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Climate change and its implications on health in Bhutan

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The Hindu Kush and Himalaya (HKH) region is witnessing unprecedented impacts resulting from climate change. The region extends over 3500 km over all or parts of Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan¹. It has an estimated population of 240 million people. The HKH region has 951,000 km² of snow cover during winter with 87,340 km² of glacial cover. Ten large river systems that provide water to 1.9 billion people in the Indian sub-continent are crucial in the region. Climate change is impacting immensely on the ecosystem of HKH and its population. In this editorial, we briefly discuss the situation of climate change and its impacts on health in Bhutan, one of the countries in the HKH region affected.

Bhutan is situated in the eastern Himalayas and is home to 0.7 million people. Bhutan is a carbon negative country, and has pledged to remain carbon neutral for all times. According to the national Green House Gas inventory 2015, the country emits 3.8 million tons of carbon dioxide while the country has a sequestration capacity of 9.4 million tons². Bhutan has almost 71% of its area under forest cover—a good indicator above the requirement of the Constitution which requires a mandatory cover of at least 60%. Environment conservation is one of the pillars of Gross National Happiness, the principle guiding the overall human development in Bhutan. Environmental conservation is enshrined in the 2008 Constitution making it the responsibility of both the State and the people.

Bhutan has a low carbon intensity economy with 0.15 kg carbon dioxide emission per USD of GDP purchasing power compared to 0.46 among other developing countries³. However, energy-related emissions (industries, aviation and transport industries, residential sectors) and agriculture are the major carbon emitters. Industry and transport are the fastest-growing sectors in terms of energy consumption with demand doubling in 2005 – 2014 period⁴. Over this period, per capita energy consumption increased from 0.6 tonnes of oil equivalent (toe) per capita in 2010 to 0.69 toe per capita in 2017. In addition, vehicle import is on the rise with 8000 vehicles imported between June

2021 and June 2022. Bhutan had approximately 124,926 vehicles in 2022⁵, making it one vehicle for every 5.8 persons.

To offset carbon emissions, the country has dedicated resources to the identification and adoption of low-carbon strategies. Hydropower dominates the energy landscape with the adoption and expansion of other renewable energy sources: wind, solar and biogas energy. With rapid electrification in the last decade covering 99% of rural areas, the pattern of fuel consumption has shifted from fuelwood to electricity. In addition, there is an ongoing expansion of a network of biogas fuel plants across the country. The government has implemented policies to encourage electric vehicles for public transport such as providing subsidy for the purchase and installation of free charging ports, but the uptake remains limited due to higher cost and poor public perception on its utility for long-distance travel.

While Bhutan currently enjoys a relatively better state of environment compared to its neighbouring countries, the consequences of climate change transcend national boundaries. There are cross-over effects and spill over as the world shares one ecosphere. Warming of climate is one pervasive phenomenon which has particular consequences on the emergence or re-emergence of infectious diseases. In fact, the country has witnessed a northward movement of insects, pests and vectors. While the snow cover has retreated, mosquitoes have now been sighted in Lunana, which is at an elevation of 4800 metres above sea level⁶. In an analysis of dengue epidemic in April – December 2019 among 5935 confirmed cases involving 19 of the 20 districts, dengue was reported in 38 newly affected sub-districts⁷. It is possible that climate change lengthened the transmission season of *Aedes* mosquitoes during that epidemic. Such unchecked spread of mosquitoes is a concern not only for outbreaks of dengue and chikungunya at high altitudes, but it may seriously compromise malaria elimination efforts in the country. *Phlebotomus* sand fly, the vector that spreads what is termed a neglected “tropical” disease, leishmaniasis, has been reported at an altitude of 2000 metres above sea level in Bhutan. In 2022, July was reported as the hottest month in the last 25 years with temperatures 2.5 degrees Celsius higher than the average. This was associated with an outbreak of the Nairobi fly (*Paederus spp*) in the Himalayan foothills in northeastern India, Nepal and Bhutan⁸.

Warmer climates are linked to water-borne illness. In a review of diarrhoeal illnesses in Bhutan, the incidence of

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diarrhoea increased by 0.6% for every degree rise in the maximum temperature, and 5% increase in every millimetre of rainfall with significant spatial clustering accounting for climatic variations⁹. The summer months are prone to other gastrointestinal illnesses where in 2022, outbreaks of hand-foot-and-mouth disease, a viral infection, were reported in schools in Punakha, Wangdue Phodrang and Zhemgang. There were similar outbreaks reported in tropical areas in the neighbouring countries and also in Leh, in the Indian Himalayas.

Water is an important resource that is linked with health and agriculture. While the National Health Survey 2012 reported 97.7% of the population had access to improved drinking water sources, climate change and climatic variation have contributed to localized drought conditions leading to water shortages in many pockets of the country. This is a concern not only for the deterioration of health and hygiene practices but also contributes to shortages in crop production and increasing migration of people from rural to urban areas. One result of such migrations is overcrowding in hospitals in urban centres while some health facilities in rural areas remain underutilized leading to worsening health inequities¹⁰.

Climate change also results in increased frequencies of extreme weather events and natural disasters. Human settlement in Bhutan is situated along the mountain slopes and its foothills which are prone to landslides in events of persistent rainfall. In the past decade, there have been many losses of lives and properties across many districts. With increasing temperatures, the glaciers melt and form glacial lakes on top of mountains resulting in glacial lake outburst floods along the river valleys. Under high emissions scenario, it is projected that by 2030, an additional 7,600 people may be at risk of river floods annually as a result of climate change and 2,400 due to socio-economic changes¹¹.

The other health implications include an increasing burden on non-communicable diseases and mental health problems. Exposure to increasing temperature is linked to increasing cardiopulmonary mortality through multiple mechanisms. Many of the driving forces responsible for climate change also influence non-communicable disease risks through direct and indirect interplay of environmental and socio-economic factors¹². The multitude of impacts of climate change may increase the gender gap as women living in setting with resource constraints are more vulnerable.

Bhutan remains committed to environmental conservation and remaining carbon neutral. Some of the notable initiatives include the adoption of low-emission development strategies and decoupling of economic growth and greenhouse gas emissions through clean technology, innovation, renewable energy, and green job creation. The country has a strong political commitment to sustainable development initiatives for which King Jigme Khesar Namgyal Wangchuck was presented the Special Recognition Award by the United Nations Development Programme in 2019. Bhutan has ratified the Paris Agreement

in 2017, remains firm on its commitments and has delivered its second nationally determined contributions in 2021 reiterating the commitment to remain carbon neutral.

While climate mitigation efforts and adaption activities are implemented at local and national levels, the challenges to sustain the country's climate change initiatives remain imperative as the global issue is mired in protracted discussions and debates. It remains important to keep the efforts focused, timely, and sustained to keep on developing vigilant, responsive and resilient health-specific strategies within the health system of Bhutan.

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