Climate change and infections: lessons learnt from recent floods in Pakistan

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Climate change is a stark reality with which mankind is evidently struggling to cope up with. Be it with the melting glaciers in the mountains, tsunamis and hurricanes in the oceans or the floods and soaring temperatures experienced in numerous cities around the world - they lead to adverse social, economic, political consequences globally. We must also think about the short-term and long-term impact of climate change and its ensuing calamities on the spread of infections around the world. In this editorial, we have used the recent floods in Pakistan as an example of climate change triggered outbreaks.

Pakistan is facing a massive flood due to the torrential monsoon rains which started in early June and worsened in the subsequent months. According to reports, around 33 million people have been affected by the catastrophic floods with more than 1700+ deaths as of November, 2022 [1]. The Sindh and Balochistan provinces are the worst affected. Though the water has begun to recede, the death toll is persistently increasing because of infectious outbreaks of several diseases like malaria, dengue, diarrhoea, diphtheria, cholera, scabies and COVID-19 [2]. Water borne diseases like diarrhoea, cholera, dysentery and vector borne diseases like malaria and dengue are on the rise and are a major cause for concern with water logging and stagnant waters left by the flood [3]. In addition, 215,000 diarrhoea [4] and 20,064 skin disease cases were reported as of mid-September [5].

Through January-August 2022, 3.4 million+ suspected cases of malaria were reported in Pakistan. Accounting for 78% of the confirmed cases, Balochistan and Sindh provinces together observed a rapid upsurge in cases after the devastating floods in mid-June 2022. More than 170,000 cases were laboratory confirmed, out of which 77% were due to Plasmodium vivax, and 23% were due to Plasmodium falciparum. P. falciparum was the causative organism for the more severe and fatal cases [6]. Many challenges to response measures were highlighted when some flood-affected districts reported a two-fold increase in incidence rates, a high P. falciparum ratio, and limited stocks of emergency medicines, insecticides and supplies accompanied with a long lead time for procurement. Vector control is a vital component of prevention of vector borne diseases and elimination strategies as it is highly effective in preventing infection and reducing disease transmission.

Between 1 January and 27 September 2022, a total of 25,932 confirmed dengue cases and 62 deaths were reported in Pakistan, with 74% of these cases being reported in the month of September alone. The distribution of cases by province was available for 83% of the total cases, of which 32% were reported from Sindh, 29% from Punjab (including the Islamabad Capital Territory), 25% from Khyber Pakhtunkhwa, and 14% from Balochistan as reported till 22 September, 2022 [7]. About the "under-reported cases of dengue fever" in Karachi, it has been reported that hospitals were not properly sharing their data with the health department.

According to UNICEF, 8.2 million people require access to health services. WHO expert opinions say that 8 million flood-affected people who need health assistance are in need of essential medical supplies and access to basic healthcare. The floods being a major health emergency, it is estimated that Pakistan will require upwards of $81.5 million in relief funds to ensure coordinated delivery of essential healthcare services, stronger outbreak detection /control and severe acute malnutrition management. WHO has been providing emergency/ medicine supplies and efforts have been scaled up to outbreak prevention and control including strengthening disease surveillance, undertaking vaccination campaigns against measles and cholera, ensuring early diagnosis and treatment of malaria, and providing access to clean water [8].

Pakistan already had its hands full prior to the floods due to outbreaks of dengue, malaria and COVID-19. Speaking of outbreaks, monkeypox has not been reported in the country yet but that could be a sign of inadequate testing as WHO recently

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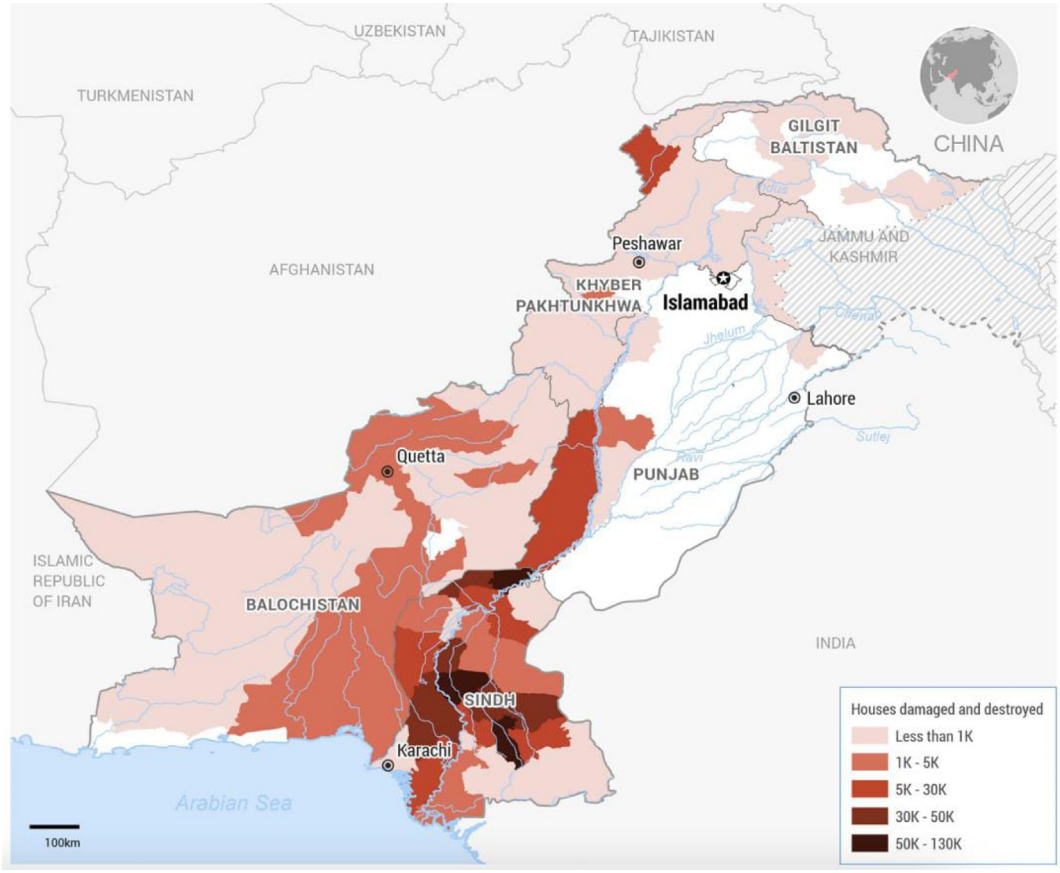
reported that even though most eminent Pakistani laboratories are equipped with PCR machines, they lack the testing kits required [9]. Waterborne diseases like cholera, typhoid fever and leptospirosis have been prevalent in the nation and will inevitably be on the rise due to the floods [10]. It has also been observed that a significant proportion of strains of *Salmonella Typhi*, the causal organism of typhoid fever, found in Pakistan are extensively drug resistant but remain susceptible to azithromycin and carbapenems [11]. Studies suggest that the main causes of diarrhoeal diseases in developing countries like Pakistan are due to organisms like *campylobacter jejuni,* rotavirus, shigella and *E. coli* [12]. Other vector-borne neglected infections seen emerging in Pakistan are chikungunya, Japanese encephalitis, Crimean-Congo Hemorrhagic fever (Tick Bite), Leishmaniasis (Sand fly bite) [13].

With about 33 million people displaced from their homes, zoonotic diseases like rabies, brucellosis and hantavirus pulmonary syndrome can be expected to be exacerbated due to unprecedented and inevitable human-animal interaction. *Giardia lamblia* which causes giardiasis, is deemed a neglected infection even though it is one of the most common protozoans infecting the small intestine of humans and is a major cause of enteric infection throughout the world, especially in children [14]. With 16 million children being adversely affected by the floods, even such neglected diseases could be a source of major morbidity. In a crisis of such magnitude, neglected diseases like giardia, entamoeba, cystic echinococcosis, leishmaniasis and rabies could go under the radar and be grossly overlooked.

Pakistan shares its borders in terms of land and water bodies with many countries including India. Sindh, one of the most badly hit provinces lies just above Gujarat. There is high population movement between Pakistan and its border countries, particularly in Khyber Pakhtunkhwa province which borders Afghanistan where nearly 800 000 Afghani refugees live in districts officially considered calamity areas hit by floods. At such close proximity to other nations, the risk of international spread of diseases, especially vector borne diseases like malaria cannot be ruled out. It would be advisable for these bordering nations to step up their disease surveillance measures to prevent the spread of such disease outbreaks.

According to new scientific analysis, the floods in Pakistan were clearly due to climate change [15]. Eventhough Pakistan is home to more than 72,000 glaciers, climate experts say Pakistan's floods are not primarily attributable to glacial melt, but



the recent heavy rains. Pakistan contributes less than 1% of global greenhouse gas emissions, but is one of the places most vulnerable to climate change [16]. Such climate whiplash has already damaged crops and killed people across southeast Asia in recent years, and led to a water crisis in Chennai, India in 2019. For a country that has already suffered due to preexisting climate change dilemmas, economic, political and public health crises, it was not prepared at all for a calamity of this proportion [17]. There is an urgent need to scale up disease surveillance, replenish health supplies, and restore damaged medical facilities and prepare for emerging infections with a focus on women, children and other vulnerable groups who continue to bear the brunt of this crisis.

Map showing flood affected areas in Pakistan in terms of houses damaged and destroyed.(Source : UN OCHA)

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