

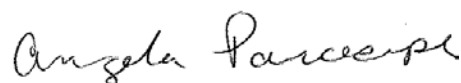
**INFANT AND YOUNG CHILD FEEDING PRACTICES
IN THE CONTEXT OF NATURAL DISASTERS: A SYSTEMATIC REVIEW**

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Abstract

The Operational Guidance on Infant Young Child Feeding in Emergencies (IYCF-E) includes evidence-based recommendations for all emergency settings. A systematic review on infant feeding in the context of disasters was conducted to identify challenges unique to disasters and areas for future research. I searched Pubmed and Web of Science in May 2019 using the terms “breastfeeding” and “natural disasters”. Seven articles met eligibility criteria. Common themes identified across studies include low adherence to recommended IYCF practices, stress among mothers’, and vulnerability of IYCF to diarrhea and malnutrition. Further research is needed to better understand breastfeeding rates before and after a disaster event, the impact of caregiver stress on feeding practices, barriers to implementing global ICYF-E guidelines, and complementary feeding practices.

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Introduction

The World Health Organization recommends exclusive breastfeeding for the first six months of life, and continued breastfeeding with complementary foods up to two years or beyond.¹ Breastfeeding provides infants with numerous health benefits including the promotion of sensory and cognitive development.^{1,2} Breastmilk contains secretory IgA antibodies and other bioactive compounds, protecting infants from infections including diarrhea and respiratory tract infections.³ Colostrum is the first stage of breastmilk produced during the first few days after birth and is a natural immune booster.^{3,4} Breastmilk is easier to digest than breastmilk substitutes, such as infant formula, and reduces infants' risk of sudden infant death syndrome.^{5,6} Evidence suggests breastmilk also protects against chronic diseases including overweight and diabetes.² In addition to improved infant health outcomes, for women, breastfeeding reduces the lifetime risk of breast cancer and cardiovascular disease, and is associated with a decreased risk of ovarian cancer and type II diabetes.^{2,7} Breastfeeding also contributes to elevated levels of oxytocin that enhance maternal-infant bonding and attachment, which may protect against postnatal depression and supports perinatal mental health.⁸

Despite the known risks of not breastfeeding as recommended by the WHO and UNICEF, there are many social and structural barriers to following these recommendations at multiple levels of the socioecological framework.^{9,10} For example, mothers with lactation difficulties report challenges including sore nipples, engorgement, infections, and mastitis.¹¹ Qualitative

research has found that while health professionals including obstetricians, pediatricians, obstetric and pediatric residents, nurses, midwives, and lactation consultants recognized the risks of formula feeding, they often lacked current knowledge and gaps existed between knowledge and actual clinical practice.¹² In many cultures, grandmothers may have a strong influence on mothers' breastfeeding decisions and feeding outcomes.¹³ Work environments can influence breastfeeding initiation, exclusivity, and duration through availability of policies that provide maternity leave and mandated breastfeeding breaks.¹⁴ Paid leave and duration of leave are associated with better breastfeeding outcomes.¹⁴ However mothers do not have equitable access to supportive policies and services.¹⁴ The marketing of breastmilk substitutes and donation of free samples by formula companies undermines breastfeeding by reducing mother's confidence in their breastmilk.^{13,15} Supportive policies, including the 10 Steps to Successful Breastfeeding through the Baby-Friendly Hospital Initiative, improve breastfeeding rates.¹⁵ Unfortunately, the Baby-Friendly Hospital Initiative has reached a majority of births in only 24 countries.¹⁶

Understanding breastfeeding barriers and facilitators prior to a shock is important to IYCF-E response, recovery, and preparedness. Following a natural disaster, existing barriers may be exacerbated and joined by additional challenges. Natural disasters such as tsunamis, earthquakes, floods, storms, droughts, and wildfires have profound impacts on population health, and evidence suggests that climate change is contributing to the increased frequency and severity of extreme weather events.¹⁷ In emergency settings including natural disasters, breastfeeding becomes even more crucial as safe conditions for formula feeding are compromised via food insecurity, contaminated water, and unsanitary living conditions.¹⁸

Formula-fed infants are especially vulnerable during emergencies.¹⁹ Food insecurity can create barriers to accessing a sustainable supply of infant formula.^{18,19} Formula-fed infants may be exposed to infectious agents via contaminated water used to reconstitute infant formula and/or clean bottles and nipples.¹⁹ Unsolicited donation of breast milk substitutes in emergency settings also compromises breastfeeding rates, despite the known benefits of breastfeeding.¹⁹ Human milk contains immunological factors including oligosaccharides, glycoconjugates, and bacterial microbiota that protect against diarrhea, pneumonia, and respiratory tract infections – common morbidities among infants and young children in emergencies.²⁰ Immunological protection is unique to human milk and absent in formula.²⁰ In emergencies, the risk of death due to pneumonia is fourteen times higher among formula fed infants, and the risk of death from diarrhea is ten times higher among formula fed infants.²¹ Emergencies increase the vulnerability of infant and young children’s health, especially those who are formula fed.¹⁹ Thus supporting breastfeeding in the context of natural disasters is of critical importance.

Global recommendations for infant and young child feeding in emergencies are found in the Operational Guidance on Infant and Young Child Feeding in Emergencies (OG-IFE) and the Infant and Young Child Feeding Toolkit.^{22,23} The Save the Children Toolkit provides tools to support implementation of the OG-IFE, and the 71st World Health Assembly on IYCF requested all member states to develop tools for training, monitoring, advocacy and preparedness for the implementation of the OG-IFE.^{23,24} The three basic core principles of recommendations for IYCF-E are: 1) supporting breastfeeding, including early initiation of breastfeeding, exclusive breastfeeding for the first six months of life, and continued breastfeeding until two years of age; 2) supporting non-breastfed infants through enabling access to breastfeeding or human

milk wherever possible and through the provision of support and resources for formula feeding wherever breastfeeding is not possible; and 3) supporting complementary feeding through ensuring that older infants and young children have access to appropriate complementary foods.¹⁹

Greater understanding is needed of infant and young child feeding practices in natural disaster settings. Such research can inform medical, humanitarian, and government communities' preparedness and response to better support optimal infant and young child feeding practices following a natural disaster. To our knowledge, no systematic review has been published examining infant and young child feeding practices in the context of a natural disaster. Natural disasters are unique to other emergencies in that serious environmental and ecosystem changes may occur in a short period of time. They are often unpredictable and can occur anywhere. A systematic review can contribute to infant and young child feeding guidance by highlighting challenges that may be unique to natural disasters. In this review, I explore infant and young child feeding in the context of natural disasters including breastfeeding, formula-feeding, and complementary feeding practices, and examine the consequences on infant physical health. The purpose of this review is to tease apart infant and young child feeding challenges unique to natural disasters and provide a roadmap for further research.

Methods

A systematic review was conducted to identify non-intervention studies which examined infant and young child feeding practices in the context of a natural disaster.²⁵ The first phase of the search was conducted in May 2019. PubMed and Web of Science were searched using the terms "breastfeeding and natural disasters". No language or date restrictions were used in the

search. The preliminary search yielded 33 results. The reference lists of relevant articles were screened to identify additional potential sources.

A second search was conducted in which search terms were changed to: ("breast feeding"[MeSH Terms] OR ("breast"[All Fields] AND "feeding"[All Fields]) OR "breast feeding"[All Fields] OR "breastfeeding"[All Fields]) OR "infant feeding"[All Fields] AND ("natural disasters"[MeSH Terms] OR ("natural"[All Fields] AND "disasters"[All Fields]) OR "natural disasters"[All Fields]) OR "hurricane"[All Fields] OR "earthquake"[All Fields] OR "flood"[All Fields] OR "typhoon"[All Fields]) on PubMed. This search strategy yielded 1,825 results after filtering for full-text articles available in English, articles published after 2009, and specifying the species (human). The first 10 pages of results were reviewed. No additional articles that met inclusion criteria were identified through this method.

Inclusion Criteria

Published articles in peer-reviewed journals were included in the review if they met the following criteria: 1) full-text peer-reviewed article available in English 2) original research and 3) non-intervention study design. The decision was made to exclude intervention studies in order to learn more about the context of infant feeding in emergency settings in the absence of an intervention. There were no restrictions on country or type of disaster. Journal articles that did not focus on infant and young child feeding in the context of natural disasters, were intervention studies (including randomized controlled trials and quasi-experimental trials), or did not contain original research (including descriptive case studies) were excluded.

Analytical Strategy

Twenty full-text articles were assessed for eligibility through a structured abstraction form to extract key information from each article including research question, study design, sample size, and results. The abstraction form was adapted using Cochrane Methods' suggested review sheet of meta-analyses and systematic reviews on patient-reported outcomes.²⁶

Results

The search terms “breastfeeding and natural disasters” identified 33 results in PubMed and 17 results in Web of Science. After removing duplicates and articles that did not meet inclusion criteria, 16 articles remained. Four additional articles were identified after screening the references of these 16 articles. Full-text screening was conducted on these 20 articles, and 7 articles met inclusion criteria (see Figure 1). The articles that met eligibility criteria described 7 individual natural disaster events in 7 different countries.

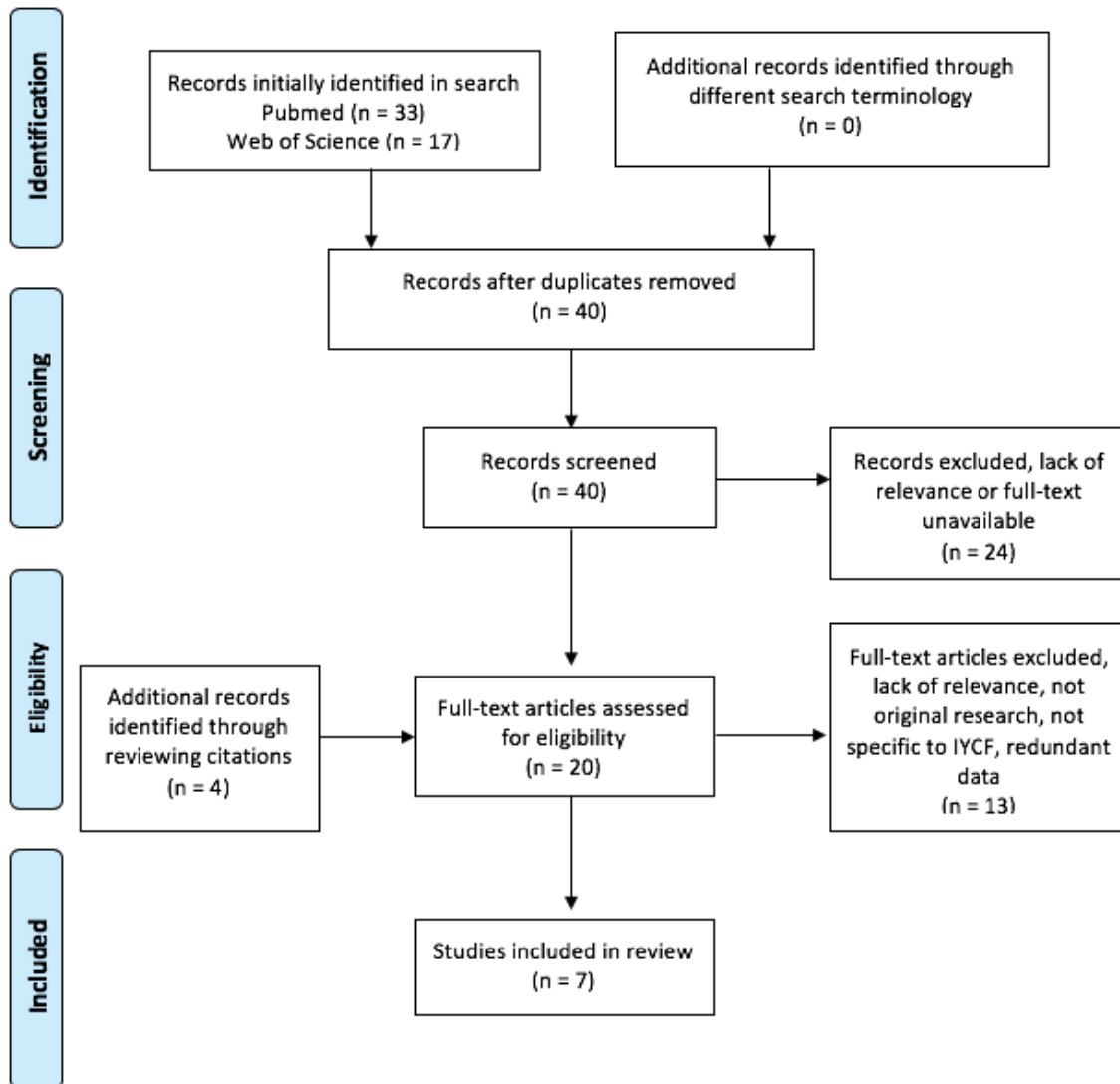


Figure 1. Study Selection Flow Chart

The identified literature consisted of five mixed-methods studies that used surveys, questionnaires, interviews, focus group discussions, and participant observation. Two studies utilized a survey as their only method of data collection. All seven studies were published in peer-reviewed journals specific to maternal and child health and/or nutrition. Five of the articles discussed disasters occurring in Asia, one in North America, and one in the Caribbean. The most frequently documented disaster-type was earthquake (n=4). Tsunamis, wildfires, and

flooding were each responsible for one included study. The study conducted in Japan focused on the impact of the nuclear accident resulting from an earthquake. Study characteristics and key findings are illustrated in Table 1. The components these studies assessed are represented in Figure 2.

Author	Year	Country	Disaster Type	Study Design	Sample Size	Research Question	Summary of Findings
Adhisivam et al.	2006	India	Tsunami	Mixed methods; Questionnaire-guided interviews, in-depth interviews, focus group discussions	100 mothers; 176 children	What are the problems related to feeding of children post-tsunami in four villages in Pondicherry?	<ul style="list-style-type: none"> • Over two thirds of mothers felt breastfeeding was impacted by the tsunami, however only 5% reported their feeding patterns changing. • Nearly three quarters of mothers received donated breast milk substitutes. Among children with diarrhea, 73% had consumed BMS. • Many mothers reported stress impeding their milk production.
DeYoung et al.	2018	Canada	Wildfire	Mixed methods; Survey with categorical and open-ended questions	115 caregivers	In what ways did the Fort McMurray wildfire evacuation affect infant feeding?	<ul style="list-style-type: none"> • Evacuation from the wildfire was associated with a decrease in breastfeeding and increase in formula use. • The odds of exclusive breastfeeding were higher before the evaluation compared to after (OR 1.96). • Caregivers reported various sources of stress following the wildfire including living conditions, food security, and decreasing milk supply. Several respondents reported that breastfeeding provided comfort amidst the stress.

Dornemann et al.	2018	Haiti	Earthquake	Mixed methods; Household survey, in-depth interviews, focus group discussions	1131 mothers	What are the attitudes, practices and beliefs of breastfeeding in post-earthquake Haiti?	<ul style="list-style-type: none"> • There was a wide variety of perceptions regarding how the earthquake impacted feeding practices. • Breastfeeding women reported a number of stressors including finances, missing family members, climate, and living conditions. • Many mothers believed the quality of their milk had been compromised. There was also the common belief that breastmilk is an unstable and dynamic substance impacted by 'bad blood'.
Goudet et al.	2011	Bangladesh	Flood	Mixed methods; participant observation, semi-structure interviews, household questionnaire, anthropometric measurements	18 mothers; 5 CHWs; 55 children	What is the impact of flooding on IYC's feeding practices and what are the coping strategies developed by caregivers?	<ul style="list-style-type: none"> • Complementary feeding practices worsen during times of flooding; many infants and young children eat the same food as the rest of their family. • Food insecurity is a contributing challenge to IYCF for many mothers, who believe their milk is insufficient due to their underweight status.

							<ul style="list-style-type: none"> • Mothers reported more morbidity episodes among their children during times of flooding.
Hipgrave et al.	2011	Indonesia	Earthquake	Survey	831 caregivers	What was the magnitude of BMS distribution after the earthquake, its impact on feeding practices and the association between consumption of infant formula and diarrhea among infants and young children?	<ul style="list-style-type: none"> • 89% of caregivers received breast milk substitutes following the earthquake. • The percentage of infants who had consumed formula increased from 32% to 43% after the earthquake (P<0.001). • The incidence of diarrhea among children 12-23 months was five times higher after the earthquake compared to before. • The one-week incidence of diarrhea among those who received donated infant formula was higher compared to those who did not.
Ishii et al.	2016	Japan	Earthquake	Survey	8366 mothers	What factors are associated with infant feeding methods after the Fukushima nuclear power plant accident?	<ul style="list-style-type: none"> • 20.3% of mothers opted to formula-feed out of concerns related to radioactive contamination of breastmilk and the nuclear power plant accident following the earthquake.

							<ul style="list-style-type: none"> • The breastfeeding rate in the survey was lower than expected compared to national data. • Use of formula was higher among women whose antenatal care had been interrupted and among those who lived in the evacuation area.
Sun et al.	2013	China	Earthquake	Mixed methods; survey, interviews	1254 children	What is the nutritional status and feeding practices of young children in the worst affected areas of China two years after the Wenchuan Earthquake?	<ul style="list-style-type: none"> • Rates of having ever-breastfed were high at 90.9%. • The requirements for minimum meal frequency were met by 39% of breastfed and 7.6% of non-breastfed children 6-23 months of age. • Many children living in areas impacted by the earthquake have high rates of malnutrition including anemia. The prevalence of anemia in the earthquake affected area was twice as high as the national figure in rural areas.

Table 1. Impact of disasters on feeding practices and IYC health

Author	Breastfeeding	Breastmilk Substitutes and/or Complementary Feeding Practices	Self-Reported Stress and Anxiety among Mothers	Infant and Young Child Physical Health
Adhisivam et al.	X	X	X	X
DeYoung et al.	X	X	X	
Dornemann et al.	X	X	X	
Goudet et al.	X	X		X
Hipgrave et al.	X	X	X	X
Ishii et al.	X	X	X	
Sun et al.	X	X		X

Table 2. Components Assessed in Included Studies

Breastfeeding Beliefs, Perceptions, and Practices

When breastfeeding is not possible or desired (e.g., in the cases of maternal death; exclusively formula fed prior to the shock; HIV or other infectious disease; maternal trauma), the World Health Organization and UNICEF recommend the initiation of breastfeeding within the first hour after the birth; exclusive breastfeeding for the first six months; and continued breastfeeding for two years or more, together with safe, nutritionally adequate, age appropriate, responsive complementary feeding starting in the sixth month.²⁷ Low rates of recommended breastfeeding practices following the natural disaster were common across studies. Exclusive breastfeeding for the first six months of life was not practiced by the majority of mothers included in each sample.²⁸⁻³² The range of exclusive breastfeeding prevalence among infants below six months reported in the studies was 20.0%²⁸-33.0%³⁰. Following natural disasters, breastfeeding rates often declined.^{29,30,32} The odds of exclusive breastfeeding prior to the evacuation from the wildfire in Fort McMurray, Canada were 1.96 times higher than following the evacuation.³² Despite the low rates of exclusive breastfeeding, the majority of women reported having ever breastfed,^{28,29,31,33,34} and many women continued breastfeeding their babies for over one year.^{28-30,33}

Another common theme was self-reported anxiety regarding the quality of breastmilk among breastfeeding mothers following a natural disaster. Mothers across studies reported being concerned about the quality of their breastmilk due to a variety of factors including contamination,³¹ poor diet,^{28,29} 'bad blood',²⁸ and low breastmilk supply.^{29,31} These concerns often were described as contributing to a reduction in breastfeeding rates and/or an increase in complementary feeding.

Mothers felt that breastfeeding was impacted following the tsunami in Pondicherry, India, however 95% reported their feeding practices to be the same.³³ This illustrates that while breastfeeding may be affected by a natural disaster, it may not necessarily alter the mother's feeding practices.

Mothers in Canada reported breastfeeding as a source of comfort following the disaster,³² and a mother in Haiti reported losing everything in the earthquake, except for the ability to breastfeed.²⁸ These case studies illustrate the potential for breastfeeding to provide solace to women and their infants during tumultuous times. Women in Canada expressed difficulties breastfeeding while being far away from their lactation support groups, indicating the importance of peer-support for breastfeeding, in particular.³²

Studies also revealed widespread beliefs held by mothers regarding breastfeeding. As previously mentioned, many mothers believed that stress reduced their milk production.^{30,32,33} Nearly two thirds of women surveyed in Pondicherry believed that breastfeeding should be stopped when a child has diarrhea, and 74% believed a malnourished mother cannot breastfeed her baby.³³ Mothers in Haiti believed breastmilk to be an unstable and changing substance.²⁸ They reported 'bad blood' as a common disease compromising breastmilk that should result in breastfeeding cessation.²⁸ The etiology of this condition is believed to be a disturbance in mood, and as many mothers reported stressors following the disaster, it is likely the earthquake created optimal conditions for the disease.²⁸

Breast Milk Substitutes and Complementary Feeding Practices

Despite recommendations against uncontrolled donations of formula in emergency settings donation of breast milk substitutes was widespread in disasters.^{30-33,35} Following the

2004 tsunami in Pondicherry, 72% of families received free breast milk substitutes.^{33,36}

Similarly, after the earthquake in central Java, Indonesia, 89% of households received either infant formula or powdered milk.³⁰ In Fort McMurray after the wildfire, 31.57% of evacuated mothers were not given instructions on safe preparation following the distribution of free powdered infant formula.³²

Unsolicited donations of breast milk substitutes can lead to a decrease in breastfeeding rates and an increase in formula feeding.³⁷ The percentage of infants 0-5 months who had consumed formula increased from 32% to 43% following the earthquake in Indonesia, and the percentage of formula-fed infants was significantly higher among those who received free breast milk substitutes.³⁰ In Central Java following the earthquake, infants in households who received donated commodities – such as porridge – were significantly more likely to consume them than infants in households who did not receive donated commodities.³⁰

In Haiti, mixed-feeding – combining breastfeeding and formula feeding – was the norm among mothers prior to the earthquake.²⁸ There was no widespread distribution of formula following the earthquake; only 4% of families with children ages 0-23 months in the study received powdered milk without paying for it.²⁸ One study following the earthquake and nuclear power plant accident in Fukushima, Japan found that formula feeding was higher among women whose antenatal care had been disrupted and who resided within the evacuation area.³¹ Twenty percent of formula-feeding mothers chose to do so out of concern regarding radioactive contamination of breastmilk.³¹ Seventy-five percent prepared their formula using bottled water.³¹ Mothers in Canada reported that evacuation centers lacked the

proper infrastructure to prepare formula despite its distribution; there was inadequate space for families to wash and sanitize their bottles.³²

According to WHO, complementary foods should include a variety of foods to meet the nutritional needs of the child.³⁸ Natural disasters deteriorate feeding practices for infants and young children,²⁹ especially in circumstances in which compliance with recommendations is already low. Across studies, complementary feeding practices often did not adhere to WHO and UNICEF's recommendation for safe, nutritionally adequate, age appropriate, responsive complementary feeding starting in the sixth month.²⁷

Infants in Dhaka, Bangladesh are often fed rice water (suji) and cow's milk at as early as 2-3 days old.²⁹ Families often do not have the financial means to purchase formula, and their food insecurity is exacerbated during the flood season.²⁹ As a result, during times of flooding infant and young children often eat the same food as the rest of their family.²⁹ Following the tsunami in Pondicherry, cow's milk was used as complementary feed by 11% of mothers in the sample group, and rice by 38%.³³ During the flood season in Bangladesh women have a heavier work load, which also contributes to a deterioration in complementary feeding.²⁹ Food is more difficult to prepare as a result of flooded stoves and/or disconnected gas lines, so women resorted to cooking with a clay stove which was time consuming.²⁹ Eighty-seven percent of infants 6-8 months in China following the Wenchuan earthquake had consumed solid, semi-solid, or soft foods, however less than half (45%) of children under two years met minimum dietary diversity.³⁴ Following the earthquake there was poor dietary diversity, meal frequency, and iron intake due to poor access, displacement, and disrupted income.³⁴

Stress and Anxiety

Following a humanitarian emergency – such as a natural disaster – many breastfeeding women reported stress impeding their milk production. This belief was a common theme across studies included in this review. Eighty-six percent of mothers sampled in Pondicherry believed that maternal stress decreased milk production,³³ and mothers in Fort McMurray experienced anxiety regarding their milk supply.³² Mothers in Central Java may have been less likely to breastfeed because of stress.³⁰ Some families opted to supplement with formula out of anxiety regarding their milk production.³¹

Mothers and families experienced stress for a variety of reasons. Displacement and evacuation were common sources of stress across studies.^{30,32,33} Mothers were also worried about missing family members,²⁸ recurring disasters (i.e. aftershocks, tsunamis, etc.),³³ property damage,³⁰ privacy,³⁰ and finances.²⁸ Women in Japan had concerns about radioactive contamination of their breastmilk.³¹

Food insecurity was another prevalent stressor among women.^{28,29,32} Some mothers experienced food insecurity in regards to obtaining formula,^{29,32} whether it be from a lack of financial means or limited access and availability. Other mothers experienced hunger themselves,^{28,29} or were unable to eat well as a result of anxiety.³³ These mothers were concerned their lack of nutritious intake would impact the quality of their breastmilk and provide insufficient nourishment for their babies. Mothers in Haiti believe breastmilk can transfer ‘bad blood’ to the baby, and that bad blood is caused by emotional distress.²⁸ To protect their infants from the consequences of bad blood, many mothers chose to prematurely wean.²⁸

Infant and Young Child Physical Health

Difficulties with malnutrition, diarrhea, and poor infant health following the natural disaster were commonly reported across studies.^{29,30,33,34} Within 15 days of the tsunami in Pondicherry, 21% of children had diarrhea. Seventy-three percent of children with diarrhea had consumed free breastmilk substitutes that had been distributed.³³ Other health issues reported among children included chickenpox (14%), lower respiratory tract infections (6%), and dermatological problems (21%).³³ During the flooding seasons in Dhaka, mothers reported that their infants lose weight and become thin (sukae jae).²⁹ Mothers also reported more morbidity episodes including diarrhea, acute respiratory infection, fever, and cold.²⁹ Following the earthquake in Central Java, there was a large increase in new cases of diarrhea.³⁰ More than a quarter of children 0-23 months who received infant formula experienced diarrhea, while only 11.5% of children 0-23 months who did not receive infant formula experienced diarrhea.³⁰ Prevalence rates of anemia increased substantially one year after the Wenchuan earthquake in China.³⁴ Of infants 0-11 months, 52.4% were anemic and of children 12-23 months, 42.5% of were anemic. Two years following the earthquake, 69.9% of infants 6-11 months were anemic, and over half of all (52.2%) children 6-23 months were anemic. Other health issues reported included respiratory disease, diarrhea, and rickets.³⁴

Discussion

The aim of this systematic review was to examine infant and young child feeding practices and consequences in the context of a natural disaster, to inform guidance for infant and young child feeding specific to natural disasters and provide recommendations for further research. The evidence suggests a cyclical relationship between the four themes discussed above (i.e., breastfeeding, breastmilk substitutes/complementary feeding practices,

stress/anxiety, and infant and young child physical health). For example, the impact of stress may aggravate poor feeding practices, and poor feeding practices may aggravate stress. Unsanitary feeding practices, such as mixing formula with contaminated water, can result in diarrhea, malnutrition, and mortality among infants and young children.³⁹ Poor infant and young child physical health may heighten stress among mothers and caregivers. Stress among mothers may result in reduced breastfeeding due to the perception that her milk supply is insufficient.^{30,32,33} Food insecurity may influence feeding practices through multiple mechanisms; inadequate access to formula resulting in poor complementary feeding practices,^{11,16} and/or a mother's poor nutrition status resulting in a reduction in breastfeeding or an increase in formula-use.^{28,29} The interconnectedness of these themes demonstrates the need for a multifaceted approach to address infant and young child feeding in the context of natural disasters.

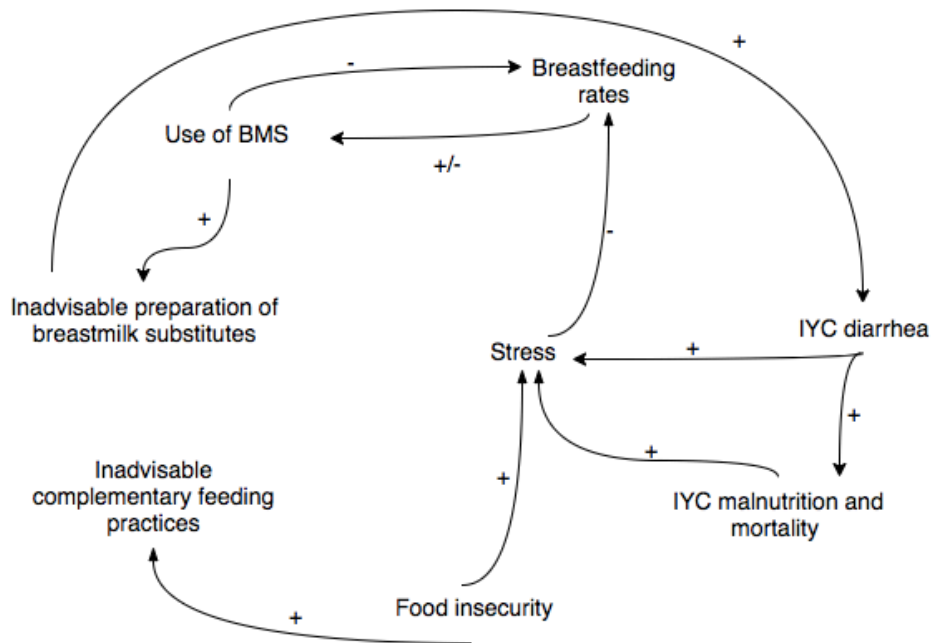


Figure 2. Causal loop diagram illustrating hypothesized relationships between research components in the context of natural disasters

This systematic review reinforces the basic core principles of IYCF-E that are supported by the existing Operational Guidance on Infant and Young Child Feeding in Emergencies. The Operational Guidance on Infant and Young Child Feeding in Emergencies (OG-IFE) seeks to promote and protect optimal feeding practices while minimizing the risks of artificial feeding in emergency settings.²² The OG-IFE includes guidance on providing adequate and timely complementary foods in emergency settings, a key challenge identified by multiple studies in this review.^{22,29,34} The guidance integrates support for pregnant and lactating women to ensure nutritional adequacy.²² This component is especially important given that many women were concerned that their poor nutritional or underweight status was negatively impacting the quality of their breast milk.^{28,29} Other studies in disaster settings support this finding; 20% of lactating women were underweight following a tsunami in Sri Lanka.⁴⁰ The OG-IGE also considers cultural sensitivities; the study in Haiti demonstrated the importance of cultural context given that mothers believe ‘bad blood’ can be transferred to the baby through breastmilk.²⁸

The OG-IGE applies the International Code of Marketing of Breastmilk Substitutes, which has been fully adopted by 37 countries.^{15,22,41} This code seeks to eliminate the promotion of breastmilk substitutes to protect and promote breastfeeding.³⁵ This review reiterates the importance of controlling formula distribution following an emergency, given that infants who consume formula are at a higher risk of morbidity and mortality than infants who exclusively breastfeed.¹⁹ For example, during a pediatric diarrhea outbreak that coincided with flooding in

Botswana, 88% of children under two hospitalized with diarrhea were not breastfeeding.⁴²

Breastfeeding helps protect infants and young children from diseases including diarrhea, respiratory tract infections, and malnutrition – the most common causes of death in emergencies.⁴³ However, breastfeeding is often undermined in emergency settings due to the unsolicited distribution of breastmilk substitutes. This results from this review support the resolutions of the International Code of Marketing of Breastmilk Substitutes.

This review excluded intervention studies with the goal of learning more about the context of infant feeding in natural disasters in the absence of intervention and provide a roadmap for future research. Very few infant and young child feeding interventions have been evaluated in the context of natural disasters with the exception of mother-baby tents in Haiti following the 2010 earthquake.⁴⁴ The tents operated as a private space to breastfeed, receive nutrition and breastfeeding counseling, receive psychosocial support, and a place for formula-fed infants to safely receive ready-to-use formula.⁴⁴ Seventy percent of infants under six months whose mothers attended the tents were exclusively breastfed.⁴⁴ The tents also monitored infant growth and offered referrals to children with acute malnutrition.⁴⁴ The findings from this review support having an established and private space for mothers to practice optimal infant and young child feeding. Several maternal needs identified in this review are addressed through this intervention, including lactation support, nutrition counseling, resources for safe preparation of BMS, and infant health and nutrition monitoring.⁴⁴ These private spaces could also be utilized for mothers to receive mental health screening and services, such as The WHO-UNHCR Assessing Mental Health and Psychosocial Needs and Resources: Toolkit for Humanitarian Settings.⁴⁵ This is important component to integrate into

IYCF-E interventions as stress and self-reported anxiety were pervasive among mothers included in this review.^{28,30,31,33}

Recommendations

While this review supports existing evidence-based guidelines for IYCF-E, there are several gaps in the literature:

Policy evaluation research is needed regarding the fidelity and implementation of global guidelines for infant and young child feeding in emergencies.

Despite the previously discussed existing global guidance on infant and young child feeding in emergencies, adherence was poor in the disaster settings examined in this review. Qualitative research of public health professionals, humanitarian agencies, and local governments is needed to better understand barriers to the implementation of these policies and why adherence is low in disaster settings.

Longitudinal research is needed examining breastfeeding rates in communities before and after emergencies.

There is a gap in the literature of longitudinal research assessing breastfeeding rates (exclusive and non-exclusive) before and after a disaster event. It is important to understand breastfeeding rates in a population prior to a disaster to understand the impact of natural disasters on infant and young child feeding practices. Longitudinal research is also needed to better understand the directionality of the association between a reduction in breastfeeding rates and an increase in formula-use, complementary feeding, and stress. The Demographic and Health Surveys Program provides valuable data that should be analyzed to better understand the associations between breastfeeding rates, formula-use, and complementary feeding.

Questions regarding maternal stress in the context of IYCF should be integrated into the survey. Such research should also assess the impact of feeding practices on child morbidity and mortality using anthropometric measures.

Qualitative research is needed on the psychological impact of natural disasters on mothers and families with young children.

This review illustrated that women across studies experienced stress as a result of the disaster event. It is important to note that stress among breastfeeding women is not unique to disaster settings. Several studies have found an association between maternal stress or anxiety and breastfeeding cessation in non-disaster settings.^{46,47} Further qualitative research is needed on the psychological impact of disasters on mothers with young children to develop population-specific mental health resources and protocols. Research should assess the impact of stress on feeding practices and contextual factors that buffer against breastfeeding cessation. Research should also evaluate and adapt trauma-informed models of care for IYCF-E interventions.

Intervention research is needed to standardize complementary feeding interventions in emergency settings.

A scoping review of current resources for complementary feeding in emergencies published by the IFE core group acknowledged the lack of standard criteria for using fortified foods and supplements in children of complementary feeding age.⁴⁸ The use of supplements, including lipid-based nutrient supplements, is a potentially lifesaving intervention to treat and prevent malnutrition.⁴⁸ Intervention research is needed to understand the effectiveness of such supplements in emergency settings and the implications on complementary feeding practices. This recommendation is supported by an online-survey that identified research on the

effectiveness of complementary feeding strategies as a priority among people affiliated to Save the Children, the IFE core group, and universities actively involved in IYCF-E research.⁴⁹

Limitations

To the best of our knowledge, this is the first systematic review focused on infant and young child feeding practices in the context of a natural disaster. However, some limitations should be acknowledged. This systematic review was conducted by one person, and some articles that met inclusion criteria may have been missed.

Conclusion

Natural disasters often worsen infant and young child feeding practices and cause great psychological distress to parents and other caretakers. Promoting optimal infant and young child feeding practices before, during, and after a disaster is critical for children's long-term health and development. The findings of this review support the recommendations in the Operational Guidance on Infant and Young Child Feeding. This systematic review identified complex relationships between breastfeeding, breastmilk substitutes, complementary feeding practices, stress, and infant and young child feeding practices. Longitudinal research is needed to improve our understanding of these relationships as causal pathways, in addition to breastfeeding rates before and after a disaster event. While global guidelines exist including the International Code of Marketing of Breastmilk Substitutes and the OG-IFE, the studies revealed poor fidelity. Policy evaluation research is needed to better understand barriers to implementation of these guidelines. Qualitative research is needed to enhance our knowledge of the impact of parental stress on feeding practices. Finally, intervention research is needed to develop standardized recommendations for complementary feeding in emergencies.

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