

# Flooding and Climate Change and Its Effect on Skin Disease

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Several countries around the world have become more susceptible to extreme weather conditions over the last decade owing to the effects of climate change. Pakistan, due to its hazard-prone geography, is one such country. In 2022, Pakistan has seen temperatures soar as high as 50 °C during the summer months, resulting in rapid melting of glaciers in the northern regions and overflowing of river tributaries. Higher temperatures have also led to increased air moisture retention, causing unprecedented torrential rainfall during monsoon months (Safdar et al., 2019). Global warming, coupled with outdated drainage infrastructure in many parts of Pakistan, has led to the catastrophic flash floods in 2022, affecting nearly 33 million people, with tens of thousands internally displaced and nearly two thousand lives lost (Bhutta et al., 2022). Stagnant flood water has led to a rise in communicable and non-communicable skin diseases not dissimilar to the trends seen during the aftermaths of Pakistan's 2010 floods (Shabir, 2013).

Data from the United Nations Satellite Centre (Geneva, Switzerland) were used to create pictorial representations of floodwater evolution in Pakistan's affected regions, mainly the southern provinces of Sindh and Balochistan (Figure 1). According to Gupta et al. (2022),<sup>1</sup> the two provinces experienced their highest ever rainfall in August 2022 (Balochistan, 590% above average; Sindh, 726% above average).

Reports from front-line responders, including healthcare workers, suggest that skin disease is one of the chief health issues faced by many flood victims in Pakistan. Data collected by one of the authors (EAL) at the Provincial Disease Surveillance and Rapid Response Unit in Quetta, Balochistan reported 6,566 cases of skin disease during a 1-week period in September 2022, owing to nearly a third of all health-related presentations at medical camps in Balochistan (Table 1).

A review article by Dayrit et al. (2018) highlights the effects of climate change and flooding on skin disease. Cutaneous infections or infestations, traumatic skin disorders, and inflammatory dermatoses such as allergic or irritant contact dermatitis (CD) are among the most frequently reported skin issues in flood affectees. Dermatophyte and nondermatophyte fungal infections tend to be the most common causes of cutaneous morbidity, followed by bacterial and parasitic infections. Ectoparasitic infestation of scabies and lice, vector-borne illness such as cutaneous Leishmaniasis, and insect bite reactions also abound in large bodies of stagnant putrid water and overcrowded temporary shelters with poor sanitation or bathing/laundry facilities. Inadequate protective gear (tents, pillows, blankets, etc.) and clothing make displaced people more susceptible to extreme weather conditions risking frostbite and hypothermia or sunburn and dehydration leading to heatstroke. Furthermore, prolonged immersion in flood water increases the risk of trench foot. Damage to natural habitats causes displaced animals to seek refuge in dry areas, making snake and reptile bites more common; given the difficulty in access to snake antivenom in Pakistan, these bites are often lethal (Ralph et al., 2019). Trends seen during the recent floods were no different, with snapshot data from Balochistan medical camps recording 119 snake bites over 1 week (Table 1).

“Pakistan is at the flashpoint as a global case study that conveys the gravity of climate change and its impact on global skin health, highlighting the need for a coordinated international effort to curb further flood-related devastation in not just Pakistan, but all affected and vulnerable nations.”

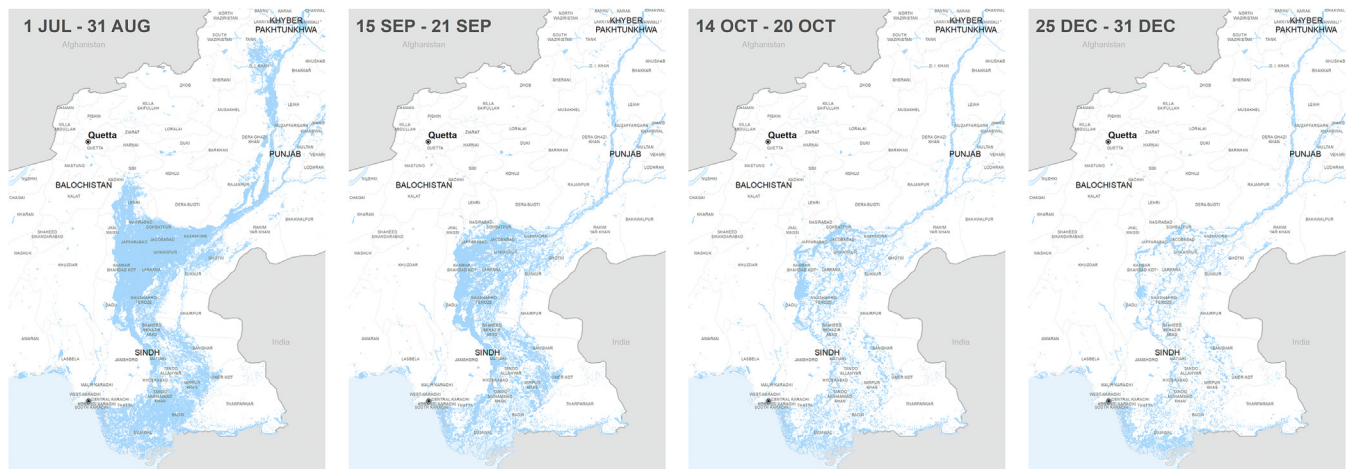
Damaged roads and electricity networks make communication and transport to shelters difficult and dangerous. In addition, rising flood water increases the risk of traumatic injury by concealed objects, including sharp objects such as metal and rusted nails, rocks, and debris from destroyed buildings. Concealed electrical hazards risk electrocution-related injury, burns, and death. Flood water may contain irritants and chemicals from damaged factories, industries, and households that can cause skin reactions such as irritant or allergic CD. Given the poor access to health care, particularly

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<sup>1</sup> Gupta PK, Dubey AK, Pradhan R, Chander S, Singh N, Jha VB, et al. Pakistan Flood of 2022: assessment using suite of satellite sensors and hydrological modelling. Research Square, 2022



**Figure 1. Infographic representation of floodwater evolution in the provinces of Sindh and Balochistan, Pakistan, between July and December 2022.**

\*Permission received from the United Nations Office for the Coordination of Humanitarian Affairs to use the image (also publicly available). AUG, August; DEC, December; JUL, July; OCT, October; SEPT, September.

dermatologic care, this results in great physical and psychological morbidity. Itching and excoriations provide entry portals for secondary bacterial and fungal infections. Limited access to dermatologic care and treatment coupled with ongoing exposure to irritants in flood water may worsen chronic and pre-existing skin conditions such as psoriasis and eczema. The emotional and psychological stressors experienced by flood victims are likely to exacerbate chronic skin conditions such as eczema, psoriasis, and alopecia areata—especially in places like Pakistan where health inequity is rampant and the majority of flood victims already have limited access to medication and healthcare facilities.

Although Pakistan is responsible for less than once per cent of the world's total carbon emissions, it is one of the countries most affected by consequences of climate change (Lin and Raza, 2019). This is the second time in just over a decade that the country has endured extreme consequences of global warming through deadly and destructive flooding, bringing an already fragile health system to near collapse. Pakistan is just one example of a country suffering the consequences of climate change.

In the last year, torrential rainfall and flash floods have wreaked havoc across other developing nations, especially

those with poor health infrastructure that are ill equipped to manage the health effects of flooding. Managing skin disease becomes especially challenging in places where there are not enough trained dermatologists. Ayanlowo (2022) reports that Nigeria, for instance, has only 185 dermatologists (this includes those in training) catering to a population of over 200 million people. Personal communication with physicians responding to the health needs of flood affectees in West Africa has confirmed a surge in cases of scabies, bacterial and fungal skin infections, and flare of pre-existing dermatologic diseases, with insufficient resources and inadequately trained individuals to treat these.

Displaced persons are especially vulnerable to dermatologic disease, which accounts for one of the highest numbers of medical consultations in flood-affected persons. Where possible, the global dermatology community should provide support to local healthcare professionals in Pakistan and other flood-affected nations, possibly through the use of digital platforms such as easy-to-use encrypted photo sharing and messaging services and rapid implementation of tele-dermatology and remote training. A greater understanding of the immediate and long-term consequences of protracted trauma, flood-related injury, and displacement in affected persons is essential to meet their specific health needs. In the long term, it is crucial to understand the impact climate change can have on health, especially skin health, and take active steps to implement interventions that reduce global greenhouse gas emissions to mitigate the consequences of global warming. Unfortunately, Pakistan is at the flashpoint as a global case study that conveys the gravity of climate change and its impact on global skin health, highlighting the need for a coordinated international effort to curb further flood-related devastation in not just Pakistan but all affected and vulnerable nations.

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**Table 1. Data from Balochistan Medical Camps for Flood Victims during a 1-Week Period in September 2022**

Diseases	n	%
Diarrhea	6,522	28.29
Acute watery diarrhea (suspected cholera)	304	1.32
Acute respiratory infection	6,868	29.79
Skin disease	6,566	28.48
Eye infection	715	3.10
Malaria	1,944	8.43
Dog bite	15	0.07
Snake bite	119	0.52
Miscarriage	3	0.01

**CONFLICT OF INTEREST**

The authors state no conflict of interest.

**AUTHOR CONTRIBUTIONS**

Conceptualization: MHJ, EAO; Data Curation: EAL; Supervision: EAO, AS; Writing - Original Draft Preparation: MHJ; Writing - Review and Editing: MHJ, SK, EAL, AA, EAO, AS

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