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Introduction

With improved media coverage of both domestic and international events, public awareness of disasters is increasing. To the casual observer, it can seem that on any given night, the news will include at least one story about a disaster. Usually, these seem like far away events: a flood in another state, an earthquake in South America, a famine in southeast Asia, an evacuation/refugee crisis in Africa. Media coverage of these crises often motivates people to help in some way. An immediate need for safe food and drinking water is often perceived by the media and the public as a high priority for those affected by the disaster. Photographs and video tape of hungry children, or families standing in long lines for food often result in public outpourings of money and foodstuffs to various volunteer and government agencies. While this creates good feelings among the donors, it is important to ask whether food and water were in fact immediate needs for a large number of the people affected by the disaster (1). Is malnutrition in any of its various forms really a cause of morbidity and mortality in communities immediately after a disaster? This paper will examine the epidemiology of malnutrition in disaster affected communities.

There are many different types of events that may be called "disasters." In this paper, a broad definition will be used which includes both natural events (earthquakes, fires, floods, hurricanes, tornadoes, tidal waves, wildfires, structure fires, etc.) and technological or human-created events (war, terrorism, civil unrest, hazardous materials spills, etc.). Two main factors which determine whether malnutrition will be an important concern in a disaster are the type of disaster (from those listed above) and the location of the disaster (in a developed vs. developing nation, etc.) Malnutrition is most likely to occur during disasters that are in developing nations, and of a type that destroy sources of food, not just food distribution systems (1,2). In developed, industrialized nations, disasters may temporarily disrupt food distribution systems (e.g. roads may be destroyed, airports may be damaged, ports may be unusable, restaurants and grocery stores may be closed). However, in a developed nation that has the resources to quickly reestablish food distribution systems, this is unlikely to lead to the type of long term shortage of food necessary to cause clinical malnutrition. However, it should be noted that nutrition issues among people affected by disasters in the U.S. and other industrialized nations is a poorly studied topic. It is possible that disasters have important effects on people's eating habits (3). In contrast, in a developing nation, large parts of the population may already be nutritionally at risk. A disaster that either destroys food sources directly (such as a flood or hurricane that destroys crops and kills livestock) or separates a population from their normal food supply (such as a mass evacuation / refugee crisis), can cause serious, long-term food shortages. It will be more difficult for a nation with fewer resources to establish distribution systems for alternative food sources quickly (1,2). However, it should be noted that widespread malnutrition after a disaster is now the exception, rather than the rule. Most disasters do not cause the type of long term food shortages that lead to malnutrition (5).

Protein-Energy Malnutrition:

In disaster affected communities that are prone to malnutrition, there are two types of malnutrition that can develop: protein-energy malnutrition (PEM) and micronutrient malnutrition. In PEM, the body is taking in fewer calories than it is expending. When the deficiency is limited to protein intake, this is called kwashiorkor (from the language of Ghana, meaning "disease of the displaced child"(4)). A deficiency of total calories is called marasmus,

and is often accompanied by kwashiorkor (marasmic kwashiorkor (4)). The following will provide some perspective on just how little one needs to eat in order to see clinical malnutrition. The average adult male in a developed country in which the food supply is unrestricted consumes about 3000 kcal/day. In a situation in which food supply is limited, 2200-2500 kcal/day is a minimum level to maintain strength and immune system function with a normal activity level. After a disaster where heavy labor may be required, up to 3500 kcal/day may be needed. Once daily intake drops below this minimum value based on activity level, some malnutrition begins to occur. If the degree of deficiency is low, the person can survive for several months with only modest effects. The World Health Organization (WHO) defines 1800 kcal/day as a maintenance ration. Many relief agencies aim for this in emergency feeding operations that are temporary until people can resume their normal diets. After several months of feeding at this reduced level, the intake must be increased to the recovery ration of at least 2000 kcal/day. A survival ration is defined by WHO as 1500 kcal/day and, as the name implies, will probably keep someone alive for at least a few weeks, but is clearly inadequate for normal activity. 1400 kcal/day is only sufficient for total bed rest, and below 1300 kcal/day, rapid physical deterioration, starvation, and death occur (5). WHO has also defined minimum guidelines for children's total energy intake based on age and sex. Pregnant women require extra calories (about 2560 kcal/day) and lactating women require even more than that (about 2750 kcal/day) (5).

Protein-energy malnutrition is closely linked to mortality among refugee populations (2). Several recent disasters show that there is a relationship between disasters and malnutrition. For example, in Rwandan refugee camps in Eastern Zaire, incidence of malnutrition among children was between 18% and 23%, compared with a normal rate of 5% during non-emergency periods in stable, developing nations. Even higher rates of malnutrition among refugees was seen in Somalia in 1992, during which the incidence was reported as high as 80% (6). The next year in southern Sudan, rates were again as high as 81% (2). The United Nations recommends that emergency disaster relief programs provide at least 1900 kcal/day per person (2). Among Somali refugees in Ethiopia in 1989, the average daily intake among refugees was only 1400 kcal/day during a three-month period when both malnutrition and mortality were the highest. This again demonstrates the link between disasters, PEM, and mortality (2).

Micronutrient Malnutrition:

Micronutrient malnutrition is also common among the same populations. This can be caused both by a deficiency of micronutrients in the food being distributed in emergency relief programs, as well as disease states that reduce absorption of micronutrients. A common micronutrient deficiency in disasters is Vitamin A. Not only do relief diets often lack sufficient Vitamin A, but measles and diarrhea, both common in refugee camps, deplete the body's stores of Vitamin A. Vitamin A deficiency can be very serious in this situation because it is associated with blindness and increased mortality among refugee children (2). Vitamin C deficiency, or scurvy, is another type of malnutrition associated with long stays in refugee camps, with higher prevalence among women and the elderly (7). Iron-deficiency anemia is common in refugee camps among women and children (2). Pellagra, a deficiency of Niacin, can also be seen when emergency food supplies are deficient in this nutrient (8).

Prevention:

Prevention of protein-energy malnutrition seems fairly straightforward—simply increase the amount of food being distributed. Obviously in a disaster in which community infrastructure is damaged this is easier said than done. Even if enough food is being delivered to the disaster-affected area, the next challenge is to make sure that each individual is getting enough. Groups that have been shown to be socially vulnerable, such as families headed by women, unaccompanied children, and the elderly need special attention from relief workers to make sure they are getting their fair share (8). Systems need to be established to identify malnourished individuals early. Anthropometry is one of the most widely used measures for detecting PEM. Standard measurements such as height-to-weight ratio or upper arm circumference are often used. Usually malnutrition is identified in an individual at some arbitrary cutoff point, such as 70-80% of the mean reference value on an anthropometric test (5). Such individuals then need to be the focus of special feeding programs to rehabilitate them (2). In some situations, where food supplies have been reduced, but not completely eliminated by the disaster, disaster relief agencies will provide a supplementary feeding program, in which about 400-600 kcal/person/day are provided. However, workers must carefully monitor for protein-energy malnutrition, since it may be less apparent if a family is not meeting the 1900 kcal/person/day goal than it would be if families were totally dependant on relief programs. In particular, it has been shown that when the total food provided to a family is inadequate, often it is the children who are undernourished (2).

Prevention efforts for micronutrient malnutrition are twofold. First, the food being distributed must contain adequate micronutrients. Situations in which there is widespread micronutrient malnutrition often can be traced back to a lack of nutrients in the relief programs' menus (2). Secondly, steps must be taken to control diseases that promote micronutrient deficiency. Because measles can deplete Vitamin A stores in children, measles is the highest priority among vaccinations for children living in congregate care after a disaster. Diarrhea is a common problem after disasters and can cause micronutrient malabsorption. The primary prevention for diarrhea is to assure safety of drinking water and sanitation systems. It is more important to supply large amounts of relatively clean water to people affected by a disaster than to provide small amounts of pure microbe-free water. In the latter case, families may supplement the small amount of safe water with grossly contaminated water from other sources. The UNHCR recommends 15 liters/person/day be provided (2). The second way to prevent diarrhea is to assure adequate sanitation. The first step in the emergency phase is to establish designated areas for defecation that are away from food preparation and eating areas. Later, the ideal system for those in congregate care is for each family to have their own latrine, hygiene education, and adequate soap (2). Finally, it is important to institute a system for monitoring health problems of the population. Many of these, including crude mortality, can help identify micronutrient malnutrition among the population (2).

Conclusion:

Malnutrition is an important threat to the public health in certain disasters. Both protein-energy malnutrition and micronutrient malnutrition can be seen in significant parts of a population when they are separated from their normal food supply by the disaster. The fact that malnutrition exists even during massive disaster relief efforts suggests that alterations are needed in the way such relief efforts are carried out. Efforts must be made to supply sufficient quantities of food throughout the disaster-affected population, and this food must contain adequate micronutrients. Many times, public outpourings of canned or dry foods in countries distant from the disaster site

turn out to be a waste. Besides the difficulty in physically moving large amounts of food across oceans, the food may lack important nutrients, and be so different from the foods normally encountered as to be unusable. Further, since the true road to long term recovery from a disaster is to reestablish normal food supplies, injecting large amounts of free food into an area may actually cripple local food providers (5). Finally, as discussed above, large amounts of food are not needed in many disasters, and the influx of unneeded donations is often called, "the second disaster."(1,2). For these reasons, the best way that people can help after a disaster is to donate money. This money can be used in the disaster-affected area to purchase food from local sources, helping to reestablish normal food supplies. This will also allow relief workers maximum flexibility to insure that the food provided contains appropriate nutrients (5). Further study in the area of disaster malnutrition is needed to further reduce unnecessary morbidity and mortality from this secondary effect of disasters.

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