

Appendix A: Challenge Statement 2

Addressing Micronutrient Deficiencies

Summary

Globally, more than 2 billion people suffer from some degree of deficiency in one or more micronutrients. Micronutrient deficiency can lead to serious health conditions and is recognized as a major public health problem. Interventions such as fortification and supplementation have proven to be effective when delivered regularly; however, accurate data for evaluating dietary needs is still needed. To address this gap, students will be asked to design a noninvasive, nonintrusive means of evaluating the dietary needs of people living in areas with the highest rates of malnutrition and micronutrient deficiency: India, Africa, and Southeast Asia.

Background

According to the Centers for Disease Control and Prevention, micronutrients are the dietary components often referred to as vitamins and minerals. With the exception of vitamin D, which is produced in the skin, and vitamin K, which is produced in small amounts by gut bacteria, micronutrients are not produced in the body and must be obtained from the diet. Though required only in small amounts, micronutrients are vital to development, disease prevention, and wellbeing. Each of the known 13 vitamins and 20 essential minerals has specific functions in the body, and no single food contains all of them, so a varied diet is vital to meet the body's requirements.

More than 2 billion people globally are affected by micronutrient deficiencies, including at least half of all children between the ages of 6 months and 5 years old. Deficiencies in vital micronutrients such as iron, iodine, vitamin A, folate (folic acid), and zinc can lead to severe, long-lasting negative consequences. Micronutrient malnutrition damages health, learning and cognitive abilities, and daily functioning. Additionally, micronutrient deficiency has high socioeconomic and public costs, as high rates of illness and disability lead to reduced work capacity.¹ The key factors contributing to micronutrient deficiencies are poverty, lack of access to a variety of foods, inappropriate dietary practices, and infectious diseases.

Eliminating Micronutrient Malnutrition

The Food and Agriculture Organization and the World Health Organization have adopted four main strategies to eliminate micronutrient malnutrition:

1. Increasing the diversity of food consumed through increased production, preservation, and marketing of micronutrient-rich foods combined with nutrition education. This requires programs that increase the availability of different types of micronutrient-rich foods (such as

animal products, fruits, and vegetables), especially among those at risk for micronutrient malnutrition, as well as programs that educate the populace to consume these foods in adequate quantities.

2. Food fortification can be a fast-acting and cost-effective public health intervention, often utilizing existing technology and local distribution networks.
3. Supplementation through the use of large or typical doses of specific micronutrients, supplied in a highly absorbable form—usually via pills, capsules, syrups, or nutrition bars. Supplementation is often the fastest way to eliminate deficiencies in individuals, as well as population groups.
4. Public health and other disease-control measures are often required to help prevent and correct micronutrient malnutrition because deficiencies are often associated with poor overall nutritional status and a high prevalence of infection. Such measures include infection control (e.g., immunization, malaria and parasite control) and improved access to clean water, along with other sanitation measures.²

The Need for Better Data

While many products designed to tackle micronutrient deficiencies have proven effective, in general these products are not readily available to those who need them. If the socio-economic situation of poor, less stable regions does not improve, then long-term adherence to consumption of fortified foods decreases over time unless the foods become staple foods.

Current methods for determining whether someone needs fortified foods have serious drawbacks. Often these methods are intrusive, and usually require blood tests to produce accurate results. This means that people must travel to a local clinic or medical professional with the proper equipment to administer a test and analyze the results. Another standard method for identifying micronutrient deficiency is a simple questionnaire comprised of questions about the respondent's diet. Because this method relies on self-reporting, the data are often unreliable.

The Challenge

Design a noninvasive, nonintrusive technology-based method of evaluating the dietary needs of people living in areas with the highest rates of malnutrition and micronutrient deficiencies: India, Africa, and Southeast Asia. This may include methods for determining food intake or evaluating the nutritional quality of readily available foods. (Note: "technology-based" is defined as using scientific and/or technological knowledge.)

Success Criteria

Solutions will be judged based on the following criteria:

- **Innovation:** Is this a breakthrough in thinking or design? Ideas that show the greatest innovation will be viewed more favorably.
- **Quality of Presentation:** Is the concept concisely and clearly explained?

- **Commercial Viability:** Does an interesting and viable market exist? Can the idea be commercialized within two years? Is there a clear strategy for commercializing the idea?
- **Sustainability:** What is the social impact? Is the technology scalable?
- **Teamwork:** Was the experience a collaborative endeavor?

Additional Considerations

- A successful solution *should not* require a significant commitment of additional resources, policy changes, or improved core infrastructure for success.
- A successful solution *should* consider existing interventions.
- A successful solution *should* consider the local population and local context.
- A successful solution *should* be cost effective and affordable for the target consumer.
- A successful solution *can* facilitate change in one particular country or region, and does not have to apply globally; however, solutions that are applicable in the global context are preferred.
- Successful teams *should* complete and properly submit all deliverables on time.
- Successful teams *should* demonstrate that they worked collaboratively.
- Successful teams are *encouraged* to work with a mentor, if possible, and interact with him/her on a weekly basis.

Notes

1. Micronutrients: Macro Impact, the Story of Vitamins and a Hungry World, 2011
http://www.sightandlife.org/fileadmin/data/Books/Micronutrients_Macro_Impact.pdf
2. Guidelines on Food Fortification With Micronutrients. Edited by Lindsay Allen, Bruno de Benoist, Omar Dary, and Richard Hurrell. Geneva: World Health Organization and Food and Agriculture Organization of the United Nations, 2006.