

Flood Disasters in Nepal (2000-2026): A rapid review of epidemiological trends, health impacts and health system preparedness and response

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Abstract:

Background: Floods are among Nepal's most frequent climate-sensitive disasters, causing recurrent mortality, displacement, infrastructure damage, and public health emergencies. The objective of this review was to synthesize evidence on the epidemiology, health impacts, health system preparedness and response associated with major floods in Nepal from 2000 to 2026.

Methods: A rapid review of flood-related disasters (2000-2026) was conducted using Emergency Events Database EM-DAT, government and humanitarian reports and peer-reviewed literature.

Results: Forty major flood disasters were identified, most triggered by intense monsoon rainfall and often accompanied by landslides. The August 2026 floods along the Bhote Koshi and Trishuli river corridors were the deadliest event, causing 6,342 deaths and affecting over 84,000 people. Other major disasters included nationwide floods and landslides in 2020 (448 deaths), floods in 2003 (300 deaths), the Jure landslide and Sun Koshi disaster in 2014 (294 deaths), and floods in 2024 (268 deaths). The 2024 floods affected the largest population (2.59 million). Common health impacts included waterborne and respiratory diseases, malnutrition, psychosocial distress, and disruption of health services and infrastructure.

Conclusions: Floods remain a major public health challenge in Nepal. Strengthening climate-resilient health systems, early warning, preparedness, emergency response, and disease surveillance is essential to reduce future risks and build national resilience.

Keywords: Nepal; floods; disaster mortality; health impact; health system response

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Introduction

Floods are among the most frequent natural disasters worldwide and are responsible for repeated deaths, injuries, displacement, infrastructure damage, and economic losses. Climate change is also contributing to more frequent and intense episodes of extreme rainfall in many regions, increasing the likelihood of flooding. The health effects of floods extend beyond immediate fatalities and injuries. Flooding can restrict access to healthcare, safe drinking water, sanitation, and food, while also increasing the risk of infectious disease outbreaks and longer-term psychological distress [1–4].

Nepal is highly vulnerable to flooding because of its mountainous terrain, fragile geology, and extensive river network. Rivers such as the Koshi, Gandaki, Karnali, Bagmati, Rapti, Trishuli, and Bhotekoshi transport substantial amounts of water and sediment from the Himalayas to the densely populated lowlands. Most of Nepal's annual rainfall occurs during the summer monsoon, and intense monsoon precipitation frequently triggers floods and landslides. These hazards are among the most recurrent disasters affecting the country [5–7].

Flood exposure has increased in recent decades as a result of both environmental change and socioeconomic development. Rapid urbanisation, changes in land use, deforestation, and settlement in flood-prone areas have placed more people and assets at risk. Rising temperatures have also accelerated glacier retreat and contributed to the development of potentially unstable glacial lakes in the Himalayas. Consequently, glacial lake outburst floods, failures of landslide-dammed lakes, and other cascading hazards have become important concerns for communities, infrastructure, and health services in Nepal [8–10].

Floods affect health through several direct and indirect pathways. Immediate impacts include death, injury, and displacement. In the days and weeks that follow, floodwater may contaminate drinking-water sources, damage sanitation facilities, interrupt food supplies, and limit access to essential health services. These conditions can increase the risk of communicable diseases and worsen existing health problems. Children, older adults, pregnant women, people with disabilities, and households with limited socioeconomic resources are often particularly

vulnerable [2,3,11]. Damage to roads, health facilities, water-supply systems, and communication networks can further delay emergency assistance and hinder recovery [4,12].

Nepal has experienced a range of severe flood disasters, including extensive monsoon flooding in the Terai and hill regions, the Koshi embankment breach, flash floods and landslide-dam failures in mountain districts, and more recent glacier-related flood events. These disasters have caused deaths, injuries, displacement, and considerable socioeconomic losses, underscoring the importance of disaster-risk reduction and climate adaptation [5,6,8]. However, evidence on the epidemiological patterns, health effects, and health system responses associated with flooding in Nepal remains fragmented.

This review therefore aimed to: (1) examine trends in major flood-related disasters in Nepal between 2000 and 2026; (2) synthesize evidence on health impacts and disease risks associated with flood events, including mortality, injuries, displacement, and post-disaster health outcomes; and (3) assess health-system preparedness, response capacity, and challenges reported during flood emergencies. A clearer understanding of the public health burden of flooding and the performance of health system responses can support stronger disaster preparedness, improve climate resilience, and guide evidence-based emergency health management in Nepal.

Methodology

Study design

This study employed a retrospective rapid review of major flood-related disasters occurring in Nepal between January 2000 and September 2026, complemented by a structured review of published literature on flood-related health impacts. A rapid review approach was selected to provide a timely synthesis of evidence by streamlining selected components of a conventional systematic review while maintaining a transparent and reproducible methodology [13].

The study aimed to characterize the epidemiology of flood disasters and synthesize evidence on mortality, injuries, affected populations, displacement, health outcomes, health system preparedness and response associated with flooding in Nepal. Disaster-event records served as the primary unit of analysis, while

evidence from published studies was systematically identified, screened, and synthesized to contextualize and interpret the observed health impacts.

Data sources

Two complementary data sources were used. First, for the disaster-event review, disaster-event data were obtained from the Emergency Events Database (EM-DAT) and supplemented with information from humanitarian situation reports, government assessments, disaster response reports, and organizational publications documenting major flood disasters in Nepal. Key sources included UN Office for the Coordination of Humanitarian Affairs (OCHA) Situation Reports and Flash Updates, UNICEF Humanitarian Situation Reports, UNFPA Flood Situation Reports, annual National Disaster Risk Reduction and Management Authority (NDRRMA) and Ministry of Home Affairs (MoHA) disaster reports, and technical assessments from the Department of Hydrology and Meteorology (DHM). These sources provided information on flood characteristics, mortality, injuries, affected populations, displacement, morbidity, health outcomes, infrastructure damage, and health system response activities.

Second, for the structured review, a systematic search of published literature was conducted to identify studies examining the health impacts of floods in Nepal. Electronic searches were conducted in MEDLINE and Scopus using combinations of keywords related to flood hazards (floods, flash floods, landslides), health outcomes (mortality, injury, infectious diseases, malnutrition, mental health), and Nepal.

Eligibility criteria

For the disaster-event review, all flood disasters recorded in the Emergency Events Database (EM-DAT, <https://www.emdat.be/>) and occurring in Nepal between January 2000 and September 2026 were eligible for inclusion. Events were identified according to the EM-DAT disaster classification system and included all flood-related disasters reported during the study period. Information on disaster characteristics, mortality, injuries and affected populations was extracted from EM-DAT. Additional information on health outcomes, infrastructure damage, and health system response measures was obtained from humanitarian situation reports,

government assessments, disaster response reports, and organizational publications where available.

For the structured review, quantitative, qualitative, and mixed-methods studies published in peer-reviewed journals were eligible for inclusion if they were conducted in Nepal and examined flood-related health impacts, disaster outcomes, vulnerability factors, or public health consequences of flooding. Editorials, commentaries, conference abstracts, and studies not reporting health-related outcomes were excluded.

Study selection

All identified reports from key sources aligned with the Emergency Events Database (EM-DAT) major flood-related disasters in Nepal between 2000 and 2026 were included. In addition, all records identified from MEDLINE and Scopus were imported into Rayyan and screened for duplicate records. Titles and abstracts were independently screened against the eligibility criteria by two reviewers. Disagreements were resolved through discussion and consensus. Potentially eligible articles subsequently underwent full-text review.

The literature search identified 307 records (MEDLINE, $n = 108$; Scopus, $n = 199$). After removal of 56 duplicates, 251 records were screened by title and abstract, of which 218 were excluded. Thirty-three full-text articles were assessed for eligibility, and five studies reporting flood-related health outcomes met the inclusion criteria and were included in the narrative synthesis. The selection process was documented using a PRISMA flow diagram (Figure 1).

Data extraction

A standardized data extraction form was used for both disaster-event records and published studies. For each disaster event, data extracted included year of occurrence, affected location, disaster trigger, flood type, number of deaths, number of injuries, population affected, reported morbidity, health-facility damage, post-disaster response activities, rivers involved, and other contextual information.

For published studies, information was extracted on author, publication year, study location, flood event, study design, data sources, study population, sample size, health outcomes assessed, and key findings.

Outcome measures

The primary outcomes were disaster-related mortality, injuries and affected populations. Mortality was

defined as the number of reported deaths directly attributable to a flood event, while injuries referred to non-fatal physical harm resulting from flooding. Affected population included individuals experiencing loss of housing, livelihoods, property, or access to essential services.

Secondary outcomes included communicable diseases, nutritional outcomes, mental health impacts, disruption of healthcare services, and damage to health infrastructure. Disaster response measures, including search and rescue activities, emergency medical care, shelter provision, food assistance, and water, sanitation, and hygiene (WASH) interventions, were also documented.

Data synthesis and analysis

Descriptive epidemiological methods were used to summarize disaster characteristics and impacts. Flood events were described according to year of occurrence, geographical distribution, hazard type, mortality, injuries and affected populations. Events were further categorized according to their primary triggering mechanism, including monsoon rainfall and river flooding, landslide-associated flooding, embankment-breach flooding, glacial lake outburst flooding, and landslide-dam outburst flooding. Given the heterogeneity of disaster records and published studies, findings were synthesized narratively. Health impacts were grouped into major thematic categories, including mortality and injuries, communicable diseases, nutritional impacts and mental health consequences. Health system preparedness and response were categorised into health system preparedness, emergency response and health system challenges.

Ethical considerations

The study used publicly available secondary data and published literature and did not involve the collection or analysis of individual-level human participant data. Therefore, ethical approval and informed consent were not required.

Results

1) Trends in flood disasters in Nepal from 2000-2026

Characteristics of flood disasters

A total of 40 flood-related disasters were identified in Nepal between 2000 and 2026. Detailed

characteristics and impacts of all identified flood events are presented in Table 1.

The majority of events were triggered by heavy monsoon rainfall and were frequently accompanied by landslides, flash floods, river overflows, embankment breaches, or glacial and landslide-dam outburst floods. Floods were reported across all geographical regions of Nepal, affecting both mountain and lowland districts.

The number of deaths per event ranged from 8 to 6,342, while reported injuries ranged from 3 to 5,500. The number of affected people varied substantially across events, from fewer than 1,000 individuals to approximately 2.59 million people during the nationwide floods and landslides of 2024.

Temporal distribution of flood impacts

Major flood disasters occurred throughout the study period, although the severity of events varied considerably. The highest mortality burden was recorded in 2026, when a glacial landslide-induced dam formation and subsequent outburst flood along the Bhotekoshi and Trishuli river systems affected Rasuwa, Nuwakot, Dhading, Gorkha, Tanahun, and Chitwan districts, resulting in 6,342 deaths.

Large-scale flood emergencies were also documented in 2003, 2004, 2007, 2014, 2017, 2020, and 2024. The largest affected population was reported during the nationwide floods and landslides of 2024, affecting approximately 2.59 million people.

Figure 2 illustrates the mortality associated with the deadliest flood-related disasters recorded in Nepal between 2000 and 2026. The 2026 glacial landslide-dam outburst flood was by far the most catastrophic event, causing 6,342 deaths and exceeding mortality reported for all previous disasters. When the 2026 event was excluded, the highest mortality was observed during the nationwide floods and landslides of 2020 (448 deaths), followed by the nationwide floods of 2003 (300 deaths), the Jure landslide disaster in 2014 (294 deaths), and the nationwide floods and landslides of 2024 (268 deaths). These findings indicate an increasing occurrence of high-impact flood disasters, particularly those associated with complex mountain hazards and cascading flood events.

The magnitude of population exposure varied substantially across flood disasters (Figure 3). The largest affected population was recorded during the nationwide floods and landslides of 2024 (2.59 million

people), followed by major flood event in 2017 affecting approximately 1.70 million people. More than 800,000 people were affected during the 2004 floods, while over 640,000 individuals were affected during the 2007 floods. Notably, the 2026 flash-flood disaster recorded the highest mortality burden of any event identified during the study period. While several large-scale monsoon floods affected substantially greater numbers of people, this finding demonstrates that population exposure alone may not reflect the severity of health impacts associated with flood-related disasters.

Flood disasters in Nepal were predominantly associated with monsoon rainfall and river flooding, accounting for 31 of the recorded events (Figure 4). Landslide-associated flooding was the second most common disaster type (n=5), followed by embankment-breach flooding (n=3). Glacial lake outburst floods and avalanche/debris floods were less frequent but contributed to several recent high-impact disasters in mountain districts, highlighting the growing importance of climate-sensitive cryospheric hazards. Although monsoon-related flooding remained the predominant hazard, glacier- and landslide-related floods have emerged as important contributors to recent high-impact disasters in Nepal.

Geographic distribution

Flood disasters were widely distributed across Nepal, affecting eastern, central, western, and far-western regions of the country (Figure 5). Recurrently affected districts included Jhapa, Morang, Sunsari, Saptari, Kailali, Kanchanpur, Banke, Bardiya, Sindhupalchok, Dhading, and Rasuwa, reflecting persistent exposure to both riverine and flash-flood hazards across diverse ecological zones.

The geographic pattern of flooding demonstrated substantial regional variation. Eastern Terai districts were predominantly affected by flooding associated with the Koshi River basin, particularly in Jhapa, Morang, Sunsari, and Saptari. In contrast, western and far-western districts experienced recurrent flooding linked to the Karnali, Rapti, Babai, and Mahakali river systems. These river basins accounted for many of the largest flood events reported during the study period. Mountain districts increasingly emerged as important flood hotspots, particularly Rasuwa, Dhading, and Sindhupalchok, where floods were frequently

associated with landslide-dam failures, flash floods, debris flows, and glacier-related hazards. Recent events in Rasuwa, Solukhumbu, and Sindhupalchok highlight the growing contribution of cryosphere-related hazards, including glacial lake outburst floods and landslide-dam outburst floods, to Nepal's flood-risk landscape.

2) Health impacts

Flood disasters in Nepal resulted in substantial direct and indirect health consequences. Direct impacts included mortality, drowning, traumatic injuries, and landslide-related fatalities, while indirect impacts included communicable diseases, malnutrition, mental health problems, and disruption of healthcare services [14]. Humanitarian reports consistently documented increased risks of disease outbreaks, food insecurity, population displacement, and interruption of essential health services following major flood events [15-18].

Communicable diseases

Communicable diseases were among the most frequently reported secondary health impacts. Humanitarian reports documented recurrent outbreaks and elevated risks of diarrhoeal diseases, cholera, pneumonia, acute respiratory infections, skin infections, eye infections, and other waterborne diseases following major floods [18-20]. The nationwide floods of 2000 were associated with cholera and Japanese encephalitis outbreaks, while concerns regarding malaria and kala-azar transmission were also reported [21]. Similarly, the 2010 floods were linked to more than 1,500 cholera cases and eight cholera-related deaths in Banke District [22]. Flood events in 2007, 2009, 2010, 2017, and 2024 also reported heightened risks of diarrhoeal disease due to contamination of drinking-water sources and damage to sanitation infrastructure [19-24].

Nutritional impacts

Food insecurity and malnutrition emerged as important public health concerns following large-scale flood disasters. Humanitarian assessments conducted after the 2017 floods estimated approximately 15,000 cases of severe acute malnutrition and 50,000 cases of moderate acute malnutrition among affected populations [16]. Damage to crops, livestock losses, and livelihood disruption were frequently identified as contributing factors [16].

The findings from published studies further support the relationship between floods and adverse nutritional

outcomes. A cross-sectional study conducted among 444 pregnant women affected by the 2017 floods in Siraha District reported that household food insecurity, low dietary diversity, unemployment, and low educational attainment were significant predictors of acute malnutrition [25]. Another national study using disaster and demographic survey data found that exposure to flood disasters was associated with increased risk of childhood stunting, highlighting the longer-term nutritional consequences of recurrent flooding [26].

Mortality and injuries

Flood-related mortality represented one of the most severe consequences of flooding. Humanitarian reports documented deaths resulting from drowning, landslide burial, structural collapse, and other direct physical impacts [19-24]. Published evidence further demonstrated that children are particularly vulnerable to flood-related mortality. A community-based study conducted following the 1993 flood in Sarlahi District found that flood-related mortality among children was nearly six times higher than pre-flood mortality rates, with higher risks observed among socioeconomically disadvantaged households [27].

Research examining flood fatalities across Nepal and other Asian countries indicated that drowning was the leading cause of flood-related death, accounting for approximately 44% of all fatalities [14]. Most deaths occurred during or immediately after disasters and were attributable to drowning, burial, structural collapse, and electrocution, while a smaller proportion resulted from post-disaster conditions such as waterborne diseases and animal bites [14].

Mental health impacts

Mental health impacts were less frequently documented than physical health outcomes; however, psychosocial distress was reported following several flood emergencies. Humanitarian reports from the 2017 floods specifically noted psychosocial trauma among affected communities [16]. Although quantitative evidence remains limited, displacement, loss of livelihoods, destruction of homes, and bereavement associated with major flood disasters suggest that mental health consequences may represent a substantial but under-recognized component of the overall disaster burden [16].

Health-system impacts

Flood disasters frequently disrupted healthcare delivery through damage to health facilities and critical infrastructure. Across Nepal's floods from 2000 to 2026, health-service disruption emerged in humanitarian and government reports as a recurring systems problem extending beyond direct facility damage. Floods and landslides damaged or submerged health facilities and WASH infrastructure, blocked roads and bridges, and interrupted electricity, communications, referrals and medical supply chains, particularly in remote communities. Notably, assessments of the Melamchi and 2024 floods showed how damage to transport and essential infrastructure constrained access to services [28, 29]. The 2026 flood reports indicated that these vulnerabilities persisted. Published articles reinforce these findings by identifying barriers to remote healthcare access [30], interrupted healthcare services and uneven local preparedness capacity [31], and gaps in flood-specific hospital planning, supplies and outpatient continuity, and sanitation failure [32,33]. These findings explain how floods may disrupt access to and continuity of care, but they do not quantify the disruption across Nepal's flood events.

3) Health system response and preparedness

Health system preparedness and response included rescue and evacuation, temporary shelters, health camps, food and relief distribution, and provision of essential WASH supplies. Security personnel, Nepal Red Cross volunteers, rapid-response teams and mobile health teams were deployed, supported by drones, satellite imagery and flood modelling. Evidence came mainly from humanitarian reports, but inconsistent reporting limited comprehensive comparisons.

1) Health system preparedness

Nepal has established disaster policies, local committees and hospital preparedness plans, but implementation remains uneven. Studies report limited municipal funding, training, coordination, and locally tailored early warnings [31], while district hospitals need stronger planning for floods, vulnerable patients, staffing, emergency supplies, and drills [32]. Flood resilience also requires improved sanitation, as flood exposure and inadequate facilities are linked to household sanitation failure [33]. These findings

highlight gaps in local planning, hospital readiness, psychosocial care, and flood-resilient sanitation, but do not establish national health-system preparedness.

2) Emergency response

The reports highlighted a progressive organisation of emergency-response capacity across Nepal's floods between 2000 and 2026, but they also indicated that implementation and reporting remained uneven. Earlier responses depended mainly on district relief committees, security forces, the Nepal Red Cross Society, volunteers and humanitarian organisations, with activities centred on rescue, evacuation, temporary shelter, food and essential relief supplies [19, 34, 35]. Health-system involvement subsequently became more prominent through mobile health teams, referrals, health camps, WASH interventions and disease surveillance [16, 36]. Later responses increasingly engaged national and subnational health authorities, emergency coordination structures, rapid-response teams and international partners, while satellite imagery, drones, flood modelling and mobile network data strengthened situational awareness and damage assessment [28,29]. The 2026 response used the Surveillance Outbreak Response Management and

Analysis System (SORMAS) to integrate information from health facilities and communities, marking a shift toward coordinated surveillance from multiple sources and more proactive action [37].

3) Health-system challenges

Evidence from this review highlighted persistent health-system challenges. Recurrent dependence on mobile teams, temporary services and external humanitarian support suggests continuing limitations in local clinical and logistical surge capacity [16]. Assessments of the Melamchi and 2024 floods also showed that damage to roads and essential infrastructure continued to restrict access and delay recovery despite improvements in coordination and technology-supported assessment [28,29]. The 2026 floods confirmed that health facilities and hospital access remained exposed to flood damage [32]. Mental health and psychosocial support also remained less integrated and documented [30]. Overall, these findings underscore the need to strengthen climate-resilient infrastructure, local surge capacity and the integration of mental health support within health-system preparedness and response in Nepal.

Figure 1. PRISMA flow diagram

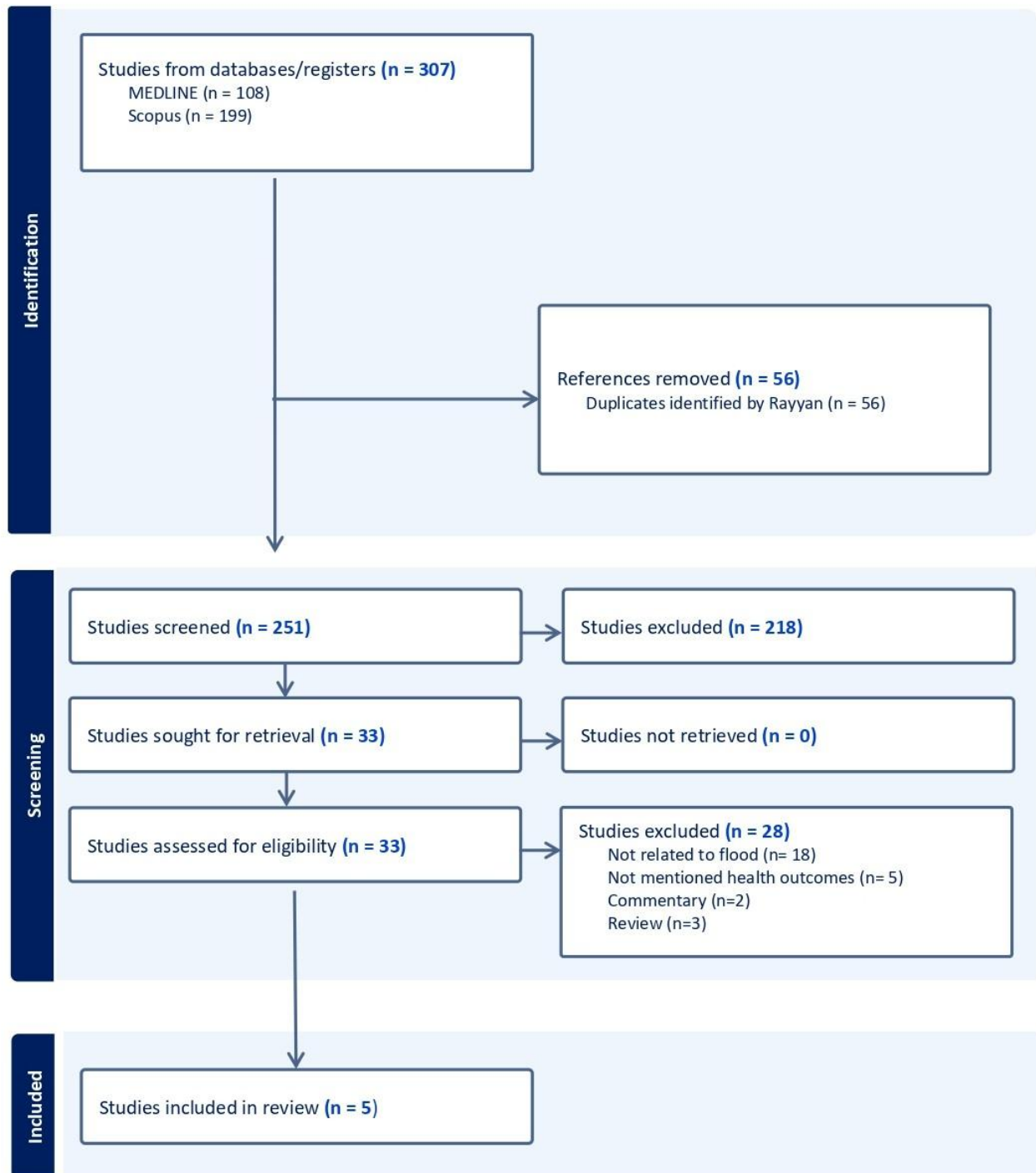
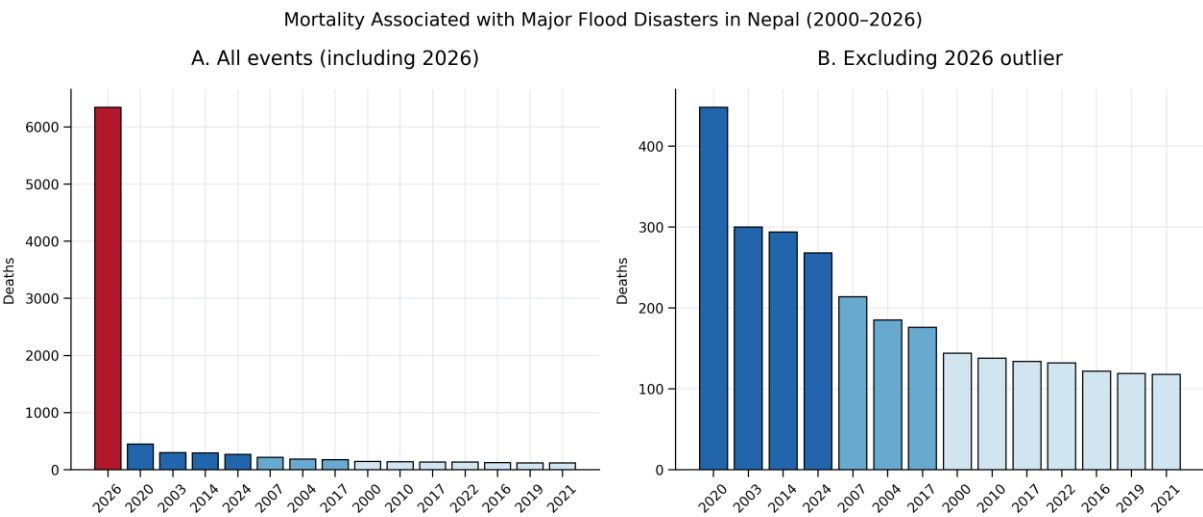


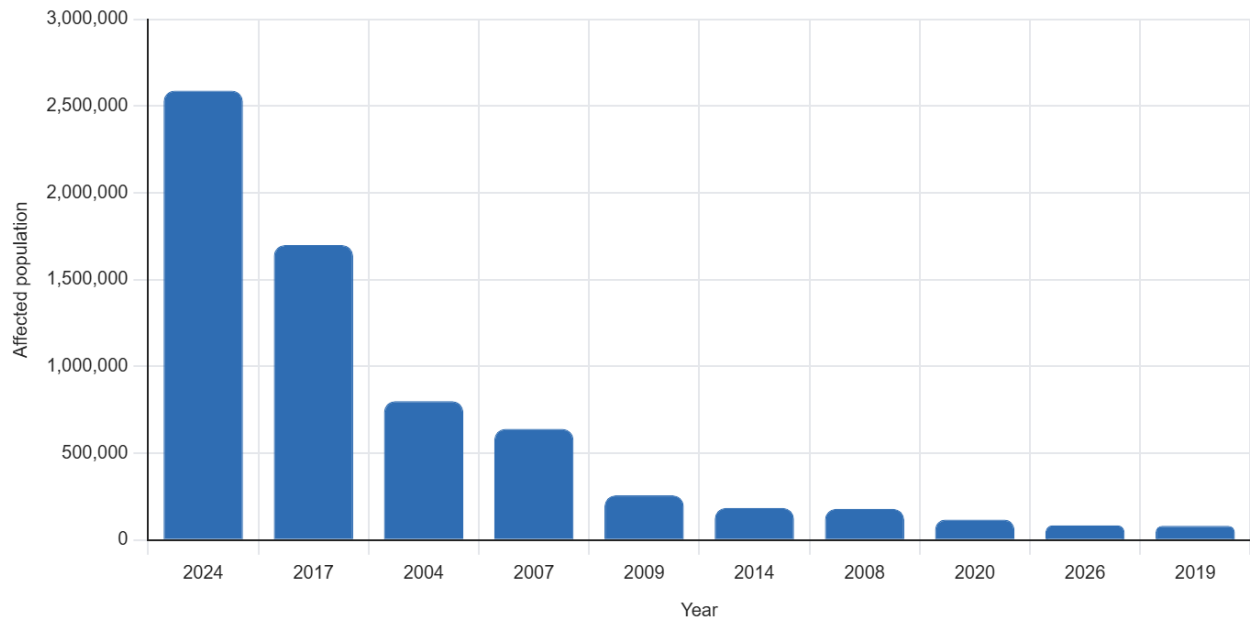
Figure 2. Mortality associated with major flood disasters in Nepal, 2000-2026.



Note: Panel A presents mortality associated with major flood disasters including the 2026 Rasuwa-Nuwakot-Dhading-Chitwan glacial landslide-dam outburst flood (6,342 deaths). Panel B excludes the 2026 outlier to facilitate comparison among the remaining high-mortality flood disasters.

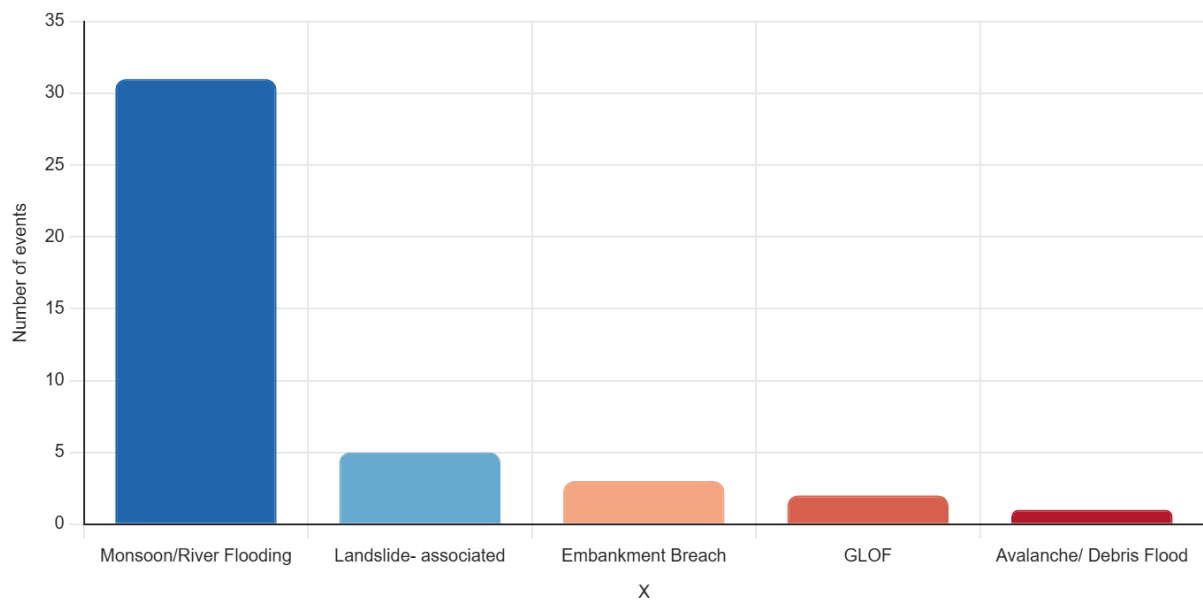
Source: EM-DAT, CRED / UCLouvain, Brussels, Belgium, <https://www.emdat.be>

Figure 3. Population affected by major flood disasters in Nepal between 2000 and 2026



Note: Data were derived from EM-DAT, CRED / UCLouvain, Brussels, Belgium, <https://www.emdat.be>.

Figure 4. Distribution of major flood disaster types recorded in Nepal between 2000 and 2026.



Note: Monsoon rainfall and river flooding accounted for the majority of recorded flood disasters (n=31), followed by landslide-associated flooding (n=5), embankment-breach flooding (n=3), glacial lake outburst floods (GLOFs; n=2), and avalanche/debris floods (n=1). Categories are not mutually exclusive and that individual events may contribute to more than one categories. Data were derived from EM-DAT, CRED / UCLouvain, Brussels, Belgium, <https://www.emdat.be>.

Figure 5. Geographic distribution of floods in Nepal between 2000 and 2026.

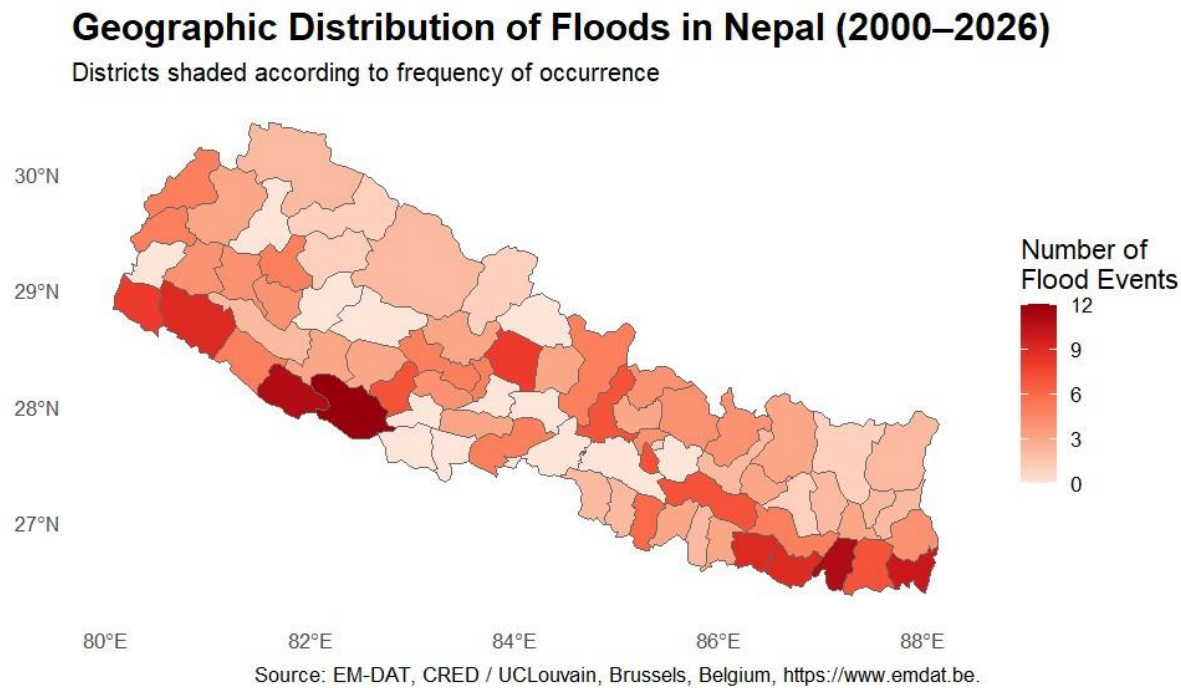


Table 1. Summary of floods in Nepal from 2000-2026

Year	Location	Total Deaths	No. Injured	Total Affected
2026*	Rasuwa, Nuwakot, Dhading, Gorkha, Tanahun, and Chitwan districts	6342	267	84267
2025	Rasuwa district	18	35	5585
2025	Ilam district (Koshi province); Jhapa District	57	47	20342
2024*	Kathmandu, Kavrepalanchowk, Lalitpur, Bagmati, Gandak	268	178	2590178
2024	Solukhumbu district (Koshi province)			135
2023	Nuwakot, Okhaldhunga, Panchthar, Shankhuwasabha, Taplejung, Dhankuta and Ilam (Koshi province)	36	6	1506
2022	Darchula District (Sudurpashchim Province); Kanchanpur District (Sudurpashchim Province)	15	11	511
2022*	Belaka municipality of Udayapur district; Saptakoshi	132		5500
2021*	Kanchanpur District (Sudurpaschim Province)	118	10	10
2021	Helambu and Melamchi (Sindhupalchok district, previously in Bagmati)	46	20	820
2021	Province 1, Bagmati Province, Gandaki Province and Sudur Pashchim Province	74	51	2101
2021	Bagmati, Lumbini and Gandaki Provinces	13	10	1010
2020*	Parbat, Lamjung, Gorkha, Kalikot, Syangaja, Gulmi, Bajhang, Darchula, Bajura, Sindhupalchok, Kaski, Dailekh, Myagdi, Jajarkot, Rukum Paschim, Dhading, Shankhuwashaba, Jhapa, Tanahun, Baglung, Saptari, Lalitpur, Nawalparasi Purba, Chitwan, Dang, Surkhet, Kailali districts	448	287	117677
2019*	Lalitpur, Kathmandu, Bhaktapur, Jhapa, Morang, Sunsari, Saptari, Dang, Dhanusha, Siraha, Sarlai, Bara, Parsa, Bhojpur, Udayapur, Rautahat, Mahottari, Kavre, Makwanpur, Dhading, Ramechhap, Khotang, Dolpa, Sindhuli, Panchthar, Dholakha, Illam, Okhaldunga, Palpa, Kapilabastu and Dhankuta districts	119	41	82541
2018	Runtigadhi (Rolpa district); Parsa, Kailali, Banke, Dang, Sarlahi, Sindhuli districts; Tanahu, Kathmandu	15	6	1406
2017*	Lalitpur, Palpa, Jhapa, Morang, Sunsari, Saptari, Bardia, Dang, Banke, Sirha, Sarlai, Bara, Sindhuli, Panchthar, Rasuwa, Rupendehi, Baglung, Nawalparasi, Kailali, Kalikot, Doti, Dhading, Ramechhap, Syangia, Parbat, Pyuthan, Kaski, Terathum, Dolakha districts	176	134	1700134
2017	Kaski, Syangja (Gandaki), Mugu (Karnali), Sindhuli, Dudhauri (Janakpur), Saptari, Tilathi (Sagarmatha) districts, Parbat district (Dhaulagiri), Myanglung, Terhathum district (Koshi), Pyuthan district (Rapti)	11		6000
2016	Rapti, Kerauja VDC, Gorkha, Lamjung (Gandaki); Malikarjun, Kakada, Sarmoli, Uku (Mahakali), Dolakha (Janakpur), Dhading, Nuwakot, Bhagawati, Kavre, Rasuwa (Bagmati)	25	23	10023
2016*	Pyuthan (Rapti), Gulmi, Palpa, Rupandehi (Lumbini), Makwanpur (Narayani), Udaypur (Sagarmatha), Baglung, Setibeni Bazaar (Dhaulagiri), Banke (Bheri), Jhapa (Mechi)	138	51	10551
2014	Sindhupalchok, Lalitpur areas (Bagmati district, Central province), Chitwan area (Narayani district, Central province)	16		2400
2014	Far Western province	8		

2014*	Jure, Mankhaa villages (Sindhupalchok area), Lalitpur area (Bagmati district, Central province), Surkhet, Banke, Bardiya, Jajarkot areas, Dang, Salyan, Rukum, Rolpa areas (Rapti district, Mid Western province), Kaski, Gorkha areas, Achham area, Chitwan area	294	149	184894
2013*	Jhapa area (Mechi district, Eastern province), Morang, Sunsari areas (Koshi district, Eastern province), Saptari area (Sagarmatha district, Eastern province), Rautahat area (Narayani district, Central province)	119	6	4320
2013	Kathmandu area, Sindhuli area, Rautahat area, Dhankuta, Morang, Sunsari areas, Taplejung, Jhapa areas, Okhaldhunga, Saptari, Solukhumbu, Udayapur areas, Baitadi, Dadeldhura, Darchula, Kanchanpur areas (Mahakali district, Far Western province), Achham, Bajhang, Doti, Kailali areas, Bardiya, Dailekh areas, Kalikot, Humla areas, Dang, Pyuthan, Rolpa areas, Nawalparasi area, Mustang area	76	29	12503
2012	Kaski area (Gandaki district, Western province)	72	5	5
2011	Accham area (Seti district, Far Western province)	15		
2011	Mid Western, Far Western, Central, Eastern provinces	89	32	1858
2010	Sunsari area (Koshi district, Eastern province), Rupandehi area (Lumbini district, Western province), Jhapa, Ilam areas (Mechi district, Eastern province), Rautahat area (Narayani district, Central province), Siraha area (Sagarmatha district, Eastern province), Parbat area (Dhawalagiri district, Western province)	12		
2010*	Sankhuwasabha, Morang, Sunsari areas, Taplegunj, Ilam, Jahpa areas, Udayapur, Saptari areas Dhading area, Sindhuli, Dolakha, Dhanusha, Sarlahi areas, Chitwan, Makwanpur, Rautahat, Parsa areas, Syangja, Kaski, Tanahu areas, Baglung, Parbat, Myagdi, Gulmi, Nawalparasi areas Rukum, Dang, Pyuthan areas, Bardiya, Banke, Jajarkot, Dailekh areas, Kalikot, Dolpa areas Bajura, Achham, Kailali areas, Kanchanpur, Dadeldhura areas	138		8000
2009	Kanchanpur, Baitadi, Dadeldhura areas (Mahakali district, Far Western province), Kailali, Doti, Achham, Bajhang areas (Seti district, Far Western province), Bardiya, Banke areas (Bheri district, Mid Western province), Dang area (Rapti district, Mid Western province), Myagdi area (Dhawalagiri district, Western province), Jumla, Kalikot areas (Karnali district, Mid Western province)	87	62	257786
2009	Takdoo village (Bagmati district, Central province)	30		
2008	Kusaha, Laukahi, Ghuski, Shripur, Haripur, Narsingha, Madhuban, Basantapur villages (Sunsari area, Koshi district, Eastern province), Dadeldhura area (Mahakali district, Far Western province), Siraha area	65		70000
2008	Bardiya, Banke areas, Dadeldhura, Kanchanpur areas, Kailali, Doti areas (Seti district, Far Western province), Dang, Salyan areas (Rapti district, Mid Western province),	50	3	180003
2007*	Mahottari, Dhanusha, Sindhuli areas, Jhapa area, Sunsari area (Koshi district, Eastern province), Nawalparasi, Gulmi areas, Dang areas, Solukhumbu area	214	48	640706
2006	Banke area, Kaski area			
2005	Kanchanpur, Baitadi, Dadeldhura, Darchula areas	51		1600
2005	Banke area, Sunsari area			30000

2004*	Morang, Sunsari areas, Jhapa area (Mechi district, Eastern province), Okhaldhunga, Saptari, Siraha, Udayapur areas, Pyuthan, Dang areas, Janakpur, Narayani districts	185	15	800015
2003*	Baitadi, Kanchanpur areas, Bajura, Kailali areas, Banke, Jajarkot areas, Humla area, Dang, Pyuthan, Rukum areas, Central, Eastern, Western provinces	300	284	59254
2000*	Dhading, Lalitpur areas, Dolakha, Sarlahi areas, Makwanpur, Parsa, Rautahat areas, Bhojpur, Morang, Sunsari, Terhathum areas, Siraha, Saptari areas, Baitadi, Darchula areas, Kailali area, Banke, Dailekh areas, Salyan area, Baglung area (Dhawalagiri district, Western province), Argakhachi area, Gorkha, Lamjung, Tanahu, Kaski areas and Mechi district	144	70	50070

Note: Flood events marked with an asterisk had more than 100 reported deaths.

Source: EM-DAT, CRED / UCLouvain, Brussels, Belgium, <https://www.emdat.be>

Table 2. Summary of reported health impacts associated with flood disasters in Nepal (2000–2026)

Health impact	Evidence from humanitarian reports	Evidence from published studies
Mortality	Drowning, landslide burial, structural collapse [19-24]	Children experienced significantly higher flood-related mortality [27]; drowning accounted for 44% of flood deaths [14]
Physical injuries	Trauma, fractures, crush injuries [19-24]	Frequently reported following flood and landslide events [14]
Waterborne diseases	Diarrhoea, cholera, contaminated drinking water [18-20]	Not available
Respiratory diseases	Pneumonia, acute respiratory infections [18-20]	Not available
Other communicable diseases	Skin infections, eye infections, viral infections [18-20]	Not available
Nutritional impacts	Food insecurity, severe and moderate acute malnutrition [16]	Acute malnutrition among pregnant women and increased risk of childhood stunting [25.26]
Mental health impacts	Psychosocial trauma among affected populations [16]	Not available
Health-system impacts	Damage to health facilities, water systems, transport infrastructure [28, 29]	Not available

Source: EM-DAT disaster records, humanitarian situation reports, and published studies included in the review.

Discussion

This review provides a comprehensive overview of major flood-related disasters in Nepal between 2000 and 2026 and highlights the substantial public health burden associated with flooding. The findings demonstrate that floods remain one of the most important natural disasters in Nepal, causing significant mortality, injuries, displacement, disease outbreaks, nutritional consequences, and damage to infrastructure. Although monsoon rainfall continues to be the main driver of flood disasters, recent events indicate the increasing importance of glacier- and landslide-related disasters in shaping Nepal's contemporary flood-risk landscape.

One of the most notable findings was the considerable variation in mortality and population exposure across flood events. The recent 2026 flash flood affecting Rasuwa, Nuwakot, Dhading, Gorkha, Tanahun, and Chitwan districts resulted in 6,342 deaths, making it the deadliest event identified in the study period [15,38]. In contrast, the largest affected population was recorded during the nationwide floods and landslides of 2024, which affected approximately 2.59 million people [17,38]. This discrepancy suggests that mortality burden is not solely determined by the number of individuals exposed but is also influenced by disaster characteristics, warning systems, settlement patterns, vulnerability, and response capacity. Catastrophic mountain flood events may affect smaller populations but produce disproportionately high mortality because of their sudden onset, limited warning time, and extreme destructive force.

The predominance of monsoon rainfall and river flooding observed in this review is consistent with Nepal's climatic and geographical context. More than three-quarters of the identified flood disasters were associated with monsoon rainfall and river overflow, reflecting the country's dependence on seasonal precipitation patterns and the influence of major river basins such as the Koshi, Karnali, Rapti, and Mahakali systems [38]. However, the emergence of high-impact events associated with landslide-dam failures, glacial lake outburst floods (GLOFs), and complex cascading mountain disasters suggests a gradual diversification of flood risks. Recent disasters in Rasuwa, Sindhupalchok, Solukhumbu, and Melamchi illustrate how climate-sensitive mountain processes increasingly contribute to disaster risk in Nepal [38].

The study also underscores the extensive public health consequences of flooding. Humanitarian reports consistently documented outbreaks or elevated risks of diarrhoeal diseases, cholera, respiratory infections, skin diseases, and eye infections following major flood events [18-20]. These findings reflect the well-established pathways linking floods to contamination of drinking-water supplies, damage to sanitation infrastructure, overcrowding in temporary shelters, and reduced access to

healthcare services [39]. Particularly concerning were reports of cholera outbreaks following the 2000 and 2010 floods and repeated concerns regarding waterborne diseases after subsequent disasters.

Nutritional impacts emerged as another important consequence of flooding. Humanitarian assessments of the 2017 floods estimated approximately 15,000 cases of severe acute malnutrition and 50,000 cases of moderate acute malnutrition among affected populations [16]. Findings from the reviewed literature further support these observations. Aryal et al. (2022) reported that household food insecurity, poor dietary diversity, unemployment, and low educational attainment were significant predictors of acute malnutrition among pregnant women affected by flooding, while Gaire et al. demonstrated an association between disaster exposure and childhood stunting. Together, these findings suggest that floods contribute not only to acute health emergencies but also to longer-term nutritional vulnerabilities, particularly among women and children [25,26]. The reviewed studies also highlighted the role of social vulnerability in shaping flood impacts. Pradhan et al. found that children living in socioeconomically disadvantaged households experienced substantially higher flood-related mortality following the 1993 Sarlahi flood, while a nationwide study demonstrated that higher levels of education were associated with reduced disaster-related mortality and household losses [27]. These findings suggest that flood impacts are not distributed equally and that socioeconomic disadvantage, poor housing conditions, limited resources, and inadequate access to information may amplify vulnerability during disasters [27,40]. Consequently, flood risk reduction strategies should extend beyond structural mitigation and incorporate measures that address social determinants of vulnerability.

Another important finding relates to geographic patterns of risk. Recurrent flooding was concentrated in eastern Terai districts, including Jhapa, Morang, Sunsari, and Saptari, and western Terai districts, including Kailali, Kanchanpur, Banke, and Bardiya [38]. These areas have experienced repeated exposure to riverine flooding associated with major river systems [38]. At the same time, mountain districts such as Rasuwa, Dhading, Sindhupalchok, and Solukhumbu emerged as increasingly important hotspots due to flash floods, debris flows, landslide-dam failures, and glacier-related hazards [38]. This dual pattern highlights the need for geographically differentiated disaster risk reduction strategies that reflect the distinct flood mechanisms operating in lowland and mountain environments. Flood disasters also had significant implications for health-system resilience. Several events damaged health posts, clinics, water-supply systems, transportation networks, and communication infrastructure, reducing access to essential services at times of greatest need. Damage to health facilities

and water infrastructure observed during the Melamchi disaster, Saptakoshi flood, and Solukhumbu flood illustrates how floods can simultaneously increase demand for healthcare while undermining the capacity of health systems to respond. The 2026 floods again damaged health facilities and affected hospital access, while assessments following the 2024 floods documented the need to monitor whether essential services were functioning [41,42]. These findings show that preparedness measures must address the critical infrastructure and systems that health facilities depend on. Priority actions are to assess facility exposure, protect power and WASH systems, and establish workable referral routes and alternate care sites before floods occur. Nepal's inclusion of alternate care sites in hospital preparedness planning provides a basis for this work [41].

The increased use of coordinated health teams and digital surveillance in recent floods indicates improved response capacity; however, available reports describe activities rather than demonstrating faster or more equitable access to care [28, 37]. During the 2026 floods, surveillance systems combined information from health facilities, mobile teams, temporary shelters and community sources, providing a more comprehensive picture of emerging health needs [37]. Nevertheless, published studies found that municipal preparedness remained focused primarily on post-disaster relief, while hospitals reported continuing gaps in coordination, staffing and emergency supplies [31,32]. Authorities should therefore test referral and deployment plans jointly with hospitals and community organisations and pre-position essential supplies in areas likely to become inaccessible during floods.

Preparedness must also sustain care beyond rescue and acute treatment. Earlier research identified inadequate integration of mental health and psychosocial support into Nepal's disaster planning; the 2026 WHO assessment identifies these needs but does not establish how consistently support was delivered [30,42]. Plans should specify how routine mental healthcare will continue alongside injury care, WASH and surveillance. Finally, consistent reporting of facility function, service interruption, referrals and population reach is needed to evaluate whether preparedness measures work. The predominantly humanitarian evidence and varied reporting measures in this review limit comparisons of response effectiveness across flood events, with evidence suggesting gaps in Nepal's disaster and facility preparedness data [43]. Therefore, addressing these gaps is essential to developing a more timely, coordinated and sustainable health-system response.

Limitations

The study has some limitations. First, the disaster-event data were obtained from multiple secondary sources with varying

levels of completeness and quality. Second, some events lacked detailed information on morbidity and health-system impacts. Third, the number of peer-reviewed studies examining flood-related health outcomes in Nepal was limited, particularly regarding mental health, chronic disease management, disability, and long-term recovery. Finally, inconsistencies in reporting across disaster databases and humanitarian reports may have influenced some estimates. Despite these limitations, this review provides one of the most comprehensive syntheses of flood-related health impacts in Nepal covering a 26-year period. The findings highlight the continued importance of strengthening early warning systems, disaster preparedness, disease surveillance, emergency medical response, climate-resilient infrastructure, and targeted interventions for vulnerable populations. Given the increasing contribution of glacier- and landslide-related hazards, enhanced monitoring of mountain environments and stronger integration of climate adaptation into disaster risk reduction policies will be essential for reducing future flood-related health burdens in Nepal.

Conclusion

Flooding remains a major public health challenge in Nepal, causing mortality, displacement, disease outbreaks, nutritional problems, and disruption of essential services. While monsoon-driven riverine floods continue to dominate, glacier-related hazards, landslide-dam failures, and other mountain flood events are becoming increasingly important contributors to disaster risk. The findings also demonstrate that flood impacts are shaped not only by hazard exposure but also by underlying social vulnerability, preparedness, and health-system resilience. Strengthening resilience will require investments in multi-hazard early warning systems, climate-resilient infrastructure, disease surveillance, emergency preparedness, and continuity of healthcare services, particularly for vulnerable populations. As climate change intensifies extreme weather and cryosphere-related hazards in the Himalayas, integrated disaster risk reduction and climate adaptation strategies will be essential to reduce future flood-related health burdens and enhance resilience across Nepal.

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Authors' contribution

PS and KSL conceptualized the study and drafted the manuscript. MI, BK, RKS, LKS, BS and KSL retrieved data and conducted the literature review. All authors critically reviewed the manuscript, contributed to its revision, and approved the final version for publication.

Competing interests

The authors declare no competing interests.

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