Universal salt iodization (USI) is the main strategy to eliminate iodine deficiency. Over the past two decades, national salt iodization programs have been introduced and scaled up in many countries. The basic concept of USI implies that all edible salt (household, processed food and animal salt) should be iodized. The programming and monitoring reality, though, have focused mainly on iodized salt purchased and consumed within households and iodine status has been measured through urinary iodine concentration (UIC) in school age children.

However, the program context has changed significantly with an increasing percentage of salt consumed which is obtained from processed foods, a greater emphasis is placed on assuring adequate iodine status of pregnant women, more countries reaching program maturation and needing to make adjustments in salt iodization standards, and recognition of the need to reduce both deficiency as well as excess. These changes have implications for program design, implementation and monitoring. To inform global partners on their strategic direction, an analysis was carried out of the current challenges and needs with the aim to guide national programs and help direct global support. This analysis assumes that USI is the main strategy to be pursued and is central to achieving and sustaining optimal iodine nutrition for populations.

1. Assessment of program progress: global status of iodine nutrition and USI

Two indicators are currently recommended to track population level progress towards the achievement of USI (USI criteria > 90% households using adequately iodized salt, with iodine content according to national standards) and optimal iodine nutrition: proportion of households using adequately iodized salt (HHIS) and iodine status (urinary iodine concentration—UIC). These are collected nationally through surveys and tracked globally on a periodic basis by WHO (UIC) and UNICEF (HHIS). The assumption has been that the availability of iodized salt in households would capture the total iodine intake, and in turn, the iodine status measured among school aged children, would represent the iodine status of the population. As such, assessment of these two indicators has long deemed sufficient to track progress in national iodine program efforts. This original paradigm is presented graphically in Figure 1.

The global iodine status was recently updated (1) and estimates are now available for 96% of the world’s population. There has been major progress between 2003 and 2011 in most regions of the world. The number of countries classified as iodine deficient has declined from 54 to 32, while the proportion of all countries which have an adequate iodine status has increased from 34% to 47%. At the same time, there has been an increase in the number of countries with more than adequate or excessive iodine from 29 to 47 (Table 1). These data suggest that iodine nutrition has been improving since 2003, but progress has also been slowing. As programs continue to mature, special attention should be paid to supporting those countries and populations who continue to struggle to achieve optimal iodine status.
To complement measures of iodine status, progress towards the achievement of USI has been assessed based on the HHIS. The current average HHIS for developing countries is 71% (Ref: UNICEF SOWC 2011, 2012) (Figure 2). The global estimate reached 70% around 1990 and then has stagnated at this level for the past decade. A closer look shows, however, that the number of countries reporting on HHIS has increased from 90 in 2002 to 128 in 2012 indicating that more countries are monitoring and reporting. While there is an increase in the number of countries that have attained USI (HHIS>90%), some countries have also been sliding back with declines in coverage (Table 2).

### Table 1: Status of Iodine Nutrition – Number of countries in terms of iodine status and the total number of country estimates

<table>
<thead>
<tr>
<th>Iodine intake</th>
<th>2003</th>
<th>2007</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient: severe iodine deficiency</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Insufficient: moderate iodine deficiency</td>
<td>13</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Insufficient: mild iodine deficiency</td>
<td>40</td>
<td>37</td>
<td>23</td>
</tr>
<tr>
<td>Adequate</td>
<td>43</td>
<td>49</td>
<td>69</td>
</tr>
<tr>
<td>More than Adequate</td>
<td>24</td>
<td>27</td>
<td>36</td>
</tr>
<tr>
<td>Excessive</td>
<td>5</td>
<td>7</td>
<td>11</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Countries with data</th>
<th>126</th>
<th>130</th>
<th>148</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Countries</td>
<td>192</td>
<td>192</td>
<td>193</td>
</tr>
<tr>
<td>Countries with no data</td>
<td>66</td>
<td>62</td>
<td>45</td>
</tr>
</tbody>
</table>

To complement measures of iodine status, progress towards the achievement of USI has been assessed based on the HHIS. The current average HHIS for developing countries is 71% (Ref: UNICEF SOWC 2011, 2012) (Figure 2). The global estimate reached 70% around 1990 and then has stagnated at this level for the past decade. A closer look shows, however, that the number of countries reporting on HHIS has increased from 90 in 2002 to 128 in 2012 indicating that more countries are monitoring and reporting. While there is an increase in the number of countries that have attained USI (HHIS>90%), some countries have also been sliding back with declines in coverage (Table 2). National aggregate estimates mask disparities within countries, and HHIS coverage is higher among the richest households than poorer households in countries with available data (Figure 3) (Source: MICS, DHS and national nutrition surveys 2003-2009, with additional analysis by UNICEF; 2010).

### 2. Status of countries

As USI programs mature and additional insight into implementation is gained, it has become important to distinguish countries with different characteristics and needs. For this analysis, countries have been divided into four groups, each with specific issues and challenges.

#### A. Countries with scaled up programs

- These countries have already achieved an optimal iodine nutrition status with scaled-up USI programs. The current focus is on consolidation, program adjustments and on sustaining the achievements.
- The key challenge for these countries is to sustain the current success i.e. avoid sliding back, maintain periodic oversight, renew commitment and mainstream iodine nutrition, ensure a functional coalition, and adjust the program to the changing national context. Inadequate program reach for the disadvantaged and marginalized population could be a challenge for these countries. Possibly, there could also be external threats to the program, such as objections voiced by opponent groups, complacency among policy and program staff, or changes in the enabling environment.

#### B. Countries in scale up phase

- This group of countries is in the process of scaling up USI, but have yet to achieve either high coverage of HHIS and/or optimal iodine status. The program focus is on improving the proportion of poorly iodized salt (quality of iodized salt in key areas & market segments, typically amongst medium-size producers), and expanding capacity to suppliers with no iodization, typically small producers, and expanding the use of iodized salt by the processed food industry.
- The key issues and challenges are to address capacity problems along the supply value chain; quality control and quality assurance; ensure iodization by small producers, as well as advocacy & communication. These countries often need to improve commitment (reflected by poor regulatory monitoring and enforcement, unobstructed flow of illegal non-iodized salt, lack of control over imported salt, or presence of disincentives

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**Figure 2: Household use of adequately iodized salt**

**Figure 3: Use of iodized salt by households is often not equitable**

Source: M Zimmermann
Table 2: National Estimates of Household Coverage of Iodized Salt

<table>
<thead>
<tr>
<th>HHIS (%) adequate</th>
<th>SOWC 2002</th>
<th>SOWC 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;90%</td>
<td>21%</td>
<td>37%</td>
</tr>
<tr>
<td>70-90</td>
<td>17%</td>
<td>27%</td>
</tr>
<tr>
<td>50-69</td>
<td>17%</td>
<td>25%</td>
</tr>
<tr>
<td>20-49</td>
<td>22%</td>
<td>27%</td>
</tr>
<tr>
<td>&lt;20</td>
<td>13%</td>
<td>12%</td>
</tr>
</tbody>
</table>

Countries with data: 90 128
Total number of countries: 156 157
Countries with no data: 66 29

Table 2: National Estimates of Household Coverage of Iodized Salt

- The last group includes countries in which USI may or may not have been (fully) implemented and where iodine status may or may not be optimal. The countries are characterized by a fragile enabling environment (political, economic, sudden shocks due to natural or man-made disasters) which undermines USI and therefore the iodine status as well. Strategies are not in place or are weakening; there is a lack of attention and low priority for iodine nutrition.

- The aim in these settings is to expand commitment and capacity to implement salt iodization, or consider alternative temporary interventions until long term USI strategy can be accelerated. There is a need to target the right population groups, prioritize efforts, and make optimal use of resources.

3. Global and national challenges in the iodine nutrition program regarding advocacy, enabling environment, supply, communication and monitoring

There are a number of rapidly changing factors which affect global and national level planning for USI programs which require attention. The following considerations affect the design and support of iodine programming and in building the capacity to assure that programs are viable and sustainable.

C. Countries without policy/plan to scale up and achieve USI/optimal iodine nutrition

- These are countries where salt iodization may have been initiated, but is not being scaled up and where the iodine status population is not in an optimal range. Typically, one would observe several issues in these countries, including a lack of understanding and awareness of the iodine nutrition problems and commitment for USI among key gatekeepers (public, private, civic, academic sectors), as well as an inadequate capacity to implement USI.

- A critical issue is to improve recognition of the importance of iodine nutrition and/or USI by policy makers or public health advisers, as well as expanding the production and supply of iodized salt. This often leads to confusion about the need for USI, either alone or in combination with other strategies to improve iodine intake. In these settings, alternative strategies are often promoted and compete with USI strategy, which could negatively influence the commitment for USI.

D. Fragile states

- The last group includes countries in which USI may or may not have been (fully) implemented and where iodine status may or may not be optimal. The countries are characterized by a fragile enabling environment (political, economic, sudden shocks due to natural or man-made disasters) which undermines USI and therefore the iodine status as well. Strategies are not in place or are weakening; there is a lack of attention and low priority for iodine nutrition.

- The aim in these settings is to expand commitment and capacity to implement salt iodization, or consider alternative temporary interventions until long term USI strategy can be accelerated. There is a need to target the right population groups, prioritize efforts, and make optimal use of resources.

Global advocacy

Nations all face multiple competing priorities in health and nutrition. As such, countries but also donors are less interested in vertical programs and emphasize nowadays integrated programs. There is a need to embed iodine programs in micronutrient and nutrition strategies and plans, and in the Scaling Up Nutrition (SUN) and other relevant movements. While there has been progress in USI over the past decade, it is important not to become complacent and a new sense of urgency, opportunity and vigour around iodine nutrition needs to be created. This can be facilitated by continuously updating and reinforcing the evidence base, generate support for programming, and position USI and iodine nutrition in the changing environment.

Enabling environment at the national level

At the national level, iodine nutrition often disappears from the agenda after USI has been achieved. Low awareness of iodine deficiency and implications are often not understood by one or more of the public, private, civic and academic stakeholders, or the supporting organizations. Renewed commitment is needed to support program implementation and oversight. For program sustainability, it is essential to have strong coordination amongst all key stakeholders, and ensure that there is mutual trust between the public and private sectors but also with the academia and consumer groups. Such coordination can be enhanced where information resources are used to create an enabling environment for program success.

Image: Iodine intake from processed foods is becoming more important in many countries

In some cases, disincentives have halted salt iodization progress because the salt industry’s point of view was poorly understood and/or solutions have not been embraced to incentivize salt iodization. On the other hand, since salt iodization is often mandated by law, legislation is often not implemented and enforcement is poor, giving the salt producers opportunity not to meet standards. Increasingly, salt is consumed through processed foods. It is important to incorporate food grade salt into the national strategy,
and provide guidance on how to program and monitor this.

Supply
There are a number of critical production and supply-related issues that currently halt progress. Internal quality assurance procedures as well as external enforcement are poorly implemented or not in place at all. Existing effective systems and good practices often remain undocumented or not available to those who need them. One of the most important challenges is the frequent absence of functional cost recovery systems for iodine premix. The legacy of external dependence and rising and variable prices of iodine premix have often led to an unsustainable and unpredictable procurement situation. Ensuring iodization of salt by small producers remains a challenge in several countries and, to date, very few sustainable business solutions have been developed to organize producers to produce quality assured iodized salt.

National advocacy and communication
The focus of most national communication strategies has been on advocacy for national legislation, commitment building of stakeholders and creating awareness on iodine and iodized salt among the population. It is also not strategic to change behaviour of consumers to increase retention of iodine in salt by better storage and delayed addition of iodized salt during cooking. What has been lacking in this approach is a direct link how these communication efforts address program challenges and deliver quantifiable results in terms of iodized salt supply and HHIS. For example, efforts should focus on building commitment among salt producers leading to salt iodization; on wholesalers, retailers and consumers in low coverage districts to demand iodized salt.

On the other hand, more emphasis is needed to capitalize on sustainable communication through inclusion of iodine and iodized salt in school curricula, training of professionals and salt packaging, logos and labelling.

Monitoring
The changing program realities urge us to revisit the indicators used in monitoring performance and impact. It is common that a conflict between HHIS and UIC exists (e.g. HHIS < 90% and UIC > 100 mcg/dl), which has led to incorrect conclusions and/or changes to the program. Accounting for iodized salt intake obtained from processed foods is increasingly important, but also iodine containing products are increasingly used such as iodine supplements, multi micronutrient supplements, home fortification products such as micronutrient powders, ready to use supplementary foods, and, in some specific cases, iodine in the natural environment. A better understanding of the iodine sources, planned and unplanned, are crucial for the design and monitoring of national iodine nutrition programs. This changing paradigm is illustrated in Figure 4.

Figure 4: Evolving iodine nutrition and program landscape: revised paradigm

Although pregnancy is the period during which iodine is crucial in brain development, iodine status is primarily assessed in SAC, because it is easier to assess. The question remains how UIC can be obtained more systematically from pregnant women and women of reproductive age. Furthermore, hardly any information is available about the iodine status of pre-school children, identified as a research need. Cut off values for adequacy and excess UIC, driven by thyroid function, require further research and clarification for different population groups.

Typically, nationally representative UIC and HHIS is collected on a periodic but infrequent basis. Lack of (recent) (sub)nationally representative data for UIC and HHIS is a concern. The US Centers for Disease Control and Prevention maintains external quality control of laboratories worldwide performing UIC analysis (EQUIP). Not all laboratories are ‘members’ and therefore UIC data quality often cannot be guaranteed. An initiative for regional resource laboratories carrying out external quality control (IRLI) was initiated in the 1990’s but was never fully pursued as well as field friendly devices to measure UIC at HHIS.

UIC and HHIS are often collected and/or analysed independently from one another thereby losing the ability to provide insight in median UIC by HHIS (with different iodine levels) which can indicate the optimal iodization level, the presence of iodine intake sources other than household salt, and sub-national variations. It is important to understand this relationship between UIC and HHIS to guide corrective action. Clarification is also needed about the UIC interpretation (by median and by proportions), the presentation of UIC results, and the use of UIC for estimating dietary intake (EAR/RDA values). Program sustainability is seldom assessed and tracked globally, while indicators for sustainability exist. The latter require a thorough review, however.

As mentioned before, current measures of HHIS do not reflect iodized salt intake from processed food nor from other iodine interventions, if these are present. Guidance is required on the use of testing equipment (e.g. WYD, iCheck, titration, test kits). Rapid salt test kits can only determine the presence or absence of iodine but still are incorrectly used to categorize adequately from inadequately iodized salt, which often leads to incorrect conclusions and misinforms national decision making. In addition, fixed international cut off values for adequacy at 15 ppm are often in not in line with national program standards that have different cut off values. This makes setting national program targets and assessing their progress confusing. Views also differ about the need to measure exact iodine
content in salt at household level if contribution of iodized salt from processed foods cannot be quantified at all and if quality assurance at production level is well functioning. The issues above have implications for the way global databases are maintained and global progress is presented.

4. Iodine nutrition and USI strategy, applied research, program management and support

USI has been successfully scaled up to current levels partly because of its focus and vertical approach, which is not sustainable in the current landscape where nutrition interventions are delivered in integrated manner and where nutrition is mainstreamed as a national development priority through Scaling Up Nutrition (SUN), REACH and the 1,000 days movement. Iodine nutrition and USI also need to be part of global and national micronutrient and nutrition policies and strategies and should not stand alone. With sodium intake reduction strategies being pursued globally it is important to align these with USI to synergize implementation and monitoring so as to maximize impact as well as to avoid confusion and competition.

With a rapid development and scale up of specialized nutritional products for the treatment and prevention of various manifestations of undernutrition in different population groups in different contexts, it is important to define the need for and content of iodine in these products. Above all it should remain clear to national policy makers that USI is the main strategy and other interventions are to be seen as temporary or complementary. Within this context it is important to show that USI can achieve optimal iodine status for all population groups. Guidance on the feasibility of these complementary interventions also needs to be provided.

What emerges from the current landscape is the need for clear guidance on how to set salt iodization levels in presence or absence of processed foods and how to deal with the wide variation that may exist within a country. A discussion is also required on the use of HHIS data for program corrective action such as setting iodization levels. When is information needed on iodine intake from natural sources (e.g. water) and how to monitor this? Similarly, guidance is needed how to identify the processed foods to target for iodization, and how to assess its attribution to the iodine status.

Structured coordination between public-private and civic sectors is required for effective implementation, information exchange, program oversight and corrective action. Countries have expressed a need for better guidance to establish these and how to strengthen public-private trust. A wealth of experience, materials and lessons learned exist but are often not accessible to peers in other countries. A community of practice and more systematic documentation of lessons and experiences can provide a solution to this.

Global coordination on iodine nutrition and USI among partners is important but is currently not strongly linked with other micronutrient and nutrition platforms such as the Micronutrient Forum, the Flour Fortification Initiative, and the Home Fortification Technical Advisory Group. Among program support providers - even while there is agreement on USI - true USI is often not fully understood and guidance and support differs in scope and results that can be anticipated. This leads to confusion, conflicting advice, and as a result different program practices, for example the criteria to start iodine supplementation and the omission of processed food as an important strategy component.

In the past, there has been some difficulty in maintaining consistency in approaches that have been taken by different organizations that provide support. It is critical to “speak with one voice” and develop, agree and promote a common approach and guidance to countries. This is enhanced by ensuring that policy, information and tools are managed by true collaboration among support providers. A forum at the global level for planning and discussion of programming approaches and implementation issues will go a long way to guarantee such harmonization.

What is also required is a strong global voice and stewardship for iodine nutrition and USI. Tracking progress and a solid analysis should help define the advocacy, communication and support functions. This could, for example, highlight the “forgotten” problem of sub-optimal iodine nutrition in industrialized countries, advocate for sustainability, and highlight needs and opportunities.