GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

Bangladesh

National Dengue Prevention and Control Strategy
(2024-2030)

December 2023

ডা: সামন্ত লাল সেন
মাননীয় মন্ত্রী
স্বাস্থ্য ও পরিবার কল্যাণ মন্ত্রণালয়
গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

অবহেলিত ক্রান্তীয় রোগসমূহের মধ্যে ডেঙ্গু অন্যতম। গত দুই দশক ধরে বাংলাদেশে ডেঙ্গু রোগীর সংখ্যা ক্রমাগত বেড়েই চলেছে। বৈশ্বিক উষ্ণায়ন, জলবায়ু পরিবর্তন, দ্রুত নগরায়ন ও শিল্পায়নের অভিঘাতে ডেঙ্গু সংক্রমণ বর্তমানে সারা দেশে ছড়িয়ে পড়েছে। ইতিমধ্যে ডেঙ্গু অন্যতম জনস্বাস্থ্য সমস্যা হিসেবে পরিচিতি লাভ করেছে।

বিভিন্ন পর্যায়ের অংশীজন এবং বিশেষজ্ঞগণের মতামতের ভিত্তিতে স্বাস্থ্য অধিদপ্তরের উদ্যোগে 'National Dengue Prevention and Control Strategy ২০২৪-২০৩০' প্রণয়ন করা হয়েছে। এতে বাস্তবমুখী, স্বল্প, মধ্যম ও দীর্ঘমেয়াদী পরিকল্পনা ও কর্মসমূহ অন্তর্ভুক্ত করা হয়েছে। স্বাস্থ্য মন্ত্রণালয় ও স্বাস্থ্য অধিদপ্তরের জন্য এটি একটি সময়োপযোগী উদ্যোগ।

'National Dengue Prevention and Control Strategy ২০২৪-২০৩০' প্রণয়নে যারা সক্রিয়ভাবে অংশগ্রহণ করে সুচিন্তিত মতামত প্রদান করেছেন তাদের সকলকে বিশেষ করে স্বাস্থ্য অধিদপ্তরের রোগ নিয়ন্ত্রণ বিভাগ, WHO, UNICEF, IFRC সহ অন্যান্য উন্নয়ন সহযোগী সংস্থা সমূহকে প্রয়োজনীয় সহায়তা প্রদান করার জন্য স্বাস্থ্য ও পরিবার কল্যাণ মন্ত্রণালয়ের পক্ষ থেকে ধন্যবাদ জ্ঞাপন করছি।

আমি আশা করি সংশ্লিষ্ট সকলের আন্তরিক সহযোগিতা ও অংশগ্রহণে 'National Dengue Prevention and Control Strategy ২০২৪-২০৩০' বাস্তবায়নের মাধ্যমে বাংলাদেশে ডেঙ্গু প্রতিরোধ ও নিয়ন্ত্রণের ক্ষেত্রে সাফল্য অর্জন করা সম্ভব হবে।

Md. Jahangir Alam
Secretary
Health Services Division
Ministry of Health and Family Welfare
Government of the People's Republic of
Bangladesh

The number of Dengue cases in Bangladesh has reached alarming levels in recent years posing a significant public health threat resulting in substantial morbidity, mortality and economic burden. Bangladesh managed the situation with wholeheartedly through devoted, committed and hardworking team of the Ministry of Health and Family Welfare, Ministry of Local Government, Rural Development & Co-operatives, Directorate General of Health Services and City Corporations.

MOH&FW responded with various initiatives to control this mosquito-borne diseases, including awareness campaigns, elimination of mosquito breeding sites, establish dengue corner in different health facilities, reporting, supply of IV fluid and diagnostics, develop necessary guidelines and provide training to healthcare providers at all levels.

In preparation for a policy framework towards Dengue prevention and control in Bangladesh, it is crucial to develop a National Strategic Plan. This plan outlines a multi-sectoral approach to reduce the incidence of Dengue case, prevent Dengue-related deaths, strengthen dengue surveillance, early warning systems and integrated vector control management. It also focuses on improving the management of Dengue cases and promoting community engagement and behavior change.

I would encourage all senior level managers of Health Services Division as well as Directorate General of Health Services for proper utilization of the National Dengue Prevention and Control Strategy (2024-2030).

I express my gratitude and thanks to each member of the team, partners and stakeholders who have played a fundamental role in crafting this milestone event for Dengue prevention and control to make significant strides in fortifying our nation's health defenses and securing a healthier future for all.

Prof. Dr. Abul Bashar Mohammad Khurshid Alam
Director General
Directorate General of Health Services
Ministry of Health and Family Welfare
Government of the People's Republic of Bangladesh

In 2023 the upsurge of Dengue cases in Bangladesh has created a public health threat resulting in substantial morbidity, mortality and economic burden. Directorate General of Health Services responded efficiently to the crisis by improving the diagnostic capacity to meet the increasing needs and strengthening the capacity of health facilities as well as physicians to manage the critical Dengue patients.

To address the growing burden of Dengue in Bangladesh, a National Strategic Plan is essential to provide a comprehensive framework. This plan outlines a multi-pronged approach to reduce the incidence of Dengue, prevent dengue-related deaths, and strengthen Dengue surveillance and early warning systems. It also focuses on improving the management of Dengue cases and promoting community engagement and behavior change.

This plan is a testament to our collective strength, foresight, and commitment to ensure the health security of our communities. As we move forward, our expertise and dedication will be invaluable in translating this plan into action, implementing its strategies effectively and making a tangible difference in our fight against Dengue.

I would like to thank everyone who contributed to this National Dengue Prevention and Control Strategy (2024-2030). It will surely serve to the need of all stakeholders for prevention and control of Dengue. Together, we will march forward to create a healthy Bangladesh.

Prof. Dr. Md. Nazmul Islam
Director, Disease Control and LD,
Communicable Disease Control
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Dengue is an important infectious disease caused by an Arbo-virus named 'Dengue virus'. Recently, thousands of world populations are affected by Dengue. As a vector borne disease it is widely distributed in many tropical countries. Each year, thousands of Dengue cases are reported and there are several outbreaks of Dengue in many countries including Bangladesh.

In Public Health perspective controlling Dengue is a major challenge. However, in recent years some outbreaks presented atypical clinical presentations that made the diagnosis and management more difficult. More people are at risk of mortality and morbidity. To manage the challenge an effective national strategic plan for control Dengue is important.

The National Strategic Plan objectives include vector control; enhance capacity of Doctors, Nurses & Hospitals; establish strong surveillance (disease & vector); ensuring multi-sectoral participation; effective community engagement; and early case detection, prompt and effective case management.

I extent my heartfelt thanks and gratitude to all expert groups for their valuable contributions in development of the National Dengue Prevention and Control Strategy (2024-2030). I am also thankful to those who contributed at different areas for finalization of this document including development partners.

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List of Acronyms/Glossary

ADP	Annual Development Plan
APIP	Annual Program Implementation Plan
BCC	Behavioural Change Communication
BI	Breteau Index
BSMMU	Bangabandhu Sheikh Mujib Medical University
BRCS	Bangladesh Red Crescent Society
BTRC	Bangladesh Telecommunication Regulatory Commission
CBC	Complete Blood Count
CBHC	Community Based Health Care
CBO	Community Based Organization
CC	Community Clinics
CDC	Communicable Disease Control
CHCP	Community Health Care Provider
COP (COP28)	Conference of the Parties
DENV	Dengue Virus
DCC	Dhaka City Corporation
DHF	Dengue Hemorrhagic Fever
DGFP	Directorate General of Family Planning
DGHS	Directorate General of Health Services
DGME	Directorate General of Medical Education
DGNM	Directorate General of Nursing & Midwifery
DP	Development Partners
EPI	Expanded Programme on Immunization
FSD	Field Services Delivery
FWA	Family Welfare Assistant
FWV	Family Welfare Visitor
GIS	Geographic Information System
HSD	Health Services Division
IEDCR	Institute of Epidemiology, Disease Control and Research
IFRC	International Federation of Red Cross
IG	Inspector General
IGR	Insect Growth Regulator
IPCC	Intergovernmental Panel on Climate Change
IPH	Institute of Public Health
IPC	Infection prevention and control
IVM	Integrated Vector Management
LD	Line Director
L&HEP	Lifestyle and Health Education & Promotion
LGI	Local Government Institutes
LGD	Logal Government Divisions
MCRAH	Maternal, Child, Reproductive and Adolescent Health

MNCAH	Maternal, Neonatal, Child and Adolescent Health
MIS	Management Information System
MOH&FW	Ministry of Health & Family Welfare
MoLDRD&C	Ministry of Local Government, Rural Development and Cooperatives
NGO	Non-Government Organization
NILMRC	National Institute of Laboratory Medicine & Referral Center
NIPSOM	National Institute of Preventive and Social Medicine
NS/NSP	Nonstructural Protein
PCR	Polymerase Chain Reaction
PH	Public Health
PMEI	Planning, Monitoring, Evaluation and Inspection
RCCE	Risk Communication and Community Engagement
REHAB	Real Estate and Housing Association of Bangladesh
RCP	Representative Concentration Pathways
RT-PCR	Reverse Transcription Polymerase Chain Reaction
SEARO	WHO Regional Office for South-East Asia
SSP	Shared Socioeconomic Pathways
SOP	Standard Operating Procedure
TOT	Training of Trainers
USG	Ultrasonography
UH&FPO	Upazila Health and Family Planning Officer
UzHC	Upazila Health Complex
US CDC	US - Centers for Disease Control and Prevention
WHO	World Health Organization

Executive Summary

Dengue is a viral infection caused by the dengue virus (DENV), transmitted to humans through the bite of infected mosquitoes. The primary vectors that transmit the disease are *Aedes aegypti* mosquitoes and, to a lesser extent, *Aedes albopictus*. Female mosquitoes acquire the virus while feeding on the viremic blood of a DENV-infected human. Both *Ae. aegypti* and *Ae. albopictus* mosquitoes feed during the daytime from morning until dusk; however, nighttime biting has also been reported in *Ae. albopictus*. DENV causes a spectrum of illnesses in humans, ranging from asymptomatic to mild fever, as well as dengue hemorrhagic fever and dengue shock syndrome, which are often fatal if not properly treated. The World Health Organization (WHO) revised dengue case classification, where severe dengue cases were grouped as cases with severe plasma leakage leading to dengue shock syndrome and fluid accumulation with respiratory distress, severe bleeding, and severe organ involvement, including the liver (AST or ALT $\geq$ 1000) and central nervous system, which may cause impaired consciousness, and other organs including heart, and occasional death may occur.

There is no specific treatment for dengue; however, the timely detection of cases, identifying any warning signs of severe dengue infection, and appropriate case management are key elements of care to lower case fatality rates to less than 1%.

Dengue was first recorded in the 1960s in Bangladesh (then known as East Pakistan) and was known as "Dacca fever". First outbreak of dengue reported in Bangladesh during June to October 2000. Bangladesh has been experiencing episodes of dengue fever in every year since 2000. All four serotypes have been detected. Since 2010 cases of dengue appear to coincide with the rainy season from May to September with higher temperatures and humidity. In 2019, there is another upsurge of Dengue. In 2022 and 2023, the reported cases and deaths crossed all the previous records (2022: cases – 62,382; deaths 281. 2023 up to 15 Dec.: cases 315,623; deaths 1,629).

Bangladesh's climate conditions are becoming more favourable for the transmission of dengue and other vector-borne diseases including malaria and chikungunya due to excessive rainfall, waterlogging, flooding, rise in temperature and the unusual shifts in the country's traditional seasons. Dengue trends showed seasonal patterns, with transmission often peaking during and after rainy seasons (6-8 weeks after rains or floods). The mosquito density and the number of cases mainly depend on the early rainfall with other meteorological factors (Temperature, Humidity etc.). The transmission dynamics of dengue are complex, but there are several factors likely contributing to this recent increase and they include:

- high mosquito population density,
- susceptibility to human population of circulating serotypes,
- introduction of new virulent serotypes (serotype switch),
- favourable air temperature, precipitation and humidity all of which affect the reproduction and feeding patterns of mosquito populations, as well as the dengue virus incubation period.

The key elements of Integrated vector management are (a) integrated approach, (b) evidence-based decision-making based on local vector ecology, epidemiology and resources, guided by operational research and subject to routine monitoring and evaluation, (c) collaboration within the health sector and with other sectors, (d) advocacy, social mobilization and legislation and (e) capacity-building. The primary method of controlling Aedes vectors is to eliminate the breeding sources, besides knocking

down the infected mosquito vectors during the outbreak. Larval control can be done through environmental management, biological control agents and larviciding.

Climatic conditions influence the mosquito lifecycle:

- ➢ *Temperature:* Mosquitoes are sensitive to temperature:
  - Minimum temperature has the most impact on dengue fever. Minimum temperatures of 18°C or more conducive.
  - Maximum temperature of 25°C–35°C is ideal for dengue fever, with a peak at 32°C. Beyond 35°C, mosquitoes die.
- ➢ *Humidity:* Humidity of 60–80% is suitable for mosquitoes.
  Rainfall: Dengue cases increase with rainfall in the range of 200–800 mm; peak at 550–650mm. Increased dengue fever risk is at the onset of rainfall, lasting for at least three months.

Significantly all three weather variables (temperature, humidity and rainfall) must be in the suitable range for the mosquitoes to breed and survive.

WHO and the United Nations Framework Convention on Climate Change (2015) project mean annual temperature to rise between 1.4°C and 4.8°C over the period 1990–2100 in Bangladesh. Temperature is predicted to rise by 2°C in the next 25 years. Dengue cases likely to increase with the increase of temperature. Dengue cases are projected to more than double by 2050. Case load likely to be 10xhigher during endemic years, such as in 2019 and 2023). Fifty seven percent of these projected cases would be caused by climate change. Overall climatic conditions in Bangladesh are evolving that will result in larger outbreaks of climate sensitive diseases like dengue. Climate induced dengue cases will increase to 59,000 cases (in a normal year) or 323,000 cases in endemic/epidemic years (like 2023).

Based on the situational analysis, it is imperative for the Ministry of Health and Family Welfare to develop a comprehensive, continued, inclusive, efficient and successful **National Dengue Prevention and Control Strategy** taking into consideration all factors that is essential for dengue control and prevention.

Building on the strengths and current initiatives taken up by DGHS, there is an opportunity to develop a robust ***Bangladesh National Dengue Prevention and Control Strategy (2024–2030)*** which will provide and takes on a holistic multi-pronged approach that transcends traditional boundaries considering the intricate web of factors that contribute to dengue transmission.

Aligning with the MOHFW's 5th Health, Population and Nutrition Sector Program (2024-2030) the time frame of this strategy has been taken for next 7 years beginning on 2024 and ending on 2030.

- ➢ Vision Statement: *Ensuring a Dengue Diseases free Bangladesh through a coordinated holistic approach.*
- ➢ Goal: *To reduce mortality and morbidity with Dengue in Bangladesh*
  - i) *To achieve case incidence below 100/100,000 population by the year 2030*
  - ii) *To reduce and maintain case fatality rate below 0.1 % by the year 2030*
- ➢ Strategic Objectives: *To address the key opportunities that emerged during the analysis six strategic objectives have been proposed.*
  - ✓ Strategic Objective 1: Ensure governance and effective coordination mechanism involving relevant ministries and other stakeholders. The Strategic Objective 1 is composed of three outputs and five strategic activities.

- ✓ Strategic Objective 2: Enhance capacity of Doctors, Nurses and Allied health workforce to ensure prompt diagnosis and treatment of all cases at all health care facilities in line with the National Guidelines for Management of Dengue/DHF. The Strategic Objective 2 is composed of nine outputs and twenty-nine strategic activities.
- ✓ Strategic Objective 3: Institutionalize appropriate vector control measures based on Integrated Vector Management. The Strategic Objective 3 is composed of three outputs and twenty-four strategic activities.
- ✓ Strategic Objective 4: Strengthen country's capacity on real time reporting and surveillance for disease trend, characterization, prediction and response to Dengue outbreaks. The Strategic Objective 4 is composed of three outputs and nine strategic activities.
- ✓ Strategic Objective 5: Strengthen the multi-sectoral and effectiveness of the risk communication and community engagement (RCCE) approaches nationwide to ensure household level actions for dengue prevention, control, care & management for patients. The Strategic Objective 5 is composed of eight outputs and thirty-seven strategic activities.
- ✓ Strategic Objective 6: Undertake research on effective dengue vaccine, clinical management, surveillance and vector control to address programme gaps and challenges. The Strategic Objective 6 is composed of four outputs and fourteen strategic activities.
- ✓ Strategic Objective 7: Ensure availability and undertake nationwide dengue vaccination using WHO prequalified vaccine through global collaboration. The Strategic Objective 7 is composed of one output and four strategic activities.

The strategic outputs and strategic actions provide a glimpse of the critical activities of the national strategy that need to be implemented. The priority of the strategy is to integrate all actions under a coordinated and functioning governance structure at the Ministry level, Directorate General levels, Directorate levels, Divisional, district, and upazila levels for a strong foundation for implementation of the strategy and to develop the dengue prevention, control and case management systems including a robust learning and surveillance system at all levels for continuous improvement.

It is proposed that a detailed costed "Implementation Plan" would be developed as a next step detailing out specific steps to be implemented at national, divisional, district, upazila and community-level, with specific measuring indicators splitting up by time horizons of the strategy (short-term, medium-term and long-term) for its effective implementation. The plan would elaborate on additional details on implementation, including detailed procedures, responsibility, partners, target groups and key performance indicators as well as functioning of the coordination arrangement.

CDC-DGHS will be the lead coordinating agency for all strategic objectives in the *Bangladesh National Dengue Prevention and Control Strategy (2024–2030)* as well as in the Implementation Plan. If necessary, CDC-DGHS will channel earmarked funds to supporting agencies. The supporting agencies at the activity level in the implementation plan would be responsible for incorporation in their respective Operational Plan of the 5th Sector Program of MOH&FW as "*Dengue Prevention and Control*" component of their respective Operational Plans and should be monitored through ADP review as well as the Annual Program Implementation Plan (APIP) as part of the overall sector program. CDC, DGHS would take necessary steps for its inclusion in all relevant Operation Plans for effective implementation and institutionalization of Dengue Prevention and Control.

Additionally, a mid-term assessment would be conducted in 2027 to measure progress and concurrently due course correction would be made of this strategy.

1. Introduction

Dengue is a viral infection transmitted to humans through the bite of infected female *Aedes* mosquitoes (WHO 17/03/2023 and 11/08/2023), mostly in urban and semi-urban areas. Dengue virus is primarily transmitted by the *Aedes* species of mosquito which is also responsible for the spread of chikungunya and Zika viruses. The primary vectors that transmit the disease are *Aedes aegypti* mosquitoes and, to a lesser extent, *Aedes albopictus*.

The DENV, the causal agent of dengue, is a positive-sense, single-stranded RNA virus with a genome size of 10.7 kb and belongs to *Flavivirus*, in the family Flaviviridae[1] . *Flavivirus* contains many other important pathogenic viruses, including yellow fever virus, Japanese encephalitis virus, tick-borne encephalitis virus, Usutu virus, West Nile virus, and Zika virus[2]. The DENV genome encodes three structural proteins, namely the capsid (C), membrane (M), and envelope (E) proteins, and seven nonstructural proteins, including NS1, NS2A, NS2B, NS3, NS4A, NS4B, and NS5[3]. There are four DENV serotypes, DENV-1, DENV-2, DENV-3, and DENV-4, which are genetically related but antigenically distinct[4]. All four DENV serotypes emerged from sylvatic strains in the forests of Southeast Asia[5]. Infection with one serotype provides long-term immunity to the homologous serotype but not to the other serotypes; sequential infections with a different serotype put people at greater risk for severe dengue. Many DENV infections produce only mild flu-like illness and over 80% of cases are asymptomatic.

The DENV is spread via a human-mosquito-human cycle through the bites of infective female *Aedes* mosquitoes, mainly *Aedes aegypti*, and to a lesser extent, *Aedes albopictus*. Female mosquitoes acquire the virus while feeding on the viremic blood of a DENV-infected human. Vertical transmission of DENV in mosquitoes between generations has also been reported; however, its significance remains unclear. Both *Ae. aegypti* and *Ae. albopictus* mosquitoes feed during the daytime from morning until dusk; however, nighttime biting has also been reported in *Ae. albopictus*. DENV causes a spectrum of illnesses in humans, ranging from asymptomatic to mild fever, as well as dengue hemorrhagic fever and dengue shock syndrome, which are often fatal if not properly treated. The World Health Organization (WHO) revised dengue case classification, where severe dengue cases were classified with severe plasma leakage leading to dengue shock syndrome and fluid accumulation with respiratory distress, severe bleeding, and severe organ involvement, including the liver (AST or ALT ≥ 1000) and central nervous system, which may cause impaired consciousness, and other organs including heart, and occasional death may occur.

Aedes borne arboviruses continue to cause significant burden in over 100 countries across the world. Below some key points are highlighted which needs to be considered in order to prevent and control the vector and reduce the burden of the disease. The two mosquito vectors in Bangladesh have the following characteristics:

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[1] Kuhn R.J., Zhang W., Rossmann M.G., Pletnev S.V., Corver J., Lenches E., Jones C.T., Mukhopadhyay S., Chipman P.R., Strauss E.G., et al. Structure of dengue virus: Implications for flavivirus organization, maturation, and fusion. *Cell.* 2002;108:717–725. doi: 10.1016/S0092-8674(02)00660-8

[2] Pierson T.C., Diamond M.S. The continued threat of emerging flaviviruses. *Nat. Microbiol.* 2020;5:796–812. doi: 10.1038/s41564-020-0714-0.

[3] Guzman M.G., Halstead S.B., Artsob H., Buchy P., Farrar J., Gubler D.J., Hunsperger E., Kroeger A., Margolis H.S., Martínez E., et al. Dengue: A continuing global threat. *Nat. Rev. Genet.* 2010;8:S7–S16. doi: 10.1038/nrmicro2460

[4] Simmons C.P., Farrar J.J., van Vinh Chau N., Wills B. Dengue. *N. Engl. J. Med.* 2012;366:1423–1432. doi: 10.1056/NEJMra1110265.

[5] Wang E., Ni H., Xu R., Barrett A.D.T., Watowich S.J., Gubler D.J., Weaver S.C. Evolutionary Relationships of Endemic/Epidemic and Sylvatic Dengue Viruses. *J. Virol.* 2000;74:3227–3234. doi: 10.1128/JVI.74.7.3227-3234.2000

Table 1: Characteristics of Aedes Aegypti and Aedes Albopictus in Bangladesh[6]

| Characteristics	*Aedes aegypti*	*Aedes albopictus*
Climatic Conditions	Tropical and Subtropical	Tropical and Temperate
Habitat	Urban Centres	Urban and Rural
Feeding Pattern	Multiple blood meal (leading to clustering of cases)	Single blood meal
Feeding preference	Humans (Anthropophilic)	Opportunistic feeder; Feeds on animal too
Feeding Place	Inside Houses	Inside and Outside Homes
Breeding sites	Artificial water containers, mud pots, used tires, stagnant water in construction sites	Tree holes, axils, bamboo stumps
Eggs	Withstands desiccation	Withstands desiccation
Flight range	400-500 metres	400-500 metres
Susceptibility to viruses	High - Moderate	Low to moderate

There is no specific treatment for dengue; however, the timely detection of cases, identifying any warning signs of severe dengue infection, and appropriate case management are key elements of care to lower case fatality rates to less than 1%.

The higher incidence of dengue is taking place in the context of an unusual episodic amount of rainfall, combined with high temperatures and high humidity, which have resulted in an increased mosquito population throughout Bangladesh.[7]

1.1 Historical Background

Dengue was first recorded in the 1960s in Bangladesh (then known as East Pakistan) and was known as "Dacca fever". First documented outbreak of dengue reported in Bangladesh during June to October 2000 with 5,551 cases and 93 deaths. Number of cases and deaths were low in subsequent years.

*Figure 1: Dengue Cases and Deaths (2000 – 2023 upto 10 December 2023)[8]*

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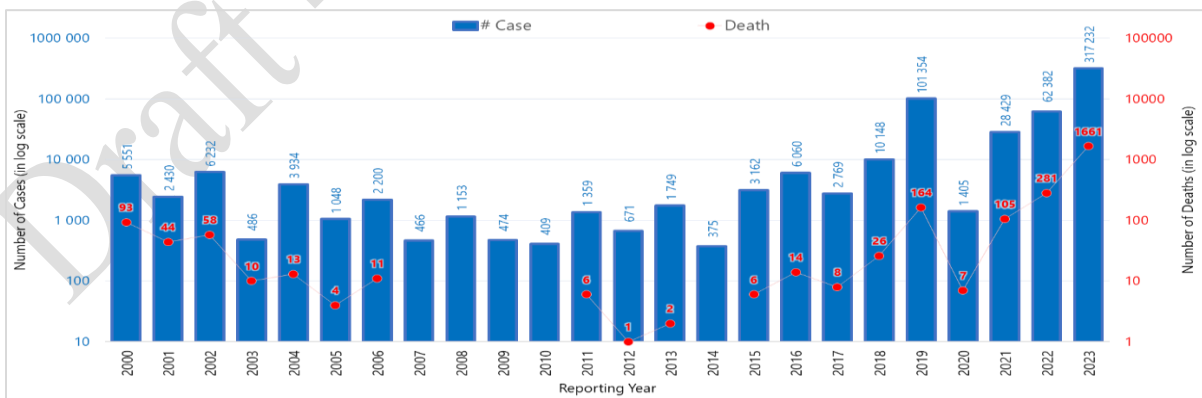
[6] Draft Bangladesh Dengue Prevention and Control Strategy (2020-2024)
[7] https://www.who.int/emergencies/disease-outbreak-news/item/2023-DON481
[8] Data Source: HEOC & Control Room, MIS, DGHS

Since 2010 cases of dengue appear to coincide with the rainy season from May to September and higher temperatures. In 2019, there is another upsurge reporting 101,354 cases with 164 deaths. There is sharp rise in the incidence of dengue cases worldwide too in the last 20 years from 505,430 cases in 2000 to around 3,643,763 in 2022. In 2022 and 2023, the reported cases and deaths crossed all the previous records (2022: cases – 62,382; deaths 281. 2023 upto 15 Dec.: cases 315,623; deaths 1,629). The graph below gives a detailed account of cases recorded from 2000-2023.

Figure 2: Dengue Case Comparison in Last 5 Years (Till 15 December 2023)[9]
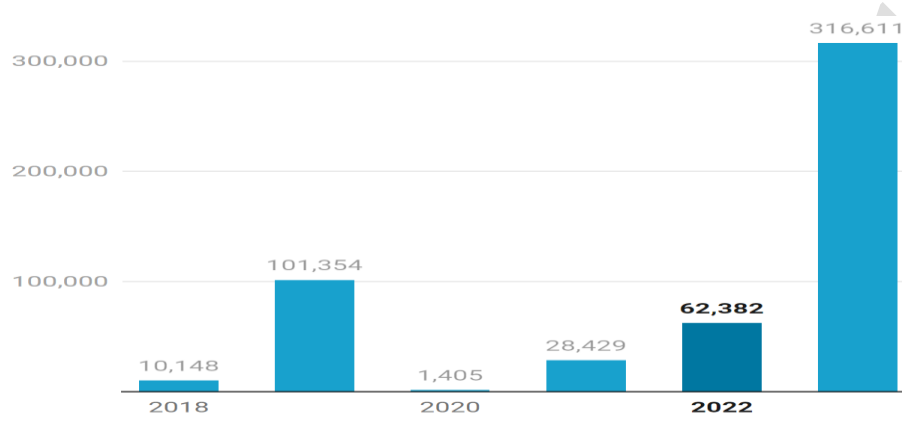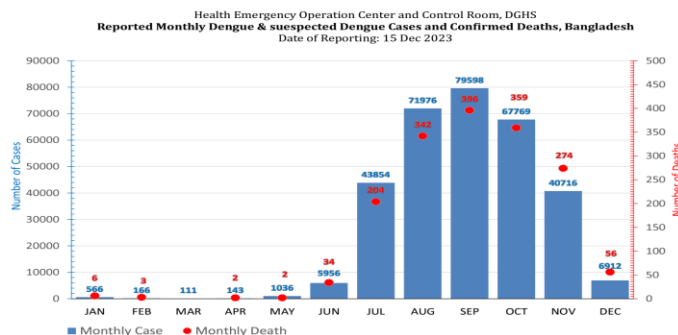

Bangladesh's climate conditions are becoming more favourable for the transmission of dengue and other vector-borne diseases including malaria and chikungunya due to excessive rainfall, waterlogging, flooding, rise in temperature and the unusual shifts in the country's traditional seasons. Dengue trends showed seasonal patterns, with transmission often peaking during and after rainy seasons (6-8 weeks after rains or floods). The transmission dynamics of dengue are complex, but there are several factors likely contributing to this recent increase and they include:
- high mosquito population density,
- susceptibility to human population of circulating serotypes,
- introduction of new virulent serotypes (serotype switch),
- favourable air temperature, precipitation and humidity all of which affect the reproduction and feeding patterns of mosquito populations, as well as the dengue virus incubation period.

*Figure 3: Reported Monthly Dengue & Suspected Dengue Cases and Confirmed Death (till 06 December 2023)[10]*

[9] Source: HEOC & CR, MIS, DGHSCreated with Datawrapper
[10] chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://old.dghs.gov.bd/images/docs/vpr/20231129_dengue_all.pdf

Health Emergency Operation Center and Control Room, DGHS
Reported Monthly Dengue & suespected Dengue Cases and Confirmed Deaths, Bangladesh
Date of Reporting: 15 Dec 2023

The map below shows a spatial distribution of Dengue outbreak in 2023.

Figure 4:*District Wise Distribution of Dengue Cases as of 10 December 2023*[11]
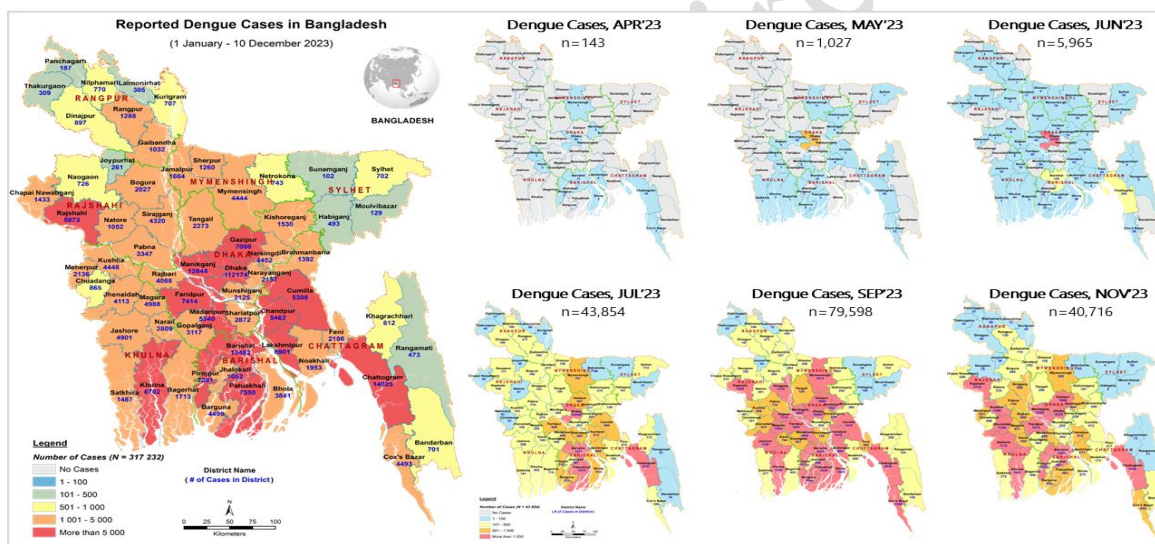
2. Circulating Dengue Serotype

Bangladesh has been experiencing episodes of dengue fever in every year since 2000. All four serotypes have been detected, with DENV-3 predominance until 2002[12].

During 2013-2016, DENV-2 was predominant followed by DENV-1 in circulation[13]. IEDCR predicted that as the serotypes DENV-3 and DENV-4 are in circulation in the neighboring countries, they may create epidemics of secondary dengue in the near future in Bangladesh.

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[11] *Data Source: HEOC & Control Room, MIS, DGHS*

[12] Islam M.A., Ahmed M.U., Begum N., Chowdhury N.A., Khan A.H., Parquet M.D.C., Bipolo S., Inoue S., Hasebe F., Suzuki Y., et al. Molecular characterization and clinical evaluation of dengue outbreak in 2002 in Bangladesh. *Jpn. J. Infect. Dis.* 2006;59:85–91. [PubMed] [Google Scholar]

[13] Huhn N. Dengue Outbreak in Bangladesh. 2021. [(accessed on 13 September 2022)]. Available online: https://www.outbreakobservatory.org/outbreakthursday-1/9/23/2021/dengue-outbreak-in-bangladesh#:~:text=According%20to%20researchers%20at%20the,virus%20associated%20with%20higher%20mortality

- In 2013, DENV-2 was the only serotype that was in circulation in Chittagong and Khulna metropolitan cities, whereas in Dhaka, along with DENV-2, DENV-1 (31%) was also found to be circulated.
- In 2014, it was observed that DENV-1 began to spread outside Dhaka and emerges in Chittagong, but still Khulna was free from DENV-1.
- IN 2015, DENV-1 appeared in the circulation along with DENV-2.
- In 2016, DENV-2 became the predominant strain with existence of DENV-1 in all three cities.
- In 2017, DENV-2 was the predominant serotype (91.3%) in Dhaka City[14].
- In 2018, reemergence of DENV-3 was identified; subsequently there was a sharp rise in dengue cases from the beginning of the monsoon season in 2018. DENV-2 was reported as the predominant serotype (40.95%), followed by DENV-3 (33.07%) and DENV-1 (25.98%).[13]
- In 2021, the circulating strain was DENV-3 in Dhaka city was 100%. There was no clear picture of the circulating strain in some major cities of the country like Rajshahi, Rangpur, Sylhet and Mymensingh.[15]
- In 2022, there is re-emergence of DENV-4 in Dhaka city.

Table 2: Distribution of DENV Serotypes in Bangladesh

Year	DENV1 (%)	DENV2 (%)	DENV3 (%)	DENV4 (%)
2013	14%	86%	0%	0%
2014	40%	60%	0%	0%
2015	50%	50%	0%	0%
2016	24%	76%	0%	0%
2018	9%	41%	31%	0%
	Co-infection: DENV2 & 3 - 11%, 1 & 3 - 5%, 1 & 2 - 3%			
2019	3%	1%	90%	0%
	Co-infection: DENV2 & 3 - 3%, 1 & 3 - 3%			
2021	0%	0%	100%	0%
2022	0%	0%	76%	24%

Figure 5: Timeline of Dengue Serotypes in Bangladesh
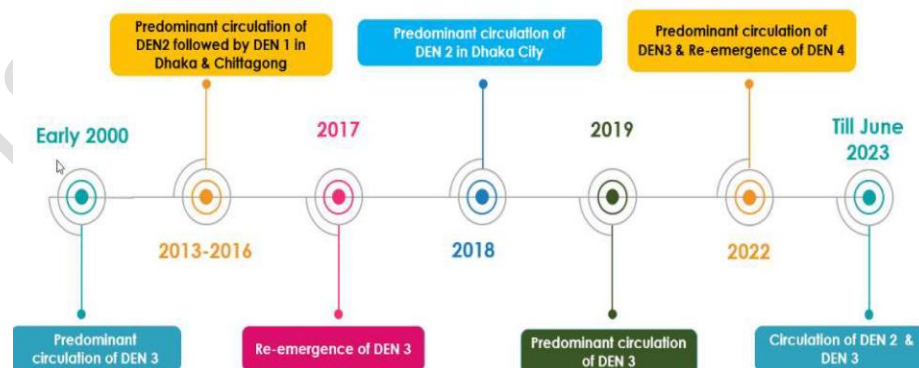
[14] Rahim R., Hasan A., Hasan N., Nakayama E.E., Shioda T., Rahman M. Diversity of Dengue Virus Serotypes in Dhaka City: From 2017 to 2021. Bangladesh J. Med. Microbiol. 2021;15:23–29. doi: 10.3329/bjmm.v15i2.57817. [CrossRef] [Google Scholar]

[15] Hasan K., Hossain M., Sarwar S., Wilder-Smith A., Gozal D. Unprecedented rise in dengue outbreaks in Bangladesh. Lancet Infect. Dis. 2019;19:1287. doi: 10.1016/S1473-3099(19)30616-4. [PubMed] [CrossRef] [Google Scholar]

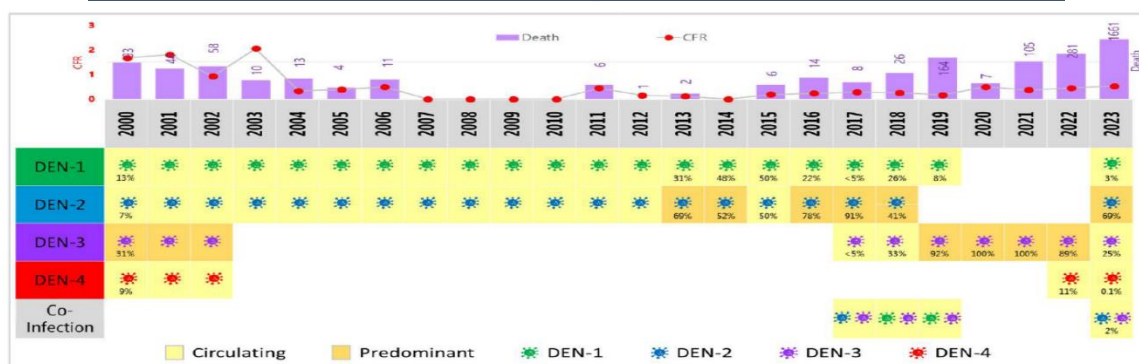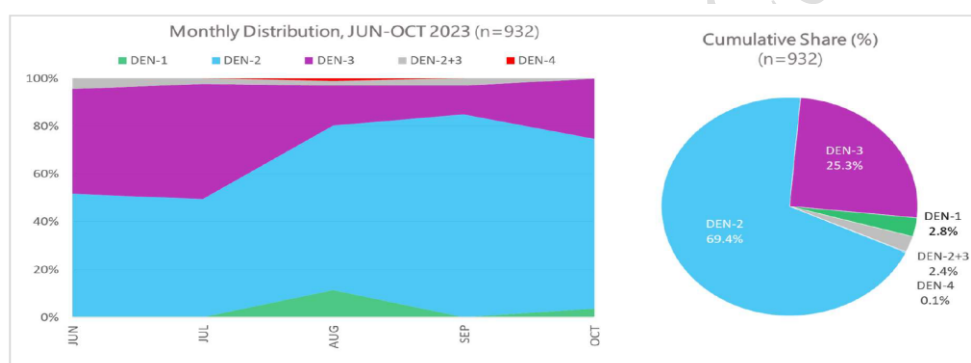*Figure 6: Dengue Death, CFR and Serotype, Dhaka City, Bangladesh, 2022-23[16]*

Figure 7: Circulating Dengue Serotypes in Dhaka (upto October 2023)[17]

3. Dengue Death Analysis

21-30 years of age group population were mostly affected with dengue during 2023, however, the predominance of death is observed within 31-40 years age group population (fig-8). Males were mostly affected but case fatality was higher within the female population (fig-9).

Figure 8: Age-Sex Distribution of Dengue Cases and Deaths (As of 10 December 2023)[18]

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[16] Data Source: Illustrated from literature review: Sharmin S et.al. (2015), Muraduzzaman AKM et.al (2018), Rahman SMM et.al (2022), Hossain MA et.al (2023)

[17] Data Source: IEDCR & NILMRC

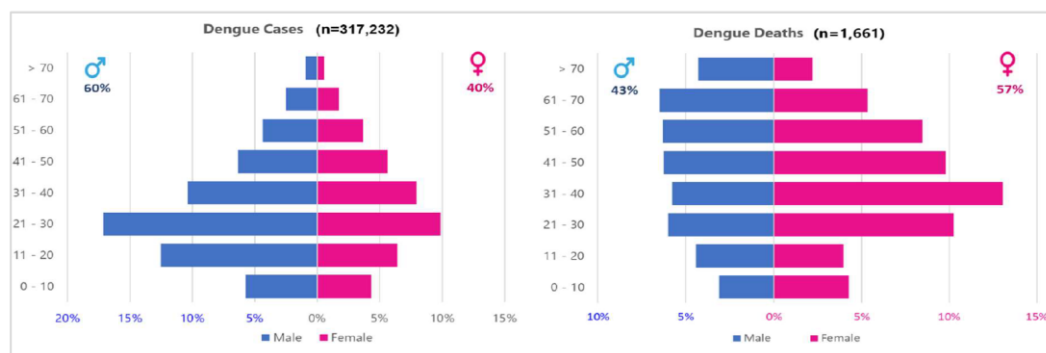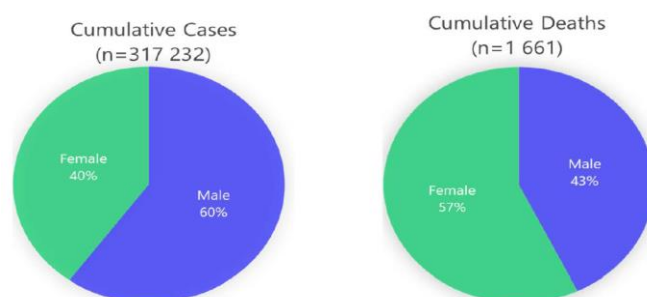[18] Data Source: HEOC & Control Room, MIS, DGHS

Figure 9: Distribution of Dengue Case and Death by Gender, 2023 (As of 10 December 2023)[19]

Amongst causes of death dengue shock syndrome ranks in top taking 74% of the share (fig-10) indicating delay in receiving skilled and proper care.

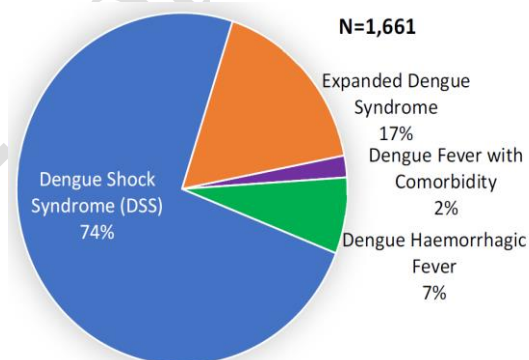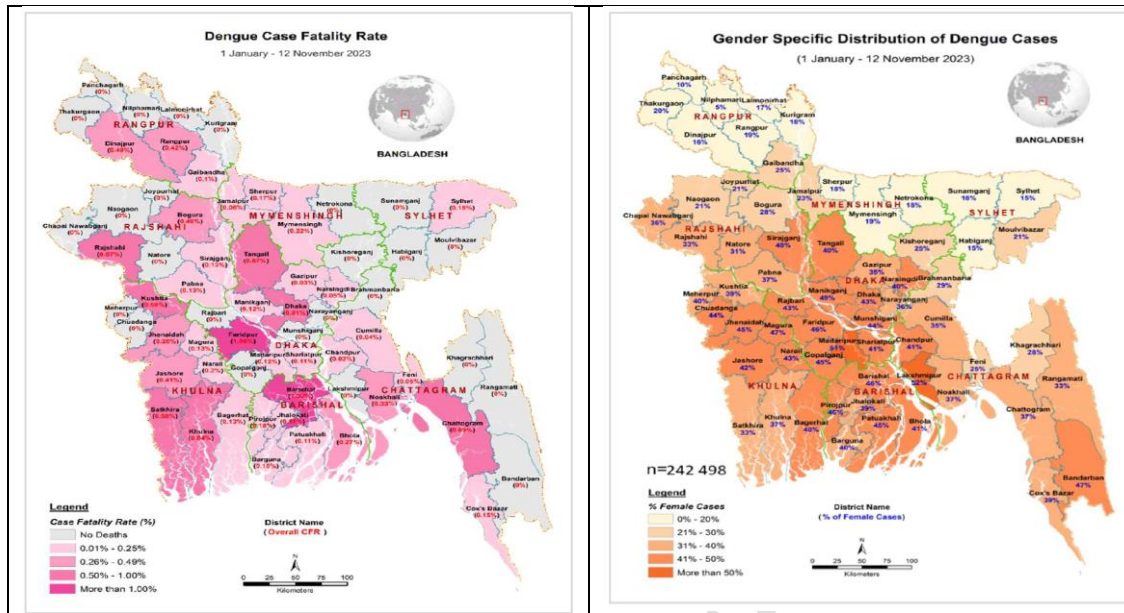*Figure 10: Underlying Cause of Deaths (As of 10 December 2023)[20]*

Figure 11: District-wise Dengue Case Fatality rate and Gender Specific Distribution of Dengue Cases[21]

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[19] Data Source: HEOC & Control Room, MIS, DGHS

[20] WHO Analysis

[21] WHO Analysis

4. Influence of Climate Variability on Dengue

Dengue is one of the most important mosquito-borne diseases affected by climate variability, and it continues to spread throughout the tropical and subtropical regions globally (Costa et al. 2010). Dengue, chikungunya, and Zika virus are spread by the same mosquito species, *Aedes aegypti* (Lowe et al. 2017)[22].

Figure 12 presents the pathways by which dengue transmission cycles are altered by weather variables and other factors.

Figure 12: WHO and World Meteorological Organization Framework on the Interaction of Meteorological and Other Determinants of Dengue Transmission Cycles and Clinical Diseases[23]
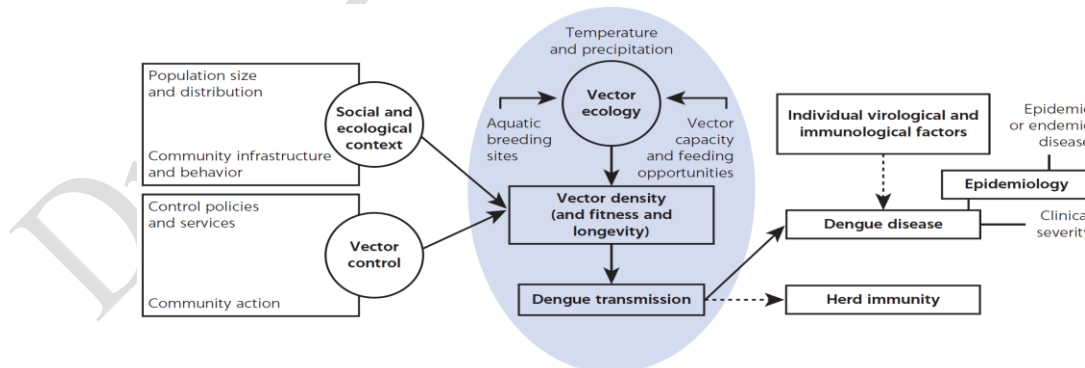
Ebi and Nealon (2016) summarize the life cycle of a mosquito: female mosquitoes lay eggs on the side of water-holding containers while humans provide the blood meals necessary for egg development. These female mosquitoes usually rest in cool and dark places and generally bite humans indoors. After

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[22] Climate Afflictions; Iffat Mahmud, Wameq A. Raza, and Md Rafi Hossain; © 2021 International Bank for Reconstruction and Development / The World Bank

[23] Source: Ebi and Nealon 2016

flooding or rain, the eggs hatch into larvae. In a week or so, under favorable environmental conditions, the larvae transform into pupae and evolve into adult mosquitoes.

With respect to the viruses spread by these mosquitoes, it takes between 5 and 33 days, with a mean of 15 days, at 25°C for the virus to multiply, mature, and travel to the salivary glands of the mosquito before the insect can start transmitting the virus by biting a person. The variability in climatic conditions—temperature, precipitation or rainfall, and humidity—because of climate change will affect the biology of mosquito vectors as well as the risk of disease transmission (Costa et al. 2010). Colón-González, Lake, and Hunter (2013) conclude that dengue transmission rapidly increases when the minimum temperature increases above 18°C, based on data from Mexico on laboratory-confirmed dengue cases from 1985 to 2007 and weather data—monthly averages for minimum temperature, maximum temperature, and rainfall (figure 9). They conclude that the minimum temperature has the biggest impact on dengue—with zero risk below 5°C and a rapid increased risk when the average minimum temperature is above 18°C. The maximum temperature also influences dengue independently from the minimum temperature; the authors found that dengue cases increase in the range of 25°C to 35°C with a peak at 32°C. At temperatures above 32°C the risk of dengue decreases, with adult mosquitoes dying at temperatures above 35°C. With respect to rainfall, dengue cases increase in the range of 200 to 800 millimeters of rainfall, with a peak at 550–650 millimeters. The authors also found higher incidence of dengue in the wet season from May to October for Mexico. Zhang et al. (2019) conclude that periods of increased temperatures can cause occurrence of dengue epidemics.

Figure 13: Relationship Between Incidence of Dengue and Minimum Temperature, Maximum Temperature, and Rainfall[24]
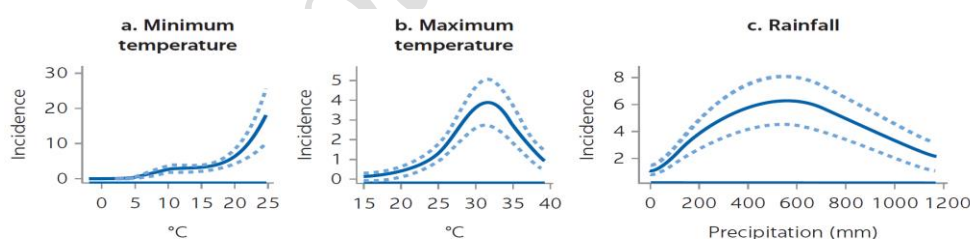
Note: Data are from laboratory-confirmed dengue cases in Mexico from 1985 to 2007. Solid lines indicate the average expected number of dengue cases per 100,000 people per month; dashed lines indicate the estimated 95% confidence intervals.

5. Findings of Aedes Survey-2023 in DNCC & DSCC Areas

Entomology unit of NME&ATDs Control Programme of Disease Control division under DGHS and Department of Zoology, Jahangirnagar University jointly carried out an entomological survey in 2017, 2018, 2019, 2020, 2021 and 2022 in Pre-monsoon, Monsoon and Post-monsoon season and pre-monsoon & Monsoon season during 2023 in DNCC and DSCC areas. The density of vector *Aedes* mosquito in most of the areas were low to medium and some areas were comparatively high based on season. Month of March to May is the pre-monsoon period in Bangladesh when the number of

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[24] *Source:* Colón-González, Lake, and Hunter 2013.

breeding sources and cases are comparatively low. The mosquito density and the number of cases mainly depend on the early rainfall with other meteorological factors (Temperature, Humidity etc.).

4.1 Major findings of Monsoon Aedes Survey- 2023 in DNCC & DSCC Areas

Total 3,150 households were visited & checked, among the visited households almost 21% (657 households) were positive in 98 wards (40 wards in DNCC & 58 wards in DSCC) in both city corporation areas.

Table 3: Percentage of Major & Potential Breeding Sources identified during Monsoon Survey in 2021, 2022 & 2023

Breeding sources	2021	2022	2023
Plastic Drum	8.66	10.74	07.07
Flooded floor	11.92	12.24	20.14
Plastic Bucket	13.03	12.51	10.13
Water Tank	3.51	2.82	3.47
Hole of Water Meter	1.33	1.68	2.71
Flower Tub & Tray	17.39	11.92	8.63
Hole of Left	0.47	1.75	0.59
Plastic mug/pot/Bodna	3.58	3.32	7.16
Discarded Food	4.12	5.78	2.8
Used Discarded tire	3.31	2.14	4.62

Figure 14: Distribution of Dengue Vector Larval Density in DCC (South and North) During Monsoon Season[25]

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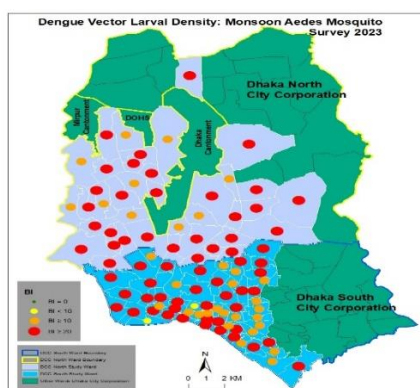
[25] Pre-monsoon Aedes Mosquito Survey 2023

Figure 14 shows that in *DNCC* the BI ≥ 20 = 27 Wards, BI ≥ 10 = 09 Wards, BI < 10 = 03 Wards, BI=0 in 01 Wards, in *DSCC* BI ≥ 20 = 28 Wards, BI ≥ 10 = 17 Wards, BI < 10 = 12 Wards, BI= 0 in 01 Wards. Among the positive households 17.81% were under construction house, 44.44% multistoried house, 24.51% independent house, 9.13 % slum/semi-pucca and 9.13 % were vacant plots.

Table 4: Distribution of Dengue Vector Larval positive House (PH) and Positive Wet Container (PWC) in DCC (South and North) During Monsoon Season

House Type	House Checked	Positive House	No. of Wet Container	No. of +ve Wet Container	% PH	% of PWC
Under Construction	377	117	605	139	17.81	16.45
Independent dwellings	683	161	802	231	24.51	27.34
Multistoried	1555	292	1394	361	44.44	42.72
Semi-pacca/Slum	375	60	365	77	9.13	9.11
Vacant Plot	160	60	230	37	9.13	4.38

PH = Positive House   PWC = Positive Wet Container

The major potential breeding sources are flooded floor (basement) – 14.54%, Plastic bucket 9.28%, Plastic drum 8.73%, Flower tub & Tray 8.03, Plastic Mug/pot/Bodna 7.89%, used discarded tires 7.76%, Clay pot 7.48%, Water Tank 3.46% and Hole of Water meters 2.63%.

Table 5: Percentage of Top 5 (+Ve) Wet Container According to House Type in Monsoon Survey-2023

Type of B. Source	Multistoried	Independent	Construction	Vacant plot	Semi-pucca
Flooded floor	28.25	7.36	48.20	5.41	9.09
Plastic drum	4.43	5.63	12.95	2.70	15.58
Plastic bucket	13.85	16.45	4.32	2.70	16.88
Used Discarded Tires	4.43	9.96	1.44	29.73	2.60
Flower tub & tray	4.99	7.79	0.72	2.70	3.90

In monsoon Aedes survey in DNCC & DSCC, the major potential positive breeding sources were flooded floor (basement or otherwise)- 23.08%, Plastic bucket-12.78 %, Plastic drum (Sealable)-7.10 %, Used Discarded Tires 6.39 %, Plastic Mug/pot/Bodna - 5.68 % , Flower tub & tray 4.58 %, Water tank(Cement) 3.79 %, Clay pot 3.47% respectively.

6. Integrated Vector Management

Integrated vector management (IVM) is "a rational decision-making process for the optimal use of resources for vector control". Its goal is to make a significant contribution to the prevention and control of vector-borne diseases. The key elements of IVM are (a) integrated approach, (b) evidence-based decision-making based on local vector ecology, epidemiology and resources, guided by operational research and subject to routine monitoring and evaluation, (c) collaboration within the health sector and with other sectors, (d) advocacy, social mobilization and legislation and (e) capacity-building.

Figure 15: Integrated Vector Control Management

Both *Aedes aegypti* and *Aedes albopictus* species have wide distribution in both urban and rural localities, infesting all the habitats in the domestic and peri-domestic settings. These vector species exploit all the human made habitats. Natural habitats such as tree holes and bamboos stumps are found only in the forest fringe areas. More number of breeding sources are found during rainy months, supporting profuse breeding of the vectors. Habitats that are "essential" include water storage containers and tanks which are used for domestic purposes. Discarded "non-essential" habitats are common around the houses. Water storage containers supports year-long breeding of the vectors while the discarded containers are the key (in terms of number and positivity) vector breeding sources during monsoon.

The primary method of controlling Aedes vectors is to eliminate the breeding sources, besides knocking down the infected mosquito vectors during the outbreak. Larval control can be done through environmental management, biological control agents and larvicide.

6.1 Environmental Management
- ➢ Larval Source management involves removing, destroying, covering or emptying aquatic habitat: Habitat elimination by the Household, Community and by the Government.
- ➢ House screening and breeding source reduction with special focus on construction sites and basement of the multistoried building.
- ➢ Solid waste management

6.2 Biological Control
Biological control uses natural enemies to mosquitoes to help manage mosquito populations. There are several types of biological control like the direct introduction of parasites, pathogens and predators to target mosquitoes.
- ➢ **Biolarvicide:** Biolarvicides, based on mosquitocidal toxins of certain strains of *Bacillus sphaericus, Bacillus thuringiensis var israelensis* H-14 (Bti) and Spinosad are highly effective against mosquito larvae at very low doses and safe to other non-target organisms.
- ➢ **Copepods to Control Aedes Larvae**: Copepods, mainly *Mesocyclops* and *Macrocyclops* species, are crustaceans that have been used for biological control for *Aedes* species mosquitoes by mainly feeding on first instar larvae.
- ➢ **Larvivorous fish:** One of the most successful and widely used biological control agent against mosquito larvae is the top water minnow or mosquito fish *Gambusia affinis*. Fish other than *Gambusia* which has received the most attention as a mosquito control agent is *Poecilia reticulata*, the common guppy.

- **Wolbachia infected mosquitoes:** Male mosquitoes with *Wolbachia* are released regularly into an area by mosquito control professionals. Male mosquitoes with *Wolbachia* mate with wild female mosquitoes. Because the eggs don't hatch, the number of *Ae. aegypti* mosquitoes decreases.
- **SIT:** Classical Sterile Insect Technique (SIT) uses radiation to sterilize insect pests. This technique has been used since the 1950s to control insect pests, including *fruit flies* and the *screwworm fly*. This non-patented SIT pest control method uses radiation to sterilize male mosquitoes.

6.3 Chemical Control

Insecticides reduce the spread of mosquito-borne disease. Over the past century, mosquito control has mostly relied on neurotoxic chemicals-such as pyrethroids, neonicotinoids, chlorinated hydrocarbons, carbamates and organophosphates-that target adults. However, their persistent use has selected for insecticide resistance.

6.3.1 Larvicide
- Chemical (larval) control: Temephos or pyrethroids, Oil and fatty acid (FFSA)
- IGR: Pyreproxifen, Novaluron, Methoprene, Diflubenzuron etc.

6.3.2 Adulticide
- Fogging: Thermal or ULV with effective insecticides
- IRS or ORS for Aedes: Targeted IRS or ORS

6.4 Community Engagement

7. Burden of Climate Change on Human Health and Associated Economic Losses

The Bangladesh evidence paper presented in the ongoing 2023 UN Climate Change Conference (COP 28-December 2023) by World Bank group[26] provided detail effect of climate change in Dengue outbreak in Bangladesh and its future implications. The findings informed through two studies that leverage primary data for analysis:
- Climate Afflictions Survey (2019/20); Two-round panel survey comprising of 3,610 households, capturing the peak of the summer and winter seasons
- Air Pollution Survey (2022): Representative survey carried out in the most (Dhaka City Corporation and outskirts) and least polluted (rural Sylhet) in the country

Exposure to climatic variables (temperature, humidity, and rainfall) are calculated as an average of two months preceding the survey. The findings provided evidence that climate change is impacting on infectious disease prevalence in Bangladesh:
- Malaria is on the decline
- Diarrhea prevalence is also declining
- However, Dengue is increasing

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[26] Iffat Mahmud and Wameq Reza Chowdhury; The World Bank, Bangladesh; Presentation at COP28
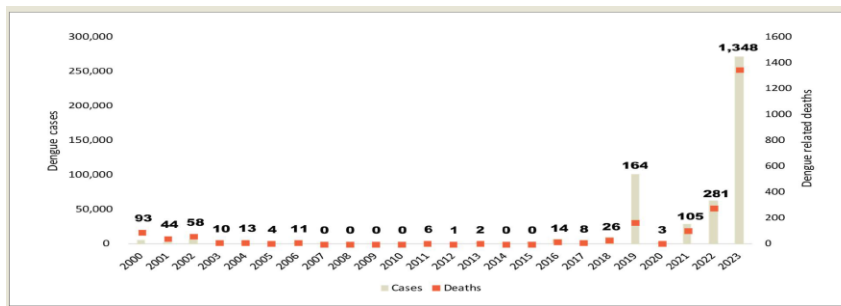
Urban areas are bearing a greater burden (Fig-17). Additionally, Dengue "season" is shifting. (Fig-18 & 19).

Figure 17: Dengue Cases by Geographic Division[28]

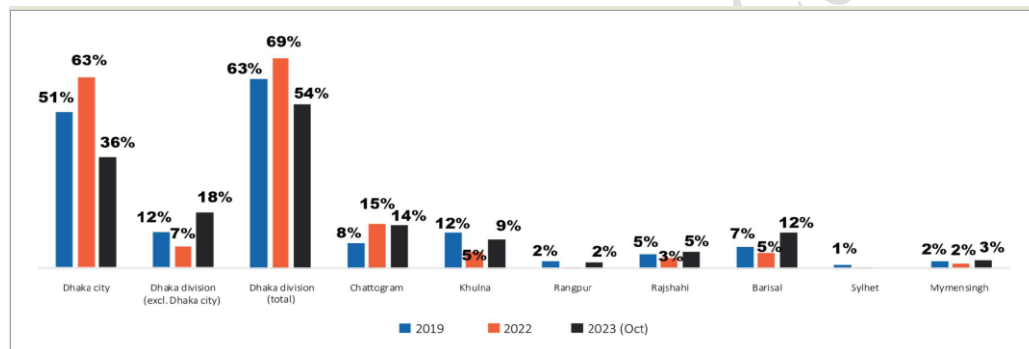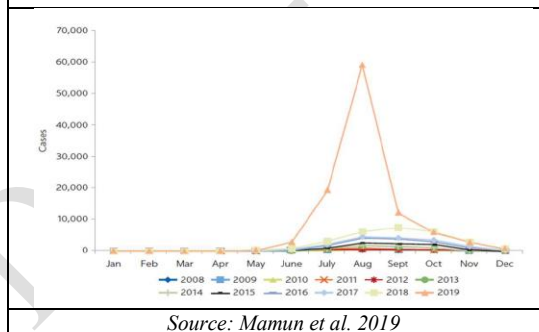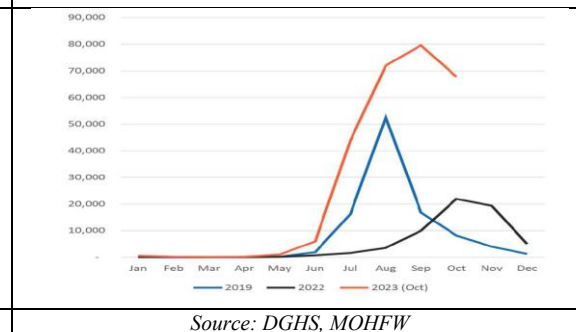| *Figure 18: Distribution of Dengue Fever Cases by Month in Bangladesh, 2008-2019*	*Figure 19: Dengue Cases Monthly Pattern, 2019-2023*
Source: Mamun et al. 2019	*Source: DGHS, MOHFW*

Climatic conditions influence the mosquito lifecycle:

> ➢ *Temperature:* Mosquitoes are sensitive to temperature:

- Minimum temperature has most impact on dengue fever. Minimum temperatures of 18°C or more is conducive.
- Maximum temperature of 25°C–35°C is ideal for dengue fever, with a peak at 32°C. Beyond 35°C, mosquitoes start to die.

➢ *Humidity:* Humidity of 60–80% is suitable for mosquitoes.

➢ *Rainfall:* Dengue cases increase with rainfall in the range of 200–800 mm; peak at 550–650mm. Increased dengue fever risk is at the onset of rainfall, lasting for at least three months.

Significantly all three weather variables (temperature, humidity and rainfall) must be in the suitable range for the mosquitoes to breed and survive. Figure 16 shows that over the years the maximum temperature is increasing in Dhaka and is within 25°C – 35°C.

Figure 20: Variation of Temperature Over the Years
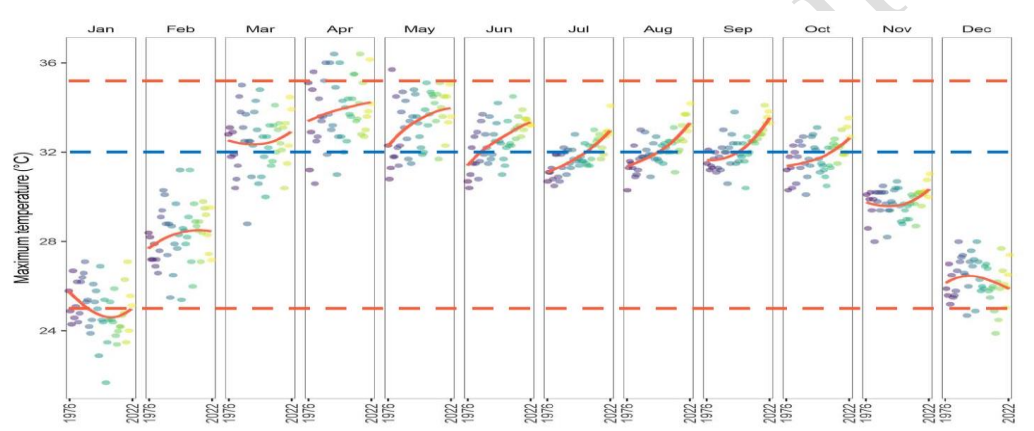
Rainfall is also playing a key role in dengue outbreak (Fig-17). Increased risk of dengue is at the onset of rainfall, lasting for at least 3 months. Rainfall in Sept and Oct 2022 more than 200mm – triggered dengue outbreak in Jan 2023 in Dhaka. Low rainfall between Nov 2022 and Jan 2023 resulted in low dengue cases between Feb and Apr 2023 in Dhaka. From April 2023, with rainfall increasing, dengue cases escalated.

Figure 21: Dhaka: Monthly Rainfall and Dengue Cases
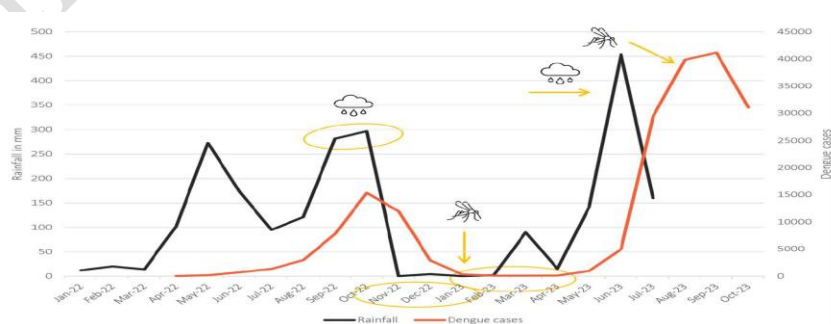
WHO and the United Nations Framework Convention on Climate Change (2015) project mean annual temperature to rise between 1.4°C and 4.8°C over the period 1990–2100 in Bangladesh. Temperature

is predicted to rise by 2°C in the next 25 years (Fig – 22). The SSP3:RCP7 scenario assumes a continuation of rising greenhouse gas emissions, doubling of carbon dioxide concentrations, and significant utilization of fossil fuels by countries, resulting in a global temperature increase of 4°C by 2110 (IPCC, 2023).

Figure 22: Projected Average Mean Surface Air Temperature, 2024-2059[29]

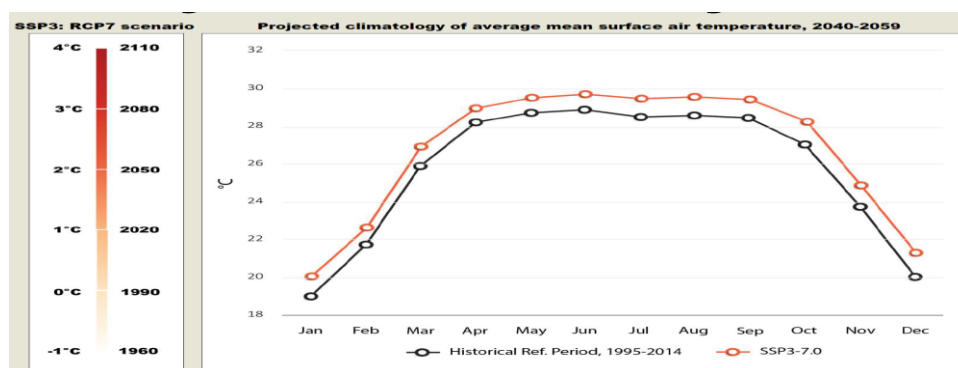Dengue cases is likely to increase. Dengue cases are projected to more than double by 2050 (Fig – 19). Case load is likely to be 10xhigher during endemic years, such as in 2019 and 2023. Fifty seven percent of these projected cases would be caused by climate change.

Figure 23: Projected Case Load
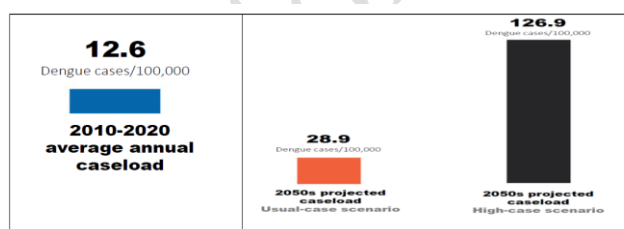
Economic analysis was conducted by the team which found out that dengue treatment would cost the economy and its attribution to climate change.
  ➢ Low case scenario - US$ 30m
  ➢ High case scenario - US$ 131m

Table 6: Projected Impact on Economy on Dengue Treatment Cost

	Base (2010-2020)	2050 (low case)	2050 (high case)
Case load per 100,000 people	12.6	28.9	126.9
Dengue cases (annual)	21,700	58,928	258,682
Dengue treatment cost (US$ million)	$5.0m	$29.9m	$131.3m
Dengue treatment cost (% of GDP)	0.00%	0.01%	0.03%

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[29] Source: https://climateknowledgeportal.worldbank.org/country/bangladesh/climate-data-projections

The analysis concluded that overall climatic conditions in Bangladesh are evolving that will result in larger outbreaks of climate sensitive diseases like dengue. Climate induced dengue cases will increase to 59,000 cases (in a normal year) or 323,000 cases in endemic years (like 2023).

8. Rationale for Developing the Strategy

8.1. Situational Analysis

Lack of coordination and misunderstanding among community people, leaders and government agencies challenges efforts to control dengue transmission and prevention. There is an urgent need to have common vision and approach in policy-making and execution of works, stressing on the understanding of the recognized relationship between health sector and another sector to take action to achieve health outcome to be more effective, efficient or sustainable. There is a need to develop coordinated actions for sustainable dengue vector management within and outside of the health sector. To increase visibility and sustainability, there is a need to provide greater opportunities to decision-making on vector control. There is also need for sharing of resources, knowledge and expertise to reduce duplication of effort, better coordination and having a unified voice. There is a need to put in place innovation to address complex issues and building of positive relationships of cooperation between different sectors of society such as the public sector, civil society and the private sector for the long-term.

In the absence of an effective mechanism to share knowledge and a learning network, learning opportunity is nearly absent. Evidence-based guidelines are one of the most useful tools for improving public health and clinical practice. Their purpose is to formulate interventions based on strong evidence of efficacy, avoid unnecessary risks, use resources efficiently, reduce clinical variability and, in essence, improve health and ensure quality care, which is the purpose of health systems and services. To ensure effective case management of dengue cases at all tiers of service delivery systems especially in remote, hard to reach areas there is a need to develop the capacity of health care professionals and allied health work force. There is also a need for creating learning opportunities for sharing knowledge and a learning network with the generation of evidence on effective care.

Preventing and controlling the dengue vector is crucial in reducing the transmission of the virus and preventing dengue outbreaks. In order to stop the virus from spreading and stop dengue outbreaks, it is essential to stop and manage the dengue vector. The need is to minimize mosquito populations and reduce mosquito breeding grounds. There is a strong need to institutionalize a strong entomological surveillance system managed by professional entomologist, and supported by integrated vector management strategy incorporating environmental and biological control.

A well-functioning health system requires a well-functioning health information system (HIS). For evidence based effective planning, well established improved governance and decision-making is pivotal through implementing an efficient and effective integrated surveillance system. There is need i) to monitor trends in the distribution and spread of dengue over time and geographically; ii) to facilitate planning and resource allocation based on lessons learnt from program evaluation; iii) to measure the burden of the disease and characterization of the pathogens to identify any change of the disease pattern, for the assessment of its social and economic impacts on affected communities; iv) to

monitor environmental and meteorological factors for efficient early warning and effective intervention; and v) to evaluate the effectiveness of dengue prevention and control program.

Community engagement is a must to tackle the current and increased scale of dengue outbreak and address the changes in the seasonality of the disease due to climate change. Dengue has posed a significant public health threat already, and a concerted effort involving relevant sectors is crucial to ensure a unified and well-coordinated approach for engaging communities and communicating the risks. By enhancing collaboration between health, local government entities, education, information and other relevant ministries, Bangladesh can foster a more integrated response to dengue prevention at the household level. While this multi-sectoral and coordinated approach will be emphasized on the household level actions, it will further facilitate the dissemination of accurate information, promote community awareness, and encourage proactive measures for dengue prevention, control, care, and management. By adopting a holistic strategy that involves all stakeholders, Bangladesh can create a more resilient and responsive system, ultimately reducing the incidence of dengue and improving the overall health outcomes for the people. Thus, therefore, there is need to strengthen multi-sectoral and inter-ministerial coordination in risk communication and community engagement (RCCE) which is imperative for the effective implementation of a comprehensive national strategy for dengue prevention, control, care, and management in Bangladesh. To achieve robust and agile system and mechanism for coordinated risk communication and community engagement (RCCE) at all levels there is a need to strengthen multi-sectoral and inter-ministerial coordination and cooperation to utilize community engagement following its global standards to ensure household level actions.

Research is an important element for dengue prevention and control strategies to anticipate and prepare for and its integration with other tools. Introduction of quality research on deployment of safe, immunogenic, effective, long-lasting vaccine is a necessity. Investment must be assured on quality research to develop suitable vaccines, effective clinical case management tools, establishment of early warning, outbreak response and surveillance systems, use of sensitive and specific diagnostic tools, and vector control tools.

There is a need for evidence-based careful decision-making on the introduction of vaccines and their use with reliable data on vaccine product characteristics (e.g. safe, immunogenic, effective, long-lasting protection etc.) but also information on effective vaccination strategies, their likely impact on disease burden and cost effectiveness. This is linked for investing in quality research, enhance diagnostic precision, enabling early and accurate identification of dengue cases for more effective public health response.

Dengue prevention and control strategies must include vaccines as an important element to prevent dengue fever from all serotypes and in preventing hospitalization. There is a need for the integration of vaccines with other tools for dengue prevention and control, and investments in safety monitoring of vaccines.

8.2. Need for Development of National Strategy

Based on all the cumulative analysis, it is imperative for the Ministry of Health and Family Welfare to develop a comprehensive, continued, inclusive, efficient and successful **National Strategy for Prevention and Control of Dengue** taking into consideration all factors that is essential for dengue control and prevention.

Building on the strengths and current initiatives taken up by DGHS, there is an opportunity to develop a robust *Bangladesh National Dengue Prevention and Control Strategy (2024–2030)* which will provide and takes on a holistic multi-pronged approach that transcends traditional boundaries considering the intricate web of factors that contribute to dengue transmission.

9. Time Line of the Strategy

Aligning with the MOHFW's 5th Health, Population and Nutrition Sector Program (2024-2030) the time frame of this strategy has been taken for next 7 years beginning on 2024 and ending on 2030.

10. Strategy for the Prevention and Control of Dengue

10.1 Vision Statement

Ensuring a Dengue Diseases free Bangladesh through a coordinated holistic approach.

10.2 Goal

To reduce mortality and morbidity with Dengue in Bangladesh
- i) *To achieve case incidence below 100/100,000 population by the year 2030*
- ii) *To reduce and maintain case fatality rate below 0.1 % by the year 2030*

10.3 Strategic Objectives

To address the key opportunities that emerged during the analysis six strategic objectives have been proposed:

Figure 24: Mission, Goal and Strategic Objectives for Prevention and Control of Dengue
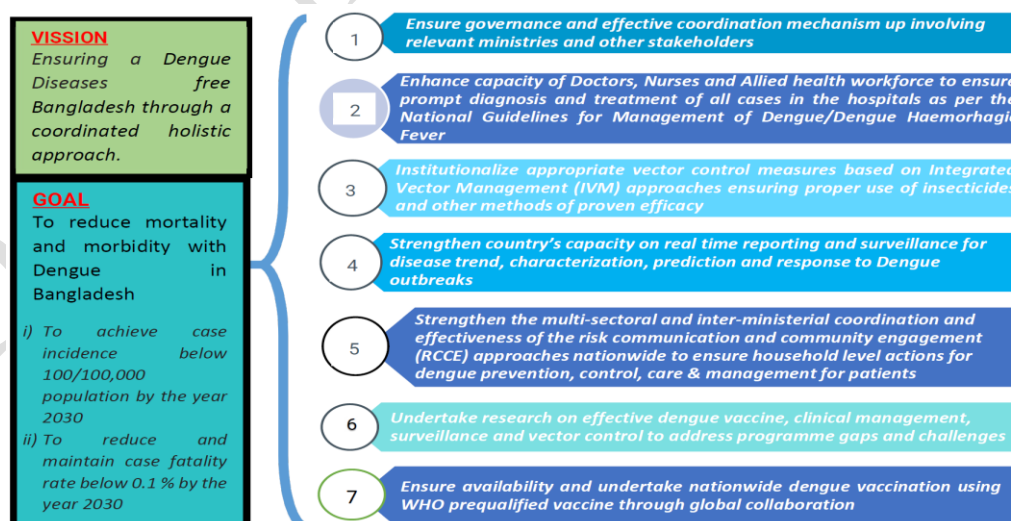
9.1 Strategic Outputs and Strategic Actions

The strategic outputs and strategic actions as outlined below provide a glimpse of the critical activities of the national strategy that need to be implemented. The priority of the strategy is to integrate all actions under a coordinated and functioning governance structure at the Ministry level, Directorate General levels, Directorate levels, Divisional, district, and upazila levels for a strong foundation for implementation of the strategy and to develop the dengue prevention, control and case management systems including a robust learning and surveillance system at all levels for continuous improvement.

The following tables detail the suggested activities to achieve each of the ambitions outlined in each of the strategic objective's areas.

<table>
<tr><td colspan="2" style="background:#29ABE2">Strategic Objective 1: Ensure governance and effective coordination mechanism involving relevant ministries and other stakeholders</td></tr>
<tr><td colspan="2" style="background:#6AA84F">Synopsis: Addressing the intricate relationships between the disease, its vectors (Aedes mosquitoes), and their ecological habitats and recognizing the interconnectedness of human, and environmental health, through concerted, coordinated and timely prevention efforts orchestrated among all government agencies, local government institutes and social development agencies from highest level of the government with support from development partners, NGOs, and research institutions.</td></tr>
<tr><td>Strategic Outputs and Corresponding Strategic Actions</td><td>

1) *Output 1.1: Central coordination cell* – Strengthen supervision and monitoring activity through formation of Central coordination committee (CCC) at Honorable Prime Minister office headed by Cabinet Secretary/Principle Secretary of Prime Minister.
   - ❑ Strategic Action 1: *Functioning of the CCC* – Develop ToRs and organize monthly meetings of the CCC to steer coordinated effort for whole of government actions.

- *Output 1.2: High level committee* – Form "National Task Force" to ensure concerted and whole of government actions with Minister for Health and Family Welfare as chair and Minister(s) for LGRD&C, Finance, Education, Public Administration; Mayors of CCs, Cabinet Secretary, IG of Police and members of other stakeholders.
   - ❑ Strategic Action 1: *Functioning of the NTF* – Develop ToRs and organize monthly meetings of the NTF to steer coordinated effort for vector control, case management, resource mobilization and to recommend dengue vaccine which is safe, immunogenic, efficacious, durable with minimal adverse events and cost effective.

- *Output 1.3: Technical committee* – Form a "Technical Committee" to prepare, plan and manage outbreak response with DG-HS as Chair and Director CDC as member secretary and Director (s), e-Health, Hospital and Clinics, LD-MNCAH (EPI), LD-UzHC, LD-CBHC, LD-L&HEP, Director IEDCR, Director IPH, Director, NILMRC & Director, NIPSOM of DGHS, Directors of specialized and tertiary hospitals, BSSMU, academia's and researchers as members

</td></tr>
</table>

	❑ Strategic Action 1: *Functioning of the TC* – Develop ToRs and organize monthly meetings to review and initiate actions based on strategic actions of National Dengue Prevention and Control Strategy ❑ Strategic Action 2: *Partner engagement* - Define roles & responsibilities and coordinate support of all international partners and donors. ❑ Strategic Action 3: *Media management* – Member Secretary (MS) to act as spokesperson for all media contact and plan for expertise enhancement of journalists.
Responsibility	Additional Secretary (PH), HSD-MOHFW; Director CDC, DGHS; LD-MNCAH (EPI), DGHS; Director IEDCR; Director IPH; and Director, NIPSOM.

Timeline	Start Date: Fiscal Year January 2024	End Date: Fiscal Year December 2030	Total Duration: 7 years

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Strategic Objective 2: Enhance capacity of Doctors, Nurses and Allied health workforce to ensure prompt diagnosis and treatment of all cases at all health care facilities in line with the National Guidelines for Management of Dengue/ Dengue Haemorhagic Fever

Synopsis: A system of applied training, updating knowledge and establishing a learning culture of cooperation and alignment and also equipping them with new technologies that ensures the professional (quality clinical care, public health actions, and preventive practices) effectiveness of all, where all health leaders, professionals, practitioners, and staff are capable of and feel supported and empowered to provide prompt diagnosis and management, care and referral, if needed.

Strategic Outputs and Corresponding Strategic Actions	• *Output 2.1:* Clinical quality standards and protocols for care delivery, fluid management, and necessary forms are updated/developed, introduced, institutionalized, monitored, and refined regularly, where necessary and disseminated broadly for improved patient management with strict adherence to the clinical case management guideline ❑ Strategic Action 1: *Standards, tools and protocols for care* - Update/develop patient management tools (national case management guidelines and algorithms; pocket guideline for case and fluid management for each clinical scenario; flowchart for decision making on fluid management etc.). ❑ Strategic Action 2: *Case management forms* – Introduce necessary standardized forms (short standardized national dengue patient admission form; monitoring form; & Case management forms for dengue patient guideline for health care professional (English & Bengali). ❑ Strategic Action 3: *Teaching materials* – Produce short videos on case management for doctors; standardized key messages for use in dengue clinical management training/refreshers training with special attention for vulnerable groups (children and pregnant women, immunocompromised patients, elderly etc.) ❑ Strategic Action 4: *Resource hub* - Impart TOT for the clinicians to develop a resource hub for dengue case management with National and international trainers (WHO, US-CDC).

- ❑ Strategic Action 5: *Capacity development of care providers* **-** Develop skills of care providers of DGHS (clinicians, nurses, allied health workforce upto UzHC), other ministries, private sector for provision of quality case management services and follow-up across all levels through hands on training, case-based discussion for the health professionals, webinars, clinical mentorship and supervised monitoring with mandatory inclusion of the followings:
  - o Diagnosis of suspected dengue
  - o Identification of warning signs
  - o Identification of plasma leakage
  - o Identification of dengue shock syndrome
  - o Comprehensive fluid management
  - o Intensive care management
- ❑ Strategic Action 6: *Capacity development of lab staff* **-** Develop skills of National Lab personnel in reference labs (WHO/ US-CDC standard).

- • *Output 2.2:* Mechanisms to facilitate learning, sharing knowledge, mentoring, and generating evidence on care through a learning network are developed, strengthened and made functional.
  - ❑ Strategic Action 1: *Continuing professional development* – Develop, strengthen and implement systems to support Continuing Professional development, sharing knowledge, and a learning network for medical and allied health professionals.
  - ❑ Strategic Action 2: *Capacity development* **–** Organize online i) knowledge-sharing workshop with national expert clinicians (Consultants, Associate Prof, Professor, etc.) and ii) online knowledge sharing among clinicians of SEARO, WHO, US CDC.
  - ❑ Strategic Action 3: *Telemedicine* **-** Develop and make widely available telemedicine system in case management.

- • *Output 2.3:* Data and practice for evidence-based actions on dengue related deaths are analyzed and synthesized.
  - ❑ Strategic Action 1: *Facility level accountability* **–** Form, strengthen and make operational dengue death review committees at all health care facilities treating dengue patients.
  - ❑ Strategic Action 2: **National** *level accountability* Form and make operational dengue expert review committee at National Level for review of deaths due to dengue.
  - ❑ Strategic Action 3: *Dengue death review at facility level* – Institutionalize death review at facility level (monthly) and at national level (quarterly and when necessary) through the formed committees.
  - ❑ Strategic Action 4: *Dengue death review at community level-* Undertake routine community deaths review through verbal autopsy and geographical mapping of death distribution.

- **Output 2.4:** Clinical care at all level of facilities for effective dengue case management is strengthened.
  - ❑ Strategic Action 1: *Dedicated ward/bed and skilled professionals* – Establish dedicated Ward/Bed for dengue cases supported by trained health care workers
  - ❑ Strategic Action 2: *Triage policy* – Develop and formalize Triage policy: focusing on critical phase of the illness for close monitoring of the patient during the critical phase to discourage referral.
  - ❑ Strategic Action 3: *Guidelines on referral* – Develop clear guidelines and flowcharts/decision trees to use on patient referral
  - ❑ Strategic Action 4: *Functional referral system* – Develop and institutionalize mechanism for functional referral system for both Rural and Urban settings to minimize overburdening of healthcare facilities.

- **Output 2.5:** Clinical Care capacity strengthened through ensuring uninterrupted supplies of necessary equipment's, drugs, and deployment of doctors, nurses and allied health work force (filling gaps or additional deployment).
  - ❑ Strategic Action 1: *Assessment*– Develop systems for forecasting of medicine, fluids and logistics at all health care facilities at Rural and Urban settings based on patient load
  - ❑ Strategic Action 2: *Strengthening services*– Strengthen primary and secondary health care facilities for management of dengue shock syndrome through ensuring uninterrupted supplies.
  - ❑ Strategic Action 3: *POCUS-* Ensure supply and use of point of care USG by medical doctors at all levels of health care facilities.

- **Output 2.6:** Diagnostic capacity strengthened and interlaboratory network established and made functional to enable diagnostic laboratories in detecting the virus
  - ❑ Strategic Action 1: *Capacity assessment*– Conduct assessment of public and private diagnostic facilities to determine capacity for dengue-related tests (mainly CBC, Serology, combo testing, real time haematocrit assay, portable USG etc.) and need for additional equipment, training and human resource and routine Quality Control.
  - ❑ Strategic Action 2: *Strengthening lab services*– Based on the assessment provide necessary lab supply to laboratories at all levels including equipment and strengthen regional laboratories and laboratories of tertiary hospitals for validation of results and expanding network on dengue testing (PCR). Establish provision of bed side haematocrit measurement.
  - ❑ Strategic Action 3: *Dedicated laboratory service-* Establish dedicated laboratory service at all divisional HQs round the clock for POC, HCT value and others.

	❑ Strategic Action 4: ***Strengthening blood transfusion services*** – Revisit and update strategy for blood transfusion to strengthen blood bank system at national, regional and Upazila level. • ***Output 2.7:*** Intensive BCC measures at all tiers of health care facilities (Private, Public and NGO) are made functional. ❑ Strategic Action 1: ***BCC materials -*** Design and produce BCC materials of using bed nets and other relevant IPC materials to prevent transmission of dengue. ❑ Strategic Action 2: ***IPC actions -*** Institutionalize and monitor IPC measures routinely at all health care facilities. ❑ Strategic Action 3: ***Access to information*** – Institutionalize a system for access to information by patients and carers (BCC materials, pamphlets, when to rush to hospital and others) and to address infodemics in collaboration with RCCE committee. • ***Output 2.8:*** Issues of human resource addressed to ensure equitable deployment ensuring skilled workforce availability at all tiers of service delivery points across urban and rural areas. ❑ Strategic Action 1: ***Distribution plan of health professionals*** - Implement the existing Bangladesh Health Workforce Strategy 2015 into action for a well-balanced distribution of skilled health professionals to drive equitable access to high-quality dengue management and care. • ***Output 2.9:*** Medical Entomology subject is introduced in curriculum for pre-service medical colleges and institutions. ❑ Strategic Action 1: ***Pre-service curriculum*** – Develop curriculum for students to gain specialized skills in the molecular biology of pathogens and vectors combining theoretical and practical in biology, control of disease vectors and the human pathogens it transmits including offering a thorough grounding in the systematics of medically important arthropods, processes regulating vector populations, and the biology of vector–parasite and vector–vertebrate interactions.
Responsibility	Additional Secretary (s) (Admin, Hospital, Nursing & Midwifery, WHO & PH), HSD of MOHFW; Director (s) Hospital and Clinics, Admin, IEDCR, IPH & NIPSOM; Director Training, DGME and BRCS, Director Generals of DGFP and DGNM, Directors of specialized and tertiary hospitals and health and FP managers of divisions, districts and Upazilas.

Timeline	Start Date: Fiscal Year January 2024	End Date: Fiscal Year December 2030	Total Duration: 1 year

	Strategic Objective 3: Institutionalize appropriate vector control measures based on Integrated Vector Management (IVM) approaches ensuring proper use of insecticides and other methods of proven efficacy
	Synopsis: Appropriate and efficient vector control measures responded through institutionalized entomological surveillance for confining transmission and controlling dengue outbreaks through personal and environmental safety precautions.

Strategic Outputs and Corresponding Strategic Actions	• *Output 3.1:* Capacity of the National Programme strengthened to implement effective integrated vector management
	❑ Strategic Action 1: *Vector management* – Develop/update and adopt a comprehensive National Integrated Vector Management (IVM) strategy in align with WHO framework.
	❑ Strategic Action 2: *Human resources* - Create posts (in the interim engage through contractual services) and recruit skilled entomologists and entomological technicians to monitor vector populations and provide technical support for implementing the IVM interventions at the following locations:
	   ✓ All Divisional Directors Office (Health)–1 Entomologists and 2 Entomological technicians
	   ✓ All Civil Surgeons Office- 1 Entomologists and 2 Entomological technicians
	   ✓ All UzHC–2 Entomological technicians
	❑ Strategic Action 3: *Capacity development* – Develop skills through specialized training programs for personnel involved in vector control and entomology at all levels of health care, from National level to Community Clinic level and equipping them with necessary entomological supplies that contains all the necessary tools to perform a complete package including insectarium, incubator along with all rearing instruments and kit of mosquito's dissection.
	❑ Strategic Action 4: *Policy advocacy* - Advocate for supportive policies at the national level to facilitate IVM implementation addressing any regulatory barriers hindering effective vector control.
	❑ Strategic Action 5: **Cross-sectorial collaboration:** Enforce collaboration between health, environmental, local government agencies, research institute, and universities to ensure a coordinated effort in dengue prevention.
	❑ Strategic Action 6: *Entomological laboratory* - Establish *"National Vector control Laboratory"* at DGHS equipped with necessary tools, equipment, and resources for entomological research and analysis to serve as a hub for conducting mosquito-based studies, testing new methods, and analyzing samples to generate data-driven insights to support developing evidence-based interventions.
	❑ Strategic Action 7: *New technologies* - Introduce and enhance advanced vector control technologies (remote sensing, geographic information systems (GIS), molecular techniques etc.) linked with capacity

development on how to effectively utilize these technologies in their work.

❑ Strategic Action 8; *Entomological equipment -* Supply updated entomological equipment that contains all the necessary tools to perform a complete package including insectarium, incubator along with all rearing instruments and kit of mosquitoes

❑ Strategic Action 9: *Surveillance system –* Establish a comprehensive entomological surveillance database to collect and preserve relevant entomological surveillance data and take necessary actions based on the surveillance data.

❑ Strategic Action 10: *Advocacy –* Advocate for government circular on nationwide 4S campaign ("Search and Destroy" mosquito breeding places, "Secure Self Protection" from mosquito bite, "Seek Early Consultation" when signs and symptoms of dengue occur, and "Say Yes to Fogging" as a last resort when there is an impending outbreak).

❑ Strategic Action 11: *Monitoring and evaluation -* Perform multiple series of regular laboratory (fecundity, fertility, wing size, oviposition preferences, residual effects, and transmission of pathogens) and small-scale field trials to assess the efficacy of insecticides (adulticides and larvicides) exposed to aedes mosquitoes and the mosquitos' behaviors against insecticides.

❑ Strategic Action 12: *Operational research:* Conduct, publish and disseminate entomological operational research on different aspect of vector control (insecticide susceptibility, vector behavior, vectorial capacity etc.) should be conducted.

- *Output 3.2:* Routine vector surveillance system and mapping established and made functional to understand the distribution, abundance, behavior, and infection rates of vector mosquitoes.

❑ Strategic Action 1: *Expanding vector-survey activities -* Strengthen vector-survey efforts by introducing new methods designed for both immature and adult stages, such as advanced data analysis, molecular techniques for species identification, community involvement, mapping of larval habitats, pupal monitoring, adult trapping and also pathogen detection to have a wide range of understanding, early detection, and control of vector populations.

❑ Strategic Action 2: *Equipment for vector surveys of larvae, pupa and adult stages -* Ensure use of updated tools for larval habitat identification, pupal monitoring, and light traps and molecular tools for adult vector surveillance to enhance data quality and species identification.

❑ Strategic Action 3: *Analysis of vector data -* Review previous years vector data to identify patterns, variation and comparative analysis with 2023 baseline data to enable the identification of changes in vector population dynamics, species prevalence and the efficacy of the past control measures.

- ❑ Strategic Action 4: ***Future data analysis -*** Continue comparative analysis of entomological data every year from 2024 to 2030 with 2023 baseline, to make informed projections; to adapt effective control measures; and to ensure a dynamic and responsive approach to vector-borne disease prevention.
- ❑ Strategic Action 5: ***Sentinel vector surveillance in DCC-*** Establish sentinel vector surveillance sites in Dhaka City for regular surveillance to systematically monitor vector populations and enhancing early detection of potential disease vectors.
- ❑ Strategic Action 6: ***Sentinel vector surveillance in other cities:*** Institutionalize round the year vector surveillance using appropriate techniques and equipment in eight divisional cites to consistently monitor vector populations, enabling the timely identification of potential threats and facilitating proactive measures for effective vector control.
- ❑ Strategic Action 7: ***Sentinel vector surveillance in other cities -*** Institutionalize round the year vector surveillance using appropriate techniques and tools in metropolitan cities of 56 district using appropriate tools to ensure a sustained and proactive approach to identify and address vector-borne disease risks.
- ❑ Strategic Action 8: ***Need based vector survey in rural areas of Bangladesh:*** Conduct targeted, need-based vector surveys in rural areas of Bangladesh to address unique vector-related challenges in rural settings, providing essential data for informed public health interventions and emphasizing community engagement for effective vector control measures in these areas.
- ❑ Strategic Action 9: ***Modern scientific methods for detection of viruses*** – Develop and *e*stablish modern and reliable mechanism for detection of viruses including their serotypes identification in mosquitoes encompassing both urban and rural areas for identifying virus serotypes/genotypes and improving early detection capabilities.
- ❑ Strategic Action 10: ***Quality insecticides -*** Ensure high quality insecticides are used for vector control (larvicide/ adulticide) focusing on the importance of efficacy, minimizing potential risks to human health, and environmental impact.

- • *Output 3.3:* For vector control efficiency, effective insecticides/Insect Growth Regulators (IGR) with proven efficacy against the targeted vectors are prioritized.
  - ❑ Strategic Action 1: ***Insecticides resistance -*** Determine the insecticides resistance and its intensification/susceptibility level undertaking regular surveillance through bioassays and data analysis of field studies.
  - ❑ Strategic Action 2: ***RT-PCR -*** Institutionalize use of Reverse transcription polymerase chain reaction (RT-PCR) to have more accurate understanding of insecticide resistance patterns.

Responsibility	Additional Secretary Public Health, HSD, MOHFW; Additional Secretary Admin, HSD of MOHFW; Director (s) Hospital and Clinics, CDC, Admin, IPH, IEDCR, NIPSOM, LD-UzHC of DGHS, Divisional Directors of Health (all), Civil Surgeons (all), UzHC (all), Director Training, DGME, BRCS, Director Generals of DGFP and DGNM.		
Timeline	Start Date: Fiscal Year January 2024	End Date: Fiscal Year December 2030	Total Duration: 7 years

Strategic Objective 4: Strengthen country's capacity on real time reporting and surveillance for disease trend, characterization, prediction and response to Dengue outbreaks
Synopsis: Functioning, integrated, evidence-based dengue surveillance system useful for decision making for management, prevention, and control of dengue.

Strategic Outputs and Corresponding Strategic Actions	• ***Output 4.1:*** Nationwide epidemiological surveillance system institutionalized, activated and monitored in areas of i) routine and case-based surveillance, ii) Community based surveillance, iii) reporting system of dengue in MIS and iv) every death investigation (Medical cause of death and verbal autopsy) for effective outbreak preparedness, investigation and response. ❑ Strategic Action 1: ***Standards, tools and protocols for sentinel surveillance system-*** Update/develop necessary protocols/guidelines and tools on surveillance (disease and vector) and outbreak preparedness, investigation and response. ❑ Strategic Action 2: C***ommunity based surveillance system-outbreak investigation:*** *develop tool for community-based surveillance, develop protocol for investigation.* ❑ Strategic Action 3: ***Dengue information system -***Develop/update software, expand and strengthen the dengue information system at MIS (Dengue MIS) for effective recording and reporting. ❑ Strategic Action 4: ***Capacity development of MIS personnel-*** Develop skills of MIS personnel at national and facility and field level on dengue information system at MIS (Dengue MIS). ❑ Strategic Action 5: ***Outbreak investigation and response –*** Ensure activation of SOPs during outbreak ❑ Strategic Action 6: ***Capacity development -*** Develop skills of providers (health managers of DGHS & DGFP), other ministries, private sector on guidelines/protocols and tools for effective actions on disease surveillance; stratification and risk mapping; and outbreak preparedness, investigation and response with follow-up across all levels through training, webinars, mentorship and supervised monitoring.

	Output 4.2: Data are synthesized and analyzed for evidence-based actions to institutionalize monitoring and evaluation of dengue control ❑ Strategic Action 1: ***Collecting and integration of Data*** – Collect, store, integration, report and disseminate routine data in dengue MIS maintaining data quality assurance ❑ Strategic Action 2: ***Analysis and synthesis of data*** – Institutionalize supportive supervision through coordination mechanisms, reviews, evaluation, survey and operational studies ***Output 4.3:*** Program monitoring and coordination arrangement institutionalized at all tiers of health care delivery with engagement of Public, DPs, Private, INGOs and NGO partners. ❑ Strategic Action 1: ***Program reviews -*** Organize periodical review meetings covering all aspects of the program implementation at central, district and Upazila levels according to below schedule: ✓ Annual planning and review meeting at central level ✓ Quarterly coordination meeting at central level ✓ Monthly coordination meeting at district level ✓ Monthly coordination meeting at Upazila level
Responsibility	Director IPH, DGHS, Director (s) of e-Health MIS, CDC, e-Health, Hospital and Clinics, CDC, IEDCR, NILMRC, NIPSOM LD-UzHC, LD-CBHC of DGHS, LD-UzHC of DGHS, Divisional Directors of Health (all), Civil Surgeons (all), UzHC (all), Director (s) of MIS, MCRAH, FSD of DGFP, BRCS, Directors of specialized and tertiary hospitals and health and FP managers of divisions, districts and Upazilas.
Timeline	Start Date: Fiscal Year January 2024 End Date: Fiscal Year December 2030 Total Duration: 7 years

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Strategic Objective 5: Strengthen the multi-sectoral coordination and effectiveness of the risk communication and community engagement (RCCE) approaches nationwide to ensure household level actions for dengue prevention, control, care & management for patients

Synopsis: A robust and agile system and mechanism in place to communicate risk associated with the aedes transmitted disease such as dengue in coordinated manner to the communities at risk with an expectation that the communities will take necessary household level actions. Furthermore, ability of the government ministries, departments, non-government organizations, private sectors, community-based organizations to be increased to coordinate locally led community actions in collaboration with the social & grassroot level networks and effectively engage communities to sustain the household level actions for dengue prevention, control, care & management for patients in Bangladesh. The overarching ambition of this strategic objective is to translate effective community engagement into a meaningful and sustainable community actions for dengue prevention, control, care & management.

Strategic Outputs and Corresponding	• ***Output 5.1:*** The National Risk Communication and Community Engagement (RCCE) Committee is formed at National and Local levels to facilitate functional and effective multi-sectoral and inter-ministerial coordination and cooperation.

Strategic Actions	- Strategic Action 1: **RCCE coordination-** Finalize ToRs and standard operating procedure (SoP) for RCCE Committee with clear articulation of the multi-sectoral and inter-ministerial cooperation and coordination. - Strategic Action 2: **Local level RCCE coordination-** Produce technical guidance for local level RCCE cooperation and coordination with a provision of detailed multi-sectoral actions to be implemented regularly annually. - Strategic Action 3: **Mapping stakeholders-** Map to engage appropriate stakeholders into the platform for better coordination and build the capacity of the RCCE Committee members - Strategic Action 4: **Standardize communication-** Establish a mechanism to standardize and validate information, messages and materials by RCCEC to for rapid dissemination and actions to ensure credibility of sources and to avoid duplication in outreach for both rapid response and regular interventions i.e., risk communication and advice to the communities around prevention, control, care, treatment, disease surveillance, vector control, vaccine etc. - Strategic Action 5: **RCCE guidance, plan and actions -** Develop and implement sectoral RCCE guidance, plan and interventions *(In collaboration with respective sector)* for dengue prevention (i.e., RCCE strategy/plan for education, local government, construction industries – REHAB, Islamic Foundation, railway, police stations etc. to follow and implement) - Strategic Action 6: C**ommunity-based approaches -** Support the development of the community-based approaches for disease and vector surveillances and linking the community-based surveillances with the national level dashboard and feedback mechanism. - Strategic Action 7: **Advocacy plan-** Develop advocacy plan including identification of the champion to influence and help achieve functional and effective cooperation and coordination for engaging and communicating with communities. - Strategic Action 8: **Private sector engagement** – Engage private sector to utilize their network to mobilize communities for household level actions in coordinated manner. - Strategic Action 9: **RCCE impact monitoring –** Develop monitoring framework and mechanism to assess the impact of RCCE interventions nationwide and to take corrective measures based on the findings. - Strategic Action 10: **Dashboard for monitoring-** Establish/integrate a dashboard for monitoring the nationwide and locally led RCCE interventions including media monitoring. - Strategic Action 11: **Feedback mechanism-** Establish a national feedback mechanism to capture community voice, feedback, opinion at real-time to analysis the effectiveness of the RCCE intervention as well as to address misinformation and disinformation.

- *Output 5.2:* Evidence generated to identify the gaps, promote good practices, scaling up the appropriate practices and building the RCCE capacities at national and local level.
  - ❑ Strategic Action 1: *Good practices -* Conduct study to map appropriate good practices for communities to follow and implement, as well as to facilitate the effective community engagement.
  - ❑ Strategic Action 2: *Evidence generation* – Generate evidence for better community engagement considering different contexts, target groups, RCCE channels etc.
  - ❑ Strategic Action 3: *Annual work plan*– Incorporate the community engagement interventions and activities in the annual work plan of relevant ministries, departments.
  - ❑ Strategic Action 4: *Advocacy plan -*Develop and implement advocacy plan including identification of the champion to achieve expected change for strengthening the community engagement approaches in the system and sustain the good practices for promoting household level actions

- *Output 5.3:* Ministry of Information in collaboration with Ministry of Health and Family Welfare (MoHFW) is mobilized to organize media campaign for dengue prevention, control, home care, and household-level management.
  - ❑ Strategic Action 1: *Capacity development-* Develop capacity of journalist/media personal to improve their knowledge and skills for promoting household level actions and sustain the practices.
  - ❑ Strategic Action 2: *Rapid information dissemination-* Form partnership with Ministry of Information for disseminating information, advice for actions and guidance through public and private sector medias.
  - ❑ Strategic Action 3: *Community Radios:* Engage and utilize community radios to mobilize communities through their access and networks to promote household level actions.

- *Output 5.4:* Coordinated mechanism established for standardized and inclusive (considering gender, geographical, cultural, children etc.) information sharing and content development for increasing knowledge, household level cleanliness action and to sustain the practices.
  - ❑ Strategic Action 1: *Standardized Content -* Develop content, materials, messages, tools for lab and clinical management including home care, vector controls, societal and household level actions, vaccine etc. to ensure consistency, avoid duplication and ensure the impacts at the community-level through participation and engagement.
  - ❑ Strategic Action 2: *Content dissemination-* Craft, test, and disseminate content, materials, tools (including media content, materials, tools for use by all types of media) for local level community engagement.
  - ❑ Strategic Action 3: *Content dissemination for other sectors -* Contextualize, test, and disseminate/implement content, materials, tools *(contextualization for respective sector)* for sector specific community engagement.

- *Output 5.5:* Local government's capacity enhanced (ministries, departments, institutions) on effective community engagement throughout the years for dengue prevention and control care and management.
  - ❑ Strategic Action 1: *Allocation of resources -* Advocate to ensure allocation of resources in the annual budget for the local government institutions to engage communities and facilitate community led actions.
  - ❑ Strategic Action 2: *Local government institutions -* Develop costed plan of actions to be implemented by the local government institutions to ensure community actions.
  - ❑ Strategic Action 3: *Capacity development of LGIs-* Conduct study to identify capacity gaps and needs assessment; Develop capacity of officials, staff and frontline workers of the local government institutions on the community engagement to promote household level actions.
  - ❑ Strategic Action 4: *Multi-channel initiatives for effective campaign-* Activate concerted plan to implement periodical multi-channel initiatives for mobilizing communities for dengue prevention, control, care and management
  - ❑ Strategic Action 5: *Community actions of LGIs in dashboard -* Establish a system within the LGIs to facilitate, support and monitor community engagement and actions (integrating the behavioral insight (BI) approach) and link the actions with the national level dashboard with feedback mechanism to ensure effectiveness and functionality.
  - ❑ Strategic Action 6: *Engagement of low-income groups –* Activate LGIs to engage low-income group (i.e., Housekeepers, construction worker, gardener, security worker, caretaker,) for regular household level actions

- *Output 5.6:* Field level Health and Family Planning workers engaged to strengthen community engagement for dengue prevention, control, especially to ensure home care and household level management.
  - ❑ Strategic Action 1: *Capacity of field workers -* Develop capacity of CHCP, health assistant, health workers, MHVs, FWA and FWV, midwives to facilitate household level actions.
  - ❑ Strategic Action 2: *Empowering Health Managers -* Reactivate Civil Surgeon and UH&FPO to coordinate and facilitate the RCCE interventions specially during the dengue outbreak to ensure home care and household level management.

- *Output 5.7:* Foster the involvement of youth organization, social networks, and community-based organizations to strengthened community engagement on dengue prevention, control, care and management.
  - ❑ Strategic Action 1: *Development of tools -* Map young people, youth organizations to be engaged create interactive platform with appropriate content, material, and tools for young people, youth organizations to organize youth-led and community centric homeward cleaning activities.

	❑ Strategic Action 2: ***Engagement of youth -*** Facilitate and support youth led dengue prevention and control actions at the at-risk communities, including the rapid intervention during outbreak/upsurge. ❑ Strategic Action 3: ***Development of guidance notes -*** Develop guidance note with supporting materials for social network, grassroot level organizations, local clubs, and CBOs on prevention, control, promotion and sustaining household level action of dengue at the local level. ❑ Strategic Action 4: ***Supporting Youth-led actions -*** Support, facilitate, monitor, and coordinate community engagement initiative for social networks, grassroot level organizations, local clubs, and CBOs to prevent and control dengue at the local level. • ***Output 5.8:*** Digital/social media utilized to mobilize communities at risk to promote and sustain household level actions for dengue prevention, control, care, and management. ❑ Strategic Action 1: ***Digital platform-*** Engage digital platform, service provider, organizations with massive subscribers, for disseminating authentic and credible information and messages to increase knowledgebase and mobilize communities. ❑ Strategic Action 2: ***Materials development -*** Develop appropriate contents, and materials for relevant platforms to increase knowledge and mobilize communities on dengue prevention, control, care and treatment. ❑ Strategic Action 3: ***Addressing infodemics -*** Identify and address misinformation, disinformation, infodemic and capture community concern, views through social listening related to dengue. ❑ Strategic Action 4: ***Mobile networks*** – Utilize mobile operator/networks to support the RCCE efforts and initiatives to further strengthen the reach and impacts.
Responsibility	Additional Secretary (s) (Admin, Hospital, Nursing & Midwifery, WHO & PH), HSD of MOHFW; Additional Secretary (s) (Admin, Urban Development, Planning and PMEI), LGD, MoLDRD & C; Ministry of Information; Ministry of Religious Affairs; Department of Mass Communication; Department of Film and Publication; Bangladesh Television; Bangladesh Betar; NIMC; BTRC; Islamic Foundation; Directorate of Primary Education; Directorate of Secondary & Higher Education; Department of Youth; NGO Affairs Bureau; Press Institute Bangladesh; City Corporations, Municipalities; Line Director, L&HEP (Bureau of Health Education), Director (s), CDC, IEDCR, IPH & NIPSOM, Divisional Director Health of DGHS; Bangladesh Red Crescent Society; Bangladesh Scouts; UNICEF; WHO and Development partners

Timeline	Start Date: Fiscal Year January 2024	End Date: Fiscal Year December 2030	Total Duration: 7 years

Strategic Objective 6: Undertake research on effective dengue vaccine, clinical management, surveillance and vector control to address programme gaps and challenges

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	Synopsis: Continued research, focusing on the creation and evaluation of innovative diagnostic methods encompassing clinical, serological, molecular, and other pertinent approaches and easy availability, access and equitable delivery for all of a safe, efficacious and cost-effective vaccine to alter the concept for dengue prevention.

Strategic Outputs and Corresponding Strategic Actions	• *Output 6.1: Vaccine research -* Conduct research and associated policy development to select effective dengue vaccine with proven efficacy.
	  ❑ Strategic Action 1: *Suitable dengue vaccines -* Recommend dengue vaccine which is safe, immunogenic, efficacious, durable with minimal adverse events and cost effective
	  ❑ Strategic Action 2: *Infrastructure development -* Build infrastructure, develop human resources and allocate sufficient budget allocation to manufacture/refill dengue vaccine
	  ❑ Strategic Action 3: *Capacity development -* Build capacity and initiate technology transfer to manufacture/ refill dengue vaccine
	  ❑ Strategic Action 4: *Private sector engagement* – Support private manufacturing companies to produce licensed and WHO prequalified dengue vaccines
	
	• *Output 6.2:* Research and analysis conducted to generate evidence based effective clinical management of dengue patients
	  ❑ Strategic Action 1: *Clinical management protocols -* Conduct clinical research and evaluate newer/re purposive drugs/anti-viral for treatment of severe dengue patients
	  ❑ Strategic Action 2: *Case management -* Undertake operational research to standardize uniform dengue case management and referral system across all tiers of health delivery system.
	  ❑ Strategic Action 3: *Diagnostic tools -* Develop and evaluate new and highly sensitive cost-effective dengue diagnostic tools (Clinical, Serological, Molecular etc.) through quality research for effective case management
	  ❑ Strategic Action 4: *Death review* - Conduct research to identify the actual cause of death to ensure effective disease management.
	
	• *Output 6.3:* Research and analysis conducted for establishment of effective surveillance system
	  ❑ Strategic Action 1: *Early warning system -* Develop models for dengue case prediction, individuals risk assessment and GIS mapping for hot spots identification to develop early warning system for dengue prediction.
	  ❑ Strategic Action 2: *Novel methods -* Develop new and effective dengue surveillance methods through introducing novel and molecular methods in dengue surveillance including serotyping and genotyping.
	  ❑ Strategic Action 3: *Vector surveillance tools -* Implement vector surveillance across the country by introducing innovative tools and strengthening capacity at the central and local levels.

	• *Output 6.4:* Novel vector control tools are developed and introduced for effective dengue preventive measures ❑ Strategic Action 1: ***Entomological research -*** Conduct entomological research to better understand the behaviours and insecticide resistance of dengue vectors through observing their biology, bionomics, population dynamics, competency ❑ Strategic Action 2: ***New methods of control -*** Develop and evaluate new and effective dengue vector control methods ❑ Strategic Action 3: ***New methods of prevention -*** Develop and evaluate new and effective dengue prevention strategies such as implantation of Wolbachia, SIT etc. based strategy.
Responsibility	Director (s) CDC, IEDCR, IPH, NIPSOM of DGHS, Academia's -BSMMU, Universities and Research Organization and Institutes
Timeline	Start Date: Fiscal Year January 2024 End Date: Fiscal Year December 2030 Total Duration: 7 years

Strategic Objective 7: Ensure availability and undertake nationwide dengue vaccination using WHO prequalified vaccine through global collaboration

Synopsis: Population is protected through a safe, effective and affordable dengue vaccine against the four strains providing individual-level effects by reducing the probability of infection given exposure to an infected mosquito i.e., vaccine efficacy (VE) for susceptibility to infection, reducing the probability of clinical disease given infection or the probability of severe disease.

Strategic Outputs and Corresponding Strategic Actions	• *Output 7.1:* Nationwide vaccination campaign intensified to protect the population adequately against dengue ❑ Strategic Action 1: ***Vaccine selection -*** Select suitable dengue vaccines for population/risk group which is safe for all age groups. ❑ Strategic Action 2: ***Vaccine distribution -*** Roll out vaccine delivery to reach target populations ❑ Strategic Action 3: ***Monitoring –*** Institutionalize monitoring at all points from production/procurement point beginning from manufacturing (safety and quality control), refilling (safety and quality control) to administration at the user end ❑ Strategic Action 4: ***Awareness –*** Define messages for each of the key audiences to be reached and mobilize community awareness and advocacy for dengue vaccine.
Responsibility	LD-MNCAH (EPI), DGHS. Director (s) CDC, IEDCR, IPH, of DGHS
Timeline	Start Date: Fiscal Year January 2024 End Date: Fiscal Year December 2030 Total Duration: 7 years

11. Next Steps

It is proposed that a detailed costed "Implementation Plan" would be developed as a next step detailing out specific steps to be implemented at national, divisional, district, upazila and community-level, with specific measuring indicators splitting up by time horizons of the strategy (short-term, medium-term and long-term) for its effective implementation. The plan would elaborate on additional details on implementation, including detailed procedures, responsibility, partners, target groups and key performance indicators as well as functioning of the coordination arrangement.

CDC-DGHS will be the lead coordinating agency for all strategic objectives in the *Bangladesh National Dengue Prevention and Control Strategy (2024–2030)* as well as in the Implementation Plan. If necessary, CDC-DGHS will channel earmarked funds to supporting agencies. The supporting agencies at the activity level in the implementation plan would be responsible for incorporation in their respective Operational Plan of the 5th Sector Program of MOHFW as "*Dengue Prevention and Control*" component of their respective Operational Plans and should be monitored through ADP review as well as the Annual Program Implementation Plan (APIP) as part of the overall sector program. CDC, DGHS would take necessary steps for its inclusion in all relevant Operation Plans for effective implementation and institutionalization of Dengue Prevention and Control.

Additionally, a mid-term assessment would be conducted in 2027 to measure progress and concurrently due course correction would be made of this strategy.

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