

Health Consequences of Natural Disasters: An Overview of Recent Literature on Floods



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Abstract

Disasters, whether arising from natural forces or human activities, engender substantial harm, loss, and, in severe cases, fatalities. The enduring repercussions extend across individuals, animals, societies, ecosystems, and geographical locations. The consequences of disasters on public health are particularly pronounced, manifesting in a spectrum of medical outcomes. This review delves into the specific impact of floods on distinct age groups, scrutinizing the varying vulnerabilities within each demographic. Infants, young children, teenagers, adults, and the elderly encounter distinctive challenges during and post-flood events, encompassing respiratory ailments, waterborne diseases, infections, hunger, physical injuries, and psychological disorders. Floods not only compromise healthcare services but also precipitate shortages in medication and suboptimal treatment. Health issues resulting from floods exhibit divergence among neonates, infants, children, adolescents, and older individuals. The susceptibility to physical injuries, infections, respiratory disorders, healthcare disruptions, mental health issues, malnutrition, and waterborne diseases varies with the unique vulnerabilities of each age group. Disruptions to routine life disproportionately impact children and adolescents, whereas infants and older individuals exhibit heightened susceptibility. Extreme flood events pose the potential for fatalities, with the risk contingent on both the severity of the flood and the age group affected. Older adults, newborns, and infants face a higher likelihood of mortality attributable to flood-related causes. Mitigating the adverse health effects of floods necessitates robust disaster planning, improved infrastructure, and targeted health interventions tailored to the age-related vulnerabilities of the population.

Keywords: Disasters, natural disasters, man-made disasters, health impacts of disasters, health impacts of floods

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Introduction

Disasters are the events or occurrences that result in severe damage, devastation or loss of life. These events can be caused by natural phenomena or human activities, such as flood, earthquake, war, explosion, terrorist attack, cyclone, and nuclear power plant failure. Almost all disasters have two fundamental characteristics; an unpredictable and sudden incident, and causing significant loss of life, property and environment (1).

Disasters can be natural or manmade. Natural disasters are unpredictable adverse events resulting from natural processes, and that can be categorized as tropical cyclones, floods, earthquakes, heatwaves, cold waves, drought and ice storms (2,3). Human disasters are the events include accidental and intentional incidents. The accidental disasters include; industrial accidents, chemical spill and fires, whereas; the war, crime and terrorist attacks are the examples of intentional disasters (4).

The impact of disasters can be devastating on human, animal, society, ecosystem and entire region or on countries, and can be last for years. It includes medical, economic, social, political, administration, and environmental impacts. Besides the physical and financial impacts, disasters also have variety of psychological

problems. The victims may experience post-traumatic anxiety disorder and other mental health problems in the aftermath of a disaster (5). Both natural and manmade disasters can severely impact humans, animals, communities and environment during and after a disaster. Moreover; the urban infrastructure is vulnerable of a wide range of disasters (6).

Disasters can have a serious impact on public health, leading to a wide range of medical consequences. Medical impacts of disasters may include communicable diseases, physical injuries, chronic illnesses, mental health, environmental hazards, malnutrition, and healthcare system overload (7). Disasters can damage the availability of healthcare medications, services, and supplies needed to manage chronic diseases such as hypertension, diabetes, and asthma. According to the Umor & Righteous (8), disasters can release hazardous substances into the environment, such as chemicals, asbestos and radiations. These substances can cause health impact lasting for the years, including respiratory diseases, cancer, and birth defects.

Floods are the natural disasters that occur due to overflow of water that submerges dry land. They are one of the most destructive and common hydrological disasters. Floods can be formed by a wide range of factors, including dam failure, heavy rainfall, snowmelt, and storm surges (9).

This article provides an up to date review of the human health impacts of floods with particular consideration of vulnerability based on age groups. In accordance with the classification of World Health Organization (WHO) this review cascades the following six age groups from neonates to older adults). The selection of age group for this study is based on the fact that the vulnerability of disasters risk in human is very dependent on the age. The connection between different age groups, vulnerability and the disaster risk are the critical aspects of disaster preparedness, response to disasters, and post disaster recovery efforts. Diverse age groups may respond and deal with disasters in different and unique ways. For example; children are often more vulnerable to disasters because of their dependence on adults for attention and protection. They may have trouble understanding and retorting to emergency situations. Similarly, the older people may have chronic illnesses and physical limitations that make them more vulnerable to harms of disasters. Therefore, an effective disaster management requires a proper understanding of age dynamics.

1. Neonates: 0 to 28 days old. They are very critical to survive during disasters due to their sensitive body and more vulnerability to the disasters.
2. Infants: 0 to 11 months old. They are also sensitive and vulnerable to the disasters risk.
3. Children: 1 to 9 years old. Children are those kids who raised up from infant age and celebrate their first birthday on the completion of 1-year age and stretches to the age of 9 year. They are also vulnerable to the health impacts of disasters due to growing organ systems.
4. Adolescents: 10 to 19 years old. They are also vulnerable to the health impacts however the vulnerability in this group vary with intensity of the disasters. Vulnerability of adolescents is mainly because they need more air/pond of their body weight. Their skins are comparatively thin and they are at greater risk to lose their body fluids and heat (10).
5. Adults: 20 to 59 years old. In this age group the younger people (usually under 40 years are less vulnerable compared to the vulnerability in older people.
6. Older adults: 60 years old and above. Like infants and children, the older adults are also more vulnerable to the health impacts of disasters due to complications in their health conditions.

Following impacts of the floods on human health have been discussed in this article with reference to above listed age groups and vulnerability classes. The literature reveals that below listed health issues have historically been experienced in many parts of the world and reported by many researchers in isolations. Through this review article

an effort is made to compile the isolated research findings in this field.

- Respiratory problems
- Water borne diseases
- Infections
- Physical Injuries
- Malnutrition
- Mental health issues
- Disruption of healthcare
- Displacement
- Increased risk of mortality
- Hypothermia

Article also highlights some major floods happened from 2015-2022 in the world and health issues associated with them. Majority of literature reviewed in this article includes the latest research findings from 2020-2023. Studying the health impacts of natural disasters is a dynamic field, with new diseases, and health related theories emerging regularly. Therefore, using the latest literature for this review article ensures the most current state of knowledge in the field. New research in this area often builds upon or refines earlier work and incorporating the latest literature can present a more accurate and valid synthesis of the existing knowledge.

Floodwater can be fast-moving, deep, and can easily sweep people away. In the scenario of floods, one of the most immediate health risks is sinking. In addition, floods can contaminate the water, leading to the spread of waterborne illnesses such as typhoid fever, cholera, and hepatitis A. They can also damage drainage systems, leading to the dispatch of raw sewage into the environment. This can increase the risk of exposure to viral and bacterial infections. The long-lasting health impacts of floods can include respiratory problems due to exposure to mildew and mold, as well as mental health issues (11).

Respiratory problems

Floodwaters are contaminated with variety of organic and inorganic pollutants. Flood also contaminate the nearby surface and ground water resources with a variety of pathogens such as bacteria, viruses, and toxins. Flood contamination may cause the respiratory problems in human, when they ingest or inhale harmful substances (12). Flood can increase the humidity level in the air and often leave damp conditions in the area that lead to grow the molds and increase the levels of indoor air pollutants such as dust, pollen, and smoke. Exposure to high levels of mold can lead respiratory problems such as bronchitis, allergies, rhinitis, and asthma. High humidity makes it more difficult for the respiratory system to function properly (13). Short term respiratory inflammation, irritation, and infection may also be caused by the contaminated flood water. Flood can also lead to increase in airborne pollutants which irritate the respiratory system and increase respiratory problems such as chronic obstructive pulmonary disease and asthma (14).

Flood can cause the displacement of large amounts of debris and dust, which can be inhaled and also cause inflammation and irritation in the respiratory system. Flood can also have intangible impacts such as power outages, which can prevent people from using necessary medical equipment such as ventilators. This can lead to severe respiratory and other health complications (15). During the floods people may be forced to displace from their homes, which can disrupt their routines and cause stress. This can lead to worsened respiratory problems particularly in the old age people with pre-existing respiratory conditions (16).

Newborns and Infants with underdeveloped lungs are particularly susceptible to flood driven respiratory problems such as asthma, bronchitis, and pneumonia (17). Children who are exposed to mold are especially vulnerable because they may not have fully developed immune systems, and their lungs are still immature. Children may also be exposed to air pollution from vehicles and factories, who live near flood areas. Children having asthma are at risk, their condition may be worsening during floods (18). Adult mothers are also especially vulnerable to the health impacts of floods. According to a study (19), floods can increase the risk of premature delivery, low birth weight, and birth defects.

Water borne diseases

Microbial contamination of flood water such as bacteria, viruses, and parasites, can lead to the spread of water-borne diseases such as cholera, typhoid, and cryptosporidiosis. Infants are particularly vulnerable to these diseases, which can cause severe dehydration and even death (20). The drains overflow and contaminate the water sources during flood, increasing the risk of waterborne diseases such as diarrhea, dysentery, hepatitis A and E, and polio. Flood can develop stagnant pools of water that serve as breeding grounds for mosquitoes, flies and insects. Children exposed to such vectors are at risk of diseases such as malaria and dengue fever (21). Adults may be at serious risk of waterborne diseases, when come into contact with contaminated water during bathing, swimming, or laundry and; consume contaminated water for drinking cooking purposes (22).

Infections

Harmful pathogens in flood water such as viruses, bacteria and parasites, can cause infections such as pneumonia, diarrheal diseases, and skin infections. Floodwater increase the mosquitoes, which carry vector-borne diseases, such as dengue and malaria fever. Flood also disrupts medical facilities and access to healthcare facilities, making it difficult to receive careful medical attention in case of infections (23).

The standing flood water can also become contaminated with viruses, bacteria, and parasites during and after flood. These pathogens can cause various skin infections such as fungal infections, bacterial infections, and

viral infections. The most common skin infections that have been reported as a result of flood include, athlete's foot, impetigo, and scabies. The standing flood water can also serve as a breeding ground for mosquitoes. Mosquitoes are vectors can transmit diseases such as dengue fever, and malaria (24).

Newborn, infants and children are particularly vulnerable to flood related infections because their skin is delicate and more susceptible to damage (25). Adolescents who displace from their homes and parents during flood may be forced to live in overcrowded conditions. The overcrowding can also make it difficult to maintain good hygiene and practice social distancing, which can further increase the risk of disease transmission (26). Older adults with pre-existing respiratory conditions are particularly susceptible to these kinds of infections (27). Flood can cause physical injuries such as cuts, broken bones, and bruises, which can raise the risk of infections (28).

Physical Injuries

Flood may result in neonates separated from their parents without necessary and basic care and attention, which they need to survive. Apart from direct death, this leads to physical injuries to newborn babies, such as bruises and cuts from sharp objects, falls from unstable surfaces or in the water (29). Flood collapses buildings and turbulent flood water floats the debris such as rocks, sharp objects and tree branches, which can injure children if they are trapped or hit by them (30). Floodwater rises quickly and become deep enough to pose a significant drowning risk to infants. Electrical wires can become exposed by floodwater, leading to electrocution. Infants can be at risk of getting an electric shock when crawl or touch the wet surface. Children can also sustain injuries from trips, slips, and falls on slippery and wet surfaces. Floodwater also causes risk of electrocution if they come into contact with power lines or electrical equipment. Children may be unaware of the danger posed by electrical equipment (31). Floods can also cause physical injuries in adolescents such as they may be at risk of drowning, particularly when caught in fast-moving flood water currents. Adolescents may suffer from fractures due to collisions with debris, falls, or accidents during rescue operations. They may suffer lacerations and cuts from sharp objects or debris in floodwaters (32).

Malnutrition

Flood can damage crops, disrupt food supplies, and contaminate food and water sources. It can make difficult for families to provide sufficient nutrition for their infants and children. Infants who rely on breastfeeding may be at risk of malnutrition if their mothers are unable to produce milk. Flood also increase the risk of waterborne diseases, dehydration and loss of essential nutrients. Displaced families may struggle to provide sufficient nutrition and care for their infants. The loss of parents can cause emotional distress, which can impact the appetite and ability to feed

the infants (33). Families may be forced to leave their homes and food behind. These events can cause malnutrition and food shortages. Children who are already most vulnerable and undernourished are at a higher risk of severe malnutrition. Contaminated floodwater with harmful viruses, bacteria, and parasites can cause illnesses and infections, leading to reduced appetite, cause digestive problems, and nutrient deficiencies. When children consume contaminated water and food, they can develop malnutrition and become sick. This is especially problematic for older adults, who may already have nutritional deficiencies and weakened immune systems (34). Flood damages the infrastructure, disrupt food and drinking water supply. This can lead to food shortages and a lack of access to nutritious foods, which can cause malnutrition and nutritional deficiencies. The increased demand for food after flood, which causes price hikes and makes it difficult for low-income and middle-class families to afford nutritious foods (35). Shortage of safe drinking water during floods can cause dehydration, which affects the fluid balance of older adults who are particularly vulnerable. Waterborne diseases due to floods can cause diarrhea and other gastrointestinal problems. This can further aggravate dehydration and malnutrition in older adult (36).

Mental health issues

Flood causes serious impacts on psychological health of people. The impacts can be traumatic or post-traumatic. Children being separated from their parents during floods can suffer serious mental health issues such as the feelings of anxiety, fear, and helplessness (37). Flood also disrupts daily routine of children. Flood can also result in the loss of possessions, including clothes, and toys. This loss can also be traumatic for children to cope with and can lead to feelings of depression and sadness (38). Adolescents may experience social isolation trauma during and after flood, such as being displaced from their homes, parents or loss in their communities, schools and public places. This can lead to symptoms of a range of mental health problems such as depression, loneliness, anxiety, and nightmares, which can affect their health and ability to function (39). Flood disrupts stability and routine of adolescents leading to feelings of instability, insecurity, anxiety and uncertainty. Adolescents may lose personal belongings, such as electronic devices, clothing, and sentimental items, during flood. This can lead to feelings of grief and loss, which can contribute to anxiety and depression. Loss of employment, businesses, crops and other income resources can cause financial stress for families, which can cause mental health problems for adults. They may worry about the financial stability of their families and may feel pressure to contribute to the recovery efforts (40). Flood can be a traumatic experience, with people experiencing helplessness, fear, and horror feelings. These traumatic experiences can encourage the development of mental health conditions such as post-traumatic stress

disorder (41). Displacement, and disruption of daily routines can be particularly challenging for adults, who may have established careers, homes, and social networks. Flood can also cause significant financial stress and trauma due to loss of property and possessions (31). Flood can also be traumatic experiences for older adults, particularly when they are displaced from their homes and communities. This can lead to anxiety, depression, and post-traumatic stress disorders. Floods can make the older adults socially isolated, when they displaced from homes or they have to live in a shelter where they are not able to connect with their usual social networks (42). The physical health problems during floods can exacerbate existing mental health issues and cause further stress, depression and anxiety. Older adults may also experience financial strain because of the cost of repairing, or rebuilding their homes and replacing their possessions leading to mental health problems (43).

Disruption of healthcare

Flood disrupts the healthcare facilities such as clinics, hospital, and pharmacies, making it difficult for people to access necessary healthcare services, including reproductive health services, immunizations, and mental health services. Moreover, the floods can damage or destroy road, bridges and railway network, making it difficult for people to travel, or to access health care facilities (44). People especially living in rural or remote areas often prevented to access health care services during floods. People who are used to take regular medications to manage chronic health conditions, such as diabetes, asthma, or mental health disorders are at particular risk. They may face interruptions in their medication supply during and after floods (45).

Older adults are more likely to have different chronic health conditions such as cardiovascular problems, diabetic, respiratory problems, and depression, which require them to take multiple necessarily medications. They may have to displace from their homes, leaving their medication behind during flood. This can lead to medication non-compliance, which can increase the risk of complications or aggravate their health conditions (46).

Displacement

People may be forced to displace from their homes, schools, and communities by a flood. They may be separated from their families, and friends, which can disrupt their support systems and social networks leading to feelings of loneliness and isolation. Experience to new neighbors, schools, and friends can be difficult to adjust for them and may result in feelings of disconnection and isolation from their previous social networks (47). Disruption of educational system can be detrimental to the emotional and social health of children and adolescents. They can face variation in educational institutions and missing out important learning opportunities, which impact their ability to build social connections and form new relationships (40). This displacement can lead to economic and social disruptions in the adults, as well as increased risk of physical and mental health issues. Infrastructure damages during flood including buildings, bridges and roads, can force adults to seek temporary shelter elsewhere. The chances of health hazards

are high due to experiencing contaminated water, mold, and debris during displacement (48). Flood also disrupts economic activities and cause the loss of income and employment, especially who work in farmland and livestock. This can make it difficult for them to afford basic necessities (49).

Increased risk of mortality

Newborns, infants and older adults are at high risk of flood related mortalities. Older adults are more likely to suffer from a range of chronic diseases, such as hypertension, diabetes, and cardiovascular disease, which can be exacerbated by flooding. Physical injuries to older adults, such as cuts, falls, bruises and accidents, can lead to severe infections (50). They may be unable to move quickly or swim in floodwaters, which can accelerate the risk of drowning. Newborn and infants are more susceptible to hypothermia, when they are exposed to floodwaters for an extended period. Variety of toxins in flood water can cause death or illness of newborns and infants (51). Disrupted access to

medications and healthcare services during floods make it difficult for infants and older adults to receive necessary medications and medical care. This may lead to death if the situations prevail for longer periods (52).

Hypothermia

Hypothermia is the condition of exposure to wet conditions that can be aggravated by the flood water. Hypothermia, particularly in newborns and infants can be serious health issue who have difficulty in maintaining their body temperature. Newborns lose heat more quickly than adults because of their small size or their high surface area to the body mass ratio. The water conduct heat more efficiently from body than air (53). Furthermore, floodwater can wet the clothing and bedding of newborns and infants which can increase the risk of hypothermia. Flood related infections can cause fever leading to increase the rate of metabolism, heat loss and hypothermia in newborns, infants and children (54). Tables 1 highlights some health impacts arising from the major floods in the world.

Table 1. Historical evidences of health impacts from major floods in the world from 2005-2022

S. No	Year	Location	Detail	Health Impacts	Ref.
1	May, 2005	Zhejiang, China	Zhejiang province of China received flood in May 2005. The flood caused widespread damage to infrastructure, agriculture, economy and public health systems.	a. 1624 human casualties. b. Waterborne diseases: diarrhea, cholera, and hepatitis A. c. Cases of leptospirosis, a bacterial infection. d. Respiratory illnesses: bronchitis and pneumonia. e. Mental health impacts: acute stress disorder and anxiety. f. Healthcare disruptions.	55
2	July, 2005	Maharashtra, India	The flood was caused by heavy rainfall in Maharashtra province that exceeded the capacity of the local rivers and reservoirs, caused flash flooding and landslides. The districts of Mumbai, Raigad, Thane, and Pune were particularly affected by the flood. Flood caused significant loss of life and widespread damage to property and infrastructure.	a. 1503 human casualties. b. Waterborne illnesses: cholera, diarrhea, and typhoid fever. c. Mental health impacts: anxiety and acute stress disorder. d. Healthcare disruptions.	56
3	July, 2006	North Korea	The flood was caused by heavy rainfall that raised the capacity of reservoirs and local rivers, leading to flash flooding and landslides. The provinces of South and North Pyongan, Pyongyang and North Hwanghae were especially affected by the flood. It caused significant loss of life and widespread damage to property and infrastructure.	a. 844 human casualties. b. Waterborne illnesses: diarrhea, typhoid fever and cholera. c. Mental health problems: depression, anxiety and general anxiety disorder. d. Healthcare disruptions.	57
4	Aug-Dec, 2007	India	The flood was caused by heavy monsoon rainfall, and overflowing the Kosi River and its tributaries. The flood was also exacerbated by the lack of maintenance of dams and embankments, which failed to control the rising waters.	a. 1287 human casualties. b. Waterborne diseases: cholera, diarrhea and typhoid fever c. Mental health problems: anxiety and depression. d. Healthcare disruptions	58
5	July-Sep, 2008	India	There were two devastating floods, Bihar floods and other rest of the India floods in same year. In Bihar the flood was occurred by heavy monsoon rainfall and the overflow of Kosi river and reservoirs. Rest of the India floods were caused by heavy monsoon rains that overflowing of local rivers and reservoirs, which affected Uttar Pradesh, and Assam.	a. 2699 human casualties. b. Waterborne diseases: cholera, diarrhea and typhoid fever c. Mental health problems: anxiety and depression. d. Healthcare disruptions	59

S. No	Year	Location	Detail	Health Impacts	Ref.
6	May-Sep, 2010	China	The series of floods during the summer that occurred in China, affecting many provinces including Shaanxi, Sichuan, and Henan. The cause of floods were heavy rainfall that remained for several weeks, led to the overflow of rivers and reservoirs. Mudflows and landslides were also reported in some areas.	a. 3189 human casualties. b. Physical injuries. c. Waterborne diseases: cholera, diarrhea and typhoid fever d. Mental health problems: anxiety and depression. e. Healthcare disruptions	⁶⁰
7	July, 2010	Pakistan	The floods were caused by heavy monsoon rainfalls that began in end of July and lasted for several weeks. The floods were particularly severe due to inadequate infrastructure, such as poorly maintained embankments and dams, and deforestation.	a. 1781 human casualties. b. Physical injuries. c. Waterborne diseases: cholera, diarrhea and typhoid fever d. Mental health problems: anxiety and depression. e. Healthcare disruptions	⁶¹
8	June-Oct, 2011	Southeast Asia	Series of widespread floods that affected many parts of Southeast Asia, including Thailand, Laos, Cambodia, Philippines and Vietnam. Floods were caused by heavy tropical storms and monsoon rainfalls, which exceed capacity of rivers and reservoirs. The floods were exacerbated by inadequate infrastructure, such as poorly maintained embankments and dams.	a. 2282 human casualties. b. Physical injuries. c. Waterborne diseases: cholera, diarrhea and typhoid fever d. Mental health problems: anxiety and depression. e. Healthcare disruptions	⁶²
9	June, 2013	India	A series of devastating floods affected the northern states of Himachal Pradesh and Uttarakhand in India. The heavy monsoon rainfalls that actuate flash floods and landslides. The floods were severe due to the hilly terrain.	a. 5748 human casualties. b. Physical injuries. c. Waterborne diseases: cholera, diarrhea and typhoid fever d. Mental health problems: anxiety and depression. e. Healthcare disruptions	⁶³
10	Aug-Sept, 2016	North Korea	A series of floods occurred in the northern part of North Korea. Floods caused by heavy rains due to a low-pressure system and a typhoon. The floods were exacerbated by poor soil management practices and deforestation, which made the region more susceptible to flooding.	a. 525 human casualties. b. Physical injuries. c. Waterborne diseases: cholera, diarrhea and typhoid fever d. Mental health problems: anxiety and depression. e. Healthcare disruptions	⁶⁴
11	July-Aug, 2017	India	The devastating floods occurred in Bihar and Mumbai. The heavy rainfalls led to the overflowing of the Gandak, and Kosi. The districts of Kisanganj, Araria, Katihar Kisanganj, and Purnea in Bihar were particularly affected by the flood.	a. 687 human casualties. b. Physical injuries. c. Waterborne diseases: cholera, diarrhea and typhoid fever d. Mental health problems: anxiety and depression. e. Healthcare disruptions	⁶⁵
12	July-Sep, 2020	India, Bangladesh	The floods were occurred by heavy monsoon rainfalls, which led to rivers overflow and resulted in flash floods in some areas. Climate change played a main role in the severity of the floods.	a. 1922 human casualties. b. Physical injuries. c. Waterborne diseases: cholera, diarrhea and typhoid fever d. Mental health problems: anxiety and depression. e. Healthcare disruptions	⁶⁶
13	June-Oct, 2022	Pakistan	Pakistan experienced devastating floods, particularly in the Sindh, south Punjab, and Balochistan provinces due to heavy monsoon rains. The floods caused widespread damage to property, crops and infrastructure, and displaced thousands of people from their homes.	a. 1769 human casualties. b. Physical injuries. c. Waterborne diseases: cholera, diarrhea and typhoid fever d. Mental health problems: anxiety and depression. e. Healthcare disruptions	⁶⁷

Conclusion

Natural or man-made disasters have significant and complex effects on the wellbeing of people, animals, and the environment. Various age groups are more or less susceptible to these effects, and each group deals with various problems. Because of their immature systems, newborns and infants are particularly susceptible to respiratory issues, infections, malnutrition, and hypothermia after floods. Routine interruptions, mental health problems, and a higher risk of infections and waterborne illnesses may all affect children. Trauma, mental health problems, physical injuries, and the difficulties of displacement can all affect adolescents. Adults are susceptible to dangers such as physical harm, infections, mental health problems, disruptions in healthcare access, and unstable economic conditions. Older persons who already have medical disorders are more prone to death, respiratory troubles, infections, mental health problems, and hypothermia. Particularly during floods, a number of health difficulties, such as respiratory troubles, waterborne illnesses, infections, physical wounds, starvation, and mental health issues, might arise. Comprehensive measures are needed to address the physical, psychological, and social well-being of people of all ages in order to lessen the catastrophic effects of disasters. This includes making sure people have access to medical care, counseling, clean water, sanitation systems, and nutritious food both during and after disasters. Building resilience and reducing the harmful health effects of catastrophes need cooperation between governments, medical facilities, non-governmental groups, and local people. In order to influence policies and practices that can improve disaster readiness and response while preserving the health and wellbeing of people and communities around the world, it is crucial to do ongoing research as well as to communicate and educate effectively.

References

- Wu J, Xing Y, Bai Y, Hu X, Yuan S. Risk assessment of large-scale winter sports sites in the context of a natural disaster. *J. Saf. Sci. Resil.* 2022 Sep 1;3(3):263-276.
- Staupe-Delgado R, Rubin O. Challenges associated with creeping disasters in disaster risk science and practice: considering disaster onset dynamics. *Int. J. Disaster Risk Sci.* 2022 Feb;13(1):1-11.
- Jewson S. Application of uncertain hurricane climate change projections to catastrophe risk models. *Stoch. Environ. Res. Risk Assess.* 2022 Oct;36(10):3355-3375.
- Arnold O, Franke R, Jantke KP, Wache HH. Professional Training for Industrial Accident Prevention with Time Travel Games. *Int J Adv Corp Learn.* 2022 Jan 1;15(1):20-34.
- Newnham EA, Mergelsberg EL, Chen Y, Kim Y, Gibbs L, Dzidic PL, DaSilva MI, Chan EY, Shimomura K, Narita Z, Huang Z. Long term mental health trajectories after disasters and pandemics: A multilingual systematic review of prevalence, risk and protective factors. *Clin Psychol Rev.* 2022 Sep 14:102203.
- Omićević N, Bojanić Obad Šćitaroci B. Comparative analysis of the selected geophysical disaster process case studies. In *The urban rehabilitation of post-disaster scapes* 2023 Mar 15 (pp. 57-73). Singapore: Springer Nature Singapore.
- Bell SA, Horowitz J, Iwashyna TJ. Health outcomes after disaster for older adults with chronic disease: a systematic review. *The Gerontol.* 2020 Oct 1;60(7):e535-547.
- Umar A, Righteous I. Occupational health hazards and diseases of painters. LAP, Lambert Academic Publishing
- Mishra A, Mukherjee S, Merz B, Singh VP, Wright DB, Villarini G, Paul S, Kumar DN, Khedun CP, Niyogi D, Schumann G. An overview of flood concepts, challenges, and future directions. *J Hydrol Eng.* 2022 Jun 1;27(6):03122001.
- Lai BS, La Greca A. Understanding the impacts of natural disasters on children (Child Evidence Brief, no. 8). Society for Research in Child Development. Available from: <https://www.srcd.org/research/understanding-impacts-natural-disasters-children>
- Farida N, Maswanku LM. A panoramic view of the flood problem in eastern Uganda: lessons from Pakistan and India. *Islamic Univ. J Soc Sci.* 2022 Dec 12;3(1):39-68.
- Karri RR, Ravindran G, Dehghani MH. Wastewater—sources, toxicity, and their consequences to human health. In *Soft computing techniques in solid waste and wastewater management* 2021 Jan 1 (pp. 3-33). Elsevier.
- Balakrishnan B, Callahan SJ, Cherian SV, Subramanian A, Sarkar S, Bhatt N, Scholand MB. Climate Change for the Pulmonologist: A Focused Review. *Chest.* 2023 Apr 11: DOI: 10.1016/j.chest.2023.04.009
- Gayle AV, Quint JK, Fuertes EI. Understanding the relationships between environmental factors and exacerbations of COPD. *Expert Rev Respir Med.* 2021 Jan 2;15(1):39-50.
- Baniassadi A, Heusinger J, Gonzalez PJ, Weber S, Samuelson HW. Co-benefits of energy efficiency in residential buildings. *Energy.* 2022 Jan 1;238:121768.
- Marshall J, Wiltshire J, Delva J, Bello T, Masys AJ. Natural and manmade disasters: vulnerable populations. *Global health security: Recognizing vulnerabilities, creating opportunities.* 2020:143-161.
- Nanda A, Mustafa SS, Castillo M, Bernstein JA. Air pollution effects in allergies and asthma. *Immunol Allergy Clin.* 2022 Nov 1;42(4):801-815.
- Peirce AM, Espira LM, Larson PS. Climate change related catastrophic rainfall events and non-communicable respiratory disease: a systematic review of the literature. *Clim.* 2022 Jul 4;10(7):101.
- Ha S. The changing climate and pregnancy health. *Curr Environ Health Rep.* 2022 Jun;9(2):263-275.
- Rafique A, Sohail N, Sarfaraz Y. Pakistan floods: an insight into health hazards and preventive measures. *Cukurova Med J.* 2022 Dec 12;47(4):1774-1775.
- Manetu WM, Karanja AM. Waterborne disease risk factors and intervention practices: a review. *Open Access Librar J.* 2021 May 6;8(5):1-11.
- Perdana T, Onggo BS, Sadeli AH, Chaerani D, Achmad AL, Hermiatin FR, Gong Y. Food supply chain management in disaster events: A systematic literature review. *Int J Disaster Risk Reduct.* 2022 Jul 15:103183.
- Rahmat ZS, Sadiq M, Vohra LI, Ullah H, Essar MY. The impact of COVID-19 followed by extreme flooding on vector borne diseases in Pakistan: A mini narrative review. *New Microbes New Infect.* 2022 Dec 27:101075.
- Ntajal J, Höllermann B, Falkenberg T, Kistemann T, Evers M. Water and health nexus—Land use dynamics, flooding, and water-borne diseases in the Odaw River basin, Ghana. *Water.* 2022 Feb 4;14(3):461.
- Iqbal T. Floods have posed serious health and economic challenges in affected areas of Pakistan. *Pak J Physiol.* 2022 Dec 31;18(4):1-2.
- Cockrell HC, Hansen EE, Gow K, Fecteau A, Greenberg SL. The intersection of pediatric surgery, climate change, and equity. *J. Pediatr. Surg.* 2023 May;58(5):943-948.
- Precha N, Kliengchuay W, Woo C, Yamamoto N, Tantrakarnapa K. Fungal Assemblages on Indoor Surfaces with Visible Mold Growth in Homes after the 2016 Flood Disaster in Thailand. *Appl Sci.* 2020 Jul 31;10(15):5322.
- Suk JE, Vaughan EC, Cook RG, Semenza JC. Natural disasters and infectious disease in Europe: a literature review to identify cascading risk pathways. *Eur J Public Health.* 2020 Oct;30(5):928-935.
- Huda MB, Rather NA, Eslamian S. Social aspects of flooding. *Flood Handbook.* 2022 Apr 3:145-170.
- Takabatake T, Chenxi DH, Esteban M, Shibayama T. Influence of road blockage on tsunami evacuation: A comparative study of three different coastal cities in Japan. *Int J Disaster Risk Reduct.* 2022 Jan 1;68:102684.
- Amankwaa EF, Gough KV. 'We are at the mercy of the floods!': Extreme weather events, disrupted mobilities, and everyday navigation in urban Ghana. *Singap J Trop Geogr.* 2023 May;44(2):235-254.
- Maldonado-Morales MX, Yudovich S. Embodiment of the Self in Physical and Sexual Abuse During Childhood and Adolescence. In *Handbook of Mind/Body Integration in Child and Adolescent Development* 2023 Mar 15 (pp. 115-127). Cham: Springer International Publishing.
- Volk KT, DeCandia CJ, Unick GJ. The Full Picture: Incorporating ecological factors when conducting developmental screening with young children experiencing homelessness. *Child Indic Res.* 2023 Feb;16(1):87-108.
- Sherratt S. What are the implications of climate change for speech and language therapists? *Int J Lang Commun Disord.* 2021 Jan;56(1):215-227.

35. Islam MS, Samreth S, Islam AH, Sato M. Climate change, climatic extremes, and households' food consumption in Bangladesh: A longitudinal data analysis. *Environ Chall*. 2022 Apr 1;7:100495.
36. Santra G. Climate Medicine should be a Priority in Medical Curriculum. *J Assoc Physicians Indi*. 2023 Feb 1;71(2):11-12.
37. Ganie AU, Jayakumar C, Kasi S. Influence of sociodemographic variables on psychological impact and resilience among children living in multi hazard Region. *Indian J Soc Psychiatry*. 2022 Apr 1;38(2):168-175.
38. Sadeghloo T, Mikhak H. Analyzing the impacts and experiences of children in disaster. *Int J Disaster Risk Reduct*. 2022 Jun 15;76:103000.
39. Yan Y, Turale S, Klunklin P, Klunklin A. A Qualitative Study of Disaster Resilience of Chinese Adolescents Five Years after Super Typhoon Rammasun. *Pac Rim Int J Nurs Res*. 2023 Mar 27;27(2):213-229.
40. Crandon TJ, Scott JG, Charlson FJ, Thomas HJ. A social-ecological perspective on climate anxiety in children and adolescents. *Nat Clim Change*. 2022 Feb;12(2):123-131.
41. Liang Y, Zhao Y, Ji W, Bian X, Xi J. Latent profiles of psychological status among populations cumulatively exposed to a flood and the recurrence of the COVID-19 pandemic in China. *Int J. Disaster Risk Reduct*. 2023 Feb 1;85:103520.
42. Seebauer S, Winkler C. Should I stay or should I go? Factors in household decisions for or against relocation from a flood risk area. *Glob Environ Change*. 2020 Jan 1;60:102018.
43. Yodsuban P, Nuntaboot K. Community-based flood disaster management for older adults in southern of Thailand: A qualitative study. *Int J Nurs Sci*. 2021 Oct 10;8(4):409-417.
44. Pradhan NA, Najmi R, Fatmi Z. District health systems capacity to maintain healthcare service delivery in Pakistan during floods: a qualitative study. *Int. J. Disaster Risk Reduct*. 2022 Aug 1;78:103092.
45. Bouchard JP, Pretorius TB, Kramers-Olen AL, Padmanabhanunni A, Stiegler N. Global warming and psychotraumatology of natural disasters: The case of the deadly rains and floods of April 2022 in South Africa. In *Annales Médico-psychologiques, revue psychiatrique* 2023 Mar 1 (Vol. 181, No. 3, pp. 234-239). Elsevier Masson.
46. Dong S, Esmalian A, Farahmand H, Mostafavi A. An integrated physical-social analysis of disrupted access to critical facilities and community service-loss tolerance in urban flooding. *Computers, Comput Environ Urban Syst*. 2020 Mar 1;80:101443.
47. Myre M, Glenn NM, Berry TR. Experiences of Size Inclusive Physical Activity Settings Among Women With Larger Bodies. *Res Q Exerc Sport*. 2022 Mar 28:1-10.
48. Braam DH. Zoonoses in the margins: environmental displacement and health outcomes in the Indus Delta. *Int J Equity in Health*. 2022 Dec 30;21(1):189.
49. Okoko AN. Becoming flood insecure: Lessons from village level experiences in Tana Delta, Kenya. *Prog Disaster Sci*. 2022 Dec 1;16:100265.
50. Petrucci O. Factors leading to the occurrence of flood fatalities: a systematic review of research papers published between 2010 and 2020. *Nat Hazards Earth Syst Sci*. 2022 Jan 17;22(1):71-83.
51. Yoshida I, Ozaki A, Morita T, Tsubokura M, Kami M. Characteristics of flood fatalities in Japan's Typhoon Hagibis in 2019: secondary analysis of public data and media reports. *Disaster Med Public Health Prep*. 2022 Aug;16(4):1512-1516.
52. Corvalan C, Villalobos Prats E, Sena A, Campbell-Lendrum D, Karliner J, Risso A, Wilburn S, Slotterback S, Rathi M, Stringer R, Berry P. Towards climate resilient and environmentally sustainable health care facilities. *Int J Environ Res Public Health*. 2020 Dec;17(23):8849.
53. Nakstad B, Filippi V, Lusambili A, Roos N, Scorgie F, Chersich MF, Luchters S, Kovats S. How climate change may threaten progress in neonatal health in the African region. *Neonatology*. 2022 Oct 3;119(5):644-651.
54. Delaney KM, Bober JG, Koos JA, Hom J. The prevalence for the risk of serious infection in hypothermic infants ≤ 60 days: A systematic review. *Acad Emerg Med*. 2023 Jan;30(1):40-44.
55. Alphen JV, Beek EV, Taal M. Floods, from defence to management: Proceedings of the 3rd International Symposium on Flood Defence, Nijmegen, Netherlands, 25-27 May, 2005. In *Floods, from defence to management: Proceedings of the 3rd International Symposium on Flood Defence, Nijmegen, Netherlands, 25-27 May, 2005*. 2006. Taylor & Francis.
56. Dixon RW, Hema Malini B, Bharati A. Description and impact of Mumbai monsoon floods of July 2005. In *Proceedings of the Applied Geography Conferences 2008* (Vol. 31, pp. 162-165).
57. Chang H, Franczyk J, Kim C. What is responsible for increasing flood risks? The case of Gangwon Province, Korea. *Nat Hazards*. 2009 Mar;48:339-354.
58. Sahana M, Patel PP. A comparison of frequency ratio and fuzzy logic models for flood susceptibility assessment of the lower Kosi River Basin in India. *Environ Earth Sci*. 2019 May;78:1-27.
59. Singh SK, Pandey AC, Nathawat MS. Rainfall variability and spatio temporal dynamics of flood inundation during the 2008 Kosi flood in Bihar State, India. *Asian J. Earth Sci*. 2011 Jan 1;4(1):9-19.
60. Xie N, Xin J, Liu S. China's regional meteorological disaster loss analysis and evaluation based on grey cluster model. *Nat hazards*. 2014 Mar;71:1067-1089.
61. Shabir O. A summary case report on the health impacts and response to the Pakistan floods of 2010. *PLoS Curr*. 2013 Apr 11;5:PMC3625620.
62. Ahamed A, Bolten JD. A MODIS-based automated flood monitoring system for southeast Asia. *Int J Appl Earth Obs Geoinf*. 2017 Sep 1;61:104-117.
63. Cho C, Li R, Wang SY, Yoon JH, Gillies RR. Anthropogenic footprint of climate change in the June 2013 northern India flood. *Clim. Dyn*. 2016 Feb;46:797-805.
64. Lim J, Lee KS. Flood mapping using multi-source remotely sensed data and logistic regression in the heterogeneous mountainous regions in North Korea. *Remote Sens*. 2018 Jul 1;10(7):1036.
65. Ray K, Pandey P, Pandey C, Dimri AP, Kishore K. On the recent floods in India. *Curr Sci*. 2019 Jul 25;117(2):204-218.
66. Lal P, Prakash A, Kumar A. Google Earth Engine for concurrent flood monitoring in the lower basin of Indo-Gangetic-Brahmaputra plains. *Nat Hazards*. 2020 Nov;104(2):1947-1952.
67. Bhutta ZA, Bhutta SZ, Raza S, Sheikh AT. Addressing the human costs and consequences of the Pakistan flood disaster. *The Lancet*. 2022 Oct 15;400(10360):1287-1289.