IODINE globalnetwork

PROGRAM GUIDANCE ON THE USE OF IODIZED SALT IN INDUSTRIALLY PROCESSED FOODS

CONTENTS

PROGRAM GUIDANCE ON THE USE OF IODIZED SALT IN INDUSTRIALLY PROCESSED FOODS

EXECUTIVE SUMMARY

Salt iodization is well-established as a cost-efficient, effective strategy to prevent and control iodine deficiency[3]. But as global dietary patterns change, industrially processed food accounts for an increasing proportion of total salt intake relative to household salt. National programs to achieve optimal iodine nutrition need to understand the contribution of industrially processed foods to salt intake, and to potential iodine intake if this salt is iodized.

IGN and partners developed and pilot tested this Guidance[1] to assess the potential contribution of industrially processed food salt to iodine intake and to use the outcomes to strengthen strategic recommendations to achieve optimal iodine nutrition. It contains guidance on conducting a program review, how to carry out an assessment using a proposed framework and tools, and an analysis of program weaknesses and opportunities.

The Guidance is based on an understanding that salt iodization and salt reduction strategies are complementary and should be implemented and monitored collaboratively[5]. It introduces a way to assess and plan for the possible effect of successful salt reduction on potential iodine intake from different foods. The expected outcome will be evidence-based recommendations to strengthen and sustain the inclusion of food industry salt in the salt iodization strategy. Benefits of a strong salt iodization strategy that encompasses all major dietary sources of salt (household and food) include:

- Protecting present and future generations by providing an appropriate amount of iodine in salt, accounting for changes in dietary practices that may alter the main sources of salt from household salt to food industry salt
- Providing protection for populations with poor access to quality-assured iodized household salt, where the population is also consuming processed foods containing salt
- Facilitating an understanding of likely impact of adjusting salt iodine standards on population iodine intake.

Rationale for strategic change

Following the 1990 World Health Assembly resolution on elimination of iodine deficiency and the 1994 UNICEF-WHO joint committee statement on USI for the prevention of iodine deficiency disorders (IDD)[3,11], 124 countries have implemented mandatory legislation for iodization of at least some forms of food-grade salt. Almost all include household (cooking and table) salt,[12] but not all include salt used by the processed food industry.

Historically, achieving optimal iodine intake through salt iodization has been discussed in relation to household iodization, as reflected in the widespread use of the proxy indicator of ≥ 90% households using iodized salt to show achievement of USI[9]. The recognised assumptions behind this historical pathway reflect an impact on iodine status based on:

- Iodization standards that were set at an appropriate level for the national context, considering a) typical household salt supply – quality, packaging, transport and storage conditions; b) average per capita household salt intake; and c) the likely severity of iodine deficiency in the absence of iodized salt

[1] IGN recognises that consumption of processed foods high in calories, fat, sugar and salt can be a risk factor for non-communicable diseases[4] and does not endorse or encourage consumption of these industrially processed foods.

- Households having equitable access to and intake of iodized salt - quality-assured iodized salt was available, affordable, and used by all, and household salt was consumed in similar estimated quantities across population groups [(8)]

- Household salt being the main source of salt for all population groups, with little attention to consumption or iodization of other forms of food-grade salt used in production of industrially processed foods or animal feed.

In recent years, the basis for a household-salt based pathway to achieving optimal iodine intake has been challenged through a growing understanding that:

- Processed foods account for an increasing proportion of dietary salt intake across urban and rural communities in most regions of the world, with an associated decrease in the relative contribution of household salt to total salt intake[(6,8,15,16)]
- In some countries, progress towards 90% household coverage with adequately (>15mg/kg) iodized salt has been difficult to achieve, usually with particularly low coverage in certain sub-national regions. Ensuring the use of iodized salt in industrially processed foods is therefore important to help achieve optimal iodine nutrition among these populations.
- The use of iodized salt in production of foods such as bread and bouillon has a proven positive impact on iodine status among populations where these foods are widely consumed[(17–19)].

The contribution of household and food industry salt to total salt intake is likely to vary within and between countries. Dietary shifts towards more highly processed foods are not necessarily related to the level of national development, but generally occur earlier in more urbanised areas within a given country[(6,8)]. Consumption of processed foods with a high salt content, for example bouillon and fish sauce, is also known to be widespread throughout the population of some less developed countries[(19–21)].

This Guidance was developed based on the known widespread increase in consumption of industrially processed foods. The most recent WHO statement on salt reduction should be considered alongside this Guidance. https://www.who.int/news-room/fact-sheets/detail/salt-reduction

WHO reports in 2007[(22)], 2013[(23)] and 2014[(2)] confirm the original rationale for USI and verify iodization is compatible with salt reduction strategies if both are appropriately managed and monitored. There is growing recognition that iodization of all food-grade salt will help achieve and/or sustain optimal iodine status among all population groups, regardless of dietary preferences now or in the future[(10,24,25)].

Introduction

This Guidance focuses on household and food industry salt, not salt for small scale commercial food production and processing, such as local bakeries or street food vendors. Small enterprises generally use the same type of salt as households, while processed food manufacturers are likely to rely on bulk supplies that may be produced to different standards. Processed food manufacturers typically have wide product distribution and could be included in a regulatory monitoring schedule to ensure exclusive use of salt iodized to national standards.

Managers of programs to achieve and sustain optimal iodine status, for which salt iodization is the main intervention (referred to from here on as "program managers") are the main audience for this guidance. It complements existing guidance for program managers[2,9,10] and should be used in that context.

The Guidance has been developed based on review by an Advisory Partner Group which included representation from: the Institute of Nutrition of Central America and Panama (INCAP), The George Institute for Global Health, UNICEF, and USAID. IGN is committed to developing and providing training and technical assistance for its successful implementation.

Implementation tools

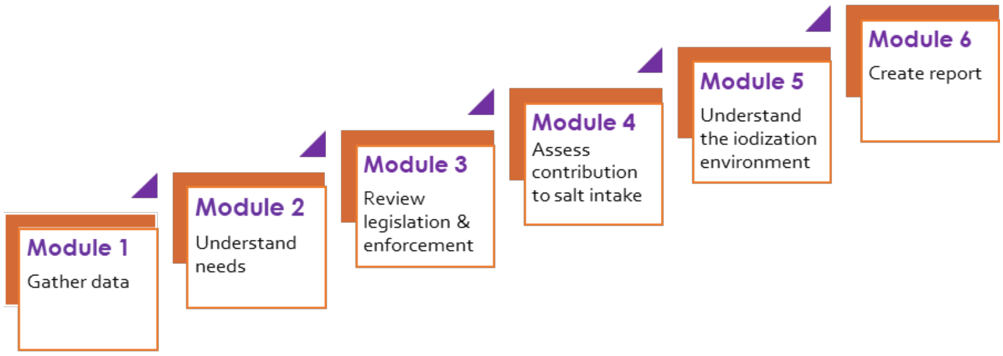
This document provides a framework, tools, and case studies to help program managers estimate the likely contribution of industrially processed foods to salt and iodized salt intake among different population groups. It contains text, figures, tables and tools in the form of Word documents and Excel files, to complete alongside the implementation process in order to create an ongoing as well as a final report. Accompanying files present examples of how some or all steps have been applied nationally. The main assessment tools for the Guidance are a series of four Excel files.

The process directs program managers through an assessment of the contribution of food industry salt and potential iodine intake if that salt is iodized. The outcome will provide information to determine the need to strengthen the salt iodization strategy to include food industry salt or the need to strengthen its implementation. Other Modules look at situational context, legislative and enabling environments, and other factors to support the development of an expanded strategy.

The Guidance provides direction on conducting a high-level review of the legislative framework and of enabling factors required to strengthen or sustain the existing salt iodization strategy, to include food industry salt as needed. By following the steps in this Guidance, program managers should have enough information to determine:

- The potential impact on population iodine intake if quality-assured iodized salt is used in the production of industrially processed foods (for the purpose of this Guidance, the term "processed foods" includes condiments)
- Any gaps and challenges in the current enabling environment for a strengthened salt iodization strategy, including food industry salt.

The pilot studies, documentation and tools provide program managers with the means to understand the role played by industrially processed foods to salt intake in their countries. The six modules must be implemented in numerical order.



MODULE 1: GATHERING DATA AND INFORMATION SOURCES

The first step in proceeding to the assessment in module 4 is the gathering of data and information sources. Module 1 facilitates a review of available data sources including surveys with food intake data, salt producer and trader records, processed food industry and government databases, research papers, and national food standards. The listing helps identify any major information gaps that may affect implementation.

This step depends on the availability of data to identify widely consumed industrially processed foods that contribute to salt intake[2]. This data may relate to production, distribution, purchase, or consumption. Information to estimate the salt content of products and, where possible, iodized salt content, is also required. Early creation of a list of data sources allows timely identification of major information gaps, clarifying the type of assessment that will be feasible, and establishing expectations for the process.

The tables below outline commonly available data sources that can be used to identify salt-containing food products and estimate their intake, grouped according to the source of the data. The country experience column includes links to documented case studies or reference to a published paper.

This Guidance proposes the use of existing sources of data (secondary data) to obtain an assessment of the current situation. Collection of new dietary or sodium/iodine excretion data (primary data) generally requires significant investment of time, cost, and personnel resources. Where gaps in data are identified as an obstacle to implementation, this should be noted in the final report with a recommendation that future data collection opportunities should be used fill these gaps. The assessment can be reconducted when new data become available.

RECOMMENDATION

Use the Module 1 data listing tool to record which data sources are available, how recent they are and what level of information they provide. For example, are data for a specific food type available for separate age groups or geographic locations, and are there estimates for average per capita consumption, or will it be possible to extrapolate estimates from household data?

[2] This category implies foods that have market reach beyond the local area of production and make a significant contribution to salt intake across all or some population groups. See Box 3 in Module 2.

HOUSEHOLD AND CONSUMER SURVEY-BASED DATA[3,4]

Table 1: National/sub-national dietary intake surveys and salt intake surveys

Dietary intake surveys collect data on consumption by individuals. Some dietary methods are listed below.

Data description	Useful data source for steps 1a and 1b of Module 4	Country experience
Weighed food diary: Lists food eaten and food weight before (and remaining after) consumption. Recorded at consumption. **Food/diet diary:** Lists foods and drinks consumed, usually with portion size estimate. Recorded at consumption. **24-h recall:** Lists foods consumed over the previous 24h. Usually includes portion size estimate. From memory. **'Multi-pass' 24-h recall** - A quick list of foods consumed over the previous 24 h. Usually includes an estimate of portion size. Followed by questioning about the foods to add detail (type of spread on bread, type of milk in tea). **Food frequency questionnaires** (FFQ) – see point 2 below. **Salt intake surveys** may be a sub-objective of a general dietary survey or specifically target salt-containing foods. Data collection for targeted foods would usually be one of the methods above.	Where data on consumption of salt-containing foods already exist, they usually provide relatively reliable information to further estimate the contribution of foods to salt, potentially iodized salt, intake. Where dietary intake data collection (or an FFQ) is included as a module within a larger survey which includes assessment of iodized household salt use, iodine status and estimates of salt intake; it may be possible to investigate associations between these factors.	The outcome of dietary intake modules was triangulated with data from market research reports, to identify widely consumed salt-containing food products to include in a survey of food industries. Indonesia and the Philippines

Table 2: Food frequency questionnaires (FFQ) including FRAT[5]

Data description	Useful data source for steps 1a and 1b of Module 4	Country experience
Food frequency questionnaires collect information on typical frequency of consumption of a predetermined list of foods over a recent period. Frequency is generally assessed as the number of days on which the food was consumed, along with the quantity typically consumed per day, or the number of times in an average day the product was consumed. The aim is to assess regularity of consumption for certain products. An FFQ may be part of a dietary survey or can be designed to complement a dietary diversity (food group-based) module, with additional questions on the specific items within a food group that are most regularly consumed, e.g. bread within the "staples" food group; or fish sauce within the group condiments and spices. A semi-quantitative FFQ includes information to estimate typical portion size/per capita daily consumption The FRAT is a hybrid of a food-frequency questionnaire and a 24-h recall that aims to measure consumption of a small set of potentially fortifiable foods.	FFQ or FRAT is generally only available for a limited number of foods, but if these include widely consumed industrially processed salt-containing foods then they can be a helpful information source. It will be important to note whether data were collected on consumption of the specific food in the home or also foods consumed away from home. Where an FFQ or FRAT module is included in a dietary survey, for the purpose of this Guidance, the data only need to be recorded in one place in the reporting tool for this module.	Used to estimate the level of consumption of pre-identified food products across population groups, as part of national iodine/nutrition surveys. **Burkina Faso, Ghana, Senegal**

[3] A comprehensive comparison of these diet-based methods (HCES, 24 hour recall and FFQ/FRAT) is presented in : Coates J, Colaiezzi B, Fiedler JL, et al. (2012) A program needs-driven approach to selecting dietary assessment methods for decision-making in food fortification programs. Food Nutr. Bull. 33, S146–S156

[4] Global review papers that could be helpful: review of studies of sodium sources in different countries https://academic.oup.com/advances/advance-article-abstract/doi/10.1093/advances/nmz134/5697078; review of salt intake where data existed in 2014 https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130247 (2019 review submitted for publication); Bayesian modelling to estimate salt intake in some countries where other measures not available https://bmjopen.bmj.com/content/3/12/e003733; surveys conducted since publication of the modelling that show some estimations were fairly accurate https://onlinelibrary.wiley.com/doi/full/10.1111/jch.13546.

[5] Baker S.K, 2012. Fortify West Africa Experiences in Implementing Large-Scale Food Fortification https://www.spring-nutrition.org/sites/default/files/2.4c-micronutrient_deficiencies_baker.pdf

Table 3: Household consumption and expenditure surveys (HCES) and household panel data[6]

Data description	Useful data source for steps 1a and 1b of Module 4	Country experience
Household consumption and expenditure surveys collect data about consumption of specified foods or categories of foods within a household. Household level food consumption data can be broken down to estimate consumption per household member using the Adult Male Equivalence (AME) method[7] (26) or by simply dividing the consumption by a known number of household members (a less reliable method). HCES generally collect food consumption information by asking respondents whether each of a predetermined list of food items was consumed during a given recall period (typically the last 7 or 14 days) and if so, how much was consumed. Recent recommendations to improve the methodology[8] for these surveys will make the datasets much more applicable for identifying widely consumed salt-containing foods. Household budget, income expenditure, and/or living standards surveys may also provide similar information. Panel surveys are usually conducted with a representative sample of households on an annual basis over time. Results are generally available from the bureau of national statistics.	HCES are less precise than individual diet surveys, however, they are cost-effective, representative, tools, which (depending on the methodology) can provide a level of detail adequate to assess which salt-containing industrially processed foods are frequently and widely consumed. The value of existing datasets depends on the list of food categories and level of breakdown within these categories. For example, older surveys did not include sufficient break down of types of processed food to be useful in identifying specific products. HCES are increasingly being designed to capture all types of dietary intake, including foods prepared outside the home and their likely ingredients. Depending on the questions included in the survey, estimates for frequency of consumption of a specific industrially processed food by the household could be available for the previous day. The frequency times a typical (or stated) serving size can be used to roughly estimate the quantity of intake.	HCES data were used to estimate the relative contribution to sodium intake from salt and salt-based condiments, processed foods (with or without added salt), and from ready meals. Brazil(27) and Costa Rica(28)

[6] Some datasets are available from the International Food Policy Research Institute www.ifpri.org/countries

[7] AMEs are used to divide total household food use by the number, sex and age of household members according to their expected relative energy requirements. Weisell R & Dop MC (2012) The Adult Male Equivalent Concept and its Application to Household Consumption and Expenditures Surveys (HCES). Food Nutr. Bull. 33, S157–S162.

[8] Inter-Agency and Expert Group on Food Security, Agricultural and Rural Statistics – aim to improve use of HCES to understand nutrition and food issues http://blogs.worldbank.org/opendata/sdgs-1-2-meeting-demand-more-and-better-household-survey-data

MARKET RESEARCH AND RETAIL-BASED DATA

Table 4: Market research reports[9] and retail market survey

Data description	Useful data source for Step 1a of Module 4	Country experience
Market research reports are pre-formulated or bespoke reports, usually detailing food sales, market drivers/trends, a market overview and industry forecast, key players in the food industry and mass grocery retail, along with population statistics and some level of breakdown of use by population group. **Retail market surveys** use a tested, standardised, methodology and questionnaire (that could be completed by interview and/or observation) to determine: the size and typical market reach of the retail outlet, top selling salt-containing products (by value, frequency of sales, and weight), labelling of products, the stated serving size and amount of sodium per serving size, product manufacturer details.	Where available, the information can be particularly useful for identification of popular food products, typical consumer group for the product, geographic variations, and the main industries producing and/or importing these products. Market research reports can be expensive to commission; therefore, the primary recommendation is to identify whether any recent reports exist and can be used, rather than looking to commission a new report for this assessment. A retail market survey is a time-intensive process and usually provides data for defined areas or a limited number of randomly selected areas according to the main reason for the survey. Retail market surveys that include labelling information can be a source of the weight or % sodium content of a product. Sodium content of may include sodium from ingredients other than salt; however, salt is usually the main contributor to sodium content. Other sodium containing ingredients, for example, monosodium glutamate or preservatives such as sodium acetate, can be checked for on the packaging and an estimated allowance in the salt calculation can be made. Depending on the national context, there may be a few major brands or numerous locally produced brands, or a mix.	Market research reports were used as to identify widely consumed salt-containing food products that were then included in a more detailed survey of food industries. Triangulated with data from national dietary survey, see below. **Indonesia and the Philippines** Retail market surveys were used to approximate the market reach of certain product types and brands, and to assess ingredient listing (whether iodized salt specified) as well as retailer awareness about iodized salt. **Bangladesh and Pakistan**

Table 5: Bakery survey

Data description	Useful data source for Steps 1a, 2a and 3 of Module 4	Country experience
In many countries bread is a major staple and, therefore, a key source of dietary salt. Bakery surveys, including observation or testing of iodine in the salt used, can be helpful to assess the market reach of products and combined with other consumption data to estimate the likely iodine intake from salt used in the product.	It is important to understand the methodology of any bakery survey to know how the data may be applied to assessing salt and potential iodine intake. Examples: was the survey conducted for industrial bakeries only?	Used to assess the use of iodized salt in industrial bakeries and to approximate iodine intake from bread. **Egypt, Bangladesh, Australia, and New Zealand**

[9] A list of food and beverage market research companies can be found here https://www.marketresearch.com/publishers/Food-Beverage-c84/

INDUSTRY-BASED DATA

Table 6: Salt industry data (from the salt industry – producers and/or importers – directly, or also or separately from the Ministry of Industry or equivalent body)

Data description	Useful data source for Steps 1a and 3 of Module 4	Country experience
The Ministry of Industry (or equivalent body) might maintain a database including some or all of the following: quantities of food-grade salt produced/ imported, proportion of this that is iodized, and an indication of the proportion distributed for use as household versus food industry salt. Individual salt producers and importers would be expected to maintain the same sort of information, along with a listing of food industries supplied. Knowing the volume of salt supplied to different food industries can help target follow up data collection about which foods they produce and their distribution network.	Food industries usually require high quality salt, which is generally more available from large scale, more industrialised, salt producers or from imports. Reliable quantitative data are more likely to be available from these sources than from small-scale producers. Experiences to date show that Ministry and salt industry-sourced data can be helpful in estimating the relative proportion of food-grade salt used by the food industry and identification of major food industries using salt.	Used to estimate the proportion of dietary salt source by the food industry and also the type of major food industry using food-grade salt. Triangulated with other data sources. **Indonesia, China, and Haiti**

Table 7: Food industry data (from specific food processors or from processed food importers or representative industry bodies)

Data description	Useful data source for Steps 1a, 1b, 2a and 3 of Module 4	Country experience
Large scale food processing companies and importers have information on the quantity, trends, and distribution/markets for salt-containing foods they produce/import. Information related to widely consumed salt-containing foods with wide market reach may be requested (although not always granted), either directly from individual industries or importers, or from food industry bodies. Processed food industry companies have information on the salt content of identified food products. This may be determined directly from domestic industrially processed food producers or from contacts at a higher level for some global-scale food industries, especially those that are part of food fortification networks. This would be particularly useful for understanding the salt and iodized salt content of imported industrially processed foods. Data may be from individual or general industry/import reports or be the outcome of semi-structured qualitative interviews.	Experiences to date show that surveys of privately owned food industry players may have a low response rate, and are relatively costly to conduct (however, considerably less resources are required than for conducting a household survey). These industry surveys become more cost-effective when one industry produces more than one product of interest. The situation might be the same for food importers. An industry's standard operating procedures and quality control records for production of a specific food could provide information on the use of salt and iodized salt including, potentially, quality control of iodine content of salt. Where available, data from food industry sources are particularly useful to identify/verify foods of interest, to understand the amount and type of salt used in production and the geographic distribution and demographic characteristics of consumer groups.	Used to estimate per capita consumption, market distribution - geographical and consumer group – and to provide information on salt source, type, salt content, iodine level and related QC practices. **Indonesia, the Philippines, China, and Haiti**

NATIONAL GUIDELINES

Table 8: Food standards

Data description	Useful data source for Steps 2a and 3 of Module 4	Country experience
Some countries have standards or technical guidelines/specifications for the composition of common food products. These specifications usually state a maximum allowable level for sodium or salt in each type of food. It should be clarified whether the same specifications are applied to imported foods.	The maximum permitted level of sodium or salt can be used to estimate potential salt content for a product, however, any modelling based on this figure should note that the actual level may be lower.	Used to estimate the maximum salt content of common products. Macedonia and Moldova

Table 9: Humanitarian food aid guidelines

Data description	Useful data source for Steps 1a, 1b, 2a and of Module 4	Country experience
International agencies may work with national governments to design and deliver a package of food assistance in areas affected by a humanitarian crisis. The population receiving food assistance may have quite different dietary habits to the rest of the sub-national region or country. It is worth conducting the assessment in Module 4 separately for these food products where consumption is unique to the population receiving humanitarian aid. Food aid may be provided according to guidelines on the type of food, including fortified products, the source of the foods, and quantity provided – based on a per capita consumption estimate.	Only model data from this source where food assistance provides for the dietary intake of a large population group over a long-term period (> 6 months). In such a case, food assistance guidelines can be used to estimate products consumed, estimated average per capita intake for different groups. and the salt and iodized salt content of each product. These data should only be used to model data for the specific area/population group receiving humanitarian aid.	No examples are currently available.

MODULE 2: DETERMINING THE NEED TO STRENGTHEN SALT IODIZATION STRATEGY

Module 2 facilitates an analysis of household use of iodized salt, iodine status among population groups, current knowledge about consumption of salt-containing industrially processed foods, and national salt and food industry structure (production and import). This allows a decision to be made on whether to implement the full Guidance. The aim is to obtain good enough data to assess the success of the existing salt iodization strategy in terms of achieving and sustaining optimal iodine status.

The situational analysis should answer four main questions (Box 1 below). Program managers are encouraged to use the best available data. Commonly used data sources to estimate household use of iodized salt and (sub) population iodine status are presented in Tables 9, 10 and 11.

Lack of data to answer certain questions may be a challenge to conducting the full situational analysis. Note that Question 3 is a preliminary inquiry based on current understanding: implementing this Guidance should answer it in more detail. The analysis will assess whether existing strategy is meeting the national aim of sustainable optimal iodine status among all population groups across all sub-national regions. In some contexts, a change to salt iodization strategy, for example advocating for or strengthening the use of iodized salt in all or in targeted industrially processed foods, would increase the likelihood of achieving this aim. In other situations, there may be a knowledge gap about the food industry's use of iodized salt that could be filled to better understand the program. Improved understanding of the sources of iodized salt will help anticipate and plan for the likely impact of dietary changes or successful implementation of salt reduction policies.

Documentation and mapping of large-scale producers, importers of salt, and relevant food industries, should be an additional component of the situational analysis. Helpful information for program management includes location and characteristics (details, size, and type of salt/foods produced or imported). Where these industry data are not available, the UNICEF guide to setting supply side targets for salt iodization provides tools that may help characterise the salt industry, iodization practices and salt supplies to the food industry[29]. It is not essential to document this information in advance of implementing the Guidance, but it is highly recommended to conduct this mapping at some stage in the strategic review process.

Knowledge of limitations in understanding of national and sub-national situation iodine status and intake can be helpful in interpreting modelling outcomes in Module 4 and in developing recommendations for future activities in Module 6.

KEY INDUSTRIALLY PROCESSED FOODS

Industrially processed salt-containing foods have market reach beyond the local area of production and make a significant contribution to salt intake across all or some population groups.

Key industrially processed food products contributing to salt intake can include:

Foods with a high salt content, regularly consumed in small amounts regularly, often in place of cooking or table salt, such as fish sauce or bouillon

Staple foods, often with relatively low salt content, regularly consumed in larger amounts, such as industrially produced bread or instant noodles

Other foods, such as convenience or snack foods, with medium to high salt content, regularly consumed by certain population groups, often according to demographic factors such as age and urban/rural location.

Strategic follow-up based on outcomes of the situational analysis

If answers to the questions below indicate that the current salt iodization strategy is achieving the desired outcome with high household iodized salt coverage and sustained optimal iodine status, the national team may consider that no immediate strategic change is needed. Where it is believed that dietary practices include a high intake of industrially processed foods, it is worth considering conducting the assessment to better understand the dietary sources of salt and, potentially, of iodine.

In all situations, it is highly recommended to:

Review current legislation for salt iodization, as outlined in Module 3. This is especially important where iodizing food industry salt in the iodization strategy is identified as a priority

Schedule a periodic review of the four-point situational analysis to monitor whether dietary changes or other factors have altered and to ensure timely strategic change when required.

RECOMMENDATION

Use the Module 2 Situational Analysis Table Tool to record the answers to the 4 questions in Box 4, to document the salt and food industry and import situation, and to note all data gaps.

BOX 1: SITUATION ANALYSIS QUESTIONS AND RELEVANCE TO ACHIEVING OPTIMAL POPULATION IODINE STATUS

Question 1	**Is household use of salt iodized to national standards (or with >15mg/kg iodine) consistently <90% for any sub-group?** The use of iodized salt by the food industry may help improve iodine intake to populations regularly consuming salt-containing processed foods. This may be particularly important in situations where households do not have consistent access to quality-assured iodized household salt.
Question 2	**Is iodine status inadequate among any population age or sex group, nationally or sub-nationally?** Typical groups with available data include school age children, women of reproductive age and pregnant women. Sub-national refers to data for administrative regions or urban/rural locations. Where available, data on iodine status disaggregated by population groups known to live in households with and without access to iodized salt should also be reported. Strategic relevance: Iodization of food industry salt may increase access to iodine through a diverse range of food products, including iodized household salt. This will improve the likelihood of achieving optimal iodine status regardless of dietary practice. Good or above optimal iodine status among one or more population/sub-national group does not by itself mean that food industry salt should not be iodized. It might indicate that salt iodine standards could be lowered while ensuring all population groups receive iodine through both household and food industry salt.
Question 3	**Based on existing (pre-implementation of this Guidance) knowledge, is it believed that food industry salt contributes significantly to salt intake among one or more sub-population groups?** Strategic relevance: Where dietary practices mean that household salt consumption is being replaced by consumption of salt from industrially processed foods, iodization of food industry salt (in addition to household salt) may help improve equitable access to iodine from all sources of salt in the diet. If there is little existing evidence at this time about the likely contribution of food industry salt to population salt intake, implementing the Guidance can be considered worthwhile to obtain this information.
Question 4	**Does a salt reduction policy exist?** Strategic relevance: To estimate likely changes in iodine intake from successful implementation of a salt reduction policy, it is important to understand the relative contribution of industrially processed foods and household salt to salt and iodized salt intake, especially where salt reduction may be targeted more specifically at certain food industry products or at household salt. Iodization of all food-grade salt facilitates adjustments to salt iodine levels, to achieve or maintain optimal iodine nutrition in parallel with expected reduced total salt intake. Where feasible, the situational analysis should report on the situation among different demographic groups and geographical regions.

HOUSEHOLD SURVEY OR MONITORING/ SURVEILLANCE-BASED DATA

Table 9: National or sub-national surveys

Data description	Other points to note
Many types of national or sub-national surveys include collection of data to assess household use of iodized salt. These include DHS, MICS, and nutrition surveys (including specific iodine surveys) and school-based surveys. Some of these surveys (mainly the nutrition surveys) may include collection of data to assess iodine status (median) urinary iodine concentration) among at least one population group.	Where these data exist, they provide useful and generally reliable information. When data for household use of iodized salt and urinary iodine data are available in the same data set it can help understand how household salt iodine might relate to iodine intake.

Table 10: Surveillance systems

Data description	Other points to note
Some countries have rolling data collection at the household (which may include collection of information to determine household salt iodine and iodine status) and/or nutritional surveillance systems, for example, routine collection and testing of urine for iodine, from pregnant women at antenatal clinics.	The data from clinic-based or other types of convenience-based collection systems may be less reliable than from a well-designed cross-sectional household survey. However, they usually require much lower resources to implement and the data may be particularly useful for describing any change to iodine status over time.

Table 11: Salt industry and/or regulatory monitoring systems

Data description	Other points to note
Salt industry records and/or government regulatory monitoring data for iodized food-grade salt production and import can indicate the mean iodine content of food-grade salt and compliance with salt iodization standards.	Depending on the level of detail from salt industry records or in the regulatory monitoring protocol it may be possible to obtain an estimate of the percent household (retail) salt that is iodized to national standards. Estimates may not be as reliable as survey-based data to estimate household use of iodized salt but may indicate whether the strategy for iodization of household salt is generally successful or not. The data may be particularly useful for investigating changes over time.

MODULE 3: LOOKING AT LEGISLATIVE FRAMEWORKS AND RECOMMENDATIONS FOR USE OF IODIZED SALT IN INDUSTRIALLY PROCESSED FOODS

Legislation for mandatory salt iodization exists in 124 countries globally,[12] with voluntary legislation in a further 21 countries. The type and language of mandatory legislation, its implementation and enforcement, varies widely between countries. Program managers must fully understand the legislative environment for salt iodization and any potential weaknesses in the legislation and its regulation and enforcement, especially regarding the use of iodized salt in the production of foods.

A priority is to review current legislation and monitoring and enforcement protocols to identify possible gaps or ambiguities related to the inclusion of food industry salt within salt iodization. For example: does the scope of the legislation include salt for processed foods; do inspection protocols of authorized food inspectors of domestic industrially processed food producers include checks that salt used is iodized?

The UNICEF East Asia and the Pacific Regional Office commissioned a comprehensive review of national legislation for salt iodization in the East Asia, Pacific and South Asia regions in 2012, with an update in 2015[31]. The report is a useful resource to guide a national legislative review. The main lessons documented with regard to inclusion of food industry salt are listed in **Box 2**, along with explanatory notes taken from a range of other references[2,31–34].Based on this review, recommended wording for legislation to achieve the iodization of both household and iodized salt is:

> ***"This legislation/regulation/standard applies to all food-grade/edible salt, including salt used as an ingredient in food processing."***

It is recommended to answer the following questions as part of a review of the legislative framework:

- Is legislation for salt iodization mandatory?
- Does legislation for salt iodization clearly indicate inclusion of salt for industrially processed foods, as well as salt for household use and consumption?
- Are appropriate regulatory authorities specified for salt production, salt import, and the use of salt in the food industry? (Is it clear which government authority is responsible for monitoring and enforcing the use of iodized salt in the food industry, including imported foods where this is mentioned?).
- Do protocols for monitoring and enforcement exist and are they effectively implemented (i.e. data collected AND used)
- Is legislation for salt iodization a standalone law or is it required under a broader law, such as a Food Act?
- Are standards for salt iodine levels incorporated into the legislative document or are they prescribed separately?

The outcome from this Module will be helpful in the assessment of and recommendations for strengthening the enabling environment, **Module 5**.

RECOMMENDATION

Use the table Module 3 Legislative and Enforcement Framework Review Tool to guide the legislative review and record the current situation and to note of any information gaps

BOX 2: LEGISLATIVE FRAMEWORK AND REGULATORY MONITORING AND ENFORCEMENT REGULATIONS

Some key recommendations related to the inclusion of food industry salt in the legislative framework for salt iodization. See the Module 3 Program Guidance tool.

1	**Legislation should be mandatory: All food-grade salt must be iodized; it is not at the discretion of the salt producer/importer** Mandatory fortification of staple foods has proved more effective and equitable than voluntary fortification in ensuring achievement of the aim of fortification
2	**Legislation should include the use of iodized salt for industrially processed foods, as well as salt for household use and consumption. This should be clearly specified. Program managers should review the wording of national legislation to ensure there is no ambiguity about the required scope, for example, legislation documents do not state that they apply only to "salt for direct human consumption"**
3	**It is important that existing food control regulations and/or salt iodization legislation delineate responsibilities for regulatory monitoring and enforcement of salt iodization requirements at points of domestic salt production and/or import and at the point of use by processed food producers** Different authorities may be assigned at different points, these should be stated in the legislation
4	**Regulatory monitoring and enforcement of salt iodization requirements and the use of iodized salt in industrially processed foods should be incorporated into inspection check lists and monitoring protocols of mandated responsible food control agencies**
5	**Legislation for salt iodization has generally been in the form of a mandatory standard for food-grade salt under the Food Act (or equivalent) or a stand-alone law** The advantage of mandating salt iodization through a mandatory salt standard is that salt iodization becomes part of the routine food production and control system. Effectiveness still depends on how well this routine system functions.
6	**The standard for salt iodine content and the legislative document are recommended to be separate documents. This enables an easier process to change standards when needed, without a requirement for government action** Standards for salt iodine content should be based on best available estimates for iodized salt intake through both household and food industry salt, what may be required to achieve optimal population iodine nutrition, and confirmed by assessing population iodine status (UIC)

MODULE 4: ASSESSING THE CONTRIBUTION OF PROCESSED FOODS TO SALT INTAKE

This module covers the main purpose of the Guidance: the assessment, which aims to provide estimates of typical salt and iodized salt intake from different food sources, including household salt, based on best available data. This will improve understanding of existing interventions and support advocacy. It provides a framework for program managers to estimate the contribution of industrially processed foods to salt intake, and to potential and estimated current iodine intake if some or all that salt is iodized. It includes a description of the four-step process and Excel-based tools to implement the assessment. Other resources are referred to in the text.

We use the term "household salt" to describe all non-bulk retail salt which generally includes salt used at the household, in small-scale local food production, and by street market food vendors.

Assessment options

Three options for the assessment are presented below and as three Excel tools with the core title **Module 4 tool – Option X**. Selecting the appropriate option depends on the type of data and information available, which should have been identified through implementing Module 1 of the Guidance. These options are shown in Table 12 in recommended order of priority. Figure 1 is a flow diagram illustrating the selection process.

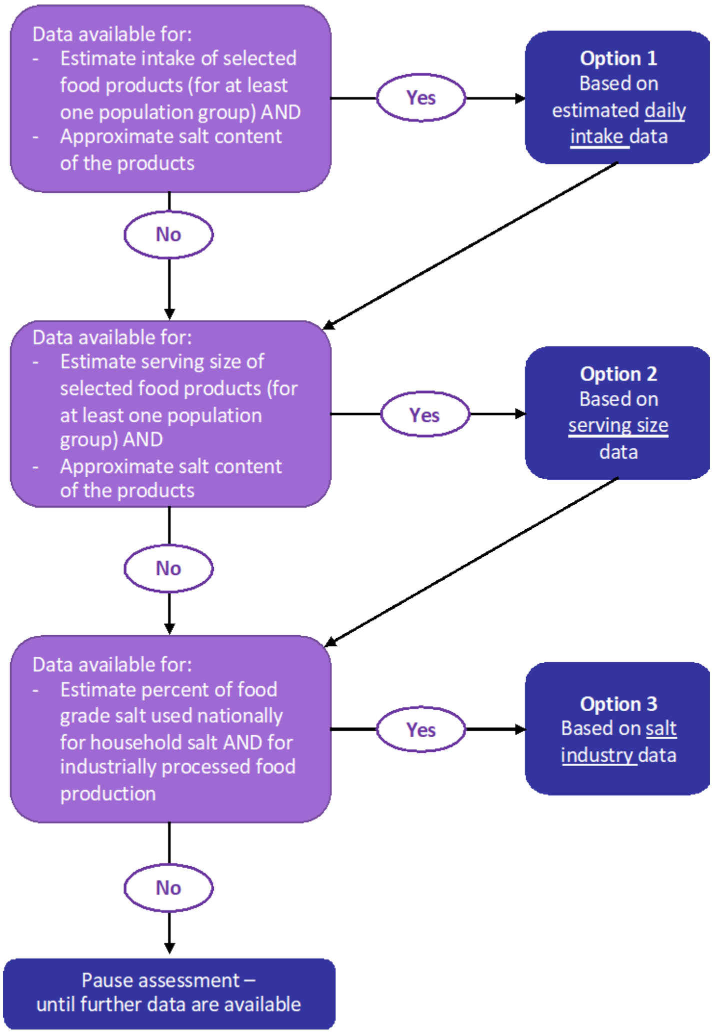
Table 12: Assessment options – information required and expected outcomes

Option	Data or information required	Expected key outcome
Option 1 Recommended as most programmatically valuable **Module 4 tool, Option 1**	• Identification of widely consumed salt-containing foods • Data that can be used to estimate typical daily intake of at least some of these foods	Percent EAR, RNI and UL for daily iodine intake ***potentially*** provided by typical consumption of selected food products Can be conducted for different population and geographic or sociodemographic groups depending on available data.
Option 2 Helpful information that can be developed further (to Option 1) when intake data become available. **Module 4 tool, Option 2**	• Identification of widely consumed salt-containing foods. • Serving size information for at least some of these foods.	Percent EAR, RNI and UL for iodine intake *potentially* provided by one serving size of the selected food product.
Option 3 Less programmatically useful, but can guide strategic focus on iodization of household salt, food industry salt, or both. **Module 4 tool, Option 3**	• Data on the quantity of food grade salt distributed as household salt and to the food industry.	The relative importance of household salt and food industry salt to national salt consumption.

RECOMMENDATION

Use the Module 4 Assessment framework tool as a checklist to record which data sources are used for what purposes and the findings for each stage

FIGURE 1: FLOW DIAGRAM TO SELECT THE APPROPRIATE ASSESSMENT OPTION FOR THE NATIONAL SITUATION[10]



Assessment framework

The assessment follows the four steps summarised below. A third option, for use in situations where other options are difficult to implement, is presented at the end of the section. **Figure 2** provides an overview of the framework for Option 1 (based on consumption data).

Inclusion of household salt in Option 1 provides a helpful comparison of the relative sources of dietary salt (household and food industry) and their separate and combined potential and estimated current contribution to iodine intake.

See the accompanying documents **Case Studies for Module 4** and **Summary Report from pilot Implementation** for national examples of how this framework has been applied in other countries.

It is important to document and report on all data sources, assumptions made, and any additional manipulation of the data used for the modelling. This will enable others to assess the level of reliability of output estimates and/or repeat/replicate them with new data.

[10] This flow chart is also shown in the first tab of the **Module 4 tool - OPTION SELECT**

Assessment framework steps

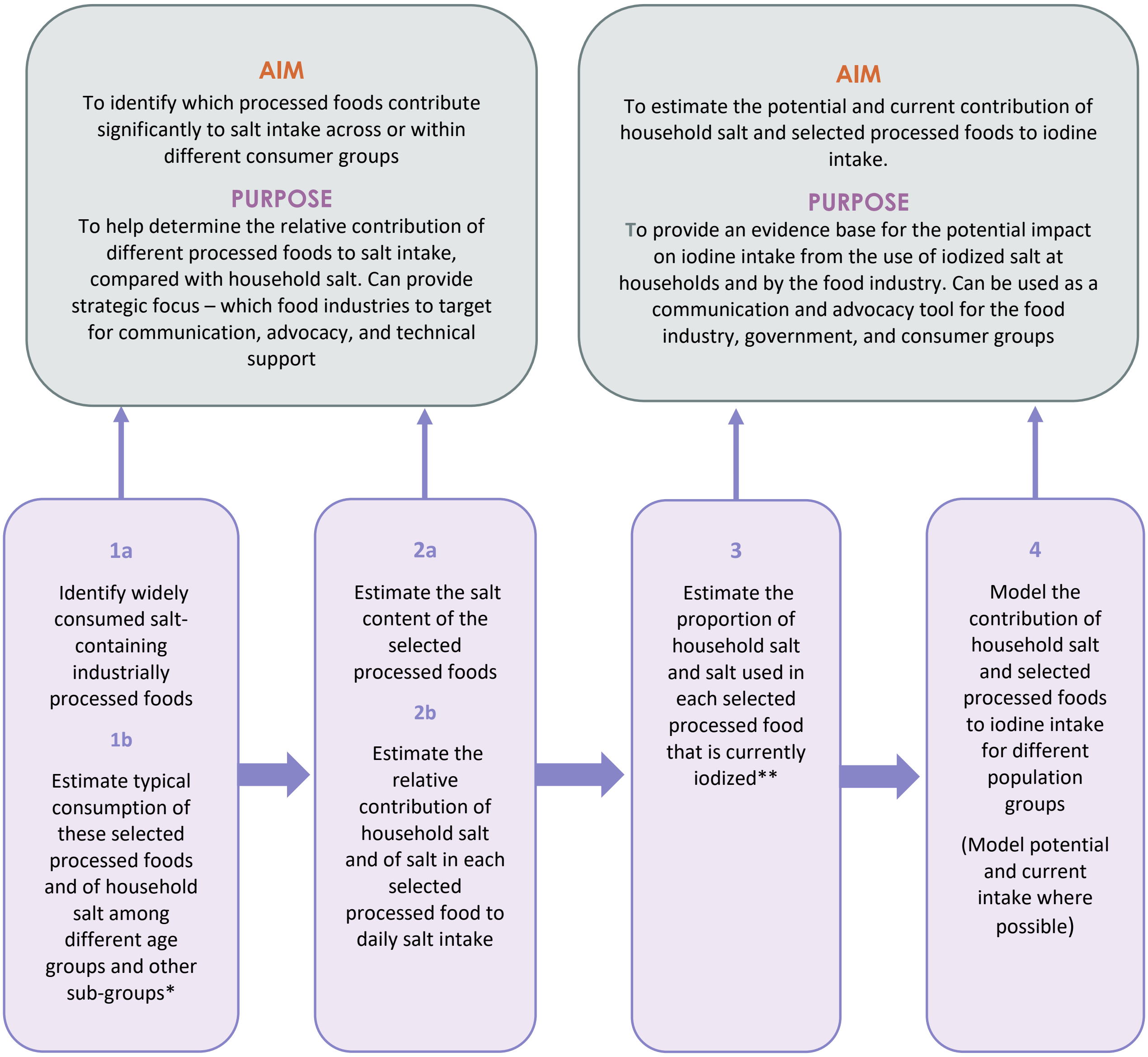
Step 1	**Identify, and select for inclusion, widely consumed salt-containing industrially processed foods** **Option 1:** Estimate typical consumption for each selected processed food among different population and other sub-groups.[11] Include household salt where estimates for daily consumption are available **Option 2:** Where no consumption data are available, determine an average serving size for each selected processed food. Including household salt has less programmatic relevance in this situation and is, therefore, not recommended.
Step 2	**Estimate the salt content of the selected processed foods** **Option 1:** Estimate the relative contribution of household salt and of salt in each selected processed food, to average daily salt intake **Option 2:** Where no consumption data are available, determine the contribution to salt intake from an average serving size for each selected processed food
Step 3	**Estimate the proportion of household salt and of salt used to manufacture each selected processed food, that is currently iodized[12]**
Step 4	**Option 1:** Model the potential contribution of household salt and selected processed food salt to iodine intake based on all food grade salt (for household and food industry) being iodized. Model current estimated contribution of household salt and selected processed food salt to iodine intake using information from Step 3. Implement models for different population, or geographic/sociodemographic, groups where data are available. **Option 2**: Where no consumption data are available, determine the ***potential*** and estimated current contribution to iodine intake from salt in an average serving size of each selected processed food.

[11] Example population groups: school-age children, women of reproductive age, lactating women, pregnant women. Example sub-groups: geographic region, residence type, socio-economic.

[12] Where this is not possible due to lack of food industry information, proceed to model potential iodine intake, Step 4

FIGURE 2: FRAMEWORK TO ASSESS THE CONTRIBUTION OF INDUSTRIALLY PROCESSED FOODS TO SALT INTAKE AND ACTUAL/POTENTIAL IODINE INTAKE

(FOR OPTION 1 – BASED ON INTAKE DATA)



* Examples of population groups often reported in surveys: school-age children, women of reproductive age, lactating women, pregnant women. Examples of sub-groups: geographic region, residence type, socio-economic.

** Based on an assumption that, if salt is iodized, it will be iodized according to national standards. Where no information is available on the use of iodized salt, it is still possible to model potential iodine intake, as if all food grade salt is iodized, Step 4

The framework steps should help determine whether food industry salt is, or could be, contributing significantly to iodine intake among different population groups.

This will help determine whether a review or modification of the salt iodization strategy is required, for example, strengthening monitoring and enforcement of existing iodization legislation for food industry salt (See Module 5).

STEP 1

IDENTIFY AND SELECT WIDELY CONSUMED SALT-CONTAINING PROCESSED FOODS AND ESTIMATE TYPICAL CONSUMPTION AMONG DIFFERENT POPULATION GROUPS

As information is likely to come from the same data sources, both parts of Step 1 can be implemented together.

a. Identify and select widely consumed processed foods containing salt

The first task is to identify and select salt-containing processed foods distributed across the country and widely consumed among all or some age groups. Commonly available data sources to identify widely consumed processed foods are presented in Module 1. Data from one or more of the recommended sources may be available. In some cases, key processed foods contributing to salt intake may have already been identified, for example, in evidence gathering for development of a salt reduction strategy.

Examples of processed foods to consider are given in Module 2. Include household salt in the list of selected foods. Look also at foods that may be popular among one population group, or at regional or other sub-national level. There may be differences between urban and rural areas, or between products popular with school age children and those popular with adults.

If no data are available to estimate typical consumption, look at other ways to select salt-containing processed foods. They could be included based on average serving size (Option 2), or you may need to look at data from neighbouring countries with similar dietary practices or use the expertise of nutritionists and dieticians.

When using any data source, it is important to understand the data collection methodology to correctly describe and interpret the reliability and representativeness of data inputs used.

b. Estimate typical daily per capita consumption

Data could be obtained from one or more of the data sources shown in Module 1, and where possible should relate to a defined population group, usually a specific age group. If data are only available per household member, without adequate information to convert this to Adult Male Equivalent for a specific population group[13](26), modelling needs to include an assumption that they represent intake for one age group (usually non-pregnant adults). Findings therefore cannot be presented as fully representative of whichever group is selected.

The list of selected processed foods and consumption data should be inserted into the relevant column of the associated tool **Module 4 tool - OPTION 1**.

Where typical consumption data are only available at national level, or for only a few foods, these can still be modelled using Option 1. Future data collection could include assessment at sub-national level and for an expanded number of industrially processed foods.

If no data are available to estimate consumption, then information on the typical serving size for each selected product should be collected using Option 2. Where different brands of the same food product have different recommended serving sizes, calculate an average serving size to use in the modelling. If information on relative market share of the product brands is available, the average serving size can be adjusted to account for this. See **Appendix 1, Table A** for an example of how average serving size may be calculated.

The list of selected processed foods and data on average serving size should be inserted into the relevant column of the associated tool **Module 4 tool - OPTION 2.**

[13] AMEs are used to divide total household food use by the number, sex and age of household members according to their expected relative energy requirements.

STEP 2

ESTIMATE SALT CONTENT OF SELECTED INDUSTRIALLY PROCESSED FOODS AND RELATIVE CONTRIBUTION TO AVERAGE DAILY SALT INTAKE

a. Estimate the salt content of industrially processed foods

Salt content as a percent of product weight may differ by producer and by brand. The aim is to obtain a reasonable average percent salt content for a similar type of processed food, e.g. white bread. Where labels on different brands of the same food product state different levels of sodium[14] or salt content, calculate the average salt content, adjusted for relative market share of the different brands where this information is available. See **Appendix 1, Table B** for an example calculation.

Data sources used to estimate salt content of selected processed foods are presented in Table 1 of Module 1. Appendix 2, Table A summarizes the processed foods included in our pilot implementation, along with approximate salt content reported for these foods.

Data for salt content of selected processed foods should be inserted into the relevant column of the associated tool **Module 4 tool - OPTION 1** where corresponding consumption data are available, or **Module 4 tool - OPTION 2** where consumption data are unavailable and assessment is based on serving size.

b. Estimate the relative contribution of selected industrially processed foods to average daily salt intake or to salt intake by serving size

An estimate for the typical consumption level of a selected processed food for a specific population group can be multiplied by the percentage salt content to determine average daily intake of salt from this product. This calculation is applied automatically in the associated tool **Module 4 tool - OPTION 1** once the relevant data from Steps 1a, 1b and 2a have been entered. For example, a typical daily adult per capita intake of 240g bread with a 1.2% salt content, would result in an estimated salt intake of 0.012 x 240 = 2.9g salt.

Include household salt where typical consumption data are available. The calculation will be estimated daily consumption for a specific population group multiplied by 100%

If no data are available to estimate typical consumption for a selected processed food, then Option 2 can be used. Information on the typical serving size for each selected processed food will be multiplied by the percent salt content to determine the average intake of salt from one serving size of the selected processed food.

This calculation is applied automatically in the associated tool **Module 4 tool - OPTION 2** once the relevant (serving size related) data from Steps 1a, 1b and 2a have been entered. For example, a typical serving size of bread of 35g with a 1.2% salt content would result in an estimated salt intake from one serving size of 0.012 x 35 = 0.4g salt.

[14] Use a conversion factor for sodium content to salt content of 2.54

STEP 3

ESTIMATE THE PROPORTION OF HOUSEHOLD SALT AND SALT USED TO MANUFACTURE EACH SELECTED CURRENTLY IODIZED PROCESSED FOOD PRODUCT[15]

The proportion of households using iodized salt will have been reviewed in Module 2. The proportion of salt used in the manufacture of selected processed foods that is iodized may be more difficult to determine. Suggested sources are listed in Table 1, Module 1. Producers of the same processed food type may have different practices related to the use of iodized salt in manufacture.

Where market share information for different brands of the same processed food type is available, an average proportion of iodized salt used in production of this food type can be adjusted for this relative market share. See Appendix 3, Table A for an example.

Where selected processed foods include imported foods, it may be difficult to determine whether salt used in their production is iodized. If the countries of origin that account for the majority of selected product market share are known, a review of the relevant national salt legislation[(12)] may help understand whether food industry salt is likely to be iodized. IGN may also be able to assist in this determination, through connection with their national and regional coordinators (info@ign.org/).

Data for the proportion of household salt and salt used to manufacture the selected processed foods that is iodized should be inserted into the relevant column of the associated **tool Module 4 tool - OPTION 1** (where corresponding consumption data are available) or **Module 4 tool - OPTION 2** (where consumption data are unavailable and the assessment is based on serving size).

A UNICEF tool, "Managing Universal Salt Iodization Communications (MUSIC)" could help determine supply-side capacity and targets for salt and iodized salt, for household salt and for the food industry [(29)].

Where information on the current proportion of iodized salt used in the manufacture of selected processed foods is unavailable, this step can be skipped. The modelling can be done for the potential iodine intake only, based on an assumption that all salt used in industrially processed foods is iodized according to national standards, see Step 4.

[15] Based on an assumption that, if salt is iodized it will be considered as iodized according to national standards.

STEP 4

MODEL POTENTIAL AND ESTIMATED CURRENT IODINE INTAKE FROM SELECTED INDUSTRIALLY PROCESSED FOODS

a. Based on typical daily intake

Potential iodine intake from typical daily intake of household salt and selected processed foods is automatically calculated in **Module 4 tool - OPTION 1** based on data inputs described for Steps 1 and 2 above. Some added assumptions in the auto-calculation of potential iodine intake are that:

100% of all household salt and salt used in the manufacture **of** the selected processed foods is iodized to the mean of national standards (described in Module 3).

An adjustment is made to account for 30% loss of iodine in the product (household salt and selected processed food) at the time of consumption.

SAMPLE CALCULATION

A typical daily adult per capita intake of 240g bread with a 1.2% salt content would result in salt intake of 0.012 x 240 = 2.9g. If 100% of this salt is iodized at 25mg/kg, then iodine intake from the 2.9g of iodized salt would be 2.9*25 = 73µg iodine. Accounting for possible loss of 30% iodine would leave a **potential adult iodine intake** from iodized salt in bread of 73 * 0.7 = 51 µg.

Estimated current iodine intake from typical daily intake of household salt and selected processed foods is also automatically calculated in **Module 4 tool - OPTION 1** based on the data inputs above (Steps 1 to 3). Some added assumptions in the auto-calculation of estimated current iodine intake are that:

i. The best available data are input for percent of total household salt and salt used in the manufacture of selected processed foods
ii. Where salt is iodized, it is iodized to the mean of national standards (described in Module 3)
iii. An adjustment is made to account for 30% loss of iodine in the product (household salt and selected processed food) at the time of consumption.

SAMPLE CALCULATION

A typical daily adult per capita intake of 240g bread with a 1.2% salt content and 50% of bakery salt estimated to be iodized, would result in iodized salt intake of 0.012 x 240 x 0.5 = 1.4g. If all iodized salt is iodized at 25mg/kg, then iodine intake from the 1.4g of iodized salt would be 1.4*25 = 35µg iodine. Accounting for possible loss of 30% iodine would leave estimated current iodine intake from iodized salt in bread of 35 * 0.7 = 25 µg.

The Excel tool **Module 4 tool - OPTION 1** can be copied and used to assess potential and estimated current iodine intake from typical daily intake of household salt and selected processed foods for different population groups.

b. Based on serving size

Potential iodine intake from one serving size of the selected processed foods is automatically calculated in **Module 4 tool - OPTION 2** based on data inputs for Steps 1 and 2 above. Some added assumptions in the auto-calculation of potential iodine intake per serving size are that:

i. 100% of all household salt and salt used in the manufacture of the selected processed foods is iodized to the mean of national standards (described in Module 3).

ii. An adjustment is made to account for 30% loss of iodine in the product (household salt and selected processed food) at the time of consumption.

SAMPLE CALCULATION

A typical serving size for bread is 35g with a 1.2% salt content would result in salt intake of 0.012 x 35 = 0.4 g. If 100% of this salt is iodized at 25mg/kg, then iodine intake from the 0.4g of iodized salt would be 0.4*25 = 10µg iodine. Accounting for possible loss of 30% iodine would leave a potential iodine intake from iodized salt in one serving size of bread of 10 * 0.7 = 7 µg.

Estimated current iodine intake from one serving size of the selected processed foods is automatically calculated in the **Module 4 tool - OPTION 2** based on the data inputs above (Steps 1 to 3). Some added assumptions in the auto-calculation of estimated current iodine intake are that:

i. The best available data are input for percent of total household salt and salt used in the manufacture of selected processed foods

ii. Where salt is iodized, it is iodized to the mean of national standards (described in Module 3).

iii. An adjustment is made to account for 30% loss of iodine in the product (household salt and selected processed food) at the time of consumption

SAMPLE CALCULATION

A typical serving size for bread is 35g with a 1.2% salt content and 50% of bakery salt estimated to be iodized, would result in iodized salt intake of 0.012 x 35 x 0.5 = 0.2 g from one serving size. If all iodized salt is iodized at 25mg/kg, then iodine intake from the 0.2g of iodized salt would be 0.2*25 = 5µg iodine. Accounting for possible loss of 30% iodine would leave estimated current iodine intake from iodized salt in one serving size bread of 5 * 0.7 = 3.5 µg.

Module 4 tool - OPTION 2 can be copied and used to assess potential and estimated current iodine intake from one serving size of the selected processed foods for different population groups.

OPTION 3 – WHERE IMPLEMENTATION OF OPTIONS 1 AND 2 ARE NOT FEASIBLE

This option is intended for use where, for example, it is not possible to identify widely consumed salt-containing processed foods. If required data are available, it can also be helpful to run this model to determine the relative importance of household and food industry salt to national salt consumption.

Information required for input to the **Module 4 tool - OPTION 3** includes:

- Total food grade salt produced/imported and distributed for domestic use (MT), broken down into:
    - Food grade salt produced/imported and distributed as household salt for national/ domestic use.
    - Food grade salt produced/imported and distributed for production of industrially processed foods for the domestic market.
- Estimate for the percent of total food grade salt (MT) that is iodized, broken down into:
    - Percent of salt for domestic household use.
    - Percent of salt for production of industrially processed foods for the domestic market.

Option 3 analysis will be less helpful where:

- A large share of the domestic market for processed foods comes from imported products.
- It is not possible to determine what percent of household salt and food industry salt production is for the domestic market and what is for export (as household salt or as industrially processed foods).

The automatic calculations processed in **Module 4 tool - OPTION 3** provide the following information:

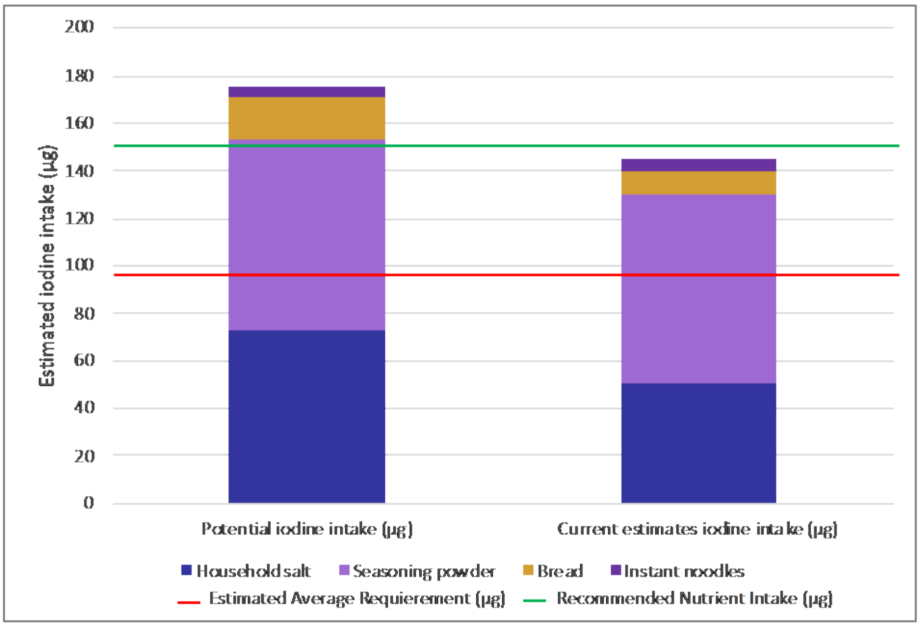
- The relative percent of total food grade salt distributed for different purposes (household and food industry) for domestic consumption.
- The current proportion of salt that is iodized and non-iodized for each of: household salt, food industry salt, and total food grade salt (household and food industry combined).

SAMPLE OUTPUTS OF MODULE 4 TOOLS

Examples of the three completed Excel Module 4 tool - OPTION tools are shown in Appendix 4 - Tables A, B and C. The source and related comment on the reliability of the estimates used as inputs to the Module 4 – OPTION tools should be documented throughout.

Examples of charts developed from the data in these tables are shown for each of Option 1 to 3 in Figures 3 to 5 below.

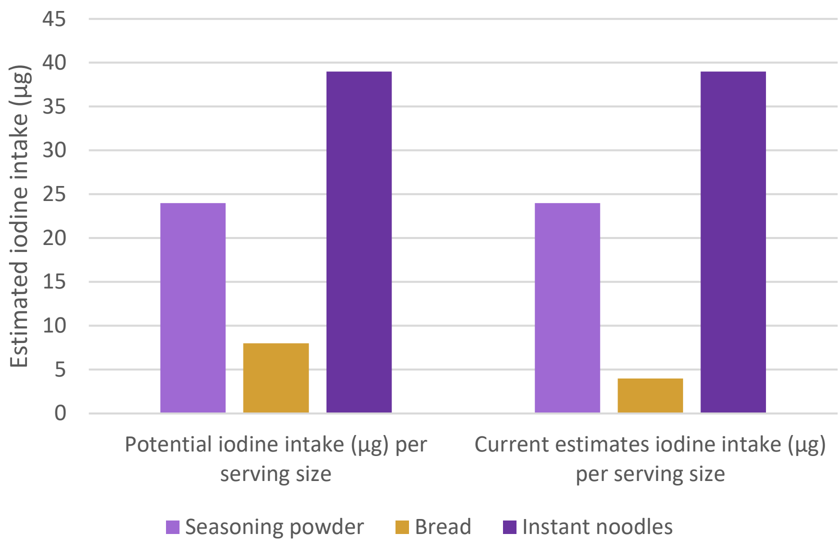
FIGURE 3: POTENTIAL AND ESTIMATED CURRENT IODINE INTAKE FROM HOUSEHOLD SALT AND IN SELECTED PROCESSED FOODS, BASED ON TYPICAL ADULT CONSUMPTION. OPTION 1 DATA



Data are based on assumptions that where salt is iodized, iodine is added at the level of the mean national standard (100% of salt for potential and current levels of salt iodization for estimated current) and factoring in a potential 30% loss of iodine from all salt at the time of consumption. Iodine intake is presented in relation to the EAR and RNI for iodine for adults. The UL, not presented here, is 600µg.

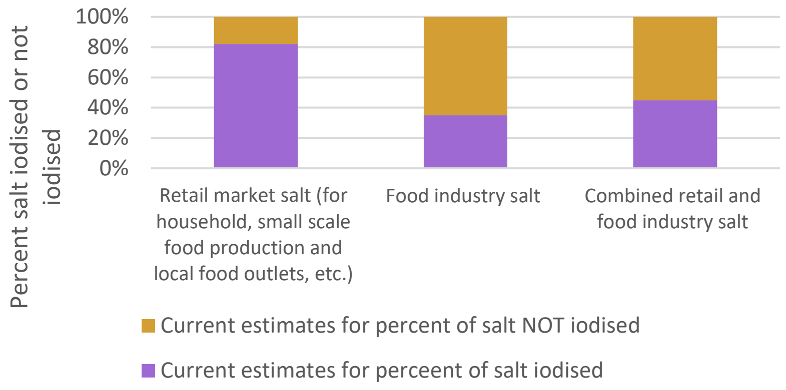
Alternative suggestions for how these data from **Module 4 tool - OPTION 1** can be represented are shown in Appendix 5, Charts A and B. Chart A shows data in the same way as in Figure 4 above, but with estimated iodine intake from iodized salt from all selected processed foods combined. Chart B presents the data in terms of the contribution of iodized salt in household salt and selected processed foods to potential and estimated current % EAR, % RNI and % UL for iodine.

FIGURE 4: POTENTIAL AND ESTIMATED CURRENT IODINE INTAKE FROM SALT IN ONE SERVING SIZE OF SELECTED PROCESSED FOODS, ASSUMING 100% OF SALT IODIZED TO THE MEAN OF NATIONAL STANDARDS. OPTION 2 DATA



Data are based on assumptions that where salt is iodized, iodine is added at the level of the mean national standard (100% of salt for potential and current levels of salt iodization for estimated current, which is 100% for seasoning powder and instant noodles and 50% for bread) and factoring in a potential 30% loss of iodine from all salt at the time of consumption

FIGURE 5: ESTIMATED CURRENT PERCENTAGE OF HOUSEHOLD AND FOOD INDUSTRY SALT IODIZED AND THEIR COMBINED CONTRIBUTION TO IODIZED SALT AS A PERCENTAGE OF ALL FOOD GRADE SALT (BASED ON DATA FOR MT QUANTITY). OPTION 3 DATA

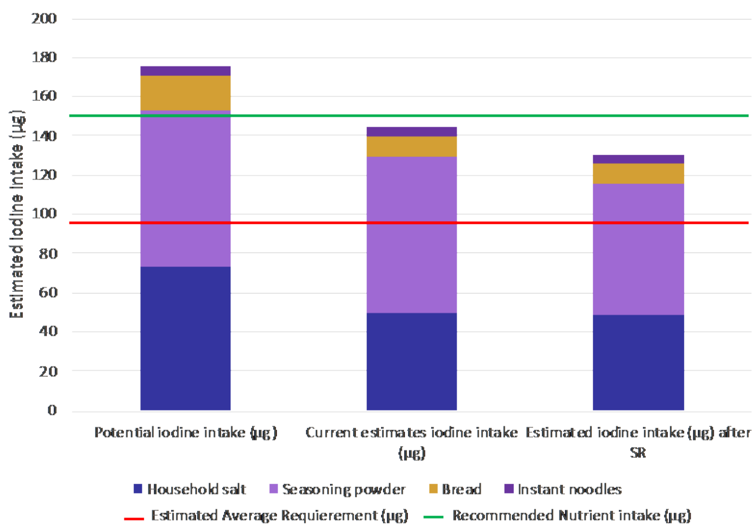


Assessment of the potential impact of salt reduction on iodine Intake

The Module 4 tool, Options 1 and 2 includes an assessment that can be conducted in countries where a salt reduction policy is being actively implemented. Input target reduction in intake of household salt and selected processed food salt that may be met through reformulation of the product and/or behaviour change initiatives. Current salt iodization data are used to estimate resulting iodine intake for each food product if the product-specific salt reduction target is achieved. An example of the graphical output for this is shown in Figure 6, which is based on the same data as Figure 3 above.

National salt reduction initiatives generally require many years of implementation before salt intake is successfully reduced[35]. Use of this optional module will be most relevant in countries where implementation of salt reduction strategies is already underway.

FIGURE 6: ESTIMATED CURRENT PERCENTAGE OF HOUSEHOLD SALT AND SALT IN SELECTED PROCESSED FOODS, BASED ON TYPICAL ADULT CONSUMPTION, BEFORE AND AFTER SUCCESSFUL SALT REDUCTION (SR). OPTION 1 DATA



Data are based on assumptions that where salt is iodized, iodine is added at the level of the mean national standard (100% of salt for potential and current levels of salt iodization for estimated current) and factoring in a potential 30% loss of iodine from all salt at the time of consumption.
Salt reduction targets used were: 5% for household salt, 3% for bread and 15% for seasoning powder and instant noodles.
Iodine intake is presented in relation to the EAR and RNI for iodine for adults. The UL, not presented here, is 600µg.

Interpreting assessment outcomes

Reliability of assessment results will depend on input quality. Data is often based on population level approximations of consumption levels and averages for serving sizes, as well as for salt and iodized salt content of selected processed foods, possibly with some additional assumptions. This should be documented with reporting on the assessment, so others understand the limitations. Reliability of inputs should be considered when interpreting the assessment outcomes.

The assessment aims to provide an overview of major sources of dietary salt how much of it (household and food industry) is iodized. This estimated current and potential iodine intake should be reliable enough for advocacy and program planning but should not be considered as accurate levels of intake for everyone. See the Summary Report from Pilot Implementation for examples of how assessment results have been presented and used to develop recommendations for policymakers.

Program managers must be careful about over-interpretation of outcomes based on broad national estimates of iodine status and the use of iodized salt, since they may not reflect the situation at sub-national level. Results based on dietary intake for one population group or consumer market segment cannot be used to represent the situation for all population groups without evidence of similar dietary patterns.

Option 1 could provide stronger information for policy if the assessment is implemented separately for different population groups and sub-national regions, providing a greater understanding of the impact of iodized salt use in products that might be widely consumed among a single population group, and of the relative impact of using iodized salt in widely consumed processed foods in areas with a low use of iodized salt at home.

Assessment outputs, together with recent data on iodine status (Module 2), can provide insight into factors that can be adjusted to improve iodine intake. Salt iodization is highly effective among different population groups when it is well implemented and includes all major sources of food grade (household and food industry) salt[(13)][16]. Assessment using any of the three options should improve understanding of how well the national program is meeting this objective for iodization of major sources of dietary salt and, therefore, how likely it is to achieve and sustain optimal iodine status.

Factors contributing to achieving optimal iodine status are outlined in Figure 1b, and include non-salt sources of iodine, but as previously noted, these are generally outside a program manager's control.

Overall, where iodine status is optimal in all population groups, then it can be assumed that iodine from household and / or food industry salt is helping sustain optimal iodine intake. If none or few sources of food-grade salt are iodized, there is a risk that some groups may not benefit from adequate iodine intake.

Factors that may influence the relationship between observed iodine status and the level of iodine intake from salt sources, as assessed using this Guidance include:

- Iodine intake from the use of iodized salt in:
  - Other industrially processed foods not included in the assessment (food industry salt)
  - Commercially produced foods manufactured for local (sub-national) markets (small scale facilities that may use either food industry or household salt)
  - Foods prepared outside the home, in restaurants, takeaways, from street food vendors (these food producers are more likely to use household salt, depending on the size of the retail outlet)
- Other widely consumed industrially processed foods manufactured using non-iodized salt but not included in the assessment due, for example, to a lack of information about consumption

[16] https://www.ign.org/blog-simplify-2018.htm

- Unknown status of the type (iodine content) of salt used in some imported processed foods
- Highly variable iodine intake from non-salt sources such as ground water (the iodine level can vary widely at sub-national level), naturally iodine-rich foods such as some sea fish and seaweed, animal products (meat, dairy and eggs) which are potentially influenced through using iodized salt or other forms of iodine supplementation in the feed.

Since it is not possible to influence or change many of these factors, the guidance does not recommend an in-depth examination, but it is helpful to be aware of them to interpret modelling outcomes. Where it is known that information for widely consumed salt-containing processed foods was not included, this should be reported with a recommendation to obtain the full information for future assessments. Examples of how assessment findings were interpreted with inclusion of additional information are provided below.

The additional assessment to account for potentially differential effects of a salt reduction strategy on iodine intake from iodized household salt and iodized food industry salt will also aid strategic plans. It could help catalyse collaboration between implementation of a salt reduction policy with implementation of the salt iodization policy. Findings from pilot implementation of the Guidance demonstrated public health links and common goals between salt iodization and salt reduction.

Using guidance options to visualize the impact of changing input parameters

Changing inputs to the Option tools can help visualise the likely impact of changes to salt iodization strategy, including:

- Increasing the percentage of iodized salt used in selected industrially processed foods, to show the expected impact of stronger regulatory monitoring and enforcement of the use of iodized salt by the food industry, for all or certain food processed products
- Changing the population group from adults to pregnant women, the group with the highest iodine requirement, to estimate whether the higher EAR and RNI for iodine would be met for this population group. Where specific intake data for pregnant women are not available, the same intake data used for non-pregnant adults can be used to obtain an idea of expected iodine intake
- Increasing or decreasing the salt iodine level to estimate the impact on iodine intake for different population groups, with or without changes to regulations. This will enable policy makers and the salt industry to see the implications of changing iodine standards
- Including salt reduction targets for household salt and each selected processed food, to be able to anticipate and plan for the likely impact on iodine intake of achieving these targets in countries where salt reduction strategies are being implemented

Closely monitoring iodine status during a transition to changed salt iodine levels or to reduced salt intake will help assess the extent to which these changes are affecting iodine intake.

Collaboration between implementation of the public health interventions of salt reduction and salt iodization is important to jointly plan for and monitor the impact of respective strategic changes so that both public health goals can be achieved in parallel.

Examples

More information on these examples can be found in the **Summary Report from Pilot Implementation**.

NATIONAL EXAMPLES WITH SMALL SCALE PRODUCERS

In some areas of a country, particularly rural areas, widely consumed salt-containing foods (such as cheese, bread, fermented fish paste or dried salty fish) may be produced locally on a small-scale by many producers. Where this is the case, an assessment of local food producers may be helpful to understand significant local dietary sources of potentially iodized salt. Examples of this type of assessment are those conducted in Bangladesh(35), Pakistan(36) and the Philippines(37) (see Case Studies for Module 4). In the Philippines, the same methodology for data collection was applied for large scale and small-scale food producers, except that the method for identifying (often unregistered) small-scale producers relied on different sources of information to that used for identification of large scale, registered, producers.

In countries like Sri Lanka and Thailand (see Summary Report from Pilot Implementation) foods prepared outside the home (in particular, street vendor-prepared foods) are consumed on a regular basis. It is considered likely that salt used in foods prepared away from home would be the same as household salt available in retail shops in that area. Therefore, where the local supply of household salt is iodized according to national legislation, it is more likely that consumers are accessing iodine from all these dietary salt sources. However, it would be important to know whether the salt from these foods was included in estimated household salt intake data, and it could be helpful to verify the type of salt used to prepare commonly consumed foods as part of follow up actions to this work.

EXAMPLES WHERE OBSERVED IODINE STATUS WAS NOT WELL EXPLAINED BY ASSESSMENT OF IODIZED SALT INTAKE AND HOW CONSIDERATION OF ADDITIONAL FACTORS IN THE INTERPRETATION WAS INCLUDED

- In Moldova, although salt iodization was below the target for household salt and particularly low for some food industry salt, iodine status was adequate among all groups with data at the national level. However, Moldova relies heavily on imported industrially processed food where the use of iodized salt was unknown (and was entered as non-iodized for the modelling). It is possible that some of these widely consumed imported processed foods were manufactured using only iodized salt and, therefore, contributing to (unrecorded) iodine intake.
- In Thailand, the national data showed high levels of iodization of household salt and food industry salt. However, there was indication of borderline adequacy of iodine status, for example, among pregnant women. The Thai assessment emphasised the benefit of having data at the sub-national level to help partially interpret the national data. It was reported, for example, that the Northeast region of Thailand had the lowest percent of households using iodized salt and inadequate iodine status among pregnant women. It is also reported that this region has a relatively high consumption of salty condiments such as fish sauce, while iodization of these products is regulated in a different way to other food industry products.
- The Thai assessment also went beyond the modelling of salt sources of iodine detailed in this Guidance, to include available data for other major dietary sources of iodine. Estimated per capita iodine intake from some commonly consumed foods, for example, milk, rice, eggs and mackerel; were combined with current estimates for iodine intake from household and food industry salt sources to look at the total average daily per capita intake for iodine and how that contributed to the percent RNI for iodine for different population groups. This was possible because food composition and consumption data already existed for these foods.

MODULE 5: INFORMING THE NEED FOR STRATEGIC CHANGE

Outcomes from the previous four modules should now be used to inform the need for strategic change. The program management team can use the combined outcomes to decide whether salt iodization strategy needs to be strengthened or changed to achieve or sustain optimal iodine nutrition among all population groups and which changes should be recommended.

This module provides an overview of the main components of the enabling environment required to achieve and sustain the use of quality-assured iodized salt by the food industry. Figure 8 incorporates these factors into expanded impact pathways. National program managers will need to develop and adapt the pathway and assumptions shown to the specific national context.

Several actions can be considered to improve the enabling environment salt iodization, with a focus on the contribution of iodized salt in processed foods. Some are presented below based on examples from other large-scale food fortification initiatives:

- **Revising existing national legislation where necessary, to specify that salt used in industrial food processing should be iodized[24,31,33,36]**
  - Mandatory iodization of salt used in all processed food is recommended. However, in some countries it applies only to foods manufactured above a certain capacity, or for manufacturers of specified processed foods that most significantly contribute to salt intake, for example, bread in Australia and New Zealand. See Module 3
- **Reviewing standards for iodine levels in salt to ensure they are based on total salt consumption, including processed foods. See WHO Guidance on Fortification of Food-Grade Salt for recommended iodine levels for different amounts of total salt intake[2]**
  - Adequacy of standards should be assessed by monitoring iodine status among different population groups, particularly pregnant women, who have the highest requirement.
  - Salt standards should be changed as indicated by these monitoring data, bearing in mind possible constraints where standards have been regionally developed and agreed[13,23,37–39].
- **Reviewing food control protocols and revising them as necessary to include assigned authorities for monitoring, inspection, and enforcement of the use of iodized salt in processed foods. This is in addition to monitoring and enforcement at salt production and import points to ensure food grade salt distributed as household salt and to the food industry meets national standards, including for iodine levels. [32,40–42]**
  - In countries with legislation for mandatory fortification of other common industrially processed food ingredients, such as wheat flour or oil, processed food industry monitoring protocols should incorporate all food ingredients, including salt, for which fortification is required by law.
- **Engaging with the food industry to assess awareness and understanding of any requirement to use only iodized salt in the manufacture of industrially processed foods. Where needed, provide additional explanation and or technical support to overcome any challenge**
  - To comply with the requirement, food industries should only order iodized salt, and require and a certificate of analysis of iodine content with each bulk salt order
  - The principles of Good Manufacturing Practices (GMP) and Hazard Analysis/Quality Analysis and Critical Control Points (HACCP/QACCP) may already be in use within larger scale food industry and can be applied and strengthened where needed to achieve industry self-regulation in the use of quality-assured iodized salt[32]
  - A code of practice describing agreed internal and external monitoring activities at processed food production facilities, should be developed by the responsible regulatory authority in collaboration with relevant processed food industry bodies
  - Experiences of working on fortification in collaboration with the food industry can be found for different staple products, including salt[43], flour[44,45] and oil[36]

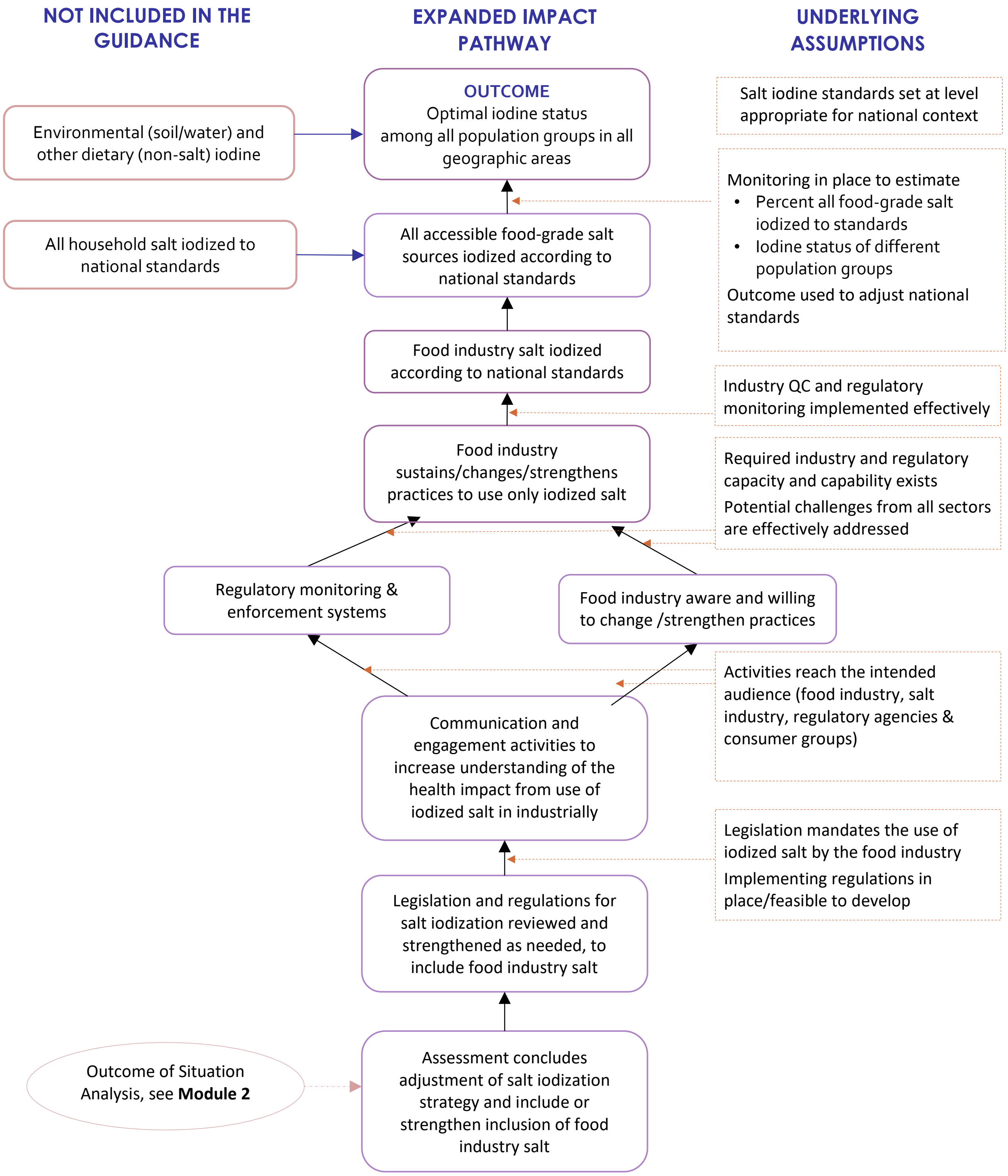
- **Developing a communication plan to increase engagement with all partners, including the salt industry, processed food industry and consumer groups. The Food Fortification Initiative has developed a guide and accompanying workbook for "advocacy and social marketing of grain fortification" which can be adapted for use with other foods[(46,47)]**
    - Show target audiences the potential impact on iodine status from using iodized salt in the processed food industry, especially in terms of equity of access to iodine through all food-grade salt
    - Demonstrate that salt iodization is complementary to salt reduction initiatives and that iodization of all food-grade salt supports adjustment of standards to optimise iodine status of all population groups, which may be especially relevant in the context of salt reduction initiatives
- **Expanding standard monitoring indicators to facilitate assessment of different sources of salt and achievement of optimal iodine nutrition**
    - Develop nationally tested and agreed data collection modules to assess consumption of household salt widely consumed salt-containing industrially processed foods among population groups. These modules should be included in any survey where there is an opportunity to collect these data, ideally providing new information every few years[17]
    - Continue to assess iodine status of women of reproductive age and school age children as part of national surveys, while also developing methods for ongoing data collection to assess iodine status, particularly among pregnant women. Where sub-national data indicate optimal iodine status among key population groups, including pregnant women, a level of assumption can be made that iodine intake from all sources is adequate, even in cases where, for example, household use of salt iodized to national standards is less than 90%
    - Use data on household salt and widely consumed processed food consumption to adjust inputs to the Guidance models in combination with iodine status data, to assess whether current salt iodine levels are appropriate to sustain optimal iodine intake among all population groups
- **Ensuring sufficient financial and personnel resources for all above requirements**
    - Ministerial budgets should support consistent enforcement mechanisms using well-trained food inspectors, quality-assured laboratories, clear legislative frameworks, and simple data monitoring methods[(32)].

RECOMMENDATION
Use the Module 5. Enabling factors tool to record the responses to the questions above along with actions to fill identified gaps.

GAIN's ENABLE platform may be a useful resource for program managers. It provides guidance and technical support on: good practice in food quality and safety, improved regulatory monitoring models, and building and coordinating partnerships between stakeholders and technical partners[(48)].

[17] Program managers should be aware of opportunities to collaborate in any forthcoming consumer, household or industry survey to obtain information that would be helpful to strengthen this assessment in the future.

FIGURE 8: EXPANDED IMPACT PATHWAY, SHOWN FOR FOOD INDUSTRY SALT ONLY



MODULE 6: CREATING A NATIONAL REPORT WITH RECOMMENDATIONS TO STRENGTHEN SALT IODIZATION STRATEGY

Implementation of the Guidance Modules 1 to 5 should provide programme managers with a good understanding of the accomplishments and remaining challenges to achieve sustained optimal iodine nutrition and the extent to which food industry salt does or can contribute.

Completed Guidance Word documents and Excel tool files will be helpful for researchers and others interested in understanding the assessment, including facilitation of repeat implementation in the future when new data are available. The assessment outcomes provide an evidence base that can be used to advocate for a strengthened, refocused, programme to achieve optimal iodine status among all population groups.

Understanding the relative importance of dietary salt sources and the proportion of each source that is iodized will facilitate programme monitoring, including interpretation of (sub) population iodine status.

The IGN therefore strongly recommend developing a national report for policy makers and food industry leaders, presenting the implementation process in brief, and making recommendations for proposed changes to the salt iodization strategy.

A recommended report structure includes the following sections; however, the final components and content should be decided on as appropriate for the national context.

i. Background on global advice to iodise all food-grade salt.
ii. Rationale for why this is important for the specified country.
iii. Methodology in brief – data sources used for information.
iv. Assessment – which foods were identified and why, outcomes of assessments using Option tools for different scenarios for population groups and geographic areas, depending on available data.
v. Conclusions, it is suggested to include:
    - Programme status in terms of iodine status and iodized household salt coverage.
    - Interpretation of the modelling outcome in terms of the ***potential*** and ***estimated current*** contribution of selected processed foods to iodine intake, discuss in terms of known iodine status at the national and sub-national level for different groups.
    - The possible impact of salt reduction on salt-related iodine intake, although this may only be important where a salt reduction policy is being actively implemented.
    - Any gaps in, or challenges to, the legislative framework and enabling environment for sustaining or strengthening the salt iodization strategy. Some challenges commonly encountered in food fortification strategies are presented in Box 8.
    - Recommended actions to address the challenges, looking for complementarity with similar programmes, especially for salt reduction, and aiming to incorporate these recommended actions into existing action plans.

There is a particular benefit to iodising processed food industry salt for populations in areas where significant challenges to increasing access to iodized household salt remains. Here, efforts to improve iodization of household salt could be continued, however, the national management team may consider that an effective use of resources would be to focus on enforcing the use of iodized salt in industrially processed foods that are widely consumed in these areas.[18]

[18] For example, it has often proved difficult to establish effective quality control and regulatory monitoring processes where household salt is sourced from multiple small-scale salt producers, often despite years of strategic efforts and input of resources to improve the situation.

COMMONLY ENCOUNTERED CHALLENGES TO FOOD FORTIFICATION

Some commonly reported challenges in implementing food fortification initiatives with suggestions of ways to prevent or to overcome them are:

- **Lack of production and distribution data from salt and industrially processed food industries and importers**
- **The need to strengthen engagement and understanding among relevant government ministries and the salt and processed industry on what the data are for and industry's role in achieving the public health goal of optimal population iodine nutrition**
- **Importation of significant proportion of key salt-containing industrially processed foods, making it difficult to obtain information about the quantity and iodine level of salt used in production**
    - Make enquiries about legislation, regulation and industry practice in the country of origin. If use of iodized salt in industrially processed foods is required in the country of origin it may be that exported industrially processed foods are produced using iodized salt. However, this cannot be assumed.
    - Investigate whether national regulatory and food product standards in the receiving country include specification for fortified ingredients (including iodized salt) for imported food products. This is not commonly stated in the legislation. However, where national legislation requires iodization of all food-grade salt, it can be inferred that this should apply to salt in imported processed foods also. Investigate whether the legislation or accompanying monitoring and enforcement guidelines can be strengthened to specify this.
    - Advocate with authorities controlling the imports to develop a system to verify, for example, through review of the Certificate of Analysis, that all industrially processed foods identified as key sources of population salt intake, are made with iodized salt.
- **Lack of disaggregated data to enable sub-national planning. For example, lack of sub-national data for household coverage of iodized salt, iodine status, and industrially processed food consumption**
    - Use whatever data are available to conduct the situational analysis, documenting the process, findings, any limitations and recommendations to strengthen the data in future.
    - Advocate for appropriate design of future surveys or monitoring systems, with adequate sample sizes to provide estimates for programmatically relevant population groups or geographic regions, to fill these data gaps.
- **Resistance among food industry partners, both salt and/or processed food producers, to using iodized salt due to concerns about organoleptic changes to the processed foods, lack of retention of iodine, and/or the potential impact on export trade to countries that don't accept products with added iodine[34]. There may also be a concern that the food industry will be held accountable for the final iodine content of industrially processed foods**
    - With regard to organoleptic changes, a number of studies have been conducted since the 1950's which have found no change in the texture, colour, or taste of different products, including: bread; potato chips; vegetables; pickles; canned tomato juice, sweetcorn and green beans; and soy sauce[48]
    - In order to address concerns that use of iodized salt may cause negative organoleptic changes in certain industrially processed foods, and recognising that it is not feasible to undertake tests on every single industrially processed food, a number of countries have included a clause in their salt iodization legislation that enables certain industrially

processed foods to be exempt if a negative organoleptic change is proven by the industrially processed food producers. An example is the Republic Act [No. 8172] for Salt Iodization Nationwide (ASIN) in The Philippines, which states:

  - *All food manufacturers processors using food-grade salt are also required to use iodized salt in the processing of their products and must comply with the provisions of this Act not later than one (1) year from its effectivity. Provided, that the use of iodized salt shall not prejudice the quality and safety of their food products: provided, however, that the burden of proof and testing for any prejudicial effects due to iodized salt fortification lies on the said food manufacturers/processor*

- Most salt iodization legislation applies only to domestically produced and imported processed foods. Foods produced for export are typically exempt because they need to comply with national legislation and standards in the receiving country. Verify this in order to assure industrially processed food producers that production of processed foods for export will not be included in enforcement measures.
- Ensure regulatory monitoring protocols focus on salt production and import points and ensuring that salt distributed from these points (including to the food industry) is iodized to national standards.

- **A perception by consumer groups of the use of iodized salt in the food industry as unwelcome interference with commonly consumed processed food products; or express concerns that using iodized salt in industrially processed foods, and labelling the product accordingly, may encourage increased intake of these processed foods**
  - Design strong communication strategies for consumer groups and similar audiences, to ensure understanding about the research which shows no evidence of organoleptic changes to most industrially processed foods from using iodized salt. Include messages explaining the complementarity of iodising food industry salt, with salt reduction strategies.

REFERENCES

1. Food and Agricultural Organization of the United Nations & World Health Organization (2006) Codex Standard for Food-grade Salt, CX STAN 150-1985, Rev. 1-1997, Amend. 1-1999, Amend. 2-2001, Amend. 3-2006. *Codex Aliment. Int. Food Stand.* http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%3A%2F%2Fworkspace.fao.org%2Fsites%2Fcodex%2FStandards%2FCODEX%2BSTAN%2B150-1985%2FCXS_150e.pdf (accessed April 2017).
2. World Health Organization (2014) *Guideline: fortification of food-grade salt with iodine for the prevention and control of iodine deficiency disorders*. Geneva, Switzerland: WHO.
3. United Nations Children's Fund & World Health Organization (1994) *World Summit for Children- Mid-Decade Goal: Iodine Deficiency Disorders*. Geneva: UNICEF-WHO Joint Committee on Health Policy.
4. WHO/NMH/NHD/18.12 (2018) A healthy diet sustainably produced. World Health Organization.
5. World Health Organization (2012) *Guideline: Sodium intakes for adults and children*. .
6. Reardon T, Tschirley D, Dolislager M, et al. (2014) Urbanization, diet change, and transformation of food supply chains in Asia. *East Lansing MI Glob. Cent. Food Syst. Innov.*
7. Spohrer R, Larson M, Maurin C, et al. (2013) The growing importance of staple foods and condiments used as ingredients in the food industry and implications for large-scale food fortification programs in Southeast Asia. *Food Nutr. Bull.* **34**, S50–S61.
8. Tschirley D, Reardon T, Dolislager M, et al. (2015) The Rise of a Middle Class in East and Southern Africa: Implications for Food System Transformation: The Middle Class and Food System Transformation in ESA. *J. Int. Dev.* **27**, 628–646.
9. International Council for Control of Iodine Deficiency Disorders, United Nations Children's Fund (UNICEF) & World Health Organization (WHO) (2007) *Assessment of iodine deficiency disorders and monitoring their elimination: a guide for programme managers.* Geneva, Switzerland: World Health Organization (WHO).
10. UNICEF (2018) Guidance on the Monitoring of Salt Iodization Programmes and Determination of Population Iodine Status. UNICEF New York.
11. World Health Organization (WHO) (1990) Forty-third World Health Assembly A43/36. http://apps.who.int/iris/bitstream/10665/173415/1/WHA43_36_eng.pdf (accessed February 2017).
12. Global Fortification Data Exchange | GFDx – Providing actionable food fortification data all in one place. .
13. Dold S, Zimmermann MB, Jukic T, et al. (2018) Universal Salt Iodization Provides Sufficient Dietary Iodine to Achieve Adequate Iodine Nutrition during the First 1000 Days: A Cross-Sectional Multicenter Study. *J. Nutr.* **148**, 587–598.
14. Aburto DNJ, Abudou DM, Candeias V, et al. Effect and safety of salt iodization to prevent iodine deficiency disorders: a systematic review with meta-analyses. 151.
15. James WP, Ralph A & Sanchez-Castillo C (1987) The dominance of salt in manufactured food in the sodium intake of affluent societies. *The Lancet* **329**, 426–429.
16. Research Institute (IFPRI) IFP (2017) *2017 Global Food Policy Report*. Washington, DC: International Food Policy Research Institute.
17. Rasmussen LB, Ovesen L, Christensen T, et al. (2007) Iodine content in bread and salt in Denmark after iodization and the influence on iodine intake. *Int. J. Food Sci. Nutr.* **58**, 231–239.
18. Li M, Eastman CJ & Ma G (2014) Iodized salt in bread improves iodine nutrition in Australia. *Victoria* **73**, 162–6.
19. Abizari A-R, Dold S, Kupka R, et al. (2017) More than two-thirds of dietary iodine in children in northern Ghana is obtained from bouillon cubes containing iodized salt. *Public Health Nutr.* **20**, 1107–1113.
20. Sutrisna A, Knowles J, Basuni A, et al. (2018) Iodine Intake Estimation from the Consumption of Instant Noodles, Drinking Water and Household Salt in Indonesia. *Nutrients* **10**, 324.
21. IPDSR Senegal (2016) Final Report 2014 National Survey on Household Use of Iodized Salt and Bouillon and Iodine Status among Women of Reproductive Age Senegal. http://www.gainhealth.org/wp-content/uploads/2018/03/Final-Report-on-TDCI-in-Senegal-August-2016-FR.pdf (accessed March 2018).
22. World Health Organization (2008) *WHO expert consultation on salt as a vehicle for fortfication. Luxembourg, 21-22 March 2007.* Luxembourg: WHO.
23. World Health Organization & others (2014) Salt reduction and iodine fortification strategies in public health: report of a joint technical meeting convened by the World Health Organization and The George Institute for Global Health in collaboration with the International Council for the Control of Iodine Deficiency Disorders Global Network, Sydney, Australia, March 2013. .
24. Timmer A (2012) Iodine nutrition and universal salt iodization: a landscape analysis in 2012. *IDD Newsl.* **40**, 5–9.
25. Mannar MV (2014) Making salt iodization truly universal by 2020. *IDD Newsl* **42**, 12–15.

26. Weisell R & Dop MC (2012) The Adult Male Equivalent Concept and its Application to Household Consumption and Expenditures Surveys (HCES). *Food Nutr. Bull.* **33**, S157–S162.

27. Sarno F, Claro RM, Levy RB, et al. (2013) Estimated sodium intake for the Brazilian population, 2008-2009. *Rev. Saúde Pública* **47**, 571–578.

28. Blanco-Metzler A, Moreira Claro R, Heredia-Blonval K, et al. (2017) Baseline and Estimated Trends of Sodium Availability and Food Sources in the Costa Rican Population during 2004–2005 and 2012–2013. *Nutrients* **9**, 1020.

29. United Nations Children's Fund (UNICEF) (2015) *Managing Universal Salt Iodization Communications (MUSIC): A Tool for Setting Supply Side Targets for Universal Salt Iodization programs*. New York, USA: United Nations Children's Fund.

30. United Nations Children's Fund (UNICEF) & Iodine Global Network (IGN) (2016) *Technical Working Group Meeting on Research Priorities for the Monitoring of Salt Iodization Programs And Determination of Population Iodine Statu*. New York, USA: United Nations Children's Fund.

31. United Nations Children's Fund, East Asia and Pacific Regional Office (2015) *Review of national legislation for universal salt iodization: South and East Asia and the Pacific*. Bangkok, Thailand: United Nations Children's Fund.

32. Luthringer CL, Rowe LA, Vossenaar M, et al. (2015) Regulatory Monitoring of Fortified Foods: Identifying Barriers and Good Practices. *Glob. Health Sci. Pract.* **3**, 446–461.

33. Zimmerman S, Baldwin R, Codling K, et al. (2014) Mandatory policy: Most successful way to maximize fortification's effect on vitamin and mineral deficiency. *Indian J. Community Health* **26**, 369–374.

34. Food Fortification Initiative Plan for Fortification - Legislation. *Food Fortif. Initiat. Netw.* http://www.ffinetwork.org/plan/legislation.html (accessed September 2017).

35. Trieu K, Neal B, Hawkes C, et al. (2015) Salt Reduction Initiatives around the World – A Systematic Review of Progress towards the Global Target. *PLOS ONE* **10**, e0130247 [DeAngelis MM, editor].

36. Gayer J & Smith G (2015) Micronutrient Fortification of Food in Southeast Asia: Recommendations from an Expert Workshop. *Nutrients* **7**, 646–658.

37. Zou Y, Lou X, Ding G, et al. (2014) Iodine nutritional status after the implementation of the new iodized salt concentration standard in Zhejiang Province, China. *BMC Public Health* **14**.

38. Zimmermann MB, Aeberli I, Torresani T, et al. (2018) Increasing the iodine concentration in the Swiss iodized salt program markedly improved iodine status in pregnant women and children: a 5-y prospective national study1–3. 5.

39. Federal Commission for Nutrition (2013) *Iodine supply in Switzerland: Current Status and Recommendations. Expert report of the FCN*. Zurich: Federal Office of Public Health.

40. van den Wijngaart A, Begin F, Codling K, et al. (2013) Regulatory monitoring systems of fortified salt and wheat flour in selected ASEAN countries. *Food Nutr Bull* **34**, S102–S110.

41. Smarter Futures FORTIMAS An approach for tracking the population coverage and impact of a flour fortification program. https://www.ifglobal.org/images/documents/FORTIMAS_%20full_document.pdf (accessed September 2017).

42. World Health Organization (2011) *Meeting on Regulatory Monitoring of Salt and Flour Fortification Programmes in Asia*. Manila, Philippines: .

43. GAIN (2014) Universal Salt Iodization: India as a case study for optimizing the production distribution and use of iodized salt. http://www.gainhealth.org/wp-content/uploads/2014/04/64.-Universal-Salt-Iodization.-India-as-a-case-study-for-optimizing-the-production-distribution-and-use-of-iodized-salt..pdf (accessed September 2017).

44. Department of Health, Republic of South Africa, GAIN & UNICEF South Africa (2007) *The South African maize meal and wheat flour fortification programme (2004 to 2007)*. .

45. Flour Fortification Initiative & Micronutrient Initiative Flour fortification in the Islamic Republic of Iran: sustainable route to improved health. http://www.ffinetwork.org/implement/documents/Iran_Case_Study.pdf (accessed September 2017).

46. Food Fortification Initiative (2017) Fortification Communications Toolkit A guide for advocacy and spocial marketing of grain fortification. http://www.ffinetwork.org/plan/documents/Communications_Toolkit_May2017.pdf (accessed September 2017).

47. Food Fortification Initiative Fortification Communications Toolkit Workbook. http://www.ffinetwork.org/plan/Communications.html (accessed September 2017).

48. ENABLE Platform. *Glob. Alliance Improv. Nutr.*