



Initiative pour les
micronutriments



Ministère de la Santé
et de l'Action Sociale



Summary Report

**National survey on household
utilisation of iodised salt and bouillon
and on iodine status of women of
reproductive age in Senegal 2014**



AUGUST 2016

Senegal Iodine Survey 2014 – Summary report

Background and Rationale

Iodine deficiency is the single greatest cause of preventable mental impairment globally and also causes many other adverse effects on growth and development due to inadequate thyroid hormone production (1, 2). These iodine deficiency disorders (IDD) can be effectively and inexpensively prevented by iodizing all salt for human and animal consumption (known as Universal Salt Iodization, USI) (1). The first standard for iodisation of household salt was adopted in 1994¹ in Senegal, followed by a prime minister's decree in 1995 setting standards for iodised salt production and distribution², and a Presidential decree for mandatory iodisation of all edible salt in 2001³. The programme has been led by CLM since 2006, under the supervision of the Prime Minister's office to ensure multi-sectoral involvement and accountability. Salt iodisation standards were revised in 2011 to the UEMOA recommendations: 30-60ppm at the point of production and 20-60ppm at distribution⁴, with the intention to allow for at least 15ppm at household level.

A national survey conducted in 2010⁵ showed relatively low (47.7%) household use of adequately-iodised salt (≥ 15 ppm) by titration. Iodine status assessed by median urinary iodine concentration (UIC⁶) among school age children was found to be borderline at the national level (median UIC 104.4 $\mu\text{g/l}$), adequate in urban areas (median UIC 141.3 $\mu\text{g/l}$) and deficient in rural areas (median UIC 82.6 $\mu\text{g/l}$). Among women of reproductive age iodine status was found to be deficient at the national level (median UIC 92.2 $\mu\text{g/l}$) and in rural areas (median UIC 73.0 $\mu\text{g/l}$) while it was adequate in urban areas (114.7 $\mu\text{g/l}$). There was a positive association between median UIC and the category of household salt iodisation in both population groups, indicating that household salt was a major source of dietary iodine. The survey indicated high levels of bouillon consumption: estimated at 6.3g/pers/day, higher in rural (8.6g/pers/day) than in urban areas (4.3g/pers/day). Since bouillon is approximately 50% salt, it provides a potential additional source of iodine if produced using adequately iodised salt, which seemed unlikely given the relatively high intake of bouillon and the poor iodine status in rural areas. This assumption was confirmed to some extent by a study in 2012 which analysed the iodine content of 13 different brands of bouillon from Senegal and estimated that seven of the samples were produced using salt with an iodine content of less than 15ppm⁷.

Renewed efforts to achieve USI were made following the 2010 survey, led by CLM with the support of the Micronutrient Initiative (MI), the Global Alliance for Improved Nutrition (GAIN) and UNICEF, together with other Government and agency partners. It is well-documented that quality assurance and enforcement of adequately iodised salt production by small scale producers is a challenge to achieving USI therefore strengthening the capacity of these producers was a focus area. This 2014 survey was conducted to re-assess iodine status, and national household coverage with adequately iodised salt, with stratification by salt-producing areas to better characterise the situation and associated factors which could potentially form the basis of a revised strategy to improve iodisation production and consumer purchasing practices in the future. Additional information about the consumption of foods containing bouillon was collected to be able to assess any association between iodine status and consumption of this potential source of iodised salt.

¹ NS 03-037 and NS 03-038

² n°003696/MSAS/MEMI/MCA

³ Senegal Standard NS 03-037. (2012)

⁴ UEMOA 1000 : 2011 ICS – 67

⁵ MSAP, MI IPDSR 2010. Etude sur les troubles dus à la carence en iode au Sénégal

⁶ Adequate iodine status among a population of school age children or women of reproductive age defined as a population median UIC over 100 $\mu\text{g/l}$. WHO/UNICEF/ICCIDD 2007 Programme Guidelines.

⁷ Spohrer et al 2015. Ann. N.Y. Acad. Sci. 1357 (2015) 43–52

Survey Objectives

The overall aim of the survey was to better understand factors associated with access to adequately iodised salt, especially in salt-producing rural areas, and provide an evidence base from which to plan, monitor and evaluate a revised strategy for achieving optimal iodine nutrition. The specific objectives were to generate national and strata level estimates for the indicators below, stratification was by urban, salt producing and rural non-salt producing.

- i. Household coverage with adequately iodised salt
- ii. The proportion of household salt sold in recommended packaging with an iodisation label or logo.
- iii. Knowledge of women of reproductive age (WRA) about iodine deficiency and iodised salt.
- iv. Frequency of consumption of bouillon, as a potential source of iodised salt.
- v. The median urinary iodine concentration among WRA
- vi. The median urinary iodine concentration among pregnant women (nationally representative only)
- vii. Associations between above indicators and each other and with a measure of household deprivation (multi-dimensional poverty index - MPI) to provide an evidence base for future programming for the achievement of optimal iodine nutrition.

Survey Design

The survey was conducted as strata-level representative cross-sectional cluster survey. The target sample was 1,968 household interviews (the primary target respondent was the person most knowledgeable about household food preparation thus it was the wife of the head of household, or the head of household if female) with the expectation of collecting 1,845 salt samples for quantitative analysis by titration, 1,350 urine samples from non-pregnant WRA and 450 from pregnant women for analysis of iodine content (a urine sample was requested from one consenting non-pregnant and all consenting pregnant women present in each household).

The sample was taken from a total of 123 primary sampling units (PSUs), 41 selected based on proportional to population size within each of the three strata. Sixteen households were selected using systematic random selection from each PSU, without replacement. The final dataset was weighted to account for the probability of household selection (the primary sampling unit) and an additional weight was applied to salt data to account for the non-random loss of salt samples from 12 PSUs. The survey was conducted between November and December 2014 by field teams from IPDSR. The process was supervised and quality controlled by senior IPDSR staff and the performance of laboratory analysis of both salt and urinary iodine was assured through an external quality assurance process. The study was approved by the National Ethics Committee of Senegal.

Key Findings

Quantitative salt iodine data from the 2014 survey show that nationally, the percent household coverage for adequately iodised salt was 37.2%, a slight decrease from 2010, the percent household coverage for salt with any iodine was 81.3% (not reported in 2010). A higher percent of urban households were found to be using adequately iodised salt (53.3%), particularly when compared with the rural salt producing stratum where coverage was very low (10.9%).

Awareness of iodised salt (72.3%) was higher than awareness of iodine deficiency (38.7%) and although both factors were associated with household salt iodine content to some extent, household access to sealed packaged salt was found to be the factor most significantly associated with salt iodine content across all strata.

Iodine status was found to be similar to the 2010 survey, with borderline status nationally (median UIC 98.0 µg/l) and better status among women in urban areas. The 2014 survey again demonstrated a high level of association between household salt iodine content and urinary iodine, indicating iodine deficiency among the population of

WRA in households where the salt iodine content was < 15ppm. Of particular concern was the low median UIC (85.7 µg/l⁸) among a national sample of pregnant women.

Summary Recommendations:

An innovative review of USI and other nutrition strategies and policies is urgently required to obtain and sustain optimal iodine status among the population of Senegal. Results from the rural salt producing areas provide valuable new information on the possible causes of the very low household iodised salt coverage in these areas, and should be the basis for future programming focus. There is an urgent need to radically modernise the salt industry and to strengthen the salt law, including improved capacity and capability to implement regulatory monitoring, with clear guidance on enforcement of regulations for violating the law at production and enforcement of the use of adequately iodised salt by large scale food industries. Temporary and/or replacement strategies are recommended to improve access to quality iodised salt and/or to alternative interventions for iodine supplementation, at least for pregnant women whose status indicates that the majority of new-borns in Senegal are currently unprotected from iodine deficiency.

⁸ Adequate iodine status among pregnant women is defined as a population median UIC over 150 µg/l. WHO/UNICEF/ICCIDD 2007

Results

Characteristics of the survey population

- Both rural areas tended to have a higher (and similar) percent of deprived households (higher MPI score, higher level of food insecurity and less dietary diversity) than urban areas.

Variable	Strata				
	N = completed interviews (unweighted n)				
	National N = 1944	Urban N = 640	Rural salt producing N = 652	Rural non salt producing N = 652	
Percent of respondents women aged 15-49 years*	90.2%	89.4%	91.8%	91.8%	
MPI score	Low (non-deprived)	42.9%	66.7%	28.3%	15.3%
	High (deprived)	57.1%	33.3%	71.7%	84.7%
Household food security	Secure	40.5%	50.7%	23.6%	29.1%
	Mildly insecure	18.2%	16.2%	21.3%	20.6%
	Moderately insecure	22.6%	17.3%	30.1%	28.5%
	Severely insecure	18.7%	15.9%	25.0%	21.8%
Respondent dietary diversity	Diverse	67.8%	76.4%	58.1%	58.0%
	Not diverse	32.2%	23.6%	41.9%	42.0%

*Nationally 8.7% of respondents were women aged 50 and over and 1.0% were men

All further tables are present weighted numbers and estimates.

Weighted numbers by strata: urban 1031, rural salt producing 12, rural non salt producing 901

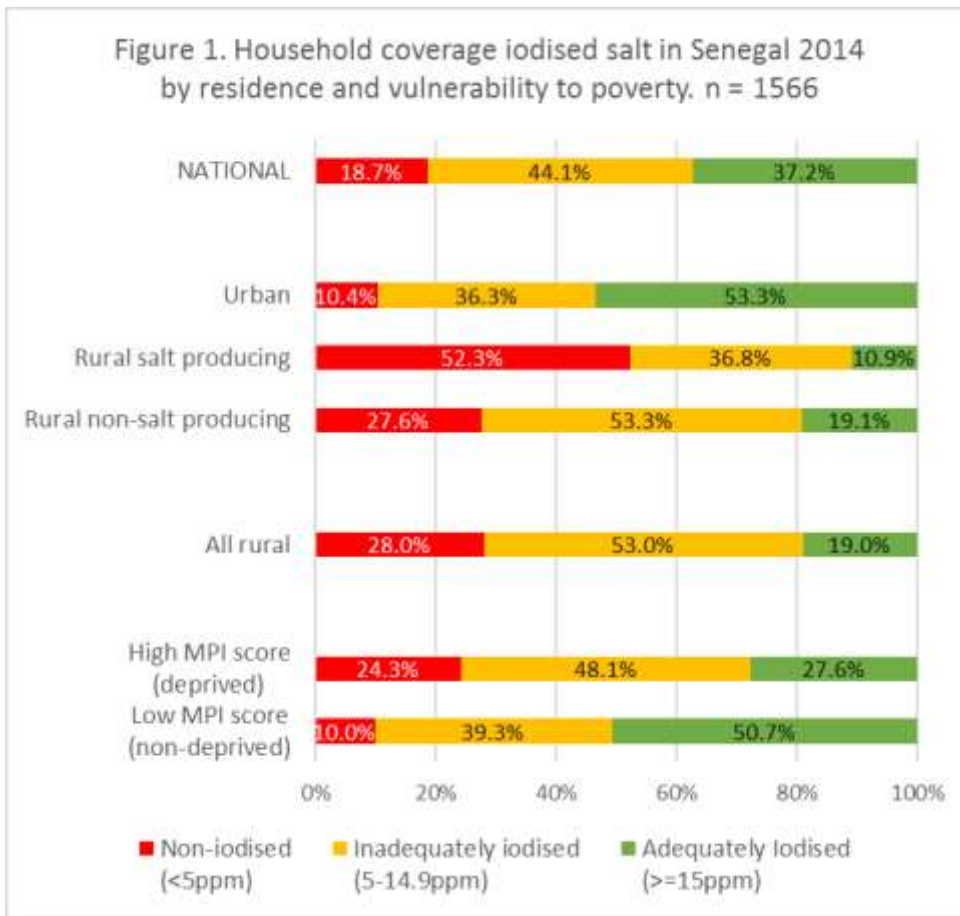
The household response rate for completed interviews was 98.8%, for households with analysed salt samples it was 79.6% (note all salt samples from 12 PSUs were mislaid between the field and laboratory), and for urine samples the response rate based on surveyed households with at least one woman of reproductive age was 85.4%.

Findings for Salt Iodine

Household Coverage Iodised Salt

- At national and urban levels, a slight trend towards decreased household coverage with adequately iodised salt observed since 2010 (when national and urban coverage was 47.7% and 59.0% respectively) and a larger decrease in coverage with adequately iodised salt in rural areas (38.7% in 2010).
- Use of adequately iodised salt highly associated with: place of residence (urban, rural), with particularly low coverage in rural salt producing areas (10.9%); and with household vulnerability to poverty (MPI score).

- The median ppm for household salt found to have at least some added iodine ranged from 8.6ppm in rural salt producing areas to 9.0ppm and 17.4ppm in rural non-salt producing and urban areas respectively.



Less than 40% of households nationally are protected from iodine deficiency through access to adequately iodised salt.

Rural populations much less likely to use adequately iodised salt than urban.

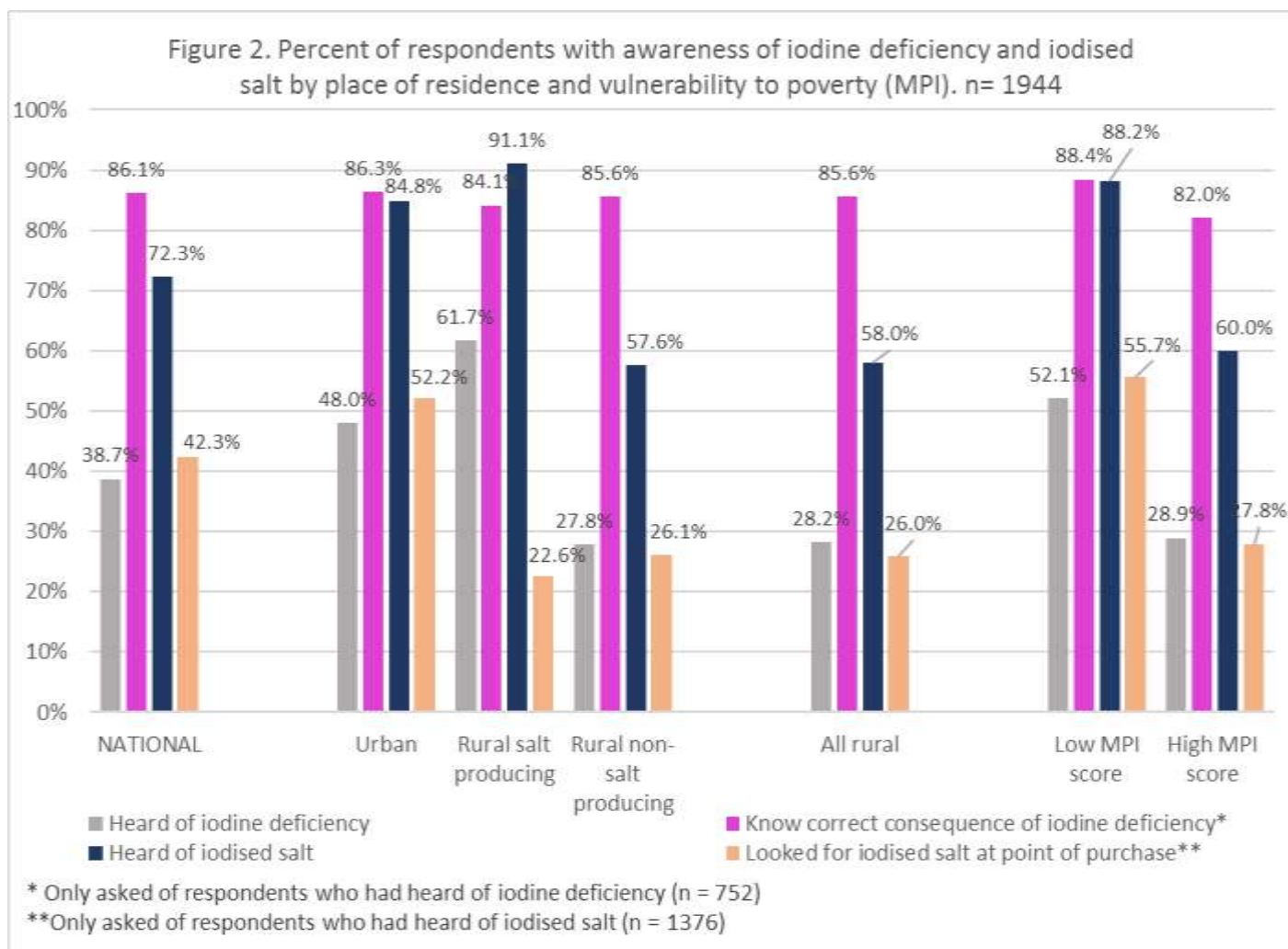
Less than 20% of households in rural areas are using adequately iodized salt, reducing to around 1 in 10 households in salt producing areas.

Households vulnerable to poverty (high MPI) are almost twice as unlikely to use adequately iodised salt as households with a low MPI score.

Knowledge and awareness related to iodine deficiency and iodised salt

- A significantly higher percent of respondents in households in rural salt producing areas reported to have heard of iodine deficiency and iodised salt than respondents from other rural households. The percent of respondents reporting awareness in urban areas was closer to the level of awareness in rural salt producing areas.
- The most commonly reported consequence of adequate iodine was prevention of goitre (65.7% of respondents mentioned this as one consequence), while around one fifth mentioned improved pregnancy outcomes (19.0%), and/or child health and development (22.5%), and/or improved adolescent and adult health (24.1%). The pattern of responses was fairly consistent across place of residence type and household MPI score.
- A higher percent of respondents from urban households than from either of the two rural areas said that they looked for iodised salt at the point of purchase.
- Reported knowledge of iodised salt was associated with higher use of adequately iodised salt in the household (41.6%) compared with 25.0% of households where the respondent had not heard of iodised salt. Having heard of iodine deficiency had a slight but non-significant effect on the use of adequately iodised salt in the household [data not shown].
- Among respondents who had heard of iodine deficiency and said that they knew a method to prevent it (n = 612), nearly all (97.5%) reported that using iodised salt was the best method of prevention, ranging from 94.4% in rural salt producing areas to 97.7% in urban areas.
- Respondents in both rural strata tended to have similar sources of information about iodised salt: friends and family (38-49%), followed by health personnel (36-41%), radio (28-34%) and television (17-26%). The

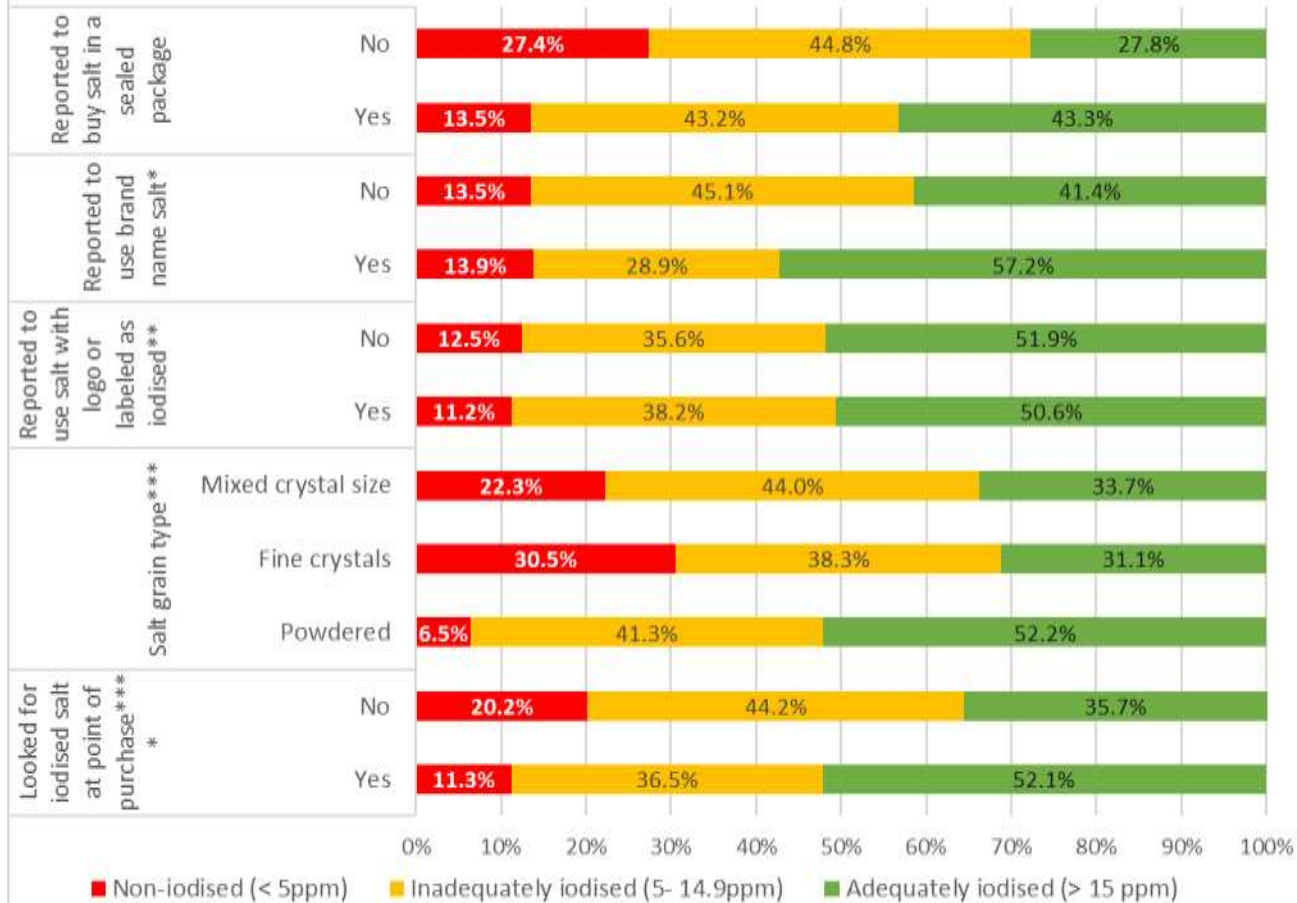
sources of information were different for respondents in urban areas: television (68.3%), followed by radio (41.1%), friends and family (27.6%), then health personnel (14.0%).



Household salt purchasing practices

- Of the total household sample 58.8% reported to have bought salt in a sealed pack. The percent was significantly higher for urban households (71.1%) compared with rural salt producing (31.1% and rural non-salt producing (45.1%). The same difference was seen by household MPI score, households more vulnerable to poverty were less likely to use sealed pack salt (48.7%) than non-vulnerable households (73.0%).
- A very small percentage of respondents who said they bought salt in a sealed pack reported using branded salt (12.1%), this was higher (14.6%) in urban areas than in rural areas (7.7%), with a similar difference between low (non-vulnerable) and high (vulnerable) MPI score households.
- Where salt was bought in a sealed pack 58.4% was reported to have a label or logo indicating it contained iodine. There was a difference between urban (62.3%) and rural (48.0%) households and a similar pattern for low and high MPI score households.
- Respondents from urban and low MPI households were also more likely to look for iodised salt at the point of purchase (52.2% and 55.7% respectively) than respondents from rural (26.0%) and high MPI scoring (27.8%) households.

Figure 3. Household salt iodine category according to salt packaging, brand, iodine logo/label, salt grain type, and whether looked for iodised salt at the point of purchase (all HHs with salt & test results n = 1515).



* n = 925 Only asked where salt bought in sealed pack
 ** n = 617 Only asked where respondent had heard of iodised salt and salt bought in sealed pack
 *** n = 1345 (25 HHs were using lumps or very large crystal salt, data not shown)
 **** n = 1050 Only asked where respondent aware of iodised salt

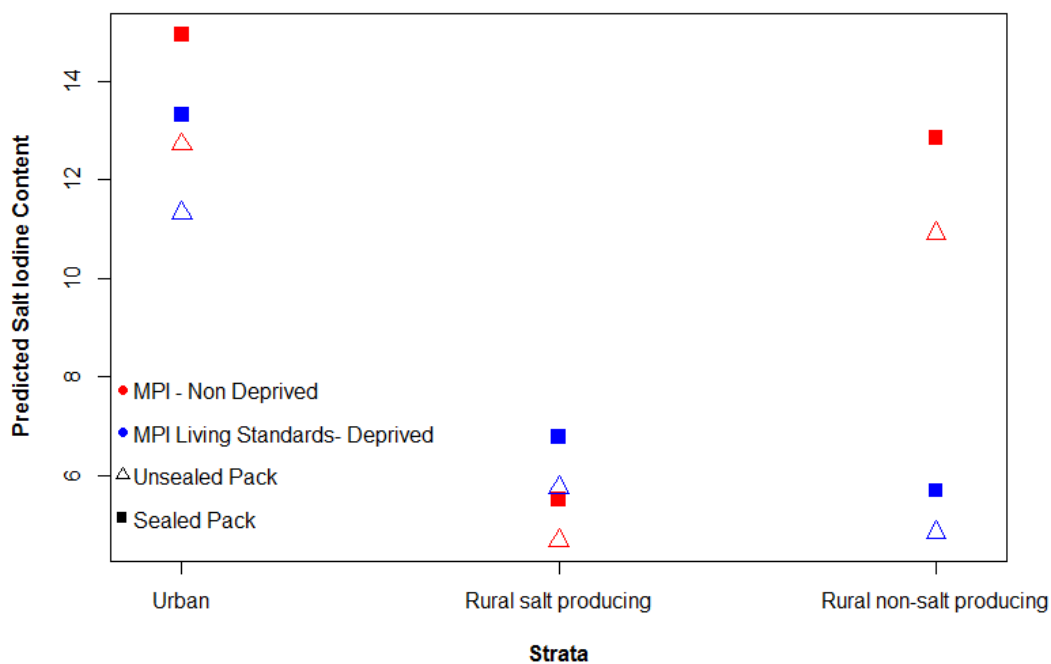
- Household salt reportedly bought in a sealed package was significantly more likely to be adequately iodised salt and half as likely to be non-iodised, when compared to salt in households reportedly buying open/loose salt.
- Sealed pack salt with a brand name was more likely to be adequately iodised than sealed pack salt without a brand name (difference not significant).
- For salt bought in a sealed pack, having a label or logo for iodisation made no apparent difference to the salt iodine content
- Over 90% of powdered salt was iodised to some extent and was significantly more likely to be adequately iodised than crystal salt. The size of crystals did not affect the quality of iodisation found (small number samples with large crystal size, approximately the same % iodised).
- Looking for iodised salt at the point of purchase was associated with higher household use of adequately iodised salt and lower use of non-iodised salt.

Regression analysis of key factors that could be influencing household salt iodine content

Log-linear regression analysis for household salt iodine content was conducted to assess associations with: strata, MPI (considered by each of the main domains - living standards, education, and health), respondents' knowledge of iodine deficiency and of iodised salt, salt obtained in a sealed pack, and all interactions between these factors.

- Salt iodine levels were consistently low within the rural salt producing stratum and consistently high in the urban stratum.
- The effect of obtaining salt from sealed packing was significantly associated with increased salt iodine content, consistent across all 3 strata, with a 16% increase in salt iodine content for households obtaining sealed pack salt.
- In the urban and rural-salt producing region obtaining salt in a sealed pack was the only factor that showed a significant relationship with the salt iodine content.
- For the rural non-salt producing stratum only, iodine levels in salt significantly increased as the MPI (living standards) decreased (moved from deprived to non-deprived). In this stratum, the effect of moving from a score of 0 to 1 was associated with an 82% reduction in the iodine content of salt. The change with MPI seen in the other two strata was much smaller, and not statistically significant.

Figure 4. Log-linear regression of modelled factors associated with salt iodine content

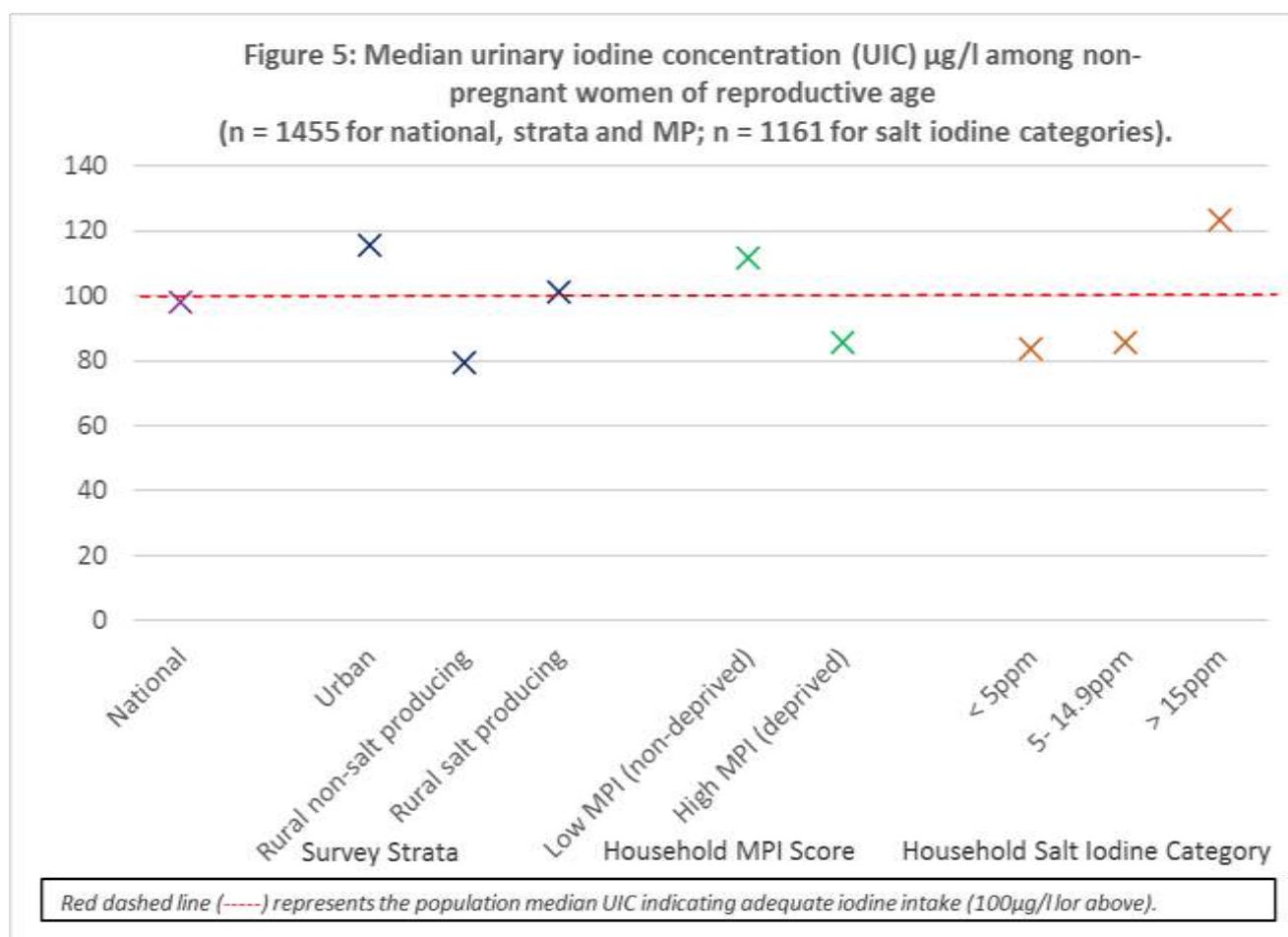


- MPI (living standards) non-deprived, sealed pack
- MPI (living standards) deprived, sealed pack
- △ MPI (living standards) non-deprived, unsealed pack
- △ MPI (living standards) deprived, unsealed pack

Findings for Iodine Status

Iodine status of non-pregnant women of reproductive age

- Iodine status among non-pregnant WRA in the 2014 survey in Senegal indicates that women in rural areas (median UIC 79.5 $\mu\text{g}/\text{l}$ for rural areas combined) have inadequate iodine intake (median UIC $< 100\mu\text{g}/\text{l}$). The same is true for WRA from households more vulnerable to poverty (high MPI score) (median UIC 85.5 $\mu\text{g}/\text{l}$).
- WRA in urban areas and from households with low MPI scores have higher median UIC (115.6 $\mu\text{g}/\text{l}$ and 111.4 $\mu\text{g}/\text{l}$ respectively), indicative of adequacy of intake.
- Overall the national median (98.0 $\mu\text{g}/\text{l}$) indicates that Senegal remains iodine deficient (almost no change in the median UIC for WRA nationally, or in urban/rural areas since 2011).
- Despite lower access to adequately iodised salt in rural salt producing areas, the iodine status of WRA in these areas is slightly better than for WRA in rural non-salt producing areas.
- An association was observed between household salt iodine category and median UIC indicating adequate iodine status only among the population of WRA using adequately iodised household salt:
 - Salt iodine $<5\text{ppm}$, median UIC 83.6 $\mu\text{g}/\text{l}$
 - Salt iodine 5-14.9ppm, median UIC 85.4 $\mu\text{g}/\text{l}$
 - Salt iodine $\geq 15\text{ppm}$, median UIC 123.1 $\mu\text{g}/\text{l}$
- The median UIC of 85.7 $\mu\text{g}/\text{l}$ ⁹ among a relatively small national sample of pregnant women (n = 278) indicates a concerning level of deficiency in this group.



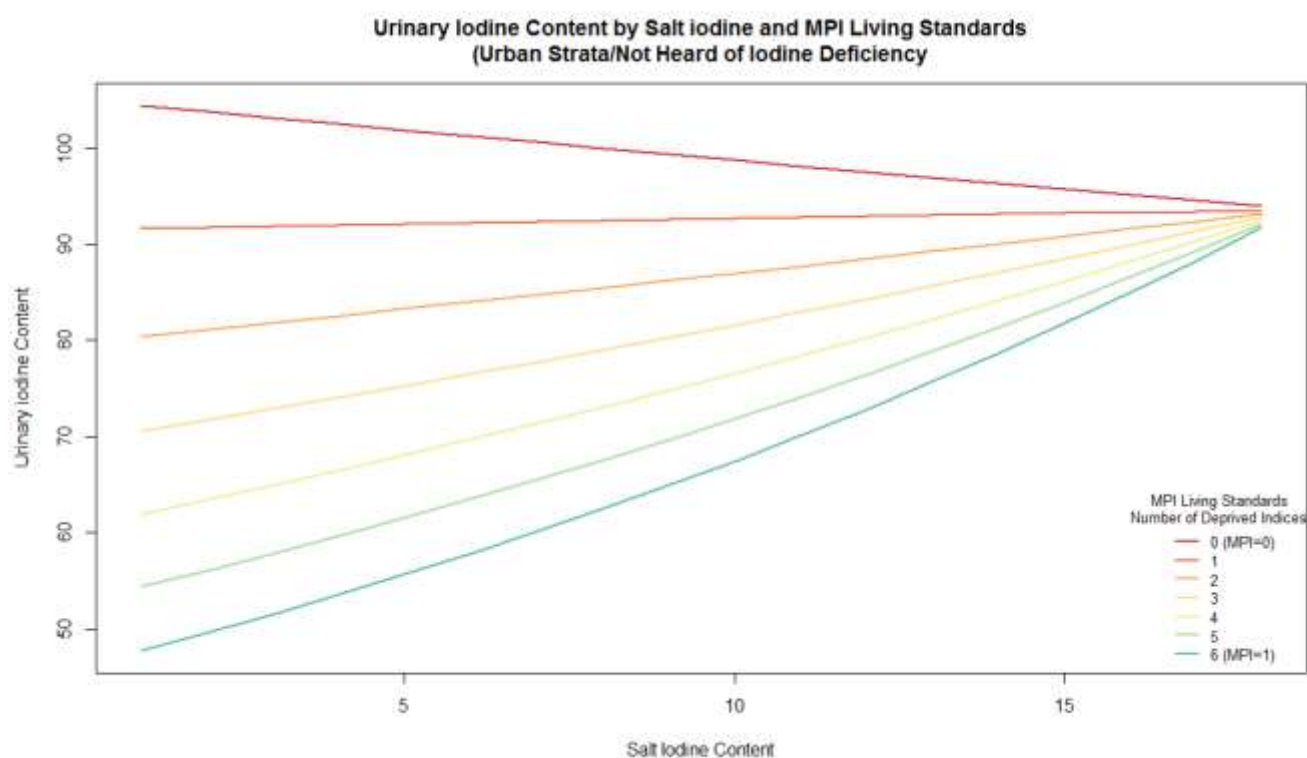
⁹ Adequate iodine status among pregnant women is defined as a population median UIC over 150 $\mu\text{g}/\text{l}$. WHO/UNICEF/ICCIDD 2007

Regression analysis of key factors that could be influencing iodine status among WRA

A log-linear regression analysis was conducted for factors associated with urinary iodine content. It included the same factors as for the salt iodine regression, with the addition of age and age squared (found to be associated with UIC), log salt iodine content, and frequency of bouillon consumption in the past 7 days. The MPI living standards domain was included in the final model as each of its 6 component indicators (electricity, cooking fuel, flooring, drinking water source, sanitation facilities, and assets).

- There were no significant differences in iodine status found related only to the strata or any of the interactions involving strata (despite the apparent differences in median UIC by strata).
- Having heard of iodine deficiency was associated with an increase of 15% in urinary iodine content.
- The effect of salt iodine content varied according to the MPI living standards result:
 - **For those with high salt iodine content (>15ppm) the urinary iodine content was consistently high; regardless of the MPI living standards score.**
 - For those with very low iodine in salt (<5ppm) those with a high MPI Living Standards Score (i.e. deprived) had very low urinary iodine content whereas those with a low MPI Living Standards Score (i.e. non-deprived) had a relatively high urinary iodine content.

Figure 6. Log-linear regression of modelled factors associated with iodine status among WRA (adjusted for urban/rural, strata, having heard of iodine deficiency).



Red line - among the population of WRA living in non-deprived households (MPI living standards = 0), urinary iodine concentration tends to be higher and not greatly associated with household salt iodine level.

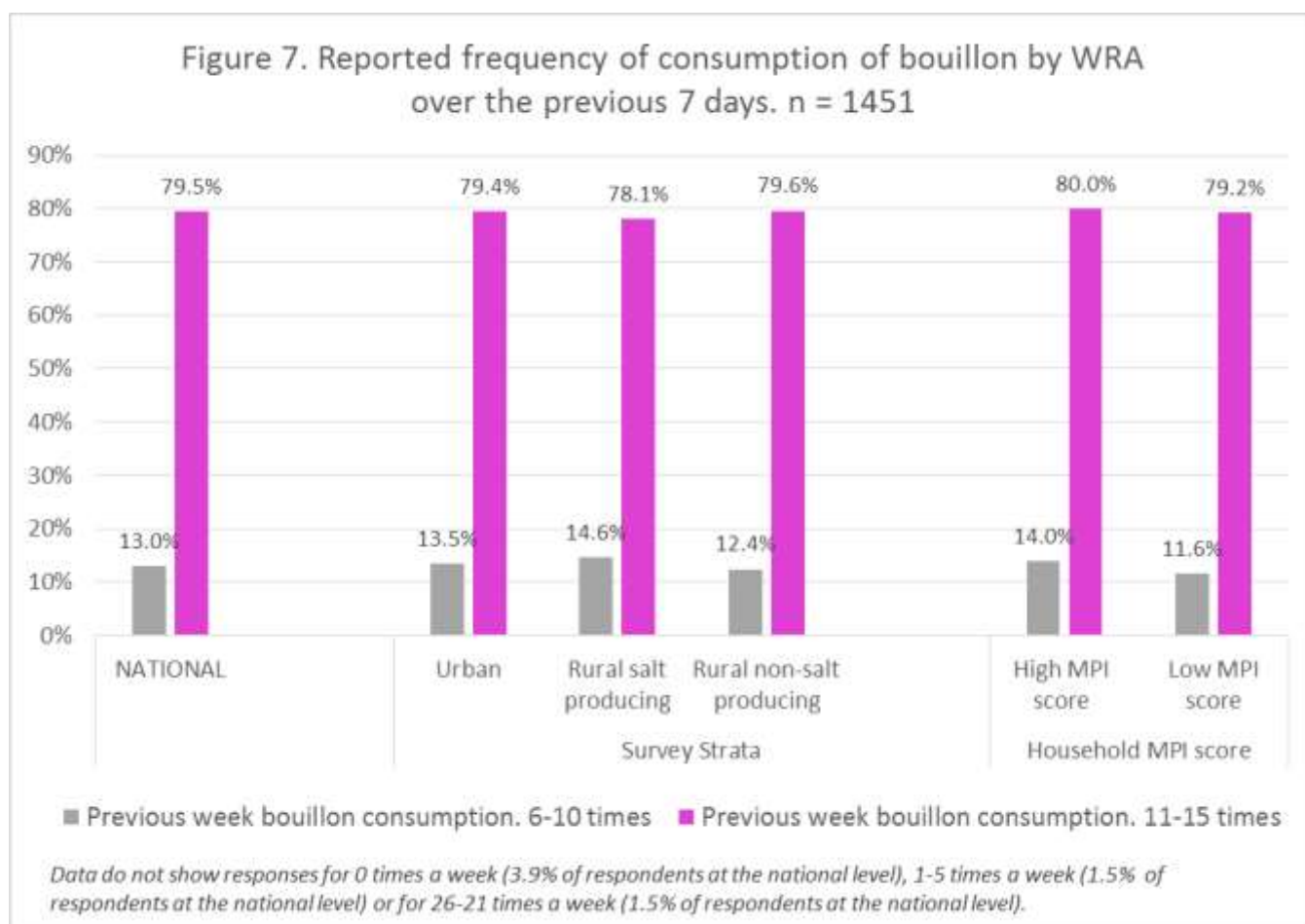
Dark green line - among the population of WRA living in the most deprived households (MPI living standards = 1, deprived in all 6 component indicators), urinary iodine concentration is highly associated with household salt iodine level.

All lines in between show the same trend as for the most deprived households, but with reducing association with household salt iodine content as the level of deprivation (MPI living standards) decreases.

Frequency of consumption of foods/condiments contributing to salt (and potentially iodine) intake among WRA

The interviews included questions for WRA about the number of days in the past week that they had consumed food containing bouillon and, on average how many times a day they consumed these foods. Also on how many days had they consumed vendor-prepared foods (prepared with non-household salt and/or bouillon).

- Frequency of consumption of bouillon was extremely high among WRA across all residence types and in households with both low and high MPI scores. 92.5% of all WRA nationally reported consuming bouillon as part of at least six meals during the past week, with 79.5% reporting to have consumed it on at least 11 occasions.
- The median UIC was higher among WRA reporting to have consumed bouillon 6-10 times (114.8 µg/l) than among WRA reporting to have consumed it 11-15 times (98.2 µg/l). This is reported as an indication of whether bouillon may be a source of dietary iodine (see discussion section).
- Based on: number of days consumed x typical number times consumed per day x average serving size for an adult (estimated to be 1.5g per person – which may be a low estimate), the mean weekly intake of bouillon for a WRA in this survey was calculated to be 19.4g (2.8g/day).
- A low percentage of WRA reported consuming vendor-cooked foods. Eighty two point five percent of WRA reported to have not consumed this type of food at all in the previous week and a further 9.0% reported consuming this only 1-2 times in the same time period. Leaving less than 9% of WRA consuming these foods more regularly.



Discussion Points

There has been little change in national household access to adequately iodised salt (from approximately 50% to 40%) or in population iodine status (deficient) in Senegal since the last national iodine survey in 2010. This survey provided evidence for the first time of the situation in small-scale salt producing areas, and showed that the use of iodised and adequately iodised salt in these areas is significantly lower than in other areas, even when respondent awareness of both iodine deficiency and iodised salt tended to be higher in this strata. However iodine status was found to be poorest in rural non-salt producing areas, possibly related to slightly poorer socio-economic status (higher percentage of households vulnerable to poverty) in these areas compared to salt-producing areas.

Household coverage with adequately iodised salt has for many years, been higher among urban households than among rural households in Senegal. The tabulations around salt purchasing practices and the regression analysis indicate that this better coverage is most likely a result of higher access to salt in sealed packages. In salt producing areas it is reported that many consumers access salt directly from the point of production before it has been through any iodisation process, if such a process is available. However, even when salt was reportedly obtained in a sealed pack in these salt producing areas, the iodine content was still relatively low (Fig 4).

Non-salt producing rural areas appear to have access to salt with the widest variation in iodine levels, clearly associated with household socio-economic status (Fig 4). The difference in salt iodine content by MPI score was observed for both packaged and unpackaged salt, suggesting there may be a difference in the price of iodised versus non-iodised salt (for packaged and unpackaged salt) and/or possible inequity in availability of adequately iodised (packaged or unpackaged) salt at the retail level in different locations.

A relatively high proportion of respondents had heard of iodised salt and this had some association with actual use of adequately iodised salt at the household. However a much lower percent had heard of iodine deficiency and in all areas except the rural salt producing, the percent responding that they looked for iodised salt at the point of purchase was similar to the percent with knowledge of iodine deficiency. In rural salt producing areas, a very low percent of respondents looked for iodised salt at the point of purchase despite this stratum having the highest proportion of respondents with awareness of iodine deficiency.

The 2014 survey indicated a high level of association between iodine status and household salt iodine category, clearly showing the protective effect on iodine status for WRA from households using adequately iodised salt. When the iodine status of the population is looked at overall, household vulnerability to poverty appears to be significantly associated with iodine status, however the regression analysis shows that once household salt has around 20 ppm iodine, the difference in iodine status of WRA in households according to vulnerability to poverty disappears and household members from all socio-demographic levels have the same likelihood of having adequate iodine nutrition.

The socio-economic dependent difference in relationship between iodine status and changes in household salt iodine levels below 20 ppm could also be presented as illustrating that increasing household salt iodine is a highly significant factor associated with urinary iodine for women in households more vulnerable to poverty, but not a significant factor for women of highest socio-economic status. Less deprived households, regardless of residence type, were shown to be more likely to have reasonable iodine status even in the absence of iodine in their household salt. This could indicate that women in these better off households have increased access to a variety of foods including processed foods and condiments and foods outside the household, which may be produced using iodised salt and/or provide additional other sources of iodine, making the iodine content of household salt a less relevant part of their total salt intake.

It should be noted that although the frequency of consumption of bouillon (and therefore salt through bouillon) was high, it was not a factor associated with urinary iodine, either in univariate cross tabulation or as part of the multivariate regression analysis. This suggests that one or all of the following apply:

- a. A large proportion of bouillon available in Senegal is not produced using iodised salt (even though the use of iodised salt by the food industry is a component of national legislation), and/or
- b. The iodine content of any iodised salt used in bouillon is highly variable and since households tend to use multiple brands in the same time period, increased bouillon intake may not be consistently associated with increased iodine intake from this source, and/or
- c. The methodology for approximating intake used in this survey needs to be improved.

The reported frequency of consumption of bouillon indicates that it is a widely consumed food type which is accessed equally by all parts of the population, regardless of residence type or socio-economic status. Bouillon is approximately 50% salt and the 2015 study by Spohrer et al. indicated high stability of iodine in bouillon during cooking. Therefore, involving the limited number of bouillon producers in Senegal as partners towards achieving elimination of iodine deficiency through USI could have an immediate and nationwide effect on iodine status. Estimates of gram bouillon intake were obtained based on a different methodology to the 2010 survey and, therefore, the results are not comparable. The conservative serving size used for estimating intake and the fact that bouillon may in some cases be part of a meal without the consumer being aware, mean that the 2014 survey estimates of intake are probably lower than actual. Even at these levels, it was calculated that if produced using salt with 15ppm or 20ppm iodine, bouillon at current levels of intake could contribute approximately 15% to 20% (respectively) of daily iodine requirements for WRA.

The use of adequately iodised salt in the production of bouillon, and in other key foods/condiments with centralised production, could be supported and monitored feasibly and effectively with significant expected benefit in terms of population iodine status. Any such work with the food industry should be done with care so it cannot be perceived as promoting bouillon or salt consumption and could be incorporated into parallel public health efforts to reduce overall salt consumption.

Key Conclusions and Recommendations

The consequences of the reported persistent iodine deficiency among WRA on national socio and economic development are of serious concern. The fact that the situation has not changed after renewed implementation efforts during the past five years indicates that new policies and strategies are urgently required to ensure national access to iodised salt of assured quality and/or that vulnerable groups such as pregnant women have access to other forms of supplementary iodine to protect the next generation of new-borns from preventable impairment of foetal brain development.

Although household salt iodine content is not the only factor significantly associated with iodine status of women, it is currently indicated to be the most important factor, especially among populations with lower socio-economic status and presumed lower access to a diversity of other foods which may contribute to iodine intake (supported by data on dietary diversity score which showed higher diversity among WRA in urban areas, which tended to also have lower MPI scores, data not included in this report). It is incumbent on the Government of Senegal and all supporting partners to ensure equitable access to quality-assured iodised salt for all. A review of the 2014 survey findings by a group of government and agency partners from different backgrounds made the following recommendations for achieving this:

1. Review current legislation and regulations for domestic salt production, sales, iodisation and their enforcement
 - a. Currently the country's one large scale producer of high quality salt is required to export 80% of its production, meaning that the domestic population has reduced access to adequately iodised refined household salt and that food and condiment producers have to import salt since the remaining domestically-produced salt is not of high enough quality for the industry.

- b. The use of iodised salt by the food industry falls within the existing legislation however this is not enforced. Bouillon and other food/condiment producers could easily incorporate well-iodised salt into production, although there may be some need to support and encourage the process, for example with initial access to laboratory verification of salt iodine content.
 - c. The capacity and motivation for regulatory monitoring and enforcement of legislation for salt iodisation, packaging and labelling should be strengthened and penalties for violation of the law should be introduced and implemented.
 2. Implement changes within the salt industry currently producing for the domestic market.
 - a. Modernisation and mechanisation of current basic salt production techniques is urgently required to improve the quality of salt and its iodisation, to increase access to iodised salt in sealed, labelled packaging and increase feasibility and reliability of production quality control.
 - b. Such a change would require considerable resources and technical support and may need to be implemented alongside strategies to ensure alternative or different livelihood schemes. However the impact of increased availability of adequately iodised salt would provide an overall benefit not only to the immediate community but to the whole country.
 3. Strengthen and develop communication approaches applicable along the whole supply chain
 - a. It is increasingly understood that increasing consumer awareness alone has little impact on long term household use of iodised salt, especially when an affordable supply of the product is not accessible. To make a radical change to the current situation, targeted communication and advocacy are required to ensure responsibility and action at all levels: policy, all scales of salt production, distribution, food industry, distributors, retailers and consumers.
 4. Integration of iodine nutrition into cross-cutting nutrition initiatives – nationally and regionally
 - a. Capitalise on the commitment by the new president of the African Development Bank to place nutrition at the heart of development. Achieving and sustaining adequate iodine nutrition in Senegal and the wider West Africa region is a feasible, low cost to benefit approach which could be achieved with carefully targeted commitment and resource allocation.
 - b. Investigate raising the profile of iodine nutrition within national nutrition initiatives, such as the SUN business alliance.
 - c. At least as an interim measure, include iodine supplementation into the package of interventions for women planning pregnancies and/or for pregnant and lactating women in Senegal, to start protecting new-borns from deficiency. Whether as part of a multi-micronutrient powder/supplement or as a stand-alone supplement to be provided through ante-natal and other health care services.
 5. Plan and implement additional research to determine bottlenecks to USI in Senegal, industry and consumer awareness and behaviour change, and to ensure closer monitoring of progress and sustainability of achievements.