A conversation with Jonathan Gorstein, Michael Zimmermann, and Maria Andersson on April 29, 2014

Participants

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Note: This set of notes was compiled by GiveWell and gives an overview of the major points made by Dr. Zimmermann, Dr. Andersson, and Dr. Gorstein.

Summary

GiveWell spoke with Dr. Zimmermann, Dr. Andersson, and Dr. Gorstein about ICCIDD's programs and about methods of measuring iodine status.

ICCIDD's work with the World Health Organization (WHO)

The International Council for the Control of Iodine Deficiency Disorders (ICCIDD) was founded mainly by endocrinologists and other medical doctors. It has served as an advisory board for the World Health Organization (WHO) since 1988.

WHO advocates both for the reduction of salt consumption and for universal salt iodization (USI).

Establishing guidelines related to iodine

ICCIDD assisted WHO in establishing guidelines related to iodine nutrition and is listed as a co-author on all of these guidelines. ICCIDD wrote one of the first documents on salt iodization standards in 1996; those standards were updated in 2014. ICCIDD also assisted in the creation of regional iodine guidelines for each of WHO's six regions. ICCIDD was involved in all steps of the process of developing guidelines, including convening meetings, writing background papers, identifying experts, and formally discussing recommendations.

ICCIDD is considered the key organization that provides scientific expertise in iodine nutrition. It has been important in setting standards because it unifies iodine experts including nutritionists, epidemiologists, laboratory technicians, and endocrinologists. Many other nutritional issues lack a single unified organization that plays a role similar to that of ICCIDD.

Monitoring and reporting data for iodine programs

As part of a World Health Assembly (WHA) resolution on universal salt iodization, countries are supposed to monitor and report progress on iodization to WHO, and WHO is supposed to summarize the results to member states at the WHA. WHO most recently reported results in 2013.

Though the WHA resolution is not binding, it can be important as an advocacy tool. For example, some nutrition officials in the health ministries in Ghana and Senegal were reluctant to administer urinary iodine concentration (UIC) surveys. Roland Kupka informed them that the WHA resolution obligated them to monitor iodine status. This convinced them to administer the surveys.

Dr. Andersson joined WHO in 2000 and assisted in developing systems to track iodine data as part of the Vitamin and Mineral Nutrition Information System (VMNIS). VMNIS helps WHO systematically collect national-level nutritional data and report progress to countries. WHO uses VMNIS to report iodine data to countries as part of the WHA resolution. ICCIDD worked closely with WHO to keep the database updated, and for the past 5 years ICCIDD has updated and maintained the Global Scorecard on Iodine Deficiency, because of insufficient resources at WHO to Maintain the VMNIS.

ICCIDD's roles in supporting iodine programs

Previously, ICCIDD provided technical assistance for implementing iodine programs at the national level, but now this work is usually done by implementing organizations, such as UNICEF, the Micronutrient Initiative (MI), and the Global Alliance for Improved Nutrition (GAIN).

One of ICCIDD's current roles is identifying bottlenecks in technical and scientific research. ICCIDD identifies important research questions through its regional coordinator network and national coordinator network. It mobilizes groups to do research to address these bottlenecks and disseminates results through the network. ICCIDD is well-suited for quickly coordinating cross-country research because of the relationships it has with officials in many countries. ICCIDD does not currently fund research, but if it had more resources, it would consider funding applied research targeted toward specific issues.

Research questions related to iodine

Determining urinary iodine concentration (UIC) targets

It is particularly important for pregnant women to receive sufficient iodine. Though many countries do not target pregnant women or women of reproductive age in iodine surveys, 12-15 countries have national-level data on iodine status in pregnant women. ICCIDD is compiling this data to estimate the global iodine status of pregnant women.

ICCIDD believes that salt iodization programs should meet the needs of all people, so it is working to determine whether it is possible to achieve adequate iodine levels for pregnant women without causing other groups to receive excess iodine. Because of work to achieve iodine targets for pregnant women, some groups such as children have received "more than adequate" levels of iodine in some countries, but it is not clear whether those levels are harmful.

In Indonesia, the 2007 national health survey showed that the median UIC was 202 micrograms per liter (μg/L). (A UIC of 200-299 μg/L is considered more than adequate.) The ICCIDD national coordinator in Indonesia reported these results at a conference that a UNICEF official attended. As a result, UNICEF raised the question of whether the UIC results were too high. China was also concerned about whether it was acceptable for the median UIC in schoolchildren to be 220-240 μg/L. Because of these concerns, UNICEF provided funding to ICCIDD to study these issues in China, Tanzania, the Philippines, and Croatia.

Discrepancy between household iodine coverage data and UIC data

There are some discrepancies between household iodine coverage data and UIC data. For example, some countries report low household iodine coverage rates but adequate UICs. This could be due to the potentially poor quality of rapid test kits that measure iodine in household salt or to sources of iodine other than iodized salt.

Other iodine interventions

ICCIDD is working to better understand the reach of supplements targeted to various age groups. It is trying to determine how to monitor results in settings in which multiple interventions are being delivered. Dr. Andersson is comparing the effects of three dosage levels of iodine, which are delivered in the form of powders and supplements to infants between the ages of 6 months and 23 months.

Regulating iodine levels in salt production

Many national governments monitor iodine concentrations in salt at the point of production. In India, the government tracks the percentages of salt with various levels of iodine – for example, the percentage of salt with 30-50 parts per million (ppm) of iodine. By using titration to quantify the iodine levels in household salt, the rate of iodine loss between factories and households can be determined. However, this type of research has not been done systematically.

In general, iodine standards have been developed with the assumption that as much as 40% of iodine is lost from salt between factories and households. This implies that factories should iodize salt with 30 ppm of iodine. However, rates of iodine loss depend on several factors. Though potassium iodate itself is not lost from salt, iodate can convert to molecular iodine, which sublimates. This reaction is catalyzed by magnesium and iron and is also accelerated by heat and moisture. The rate of iodine loss depends on temperature, humidity, impurities in the salt, the size and quality of the packaging, and the quality of the crystals.

In general, if quality assurance for salt production is good, standards for iodization should not need to be modified. In order to change iodine regulations, it is necessary to revise legislation, which requires significant effort. However, iodine standards have been changed in some countries based on new data. Based on the results of UIC surveys, China reduced the requirements for iodine levels in salt. In the 1990s, Brazil required 60-100 ppm of iodine in salt. The government reduced the requirement to 20-40 ppm and then to 10-30 ppm. Kenya has also decreased its iodine requirements. On the other hand, Switzerland and Denmark have increased iodization requirements. Switzerland increased from 20 ppm to 25 ppm and then to 30 ppm.

Household iodine surveys

ICCIDD compiles UNICEF's data on household iodized salt prevalence in a spreadsheet (the Global Scorecard) that also includes UIC data. To maintain consistency, ICCIDD accepts UNICEF's estimates of iodine coverage.

The GAIN-UNICEF USI Partnership Project uses titration to test household salt for iodine, but rapid test kits are used to test for iodine in UNICEF's other iodine programs. Rapid test kits can distinguish between the presence and absence of iodine in salt but cannot determine the concentration of iodine. It is unclear whether the data for rapid test kits is sufficient for monitoring iodine status. Frits van der Haar, ICCIDD Senior Advisor, is analyzing the accuracy of rapid test kits compared to titration.

Urinary iodine concentration (UIC) data

The iodine status of a population is typically measured using median UIC data, but there can be significant variation in UICs within a population, particularly in certain settings. A UIC measurement depends on fluid intake, urine volume, the concentration of iodine in salt, salt intake, and sources of salt. The distribution of UICs typically has a long tail in the upper range.

Ensuring the Quality of Urinary Iodine Procedures (EQUIP)

ICCIDD assists the CDC in running a global quality control program for UIC laboratories: Ensuring the Quality of Urinary Iodine Procedures (EQUIP). Laboratories that are chronically underperforming sometimes request assistance from ICCIDD. ICCIDD is able to provide national coordinators and regional coordinators to improve UIC testing. The coordinators often have more experience within particular regions than the experts that the CDC would be able to provide, which improves their effectiveness.

There are good laboratories in Tanzania and South Africa that meet the standards of EQUIP. Laboratories in Western Africa generally need strengthening, but a university staff member in Ghana has been working to make his university's laboratory meet the standards of EQUIP.

The Partnership Project uses UIC testing approved by EQUIP.

Transition period during increased iodine consumption

During iodine-deficiency, the thyroid is unable to take up all of the iodine that is consumed, so there is some iodine in the urine even of iodine-deficient people. A typical UIC for a severely iodine-deficient person is 10 micrograms per day. As the person increases iodine intake, there is a transition period in which UICs remain low, because the person is absorbing more iodine to replenish iodine stores in the thyroid. Thus the UICs will be lower than predicted based on iodine consumption. The healthy thyroid can store 10 to 20 milligrams of iodine. If a person has no iodine stores, about 200 days of sufficient iodine consumption may be required to completely replenish the iodine stores.

Alternatives to UICs

ICCIDD is considering using a functional biomarker to measure thyroid function.

Goiter data

Though the reported prevalence of goiter in Africa has increased between 1993 and 2003, the actual prevalence of goiter probably has not increased. The data reported in 2003 was from a limited sample of countries, and some of the data had been collected prior to 2003.

Iodine dietary requirements

Physiological studies have determined the levels of iodine at which changes in the thyroid occur. Another way that iodine dietary requirements have been established is by tracking the clearance rates of radioactive iodine in plasma. The amount of iodine that is cleared by the body per day in an iodine-sufficient person is interpreted as the body's daily requirement for iodine. Though an iodine-deficient person can clear 80-85% of daily iodine consumption, an iodine-sufficient person typically clears about 30% of daily consumption. These studies were used to establish the adult Estimated Average Requirement for iodine of 95 μg per day.

WHO and other organizations provide two values for dietary requirements. The estimated average requirement (EAR) is designed to meet the physiological requirements of 50% of the population. The recommended dietary allowance (RDA) is designed to meet the requirements of 97% of the population. ICCIDD's goal is for 97% of the population to achieve the EAR for iodine. The prevalence of iodine deficiency can be calculated as the percentage of the population not achieving the EAR, based on UIC data extrapolated to iodine intakes.

Iodine requirements in pregnant women

Iodine requirements increase during pregnancy for three reasons. First, the fetus needs iodine for production of its own thyroid hormones, which begins at 12-16 weeks. Second, the fetus needs to build its iodine stores (in iodine-sufficient populations, a fetus has 300 μg of iodine stored at term). Third, the maternal requirements for thyroid hormones increase.

Research suggests that a woman needs 160 μg of iodine per day during pregnancy. One way that this was determined was by studying goiter development during pregnancy.

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