upgrading its capacity to take up salt iodization, including packing and distribution. FAO could play a more active role and UNESCO needs to assume the role of mobilizer for the education sector to improve the learning capacity of school children. The Gates Foundation (through UNICEF) and many bilaterals (CIDA, AusAID, USAID, Dutch Aid and JICA) will need to continue their support.

The crucial role of the Global Network for Sustained Elimination of Iodine Deficiency, the alliance of international organizations concerned with IDD elimination is self-evident for the period ahead. The Network should help with strategic planning and identify specific areas of action. Above all, it should keep up with policy advocacy and monitor global progress and support the creation of national alliances that carry out country-level surveillance and take action to move towards the goal and to sustain IDD elimination. The continued support of civil society, most notably the superb contribution of the Kiwanis will continue to play a critical role.

Towards the Millennium Development Goals

The UN Millennium Development goals have been internationally accepted as global ambitions in an unprecedented way, although funding from the industrialized countries remains inadequate. Micronutrient malnutrition, of which iodine deficiency is a major contributing factor, has implications in the reaching of 5 out of these goals: those aiming to eradicate poverty, achieve universal primary education, promote gender
equality, reduce child mortality, and improve maternal health. And IDD elimination has been identified as having one of the greatest chances of being attained.

With the problem clear, the impact understood, and the solution affordable and sustainable, can we in all conscience allow even a single child, let alone millions of them, entering our world and growing up without the iodine protection against brain damage? If the development community should fail to attain the goal of sustained IDD elimination, what prospects does it have in tackling the more complicated development tasks?

*The time to act is now*
Appendix - 1

Iodine Nutrition and Programs for its Control:

Tables from CIDDS, UNICEF, WHO
<table>
<thead>
<tr>
<th>Country</th>
<th>Pop (M)</th>
<th>UI *</th>
<th>Compound</th>
<th>ppm</th>
<th>Implement?</th>
<th>Household Use %</th>
<th>Exists?</th>
<th>Monitoring</th>
<th>Educ?</th>
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<tr>
<td>Algeria</td>
<td>31.7</td>
<td>347</td>
<td>KIO3</td>
<td>30-50</td>
<td>P</td>
<td>68</td>
<td>Y</td>
<td>P</td>
<td>P</td>
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<td>KIO3</td>
<td>U</td>
<td>N</td>
<td>10</td>
<td>P</td>
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<td>~90</td>
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<td>----</td>
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<td>--</td>
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<tr>
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<td>U</td>
<td>KIO3</td>
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<td>U</td>
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Y = Yes, Present; N = No, Absent; P=Partial; U = Uncertain; *Where applicable median
D = Deficient; S = Sufficient; (L) = (Likely)
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*Where applicable median D = Deficient; S = Sufficient; (L) = (Likely)

Y = Yes, Present; N = No, Absent; P=Partial; U = Uncertain;
**Table 3:** Iodine Nutrition and Programs for its Control in Central America

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*Where applicable median D = Deficient; S = Sufficient; (L) = ( Likely)
### Table 4: Iodine Nutrition and Programs for its Control in North America

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Y = Yes, Present; N = No, Absent; P=Partial; U = Uncertain; *Where applicable median  D = Deficient; S = Sufficient; (L) = (Likely)  E = Excess
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<td>Y</td>
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Y = Yes, Present; N = No, Absent; P=Partial; U = Uncertain; *Where applicable median D = Deficient; S = Sufficient; (L) = (Likely) E = Excess
### Table 7: Iodine Nutrition and Programs for its Control in Southeast Asia

<table>
<thead>
<tr>
<th>Country</th>
<th>Pop (M)</th>
<th>UI* µg/L</th>
<th>Iodized Salt</th>
<th>Program</th>
<th>Status</th>
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<tbody>
<tr>
<td>Bangladesh</td>
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<td>U</td>
<td>Y KIO3 50 Y 70 Y Y  P P D(L)</td>
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<td>U P</td>
<td>Y KIO3 50 U 79 Y Y  Y  U D(L)</td>
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<td>Y KIO3 50 Y 87 Y  P N  Y  D(L)</td>
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*Where applicable median

Y = Yes, Present; N = No, Absent; P=Partial; U = Uncertain; D = Deficient; S = Sufficient; (L) = (Likely)
Table 8: Iodine Nutrition and Programs for its Control in China-Far East

<table>
<thead>
<tr>
<th>Country</th>
<th>Pop (M)</th>
<th>UT μg/L</th>
<th>Iodized Salt</th>
<th>Program</th>
<th>Status</th>
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Y = Yes, Present; N = No, Absent; P=Partial; U = Uncertain; *Where applicable median D = Deficient; S = Sufficient; (L) = (Likely)
### Table 9: Iodine Nutrition and Programs for its Control in East Europe-Central Asia

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<th>Pop (M)</th>
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<th>Compound</th>
<th>ppm</th>
<th>Implement?</th>
<th>Household Use %</th>
<th>Exists?</th>
<th>Monitoring</th>
<th>Educ?</th>
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Y = Yes, Present; N = No, Absent; P=Partial; U = Uncertain; *Where applicable median
D = Deficient; S = Sufficient; (L) = (Likely)
**Table 10**: Iodine Nutrition and Programs for its Control in West-Central Europe

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Y = Yes, Present; N = No, Absent; P=Partial; U = Uncertain; *Where applicable median

D = Deficient; S = Sufficient; (L) = (Likely)
Table 10: Iodine Nutrition and Programs for its Control in West-Central Europe (cont’d)

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<th>Pop (M)</th>
<th>UI’ µg/L</th>
<th>Iodized Salt</th>
<th>Program</th>
<th>Status</th>
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Y = Yes, Present; N = No, Absent; P=Partial; U = Uncertain; *Where applicable median D = Deficient; S = Sufficient; (L) = (Likely)
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Y = Yes, Present; N = No, Absent; P=Partial; U = Uncertain; *Where applicable median D = Deficient; S = Sufficient; (L) = (Likely)
Appendix 2

List of Books and Reports on IDD
Appendix 2

List of Books and Reports on IDD

This list is not exhaustive. Some of the key publications are listed here.


Endemic Cretinism. Eds. BS Hetzel and POD Pharoah. Institute of Human Biology, Monograph No. 2, Goroka, New Guinea 1971


Hyperthyroidism and other Thyroid Disorders - a practical handbook for recognition and management. Todd CH, WHO/ICCIDD. WHO/NHD/99.1. (Also published in French.).


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