Iodine Deficiency Disorders and Universal Salt Iodisation: South Asia Priorities
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Cover Photo: Universal Salt Iodisation is the most cost-effective and viable solution to Iodine Deficiency Disorders
Photo: Salt Trading Corporation/Nepal

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Iodine Deficiency Disorders (IDD) and Universal Salt Iodisation: A South Asia Priority

What is IDD?
IDD is a term used to describe the various negative effects of iodine deficiency disorders on people and animals. Iodine, an element and essential micronutrient, is required for the synthesis of two thyroid hormones, thyroxine and tri-iodothyronine. Inadequate iodine intake and absorption leads to insufficient production of these hormones, which in turn negatively affects various organ and muscle functions, particularly the heart, liver, kidneys and most devastatingly, the developing brain.

What are the Signs and Symptoms of Iodine Deficiency?
Insufficient iodine during the prenatal period and the first few years of life can result in irreversible brain damage, and is considered to be the major cause of preventable mental retardation. Unless the deficiency is corrected before brain development is completed, iodine deficient children will be poorly equipped to fight disease and to learn, and will become adults who are unable to work effectively, and reproduce

IDD remain a major public health problem despite the availability of a safe and simple solution for its elimination — iodisation of salt. Globally, an estimated 740 million people are affected by goitre, and more than 2 billion are estimated to be at risk of IDD. One hundred seventy two million victims of IDD are found in the South Asia Region, with another 600 million South Asians at risk. Promoting the universal production and consumption of iodised salt is the easiest and most cost-effective means to prevent, control and eliminate IDD in the region.

Goitre, a swelling of the thyroid gland, is the most visible sign of IDD

Mental Retardation due to Iodine Deficiency: A Preventable Public Health Problem
Iodine Deficiency Disorders and Universal Salt Iodisation: South Asia Priorities

Negative Consequences of IDD:

<table>
<thead>
<tr>
<th>In Pregnant Women; Foetuses and Newborns</th>
<th>In Infants, Children and Adolescents</th>
<th>In Adults</th>
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<tbody>
<tr>
<td>• Decreased fertility</td>
<td>• Hypothyroidism</td>
<td>• Goitre and its complications</td>
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<tr>
<td>• Spontaneous abortion</td>
<td>• Impaired coordination</td>
<td>• Hypothyroidism</td>
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<tr>
<td>• Stillbirths, congenital abnormalities</td>
<td>• Impaired mental function</td>
<td>• Impaired mental function</td>
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<tr>
<td>• Neonatal mortality</td>
<td>• IQ 13 points lower</td>
<td>• Lower energy and productivity</td>
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<tr>
<td>• Cretinism</td>
<td>• Retarded mental and physical development</td>
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<tr>
<td>• Psychomotor defects</td>
<td>• Diminished school performance</td>
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satisfactorily. The severity of iodine deficiency-related brain damage varies from mild intellectual blunting to frank cretinism, a condition that includes gross mental retardation, deaf-mutism, short stature, and various other physical and mental defects.

The most visible and hence well-known sign of iodine deficiency is goitre. In response to the low levels of thyroid hormones circulating in the blood, the pituitary gland secretes more thyroid-stimulating hormone (TSH) which causes the thyroid to grow in size. Small goitres can only be detected by health professionals through an examination of the front of the neck (known as palpation), whereas larger goitres are obvious and unsightly lumps that can be seen easily. Although women and girls are most susceptible to goitres, because of their increased need for thyroid hormones during the periods of adolescence and childbearing, men and boys can also have goitres. Goitres are generally considered unsightly and embarrassing, but only smaller ones can be reduced to some extent by consuming iodine. Large goitres cause serious health problems, including restriction of head movement, discomfort and obstructed breathing, and can only be removed surgically. Goitres, however, are only the tip of the iceberg: IDD has numerous consequences with potentially devastating effects on every member of the family.
Manifestations of IDD in humans have been recognised since ancient times. IDD in animals have only recently received attention although, in fact, most knowledge of the effects of iodine deficiency comes from experimental research in animals. Due to the ecology of iodine, animals such as dogs, cats, sheep, goats, cows, buffalo, pigs, and chickens in those geographical locations where IDD are greater in humans are more likely to suffer from IDD. A lack of iodine in the diet of farm animals has been shown to reduce the yield of products (eggs, milk, meat, wool, etc.), labour, and manure for cooking fuel and soil fertility. Such losses may be particularly important for rural populations where livelihoods and food supplies are dependent on farm production.

What Causes IDD?
In areas where iodine is present in the soil in adequate quantities, this essential micronutrient is ingested by people and animals through the consumption of animal and plant foods raised on that soil. However, iodine is unevenly distributed on the earth's crust, and therefore the iodine content of soil is insufficient in many parts of the world. For example, greater amounts of iodine are found in the soil of areas previously covered by ancient seas or oceans, whereas far less iodine is present in the soils of mountainous regions, such as the Himalaya and the Tibetan plateau.

Natural phenomena, such as cyclones, resulting in frequent flooding of river deltas, and man-made acts, such as deforestation, irrigation, and poor agricultural practices that erode the soil, can deplete the iodine found in soil. Even in areas where iodine levels in the soil are sufficient, food habits and practices can negatively affect the ingestion and absorption of dietary iodine. Certain foods are goitrogenic (mainly brassicas, such as kale), which means they contain substances that prevent the absorption of iodine from other sources in the diet. Although some foods are naturally rich in iodine, such as seaweed, shellfish and certain organs of sea fish (i.e. the brain), their high cost and limited availability make them unsuitable sources of iodine. For the majority of the world's population, it is impossible to consume an adequate amount to meet daily iodine needs.
Iodine Deficiency Disorders and Universal Salt Iodisation: South Asia Priorities

Even populations living in areas with access to the ocean and saltwater seas, such as the atolls of Maldives are known to be iodine deficient. Dietary habits, such as throwing away fish heads rather than consuming them, and the high cost of ocean products, prohibit many islanders from eating enough of these foods to satisfy their iodine needs. As a result, the Maldives and many coastal areas of South Asia have medium to high rates of IDD. Although it is widely believed to be true, iodine is not naturally present in sea salt in sufficient quantities to prevent IDD. All salt, including salt made from seawater needs to be iodised to provide sufficient iodine.

How is IDD Measured?
There are several ways commonly used to measure IDD, including both clinical to biochemical assessments. Goitre, the most obvious sign of iodine deficiency, has been measured in most areas to determine whether or not the less visible but more serious consequences, such as brain damage, mental retardation, miscarriages and child mortality are of public health concern.

The success of large scale IDD control programmes in the past decade has resulted in a lower prevalence of visible goitres. Therefore, programmes are increasingly using biochemical means to assess and monitor IDD, with the urinary excretion of iodine considered to be a good index of the iodine taken in. Since all iodine in the body is eventually excreted in the urine, Urinary Iodine Excretion (UIE) is a fairly accurate marker of dietary iodine intake.

According to WHO, there are three grades of goitre, indicating their severity:

- **Grade I- Palpable, non-visible goitre** (each lobe as big as the end of the thumb)
- **Grade II- Smaller visible goitre** (usually euthyroid, causing little distress)
- **Grade III-Large, disfiguring goitre** (physically disabling)

Since the absolute minimum daily iodine requirement is about 150 microgrammes (μg), a urinary iodine level of less than 150 μg indicates iodine deficiency. In fact, some degree of iodine deficiency may exist even when UIE is as high as 100 μg, per day. When the mean daily UIE in an area is less than 25...
Iodine Deficiency Disorders and Universal Salt Iodisation: South Asia Priorities

**Nutritional Status** | **UIE (mg/Litre)**
---|---
Normal | 100-200
Mild | 50-99
Moderate | 20-49
Severe | below 20

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**Effect on People** | **Humans** | **Health and Socio-economic Impact**
---|---|---
Effect on Animals | Livestock | Clinical and Reproductive disorders, decreased productivity
Goitrogens | Plants | Iodine-poor Feeds and Fodder, Low Availability of Iodine | Water, Soil | Environmental Iodine Deficiency

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Reproduced from: Iodine Deficiency Disorders in Livestock, Pandav & Rao, Oxford University Press, Delhi: 1997

mg, cretinism will frequently be found in the population. Under proper, controlled circumstances, the measurement of UIE is an effective and reliable test. However, considerable care is required to ensure that laboratory systems are adequate, and that biochemical procedures are accurately carried out. The degrees of iodine deficiency for an individual are defined as follows:

**How can IDD be Prevented and Controlled?**
The quantity of iodine required by an individual each day is extremely small, with a recommended daily intake of at least 150 mg. Less than the amount of iodine that fits on the head of a pin is all that is required each month (or a teaspoonful over a whole lifetime) to prevent IDD. Yet, iodine deficiency is one of the major public health issues faced by the developing world with more than one billion people at risk. Since iodine does not occur naturally in specific foods, but is instead present in the soil and imbibed through foods grown on that soil, IDD cannot be eliminated by simply changing dietary habits or by eating specific kinds of foods. The only ways of tackling IDD are by supplying iodine...
through an external source, either by periodic supplementation of iodine-deficient persons with iodised oil capsules or injections, or by fortifying a commonly eaten food with iodine.

**Iodised salt:** Salt is an ideal vehicle for iodisation because all humans need salt, making it an essential food item; it is ingested in very small quantities, every day, and is inexpensive and affordable for virtually everyone. Compared to other foods, the production and distribution of salt is relatively easy to control, and there is little chance, if any, of consuming too much of it. Fortifying salt with iodine does not change its taste or colour. Since the 1920's, simple, effective, low-cost technology for iodisation has been available, and was first used in Switzerland and the United States. During the 1950's efforts were begun to iodise salt in developing countries. Progress was relatively slow until the World Summit on Children in 1990, in which the leaders of most nations of the world pledged to universally iodise all salt, and to virtually eliminate IDD by the end of the millennium. Universal Salt Iodisation (USI), of salt intended for both human and animal consumption, has been recognised as the most cost-effective and viable solution to prevent and control IDD.

Salt iodisation is inexpensive: iodising one kilogramme of salt costs between two and seven U.S. cents, which is less than five percent of the retail cost of salt in most countries. Since iodine is required in very minute amounts (150 - 200 µg per day), the dosage of iodine in iodised salt is very small. The recommended concentration of iodine in iodised salt is between 30 - 100 µg per one gram of salt, providing sufficient iodine if between five and 20 grams of salt are consumed by each person every day. There are other alternatives to correct and prevent IDD such as iodised vegetable oil, iodised water, and high dose iodine injections and capsules, given annually.
However, these alternative interventions are less sustainable, cost more in terms of human and financial resources, and are less effective in the long term.

**Universal Salt Iodisation: the Most Cost-effective Solution**

Until very recently, large crystal rock salt, known in South Asia as phoda or dhike, was widely used for cooking and animal feed. Although the rock salt contains a very small amount of iodine after iodisation, studies have shown that the amount of iodine present at household level is insufficient to prevent and control IDD. Traditionally, rural families purchased a large sack of rock salt that would remain unopened for many months or even years in each household. During the lengthy storage period, without the benefit of a sealed container, the iodine content of the salt would be lost. Although some South Asians maintain a preference for rock salt, and many continue to use it for animals, efforts to mobilise people to purchase and consume iodised salt in small (no greater than 1 kg), sealed plastic packets is helping to convince more and more people of the benefits of adequately iodised salt.

**Iodised Oil Injections and Capsules:** A single dose of 0.5-1.0 ml (480 mg of iodine per 1.0 ml) may be injected by needle and syringe into the muscles of the buttock for small children or of the upper arm for older children and adults. Each injection protects against iodine deficiency for three to five years. However, the major limitations of iodised oil injection programmes are that they require direct contact between health care providers and individuals, and giving safe injections requires relatively high technical skills and supervision. Such programmes have not been found to be very cost effective due to the high costs of training health
workers, providing transportation to affected communities, the cost of syringes, and the relatively high cost of the iodised oil itself.

Although iodised oil can also be given orally, an easier method than injections, iodine supplementation programmes using iodised oil capsules also have limitations. The capsules, which contain approximately 200 mg iodine, are expensive compared to iodised salt, and need to be distributed on a yearly basis. As with iodised oil injections, capsule distributions require individual contact with a health care provider, which considerably raises the cost of the intervention.

**Iodised water:** Iodine added directly to drinking water has been shown to correct iodine deficiency. A measured amount of iodine, appropriate for achieving a daily intake of at least 150 µg, is added to the drinking water at its source or place of storage. However, unless people have regular access to a reliable source of safe drinking water, and strict measures of implementation, supervision and control are in place, iodisation of water is not a viable long-term solution for controlling IDD.

**Direct Iodine Supplements:** Daily, weekly, bi-weekly and/or monthly administration of oral iodine, in the form of Lugol's solution (6.0 µg iodine per drop) or tablets (containing from 100 - 500 µg of potassium iodide), provides a supply of iodine that is closer to humans' physiologic needs than the one-time, large doses received from iodised oil. Frequent dosing with iodine is also highly effective and relatively inexpensive. Lugol's solution is commonly available in rural pharmacies for use as a wound disinfectant, and can be easily adapted for oral prophylaxis of IDD. However, its major drawback is that it requires the constant
attention of responsible individuals to see that the iodine is actually ingested in the appropriate quantity, at the required interval. Therefore, it is difficult to apply this method to a large population.

**IDD Prevention and Control and USI on the Global and Regional Agenda:**

- **International Council for the Control of Iodine Deficiency Disorders (ICCIDD):** Established in 1986, ICCIDD is a non-profit NGO supported by UNICEF, WHO and Government of Australia with the purpose of developing and implementing national IDD elimination programmes in countries with significant IDD problems. ICCIDD's global network of consultants work in every area of IDD: epidemiological, experimental and clinical studies, assessment and programme design, salt iodisation and other iodisation technologies, planning and training, management and programme development, and technical assistance for quality control, monitoring and evaluation, communication and education, and advocacy and marketing.


- **Ending Hidden Hunger:** A Policy Conference on Micronutrient Malnutrition, Montreal, Canada, 10 - 12 October 1991.

- **International Conference on Nutrition (FAO-WHO), Rome, Italy, May 1992:** Representatives from UN Member States pledged to eliminate IDD in the Plan of Action adopted by the ICN.

**The Prevalence of IDD in South Asia**

<table>
<thead>
<tr>
<th>Countries</th>
<th>Goitre (percent)</th>
<th>Urinary iodine inadequacy(&lt;100µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afghanistan</td>
<td>33-35</td>
<td>-</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>47</td>
<td>43</td>
</tr>
<tr>
<td>Bhutan</td>
<td>14</td>
<td>24</td>
</tr>
<tr>
<td>India</td>
<td>3-37</td>
<td>-</td>
</tr>
<tr>
<td>Maldives</td>
<td>24</td>
<td>65.5</td>
</tr>
<tr>
<td>Nepal</td>
<td>40</td>
<td>35-44</td>
</tr>
<tr>
<td>Pakistan</td>
<td>10-70</td>
<td>-</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>12</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: WHO - SEARO, 1997
ICCIDD’s mandate is to:

- Promote awareness of the magnitude of IDD and the fact that it can be eliminated at an affordable cost
- Provide technical assistance in the assessment of prevalence in countries and the development of strategies for IDD elimination
- Provide technical assistance in monitoring the application of these strategies and to evaluate their effectiveness
- Support training programs at national and regional levels for survey design, program management, monitoring and evaluation, social communication and technical assistance to quality assurance systems
- Encourage research on issues relating to the virtual elimination of IDD

- **Second South Asian Association for Regional Cooperation (SAARC) Conference - Colombo, Sri Lanka, September, 1992:** SAARC Ministers pledged to achieve universal access to iodised salt by 1995; to establish national IDD programmes in all countries with IDD problems by 1995; and to attain goitre rates below 20 percent by 1995, and by 2000, to attain goitre rates no greater than 5 percent.

- **World Health Assembly (WHA) - Geneva, Switzerland, 1996:** WHA Member States unanimously agreed the Resolution of the Executive Boards of the WHO on the prevention and control of iodine deficiency disorders.

- **SAARC Summit for Children - Rawalpindi, Pakistan, 1996:** SAARC Ministers adopted through a SAARC Convention on Iodised Salt, a component of the Rawalpindi Resolution on Children of South Asia.

- **South East Asia - Iodine Deficiency Disorders Elimination Action Group (SEA-IDDEA):** SEA-IDDEA, a networking group formed in 2000, is composed of persons representing 12 countries (Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Sri Lanka, Pakistan, Democratic People’s Republic of Korea, Indonesia, Myanmar and Thailand); government partners, iodised salt industry partners, and persons from NGOs as well as the ICCIDD.
Objectives of the SEA-IDDEA Group:

- To review the status of USI in South and South East Asia.

- To identify constraints in achieving or sustaining USI including quality assurance and developing sustainable ways to continually ensure that all iodised salt contains sufficient quantities of iodine to achieve the elimination of IDD.

- To suggest remedial measures for achieving and sustaining USI. The work of USI is not a one time effort; once it is attained, the work to sustain it must go on indefinitely, or until another solution is found. The SEA-IDDEA group seeks to maintain enthusiasm and momentum for achieving and maintaining the gains of salt iodisation until all salt for human and animal consumption is iodised and until no person lacks iodine.

- To identify other partners who can help achieve and sustain USI. Since its first meeting, the group has doubled its membership, including representatives from a variety of industries and public sectors crucial to the iodisation of salt.

The first SEA-IDDEA Group meeting was held on 24-25 February 2000 at WHO-SEARO, New Delhi, and the second on 31 October-2 November 2000 in Kathmandu. Over the coming biennium (2002-2003), the SEA-IDDEA Group will focus regional and country level activities on the following priority actions: Monitoring of USI and IDD, Behaviour Change Interventions to promote iodised salt consumption, and legislation and enforcement, with each of the next three meetings devoted to these topics. The SEA-IDDEA Group members envisions "A World Free of IDD".

- Salt 2000 Symposium on IDD and USI: Marketing and sustaining Global Process in Universal Salt Iodisation, The Hague, Netherlands, May 2000. Salt industry leaders publicly accepted their role and pledged to assume their responsibilities in supporting USI.

- Establishing an International Iodine Laboratory Network Workshop, Bangkok, Thailand, 22-25 May 2001: Key actors in IDD and USI programme monitoring called for the establishment of a Global Iodine Laboratory Network to assess, monitor and evaluate efforts to eliminate IDD and achieve USI.
• The Global Alliance for Improved Nutrition (GAIN): A new alliance of public and private sector partners was launched during the United Nations Special Session on Children held on 9th of May 2002, in New York. GAIN has been established to leverage cost-effective food fortification initiatives that promise to improve the health and productivity of the poorest nations.
What is UNICEF Doing in South Asia to Eliminate IDD and to Achieve USI?

UNICEF-Regional Office for South Asia (UNICEF-ROSA):

• **1997:**
  - UNICEF-ROSA carried out an evaluation of USI programmes in South Asia in order to assess progress towards achieving the SAARC goal of universal access to iodised salt by 1995, and UNICEF’s contribution. Overall programme quality (Legislation and regulations, enforcement procedure, supply of iodised salt, production monitoring, household availability, Information Education and Communication (IEC) activities, monitoring of IDD, Planning and coordination, and sustainability) was assessed. Results of the evaluation concluded that Bhutan’s National IDD Programme was the most advanced, followed by India (with the exception of several states in South India), Bangladesh and Nepal. IEC activities, particularly those stimulating demand through the use of rapid test kits and media campaigns, were found to be the most effective, whereas enforcement of legislation and monitoring at the production level were the least successful. A review of the relative efforts applied to the various components of the programmes in each country is still needed.

• **2000 - 2001:**
  - UNICEF-ROSA served as Secretariat for the South East Asia-Iodine Deficiency Disorders Elimination Action Group and planned and conducted SEA-IDDEA Group Meetings #1 and #2.
  - Expanded SEA-IDDEA Group country team membership to include representatives of salt industry, government and key agency staff; provided oversight and coordination of the SEA-IDDEA workplan, including support to improved legislation.

• **2002 - 2003:**
  - Support a series of advocacy and technical support meetings for key players in IDD elimination and USI in South Asia, including salt
Iodine Deficiency Disorders and Universal Salt Iodisation: South Asia Priorities

- Support IDD and USI regional monitoring and evaluation system development.
- Document the story of USI and IDD elimination in South Asia over the last 50 years, highlighting the process of sustainable USI and IDD elimination programme development through a book and film.
- Trace and map the movement of salt, both non-iodised and iodised, across South Asian country borders, documenting issues of supplier movement of salt, consumer demand and preference, and socio-cultural determinants of salt practices.
- Develop and implement a region-wide advocacy and communication for behaviour change programme to re-focus the IDD elimination movement on consumer awareness, increasing consumer demand for iodised salt, and renewing commitment to sustained USI.
- Integrate advocacy, social mobilisation and communication for USI and IDD elimination with on-going programme activities in related sectors such as education, health, community development, etc.

UNICEF- South Asia Country Offices

Afghanistan
- Update the comprehensive assessment/analysis of salt provision in Afghanistan, leading to the development of a national plan including advocacy and resource mobilisation.
- Support the production/provision of iodised salt.
- Develop a communication strategy (through IDD Task Force) to promote iodised salt.

Bangladesh
- Increase efforts for better quality crude salt production and iodisation to meet demand for salt from outside the country (cross-border issues).
- Intensify IEC activities targeted at consumers, policy-makers, salt growers and producers.
- Strengthen monitoring mechanisms, particularly through quality control of iodised salt, and by implementing automated Management Information System (MIS) feedback.
Bhutan
• Improve the salt iodisation process to achieve and sustain USI through monitoring of salt iodine level at manufacturer-retailer- and household-levels, complemented by yearly cyclic monitoring, including assessment of iodine in salt samples and the urinary iodine level of school children.
• Train technicians and provide basic laboratory equipment and reagents for the assessment of iodine levels in salt at the factory, in district markets and in households.
• Prepare and disseminate information, advocacy and social mobilisation efforts to sustain awareness among stakeholders of the importance and benefits of consuming iodised salt.

India
• Identify areas with low coverage of iodised salt and intensify awareness campaigns in those areas.
• Identify pockets of resistance to iodisation, determine and analyse reasons for resistance amongst salt producers, and together with stakeholders, develop a plan of action.
• Strengthen and improve monitoring of USI and IDD.
• Legislation review.

Maldives
• Finalise legislation banning non-iodised salt for human and animal consumption.
• Develop a national logo for iodised salt and intensify IEC campaigns.
• Convince salt importers to import ONLY adequately iodised salt, to ensure the quality of salt before importation and to report incidences of falsely labeled salt.

Nepal
• Create a social marketing campaign for community-level promotion of small-packed iodised salt, through mass media, merchandising and video-on-wheels community promotion, and to raise awareness of IDD using the government-endorsed "two-child with a special focus logo" (see back cover).
• Assess the effectiveness of the current social marketing campaign.
• Monitor knowledge and consumption of small-packed iodised salt at household level.
• Develop regulations required for the Iodised Salt Act, ensuring that all salt sold in Nepal is adequately iodised.
• Strengthen the internal monitoring system on salt iodine content at various levels of distribution.
• Establish external verification systems of USI and IDD elimination.

Pakistan
• Develop a system of supply and distribution of Iodine (KIO₃) and mixing drips, requiring the motivation of salt producers and the identification of provincial and district level distributors for iodate and drips.
• Strengthen monitoring system by developing a work plan, identifying a focal person in each district, training technical personnel, and creating district IDD control committees.
• Implement advocacy and social mobilisation activities, including meetings with high level officials, seminars at district level, and involving different stakeholders at district level.

Sri Lanka
• Legislation: make provisions for the re-registration of small-scale iodising and packaging industries to improve the quality of iodised salt.
• Monitoring: form a special Task Force on IDD to streamline the existing monitoring system, and to strengthen feedback from the field to the central level.
• Communication: review the IEC materials and media currently used, develop new materials for appropriate target groups and draw up plan for a new IEC campaign.
References

A World Free of Iodine Deficiency Disorders

Two-child with special focus logo in Nepal