

Pakistan's lessons learned on climate change, malaria, and vector-borne disease transmission

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INTRODUCTION

A key principle for success in human disaster management is the speed of the response. A timely, proactive, and well-conceived emergency preparedness and response plan not only saves lives and property but also contributes significantly to resilience and post-disaster retrieval by mitigating the destructive impacts of a disaster. Readiness efforts, early cautionary arrangements, and communication systems will facilitate the effective engagement of communities and individuals endangered by the disaster, enabling them to take appropriate actions in sufficient time to reduce injury, loss of life, and damage to infrastructure. Attaining sustainability requires the full recognition of the importance of and need for emergency preparedness and response by local authorities and the community in the local context. The strategies described below are recommended for effective and efficient vector control during climate change-related emergencies.

BACKGROUND

Climate change negatively impacts health in many direct and indirect ways. In particular, climate change increases the frequency of extreme weather events, such as heat waves, which can directly cause injury, illness, and death. Climate change also indirectly affects health through alterations to the environment. For example, climate significantly influences the intensity and distribution of vector-borne diseases (VBDs), including malaria, dengue, and leishmaniasis. The negative health impacts of climate change are particularly acute in Pakistan, which ranks tenth¹ worldwide among countries severely affected by climate change. Climate change-related events, such as rising temperatures and heatwaves, natural disasters, and displacement, pose a significant risk to public health.



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Pakistan has experienced several humanitarian emergencies related to climate change. For example, heat waves have become more frequent and intense, leading to increased incidents of heat exhaustion, heatstroke, and other heat-related illnesses.

Such emergencies resulted in mass population displacement and forced migration. Locally affected populations are often compelled to relocate into formal and informal temporary camps, where living conditions are extremely poor. The indirect impacts of such emergencies are persistent and wide-ranging.

The World Bank Pakistan Country Climate and Development Report notes, «indirect long-term threats such as outbreaks of malaria, dengue, and severe gastroenteritis have been observed in Pakistan in the aftermath of a heatwave².» Increased temperatures and changes in rainfall patterns exacerbate vulnerabilities for human health³, agriculture⁴, infrastructure⁵, and water resources upon which a large part of the economy and livelihoods depend. Climate change-induced humanitarian emergencies lead to infrastructure damage, destroying essential services, food insecurity, malnutrition, limited/diminished governance, and severe health system disruption of disease prevention, diagnosis, and treatment services. Importantly, climate change increases the risk of VBD, directly impacting vector density, abundance, and distribution. For example, climate change affects the geographical distribution of VBDs as warmer temperatures expand the habitats suitable for vectors. Higher temperatures, as well as conditions such as wide-ranging stagnant water, lack of sanitation facilities, and proper drainage systems, also create more breeding

¹ World Bank Group. 2022. Pakistan Country Climate and Development Report. CCDR Series. © World Bank, Washington, DC. <http://hdl.handle.net/10986/38277> License: CC BY-NC-ND.

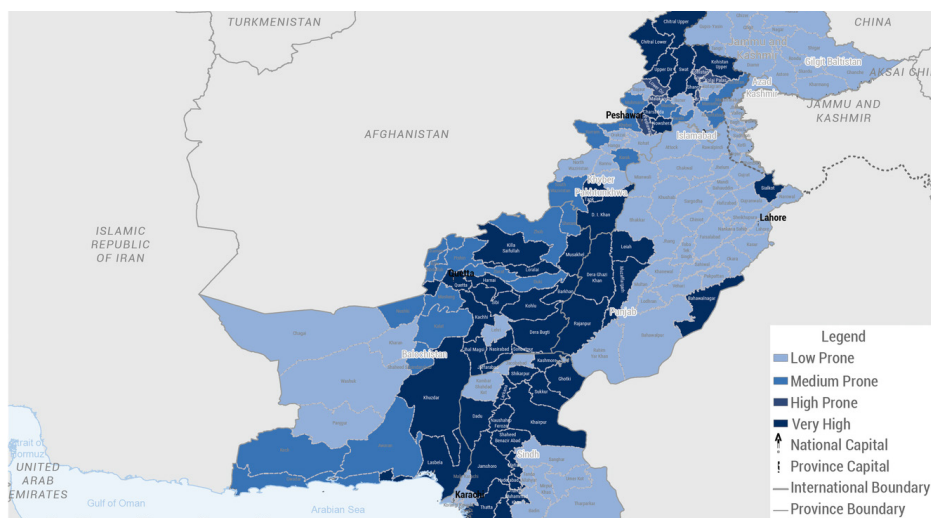
² *Idem*.

³ In 2022, the Pakistan monsoon season caused the death of 1,739 people including 647 children.

⁴ The monsoon season killed over 1.16 million livestock, mostly in Balochistan. In the agriculture sector, more than 4.4 million acres of crops and orchards were affected, destroying 97,063 metric tons of standing crops and inflicting Rs 9.16 billion (equivalent to over \$32m) losses to farmers.

⁵ The monsoon season also caused damage to 13,115 kilometers of roads and 439 bridges which impeded access across flood-affected areas. Roughly 897,014 houses were fully damaged while another 1.39 million were partially damaged.

grounds for disease-carrying mosquitoes. Climate change can also alter the behavior of vectors and humans in ways that increase transmission potential. For example, mosquitoes may become more active during warmer weather, increasing their interactions with humans, while individuals may spend more time outdoors during heat waves, increasing their exposure to vectors.



© Ocha. Government-identified areas prone to severe impact in case of heavy rainfall.

The impacts of climate change on VBDs were evident in the recent heat waves Pakistan suffered between 2020 and 2022. During the 2022 monsoon season, rainfall substantially increased in the malaria-endemic provinces of Balochistan and Sindh, with a rise of 370% and 340%, respectively.

Overall, the country witnessed a 190% increase in rainfall, leading to devastating floods that affected over 33 million people in 116 districts (>65% of the country). Furthermore, health facilities reported a significant surge in malaria cases, from 376,203 cases in 2021 to 1.7 million cases in 2022.

In addition to malaria, the World Health Organization (WHO) reported approximately 25,932 dengue cases in the country from 1 June to 27 September 2022, with 75% of these cases occurring in September. These escalating numbers of malaria and dengue cases have increasingly burdened health facilities. The impacts of climate change in Pakistan are costly. Recent analyses indicated that flood damages alone are estimated to exceed \$14.9 billion, with economic losses over \$15.2 billion and reconstruction needs over \$16.3 billion¹. In the health sector, over 2,000 health facilities were affected, resulting in limited access to health facilities, healthcare workers, and essential medicines and medical supplies. Government officials assessed at least \$30 billion in reconstruction costs and economic damage, equivalent to about 10% of the overall GDP.

CLIMATE CHANGE AND MALARIA TRANSMISSION IN PAKISTAN

Pakistan is considered a moderate malaria-endemic country, with the highest endemic areas located on the western borders with Afghanistan and Iran. In recent years, the country has made remarkable progress toward malaria elimination. In 2020, Pakistan reduced its estimated malaria case incidence by more than 40% compared with 2015². Overall, malaria transmission is typically unstable, with the major transmission period occurring post-monsoon, i.e., from August to November. *Plasmodium vivax* (78.1%) and *P. falciparum* (19%) are the prevalent species of parasites in the country, driven by established and emerging mosquito species, such as *Anopheles pulcherrimus*.

During recent floods, all 60 high malaria burden districts (Stratum-I: API >5) were severely affected. Consequently, there has been a marked rise in malaria cases since July 2022 in 34 districts in Sindh, Balochistan, and Khyber Pakhtunkhwa provinces, reaching a malaria outbreak/emergency status in August 2022.

In October 2022, the WHO expert mission estimated that 3 million cases would occur in 2022 with an extended and intense transmission season beyond December 2022 in the Southern districts of Balochistan and all districts of Sindh provinces, following the recession of floodwaters and the return of internally displaced people (IDPs) to their damaged houses.



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The country's 2022-2023 outbreak has been classified as the heaviest resurgence in the last five decades. Compared to 376,203 cases in 2021, health facilities reported 1.7 million cases in 2022. This figure does not include cases diagnosed and treated by numerous relief organizations during flood relief operations.

¹ Commentary on The Brookings Institution. Nabi Ijaz. Responding to Pakistan Floods. February 10, 2023: <https://www.brookings.edu/articles/pakistan-floods/#:~:text=Working%20with%20the%20United%20Nations,reconstruction%20needs%20over%20%2416.3%20billion.>
² World malaria report 2022. Geneva: World Health Organization; 2022. License: CC BY-NC-SA 3.0 IGO.

DISASTER MANAGEMENT IN PAKISTAN

In Pakistan, the National Disaster Management Authority (NDMA) and Provincial DMAs (PDMAs) serve as the best exemplars of disaster management. Both authorities aim to strengthen community-based preparedness through national-level simulation exercises to mitigate the impact of climate-induced disasters/emergencies in the country. All international and national donations are routed through NDMA and PDMAs to streamline disaster response. However, there is a need for the digitally updated National Emergencies and Operations Center to play a more active role as an early warning system. This entails generating alerts and providing evidence-based decision-making to proactively manage disasters or emergencies in Pakistan.



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In recent years, various partners and organizations, such as WHO, United Nations Children's Fund (UNICEF), Médecins Sans Frontières, Merlin, and United States Agency for International Development, have been engaged in emergency relief efforts in Pakistan.

However, there has been limited data sharing and coordination with Pakistan's Directorate of Malaria Control (DoMC), leading to duplication of effort and resources. For instance, UNICEF distributed 2 million insecticide-treated bed nets (ITNs) in flood-affected areas, in addition to WHO's financing of \$6.1 million for relief activities that included the distribution of ITNs and indoor residual spraying (IRS).

Additional challenges to effective disaster response and emergency relief efforts include restrictive product procurement guidelines as well as trade restrictions. Donor guidelines mandate DoMC to procure quality products internationally (imported free of tax) with a standard lead time of up to six months, hindering effective and timely disaster response. In the event of an emergency or disaster, DoMC should be allowed to procure locally if a WHO Pre-Qualified (PQ) recommended product is available. At present, Pakistan has a locally produced WHO PQ-listed ITN, but its supplier is not included on the approved list by the Global Fund to Fight HIV/AIDS, Tuberculosis and Malaria (Global Fund) due to management issues with the manufacturer. Adding to the complexity of ITN supply, the Government of Pakistan has suspended trade with India, causing delays in the distribution of WHO-PQ ITNs manufactured in India.

Finally, the experience during the 2022 emergency underscores the importance of centering the response within the local context. During the 2022 emergency, 68% IDPs resided in tents and/or temporary shelters, such as schools, hospitals, and government buildings, with facilities accommodating 15-20 families (90-100 individuals) in one large hall. Although ITNs were provided free of cost to most of the affected population, these were not the most effective tool for malaria prevention as they could not be used due to space constraints. Many ITNs were also reported damaged, misused, or lost. IRS was the best option in this emergency to prevent and control malaria transmission. However, providing ITNs to IDPs before returning to their homes remained crucial. Thus, coordination of such measures is extremely important for rational and evidence-based planning and decision-making.

Pakistan's experience with recent disasters and emergencies has generated several lessons learned that must be applied to enable more effective and timelier responses to future disasters and emergencies. These lessons are described below.

Lesson 1: Include malaria and vector-borne diseases considerations in the strategic, operational, and financial planning of the humanitarian emergency response

Rapidly responding to disasters and implementing well-conceived emergency preparedness and response plans are paramount. Measures such as readiness efforts, early cautionary arrangements, and effective communication systems significantly reduce the destructive impacts of disasters.

To ensure proper risk mitigation measures are in place from the outset, including a VBDs specialist in all Disaster Management Committees is imperative. This specialist will guarantee that interventions are not limited to "traditional" malaria or dengue vector control but address the wide range of vectors with public health significance arising from overcrowding, inadequate housing and sanitation, environmental challenges, and disruptions to community-based health systems.



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Lesson 2: Allow flexibility in the selection of malaria and vector-borne disease control tools

Humanitarian emergencies pose challenges to traditional vector control programs, particularly in terms of the availability, quality, and selection of appropriate vector control commodities for the acute phase of an emergency. Stakeholders should explore more efficient ways to conduct needs assessments, product quantification, product positioning, or stockpiling for effective and timely humanitarian response.



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Several interventions can play a crucial role in vector control, preventing both disease proliferation and associated downstream health and economic impacts. These include ITNs, IRS, larval source management (LSM), and fogging operations. WHO recommends only two core vector control interventions for malaria prevention: IRS and ITNs supported by LSM when few, fixed, and findable.

IRS is typically preferred in an emergency context; however, the availability of suitable structures necessary for implementing IRS is often compromised due to damage.

Similarly, installing ITNs in tents, commonly used as temporary shelters, proved challenging due to the size and shape of the tents compared to the provided nets. Regarding ITN distribution among IPDs living in tents, conical shape nets should be prioritized. Implementing LSM during or after flooding also presents its own set of challenges. Finally, although fogging operations are not recommended as routine interventions for malaria control, this intervention is highly effective in emergencies.

Therefore, programs and donors should be flexible and adapt interventions based on the specific scenario, including the selection of appropriate products. In addition, local health and administrative authorities, along with relief organizations responsible for establishing and managing temporary camps, must ensure appropriate water management and disposal to prevent the intensification of mosquito vectors due to poor water management in areas such as brick pits, water taps, and containers. Waste management is also a critical component that should be planned and budgeted for.

Lesson 3: Implement an integrated community-centered humanitarian emergency response

A comprehensive, people-centered approach should be adopted to effectively respond to humanitarian crises. Identifying and capitalizing on overlaps in humanitarian response efforts and actively involving communities is crucial. Integrating national emergency preparedness and disaster management plans will strengthen downstream delivery activities such as routine and campaign services for malaria and VBDs. Moreover, national stakeholders should consider integrated vector management as a sustainable mechanism to address as many VBDs as possible.

It is extremely important to conduct community-friendly awareness campaigns using all available channels and support the creation of district health committees with stronger community empowerment and engagement to strengthen accountability to affected populations.

Moreover, efforts should be made to shift from Top-Down planning to Bottom-Up planning by engaging and empowering affected communities. This approach will enhance the implementation and ownership of initiatives at the grassroots level.



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Lesson 4: Collect and share data for evidence-based decision-making and accountability

Access to data is an essential resource for evidence-based decision-making and accountability among stakeholders responding to humanitarian emergencies. However, quantifying the needs of IDPs, refugees, and migrant populations is especially difficult due to the unpredictable nature of any crisis and the countries' absorptive capacity.

Moreover, an inadequate quantification of resource needs has a cascading effect on resource availability, mobilization, and allocation. National health authorities should establish a national-level platform to provide technical assistance, enable the exchange of best practices, and facilitate rational programmatic and financial gap analysis across all implementing agencies and other partners for timely and efficient vector control under a humanitarian emergency. Additionally, this platform can be utilized for improved VBDs training, planning, implementation, monitoring, and assessment among all stakeholders.

National health authorities should also eliminate or soften policy barriers that hinder collaboration between relief organizations, local and national responders. Access to a shared data repository can break down silos, improve coordination, and increase joint investments.

Lesson 5: Increase funding flexibility for malaria response in humanitarian emergencies



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There is a need for flexible funding mechanisms for malaria and VBDs response efforts for different technical actors involved in the humanitarian emergency response, including local non-governmental organizations and private sector organizations. Such mechanisms should enable more rapid procurement of commodities and program supplies.

Governments could also enhance domestic funding and reduce donor dependency to ensure sustainability while global donors such as the Global Fund could increase country allocation to the Global Emergency Fund and Catalytic Fund for malaria in humanitarian emergencies, facilitating swift emergency response.

Lesson 6: Support development, procurement, and deployment of new malaria and vector-borne disease control tools for use in emergency settings

VBD control programs should engage partners in industry, policy, and product development consortia to promote investment in developing new products addressing the explicit needs of humanitarian emergencies, including outdoor transmission.

To ensure quality control amidst the swift deployment of VBD control tools in emergency settings, a country must have a sophisticated system of product registration and approval by stringent regulatory authorities that can be deployed, adapted, and imported immediately by emergency relief organizations. These regulatory authorities must have fast-tracked registration mechanisms or issue One-Time special waivers for disaster response for pharmaceuticals and other health products that are not registered in the country.

In the event of an emergency or disaster, DoMC should be allowed to procure locally if there is a WHO PQ recommended product available. For example, insecticide-treated clothing can be an effective tool to prevent mosquito bites, particularly in humanitarian crises. Cloth treatment can be particularly useful among IDPs when they are not using ITNs. Pakistan has vast experience using this intervention in Afghan Refugees camps in the 1990s and flood-affected populations in 2010; however, it is not currently recommended by the WHO for malaria control.

Finally, a Global Stockpile of VBD commodities, likely housed under WHO and sustained by a pooled procurement mechanism with estimated needs and pre-positioning of products, could enable the rapid deployment of suitable vector control tools during humanitarian emergencies.