Post-Disaster Food & Nutrition Security: The Disaster Food Security Framework (DFSF)

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The United States Department of Agriculture (USDA) defines food security as "access by all people at all times to enough food for an active, healthy life" (1). Following a disaster, communities and individual households may experience a disruption in food security. Disaster studies have measured food insecurity primarily following events such as hurricanes and during the COVID-19 pandemic in the United States. Individual households are often most heavily affected. This is clear in studies of households displaced by Hurricanes Katrina and Harvey, in which participants were asked whether they had enough money for food the family needed.

Two years after hurricane Katrina, 30% of the participants indicated that they did not have enough money for food their family needed. The need remained three and a half years after Katrina as 21% of participants reported not having enough money for food. At the five-year mark, 23% of participants continued to struggle with obtaining the food their family needed (2). Similar results were observed in Texas following Hurricane Harvey in 2017. One survey of rural and urban households in disaster affected counties showed that 42% of participants were at-risk for food insecurity and a study of displaced households found 54% were experiencing food insecurity (3,4).

The USDA uses the Household Food Security Scale Module (HFSSM) to measure and monitor food insecurity in the US (5). The HFSSM is an 18-item survey that focuses primarily on financial resources for food for the household and provides food security information about children and households. Shorter forms are available, including a 10-item survey for adult food security and a 6-item short version of the 18-item which provides a validate estimate of household food security but does not parse out the most food insecure groups or provide a child food security measurement. In addition, researchers have developed and validated the Hunger Vital Signs, a two-item screener for food insecurity risk (6).

Regardless of the survey version, there are limitations to the USDA metrics. The USDA metrics focus mainly on financial resources for food and the health consequence or the level of food insecurity. Levels of food insecurity include not being able to afford balanced meals or being hungry because there was not enough to eat. In a post-disaster setting, there are barriers beyond economic access to food. To effectively address food insecurity, it is important to comprehensively measure barriers to food access.

By only measuring financial resources for food, the data are well positioned to support monetary interventions. In a disaster context, monetary interventions are insufficient.

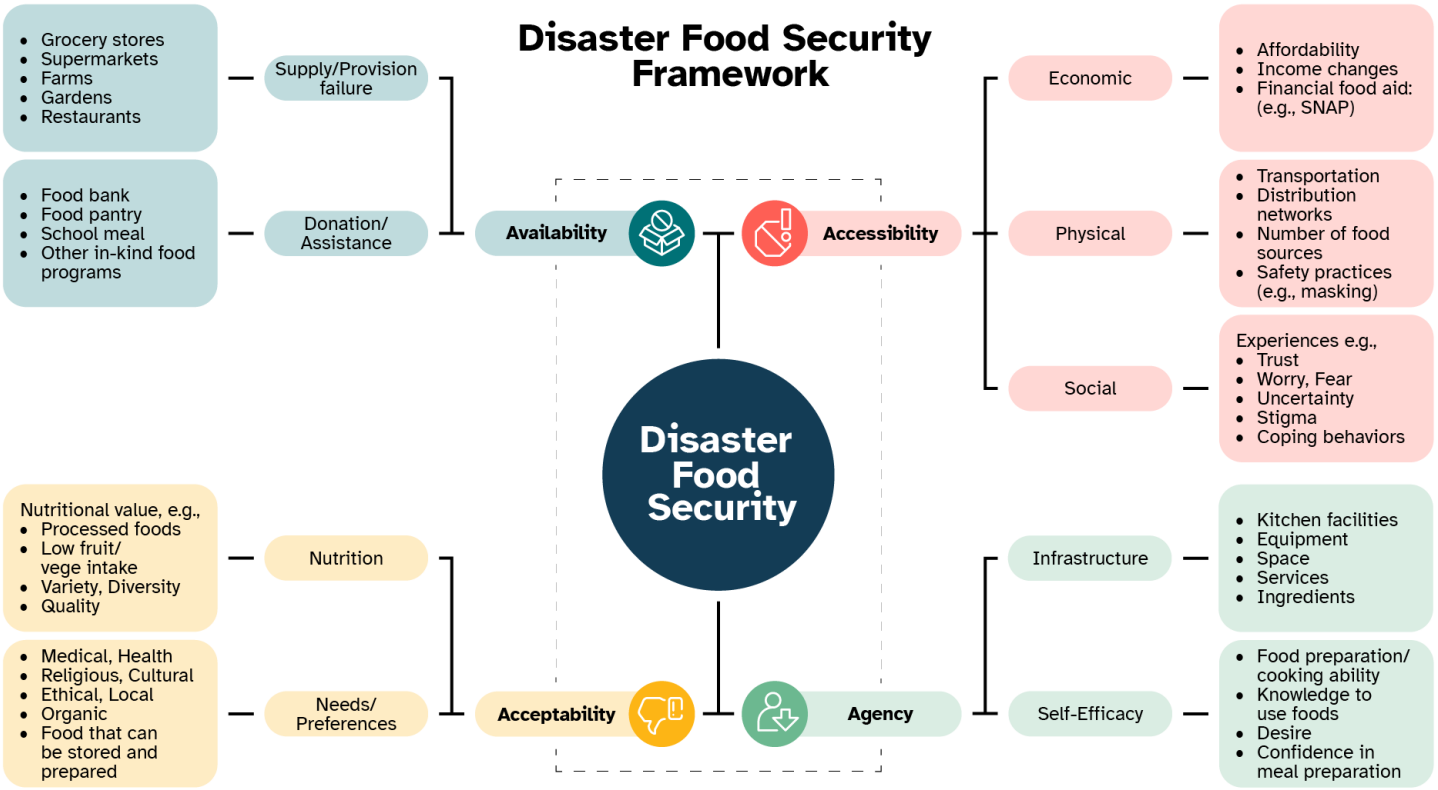
Disasters are increasing in frequency and severity in the United States (US) due to global environmental change and increased investment in assets and property in highly vulnerable areas that put infrastructure at risk (7–13). Between 2015 and 2020, fifteen or more billion-dollar weather-related disaster events have impacted the US each year; with 91 distinct events totaling more than $631 billion (14). While research and media attention focus on impacts of these large-scale disasters, many smaller-scale weather-related emergencies and disasters also affect communities. Since 2011, 90% of US counties experienced a federal disaster declaration (excluding COVID-19 which was declared for all counties in 2020), and 700 counties experienced five or more disasters (15).

Historically marginalized groups were disproportionately impacted by the results of climate related disasters (16). These disparities are due in part to policies that historically position these groups in riskier areas with fewer economic, social, and natural resources. The disparities are deepened when a disaster strikes due to our federal emergency response systems. Recent analysis of Federal Emergency Management Agency (FEMA) assistance by sociologists Junia Howell and James Elliott shows that the more assistance a county receives following a disaster declaration, the more whites get richer, and Blacks get poorer (17,18).

Four Key Domains of the Disaster Food Security Framework

To address the need for more comprehensive metrics, the Disaster Food Security Framework (DFSF) and associated metric were developed. The DFSF (Figure 1) is a validated framework that describes the full range of barriers to food and nutrition security that households may experience during or after a disaster (19).

Figure 1: Disaster Food Security Framework



The four key domains of the DFSF are availability, accessibility, acceptability, and agency. These domains were developed based on data collected during disaster field studies investigating food access, the collective input of an expert science advisory group, and existing literature on food security. Through the validation process, a definition of disaster food security was developed:

Disaster food security is when "all people have physical, social, and economic access to sufficient, safe, and nutritious food that can be prepared and stored to meet their dietary needs and food preferences while preparing for, coping with, and recovering from a disaster."

This definition was mobilized to develop a framework specific to the disaster context. Detailed information on the validation process can be accessed here, here, and here.

Availability

Availability refers to the supply and provision of food in the local food environment including retail, emergency nutrition response, and charitable food sources. Within the availability domain, disruption can occur to the food supply when critical infrastructure is damaged. Availability can be disrupted by changes in supply and demand. Changes in supply occur due to disaster damage to local infrastructure affecting the local supply chain. For example, during Hurricane Florence (2018), the local bread storage facility was flooded beyond repair resulting in a bread shortage in one community for many months while the independent contractors that deliver bread navigated ongoing road closures and traveled longer distances to move bread into the community.

Figure 2 shows the bread aisle at a grocery store in New Bern, North Carolina in the week following Hurricane Florence. Only rolls and buns of various brands were available. All sliced bread is out of stock. Bread was sold out as quickly as stores could stock the shelves. Other disruptions included damage to roads, trucking delays due to disaster declarations limiting the movement of goods, and closure of essential services due to power outages and building damage.

Figure 2. Bread aisle in the week following Hurricane Florence (2018) in Eastern North Carolina

Changes in consumer demand also influence food availability post-disaster. The types of foods that can be used in a post-disaster setting are limited when households are coping with disruptions such as loss of electricity and/or damages to homes. Residents affected by Hurricane Florence, in the days immediately following the storm, reported that it took many hours to find dinner even if grocery stores were fully stocked with meat and produce (this is detailed in the acceptability section).

Following a disaster, ready-to-eat or ready-to-heat foods are needed to support households navigating the disruption. This is especially important for those who have been displaced or whose households have been heavily affected. Some may be living without a fully functioning kitchen for days, weeks, months, or even years depending on the circumstance. Staying with friends, in a hotel, on the second floor of a damaged home, or in a mobile home all present very different challenges for access to food storage and preparation facilities. Research shows that for displaced households, especially those with lower income, it can take many years to achieve secure and stable housing (20,21). Households that may not have any damage, but are helping others in the community, will exhibit a shift in their purchasing behaviors as they buy larger quantities and different types of food than usual. They may also begin shopping at different stores depending on factors like store closures.

COVID-19 Adaptation to Disruption to Availability

The COVID-19 pandemic also provides examples of adaptation to food availability disruption. Almost overnight, consumer demand and purchasing habits shifted and the supply chain slowed as it adapted to these changes. Consumer buying behaviors changed dramatically as households shopped for different quantities of food and increased purchases of non-perishable items to be able to quarantine and eat primarily at home amid fear and uncertainty. They moved away from obtaining food through restaurants and began relying almost entirely on grocery stores to meet their food needs (22, 23, 24).

As the pandemic went on, food production slowed as farms and food processing coped with the spreading pandemic and changing policy landscape. Workers in the food supply chain coped with increased risk due to working outside the home where conditions often contributed to the risk (25). In response to the risk posed by COVID-19, changes in consumer demand, and stress on the supply chain, the food system mobilized increased direct to consumer models. In the charitable food assistance landscape, food banks and food pantries also had a difficult time keeping up with the almost overnight 61% increase in demand for services (26).

Direct to consumer models include farm to consumer models, small businesses offering locally produced goods through delivery, and little free pantries emerged in neighborhoods around the US to help families in need (27–31). To bolster community resilience to disasters, it is important to take lessons learned from these adaptations and consider what approaches might be needed in future disruptions, what can be sustained between events to better support communities and households, and what additional adaptations are needed to further prepare for disaster disruptions.

Accessibility

Accessibility refers to *economic, physical, and social* access to food. Economic accessibility to food can be disrupted in a disaster setting when additional financial resources are expended on preparedness supplies, evacuation, or to repair damaged property. Interviews with families affected by Hurricane Florence (2018) in North Carolina showed that the expense of evacuating to a safe area for a few days can push low-income families into experiencing food insecurity in the post-disaster setting (32).

Emergency feeding becomes important during this time. However, accessing emergency feeding locations can also be a challenge. Emergency feeding is offered in a variety of ways:

1. Mass feeding, provided through pick up, sending an emergency response vehicle into neighborhoods to serve, and by providing hot prepared food to local organizations to carry out the distribution.
2. Non-perishable food distribution, carried out by local government through points of dispensing or community-based organizations.
3. Through outreach into communities, carried out by a wide range of agencies and community-based organizations and often emergent following an event in response to observed needs (32).

Physical accessibility can be disrupted following disasters when infrastructure or personal property is damaged. Damage to roads and essential buildings and services, such as grocery stores, and lack of electricity can reduce physical accessibility. Further, if a family experiences damage to their personal vehicle or public transportation routes, getting to an open store might be significantly more challenging in a post-disaster setting. The same barriers present a challenge to families attempting to access emergency feeding.

Social accessibility can be impacted when there is a change in life circumstances and a family experiences fear, stigma, or disruption to social networks (33). Following disasters, especially those with significant housing damage and displacement, social networks can be disrupted (34-36). For families that previously relied on their social networks for food sharing or related support, this disruption can impact food accessibility.

Figure 3 shows an example of "Meals Ready to Eat" (MRE) used in post-disaster settings for non-perishable food distribution.

Use of emergency feeding may also carry stigma or other social barriers (37).

Adapting to Food Environment Disruption Following Hurricane Florence in 2018

In the days immediately following Hurricane Florence, families of school children in a heavily flooded area of eastern North Carolina were on social media sharing their food needs. A local school principal saw these messages and mobilized teachers, the American Red Cross, volunteers, and donors from across the country to provide prepared meals. Using prepared food provided by the American Red Cross emergency nutrition response, teachers worked in the school building cafeteria with no power to serve meals then loaded the meals into their cars and drove out in the community to deliver the meals twice a day to help families with their food needs. The food needs of school families persisted.

The school principal repurposed a small room in the school and opened a food pantry for student's families. The pantry remained open for a full year after the storm to support families during recovery (32). Emergent community-based response to observed needs are essential post-disaster. While there are major federal and state level efforts to support affected communities, it is the local organizations that have existing relationships with families that are best positioned to meet their community's needs. When developing disaster preparedness and response plans, thinking about how federal and state level resources can best support local emergent efforts will help serve those in the community with food needs.

Acceptability

Acceptability refers to nutrition as well as dietary needs and preferences. These can be based on medical diets, religious, cultural, or ethical beliefs, personal preferences, or situational. Acceptability becomes a challenge when accessibility and availability are disrupted, and food options are limited in the community. Emergency feeding operations do not offer special meals for dietary restrictions. While a short-term interruption to sufficient, nutritional calories may be acceptable in the immediate post-disaster environment, it is important that emergency plans and response organizations are working to quickly restore acceptable foods (38).

One example of a dietary challenge with emergency feeding is following medical dietary restrictions. Following Hurricane Florence, during an interview, two sisters, both diabetic, shared their struggles with making the lunch that day work for their diets. They were sitting with a friend that wasn't diabetic and discussed how they swapped foods to put together three meals as best they could to meet their specific dietary needs (32). The meal served that day (Figure 4) was pulled pork with two snacks and dessert. During COVID, there were also challenges with obtaining specific foods amid supply chain disruptions and major shifts in shopping behaviors such as going to stores less often or increased online shopping and disruption to community food programs such as school meals with the closure of schools or other community-based meal programs.

Figure 4. Lunch meal provided through mass feeding in the days following Hurricane Florence (2018) in North Carolina

In addition to dietary needs, acceptable foods include foods that can be used by households coping with major disruptions. For families that sustain home damage, they may not have a working kitchen to store and prepare food. Families that evacuated or are displaced, due to home or neighborhood damage, might be staying with family or friends, in a hotel, in a shelter, or in other temporary housing situations. This could last for weeks, months, or even years. In these cases, kitchen facilities might be limited or shared which can create challenges. During interviews conducted in the days following Hurricane Florence, individuals described how it took several hours to find dinner the previous night.

One woman said that it took her four hours to find dinner and she got lucky that a local grocery store was putting out rotisserie chicken when she arrived, and she was able to buy one before they were all sold (32). Hearing these stories and seeing the grocery shelves full of meat and produce in the community on these same days, highlights the importance of considering appropriate foods. Figure 5 shows the grocery shelf of a local store on the same day as the interview with the individual who looked for dinner for four hours.

Figure 5. Grocery shelves of a local grocery-only store in the week following Hurricane Florence (2018) in North Carolina

For households with disaster impacts to their homes, prepared meals and ready-to-eat or ready-to-heat foods are essential since they may not have food storage and facilities in which to prepare a meal.

Response workers who were interviewed expressed that there was also an element of competing priorities and time. One emergency response worker described how she worked 14 hours delivering food and supplies and checking on people and after that, maybe she'd heat up a cup-a-noodle before falling into bed, or maybe she was just going to sleep (32).

The post-disaster context is emotionally exhausting and even individuals without direct disaster losses are coping with increased stress and competing priorities with accessing nutritional food.

Pop-up Food Hub Adapts to Address Gaps in Produce for Community Nutrition Programs During COVID-19

FRESHFARM, located in Washington, DC, operates Pop-up Food Hubs, an example of a disaster resilient solution for increasing access to nutritious foods during times of disruption. Pop-up Food Hubs work with local, small scale community programs to aggregate fresh food purchasing from farms. They are low infrastructure because they rely on existing farmers markets in the region. By taking small orders from many community-based programs that would be too small for a farm order on their own, and placing a single large order with local farms, they increase access to affordable and nutritious foods while also increasing individual purchasing power. The farmers market infrastructure is used to accept wholesale purchase deliveries from farms.

At the farmers market, FRESHFARM staff re-package the wholesale goods into the individual orders for each community-based program client, and clients come to pick up at the farmers' market or FRESHFARM delivers. This is a disaster resilient approach because there is limited infrastructure, such as warehouse storage, leaving minimal opportunity for damage and disruption. It is also very responsive to frequent shifts in supply and demand. This model existed prior to the COVID-19 pandemic and because of the outdoor, low infrastructure approach, it was nimbly able to adapt to meeting evolving community food needs throughout the pandemic.

This model could be adapted to other communities to bolster resilience.

Agency

Agency refers to individual self-efficacy with acquiring food and preparing meals amid disruption to infrastructure. Agency can be affected in a disaster context when an individual's situation changes and there are new circumstances to navigate. An individual needs to have skills to adapt and navigate the new context to meet their needs and feel confident in their abilities. Families that have experienced repeated disaster or other types of stressors, may have developed these skills. Others, who have not had similar experiences, may find navigating the post-disaster context very challenging. During interviews conducted in Vermont, about food access during the COVID-19 pandemic, one individual described how navigating COVID-19 disruptions to the local food system was going okay because they were a very 'flexible and resourceful cook' and had the skills to take something like rice-a-roni and modify it to make a meal. Another individual described their agency with navigating disruption to infrastructure following Hurricane Florence and how they used the gas grill for meals because the electricity was out for an extended period.

A Disaster-Resilient Adaptation Idea for Addressing Agency

Food prescription programs are being piloted in the US. These programs use Medicaid or other federal funding to address food and housing insecurity. One organization that is participating in a pilot of this type is Project Bread in Boston, Massachusetts. Through the Food Security is Healthcare pilot program, they are addressing barriers to food security, including providing kitchen appliances and equipment for families without the necessary household supplies to store and prepare foods. In the pilot, 82% of households had appliance or equipment needs (39). This program could be adapted to mitigate food insecurity in disasters or other types of disruptions by providing equipment, appliances, and training for cooking during periods of public utility disruption.

Conclusion

In a post-disaster setting, food security is about much more than whether households have enough money for food. There are disruptions to the environment that create physical, social, and economic barriers to food accessibility; supply chain and nutrition assistance barriers to food availability; gaps in nutritionally, culturally, or medically acceptable foods; and challenges that can limit agency or self-efficacy. The Disaster Food Security Scale (DFSS) is a tool for thinking about food security post-disaster to develop preparedness and response plans and think about recovery. The associated Disaster Food Security Scale (coming 2023) is a tool for monitoring food and nutrition security at the household level. The DFSS captures data about the types of food security disruption a household is experiencing. DFSS data is immediately actionable for addressing a broad range of barriers to food and nutrition security and can serve as a sensor for the types of disruption to community food and nutrition security in a disaster context.

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Thanks for reading!

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