Iodine deficiency*

1. Brief description of the condition/disease

Iodine deficiency disorders (IDD) result from insufficient iodine in the environment and inadequate intake of iodine from food. Because development of the central nervous system depends on an adequate supply of thyroid hormone, which requires iodine for biosynthesis, iodine is an essential micronutrient for normal intellectual development and function. Endemic cretinism is the most severe manifestation of the lack of maternal and fetal thyroid hormone caused by severe dietary iodine deficiency; community-based assessments and iodine intervention trials indicate that IDD can leave entire populations with reduced intellectual capacity and impaired motor functions. Mild iodine deficiency can reduce the average population cognitive scores by 10–15%. Goitre, the most obvious clinical manifestation, frequently occurs in iodine-deficient populations.

2. Current global burden and ranking within the overall burden of disease

In 1991, using the most current data, WHO estimated that 20% of people throughout the world lived in areas in which iodine intake was inadequate. Subsequently, data became available that showed major cities in most of the developing world were also affected. In one study, 30–80% of neonates living in Asian cities had elevated TSH levels (>5 mU/l), indicating lack of iodine during the critical phase of brain development. The WHO estimates excluded data from states in the former Soviet Union, where iodized salt is generally unavailable, and where it is now known that the entire population lacks adequate iodine intake.

Since 1990, worldwide production and availability of iodized salt has increased greatly; production of iodized salt has increased from <10% to >50% in south-east Asia and India, >70% in China and Africa, and >80% in Latin America. Questions about iodized salt were included in the UNICEF-supported, household surveys conducted in 1996 in 50 countries: these surveys indicate that in 27 developing countries >90% of households use iodized salt, and in 15 countries 75–90% of households use iodized salt. In 1994, a total of 48 developing countries with IDD had no significant salt-iodization programmes; today, most of them have iodized more than half their salt. However, because problems with obtaining and maintaining the optimum level of iodine in salt have been widespread in most countries, iodine levels often are inadequate or, occasionally, too high to afford the best protection.

The global burden of disease (Christopher Murray & Alan Lopez, editors) ranked iodine deficiency in 1990 at 77, with 1562000 disability-adjusted life years (DALY); this estimate was based on the 1990 WHO data, which focused on the severe clinical manifestations of iodine deficiency and did not estimate the more widespread impact of reduced intellectual capacity in entire populations. With the success of salt iodization in most countries, the global burden of IDD has greatly decreased However, further efforts are needed in many countries, and programmes must be maintained if IDD is to be permanently controlled.

3. Feasibility (biological) of elimination/eradication

Using salt iodization, it is possible to eliminate iodine deficiency as a public health problem and to employ sensitive biological markers to document this success. The principal challenge to elimination is the permanent intervention of adequate dietary iodine intake. In both developed and developing countries, iodine deficiency was eliminated, then recurred because of a lack of vigilance and a breakdown in the continuation of the intervention. Permanent elimination of iodine deficiency requires collaboration among private salt producers and government sectors to promote and monitor the use of iodized salt or other iodine-containing foods.

4. Estimated costs and benefits of elimination/eradication

Few estimates have been published of the costs and benefits. In 1993, the World Bank estimated an attractive US$ 8 DALY cost for iodine elimination through salt fortification. The estimated cost in India in 1994 was US$ 0.02–0.05 per person per year. The cost of salt fortification depends on the type of salt

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fortified and current practices; in areas with large manufacturers producing high-quality salt, the cost to iodize is <5% of production. The greatest cost is in packaging and labelling. If the salt is already packaged and labelled, the costs are insignificant. If the entire process is upgraded, as in China (representing about one-third of the global population), the investment is approximately US$ 100 million. In 1991, UNICEF estimated that US$ 100 million (in addition to the expected investments from national governments and local industry) would be necessary to achieve the mid-decade goal of Universal Salt Iodization. From 1993 through mid-1997, bilateral, multilateral development agencies and Kiwanis have invested approximately US$ 60 million for IDD elimination. Continued investments are necessary to ensure success and sustainability of IDD elimination.

5. Key strategies to accomplish the objective

Critical to any national IDD elimination programme requiring salt iodization are policies, laws and agreements requiring all edible salt to be iodized, effective inspection and enforcement systems, and political advocacy and scientific support from community leaders. Ultimately, consumers need to be aware of the benefits so that the less expensive, unauthorized, noniodized salt does not persist in the market. Inclusion of salt testing and community education through school programmes has been effective in many countries. Because most salt is now produced by large-scale producers, once iodization is adopted and the best manufacturing practices are implemented, the impact can be massive and quality-control maintained. Salt iodization has been most difficult to implement and control in the tens of thousands of small-scale, cottage-industry producers

Quality control in salt production and iodization is not common practice and is one of the greatest challenges to eliminating IDD. Simply providing salt iodization equipment is not the long-term answer The development of cooperatives for iodization and use of micro-credit systems have been successful in some cases. Because establishing and maintaining laboratories capable of quality assurance of salt and measuring biological indicators have not been a priority for governments or agencies, long-term facilities for monitoring elimination and ensuring surveillance are widely lacking. Despite substantial achievements towards IDD elimination, the magnitude of iodine deficiency, its devastating impact on intellectual capacity, and the cost-benefit of its elimination are generally not well known beyond a small group of development professionals. Overcoming this communication deficit is probably the most important key in reaching and maintaining the elimination of IDD.

6. Research needs

Elimination of iodine deficiency requires 1) developing simple, qualitative tests to verify inexpensively the level of iodine in salt, rather than indicate only its presence or absence; 2) establishing the best practices of small-scale salt iodization, and simplifying and standardizing the process with appropriate quality assurance, 3) evaluating the impact of using iodized salt in food processing (such as pickling or cheese-making or in various types of cooking) to address the common perceptions of its negative qualities in such processes or inordinately high iodine losses; 4) evaluating factors that have led to successful implementation of IDD programmes so that these can be replicated in areas where progress is lagging or be used to model success in other nutrition or public health programmes

7. Status of elimination/eradication efforts to date

In 1990, following the World Summit for Children, heads of state and governments of over 120 countries committed themselves to virtually eliminate IDD by the year 2000. UNICEF, other United Nations agencies, and bilateral donors agreed to a mid-decade goal of universal salt iodization In September 1996, Bolivia was the first country to declare that it had achieved the "virtual elimination of IDD"

Although tremendous progress has been made in most developing countries towards producing iodized salt, substantial gaps remain The most significant is in the countries of the former Soviet Union, where salt was once partially iodized but by the end of 1997 was largely noniodized. Goitre rates in schoolchildren are high, and cretinism is reported to be serious among newborns in the Central Asian Republics IDD is serious and not addressed in countries/areas where political control or external access is limited (e.g. China (Autonomous Region of Tibet) Sudan, Afghanistan, and Democratic People's Republic of Korea). Ensuring the correct quantity of iodine in each batch or packet of salt remains a significant problem in many places. The overall adequate quality-assurance programmes are generally lacking in most countries IDD has re-emerged as a continuing concern in western Europe.

8. Principle challenges to elimination/eradication

Challenges to elimination include 1) raising the level of awareness of the nature and significance of IDD so that governments, salt producers, and others invest in their own protection; 2) ensuring participation by all countries and all regions within countries in the elimination efforts; 3) developing the best manufacturing practices for all salt producers and developing monitoring systems to ensure compliance and eliminate the black market for nonIodized salt; 4) developing and maintaining a monitoring system to ensure protection from IDD and employ warning systems to detect breakdowns in salt iodization, or in other protective measures.