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Protection of Child Health in Emergencies

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ABSTRACT

Natural disasters present a significant and growing threat to the well-being of children. Every year 175 million children globally are expected to be affected by natural disasters, including floods, cyclones, droughts, heatwaves, severe storms, and earthquakes. In emergencies, children of all age groups, especially those under 5, are the most affected part of the community, with child mortality rates 2-70 times higher than average. Clean water, sanitation and hygiene measures, vaccination to prevent infectious diseases, providing psychological support to vulnerable children in an age-appropriate approach, and paying particular attention to children with special needs are extremely important. Healthcare personnel and families should have adequate information and preparation to do what is necessary before, during, and after emergencies to minimize the negative effects on children. In this review, we aim to discuss the effects of emergencies on children and the prevention methods.

Keywords: Children, disaster, emergency, breastfeeding

INTRODUCTION

The definition of emergency conditions refers to events that cause widespread or serious damage, injury, loss of life, or property resulting from a natural phenomenon (natural disasters like earthquakes, floods, droughts, tornados) or human action (human-induced disasters, civil wars, acts of terrorism, migrations, and complex humanitarian emergencies where there is total or considerable breakdown of authority that may require an international response), and that have the potential to exceed the routine capabilities of the community with its timing and unpredictability.[1-3]

In times of emergency, children of all age groups, particularly those under the age of 5, constitute the most vulnerable members of the community. Having to leave school, food shortage, malnutrition, disruption of routine health services, infectious diseases, and the rise of childhood diseases are among the leading factors affecting child health during and after an emergency.

The World Health Organization (WHO) reports that 250 million people are affected by disasters every year, and this number will increase to 350 million in the coming years, with half of them being children.[4] Due to deforestation, climate change, and urbanization in flood-prone areas, a child born in 2020 is expected to face floods 2.8 times more often than a child born in 1960. In Pakistan, the 2022 floods affected 33 million people, leaving 8 million people displaced.[5] A recent earthquake in Kahramanmaraş has affected a large area in the southeastern region of Türkiye and resulted in 35 000 deaths and 105 000 injuries in the first week.[6]

Although the United Nations Security Council has recognized the killing and mutilation of children, the recruitment or enlistment into armed forces, and attacks on schools or hospitals as grave violations against children in times of war, 93 000 children worldwide are known to have been affected by armed conflict between 2005 and 2020.[7,8] Due to the recent

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Palestinian-Israeli conflict, the WHO states 3760 children were killed and thousands were injured in the Gaza strip as of November 3, 2023.[9]

Many aspects of child health are affected during pandemics. The Coronavirus disease-2019 (COVID-19) pandemic changed the lives of children in many ways and had a high impact on healthcare services. Children, particularly in low- and middle-income countries, had inadequate access to nutrition, shelter, water, and sanitation. Follow-up health services were interrupted, leading to disrupted vaccination schedules in 68 countries, affecting 80 million children.[10]

As of May 2022, there are 100 million forcibly displaced people all over the world due to torture, conflicts, violence, and human rights violations.[11] According to the United Nations (UN) definition, a person who has a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group, or political opinion, and who has left his or her country because of such fears and is unable or unwilling to return, is defined as a "refugee," whereas people without official recognition who seek international protection as refugees are defined as "asylum seekers." According to UN Refugee Agency data, as of mid-2023, half of the world's refugees come from 3 countries: Syrian Arab Republic, Afghanistan, and Ukraine. Türkiye and the Islamic Republic of Iran each hosted 3.4 million refugees, making them the largest 2 host countries in the world.[11]

Children face their own unique challenges in emergencies, and with their yet-developing cognitive capabilities, it is also harder for them to protect themselves from hazards that may occur during and after the events. In light of these data, it is very important for pediatricians to play an active role in emergencies. In this review, the implications of emergencies on children and the measures to prevent them will be emphasized.

For this review, scientific databases, including PubMed, Scopus, and Web of Science, were searched using the terms "infant and child health in emergencies" and "child health in disasters." Within these search terms, every subtitle in the text was searched individually. Full-text papers were reviewed after removing duplicates and screening titles and abstracts. In addition, we conducted searches on Google Scholar and the websites of international organizations including WHO, United Nations International Children's Emergency Fund (UNICEF), Save the Children (SC), and Center for Disease Control and Prevention (CDC) to retrieve policies, guidelines, reports, and statistics related to child health in emergencies.

Clean Water, Sanitation, and Hygiene

In emergencies, access to clean water can be challenging, especially in the early days. Due to overcrowding, damage to water and sanitation infrastructure, lack of access to clean water and sanitation, infections such as cholera, diarrhea, hepatitis A, typhoid, and polio may be increased.[12] After the 2004 tsunami in Aceh, Indonesia, it was reported that all survivors used well water, resulting in 85% of them having diarrhea.[13] After Hurricane Katrina in the United States of America, people evacuated from the region were diagnosed with diarrhea, and norovirus, Salmonella, and *Vibrio cholera*e were detected in their stool samples.[14] In a study conducted in camps in Gölyaka and Düzce in Türkiye, after the consecutive İzmit and Düzce earthquakes, the seroprevalence of Hepatitis A in children was found to be 68.8% in İzmit, where the first earthquake occurred, and 44.4% in Düzce, where sanitation measures were initiated faster, access to clean water and food was provided sooner, and better planning was carried out.[15] Though the study was conducted years before Hepatitis A was added to the national routine vaccination program, the result is still significant; rapid and planned action in terms of prevention of infectious diseases decreases the prevalence of the diseases.

Various chemicals may be released into the water after extraordinary situations. Thus, tap water should not be consumed until it is guaranteed to be clean and should not be used to prepare food or formula for infants and young children. Water should not be swallowed when showering, and only bottled or boiled/disinfected water must be used for tooth brushing, cleaning of toys and utensils, or washing dishes.[16] There are various methods to make water usable when clean water is not accessible[17] (Table 1).

Hand washing needs to be explained to children, and if hand washing is challenging, alcohol-containing disinfectants should be provided, and children should be trained in this regard. Preparing content for children on these issues and having them practice under adult supervision can help increase the applicability of cleaning measures by making children feel included. It is important that children's eating utensils are kept separate, materials such as toothbrushes and towels are personalized if possible, and the settlements where children are expected to stay have bathroom facilities.

Table 1. Recommended Methods for Water Sanitation in Emergencies

Boiling	Boiling water for 1 minute can kill bacteria, viruses, and parasites. If the boiled water is to be used as drinking water, a pinch of salt can be added to improve the taste, or it can be poured between 2 clean containers. Boiling does not remove gasoline, chemicals, and radioactive compounds, and is not recommended for use in questionable contamination.
Disinfection	Dropping a certain amount of bleach into the water in proportion to its concentration can kill many viruses and bacteria. Commercial bleach sold in Türkiye usually contains sodium hypochlorite at a concentration of ≤%. It is sufficient to use 0.1 mL for every 1 L of water when using bleach with concentrations between 5% and 9%.
Filtering	If the water appears cloudy and dirty, it should be passed through a clean cloth, paper towel, or coffee filter before boiling and disinfection.
Other methods	Leaving water filled in clean bottles on their sides for 6 hours in sunny weather and 2 days in cloudy weather is known to improve water quality, though it is not sufficient, especially in turbid and particle-containing water, as light may be blocked.

In times of emergency, it is important to monitor the aid sent by the community. If possible, the clothes in the aid packages should be unused or slightly used, and the toys that may be sent to the aid area should be disinfectable. In areas where people live together and share toys, it is recommended to choose toys with flat surfaces and to disinfect or wash them at least 3 times a day. Furry toys with small parts that are difficult to wash should not be used.[18]

For protection against animals, insects, and related diseases in places of collective living, exposed walls should be covered, food and water should be kept in closed containers, garbage should be kept sealed and quickly removed from the place of residence, eating utensils should be washed quickly, and food residue should not be left around.[19]

Prevention of Infectious Diseases

Providing adequate hygiene and sanitation facilities, informing the public about possible outbreaks, making the health system accessible, keeping animals away from residential areas, and vaccination are essential in preventing diseases. In UNICEF's annual report on the war in Syria, it was stated that 70220 cases were seen due to the cholera epidemic that started in September 2022, resulting in 98 deaths. Power cuts, crowded living conditions, and drought were cited as the leading causes. Moreover, 40% of hospitals were unable to operate due to a lack of personnel, drugs, and materials, and 39% of families were unable to provide healthcare services to their children in times of need.[20]

Respiratory diseases such as pneumonia and tuberculosis, as well as skin infections, are common after earthquakes.[21] The time and intensity of the earthquake, the size and characteristics of the affected area, and the presence of a tsunami affect the epidemics that may occur. Following the tsunami in Japan, 43% of hospitalizations for infectious diseases were due to *Streptococcus pneumoniae*, *Haemophilus influenza*, and *Moraxella catarrhalis,* and many cases of flu were reported.[22] Living in crowded places also tends to increase the risk of infectious diseases such as measles, meningococcemia, and hepatitis A.[12]

An increase in the incidence of tetanus and tetanus-associated mortality has been reported, especially in regions with low tetanus vaccination before the emergency. One hundred sixteen tetanus cases were reported within 1 month after the 2004 tsunami in Aceh, with a mortality rate of 18.9%.[23] In Yogyakarta Province, after the earthquake, 71 cases were reported.[24] Unlike these, after the 2011 earthquake in Japan, where vaccination rates were higher, only 9 cases were reported and none of them were fatal.[25]

After floods, the remaining floodwaters contain a lot of bacteria. Vector-borne diseases, such as malaria, may be detected, and mosquito protective measures should be taken, especially considering outbreaks that may occur after natural disasters such as floods.[12,19] Children should be the last to return to an affected area, and all items, including clothes, should be disinfected beforehand.[26]

Vaccination

In emergency situations, disruption of routine vaccination services may lead to outbreaks. Children with unknown vaccination status should be considered unvaccinated and receive vaccinations according to the routine vaccination schedule appropriate for their age group.

During and after wars, as in all states of emergency, infectious diseases increase, follow-up on children with chronic diseases is interrupted, and vaccination programs are disrupted. Inadequate water resources and unfavorable living conditions in camps contribute to the spread of infectious diseases. In Syria, thousands of newborn babies could not be vaccinated against polio, and as a result, the World Health Organization reported 10 babies infected with the poliovirus.[20] While the vaccination rate in Bosnia-Herzegovina was 95% before the conflicts started, it dropped down to less than 35% during the war in 1994.[27]

During the COVID-19 pandemic, immunization campaigns, including measles vaccines in 27 countries, meningococcal conjugate A vaccine in 2 countries, yellow fever vaccine in 4 countries, typhoid vaccine in 2 countries, poliovirus vaccine in 38 countries, oral cholera vaccine in 5 countries, and tetanus–diphtheria vaccine in 7 countries were postponed.[28] As a result of incomplete vaccination, a new polio epidemic soon emerged in Nigeria, and wild poliovirus Type 1 virus emerged in Pakistan and Afghanistan.[28,29] Of the 73 countries with more than a 5% drop in vaccination during the COVID-19 pandemic, only 15 have returned to pre-pandemic levels, while 34 continue to experience a decline.[30] Therefore, it is critical to continue with routine immunization programs as soon as access to health services is established.

Measles immunization is one of the most cost-effective public health methods in disasters. Although the preferred age range for vaccination is determined according to surveillance data, in some countries, it is a standard procedure to administer a booster dose of measles vaccine to all children under 15 years of age living in shelters or refugee camps.[31] If the vaccine is administered under the age of one, the family should be informed that the child should be re-vaccinated, and all vaccines administered should be recorded.

Whether the risk of tetanus increases in emergency situations varies depending on the country and previous vaccination status. Although it has been shown that the risk of tetanus generally does not increase in countries with adequate pre-emergency vaccination, all people visiting the disaster area should receive a single dose of Tetanus/diphtheria (Td) toxoid (preferably Tdap (tetanus, diphtheria, pertussis) if not previously administered), unless they have received a booster dose within the last 5 years.[32,33] Special attention should be paid to neonatal tetanus; vaccination of mothers at risk of becoming pregnant should not be neglected, and necessary hygiene measures should be taken during delivery.[34]

Although there is no specific recommendation for additional precautions regarding the influenza vaccine in emergencies, it should be administered to everyone over 6 months of age in the appropriate seasonal interval, following routine recommendations.[35]

Hepatitis A seroprevalence increases after natural disasters such as earthquakes.[15,36] A single dose of the Hepatitis A vaccine

should be administered to those who live in assembly areas and those who go to the region voluntarily, ideally 1 or 2 weeks before departure for the vaccine to become effective.[31]

A guideline for decision-makers has been published by the WHO for transparent and evidence-based vaccination management planning. According to this guideline, it is recommended to evaluate the epidemiological risks of vaccine-preventable diseases to determine vaccine selection. Epidemiological risk assessment involves identifying and rating general risk factors and risk levels for each vaccine-preventable disease. For example, poor hygiene and inadequate sanitation are considered high-risk factors for cholera, moderate-risk factors for diphtheria, and low-risk factors for Japanese encephalitis (Table 2).[37] The incidence of malnutrition, prevalence of chronic diseases, high birth rate, prevalence of HIV/AIDS, availability of access to health services, overcrowded living conditions, inadequate sanitation, and poor hygiene can change the risk assessment. In addition, the country's routine vaccination program, vaccine availability, economic situation, and ethical, political, and security issues should also be considered.[37]

Infant Feeding in Emergencies

In emergency situations where access to food is difficult and hygiene and sanitation are inadequate, breast milk, the most important element of an infant's diet, is the first choice. The protective effect of breast milk against infections is of critical importance particularly in these high-risk situations.[38] After the floods in Botswana in 2016, it was reported that infants who did not receive breast milk were 30 times more likely to have diarrhea than those who did.[39] Increasing the knowledge and skills of health workers on the subject is beneficial for the continuation of breastfeeding in emergency situations.[40]

In emergency situations, breastfeeding may be interrupted due to the health status of the mother, stress levels, lack of privacy needed during breastfeeding, and inappropriate breast milk substitute distribution.[41,42] In such cases, the process of resuming breastfeeding within days, weeks, or even months is called relactation. Supporting the mother's perception of self-efficacy, frequent skin-to-skin contact, stimulation of the breast with massage followed by expressing milk, breastfeeding the baby 8-12 times a day for 20 minutes, and the use of galactagogues when appropriate are among the stages of relactation.[43,44]

In cases where breastfeeding cannot be achieved, wet nursing and breast milk donation should be considered, and if these options are not suitable, an infant formula may be offered. It is important in terms of hygiene that the formula used in emergency situations should be in ready-to-use, liquid form.[45,46] If powdered formula is to be used, caregivers should be informed about storage, preparation, and cleaning procedures.[46] Feeding with alternative feeding methods should be encouraged. Alternative feeding methods include breastfeeding support systems, feeding with a spoon, finger feeding, cup feeding, and syringe feeding, which is especially useful for premature babies in neonatal intensive care units.[47-49] Cup feeding is favored in emergencies as it is physiological, easy to clean, allows eye and body contact, and may provides support for the mother.[49]

The distribution of the formula should be strictly regulated.[46] Unregulated distribution of formula can jeopardize children's health by leading to the use of the wrong type, out-of-date, or poor-quality formula. Uncontrolled distribution of formula without medical reasons is a major challenge to the preservation of breastfeeding. The solicitation, acceptance, and distribution of donations should not be accepted and should comply with The International Code of the Marketing of Breast-Milk Substitutes.

Although the recommendations for infants introduced to complementary feeding remain unchanged, there may be difficulties in food preparation and access.[46] It is important to include nutritious, clean and appropriate foods for children's nutrition in the meal support packages sent to the region.[50,51]

Psychological Support

Children's mental health is one of the most important problems after emergencies. Separation from their families, displacement, and uncertainty about the future often pose problems for children and their parents.[52] Children, regardless of their age, are affected by the changes taking place around them and may exhibit behaviors that may not be routine in the face of an emergency. Preschool children may be more moody and may show regressive behavior such as urinary incontinence and frequent crying. School-age children may fear a recurrence of the disaster and want to talk about the details. Among adolescents, alcohol and drug use, as well as tendency towards risky sexual activity, may be observed.[53]

It may take some time for children to become aware of their losses after emergencies.[52] As a result of affected mental health, sleep disorders, recurring dreams, decreased interest in the environment and activities, self-blame, and concentration problems are common.[54] After the earthquake that affected the Marmara region in Türkiye, high rates of depression and suicidal tendencies were reported among students.[55] It has been shown in different studies that earthquakes have significant effects on children and adolescents, especially if the father in the family shows signs of post-traumatic stress disorder.[55-57] Children with these findings need to be recognized and given proper guidance as soon as possible.

Table 2. Epidemiological Risk Assessment for Vaccination in Emergencies

		Level of Risk Due to General Factors		
		High	**Medium**	**Low**
Level of risk due to factors specific to the vaccine-preventable disease	High	Definitely consider	Definitely consider	Possibly consider
	Medium	Definitely consider	Possibly consider	Do not consider
	Low	Do not consider	Do not consider	Do not consider

Children should be given the opportunity to explain the extraordinary situation they are experiencing, using activity books if necessary, and should be allowed to be with their peers in playgroups. Involving school-age children and youth in non-sanitation tasks can help them regain a sense of control.[27]

Disruption of Education

The disruption of education in times of emergency has many long-term economic, sociological, and psychological effects. Due to the COVID-19 pandemic, most children continued their education online instead of face-to-face, resulting in a decrease in female education rates, an increase in early marriages, deterioration of nutrition, and psychosocial support programs, thus widening the gap between different social groups.[10] After Cyclone Idai, affecting Zimbabwe, a 13% decrease in school enrollment and a 2.6% decrease in mean pass rate were documented.[58]

Disasters also affect the long-term educational performance of children. In a study conducted 4 years after a bushfire in Australia, a significant decline was reported in the reading and arithmetic performance of children affected by the fire.[59]

It is important to initiate psychosocial support to reduce the negative effects of disasters on educational performance. Education for school-age children and revised training of staff may reduce the damages. An available full-time health personnel and basic emergency equipment are recommended for all schools. Parents should be informed about emergency health and evacuation plans.[3]

Children with Special Needs

Children with chronic illnesses or special needs may need additional support in emergency situations due to the interruption of health services, limited access to medicines and necessary medical supplies, inability to meet their mental or physical needs, and disruption of their dietary routines. When fatality rates during disasters were compared between children with and without disabilities, the rates were higher by 4.3% in children with disabilities.[60]

Children who are physically or mentally limited may feel less in control and may need emotional and physical support. It is important that they and their families are prepared for emergencies. Despite its importance, a study showed that 80% of the families do not have any emergency supply kit available, and 90% of the families do not have a family emergency communication plan.[61] It may be useful to discuss emergency plans with families to involve them and explain the risks and benefits.

A bag containing basic needs, water for drinking and sanitation, three-day food supplies, medications, and essential documents should be kept ready, and an emergency plan should be prepared.[62] Considering that there may be children away from their families, children of suitable age should be presented with information about self-care and emergency plan, while younger children should be provided with information about medication use and important notes about care in their emergency bags. The contents of emergency bags may vary depending on the child's specific situation. For example, it is important to have an additional power supply for asthma patients or patients connected to a home mechanical ventilator, whereas insulin and nutrition should be planned for a child with type 1 diabetes. For patients with chronic kidney diseases, empiric antibiotics and 2 weeks of medication should be prepared. For hemodialysis patients, switching to peritoneal dialysis may be considered since maintenance is harder for hemodialysis.[63]

Center-level preparations, including backup generators and medical supplies, should be planned and regularly checked. Every person working in the hospital should have backups and clearly defined roles.[63] Telemedicine may be a safe alternative for patients and can be used for triage, placement, management, clinical interventions, and patient follow-up.[64,65]

Preparation for Emergencies

The preparation of healthcare facilities is highly important to secure the continuity of essential medical services. As a result of the conflict in Syria, it is reported that 40% of public hospitals and 43% of primary healthcare centers were not operating at full capacity due to the lack of healthcare workers and the inability to obtain the necessary materials.[20] The "all-hazards model" facilitates the preparation and includes recommendations that ensure a similar response to emergency situations caused by different reasons.[66,67] It involves designing a command center in the hospital, including key health personnel for both administrative and health-related services, communicating with the public about the situation, securing the hospital, and planning an active triage operation.[67]

Since children are among the most vulnerable in emergencies, pediatricians should be involved in planning emergency responses.[68,69] Planning should address child-specific illnesses and vulnerabilities, and the stocked drugs and supplies should be suitable for children.[70] The pediatric staff stationed in the field should be skilled in sedation and monitoring, as well as possess intensive care and simple surgical skills in case a pediatric surgeon is not available.[69] Since non-disaster-related conditions will also be encountered, adequate planning should also be made for respiratory and gastrointestinal diseases that are common in children.[71,72] An electronic registry system is essential for triage, transfer of patients, and recording of administered vaccines.[69]

Though hospitals and healthcare professionals play an essential role during emergencies, disaster, and emergency training seems to vary between regions.[73-76] It is strongly recommended to include disaster management in medical school curriculums and residency.

CONCLUSION

In conclusion, the health of children, who constitute the most vulnerable group in society, is of critical importance in emergencies. Ensuring the continuation of breastfeeding, providing support in nutrition, maintaining immunization, taking necessary sanitation and hygiene measures, and providing psychological support will ensure the survival of children with the least damage possible. Healthcare personnel and families should have information and plans about what should be done before, during, and after emergencies.

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