Review Article

Impact of Climate Change on Public Health and Adaptation Policies: Bangladesh Perspective

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ABSTRACT

Evidence suggests that global climate change tends to have several adverse effects on public health in near future, mainly among the poorest population of the developing countries. Bangladesh has already experienced some of the severe impacts because of its climate characteristics, geographical location and conditions, combined with high population density and poor health infrastructure. Recently, many of those climate events have made the health impacts much worse due to newer environmental threats, such as changes in eco-climate, salinity intrusion in soil and water and internal displacement of population. This paper aims to identify some of the direct and indirect impacts of climate change on public health condition of Bangladesh. To identify such impacts, primary and secondary sources of information have been widely reviewed. It has been seen that health problems and hazards induced by climate change have been gaining importance of Bangladesh since last decade; however, there is still lack of research and capacity in this field. Linkage between climate change and increased incidences of diseases, rate of mortality, and availability of safe water has not yet received proper focus. Climate change has a potential adverse impact on human health in Bangladesh. The magnitude of malaria, dengue, childhood diarrhoea, and pneumonia as well as malnutrition are found high among the vulnerable communities. Moreover, health safety issues have come forward as deaths from drowning and snake bite during the extreme weather have eventually increased. Health problems, health-climate change links, and contextual issues like healthcare access, expenditure and poverty have been reported. Prevention and control of climate sensitive diseases need to be addressed with area-specific interventions guided by local-level planning of the low-income vulnerable communities. Community based adaptation strategy for health could be beneficial to minimize climate change attributed health burden of Bangladesh.

Keywords: *Climate change, public health effect, adaptation policy, Bangladesh*

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INTRODUCTION

Climate change is a global health crisis already impacting millions of people around the world. In upcoming decades, global climate change will affect human health through various pathways of complexity, scale and directness and with different timing. Similarly, impacts would vary geographically as a function both of environment and topography and of the vulnerability of the local population.[1] Observations of increase in global temperature and rising global sea level in the recent decades, show that warming of the Earth's climate is undeniable.[2] According to the World Health Organization (WHO), climate change is the single biggest health threat facing humanity, and health professionals worldwide are already responding to the health harms caused by this unfolding crisis.[3] Extreme weather can prevent people's ability to seek healthcare services, too. Moreover, in the most extreme cases, it can displace people entirely from their homes. This "extreme" case has already become very common in different parts of the world. According to the United Nations High Commissioner for Refugees (UNHCR), an average of 21.5 million people were forcibly displaced each year by weather-related

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events, e.g., floods, storms, wildfires and extreme temperatures, between 2008 and 2016.[4] These displaced populations often face the highest health risks associated with climate change because they often lack adequate shelter, sanitation, and healthcare.[5] By 2050, up to 1.2 billion people could be displaced globally because of climate change. If that population were a country, it would be the third most populous nation, after China and India — both with populations of around 1.4 billion people.[6] We have used this comparison to show how big the health threat due to climate change is.

Bangladesh is one of the countries expected to be worst affected by climate change. Bangladesh is critically vulnerable to climate induced hazards, but the core elements of its vulnerability are primarily contextual.[4] It is probably the only country in the world with most of its territory lying on the deltaic flood-plain of three major rivers and their numerous tributaries. Between thirty to seventy per cent of the country is normally flooded each year. The huge sediment loads brought by these Himalayan Rivers, coupled with a negligible flow gradient add to drainage congestion problems and exacerbate the extent of flooding. The low coastal topography contributes to coastal inundation and saline intrusion inland. Bangladesh also lies in a very active cyclone corridor that transects the Bay of Bengal. The combination of frequent natural disasters, high population density and low resilience to economic shocks, make Bangladesh very vulnerable to climatic risks.[2,4] According to UNHCR, no region is immune from climate change, but the risks of health effects and displacement of population are greatest for countries with high exposure to hazards and with large populations in areas that lack the capacity or resources to adequately prepare.[4] Hence, the discussion of current status of Bangladesh in this regard is very much relevant. This paper aims to identify some of the direct and indirect impacts of climate change on public health condition of Bangladesh as well as focus on its adaptation policies.

CLIMATE CHANGE – BANGLADESH PERSPECTIVE

Bangladesh is a poor, developing country in the South Asian region. According to the Bangladesh Census (2011), total population is around 150 million with high population density (954.4 people per sq. km.); life expectancy at birth is around 63 years and average annual population growth rate is around 2% (4.6% in urban areas). Apart from that almost 75% of the population lives in rural areas. It is predominantly agriculture-based country with two thirds of the population engaged in farming or agro-based industrial activities.[7] The climate of Bangladesh can be characterized by high temperatures, heavy rainfall, high humidity, and fairly marked three seasonal variations like hot summer, shrinking winter and medium to heavy rainy season.[8,9] Surprisingly, few countries on Earth so exemplify the inequity of the climate crisis as Bangladesh. Despite producing a negligible amount in the total global greenhouse gas emissions, Bangladesh is way more vulnerable to extreme weather and other climate impacts. Bangladesh has been frequently facing extreme climatic events, such as erratic rainfall, flooding, drought, sea-level rise, cyclones, and salt-water intrusion.[2,4] The country often feels the deep impacts of climate change because of several concurring factors: flat and low-lying topography; its disadvantageous geographic location; high population density; and a reliance of many livelihoods on climate sensitive sectors, particularly agriculture and fisheries. Most of Bangladesh is less than 10 meters above sea level, with almost 10 per cent of the country below 1 meter, making it extremely vulnerable to increasing high tide.[10]

Due to climate change in Bangladesh are likely to cause:[2,4,8-11]

1. Increased flooding, both in terms of extent and frequency, associated with sea level rise, greater monsoon precipitation and increased glacial melt;
2. Increased vulnerability to cyclone and storm surges;
3. Increased moisture stress during dry periods leading to increased drought;
4. Increased salt-water intrusion; and
5. More extreme temperatures.

Between 2000 and 2019, Bangladesh experienced 185 extreme weather events, making it the seventh most vulnerable country to climate change.[12] In recent years, Bangladesh was hit by two consecutive cyclones named as Sidr in 2007 and Aila in 2009. Research showed that cyclone Sidr caused about 3,406 deaths and over 55,000 people sustained physical injuries in the country. Heavy rain accompanying cyclones and tidal waves due to wind effects caused extensive physical destruction, casualties, damage of crops and livestock, and

flooding in a total of thirty districts across the south western part (coastal areas) of the country.[12,13] After Sidr, the government agencies carried out rapid initial assessment of the damage. Their assessment found a widespread outbreak of waterborne disease, respiratory tract infection (RTI), and other related infections. People in the nine surveyed areas were at risk of communicable diseases: diarrhoea, dysentery, acute respiratory infection, and pneumonia, and children aged five years or younger were vulnerable.[14] Similar effects were observed when cyclone Aila hit the southern coastline of the country. It was really a unique event as a storm that affected at least twelve districts and the world's biggest mangrove forest the Sundarbans badly.[15] Outbreak of waterborne diseases like diarrhoea, scarcity of drinking water and food worsened the sufferings during cyclone, flood and drought.[10,14-16] Moreover, the impact of climate change and flooding results in increased cases of fatal drowning incidents. Drowning is, indeed, a major public health issue in Bangladesh, being the leading cause of death among children aged between 1 and 17.[8,16,17] Apart from that during extreme weather events, such as floods and cyclones, the normal habitat of snakes are lost and they come out in the community which accounts for the increased number of snake bites.[8]

We observed that the south-west zone and riverine belts of the country is more prone to disaster events.[14] Like many other developing countries, Bangladesh also carries the burden of high population, natural disasters and diminishing and polluted natural resources. The added burden of increased health problems, possibly due to climate change and climate variability, will push back its developmental achievements.[11]

PUBLIC HEALTH EFFECTS

The impacts of climate change include warming temperatures, changes in precipitation, increases in the frequency or intensity of some extreme weather events, and rising sea levels.[1,11] These impacts threaten our health by affecting the food we eat, the water we drink, the air we breathe, and the weather we experience. Climate change and its rapid emergence in the past decades can be a major challenge to public health together with poverty, inequity, and infectious and non-communicable diseases for our country.[18-20] A study with multistage cluster sampling framework among 6,720 households of 224 rural villages in seven vulnerable districts of Bangladesh showed that in the previous 10 years, almost half of the respondents (45.2%) had been homeless for more than a month (mean 38 days) because of floods and cyclones. Among the homeless, about 40% were displaced twice and 20.5% more than twice. Regarding agricultural impact on nutrition, almost 71% believed that food crop production reduced during the past decade from their field experiences.[8] Some of the examples of health effects are given below:

Food security and nutrition: Extreme climatic events causing decreased food production and inadequate supply affect health, education, child nutrition and income sources of the households of the affected areas. With rising food prices, dietary diversity, quality, and quantity decline placing vulnerable populations at increased risk of malnutrition especially among at-risk population groups such as infants and young children, pregnant and lactating women, and the chronically ill individuals.[2,8,9,11,13,14] (see Fig. 1)

Fig.-1: *Impact of climate change on human health (Source: CDC, 2016)*[21]

Water-borne diseases: Contaminated floodwater and mud can carry an increased risk of wound infections, diarrhoea, cholera, dysentery, typhoid, conjunctivitis, ear, nose and throat infections and other infections such as melioidosis[,9,11,13,14,20] (see Fig. 1, Table-I).

Vector-borne diseases: Vector-borne diseases are among the most important causes of global ill-health, particularly in tropical regions.[2] The main parameters affecting vector-borne diseases include temperature, rainfall, and absolute humidity.[1,9,11] Floodwaters and pooling water from heavy rainfall provide perfect conditions for mosquito breeding. This can lead to

outbreaks of mosquito-borne infections like malaria, dengue, chikunguniya etc.[1,9,11,13,14,20] (see Fig. 1, Table-I).

Table-I

Health effects related to disaster phenomena (Source: Rahman, 2008)[11]

Diseases	Total cases	Period	Average annual cases
Diarrhoea and related disease	48302636	1998-2005	2882273
Skin diseases	23697833	1988-1996	2623092
Malaria	1018671	1974-2004	33956
Mental disorders	201881	1988-1996	22431
Dengue	19830	1999-2005	3305

Injuries: Extreme weather like cyclones and floods can cause hazards, such as slippery surfaces, objects underwater, hidden debris, trees, or objects blown by wind. These can cause serious injuries or even death, especially for older adults [11,13,14,20] (see Fig. 1).

Mental health issues: Climate change is affecting mental health, psychological wellbeing and their social and environmental determinants. Extreme events and disasters can exacerbate or compound preexisting mental health needs or trigger new mental ill-health outcomes, acute or chronic and long-term. Substantive socioeconomic implications from destruction to homes, businesses, and communities can lead to financial stressors and community strain that can increase the likelihood for domestic or community-based violence[1,8,11,13,22] (see Fig. 1, Table-I).

Moreover, the rates of non-communicable diseases like hypertension, kidney damage, heatstroke, adverse pregnancy outcomes, disrupted sleep patterns, worsening of existing cardiovascular and respiratory illness were common.[8,11,14,16] Apart from that healthcare access and infrastructure can be severely affected by floods, including loss of records, impacts on water supplies and laboratory functions, reduced access to health care, and evacuation, with subsequent consequences for the communities served. That means health problems, health-climate change links, and contextual issues like health care access, expenditures, and poverty were reported[5,8,9,11,14] (see Fig. 1).

ADAPTATION POLICIES

For Bangladesh, for so many other countries, and for *everyone's* shared future, the time to act on climate change is now. Adaptation can be defined as "the set of organization, localization and technical changes that societies will have to implement to limit the negative effects of climate change and to maximize the beneficial ones".[23] This definition encompasses extremely varied types of actions that can be applied to a wide range of sectors. However, issues may differ depending on geographic scales, zones and contexts, and its implementation involves a combination of widely diversified instruments applied internationally, nationally or locally.

Adaptation to climate change literally means "an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, that moderates harm or exploits beneficial opportunities".[24] Adaptation is a process by which individuals, communities and countries seek to cope with the consequences of climate change. The process of adaptation is not new, it varies based on geographical position and needs of the local population though. However, the idea of incorporating potential and future climate risk into the adaptation policy is crucial.[6,23] While our understanding of climate change and its potential impacts has become clearer, the availability of practical guidance on adaptation has not been updated over years.

As we have seen earlier that the developing countries like Bangladesh are more vulnerable to extremes of normal climatic variability, and climate change is likely to increase the frequency and magnitude of some extreme weather events and disasters in upcoming decades. Adaptation to climate change depends on current adaptive capacity and the development models pursued by the affected country.[23,24] These countries continue to face diverse challenges in forming and implementing climate change adaptation plans. Therefore, a meaningful adaptation policy helps people of the affected areas in mitigating and adapting to the health impacts of climate change. The impacts of climate change on our health can be observed in multiple areas including, but not limited to, food security, cultural medicines, mental health and land-based (local) practices. The policy must address the needs of climate change and health in affected communities to support

resiliency and adaptation to a changing climate both now and in the future through its emphasis on vulnerable population and capacity building.[20,23-27] Individual, community and geographical factors all contribute to capacity to adapt to change in climate.[1,24-27] In practice, reactive adaptation consists of reacting ex post to adverse impacts of climate change when they occur. Whereas proactive adaptation consists of taking action before impacts occur to reduce vulnerability to these impacts and to limit adverse consequences or to take advantage of them.[24] These include the level of material resources, effectiveness of governance and civil institutions, quality of public health infrastructure, access to relevant local information on extreme weather threats, many other socioeconomic factors, and pre-existing level of disease.[1,10,25]

Bangladesh National Adaptation Programme of Action (NAPA) was prepared by Ministry of Environment and Forest, Government of the People's Republic of Bangladesh in partnership with relevant specialized Agencies and institutions as a response to the decision of the Seventh Session of the Conference of the Parties (CoP7) of the United Nations Framework Convention on Climate Change (UNFCCC). Prevention and control of climate sensitive diseases need to be addressed with area specific interventions guided by local level planning of the low income vulnerable communities. Community based adaptation strategies could be beneficial to minimize climate change attributed health burden of Bangladesh.[6,24-27] Government initiatives, public–private strong advocacies, and international collaborations are needed to reduce OOP payments through alternative health care financing for climate victims. The maintenance of national public health infrastructure is a crucial element in determining levels of vulnerability and adaptive capacity.[1] Elementary adaptation to climate change can be facilitated by improved monitoring and surveillance systems. Basic indices of population health status (e.g. life expectancy) are available for most countries.[1,10] The reduction of socioeconomic vulnerability remains a priority. The poor (andvespecially the very young and old) are likely to be at greatest health risk because of their lack of access to material and information resources. Long-term reduction in health inequalities will require income redistribution, full employment, better housing and improved public health infrastructure. There must be improvement in services with a direct impact on health such as primary care, disease control, sanitation and disaster preparedness and relief.[1,10,28]

The government of Bangladesh established a National Climate Change Fund, with an initial capitalization of 45 million USD later raised to 100 USD, which will focus on adaptation. Health being included in the first pillar of the Bangladesh Climate Change Strategy and Action Plan a part of this fund should go into adaptation against impacts of climate change on health.[2] However, these types of funds need to be administered properly with sound disbursement modalities, an appropriate governance structure and careful resource management. Comparisons between baseline vulnerability/mortality and future projections should focus on local policy priorities, such as reducing injury and death rates, bolstering economic prosperity, and reducing health disparities.[25-28] Because Bangladesh is one of the most climate-vulnerable countries in the world, understanding the links between climate change and health is essential for making the country climate-resilient.[2,14,29] This discussion explores how Bangladesh can make further progress on these issues. Besides, the national plan involved the full range of stakeholders including community leaders, health professionals, local government, private organizations, and NGOs, to maximize the benefits in implementing adaptation measures.[2,29]

Overall, our review paper is not an extensive one rather we tried to explore and highlight: i) what is meant by climate change and its effects on environment of Bangladesh; ii) vulnerable peoples' experience how climate change affected their health in Bangladesh; and iii) adaptation policies related to climate change effects, based on existing local and foreign literature, policy papers and government's official documents.

CONCLUSION

Climate change is a complex issue that requires complex responses. Adaptation has long been neglected in the debate and policies surrounding climate change and its effects on public health. However, increasing awareness of climate change has led many stakeholders to look for the best way to limit its consequences and has resulted in a large number of initiatives related to adaptation, particularly at the local level. Adaptation has also become increasingly important in international negotiations. We hope that

Bangladesh National Adaptation Programme of Action (NAPA) is capable to support in mitigating and adapting to the health impacts of climate change. This programme seeks to address the needs of climate change and health in vulnerable communities to support resiliency and adaptation to a changing climate both now and in the future through its emphasis on allocation of resources, preventive measures, and capacity building.[29]

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