5-2014

Global Malnutrition: Challenges Associated With Current Intervention Strategies and Prevention Initiatives

Duncan Stiller
University of Rhode Island, duncan_stiller@my.uri.edu

The focus of my project was the problem of global malnutrition, specifically in children living in developing countries. The rationale for this topic choice was to combine my interests and backgrounds to form a meaningful project through which I could learn about a worldwide problem while further developing my academic skills. Specifically, I have been interested in the Psychology of personality and interpersonal relationships. In regards to Public Health, I my interests are in community health and infectious disease. Blending my background in Psychology with my current concentration in public health, I explored the current state of malnutrition.

The first component of this project began with a literature review to expound on four topics that would provide a more comprehensive understanding of the complex problem of malnutrition. Initial research focused on definition and prevalence data on malnutrition globally. The readings then examined the various causes of malnutrition. Next was an in depth study of the health outcomes of malnutrition, with special emphasis on the effect it has on children's mental and physical development. Finally, I explored a general overview of the various intervention and prevention methods that are addressing malnutrition. The second component focused on a local non-profit organization named Edesia whose mission is to combat malnutrition. This hand-on portion of the project included an interview with their director of operations as well as a factory tour. The purpose of this portion was to use Edesia as both a model and a resource to substantiate the findings from the literature review.

Definition and Distribution

The term "malnutrition" is actually a category of diseases that includes any illness that results from an imbalance of calories or micronutrients (e.g. vitamins), either in dearth or excess. My project focused on what is known as under nutrition, i.e. insufficient calories/protein and micronutrients. The World Food Program estimates that 842 million people worldwide do not have access to enough food, approximately 146 million of which are children. Those included in this estimate range from simply too little food to extreme malnourishment. The most serious types of hunger are known as Severe Acute Malnutrition (SAM) and Moderate Acute Malnutrition (MAM), with 20 million and 35 million respective cases each year occurring in children less than 5 years of age (Edesia 2012). SAM is defined as a child having a weight-for-height ratio >3 standard deviations below the mean for their age, and MAM is a height-for-weight ratio >2 but <3 standard deviations (WHO 2009). The majority of these cases occur in South Asia and Sub-Saharan Africa.

Causes

Despite programs like the Millennium Development Goals[1], a major focus of which is to eradicate extreme poverty and hunger, rates have only gone down slightly since the 1990's. Solving a problem of this magnitude will require incredible resources as well as a highly interdisciplinary approach, as the relationship between malnutrition and

[1] 1. The Millennium Development Goals are 8 international development goals implemented by the UN in 2000 in an effort to combat the following global issues: eradicate extreme poverty and hunger, universal primary education, gender equality, child mortality, maternal health, reduction of infectious disease, environmental sustainability, and to develop a global partnership for development.

poverty is complex. Each day, enough food is harvested to supply every living person with 4600 calories, yet there are still almost 1 billion people who do not have enough to eat (Stuart 2009). This discrepancy in access can be attributable to global food prices, distribution, and environmental effects on agriculture. As an example of distribution issues, the Food and Agriculture Organization (FAO) has estimated that eighty percent of malnourished children living in the developing world live in countries that produce a surplus of food (Gardener 2000). In other words, malnutrition is not an issue that originates from the world not producing enough food, but from a variety of problems, poverty being one of them. Diarrhea and other infections can lead to malnutrition through decreased nutrient absorption, decreased intake of food, increased metabolic requirements, and direct nutrient loss (Obeid 2011). As a result of high infant mortality rates in developing nations, fertility rates tend to be high as well (Tabata 2003). As a result, families tend to be larger and therefore harder to sufficiently support, ultimately meaning young children might not get enough to eat.

It has been found that undernourishment can lead to an increased susceptibility to infections, which as stated previously is a cause of malnutrition (Obeid 2011). This is an important relationship, as communities in developing nations often lack potable water and access to sanitation, ultimately increasing the exposure to infectious agents. As a result, a child could develop either SAM or MAM, which ultimately affects their ability to work or go to school, limiting their ability to contribute to the household, thus completing the cycle of poverty. This web of causes makes malnutrition incredibly challenging to solve, as each factor must be addressed before any resilient change in malnutrition will be seen.

Health Outcomes

Adding to the gravity of the problem, childhood malnutrition is associated with potentially permanent detriments to health and development. If no intervention occurs, the complications associated with malnutrition may disrupt the body's fundamental processes, leading to potentially irreversible physical and mental deficits. Both SAM and MAM have also been associated with an increased susceptibility to external pathogens such as Malaria or Tuberculosis; Malaria alone claims the lives of 3000-4000 children every day. This is especially concerning for future progress, as the first few years of life are crucial in virtually all aspects of development (McGregor 2007). In other words, children who suffer from malnutrition have an increased risk of physical and/or mental developmental deficiencies. By altering the way the body and mind grows, malnutrition can lead to a lowering of IQ by up to 15 points, delayed motor skill developments, and increased likelihood of behavior problems (Martorell 1996). These deficits will severely impact one's ability to succeed in either work or education, again, perpetuating the cycle of poverty. The three most prevalent nutritional deficiencies that have been shown to have potentially permanent adverse effects on development are protein/calorie, iron, and iodine. Protein/calorie deficiencies cause a variety of systemic issues including damage to the lymphatic system, liver damage, and stunted physical growth (BMJ 1950). The lymphatic system is also a crucial part of the immune system. Iodine and iron are associated with cognitive development. Globally, iron is the most common deficiency,

which left untreated will develop into iron deficiency anemia. While serious in adults, iron deficiency anemia is particularly damaging in developing infants. Iron-deficiency anemia affects neurological development by decreasing learning ability, altering motor functions, and permanently reducing the number of dopamine receptors and serotonin levels (Roncogliolo 1998). It was estimated in 2007 that 200 million children each year are not developing to their full potential either mentally or physically due to endemic hunger (McGregor 2007). While malnutrition rates globally have improved slightly since 2007, the consequences of this lack of development are still of concern in areas where malnutrition has not improved.

Newer research has begun to associate Zinc deficiencies with a variety of developmental problems. While this topic is new and understudied, I chose to include it as an example of the increasing awareness of the impact that nutrient and vitamin deficiency can have. Most interesting to me is an increased emotionality, poor memory, and an abnormal response to stress (Black 2003). While it is clear that the effects of zinc deficiency would impact an individual's ability to learn, it has recently been hypothesized that the increase in emotionality and abnormal stress response can be associated with high levels of violence and political instability (Hartke 2013). The result of which makes a contribution to the cycle of poverty as well through stunted economic and political growth of not only a person, but also their nation.

Approaches to Solutions

My research up to this point in the project made it clear that malnutrition is a major piece of the complex relationship between the various issues that developing

nations face. The Millennium Development Goals rightly group the eradication of poverty and the reduction of world hunger under the same goal, as the two have been shown to be closely associated. As a result, I began to explore the current efforts to relieve the burden of malnutrition globally through both prevention and intervention methods. The most widely used intervention model employs Ready-to-Use Therapeutic Foods (RUTFs). RUTFs are nutritionally fortified lipid based supplements, typically peanut based, that come in durable plastic wrappers. They require no refrigeration and have a very long shelf life. There are a variety of manufacturers of these products, however one of the most well known is the Plumpyfield network. Founded by a French organization called Nutriset, Plumpyfield is a network of organizations that produce RUTFs to be used to treat malnutrition. Perhaps the most important reason Plumpyfield's product is so innovative is that it does not need any added water, which as stated previously, access to potable water is limited. Plumpyfield is composed of 10 different organizations, mostly based out of Africa, with the largest being Nutriset. The second largest is based out of Providence, Rhode Island, and is named Edesia. Taking advantage of the proximity, I traveled to the factory for an interview and tour in order to gain a better understanding of their mission. I learned that Edesia and the other organizations that make up Plumpyfield are projected to manufacture approximately 50,000 tons of product in 2014, which is enough to treat about 5 million children suffering from either SAM or MAM. After production, Plumpyfield sells their products to organizations like UNICEF and Doctors Without Borders who then distribute based on need. As a result, Plumpyfield is able to better focus their resources solely on manufacturing efforts. Furthermore, the Plumpyfield organizations are primarily based out of countries in

Africa, where the need for products like these is great. This is especially important because it not only makes distribution easier, but it also creates local jobs. However it is beneficial for Edesia to be located in the US, as it allows for greater access to grants and resources, which is reflected in their production capacity (Edesia produces almost twice as much as the next largest organization). Edesia cites that their products have a 90% success rate when a child is given the full course of treatment for SAM or MAM (Kasparian 2014). If Plumpyfield reaches their 2014 projected production capacity, they will have manufactured enough RUTFs to treat 5 million children. Edesia and its affiliates are doing an excellent job treating childhood malnutrition in developing nations.

Despite all of their success, Edesia and Plumpyfield have limitations. Each year, 146 million children will become malnourished; if they reach 5 million children, this means that their products reach only 3.42% of those who need it. Furthermore, their intervention is implemented *after* a child becomes malnourished, meaning it does little to prevent malnutrition from occurring. Finally, a number of questions remain - research has questioned whether or not this foreign food product is sustainable in that it is not only a potential source of non bio-degradable wrappers, but despite its intended temporary use, RUTFs may also have a propensity to replace breast-feeding (Dewey 2012). This is especially important, as breast-feeding is critical to healthy development for several reasons. Breast milk contains the mother's antibodies, which aids in immune system development. Breast milk is also sanitary, as direct breast-feeding does not have a risk of contamination. Sanitation is crucial, as exposure to contaminated water is an significant risk factor of malnutrition. Breast milk is also highly nutritious, and the risk of childhood

malnutrition increases dramatically when breast-feeding ceases, as the diet typically transitions to being very high in starchy carbohydrates and low in protein.

This is representative of the challenges faced by intervention efforts of virtually any type of global issue. Interventions are very important in that they serve as a treatment of the consequences, however, they do not necessarily address the causes. As such, the factors that initially lead to the issue are not addressed, and the incidence is not likely to improve. While Edesia focuses on the intervention approach, there are organizations that focus on community development as a means of relieving the burden of malnutrition, such as Heifer International. Heifer donates livestock along with agricultural and values-based training to families in need in an effort of providing self-sufficiency. Those helped must agree share the livestock offspring, as well as the skills and knowledge of animal husbandry and agricultural training with other impoverished families. I particularly like organization because their initial work directly benefits families, but then it spreads and helps others without any additional resources. When Heifer is successful, they are preventing malnutrition from occurring by giving people the resources to be self-sufficient in their ability to provide food for their families.

In order to make a sustainable improvement in world hunger levels, all facets of malnutrition must be addressed. The 1.2 billion people living on less than $1.25 per day will always be at risk of hunger so long as they live in extreme poverty (UN 2013). The lack of sanitation and clean water that is common throughout the developing world results in the exposure to a variety of disease causing pathogens. Furthermore, the malnourished suffer from an increased susceptibility to the pathogens, which often results in an inability to work or go to school, making it incredibly difficult to escape extreme

poverty. Sustainable prevention of future malnutrition will likely be a result of the reduction of the issues of poverty, sanitation, and education. While the 90% success rates of RUTFs indicate that they are effective at saving lives (Kasparian 2014), their limitations must not be overlooked. There are still over 700 million other children and adults who do not have enough to eat. RUTFs have been shown to be a successful intervention, however they are not a sustainable approach to preventing malnutrition, as they are intended to treat the consequences, yet do not address the factors that initially lead to malnutrition. The decline in hunger rates since 1990 are instead attributable to changes in local infrastructure and food programs designed to improve access to resources and farming practices (UN 2013). The debate between intervention and prevention is essentially the distinction between either saving current lives, or preventing future deaths. Resources, however, are finite, and as long as they are being focused on treating malnutrition after it occurs, opportunities for prevention efforts will suffer.

As a result of this project, I now have a better understanding of the massive global problem that is malnutrition. It is much more complex than I previously believed, as well as intertwined with a variety of other global issues. For example, malnutrition is closely associated with infectious disease, poverty, education, economics, and perhaps even politics. Due to this complex relationship, I believe the only way that these issues will be completely solved with any lasting results will be through the alleviation of each aspect that is associated with malnutrition. In other words, the path to solving these global issues will not merely focus on the treating the consequences, but fixing the causes of these problems as well.

References

Contributors' names (Last edited date). *Title of resource*. Retrieved from http://Web address for OWL resource

Black MM (2003). *The Evidence Linking Zinc Deficiency with Children's Cognitive and Motor Functioning*. *J. Nutr.* **133** (5 Suppl 1): 1473S-6S.PMC 3137935. PMID 12730446.

The British Medical Journal , Vol. 2, No. 4673 (Jul. 29, 1950), p. 284 doi:10.1136/bmj.2.4673.267

Dewey KG, Arimond M (2012) *Lipid-Based Nutrient Supplements: How Can They Combat Child Malnutrition?* PLoS Med 9(9): e1001314. doi:10.1371/journal.pmed.1001314

Gardener, G. (2000, January 1). *Escaping Hunger, Escaping Excess*. Worldwatch Institute. Retrieved May 9, 2014, from http://www.worldwatch.org/node/488

Hartke, K. (2013, November 22). *Violent Behavior Linked to Nutritional Deficiencies*. Retrieved May 7, 2014, from http://www.westonaprice.org/press/violent-behavior-linked-to-nutritional-defiencies/pdf

Kasparian, M. (2014, March) Personal interview

Martorell, R. 1996. *Undernutrition During Pregnancy and Early Childhood and its Consequences for Behavioral Development*. Paper prepared for World Bank's Conference on Early Child Development: Investing in the Future, April 8 & 9, 1996. Retrieved on May 9, 2014

McGregor, S. (2007, January 1). *Developmental potential in the first 5 years for children in developing countries.* Retrieved May 7, 2014, from http://www.sciencedirect.com/science/article/pii/S0140673607600324

Obeid, O. *The Paradox of Nutrition-Related Diseases in the Arab Countries: The Need for Action*. International Journal of Environmental Research and Public Health, 3637-3671. Retrieved on May 9, 2014

Roncogliolo, M., Garrido, M., Walter, T., Peirano, P., & Lozoff, B. *Evidence of altered central nervous system development in infants with iron deficiency anemia at 6 mo: delayed maturation of auditory brainstem responses*. The American Journal of Clinical Nutrition, 68, 683-690. Retrieved May 12, 2014, from http://ajcn.nutrition.org/content/68/3/683.short

Scrimshaw, N. (1998, February 1). Malnutrition, brain development, learning, and behavior. *Malnutrition, brain development, learning, and behavior*. Retrieved May 7, 2014, from http://www.sciencedirect.com/science/article/pii/S027153179800027X

Stuart, T. (2009). *Waste: uncovering the global waste scandal*. London: Penguin.

Tabata, K. (2003). Inverted U-shaped fertility dynamics, the poverty trap and growth. *Economics Letters*, 241-248.

WHO., & UNICEF. (2009, January 1). WHO child growth standards and the identification of severe acute malnutrition in infants and children : joint statement by the World Health Organization and the United Nations Children's Fund. . Retrieved May 12, 2014, from https://extranet.who.int/iris/restricted/bitstream/10665/44129/1/9789241598163_eng.pdf

The Millennium Development Goals Report 2013. (2013). *www.un.org*. Retrieved from http://www.un.org/millenniumgoals/pdf/Goal_1_fs.pdf