China: leading the way in sustained IDD elimination
In the early 1990s, over 700 million people in China were iodine deficient. In 1993, China adopted salt iodization as its principal control strategy. By 2000, USI had virtually eliminated IDD. This review celebrates this remarkable achievement and describes how the program is adapting to the ‘changing landscape’ of iodine nutrition, to ensure sustainability.

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Program management and implementation – past and present

Since its inception, China’s salt iodization program has been one of the most successful in the world (Box 1). The national standards for the production, wholesale, and inspection of salt and iodized salt have been defined in a series of regulatory documents on edible salt monopoly, iodine content, and production/wholesale quality management. Only designated salt producers may iodize salt if they are judged to meet these standards. Stringent internal and external quality assurance testing is undertaken at both the production and wholesale levels. As a result, almost all salt is iodized, except in areas with high levels of iodine in the drinking water, where policy requires that non-iodized salt be provided.

The IDD Elimination Program is supported by the Chinese Surveillance System of Iodine Deficiency Disorders (CSSIDD), a broad-based system of complementary mechanisms to evaluate and monitor (i) the quality of salt throughout production and at the wholesale and retail levels, (ii) the household coverage of adequately iodized salt at the sub-national and national levels, and (iii) the population’s iodine status at the sub-national and national levels.

The health-associated aspects of salt iodization (household coverage of iodized salt and iodine status in the population) are monitored under a trial National IDD Surveillance Plan that is currently being implemented. The four components of the plan include:

1. **National salt monitoring** – Coverage at household level is evaluated annually to identify regions that may be at high risk of lower coverage, but also to monitor the coverage of non-iodized salt in iodine excess areas (with high levels of iodine in water).

2. **National IDD Survey** – Carried out every 2 to 5 years, it evaluates the population’s iodine status based on three indicators: children’s urinary iodine excretion, household iodized salt coverage, and thyroid volume (goiter). Pregnant women were included in the survey for the first time in 2011, and the next survey is due in 2014.

Box 1: Key factors contributing to China’s success

- High and sustained levels of political commitment and leadership, including sufficient funding and prioritization of IDD elimination on the social and economic development agenda
- Multisectoral cooperation
- National monopoly that prohibits sale of non-iodized edible salt and relevant systems for law enforcement, plus substantial investment in the salt industry, and industry commitment to iodization
- Strategic support to high-risk areas
- Frequent, well-coordinated, and high-quality surveillance and quality assurance that provides accurate information on the IDD situation and the impact of the program. Together they form the basis for policy development, guide program implementation, and enable modification
- Consolidation of achievements for sustained IDD elimination
3. **High-risk area monitoring** – It was added to the CSSIDD in 2008. Its objective is to monitor iodine levels and IDD epidemic situations in regions where iodized salt coverage is below 80% and where cases of endemic cretinism have been recorded. If necessary, remedial actions can follow quickly, including emergency supplementation with iodized oil capsules and free distribution of iodized salt to populations at risk.

4. **IDD Laboratory Quality Control Network** – Implemented by the National Reference Laboratory (NRL), the network aims to standardize the operating procedures and test the proficiency of laboratory technicians to ensure that all laboratories responsible for testing urinary and salt iodine levels provide scientific and reliable data. Their certification is renewed annually.

In addition to the above, the Endemic Disease Control Center and the Institute of Nutrition and Food Safety of the Chinese Center for Disease Control and Prevention have undertaken a number of special investigations or studies of specific issues to provide supplementary information to the surveillance system:

- In 2005, an investigation of iodine excess identified 109 counties in 9 provinces as being high water iodine areas. Regions with iodine excess lie in the former flood plain of the Yellow River, and are often ‘embedded’ in areas with inadequate or deficient water levels of iodine. This investigation was later used to formulate a national strategy on IDD prevention and control in high iodine areas.

- In 2007, a survey of high-risk areas identified 40 counties as high risk, with 249 new cases of cretinism, and a prevalence of goiter >5%. In all cases, the cause of iodine deficiency was access to raw salt (from local salt lakes and salt deposits). Easy access makes law enforcement and prevention of illegal salt entering the market more difficult.

- A survey of four coastal provinces in 2009 investigated whether their populations were consuming excessive iodine through a combination of iodized salt and seafood. Contrary to expectations, iodized salt was the main source of dietary iodine, and iodine nutrition was found to be adequate in general, with some women showing borderline or mild deficiency. This analysis contributed to a peer-reviewed study investigating the variability of iodine intake across China, published in 2012 (1).

- From 2011 to 2012, a study project evaluated the status of interventions in high water iodine areas with the aim of making recommendations for an updated ‘prevention and control strategy’ in high water iodine areas (2).

**Sustaining the achievements at national and sub-national level**

The National Plan for the Control and Prevention of Key Endemic Diseases has foreseen several phases of IDD Elimination. Based on the global WHO/UNICEF/ICCIDD indicators (3), the target of sustained elimination of IDD has been met:

![FIGURE 1 Regular monitoring and adjustment of salt iodine content ensures adequate iodine intakes in children in China.](image)

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(i) sustain IDD elimination at the national level,
(ii) achieve IDD elimination in 90% of counties in Hainan, Tibet, Qinghai, Xinjiang,
(iii) maintain IDD elimination in 95% of counties in other provinces,
(iv) prevent new cases of cretinism, and
(v) maintain iodine nutrition of the general population at adequate levels (i.e., prevent both iodine deficiency and excess).

Between 2007 and now, the central government and local governments have implemented iodized salt subsidies for farmers in Qinghai, Xinjiang, and Tibet, which significantly improved the coverage of iodized salt. In 2009, five provinces with low coverage were selected as focus provinces for the GAIN-UNICEF USI Partnership Program, including Tibet, Hainan, Xinjiang, Guangdong, and Qinghai. UNICEF supported communication and demand-creation activities in all the low coverage provinces. In addition to salt iodization, interventions focused on improving the distribution systems and emergency iodine supplementation of reproductive-age, pregnant, and lactating women. GAIN has supported iodized salt supply and monitoring and evaluation activities, including the strengthening of laboratory capacity, in three of the target provinces, and research on the contribution of iodine in pre-packaged food. The Salt Monitoring Reports in 2009, 2010, and 2011 have all shown that the situation in these provinces has improved such that the coverage of adequately iodized salt is now over 90%.

### An example: new standards for salt iodization

In March 2012 China implemented new standards for salt iodization (4). The national standards have been narrowed from 20–50 mg/kg (35 ± 15 mg/kg) to 14–39 mg/kg (20–30 ± 30% mg/kg), which both lowers the amount of iodine in the salt and reduces the range of salt allowed. In an effort to transfer some autonomy and responsibility to the provinces, each province has been mandated to choose its own average iodine content within the permitted range, taking into account the actual iodine nutrition of the local population (Table 1). The decision to move from one national standard to provincial standards takes account of the differences in iodine nutrition between provinces and aims to prevent both re-emergence of iodine deficiency and iodine excess.

### Table 1 Salt standards selected by each province based on a national range

<table>
<thead>
<tr>
<th>National standard range and median iodine level in mg/kg</th>
<th>No. of provinces</th>
</tr>
</thead>
<tbody>
<tr>
<td>14–26 (20 ± 30%)</td>
<td>0</td>
</tr>
<tr>
<td>18–33 (25 ± 30%)</td>
<td>14</td>
</tr>
<tr>
<td>21–39 (30 ± 30%)</td>
<td>11</td>
</tr>
<tr>
<td>18–33 for general population; 21–39 for pregnant women</td>
<td>7</td>
</tr>
</tbody>
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### Two decades of annual IDD Days in China

**Why does China have an IDD Day?**

May 15th each year is national IDD Day in China. The aims of the IDD Day are to increase the knowledge of the population about the adverse effects of IDD and to promote population health.

**When did it start?**

In 1993 the State Council of China held the Virtual Elimination of IDD in China by 2000 Advocacy Meeting. In 1994 Ministry of Health and related ministries set May 5th as the national IDD Day. It was changed to May 15th in 2002 and has been running since then. This year, May 15th 2014, is the 21st IDD Day.

**What happens on IDD Day?**

The IDD Day each year has a specific theme; the relevant government ministries and commissions send out an announcement about the IDD Day theme. For example, the theme of the first IDD Day in 1994 was *Iodized Salt and Health*, promoting salt iodization as the national strategy. The theme for the 10th IDD Day in 2003 was *Using Iodized Salt and Protecting Children’s Intelligence Development*. The theme for this year is *Providing Iodine Scientifically for Normal Intelligence*, highlighting the importance of sufficient iodine nutrition to health and brain development. On this day, there are many types of activities to promote the awareness of IDD and to celebrate the achievements.
The impact of the new standards has since been assessed through a pilot study, carried out between March 2012 and April 2013 in three provinces with different levels of urinary iodine concentration in children (Fujian, Shandong, and Anhui). The results showed that the MUIC in children will decrease if the iodine levels of salt decrease by >5 mg/kg.

The challenges ahead and agenda for change

China has made enormous progress towards sustained IDD elimination in the world’s most populous country and set an example for the rest of the world to follow. But as China’s achievements have been consolidated, there are still some issues that require additional effort. The remaining households that do not yet consume adequately iodized salt are mostly the poorest and are in remote, underdeveloped areas (mainly in Western China) and are, therefore, the hardest to reach. Reaching them may be the biggest challenge currently facing the Chinese government.

Ongoing efforts are also required to sustain IDD control at sub-national levels. There have been concerns that, despite the efforts to optimize the iodine content of salt, children in some areas may still be consuming excessive amounts of iodine, and measures may be needed to moderate their intake. On the opposite end of the spectrum there are concerns that further reductions in salt iodine levels, combined with ongoing efforts to reduce salt intake, may lead to a greater proportion of the population, women in particular, not consuming adequate iodine. As the landscape of iodine nutrition and USI continues to change globally, these challenges will arise for many governments. With its position as a leader in IDD elimination, China is uniquely placed to develop the next set of strategies that would set the course for the global IDD elimination programs of the future.

In the course of 2014, China’s National Health and Family Planning Commission (NHFPC, formerly the Ministry of Health and the National Population and Family Planning Commission) is organizing a series of workshops on IDD elimination, including an International Workshop on the IDD Prevention and Control Strategy in China. The main objective of the latter will be to discuss the latest international evidence and experience on IDD elimination, to discuss and further refine China’s IDD prevention and control strategy.

References