National Strategic Plan for Malaria Elimination in Bangladesh: 2021-2025

National Malaria Elimination Programme
Directorate General of Health Services
Ministry of Health & Family Welfare
Government of Bangladesh

DGHS.MOH&FW
BANGLADESH

World Health Organization
Bangladesh

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MESSAGE

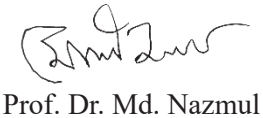
Bangladesh has made tremendous progress in the fight against malaria over the last decade or so. The number of malaria cases has dipped to 17,225 in 2019 and further to 6,310 in 2020 relative to nearly 40,000 cases in 2015. The number of deaths has also notably reduced to single digits with few exceptions. Such remarkable success shows that the country is on track to achieve malaria elimination by 2030 in line with the global and South-East Asia Region goal and Sustainable Development Goal 3. The success is based on sound strategy, intensified interventions, health and community systems strengthening, partnership and coordination; besides domestic investments and donor and partner support.

Malaria epidemiology exhibits enormous heterogeneity in the country and the disease is increasingly becoming focal with most of the burden concentrated in the three Chittagong Hill Tracts (CHT) districts. Whilst transmission reduction and decrease in disease burden in the CHT remain high priority, achieving elimination at subnational level starting from low endemic districts with few cases will be underscored. In addition, absence of indigenous transmission in 'non-endemic' districts and areas will be determined. Tailored implementation relevant to programme phasing and local context with special emphasis on reaching the hard-to-reach areas and key and vulnerable populations in the next five years will be vital for sustaining the gains accomplished so far and desirable returns on investments.

Attaining zero indigenous cases and zero deaths due to malaria will take efforts beyond business-as-usual. The National Strategic Plan (NSP) underlines the strategies and activities regarding early case detection, prompt and effective treatment, prevention with appropriate vector control measures, communication and social mobilisation, advocacy for strengthening enabling environment, quality programme implementation and management, capacity buiding and strengthening, regular programme review and strategic planning. Robust surveillance and M&E will continue to be emphasized as core interventions. All levels especially the local level, will need to be responsive to malaria data. As the number of cases drops, the risk of outbreaks increases, hence, systems will need strengthening for early warning and response. Expanding implementation research, tracking drug and insecticide resistance, developing/applying new tools and technologies will facilitate evidence-based programme. A multi-sector approach engaging a wide range of stakeholders and partners leveraging their resources, expertise, know-how, and experience will be advantageous for joint responsibilities. Cross-border collaboration with India, Myanmar and other countries will be important to preclude any adverse impact on elimination progress and possible threat of importation of resistant parasite strains. The COVID-19 pandemic has taught us the critical need for resilient health systems, strengthened implementation and coordination, and improvised options. Lessons learned from the pandemic and various other programmes will help in overcoming complexities in the pathway to elimination.

I congratulate the National Malaria Elimination Programme for development of the National Strategic Plan for Malaria Elimination 2021-2025 together with various stakeholders, partners, and national and international experts. I wish successful strategy implementation for accomplishing the set milestones and targets related to lessening malaria burden and attaining elimination and prevention of resurgence. In this journey, political commitment from the highest level will be essential for sufficient resources. Cooperation

from the MoHFW and relevant non-health ministries, Armed Forces and other security agencies, technical support from the WHO, additional resource support from the Global Fund and others, and collaboration with partner NGOs like BRAC, civil society, community, development agencies, research/academic institutions, and private sector, will be crucial, towards realizing the vision of malaria-free Bangladesh and overall socio-economic development.



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CONTENTS

ABBREVIATIONS AND ACRONYMS

ABER	Annual Blood Examination Rate
ACD	Active Case Detection
ACSM	Advocacy, Communication and Social Mobilization
ACT	Artemisinin-based Combination Therapies
AHI	Assistant Health Inspector
An.	Anopheles
ANC	Antenatal Care
API	Annual Parasite Incidence
APLMA	Asia Pacific Leaders Malaria Alliance
APMEN	Asia-Pacific Malaria Elimination Network
BCC	Behavior Change Communication
BCCM	Bangladesh Country Coordinating Mechanism
BDHS	Bangladesh Demographic Health Survey
BDT	Bangladesh Taka (Currency of Bangladesh)
BGB	Border Guard Bangladesh
BCDM	BRAC Centre for Development Management
CBHC	Community Based Health Care
CC	Community Clinics
CDC	Communicable Disease Control (Unit)
CHCP	Community Health Care Provider
CHWs	Community Health Workers
CHT	Chittagong Hill Tracts
CMRL	Central Malaria Reference Laboratory
CQ	Chloroquine
CS	Civil Surgeon
CSO	Civil Society Organization
DDT	Dichloro Diphenyl Trichloroethane
DGDA	Directorate General of Drug Administration
DGHS	Directorate General of Health Services
DHIS	District Health Information System
DPM	Deputy Programme manager
ECA	External competency assessment
EDPT	Early Diagnosis and Prompt Treatment
ELISA	Enzyme-linked Immunosorbent Assay
EWG	Executive Working Group
FDMN	Forcefully Displaced Myanmar Nationalities
FWA	Family Welfare Assistant
GDP	Gross Domestic Product
G6PD	Glucose-6-Phosphate Dehydrogenase

GF	The Global Fund
GFATM	The Global Fund to Fight AIDS, TB & Malaria
GIS	Geographic Information System
GMS	Greater Mekong Subregion
GoB	Government of Bangladesh
GTS	Global Technical strategy
HA	Health Assistant
HDI	Human Development Index
HI	Health Inspector
HPNSP	Health, Population and Nutrition Sector Program (4th HPNSP)
HR	Human Resources
HW	Health Worker
icddr, b	International Center for Diarrhoeal Disease Research, Bangladesh
IEC	Information Education and Communication
IEDCR	Institute of Epidemiology, Disease Control and Research
INGO	International Non-Governmental Organization
IOM	International Organization for Migration
IPC	Inter-Personal Communication
IRS	Indoor Residual Spraying
IVM	Integrated Vector Management
JMM	Joint Monitoring Mission
LLIN	Long Lasting Insecticidal Net
LMIS	Logistics Management Information System
LSM	Larval Source Management
M&E	Monitoring and Evaluation
MDA	Mass Drug Administration
MHV	Multipurpose Health Volunteer
MIS	Malaria Information System/Management Information System
MNCAH	Maternal Neonatal Child and Adolescent Health
MoF	Ministry of Finance
MoHFW	Ministry of Health and Family Welfare
MT	Medical technologist
NGO	Non-Government Organization
NHSS	National Health Sector Strategy
NMEP	National Malaria Elimination Programme
NMETF	National Malaria Elimination Task Force
NSP	National Strategic Plan
MEOC	Malaria Elimination Oversight Committee
OP	Operational Plan
PACD	Proactive Case Detection
PCD	Passive Case Detection
PCR	Polymerase Chain Reaction
P. falciparum	Plasmodium falciparum

PPM	Pooled Procurement Mechanism
PQ	Primaquine
PR	Principal Recipient
PSM	Procurement and Supply Chain Management
P. vivax	Plasmodium vivax
QA/QC	Quality Assurance/Quality Control
RACD	Reactive Case Detection
RAI	Regional Artemisinin-resistance Initiative
RBM	RBM Partnership
RDT	Rapid Diagnostic Test
RRT	Rapid Response Team
RSSH	Resilient and Sustainable Systems for Health
SDGs	Sustainable Development Goals
SEAR	South-east Asian Region
SMO	Surveillance Medical Officer
SOP	Standard Operating Procedure
SSS	Sustainable Social Services
TA	Technical Assistance
TES	Therapeutic Efficacy Study (of antimalarial medicine)
ToT	Training of trainers
TWG	Technical Working Group
UH&FPO	Upazila Health & Family Planning Officer
UHC	Upazila Health Complex
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
USD	U.S. Dollar (official currency of United States of America)
WHO	World Health Organization

EXECUTIVE SUMMARY

Bangladesh has demonstrated significant progress in reducing the malaria caseload over the years except fluctuations in terms of upsurges in 2014 and again in 2019. Overall, with significant decline in the number of confirmed malaria cases in 2019 (17,225) and 2020 (6,130) relative to 2015 (39,719) [57% and 85%, respectively], the country appears to be on track towards reducing disease burden gradually moving towards achievement of the vision of malaria elimination. The Honorable Prime Minister of the People's Republic of Bangladesh has made strong commitment to achieve Sustainable Development Goals (SDGs) including SDG 3: "Good Health and Well-Being" with specific target 3.3 underscoring "end malaria" by 2030. For Bangladesh, combating and ending malaria are not only commitments for achieving Sustainable Development Goal (SDG) 3 but other SDGs especially SDG 1: "Eradicating Extreme Poverty for All People Everywhere" by 2030.

The success is anchored on sound strategy and progressive improvements in implementation of effective preventive and curative interventions, surveillance, and M&E by the National Malaria Elimination and Aedes Transmitted Diseases Control Programme of the Ministry of Health & Family Welfare (MoHFW) of the Government of Bangladesh (GoB) [malaria component of the national programme is henceforth mentioned as National Malaria Elimination Programme (NMEP) in this National Strategic Plan for Malaria Elimination (NSP) 2021-2025]. The non-government implementation partner organization [BRAC and its collaborating non-government organizations (NGO)] are laudably complementing the NMEP efforts at community level and the Malaria Technical Committee and technical partners, viz., World Health Organization (WHO) are providing and technical stewardship. It is estimated that 18.74 million (~11.5% of the 163 million country's total population) people living in the 13 Districts (72 Upazilas) are at risk of contracting malaria infection in 2019. In the rest of the 51 districts (and a few areas within endemic districts) that are considered 'non-endemic' & 'free from indigenous malaria transmission', determination of the status is being initiated. In 2020, malaria burden remained very high in three Chittagong Hill Tracts districts (03 CHT districts) [93%] [viz., Bandarban, Rangamati and Khagrachari] and *Plasmodium falciparum* (*P. falciparum*) cases were 94%]. Bandarban district alone accounted for 68% of malaria cases. An Annual Parasite Incidence (API) per 1,000 population greater than 1 was recorded by Bandarban and Rangamati (6.98 and 1.86 per 1,000 population, respectively). The most vulnerable are those living in the hard-to-reach areas. They are ethnic groups, mobile and migrant populations (jhum cultivators, forest-goers, etc.), who are also often socio-economically marsginalized. Sustenance of intensified efforts and adequate resources are necessary towards elimination and prevention of re-introduction in malaria-free areas.

Further, apart from the 2014 outbreak and the slight increase in caseload in 2017, in most districts overall progress has been made towards malaria control and elimination since 2013. While overall reduction in malaria burden has been impressive, the persistent high transmission in the 03 CHT districts suggests that much more intensive measures are needed for transmission reduction and moving these districts towards elimination. As mentioned earlier, malaria is becoming an increasingly focal disease in Bangladesh with 03 CHT districts contributing 93% of total cases. In 2020, maximum caseload is contributed by Bandarban (3,207) and Rangamati (1,277) out of the 13 endemic districts. Only these two districts recorded an Annual Parasite Incidence (API) per 1,000 population greater than 1 (6.98 and 1.86 per 1,000 population, respectively).

Whilst the recent gains are impressive and the country has been tackling the COVID-19 pandemic, comprehensive assessment of impact of COVID-19 on malaria service delivery, surveillance, and M&E in 2020 and 2021 is envisaged.

Even though the NSP 2017-2021 was still valid, the Malaria Technical Committee, individual experts deliberated that the current version will be updated as National Strategic Plan (NSP) for malaria elimination 2021-2025 in view of JMM4 recommendations and current malaria stratification, robust needs assessment

and gap analysis. The NSP 2021-2025 will provide strategic direction to progress in the pathway towards phased elimination and malaria free Bangladesh by 2030.

The NSP 2021-2025 was developed through consultative process with various stakeholders and individual experts. It is aligned with the WHO Global Technical Strategy for Malaria 2016-2030 (WHO, 2016) and Regional Action Plan 2017–2030. Towards 0. Malaria-Free South-East Asia Region (WHO, 2017) as well as the Sustainable Development Goals (SDGs) and draws from findings and recommendation of the JMM4. In addition, several documents served as reference materials during the development of the NSP 2021-2025, viz. A Framework for Malaria Elimination (WHO, 2017); Malaria Surveillance, Monitoring & Evaluation: A Reference Manual (WHO, 2018); Manual for Developing Malaria Strategic Plan (WHO, 2019); World Malaria Report 2019 (WHO, 2020); amongst others.

The NSP 2021-2025 will be a living document and updated with added guidelines and SOPs, as needed, in consultation with the Malaria Technical Committee of the NMEP and individual experts, and the WHO, following updates in international guidance and importantly, drawing from country experience as transmission reduction to reduce disease burden is accelerated in 03 CHT districts; elimination interventions are rolled out in rest of the country in phased manner and areas and districts progressively reach the prevention of re-introduction stage. Interventions and activities for malaria-free areas for prevention of re-introduction and re-establishment of malaria transmission will follow the WHO guidance and expected to evolve over time and the particulars will be accordingly revisited and updated.

Vision
A malaria-free Bangladesh by 2030.

Mission
The mission is to achieve malaria elimination in phased manner with effective interventions in an equitable manner towards improving quality of life of at-risk populations and contributing to achievement of Sustainable Development Goals (SDGs).

Goals
By 2025, reduce malaria annual parasite incidence (API) to less than 1 per 1,000 population at risk in three CHT districts compared to 2019, interrupt locdal transmission of and eliminate indigenous malaria in phased manner in 10 other endemic districts, determine malaria-free status of remaining 51 districts, and maintain malaria-free status in areas where malaria transmission has been interrupted and prevent re-establishment of local transmission.

Objectives
Objective-1: To achieve and sustain universal coverage by early case detection and prompt treatment of all confirmed cases through 2025.
Objective-2: To achieve and sustain universal coverage of population at risk with appropriate preventive interventions through 2025.
Objective-3: To strengthen context-specific surveillance in all malaria settings and outbreak preparedness and response through 2025.
Objective-4: To achieve universal coverage by Advocacy, Communication and Social Mobilization (ACSM) activities for uptake of preventive and curative interventions, optimal community engagement through 2025.
Objective-5: To strengthen program management, monitoring & evaluation and partnership and coordination through 2025.
Objective-6: To strengthen and expand research through 2025.

Key Strategic Elements

- Universal coverage by quality-assured prompt diagnosis and treatment for all at-risk populations including the key and vulnerable populations (mobile and migrant populations, ethnic minority groups, disadvantaged/underserved communities, communities in border and conflict areas, and refugees).
- Universal coverage by appropriate prevention interventions for all at-risk populations including the key and vulnerable populations.
- Strengthen epidemiological and entomological surveillance appropriate for different settings.
- Review and refine malaria stratification periodically based on data related to transmission risk, receptivity, and vulnerability for targeted interventions.
- Strengthen M&E and reinforce regular supportive supervision and feedback; initiate and strengthen DHIS2 based MIS; and emphasize data quality and its use especially at subnational levels.
- Build resilient and sustainable health systems, including improvement of health workforce capacity with requisite skillsets at all levels, and uninterrupted access to quality-assured commodities.
- Foster strengthening of community systems; and enhance participation and ownership through intensified community engagement endeavours.
- Address human rights and gender-related barriers and inequities related to service access, uptake especially meeting the needs of key and vulnerable population groups.
- Strengthen quality service delivery through public health facilities as well as community health workers & volunteers (including those with partner NGOs).
- Scale up private sector engagement to expand coverage of case detection, streamline case management protocol, ensure timely reporting.
- Foster multi-sector strategic coordination and collaboration (with health and non-health sectors, local governments as well as partner agencies).
- Gather evidence continually on efficacy of first-line antimalarial drugs for early detection of possible emergence of drug resistant *P. falciparum*.
- Initiate cross-border collaboration between Bangladesh and India, Myanmar to tackle malaria transmission potentials through population movement along international borders; and maximize service delivery, surveillance within national boundaries.
- Promote research for addressing programmatic challenges, needs and gaps.
- Advocate for malaria elimination and prevention of re-introduction at all levels and sufficient and sustained resources.

Programme Prioritization and Phasing

Malaria is a focal disease in Bangladesh. It is therefore essential to identify and stratify the areas and populations at risk to prioritize interventions through a targeted approach and to ensure effective use of limited resources.

Programme Prioritization

Malaria is a focal disease in Bangladesh exhibiting considerable heterogeneity. It is therefore essential to identify and stratify the areas and populations at risk according to the burden of malaria. This process will identify districts to prioritize interventions through a targeted approach (district is considered as the operational unit for all interventions). Deployment of specific interventions at the local level will help NMEP for effective utilization of available resources. The strategy prioritizes progressive transition of high burden areas to low burden and low burden areas to elimination and sustaining it by preventing resurgence of indigenous malaria besides determining 'non-endemic' status of rest of the districts. Based on these considerations, the priorities are set as follows:

- Accelerated and sustained reduction of malaria burden in 03 'endemic' districts (03 CHT districts: Bandarban, Khagrachari and Rangamati).
- Phased elimination of malaria from remaining 10 'endemic' districts and maintaining the status.
- Determination of rest 51 districts (and a few areas within endemic districts) as 'non-endemic' and maintaining the status.

Programme Phasing

Drawing from prioritization, programme phasing is envisaged, since malaria burden must be lowered before it is possible (and rational) to investigate and treat every case and because premature application of the elimination approach might be prohibitively demanding. Successful elimination vision requires a distinction between a transmission reduction phase, where a combination of interventions is applied in endemic areas, and an elimination phase, where these measures are targeted to remaining foci and case-based surveillance intensified with measures to rapidly detect and cure every case.

Overall, the country is stratified into 3 strata based on API. The areas where API is more than 1 per 1,000 population is categorized as high transmission areas (stratum 3), while where API is less than 1 per 1,000 population are categorized as low transmission areas (stratum 2); and where API is equivalent to zero with receptive areas or with non-receptive areas are categorized as potential transmission areas (stratum 1). Accordingly, the national response is categorized into programme phasing (accelerated transmission reduction; elimination; and prevention of re-introduction) during the implementation period of the updated NSP (2021-2025) on the path to malaria elimination and maintaining the status:

- Accelerated Transmission Reduction Phase (control phase): Aims to bring malaria incidence to below 1 case per 1,000 population at risk[1]). Interventions aim to reduce transmission and have an impact on morbidity and mortality. This involves scaling up and sustaining universal coverage by effective preventive and curative interventions in three high transmission CHT districts, viz. Bandarban, Khagrachari, and Rangamati.
- Elimination Phase: Aims to interrupt local transmission and reduce indigenous malaria incidence to zero. Malaria case and entomological surveillance become the core interventions – every case is investigated and managed to avoid onward transmission. Based on the investigation, the focus of transmission is identified, appropriate antimalarial drug-based and vector control interventions are deployed to rapidly interrupt transmission in 10 low transmission districts. In addition, 'non-endemic' status of the rest 51 districts (and a few areas within endemic districts) is determined indicating no reported indigenous case from these districts through appropriate & strengthened surveillance system and capacity building.
- Prevention of Re-introduction Phase: Even after indigenous malaria cases have been reduced to zero, the health system and malaria case and entomological surveillance operations remain fully capable of preventing re-establishment of malaria transmission. At this stage, maintenance of malaria-free status will become the responsibility of the general health services, as part of their normal function in communicable disease control, in collaboration with other relevant sectors.

Appropriate implementation of interventions will be packaged for a particular stratum and phase tailored to the local epidemiology. Receptivity and vulnerability risk factors including the past and current intensity of transmission in an area, and the size and mobility of affected populations will be considered.

As malaria elimination is achieved at subnational levels, efforts will be made to prevent re-introduction and re-establishment of malaria transmission in malaria-free areas in terms of appropriate surveillance and response aligned with malariogenic potential of an area determined by receptivity and vulnerability of the area.

Key strategies

STRATEGY 1.1 Early Case Detection
STRATEGY 1.2 Prompt and Effective Treatment
STRATEGY 2.1 Malaria Prevention with Appropriate Vector Control Measures
STRATEGY 3.1 Epidemiological Surveillance
STRATEGY 3.2 Entomological Surveillance
STRATEGY 4.1 Community Awareness and Participation
STRATEGY 4.2 Programme Communication
STRATEGY 4.3 Advocacy for Strengthening Enabling Environment
STRATEGY 5.1 Programme Management, Capacity Buiding and Strengthening

STRATEGY 5.2 Programme Review, M&E, Strategy and Planning
STRATEGY 5.3 Partnership and Coordination
STRATEGY 6.1 Strengthen and Expand Reasearch

Milestones and targets

By 2021

- Bangladesh NSP 2021-2025 is officially launched nationwide.
- Empowered national malaria elimination task force (or similar body) in place.
- Stratification of malaria risk strengthened for targeted interventions.
- Universal coverage with long-lasting insecticidal nets (LLINs) for population at risk in target areas with particular attention to key and vulnerable populations.
- Universal coverage by quality malaria case management.
- Robust village level epidemiological surveillance strengthened in the CHT (03 districts).
- Case-based surveillance system established at national, district, Upazila levels in all other districts going into 'elimination' in phased manner.
- Local transmission has been interrupted and no indigenous case in 04 districts of Mymensigh zone.
- System, process to determine 'non-endemic' 51 districts (and a few areas within endemic districts) considered to be 'malaria free' initiated.

By 2023

- 'Malaria free' status of 51 districts (and a few areas within endemic districts) determined.

By 2025

- Local transmission has been interrupted and no indigenous case in 04 districts of Sylhet zone; and Chattogram and Cox's Bazar.
- Annual Parasite Incidence reduced to <1 per 1,000 in 03 CHT districts.

By 2030

- Local transmission has been interrupted nationwide.

Resource requirements for NSP 2021-2025

The NSP 2021-2025 will be implemented under the MoHFW flagship programme HNPSP through the National Malaria Elimination Programme (NMEP). The resource requirements for NSP 2021-2025 will be USD 131,792,587 (1 USD = 84.47 BDT). Much of the resource needs is expected to be covered under the current GoB HNPSP OP 2017-2022 and upcoming OP for the next period. In addition, support by external partners, especially the GF will be extremely crucial. In addition, technical assistance by the WHO will also be vital. The NMEP/GoB will continue to explore resources from all sectors to fulfil the resource needs for NSP 2021-2025.

CHAPTER-1 INTRODUCTION

1. INTRODUCTION

Bangladesh has demonstrated significant progress in reducing the malaria caseload over the years except fluctuations in terms of upsurges in 2014 and again in 2019. Currently, it is estimated that 18.74 million (~11.5% of the 163 million country's total population) people living in the 13 Districts (72 Upazilas) are at risk of contracting malaria infection in 2019. In the rest 51 districts (and a few areas within endemic districts) that are considered 'non-endemic' and 'free from indigenous malaria transmission', determination of the status is initiated. In 2020, malaria burden was very high in 03 CHT districts (93%) [viz., Bandarban, Rangamati and Khagrachari]; and *P. falciparum* cases being 80%. Bandarban district alone accounted for 68% of total malaria cases.

1.1 Policy and Programme Environment

Malaria is recognized as a public health and socioeconomic problem in People's Republic of Bangladesh. The impact of malaria takes its toll on the poorest and the marginalized. Therefore, malaria elimination is one of the public health priorities. The Honorable Prime Minister of the People's Republic of Bangladesh is committed to achieve Sustainable Development Goals (SDGs) including SDG 3 "Good Health and Well-Being" with specific target 3.3 underlining "ending malaria" by 2030. For Bangladesh, combating and ending malaria are not only commitments for achieving SDG 3 but realizing other SDGs especially SDG 1: "eradicating extreme poverty for all people everywhere" by 2030. The National Health Policy (2011) highlights the critical need for tackling malaria. The Ministry of Health and Family Welfare (MoHFW) is playing strategic stewardship and governance roles for policy and strategy development, review, and advocacy in the pathway to malaria elimination.

Level of national commitments: Strong political commitment and an expansion of international and domestic financial resources are required to achieve malaria elimination. As mentioned, the Honorable Prime Minister of the People's Republic of Bangladesh is committed to achieve the SDGs. In 2017, the Honorable Health Minister of the GoB has signed the Ministerial Declaration on "*Accelerating and Sustaining Malaria Elimination in the South-East Asia Region"*, which was facilitated by the WHO South-East Asia Region (SEAR) to reaffirm the high-level commitment for moving towards malaria elimination. This declaration called for actions on high-level political commitment, adequate financial and human resources, universal access to malaria prevention, quality-assured prompt diagnosis and treatment, robust surveillance, uninterrupted supply of quality assured commodities, as well as multisectoral and inter-country cooperation, amongst others.

Further, the Government of Bangladesh has approved a mega programme called 4th Health, Nutrition and Population Sector Program (4th HNPSP: 2017-2022). The programme is guided by Bangladesh's Vision 2021 and is in line with the SDGs. The 4th HNPSP incorporates appropriate strategies and activities for focused improvements in increasing access to and utilization of health care. It also aims at improving equity along with financial protection to meaningfully realize the objectives of universal health coverage by 2030. Malaria is one of the priorities under this programme. The 4th HNPSP OP mentions about the commendable success in controlling malaria through reduction of cases and death besides setting targets of achieving 75% reduction of morbidity and mortality by 2025 and zero transmission by 2030. The following activities are to be implemented during the 4th HNPSP: updating national strategy and budgeted national action plan; sustenance of the early diagnosis and prompt treatment with universal coverage; supply of drugs, insecticides, spray machine and other logistics; two rounds of integrated vector management in all the endemic focuses of the 13 malaria districts of the country; strengthening of cross-border collaboration with neighbouring countries; promotion of operational research for insecticide resistance monitoring; and community participation through multipurpose health volunteers for the purpose of detection and

management. The 4th HPNSP provides special focus on improving health services and strengthening health systems.

1.2 Review of Implementation of National Strategic Plan 2017-2021: Lessons Learned

The current NSP (2017-2021) provides strategic directions for phased malaria elimination in the country. The goal is to ensure that the country is on track to eliminate malaria by 2030 contributing towards country development and the SDGs. The objectives of NSP are to: 1) reduce Annual Parasite Incidence in the 13 'endemic' districts to less than 0.46 by 2021; 2) interrupt the transmission of malaria in 8 of the country's 13 'endemic' districts by 2021; 3) ensure that the remaining 51 districts are free from malaria transmission by 2021; 4) prevent the re-establishment of malaria in districts where transmission has been interrupted; and 5) prevent the emergence of ACT resistant Plasmodium falciparum in Bangladesh. Key interventions included: early case detection (RDT & Microscopy) and effective management (ACT); prevention (LLINs); and case and entomological surveillance and other supporting interventions.

Some lessons learned:

- Overall, with significant decline (57%) in the number of confirmed malaria cases in 2019 (17,225) relative to 2015 (39,719) [baseline year] despite fluctuations, the country appears to be on track towards reducing disease burden and elimination. This is anchored on sound strategy and progressive improvements in programme implementation and M&E by NMEP and its partners. A combination of LLINs distributed through mass campaign every three years and through periodic continuous distribution to high-risk populations as well as early case detection and effective management with ACT (for P. falciparum malaria) and other antimalarials delivered through the public sector and community health worker network offered the opportunity to achieve success.
- Improvement in surveillance and M&E, ACSM, PSCM, QA/QC were important interventions, amongst others.
- Availability of external funding from the Global Fund (GF) and considering the value for money (selection of technically sound and cost-effective and feasible strategies) and targeting high burden areas contributed to impact and opened the door to progress to malaria elimination countrywide.
- Coordination with local stakeholders and community engagement were important route for successful distribution of LLINs, EDPT and referring suspected malaria cases to the nearby health facilities.
- Collaboration between NMEP and partner NGOs has been effective to achieve results through complementarity on the ground.
- Community-based malaria elimination program has successfully created a stable foundation toward malaria elimination. The community-based programme contributed to improving the coverage of malaria interventions and reducing malaria-associated morbidity and mortality. As malaria morbidity goes down, the health providers will have more time to manage others disease. Moreover, the resources could be shifted to some other health related aspects.
- Capacity building through trainings/re-trainings helped improving service delivery and programme management.
- Technical assistance by the WHO facilitated strategy and policy development, reviews, etc.

The National Malaria Elimination Program (NMEP) of the GoB leads joint monitoring mission [referred as Joint Monitoring Mission 4 (JMM4)] to assess country's progress periodically. An independent mid-term review (MTR) of the NSP 2017-2021 [referred as Joint Monitoring Mission 4 (JMM4)] was carried out in July 2019 by a team of national and international experts. The JMM4 report summarized the following aspects:

Bangladesh has demonstrated significant improvement in reducing the malaria cases in recent years and is poised for malaria elimination in phased manner. Malaria is becoming an increasingly focal disease in Bangladesh with 03 CHT districts accounting for the highest caseload. Overall, the NMEP attempted to leverage strengths and opportunities, overcome challenges, and strengthen the foundation for malaria

elimination in Bangladesh by 2030. There are several lessons learned and challenges. Therefore, the NMEP should:

- aggressively advocate malaria elimination agenda at the highest level of political leadership and at the same time ownership and leadership at subnational level.
- revisit the targets and milestones with a view to accelerate efforts for subnational elimination; whilst focusing on radically reducing malaria burden in 03 CHT districts.
- revise the malaria risk stratification based on epidemiological data (including data on receptivity and vulnerability, where available) for optimal planning and effective targeting.
- Strengthen epidemiology-led entomology for problem solving.
- update strategies, guidelines and SOPs, modules, tools & formats for each setting, viz. transmission reduction and elimination, as appropriate.
- ensure universal coverage of the populations at risk with appropriate interventions informed by stratification and ensure provision of supplies.
- utilize all service delivery mechanisms, which have proven to be effective so that lead-time to achieve results can be minimized.
- strengthen surveillance and M&E across all settings in line with transmission reduction and elimination requirements.
- prevent emergence of ACT resistant Plasmodium falciparum.
- prioritize multi-sector strategic collaborations across health and non-health sectors, Armed Forces and Border Guard Bangladesh (BGB), local governments/local tribal leaders as well as partner agencies; and ensure harmonization and oversight.
- consolidate partnerships with current NGO partners that contributed to outcomes & impacts as well as involve other CSOs/NGOs (national & INGOs) for programme implementation and addressing FDMN issue (in coordination with UNHCR and relevant others).
- strengthen community engagement urging their participation in malaria elimination agenda.
- enhance BCC through channel-mix contributing to desired outcomes.
- scale up private sector engagement.
- conduct rapid gap analysis in terms of human resources from central to district and Upazila levels and ensure adequate human resources with necessary expertise/skill sets at all levels.
- cross-border collaboration between Bangladesh and India, Myanmar by adopting & adapting the WHO operational framework (2018).
- identify research agenda and lead/coordinate appropriate research.
- advocate for sustained investments from domestic and external sources like the Global Fund & other development partners; as well as improve efficiency in the use of available resources.

The JMM4 recommendations are appended as Annex-1.

1.3 Process of Developing the Current Strategic Plan

Even though the NSP 2017-2021 was still valid, the Malaria Technical Committee, and various individual experts deliberated that the current version will be updated as National Strategic Plan (NSP) for malaria elimination 2021-2025 in view of JMM4 recommendations and current malaria stratification, needs assessment and gap analysis. The NSP 2021-2025 will provide strategic direction to progress in the pathway towards phased elimination and malaria free Bangladesh by 2030.

The NSP 2021-2025 was developed under leadership of the Director, CDC, DGHS and the DPM of NMEP with support from international and national experts, and the WHO and partner NGO. In addition to consultation with the GF, the NMEP held a consultative workshop with various stakeholders and individual experts. The members of the Malaria Technical Committee provided valued inputs. In addition, a subnational consultation was held with partner NGO field units and local public health authorities in Cox's Bazar. A Focus Group Discussion (FGD) was conducted in Pekua Upazila of Cox's Bazar District involving

public health care service providers, community health workers as well as tribal people, forest goers and woodcutters.

The NSP 2021-2025 is aligned with the WHO Global Technical Strategy for Malaria 2016-2030 (2021 update) and the SEARO Regional Action Plan 2017–2030. Towards 0. Malaria-Free South-East Asia Region as well as the Sustainable Development Goals (SDGs) and draws from findings and recommendation of the JMM4. In addition, several other documents served as reference materials during the development of the NSP 2021-2025, viz. WHO Manual for Developing Malaria Strategic Plan 2019; A Framework for Malaria Elimination, WHO, 2017; World Malaria Report 2020; Malaria Surveillance, Monitoring & Evaluation: A Reference Manual, WHO, 2018; amongst others (Annex-2).

The NSP 2021-2025 will be a living document and updated with added guidelines and SOPs, as needed, in consultation with the Malaria Technical Committee of the NMEP and individual experts, and the WHO, following updates in international guidance and importantly, drawing from country experience as transmission reduction to reduce disease burden is accelerated in 03 CHT districts; elimination interventions are rolled out in rest of the country in phased manner and areas and districts progressively reach the prevention of re-introduction stage. Interventions and activities for malaria-free areas for prevention of re-introduction and re-establishment of malaria transmission will follow the WHO guidance and expected to evolve over time and the particulars will be accordingly revisited and updated.

1.4 Alignment with National Planning and Budgeting

National strategic plans are implemented by Operational Plan (OP) and project implementation Plan (PIP) and in line with the budgeting cycle (July to June) of the GoB. The NSP 2021-2025 is aligned with the national planning and budgeting cycle and implementation tools such as 4th HNPSP, OP-PIP. Current OP (2017-2022) has an allocated budget of BDT 13,432.10 Lacs [GoB resources and reimbursable project aid (RPA)] for malaria elimination in support of the NSP (2017-2021) [Table-1]. This allocation will be reviewed, and the allocation of the next OP will be provided taking into consideration the current needs as well as the needs of the NSP 2021-2025. In addition, resource support from external partners, viz. the GF are received since 2007-2008. So far, a total of USD 118.31 million has been received, in addition to the approval of USD 24.10 million for the period 2021-2023. Besides, the WHO also provides support in terms of technical assistance.

Table-1: The GoB resources 2017-2022 for Malaria & ATD Programme (Figures in BDT in Lacs)

FY	GoB	RPA	Total
2016-17	391.00	387.50	778.50
2017-18	566.80	1,772.00	2,338.80
2018-19	571.00	1,782.00	2,353.00
2019-20	666.30	2,262.00	2,928.30
2020-21	644.74	2,093.91	2,738.65
2021-22	430.70	1,864.15	2,294.85
Total	**3270.54**	**10,161.56**	**13,432.10**

Source: Government of Bangladesh (GoB)

CHAPTER-2 COUNTRY PROFILE

2. COUNTRY PROFILE

The People's Republic of Bangladesh is a sovereign state in South Asia. It forms the largest and easternmost portion the ethno-linguistic region of Bengal. The country had been a colony of Great Britain for nearly 200 years, from which it emerged as part of Pakistan in 1947. Bangladesh emerged as an independent nation following a heroic war of liberation from Pakistan, which ended in victory for Bangladesh in December 1971. Located at the northern tip of the Bay of Bengal, the country is bordered by India and Myanmar and is separated from Nepal and Bhutan by the narrow Siliguri Corridor of India. With an estimated population of 163 million in 2019[2], it is the world's eighth-most populous country and the fifth-most populous in Asia. Bangladesh is also one of the most densely populated countries in the world. The capital Dhaka and the port city of Chattogram (formerly Chittagong) are the most prominent urban centres.

2.1 Demographic Profile

The population and its density are described in the Table-2 below. The population growth rate may have an impact on malaria epidemiology, as any increase in population will push the NMEP to revisit its planning to match the real-life situation.

Table-2: Population Statistics in Bangladesh

Population Variables	
Total population in 2019 (in millions)	163
Population, female (% of total population) [2019]	49
Population, rural (% of total population) [2019]	63
Population density per square kilometre (2019)	1,253
Population growth rate per annum (2019)	1.03
Male/Female sex ratio	102/100
The population household size per family unit	5.01

Source: https://datacatalog.worldbank.org/dataset/world-development-indicators; https://knoema.com/atlas/Bangladesh/topics/Demographics/Population/ Population-density; Population growth rate; Male-to-female-ratio

A total of 63.37% of the population lives in rural Bangladesh, while 36.63% lives urban areas (2018). The population of Bangladesh comprise Bengalis and various ethnic groups. The tribes comprise of *Chakma, Tanchangya, Kuki, Bawm, Garo, Marma and Santal*, and others.

2.2 Administrative Structures

2.2.1 Administrative Structure

For administrative purpose, the country is divided into 8 administrative divisions. These divisions are further divided into 64 districts and 492 Upazilas. In rural areas, the administrative governance goes through 4,571 unions and wards. Each union consists of multiple villages. In addition, 316 municipalities and 12 City Corporations were set up in suburban and urban areas, respectively. A ward is the lowest administrative unit of the government structure. Direct elections for chairperson and members are held at the union level, while government officials are appointed at the higher administrative levels. The administrative structure[3] is summarized in the Table-3 below.

Table-3: Administrative structure in Bangladesh

S. No.	Administrative Statistics	Number	Administrative Head
1.	Division	8	Divisional Commissioner
2.	District	64	Deputy Commissioner
3.	Upazila	492	Upazila Nirbahi Officer
4.	Union	4,554	Union Chairman
5.	Ward (in rural area)	40,977	Ward Member
6.	Village (approx.)	87,320	Village Headman
7.	Household/Village (Average)	250-500	Household Head
8.	City Corporation	12	Mayor
9.	Metropolitan City	4	Mayor
10.	Municipality	328	Mayor

Source: Health Bulletin, MoHFW, GoB, 2019; Bangladesh Bureau of Statistics, 2021.

2.2.2 Governance Structure

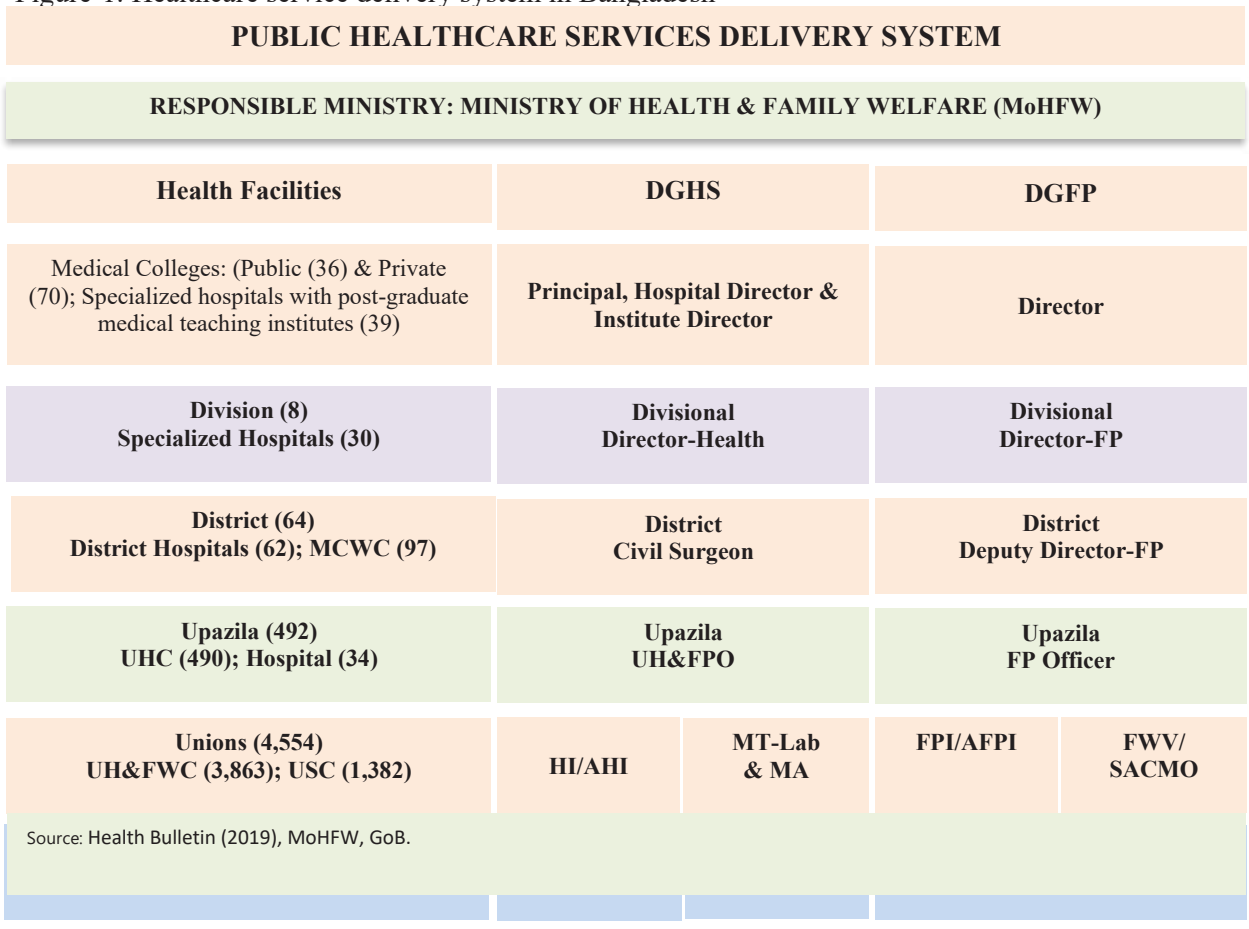
Bangladesh governance structure institutionalizes a matrix, in which individual actors, firms, social groups, civic organizations and policy makers interact with each other to implement and enforce public policies and to improve private sector coordination. Bangladesh governance structure also includes system of politics and their functions in relation to public administration and law. To practice good governance, the Bangladesh Constitution provides elements driving fully to develop good governance and capturing institutional and non-institutional parameters of governance.

2.3 Overview of Health System and Linkage of NMEP with MoHFW

The MoHFW is the key ministry responsible for the provision of comprehensive health services and financing in Bangladesh through different directories. The MoHFW has established an organizational structure and built adequate healthcare infrastructure at country's administrative levels (national, divisional, district, Upazila, union, and ward levels) for making policy; organizing, managing, and coordinating implementation; and regulating national health and family planning related activities and programs. The MoHFW, through its DGHS and DGFP, manages general health and family planning services through Medical College Hospitals at national level, District Hospitals at district level, Upazila Health Complexes at sub-district level, Union Health and Family Welfare Centres at union level, and Community Clinics (CCs) at ward level. Moreover, DGHS also operates tertiary level health care services through specialized hospitals and health institutes. In addition, the Ministry of Local Government, Rural Development and Cooperatives through its Local Government Division (LGD) manages the provision of urban primary care services in the City Corporations and municipalities.

The Honorable Health Minister leads, directs, and guides the MoHFW in making policies, acts, strategies, rules, and regulations related to the national healthcare services. The Secretary is the Chief Executive Officer (CEO) of the MoHFW playing a leadership role in developing major policy initiatives; implementing different health acts, policies, and strategies throughout the country; and overseeing the efficient and effective delivery of government policies, services, and programs. Moreover, the Secretary, as a CEO of the ministry, oversees eight different directorates (Figure-1) responsible for the implementation of healthcare services delivery. The Directorate General of Health Services (DGHS) is one of the eight directors overseeing development and execution of health policies and strategies; annual plans; and implementation management of health programmes across the country.

Figure-1: Healthcare service delivery system in Bangladesh



The National Malaria Elimination Programme (NMEP) is implemented by Communicable Disease Control (CDC) Unit under the DGHS of MoHFW. Malaria services are provided along with other essential and primary healthcare services at district, Upazila and community levels through district hospitals, Upazila health complexes, union health centres, rural dispensaries, and CCs.

Central level: At the central level, the NMEP under the CDC, DGHS, MoHFW, has direct responsibility for planning and implementing malaria control and malaria elimination. The NMEP leads development of policy, strategy, guidelines, SOPs, QA/QC, and planning and implementation of interventions, procurement of health products/pharmaceuticals and supply to public sector health system and partner NGOs, besides leading M&E/MIS, oversight as well as partnership and coordination, research. The NMEP has three main sections: Epidemiology; Entomology and Laboratory (Central Malaria Reference Laboratory - CMRL). A surveillance and monitoring and evaluation system is in place for assessing program performance periodically.

The NMEP has been receiving support from the GF since 2007. The GF supported Program Management Unit (PMU) is set up at the central level comprising technical and administrative staff at the central and district levels.

The NMEP has established partnership and achieved credible results in mobilizing NGO partners (BRAC and its collaborating partners) with the GF support. From 2021, partner NGOs provide strong complementary support in 03 CHT districts and Chattogram and Cox's Bazar districts. Key functions include diagnosis and treatment, and surveillance and M&E at community level, LLIN distribution and ACSM activities, amongst others. They proactively coordinate with the NMEP as well as district/Upazila authorities and below levels for timely and quality implementation and reporting. The Armed Forces and

other law enforcement agencies also contribute to malaria diagnosis, treatment, surveillance in their service areas in endemic districts; besides few international NGOs (INGOs) in FDMN camps.

In addition, there are few research and academic institutions, which support the NMEP from time to time. Example, Bangladesh Institute of Tropical and Infectious Diseases (BITID); and NIPSOM, IEDCR (besides private sector institutions like iccdr, b).

2.3.1 Community Systems in Service Delivery

The Government of Bangladesh introduced CCs in the 1990s with an aim to deliver primary health care, family planning and nutrition services to rural people at the grassroots level. Currently there are 13,500 CCs in Bangladesh, aimed to cover every 6,000 rural population in Bangladesh. They are conceived as one-stop centres for access to healthcare at the community level. The CC has one trained Community Healthcare Provider (CHCP) as its main staff. A Health Assistant from Upazila and a FWA from Union health facility visits CC on designated days in a week.

Trained female frontline community health care providers (with partner NGOs), viz., female health volunteers (*Shasthya Shebikas)* and health workers *(Shasthya Kormis)* play a pivotal role in malaria interventions at the community level by promoting community participation and bridging the community and the government's formal healthcare services in 03 CHT districts as well as Chattogram and Cox's Bazar. In addition, special health workers are also being positioned in selected Upazilas of endemic districts (other than the above-mentioned ones). They support the public sector peripheral health workers and CCs. This community health workforce is hired locally to cover small areas including hard-to-reach pockets in remote hilly, forest and border areas to maximize the outreach of malaria services. Originating from the same community and verbalizing in the same language overcome the communication barriers as well as transport accessibility related constraints, thereby making the service delivery more profound and simplified. Besides, the GoB is planning to recruit multipurpose health volunteers nationwide to facilitate community-based services at the doorstep. They will encourage the community regarding malaria awareness, educate people about the use of LLINs, diagnose and treat patients and follow up the prognosis through household visits. They identify the need of LLINs, plan and distribute those in eligible endemic areas free of cost and ensure their utilization. They also refer the patient to the nearest health facility if there are any signs of severe malaria, without any delay. Malaria awareness messages are disseminated through community based and led sessions (referred as courtyard meetings), apart from health forums and group meetings at marketplaces, thereby making attempts to involve more of the community. BCC/Information, Education and Communication (IEC) materials are used regularly during such sessions besides inter-personal communication.

Orientation on malaria prevention and control are also organized at the union level gathering influential people from the community/community leaders to make them aware of malaria symptoms, diagnosis and treatment services and prevention methods. Formal meetings are held with the local community/village leaders (Headman, Karbari), religious leaders etc., where the objectives of the programme are shared; gaps in service provision are discussed and the different suggestions from the participants are considered for improving service delivery and raising awareness.

Orientation on malaria prevention and availability of diagnostic and treatment facilities among high-risk groups has also been initiated like *Jhum* cultivators, forest goers, mobile and migrant populations, etc. In addition to providing supplementary LLINs, sometimes health camps are conducted at entry or exit points of forest, *Jhum* land, and border belt areas for screening of malaria.

School students from grade five to ten of malaria endemic area are also oriented on the disease and available services so that they can disseminate the message to their family and inform the local community as well.

2.3.2 Role of Private Sector

Public sector health care delivery system of Bangladesh reaches up to community level. Private medical colleges as well as clinics, diagnostic centres supplement the public health system. At community level, besides CCs and community health workers/volunteers of partner NGOs, private sector health care service providers are also involved in malaria case management especially in hard-to-reach areas. Thus, the private sector plays a significant but ill-defined role in malaria case management in Bangladesh. Efforts have been initiated in few districts to map, orient and seek report from the private sector to ensure prompt referral and appropriate malaria diagnosis and treatment, which needs to be augmented. Malaria is a notifiable disease in Bangladesh under the Infectious Disease Act 2018. However, reporting from non-government/private sector is yet to be optimal and needs to be pursued.

In 2019, the NMEP led a process of assessing private sector role, readiness and performance relating to malaria elimination in four selected Upazilas with technical assistance by the WHO. Both quantitative and qualitative data were collected from different categories of health facilities (private hospitals, private clinics, diagnostic centres, pathology laboratory and NGO clinics, etc.) and health care providers (graduate doctors, medicine shopkeepers and informal practitioners, etc.). Approximately, 60% of private sector health facilities were able to carry out parasitological examination with both RDT and microscopy. However, the assessment reported that majority of private sector health care providers did not use pre-qualified diagnostic product. Additionally, it was reported that more than 50% of private sector health care providers provided a combination of antimalarials, which are not in line with the approved national treatment guidelines. The assessment indicated that awareness on malaria control and elimination as well as knowledge on malaria treatment guidelines were not high among the private sector providers. Moreover, the number of cases diagnosed and treated were not fully reported to the NMEP. Nevertheless, majority of private sector health care providers expressed interest for collaboration with the NMEP. The assessment recommended an expanded survey with larger representative samples from different malaria endemicity areas using the existing survey tools. Furthermore, mapping of potential private stakeholders in high-risk areas was highly recommended.[4]

2.4 Health Sector Policies and Strategies and Synergies with NMEP

The National Development Plan of Bangladesh has captured all 17 sustainable development goals (SDGs). The GoB aims to achieve the associated health related vision for 2021 through the implementation of its Health, Nutrition and Population Sector Programme' (HNPSP). The 4th HNPSP vision is for people to be healthier, happier, and more economically productive and for Bangladesh to be a middle-income country by 2021. The GoB intends to establish a 'people-oriented' responsive health care system, which emphasizes the needs of women, children, adolescents, the elderly, the poor, and the marginalized segments of the population through developing an effective, efficient, and sustainable health service delivery system.

Scaling up of health services towards SDGs and expanding access aim at improving priority to accelerate progress to achieve SDGs in 2030. These components add increased attention to maternal, neonatal, child, reproductive and adolescent health; communicable and non-communicable diseases; climate change and health protection; disease surveillance; and behavior change communication (BCC) related programmes.

At the community level, revitalizing CCs as part of a functional Upazila Health System has been underscored. Strengthening overall health system governance, a sound M&E System and health equity for the poor and for marginalized populations are given due consideration. To increase coverage and quality of services, the GoB has also been encouraging coordination with other inter-sectoral, NGO and private sector service providers.

As all CDC programmes are implemented through the integrated primary healthcare system at district, Upazila and below, malaria health services delivery is one of the priorities. Malaria programme finds

synergies within the primary healthcare systems of the CDC. Activities are delivered through multipurpose health workers maximizing opportunities for integration of training etc.

The MoHFW works in collaboration with the Ministry of Social Welfare, Ministry of Chittagong Hill Tract Affairs, the CHT Board, NGOs, and the private sector, amongst others. The 'Essential Services Package (ESP)' is provided in hard-to-reach areas through appropriate arrangements with NGOs and community-based organizations (CBOs) to overcome the shortage of public sector human resources based on comparative advantages.

Linkage between NSP 2021-2025 and Sector Strategies: The 4th HNPSP Operational Plan (OP) for Communicable Disease Control 2017 – 2022 goal is to ensure quality and equitable health care for all citizens by improving access to and utilization of health, population and nutrition services and the development objective is to improve both access and utilization of such services particularly for the poor. The general objective is to control/eliminate specific communicable diseases from Bangladesh. The component-1 of the HNPSP OP includes malaria elimination as a priority towards malaria-free Bangladesh by 2030.

Strengthening of primary healthcare and emergency care for all is crucial in the health system in terms of maximizing access and coverage. The number of healthcare providers in the public sector is low [Physician density (per 1,000 population) is 0.58 (2018); Nursing and midwifery personnel (per 1,000 population) is 0.41 (2018) and Hospital beds per 1,000 population is 0.79 (2016)].[5] Most of these health workers are concentrated in urban areas. There is a need for adequate supply of health professionals and sufficient hospital beds in public facilities. The quality of health care services remains a concern. In order to ensure quality of healthcare services, MoHFW being a regulatory authority needs to address some critical problems such as: to regulate unauthorized clinic and hospitals, identify and punitive actions against fake, quack and unlicensed doctors, restrict the function of below standard medical colleges and control the counterfeit medicine producing pharmaceutical companies.[6,7] Current systems of geographic resource allocation need strong improvement to contribute to the improvement of health status of the most vulnerable groups as the poor, women, and children. This improvement is one of the objectives of the HNPSP. Resources are currently allocated to District Hospitals and Upazila Health Complexes largely according to the size of the inpatient-outpatient facilities and numbers of staff in post. This leads to wide different in district per capita allocations in both the Revenue Budget and Development Budget.[8]

2.5 Socio-Economic Situation

2.5.1 Political Stability

Bangladesh is a democratic country practicing parliamentary form of government with multi-party system. Executive power is exercised by the government headed by the Honorable Prime Minister while the legislative power is vested in both the government and parliament. The President is the constitutional head of state and is elected for a five-year term by the parliament.

The Gross Domestic Product (GDP) growth rate of Bangladesh was 8.15% 2019, reflecting good political stability. The growth rate in Bangladesh was one of the highest in the South-East Asian countries.[9]

2.5.2 Socio-Economic Variables

An overview of socio-economic variables of Bangladesh is presented in Table-4.

Table-4: Socio-economic Variables of Bangladesh

Socio-economic variables	Value
Life expectancy at birth male/female (years, 2019)	70.88/74.60
Probability of dying between 15- and 60-years male/female (per 1,000 population, 2019)	149/113
GDP (billion current USD) [2019]	302.56
GDP growth (annual %) [2019]	8.15
GDP per capita ((billion current USD) [2020]	1968.79
Current health expenditure (% of GDP) [2018]	2.34
Current health expenditure per capita in 2018 (current USD) [2018]	41.91
Domestic General Government Health Expenditure (% of GDP) [2018]	0.38
Domestic General Government Health Expenditure Per Capita (current USD) [2018]	7.12
Domestic general government health expenditure per capita, PPP (current international $)	18.62
Domestic General Government Health Expenditure (% of current expenditure) [2018]	16.98
Domestic Private Health Expenditure (% of current expenditure) [2018]	76.50
GNI (current USD) [2019]	3.17
GNI growth (annual %) [2019]	8.29
GNI per capita [Purchasing Power Parity (PPP) Current International $] [2019)	5190
Out-of-pocket Expenditure (% of current health expenditure) [2018]	73.87
Out-of-pocket expenditure per capita (current US$)	30.96

Source: https://datacatalog.worldbank.org/dataset/world-development-indicators; https://data.worldbank.org/indicator/SP.DYN.AMRT.FE; https://knoema.com/atlas/Bangladesh/topics/Health/Health-Expenditure/General-government-expenditure-on-health-as-a-share-of-current-health-expenditure; https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=BD

In regard to poverty elimination, Bangladesh has achieved a commendable result by reducing poverty rate to 20.5% in 2019 from 24.3% in 2016 as measured by the percentage of people living below the national poverty line.[10] Based on the current rate of poverty reduction, Bangladesh is projected to eliminate extreme poverty by 2021, the first nation in South Asia to do so.[11] Many people live in remote rural areas that lack adequate services such as education, health clinics, and adequate roads, particularly road links to markets. An estimated 35 percent of the population in rural areas lives below the poverty line. An estimated 21 percent of the population in urban areas lives below the poverty line.[12]

Gini index measures the extent to which the distribution of income or consumption expenditure among individuals or households within an economy deviates from a perfectly equal distribution. In 2018, Gini index in Bangladesh was 39.5%,[13] which was found to influence the risk factors on the socioeconomic and environmental models. Gini index and wet season are the main drivers of higher transmission of malaria and the others have a marginal effect.

Education and employment: Selected variables are given in Table-5 below.

Table-5: Education and Employment; Selected Variables (2019)

Education and Employment Variables	Value
Literacy of population (of 7+ years) [Male/Female]	75.2/71.2
Literacy rate, adult (% ages 15 and older) [	73.9
Youth Gender Parity Index*	1.02
Net female school enrolment rate	98
Employment to population ratio, 15+, female (%) (18modelled ILO estimate)	33.99
Employment to population ratio, 15+, male (%) (m18odelled ILO estimate)	78.90
Female labor force participation rate (% of female population ages 15+) (modelled ILO estimate)	36.37

*: The gender parity index (GPI) of the youth literacy rate is the ratio of the female to male literacy rates of the population aged 15 to 24 years. A GPI value between 0.97 and 1.03 is usually interpreted to indicate gender parity.

Source: https://datacatalog.worldbank.org/dataset/world-development-indicators; Health Bulletin, MoHFW, GoB, 2019; Human Development Report, 2020 – http://www.hdr.undp.org/en/countries/profiles/BGD; https://data.worldbank.org/indicator/SE.ADT.1524.LT.FM.ZS?locations=BD.

2.5.3 Development Indicators

Human Development Index (HDI) and key SDG indicators are given in Table-6. The 2020 HDI value has put the country in the medium human development category, positioning it at 133 out of 189 countries and territories. Between 1990 and 2019, Bangladesh's HDI value increased from 0.394 to 0.632, an increase of 60.4 percent. According to the SDG profile report Key SDG indicators values and are improving.[14]

Table-6: Human Development Report, 2020: Selected Indicators

Indicators (based on UNDP report)	Value
Human Development Index (HDI) [2019]	0.632
Life expectancy at birth (years) [2019]	72.6
Mortality rate, under 5 (per 1000 live birth) [2018]	30.2
Mortality rate, infant (per 1,000 live births) [2018]	25.1
Expected years of schooling (years) [2019]	11.6
Mean years of schooling (years) [2019]	6.2
Gross national income per capita (2017 PPP US$) [2019]	4976
Current health expenditures (% of GDP) [2018]	2.34

Source: Human Development Report, 2020 - http://www.hdr.undp.org/en/countries/profiles/BGD; World Health Organization Global Health Expenditure database[15]; https://www.macrotrends.net/countries/BGD/bangladesh/healthcare-spending; https://datacatalog.worldbank.org/dataset/world-development-indicators.

2.5.4 Economic Pursuits Associated with Malaria

Major economic activities and livelihoods are found to associated with malaria transmission especially in Chattogram, Cox's Bazar and 03 CHT districts, and other endemic bordering Upazilas of Bangladesh. Major economic activities in which a considerable number of people are engaged in, especially in malaria endemic hilly, forest areas are:

- agriculture and irrigation (people engaged in Jhum cultivation in the hilly areas are at high risk of getting malaria);
- trade (labors engaged in wood/bamboo cutting from deep hilly forest and labors engaged in trading in the hilly border areas are at high risk of getting malaria);

- mining (labors living at border areas and engaged in coal mining in neighboring country are at high risk of getting malaria);
- fishing (fishermen catching fish from lake and large-medium-small ponds are also exposed to biting of mosquito and hence at high risk of getting malaria); and
- other development works especially in 03 CHT districts (such as labors engaged in brickfield, road construction is at high risk of getting malaria); and
- women engaged in collecting fruits, banana, other resources from deep forest are also at high risk of getting malaria.

Seasonal migrations of labor and mobility are also associated in the local transmission of malaria especially in the hilly forest districts.

2.6 Health Seeking Behaviour; Cultural Practices and Settlement Patterns in Hard-to-Reach Areas

In general, people in urban areas access both public and private sector healthcare services dependent on ease of access, expenses, quality of services. In rural areas, public sector health care services as well as private practitioners (both formal and informal) are availed. Due to literacy rate, lack of awareness relating to demand and supply of healthcare services, availability of healthcare services, most of the community people especially prefer treatment from village doctors (Kobiraj and Hekims), ayurvedic and homeopathic doctors, and other traditional healers. Besides, traditional clothing of certain ethnic minorities fails to provide complete protection against mosquito bites. The tribal groups usually are hardworking and active people, who maintain a hard livelihood. Their means of livelihood and choice of lifestyle usually make them vulnerable. The tribal groups have a diverse community, some of them live within paras with clustered households, and some prefer a scattered living with a fair distance. This poses challenges when the tribal community like to seeks malaria services apart from rendering household visits by community health workers difficult within a limited time and/or during monsoon/post-monsoon season.

2.7 Human Rights-Related Barriers and Inequities

Human Inequality Coefficient for Bangladesh is 23.7% in 2019.[16] Underserved populations are facing healthcare service deprivation due to barriers and inequities such as poverty, social exclusion, cultural and traditional norms, financial constraints, and distance to health facilities. Underserved populations are likely to experience higher risk of morbidity and mortality related to malaria, due to the barriers and inequities that they face to access to basic quality healthcare services. It is crucial to protect patient dignity, privacy, and confidentiality in respect to medical ethics. The number of CCs needs to be increased to reduce those barriers and inequities, because malaria prevention and treatment services (amongst other healthcare services) are mostly delivered by primary health care and community systems. For forest goers and jhum cultivators to seek treatment in the village from health worker/volunteers or at health facility located in the nearby town consumes a lot of time and money. This situation is exacerbated when travel becomes even more difficult during monsoon season. It is for this reason many forest workers/goers take medicines with them and indulge in self-treatment, which may be useless or even dangerous.

The NMEP commissioned technical assistance in 2020 to obtain understanding of the human rights and gender-related barriers to access in the context of malaria.[17] Key recommendations include:

- Increase the coverage by community health workers/volunteers to cater for the needs of mobile and migrant populations and consider extended working hours of the CCs.
- Introduce ‘know-your rights’ in BCC and community outreach activities as well as integrate ‘basic rights literacy’ in malaria trainings and sensitization sessions with public sector service providers, law enforcement agencies, since women, children, and workers in border areas face challenges in accessing services due to their socio-economic or legal status.
- Mobilise and orient women champions among the FDMN and host communities towards their empowered participation.

- Ensure LLINs for key and vulnerable populations in endemic districts with prioritisation of the special needs for cross border/forest workers and other mobile and migrant populations.
- Consider identifying and orienting a man and a woman amongst mobile and migrant population groups on first aid, malaria diagnosis and treatment with RDT and antimalarials with provision of requisite supplies besides essential medicines for body aches and pains, fever, malaria, diarrhoea and first aid.
- Consider feasibility of providing 'Forest Packs' for mobile and migrant populations in forest/border areas. These packs may include RDT, ACT and other antimalarials, LLINs (hammock nets) and repellents following sensitization on use. Appropriate dressing like wearing long-sleeved clothes, etc. needs to be emphasised.
- Ensure awareness generation activities and sensitisation/orientation sessions in local dialects/languages. Community consultations should inform Social Behavioural Change Communication (SBCC) strategies and tools towards enhancing knowledge, shifting attitudes and cultural norms and produce positive change in a wide variety of behaviours and inculcate community's sense of ownership.
- Ensure LLIN distribution to pregnant women and consider chemoprophylaxis, use of LLINs and antimalarial drugs are essential. Carry out targeted communication campaigns, to change the perception that antimalarials are harmful for pregnant women. Strengthen integration of malaria prevention and treatment within antenatal care.
- Consider establishing CCs along international border areas for rigorous malaria surveillance, case detection and treatment services to prevent possible cross border transmission of drug resistant malaria parasite (P. falciparum).

Forcibly Displaced Myanmar Nationals (FDMN) [Rohingya refugees): More than 1 million FDMN are residing mostly in camps and some of them within the host communities in Bangladesh. They are also exposed to malaria risk while collecting firewood. Under the leadership of the Government of Bangladesh, the MoHFW, UN agencies and a wide range of NGOs network (local and international) are providing health services to FDMN. Prevention and case management services for malaria are being provided through these networks. Additionally, the NMEP provided LLINs to FDMN with the estimation of one net per each household and envisages continuation of coverage of this high risk with support from the development partners besides GoB resources.

2.8 Gender and Age-Related Barriers and Inequities

In Bangladesh, economic and social position of women has gradually improved in line with education, income-generating activities, access to microfinance and employment in the garment industry. Women constitute a substantive part of workforce in the country today. However, gender equality remains an issue. The 2019 female HDI value for Bangladesh is 0.596 in contrast with 0.660 for males, resulting in a GDI value of 0.904, placing it into Group 4 countries with medium to low equality in HDI achievements between women and men. Further, Gender Inequality Index (GII) reflects gender-based inequalities in three dimensions – reproductive health, empowerment, and economic activity. Bangladesh has a GII value of 0.537, ranking it 133 out of 162 countries in the 2019 index.[18]

Pregnant women are at greater risk of developing severe malaria in most endemic areas due to decreased immunity, although available evidence suggests that in the event of equal exposure, adult men and women are equally vulnerable to malaria infection. Moreover, cultural or gender norms may dictate certain limitations on mobility of pregnant women or their ability to frequent public places, possibly impeding their ability to utilize health services. Gender inequalities that sometimes hinder effective responses to malaria and health vulnerabilities for women (pregnant women, forest goers) are addressed by strengthening/orienting the program implementation to ensure right to health amongst women and girls. At the same time, health vulnerabilities for men (forest goers, migrant and mobile populations, etc.) are also being addressed by focusing on interventions for men and boys. In addition, gender inequalities are also being addressed through progressive universal coverage by health care services at all levels. The GoB is also improving access to health care services by strengthening the public health system at the grassroots.

Involvement of both women and men service providers at all levels including district levels and below are improving equal access to case management and community surveillance even in hard-to-reach areas. Notably, village-based multi-purpose health volunteers have recently been introduced, many of whom are young women/girls. Women are able to utilize LLIN, to receive antenatal care, or to take their malaria-stricken children to health services without relatively less inhibition. Continuous LLIN distribution to pregnant and under-5 children, key and vulnerable populations complemented by BCC, community engagement campaigns especially in high burden areas are absolute priority of the NMEP. In high endemic CHT areas especially, there is matrilineal system and women are the head of family structures among some ethnic minorities and tribal communities. However, challenges remain.

The NMEP is committed to minimize barriers and inequities related to human rights and gender and strengthens malaria prevention and treatment services at all levels of community. NMEP coordinates these activities among partners such as the WHO, partner NGOs, and other partner agencies, such as, UNHCR, IOM. The following activities will be conducted to protect human rights and gender equality through the NSP period and in policies and policy-making processes:

- Invest and scale up programs to support women and girls, including programs to diagnosis, treatment, preventive services, and IEC activities to promote equity for accessing malaria services including gender- and age-related disparities.
- Support the meaningful engagement of key and vulnerable populations and networks.
- Include and analyse indicators disaggregated by gender and high-risk groups.

Trained female health volunteers/health workers of partner NGOs have played and continue to play pivotal role in improving access to malaria interventions at community level. Likewise, there are many instances of social mobilization groups, self-help groups who are also playing important role in social mobilization and community-based interventions. Additionally, the partner NGO has initiated development of a module titled as "Know-Your Rights" along other BCC/IEC materials, which will promote early treatment seeking behaviour and encourage taking preventive measures amongst key and vulnerable populations, thereby complementing various efforts to address barriers related to gender & human rights.

The NSP 2021-2025 draws from the community consultations related to CRG barriers to access held in 2020 as well as aligns with the upcoming updated version of the GTS 2016-2030 as well as the upcoming GF strategy 2023-2028 with a key focus on focus on equity, human rights and gender, most vulnerable populations to improve health outcomes as well as the RBM Partnership to End Malaria and Malaria No More “Achieving a Double Dividend: The Case for Investing in a Gendered Approach to the Fight Against Malaria” (2021).

2.9 Housing and Infrastructure

2.9.1 Housing conditions

In malaria endemic rural and CHT areas, housing conditions influence deployment/use of prevention interventions and malaria. Traditional elevated ‘Machang’ houses made of bamboo, wild grass, and straw, mainly a popular housing choice among the ethnic tribal communities of the CHT. The space underneath the Machang is used for various purposes such as keeping livestock, storing fuel wood, etc. The rifted flooring of these houses makes an easy way for the movement of mosquitoes at night unless a mattress is used. Besides residing in hilly forest areas, such easy access to vectors boosts the malaria transmission further.

2.9.2 Infrastructure, communication

Infrastructure and communication affect accessibility and deployment of logistics and uptake of malaria interventions. The fluctuating climatic conditions in remote areas pose huge challenges for transportation/communication thereby slowing the intervention processes. The geographical locations of

hard-to-reach areas, adds up to further challenges for health workers, where they can visit only once/twice a month with necessary logistics for interventions. In many areas, monsoon makes the movement via land hard and very limited compared to dry seasons, restricting health worker movements. Further, access to telecommunication is very poor in remote areas. It becomes hard-to-reach the staff/health worker via phone at times of need. Since access of mobile networks is available at only certain sites, which is known by the programme organizers, it often only supports a one-sided communication.

2.10 Climate: Meteorological Variables

Bangladesh's climate is tropical with a mild winter from October to March, and a hot, humid summer from March to June. A warm and humid monsoon season lasts from June to October and supplies most of the country's rainfall. The country is flat and occupied by the huge Ganges-Brahmaputra Delta and therefore, highly prone to floods, as well as to storm surges when cyclones hit the Bay of Bengal. Bangladesh Meteorological Department (BMD) calculates the monthly and seasonal variation (minimum, maximum and dry bulb) of climate parameters to understand the temporal and spatial distribution of temperature, surface wind, rainfall, relative humidity and their relationships to malaria distribution and transmission.

2.11 COVID-19 and malaria services

In Bangladesh, from 3 January 2020 to 20 August 2021, there have been 1,447,210 confirmed cases of COVID-19 with 24,878 deaths. As of 16 August 2021, a total of 21,728,150 vaccine doses have been administered.[19] Several measures, financial stimulus package, food security especially to the vulnerable population, amongst others, have been and continue to be taken by the GoB to alleviate the situation. In the beginning of the pandemic, malaria services slowed down; however, the situation improved as the NMEP/MoHFW/GoB issued guidelines for COVID-19 as well as for maintaining essential services of different health programmes including malaria programme. Supply chain for drugs and diagnostics was/is not interrupted because of provision of buffer stock. Health workers and volunteers with the support of village head supported implementation of malaria interventions in most endemic areas. Innovative methods were adopted, viz. organizing virtual training and meetings, physical meetings with strict public health measures and combining messages for COVID-19, malaria and dengue. Mass LLIN distribution was done before the peak transmission season for malaria with improvised distribution mechanism including door-to-door distribution. Further, there was reduction in the mobility of forest goers and jhum (shifting) cultivators that might have helped in reduction of case incidence as well. The GF approved reprogramming of fund for COVID-19 response helped to procure PPE and supplies for health workers and laboratory staff. In addition, the GF supported the GoB by awarding an amount of US$ 55,552,377 for strengthening COVID-19 Response Mechanism. Several partner agencies including partner NGOs and technical and development partners have also supported and continue to support the GoB in tackling the pandemic.

CHAPTER-3 MALARIA SITUATION

3. MALARIA SITUATION

3.1. Historical Perspectives

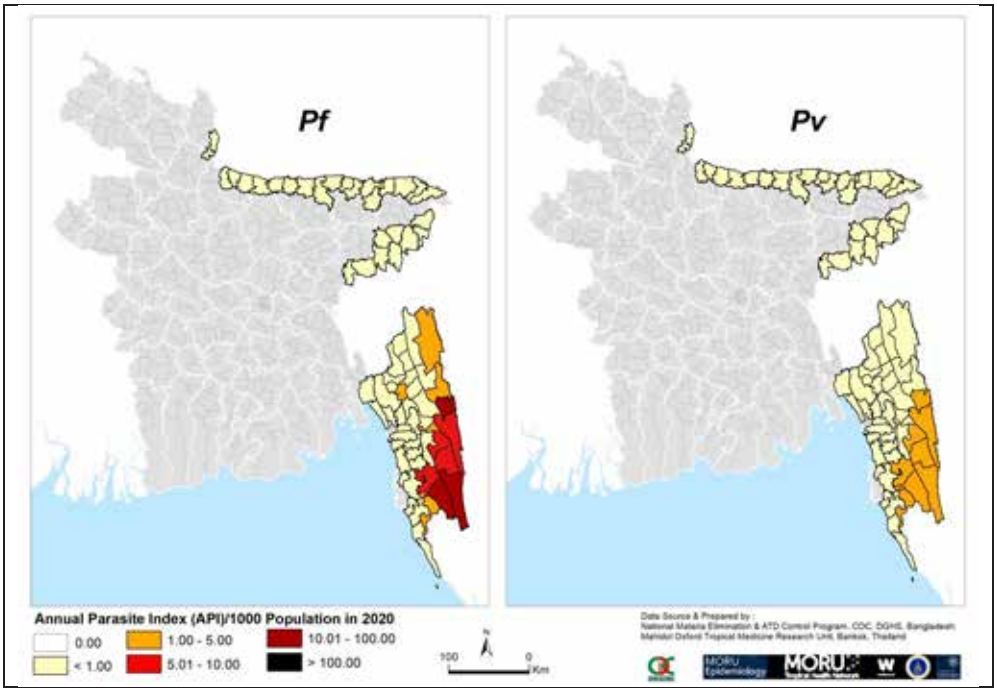
Malaria has been an age-old disease in Bangladesh. However, before 1971, malaria in Bangladesh was almost under control due mainly to the frequent use of Dichloro Diphenyl Trichloroethane (DDT) by then Malaria Eradication Program of the country. After the independence of Bangladesh in 1971, the number of cases started increasing. The key reasons were banning DDT in 1981, lack of significant commitment and funding for malaria control. In 1990, the GoB declared malaria as a public health problem due to high morbidity and mortality. The estimated malaria disease burden on a scale of Years of Life Lost (YLLs) ranked top 18 in 1990 causing 771,000 years of life lost. However later, due to effective malaria interventions, the YLLs remarkably reduced, and the malaria disease burden improved significantly and the rank of malaria on a scale of YLLs moved down to 44 in 2010 indicating that the incidence, prevalence, morbidity, and mortality have improved.[20] Since then, overall reduction in disease burden has been significant.

3.2 Malaria Epidemiology

3.2.1 Malaria Parasites

The epidemiology of malaria in Bangladesh is highly complex. All four species of human plasmodia (*falciparum, vivax, ovale, malariae*) are present. However, most of malaria cases are caused by *Plasmodium falciparum (plus mixed infections)*, which represented respectively 93% of all malaria cases in 2015 and 80% in 2020 versus 7% and 20% to *Plasmodium vivax (P. vivax)*. The geographical distribution of *P. falciparum* and *P. vivax* malaria is broadly similar (Figure-2). The evolution of and response to parasites' susceptibility to antimalarial drugs over time remain acceptable. Thus, the drugs in use are still effective.

Figure-2: Annual parasite incidence per 1,000 population (*P. falciparum* and *P. vivax*), 2020



Till date, any case of *P. knowlesi* has yet to be reported. However, healthcare service providers will be made aware that available RDTs (*P. falciparum*/*P. vivax*) are not significantly sensitive to detect *P. knowlesi* infections.

3.2.2 Malaria Vectors

The most efficient vectors, members of the *An. (Anopheles) dirus* species complex such as *An. baimai*, cannot survive without dense shade and high humidity. Deforestation therefore generally leads to substantially reduced malaria transmission. The next most efficient vector is *An. minimus (senso lato).* This species is also primarily forest-based but can survive in less densely shaded forest, forest fringes and in the patchy bamboo thickets that commonly persist post-deforestation. This relatively anthropophilic and relatively endophilic vector is highly susceptible to the effects of indoor residual spraying (IRS) and its numbers seem to have diminished very significantly since the eradication era when IRS was widespread. Primary vectors such as *An. philippinensis* and *An. dirus,* and secondary vectors such as *An. vagus* and *An. annularis* occur in areas of irrigated open farmland and in flooded rice fields and sporadic secondary transmission can take place in these areas because of the introduction of malaria by infected people arriving from endemic areas. *An. maculatus and An. willmori* have also been implicated as vectors of limited capacity. *An. sundaicus* has supported significant transmission in coastal areas in the past, particularly in areas where aquaculture projects have been abandoned resulting in accumulations of brackish water. As with *An. minimus*, this vector is highly susceptible to the effects of IRS and its numbers have also diminished very significantly since the eradication era.

The behaviour of malaria vectors in Bangladesh varies depending on climatic and other environmental factors. Both indoor and outdoor biting takes place, but primary vectors are characterized, at least seasonally, by their early outdoor biting habit. This is a key feature of the epidemiology of malaria in Bangladesh, which limits to some extent the effectiveness of key interventions for vector control and personal protection.

An entomological study by the NMEP in malaria endemic areas of Bangladesh (2016-2017) showed that the primary and most virulent vector of malaria *An. baimai* has changed their biting behavior. The suspected vector *An. willmori* indicated that the species might be playing role in malaria transmission besides slight change in biting time to evening hours. The highly anthropophilic mosquito *An. minimus* seemed to convert to feed blood from human to animal. The density of *An. vagus* was found higher in all three sentinel sites. *An. culicifacies*, the principal vector of West Bengal (India) is re-emerging in the border Upazila Kolmakanda and others in Netrokona district. More entomological evidence (intensity of transmission, behaviors, etc.) and vector distribution atlas per district and even per Upazila are needed to better measure the level of transmission. Another recent study by the NMEP (2019) entomological aspects in some malaria free areas (non-endemic) of central, western and border districts to malaria endemic and malaria prone districts, revealed only one primary vector, *An. philipinensis*. The secondary vector *An. vagus* was more abundant although another secondary vector *An. annularis* density was very low. There was no *An. culicifacies*, the principal vector of West Bengal, although the Upazila has border with India.

Vector control is an integral part of the NMEP. The NMEP has an entomology unit, with focus on routine monitoring of vector bionomics and insecticide resistance. An 'Integrated Vector Management (IVM)' Strategy will be developed and will be operationalized during the implementation of NSP 2021-2025. Despite a portion of the vector biting occurring early and outdoors, long-lasting insecticide treated bed nets (LLINs) play a critical role in reducing malaria transmission. LLIN coverage is near universal in endemic districts/areas with API>1/1,000 population. IRS is not carried out routinely. The NMEP is attempting to replace deltamethrin by organophosphates or carbamates. In addition, larval source management is and will be considered, as appropriate.

3.2.3 Major Malaria Ecotypes

Malaria distribution and transmission vary from location to location and from one population group or individual, or from one situation to another and can be broadly divided into five ecotypes (Table-7). The following geographical characteristics such as forest, coastal zones, rivers, lakes, swamps, dams, lowlands, wetlands, and altitude have their relationships to malaria distribution and transmission. These characteristics are linked to risk groups, vector behaviour, local infrastructure, and health services coverage. The risk factors also associated to malaria transmission include changing ecologies, marked deforestation and large-scale population movements associated with seasonal labour, development projects, refugee crisis and climate change. Intense malaria transmission is largely restricted to hilly, forested and forest fringe areas of the three Chittagong Hill Tracts (CHT), viz. Bandarban, Khagrachari and Rangamati.

Table-7: Malaria ecotypes in Bangladesh

S. No.	Ecotypes Features	Location	Transmission	Vectors	Population Affected
1.	Forest Hills	South-east border with India & Myanmar, primarily located in the three CHT districts	Perennial but highly seasonal and epidemic prone	*An. baimai (dirus)* *An. minimus*	Ethnic minority, "Jhum" cultivators, Forest goers, Pilgrims & tourists,
2.	Forest Fringe	Areas where the foothills stretch towards the plains	Perennial low-level seasonal transmission, Outbreaks occur but are generally focal	*An. baimai (dirus)* *An. minimus* *An. philippinensis*	New shelters; Labour for development work; Seasonal, agricultural laborers & plantation workers
3.	Plains: Border-belt areas	The belt of land within 10 km of the country's international border	Unstable transmission; Outbreaks occur but are generally focal	*An. philippinensis* *An. aconitus* *An. annularis* *An. vagus*	Settled population, Returnees from endemic areas
4.	Plains areas	The vast part of The country	Free from indigenous transmission; but cases are imported, and sporadic transmission may occur	*An. philippinensis* *An. aconitus* *An. annularis* *An. vagus* *An. subpictus*	Returnees from endemic areas
5.	Urban areas	Cities and towns	No malaria transmission but cases may be imported.	Not known	Returnees from endemic areas

Source: NMEP, 2021

Note: Issues: Limited accessibility hamper treatment seeking; Language differences hamper communication; Cross-border population may have risk of importing ACT resistance malaria; Lack of familiarity with malaria amongst health staff especially in low or non-endemic areas can result in delayed treatment, severe malaria and death.

3.2.4 Populations at risk

It is estimated that 18.74 million (~11.5% of the 163 million country's total population) people living in the 13 Districts (72 Upazilas) are at risk of contracting malaria infection. In the rest of the 51 districts (and a few areas within endemic districts) that are considered 'non-endemic', determination of the status is being initiated.

The wide variety of population groups at risk of malaria in endemic areas of Bangladesh is categorized broadly into static & mobile and migrant populations (Table-8). The level of malaria risk for each of these groups is dependent on several location-specific factors including degree of endemicity, accessibility to and strength of health system services besides socio-economic factors.

Static populations

- *Traditional farming communities* (see also mobile and migrant populations below). Traditional farming communities belong to many different ethnic groups. Most have their own distinct language and often only a small proportion of group members (predominantly men) speak the national language, making communication of health messages extremely problematic. Poverty in these communities is often extreme. Minority groups tend to be concentrated in remote areas (commonly along borders) where access to healthcare services (both public and private sector) is relatively limited. All age groups tend to be exposed seasonally to periods of transmission, which can be intense. Adults are usually partially immune but children and pregnant women are extremely vulnerable.
- *Forest fringe communities.* Many ethnic majority populations live in rice growing areas close to the forest. Villagers, predominantly young men, also make frequent overnight visits to the forest to hunt and to collect construction wood and other products. These visits frequently result in malaria infection. People returning to the village carrying malaria parasites can infect anopheles mosquitoes breeding in and around the village and although these species are less efficient vectors than the ones found in the forest, limited local transmission can occur. All age groups are therefore at risk, but most cases are found in adult males.
- *Workers in development projects.* Private companies [and at times govt. sector] involved in large-scale construction programmes (dams, bridges) & other commercial projects (road construction, large-scale logging etc.) employ large numbers of staff/labour and house them (or expect them to house themselves), often together with their families, in highly endemic areas where sparse/no public sector health care services exist. Some of these companies do provide good quality health care for their employees & dependents, but many do not.
- *Tea garden workers.* Tea gardens are common in the foothill areas of Moulvibazar, Sylhet and Chittagong. Tea plantation workers are amongst the most vulnerable populations in Bangladesh. They are largely illiterate and socially excluded from the mainstream Bengali population. Women employed for plucking tea leaves make up about 75% of the labour force. Malaria burden in tea gardens is relatively high, particularly amongst women suggesting that transmission takes place amongst the tea bushes immediately after sunset as the women return home from their day's work.

Mobile and migrant populations

- *Traditional farming communities.* Many ethnic minority groups have large communal villages that are left all but empty for much of the year as families spend months away tending their crops in small farms scattered through the nearby forest. In addition, individuals (usually young men) also spend short periods away from their homes or forest farms, hunting or collecting forest products. Access to healthcare is often more difficult in such settings. Many of these groups are known as 'Jhum' cultivators (traditional slash-and-burn).
- *Forest workers/goers and seasonal workers.* People involved in forest-based activities in both the formal and informal sectors are at high-risk of contracting malaria. Key risk groups include workers/labour involved in timber extraction (including illegal loggers and sandal wood collectors and groups digging out timber stumps to produce carved ornaments), workers involved in infrastructure development projects (such as building roads and dams). Seasonal workers harvesting fruit from

orchards and rice close to the forest are also at high-risk. While the forest workers/goers described above are mostly men, the seasonal workers include many women. The workers may come from villages near the forest, but many also come from other regions when seasonal demand for labour is low. Often, they have little or no immunity to malaria.

- Defence se*rvices/security forces.* The Defence services/security forces, forest/wildlife protection services, form a sizable and particularly mobile high-risk group. They are often deployed in hard-to-reach areas, based in camps located in the forest or forest fringes. While on night patrol duties they are at particularly high-risk of contracting malaria. The fact that they are often redeployed long distances to new malaria endemic areas, including in Africa during UN peace-keeping missions, means that they have the potential to introduce and spread new parasite strains.
- *Rohingya refugees* (referred as Forcibly Displaced Myanmar Nationals - FDMNs). Due to on-going clashes between the Myanmar Army and the Rohingya population in neighbouring Rakhine State, refugees remain a significant problem in Bangladesh, especially Cox's Bazar. These populations generally have less access to health services and hence are less well protected from malaria than other populations in the same areas, although in FDMN camps, efforts are in progress to provide malaria services including LLINs.
- *Cross-border workers.* These are a diverse mobile population who cross the border for work, both legal and illegal. Some are long term or permanent migrants, while others cross the border often or even daily. While many of these spend their time abroad in urban or other non-endemic areas, others, particularly seasonal agricultural workers, and coal miners in the case of Netrokona, are based in areas where transmission does occur. There is a possibility that cross-border workers getting infected in endemic districts of India/Myanmar. There is also particular concern given the possibility of multi-ACT resistant *P. falciparum* being introduced to receptive areas of Bangladesh from parts of the Greater Mekong Subregion (GMS) by returning workers/migrants, refugees.
- *Migrants*. Migrants may be found in most of the situations described above, working for large private companies, living in unauthorized housing developments, working as seasonal agricultural labourers or as informal forest workers. Migrants, both national and international, are a particular concern in that they could potentially contribute to the spread of artemisinin resistant malaria parasites.
- *Tourists.* Increasingly, tourists from other parts of Bangladesh including non-endemic districts are visiting areas reporting malaria cases, especially in the CHT districts. This poses a huge threat of re-establishment of malaria to non-endemic areas, as well as susceptibility of tourists to the disease.
- *Staff/workers of national/international organizations.* Increasing number of tourists and international organizations/NGOs from different parts of the country/world are also visiting/staying in Cox's Bazar district including in FDMN camps.

Table-8. Key population groups at risk of malaria

Static populations • Ethnic minority groups [EMGs] and ethnic majority (including Forest fringe communities, traditional farming communities). • Population in new settlements. • Workers in development projects [including those in camps associated with large-scale construction projects (dams, bridges, mines, etc.). • Labour/staff in rubber plantations. • Labour/staff in tea gardens. • Labour/staff - private sector/government sector. *Mobile and migrant populations* • 'Jhum' (traditional slash-and-burn) and paddy field farming communities visiting their forest farms (commonly EMGs). • Seasonal agricultural labourers (particularly those moving between low-endemic plains areas and high-endemic forested foothill areas).

- Defence services.
- Forest workers in the formal sector (police, border guards, forest/wildlife protection services).
- Forest workers/goers in the informal sector (hunters, people gathering forest products such as precious timber, construction timber, rattan, bamboo).
- Rohingya refugees (FDMN).
- Labour/staff in transient or mobile camps associated with commercial projects (road construction, large-scale logging).
- Other economic migrants.
- Formal and informal cross-border migrant workers (legal and illegal workforces), example, Netrokona residents mining coal in India.
- Pilgrims (religious individuals/groups spending extended periods at mosques and temples in endemic areas).
- Tourists travelling from urban areas to endemic forested foothills.
- Staff/workers of national/international organizations.

Source: NMEP, 2021

All the populations at risk, except those in permanent settlements close to a health centre, can be considered to have disproportionately low access to treatment services and all the mobile and migrant populations can be considered to have disproportionately low access to prevention services as well. Key factors contributing to this inequality include: language (often only a small proportion of people from ethnic minority groups speak the national language making communication of health messages problematic); remoteness (malaria transmission tends to be most intense in remote areas, commonly along borders, where access to both public and private sector healthcare services is relatively limited); poverty (the populations living in or passing through these remote areas are generally some of the poorest in the country); marginalization (ethnic minority groups and migrants are amongst the most marginalized groups in the country); and mobility (the high mobility of some individuals means that they may have moved to non-endemic areas, where health workers are less likely to be familiar with malaria, when symptoms first appear).

Providing malaria services to high-risk static populations is relatively straightforward. The location of settlements, plantations, construction sites and development projects can be mapped, populations can be quantified and plans for delivering interventions can be formulated. Furthermore, post-delivery checks can be made to validate coverage. So far, generally the 'established villages' have been well served by routine prevention operations. A comprehensive package of services for the remaining static population groups is deemed crucial as Bangladesh moves towards elimination.

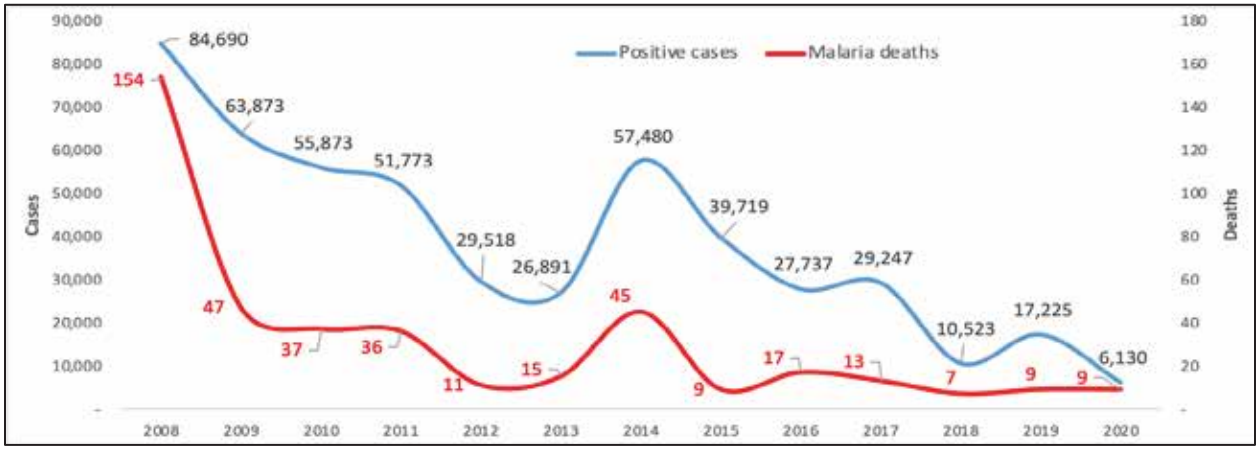
The challenges to service delivery among mobile and migrant populations are more complex. Mapping is often not possible; and there may not be any actual houses or other structures in which to suspend an LLIN. The population size may vary from day to day, making quantification of the needs difficult. In the case of illegal migrants and individuals involved in illegal activities, fear of punishment often prevents any contact with official groups or groups that are perceived to be official. Therefore, getting accurate information for health action from them is a sensitive and complex multi-sector task. While forest goers in the formal sector, such as police, border guards and forest/wildlife protection services, may receive some level of protection in the form of LLINs and access to treatment, informal forest workers are often unprotected. When ill, most of the seasonal workers attend health facilities close to the forest where they work, but many also seek treatment when they return to their homes in non-endemic areas where malaria may not immediately be suspected. In this way, these individuals also effectively have disproportionately low access to treatment services. Malaria related mortality in this group could be relatively high as a result. Reaching each of these mobile populations with appropriate prevention and case management services is crucial to the success of malaria elimination efforts. Providing a comprehensive package of services to the population at risk, both static and mobile and migrant populations would be crucial as Bangladesh moves towards elimination.

3.3 Malaria Situation

In the past decade, Bangladesh made significant progress in reducing malaria morbidity and mortality. Since 2008, malaria burden had been declining each year, although in 2014 there was an upsurge in the CHT recording an increase of 114% compared with 2013. In 2019, another malaria upsurge hit the country with an increase of 64% compared to 2018 (Figure-3), although a decline of 57% was recorded in 2019 relative to 2015. In 2020, the number of malaria cases was 6,130, recording a decline of 85% and 64% in caseload in 2020 relative to 2015 and 2019. Whilst such gains are impressive and the country has been tackling the COVID-19 pandemic since early 2020, comprehensive assessment of impact of COVID-19 on malaria service delivery, surveillance, and M&E in 2020 and 2021 is envisaged.

Despite progressive gains, malaria remains an important public health concern in Bangladesh. According to World Malaria Report 2020, malaria in Bangladesh is still endemic and contributes to 2.6% of reported malaria cases and 5.6% of reported malaria deaths in the South-East Asia Region.

Figure-3: Malaria cases and deaths: 2008 – 2020



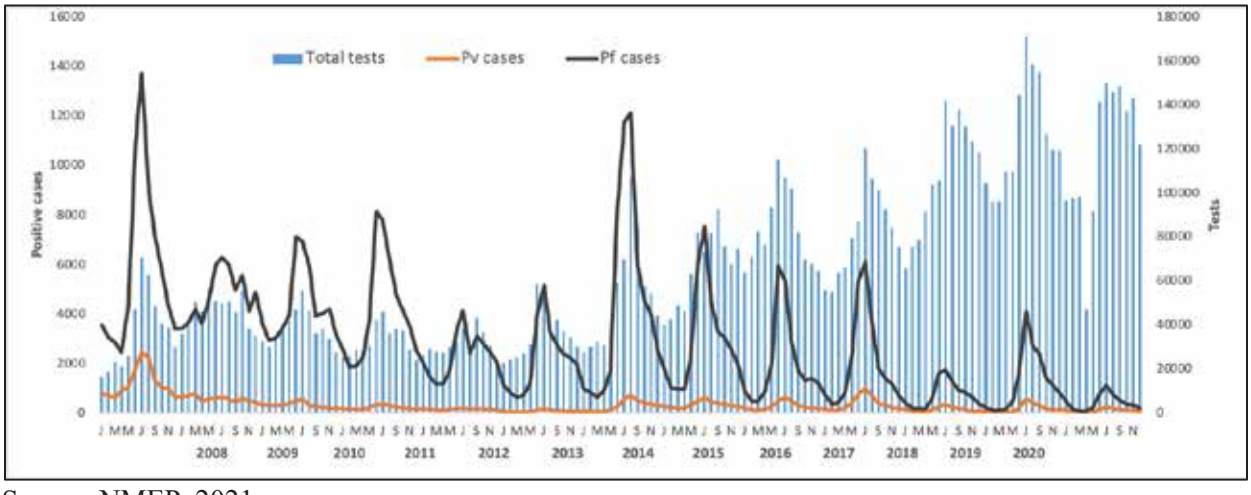
Source: NMEP, 2021

The malaria caseload reported by NMEP is based on data generated from public sector health care services and community level point of services with partner NGOs in 13 endemic districts. Private sector figures are usually not part of the malaria caseload, although reporting is initiated. In 2019 and 2020, 46 and 18 malaria cases were reported from the private sector. A private sector strategy will be developed, and orientation will be carried out to streamline and expand case management and reporting according to national guidelines nationwide including reporting from 51 'non-endemic' districts (and a few 'non-endemic' areas within endemic districts).

From 2008, when 84,690 malaria cases were reported, malaria burden (*P. falciparum* and *P. vivax*) declined each year up until 2013 when just 26,891 cases were reported. As seen in Figure-4, in 2014 there was an outbreak, which saw *P. falciparum* caseload increase by 109% relative to the previous year (up from 25,908 to 54,132 cases). There was also a real but more modest increase in *P. vivax* malaria incidence in 2014, with caseload up by 33% relative to 2013. This outbreak primarily affected settled populations in remote forested areas of 03 CHT districts. In total, 57,480 malaria cases were reported in 2014 (relative to 26,891 cases in 2013) and *P. falciparum* malaria and mixed cases accounted for 94% of these (based on data from microscopy and RDTs).[21] A high proportion of mixed cases are noted in case classification data from elimination targeted districts. An outbreak investigation conducted in 2016 concluded that unusual rainfall patterns seemed to offer the most plausible explanation for the outbreak.[22] Since the 2014 outbreak, annual malaria caseload declined steadily again until 2017 when there was a 5% increase in caseload in the CHT and a 7% increase in other endemic districts relative to the previous year. The cause of this was unclear. In 2018 however, caseload fell very significantly in both the CHT and in other endemic districts (down by

65% and 51% respectively relative to the previous year) and only 10,523 cases were reported. However, the number of cases again increased considerably to 17,225 in 2019 (64% increase compared to 2018). Maximum increase in cases is noted in 03 CHT districts viz. Bandarban, Khagrachari, Rangamati - from 9,539 in 2018 to 16,414 in 2019 (72% increase). The number of deaths has also slightly increased from 07 in 2018 to 09 in 2019 (29%). Excessive rainfall caused flooding and landslides in July 2019, which resulted in household/community level challenges to effectively use personal protection measures besides hampering community level follow up regarding regular use of prevention interventions and possible delays in early information sharing/analysis regarding build-up of cases in areas where the intensity of transmission is still high, viz. CHT districts. Moreover, previous mass distribution of LLINs happened in 2017 and therefore, possible issues related to physical integrity and residual bio-efficacy of used LLINs might have adversely impacted effective personal protection.

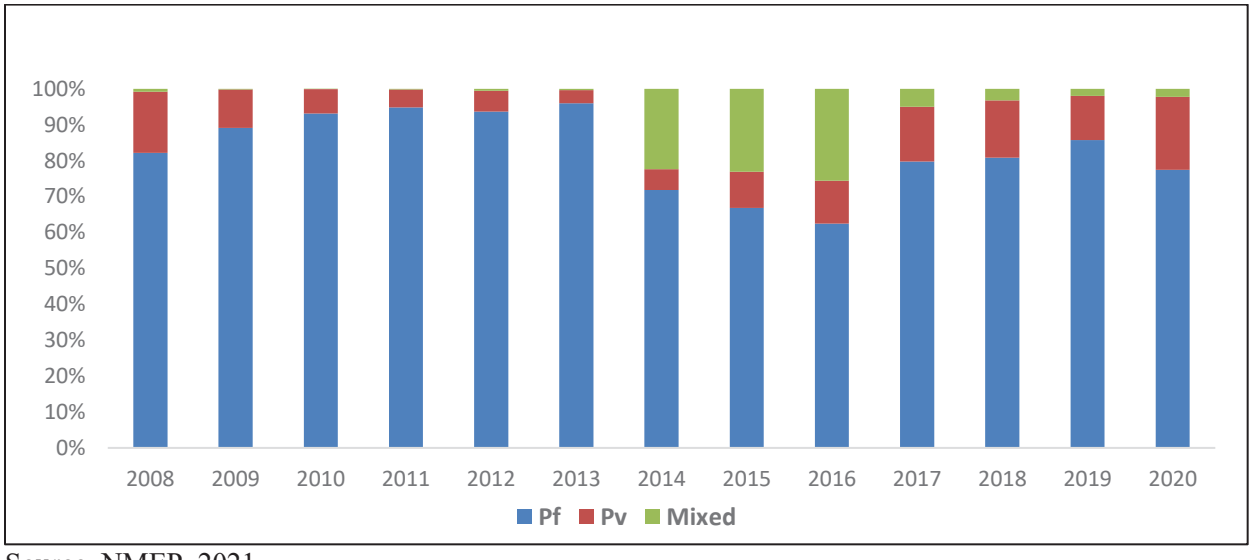
Figure-4: Total tests, *P. falciparum* and *P. vivax* malaria cases (2008 to 2020)



Source: NMEP, 2021

Historically, the vast majority of malaria cases, reported in the country, are caused by Plasmodium falciparum. However, a steady increase in *P. vivax* cases has been observed in last few years. Out of total 6,130 malaria cases reported in 2020, falciparum malaria accounted for ~80% (including mixed cases) of them. Figure-5 illustrates the species wise case proportion during the period of 2008 - 2020.

Figure-5: Proportion of malaria species, 2008-2020



Source, NMEP, 2021

Further, a review of the district wise data presented in Table-9a, 9b reveals that, apart from the 2014 outbreak and the slight increase in caseload in 2017, in most districts overall progress has been made towards malaria control and elimination since 2013. While overall reduction in malaria burden has been impressive, the persistent high transmission in the 03 CHT districts will need much more intensive measures for transmission reduction and moving these districts towards elimination. As mentioned earlier, malaria is becoming an increasingly focal disease in Bangladesh with 03 CHT districts contributing 93% of total cases. In 2020, maximum caseload of 68% and 23% is contributed by Bandarban (4,166) and Rangamati (1,390), respectively, out of the 13 endemic districts (Figure-6). Only these two districts recorded an Annual Parasite Incidence (API) greater than 1 (6.98 and 1.86 per 1,000 population, respectively).

Table-9a, 9b. Annual fluctuations in caseload by district since 2008

a) *P. falciparum* and mixed cases

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Sparkline
Sherpur	370	276	50	47	46	31	31	12	15	5	2	0	0	
Mymensingh	532	1041	400	236	167	72	23	30	14	9	3	1	1	
Netrokona	342	806	350	236	266	192	184	127	92	20	36	4	4	
Kurigram	337	231	84	49	38	12	5	3	3	2	2	1	0	
Sylhet	643	803	620	352	364	332	75	32	8	7	9	9	4	
Hobigonj	405	265	111	62	60	33	48	21	14	18	8	1	5	
Sunamganj	972	851	754	420	499	477	138	47	16	9	6	0	3	
Moulvibazar	1382	1236	685	325	284	160	126	42	24	14	14	3	3	
Chattogram	2272	2609	1333	1261	996	603	739	384	227	203	98	108	28	
Khagrachhari	17907	15106	12017	12679	5772	4031	9667	3692	1963	1382	400	692	124	
Rangamati	23735	12420	12902	12977	7722	7882	16648	13228	8860	7407	2765	5815	1277	
Bandarban	16395	14931	16738	15577	8116	9174	22649	15853	12169	14496	4994	8058	3207	
Cox's Bazar	4989	6445	6005	4973	3489	2909	3799	2237	1025	1230	506	404	229	
Total	70281	57020	52049	49194	27819	25908	54132	35708	24430	24802	8843	15096	4885	
% of cases in CHT	83%	74%	80%	84%	78%	81%	90%	92%	94%	94%	92%	96%	94%	

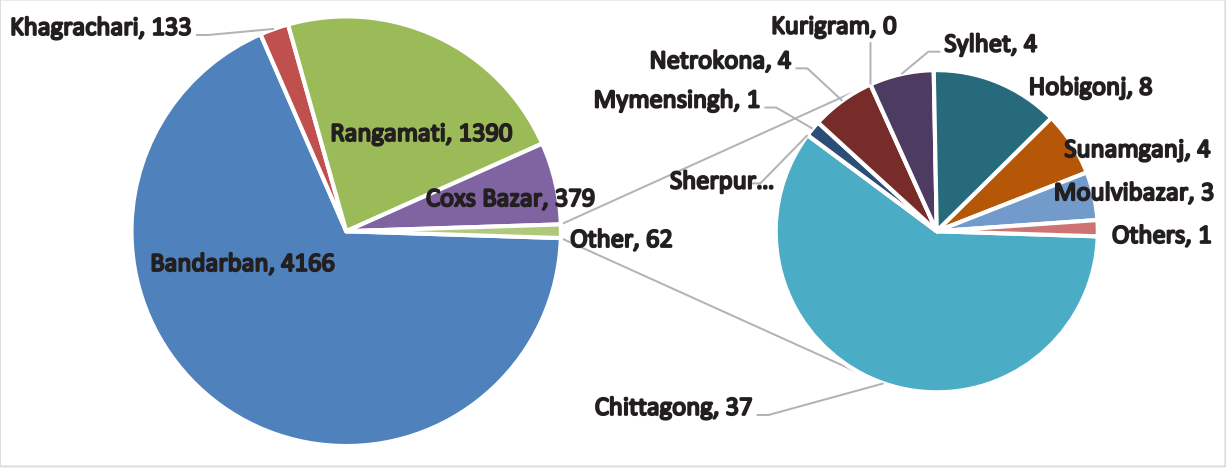
Source: NMEP, 2021

b) *P. vivax* cases

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Sparkline
Sherpur	524	194	22	21	27	12	3	5	1	2	0	1	0	
Mymensingh	263	40	18	8	1	2	3	3	3	2	0	0	0	
Netrokona	118	32	25	34	19	7	24	13	10	4	4	0	0	
Kurigram	346	335	253	119	63	52	4	0	0	0	0	1	0	
Sylhet	198	147	262	92	72	28	33	12	3	16	4	0	0	
Hobigonj	139	26	9	3	12	1	4	1	1	7	0	1	3	
Sunamganj	836	800	380	41	41	11	16	12	7	7	1	2	1	
Moulvibazar	1622	379	259	123	137	38	19	8	2	4	0	1	0	
Chattogram	1096	624	288	154	99	45	93	76	44	41	18	33	9	
Khagrachhari	1766	705	331	273	225	65	229	182	75	61	21	33	9	
Rangamati	4636	2162	1047	692	259	94	518	604	764	880	249	251	113	
Bandarban	1387	803	521	520	345	285	1769	2409	2017	2996	1110	1565	959	
Cox's Bazar	1478	606	409	499	399	343	633	686	379	424	267	231	150	
Total	14409	6853	3824	2579	1699	983	3348	4011	3306	4444	1674	2119	1244	
% of cases in CHT	54%	54%	50%	58%	49%	45%	75%	80%	86%	89%	82%	87%	87%	

Source: NMEP, 2021

Figure-6: Distribution of malaria cases in endemic districts, 2020

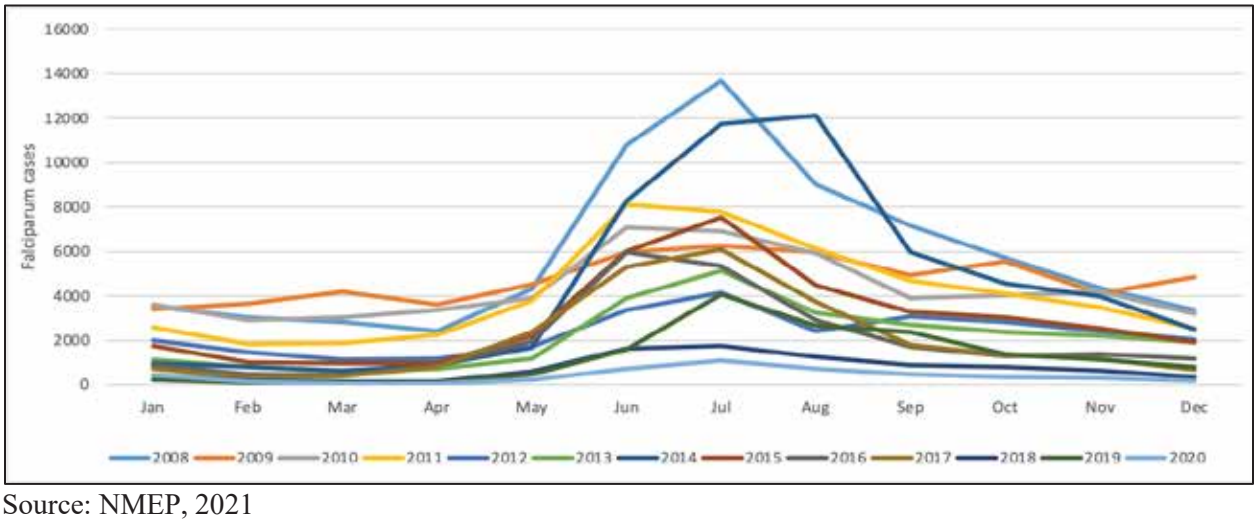


Source: NMEP, 2021

Furthermore, whilst case-based surveillance efforts has been initiated in eight elimination districts from 2015 in Mymensingh and Sylhet zones, efforts will be strengthened for case investigation and classification. Systematic recording and reporting of indigenous and imported cases will also be initiated. The number of imported malaria cases was 129 in 2015, while it was only six in 2019 and two in 2020, with most of those having travel history to India. Comprehensive analysis regarding countrywide scenario will be pursued.

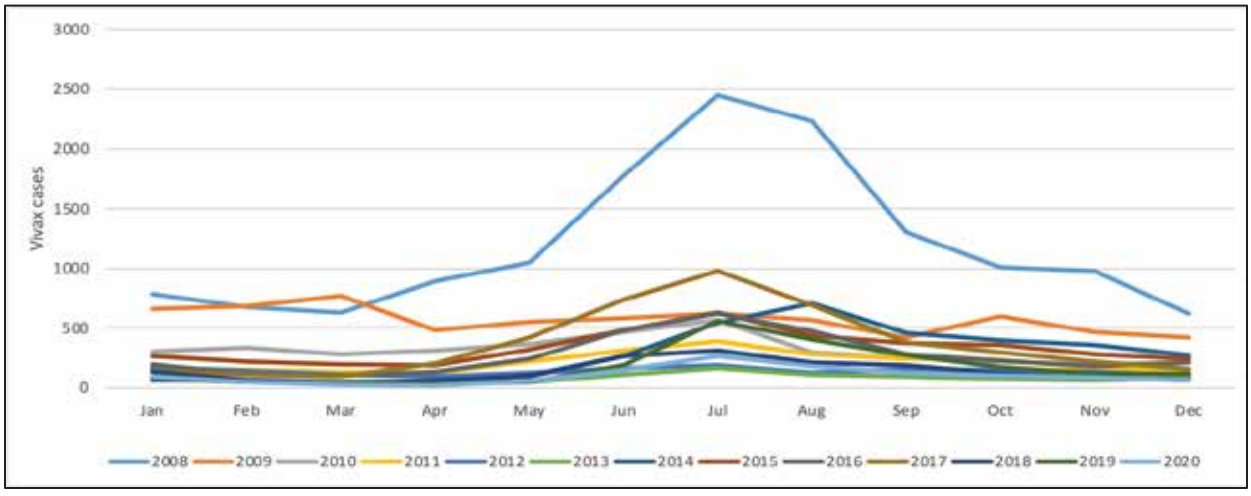
Seasonality of malaria transmission: The seasonality of falciparum malaria transmission shows rapid rise in June and peaks between June and August (Figure-7a). Few cases are seen between February and April. For vivax malaria the picture is broadly similar (Figure-7b), although relapses might result in a significant number of cases being reported after transmission has fallen in September to December.

Figure-7a: Seasonal trends in falciparum malaria, 2008-2020



Source: NMEP, 2021

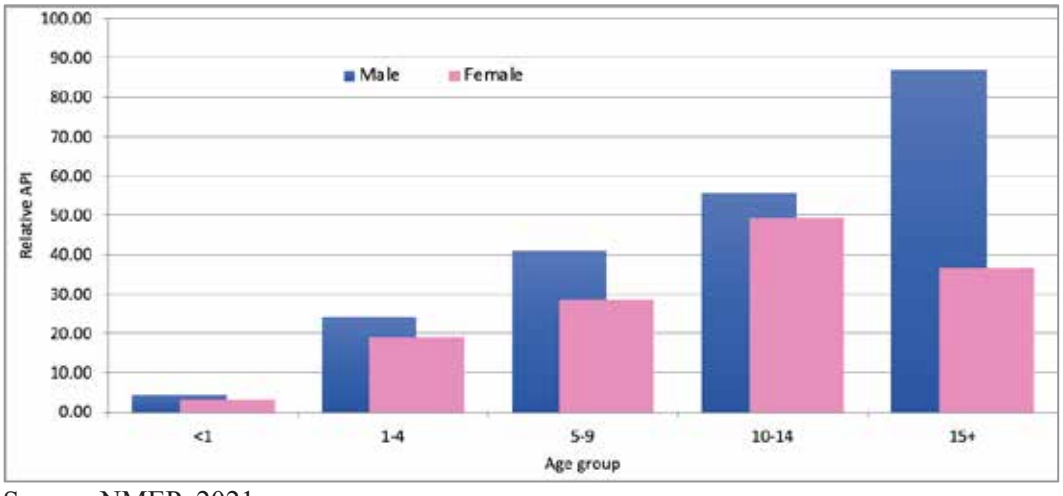
Figure-7b: Seasonal trends in vivax malaria, 2008-2020



Source: NMEP, 2020

Incidence of malaria by age and gender: Figure-8 demonstrates the heterogeneous nature of malaria transmission. Malaria incidence appears to be slightly higher amongst boys than girls (age groups between 1 and 14), which may be the result of the tendency of boys spending more time playing/spending outdoors in the evening. In some communities, intense transmission results in increasing immunity with age plus immunity amongst neonates because of maternal antibodies (as demonstrated most clearly by the lighter pink bars, which relate to females), while in other areas, occupational malaria associated with forest goers/jhum cultivators, etc. results in increased incidence amongst non-immune adult males. Malaria seems to be an "occupational disease" associated with adult men working in endemic settings within the country.

Figure-8: Relative API by age and gender (2020)



Source: NMEP, 2021

Annual blood examination rate (ABER): Malaria elimination programme aims at achieving an ABER of ~10% in populations at risk to ensure that surveillance is adequate to detect transmission. The data presented in Table-10 demonstrates that over the last 5 years Bangladesh has made progress in this regard in districts considered to be at risk of malaria. ABER has exceeded 10% since 2014 in all 03 CHT districts and even in other endemic districts ABER has grown steadily. Large parts of these other endemic districts, especially heavily populated urban areas, are likely to be at no risk of malaria and so an analysis of ABER at Upazila level is planned to assess whether ABER has already reached appropriate levels in populations truly at risk. Further, the data suggests that there is no or very limited parasitological testing in 51 districts (and a few

areas within endemic districts) that are not considered to be endemic. It is envisaged that the process of determining 'non-endemic' status of these districts will be initiated in 2021.

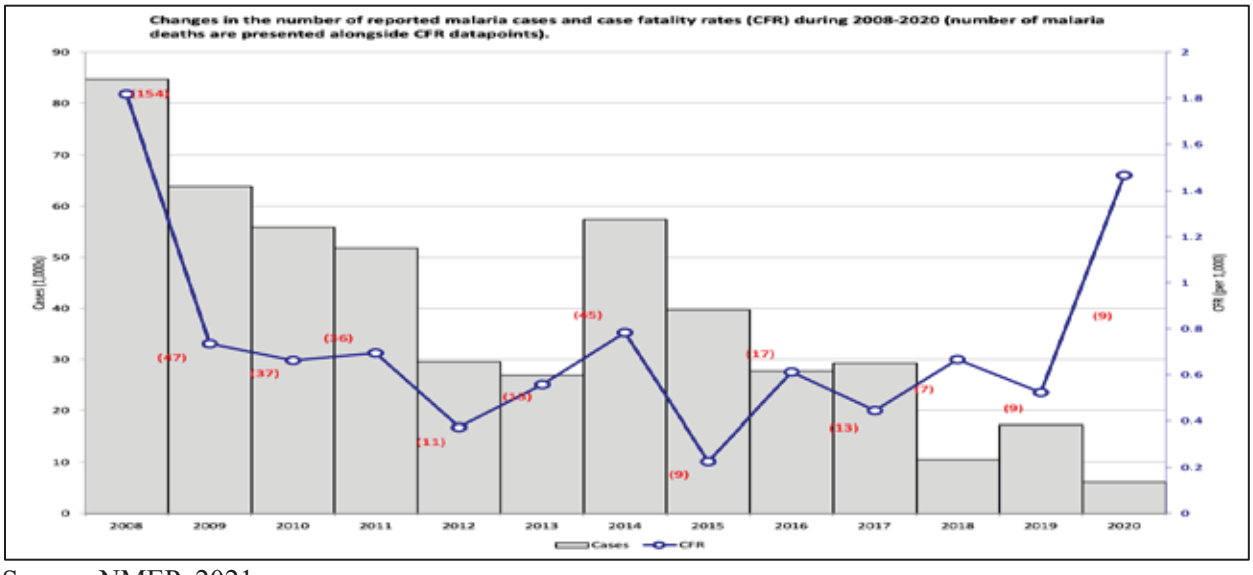
Table-10: District level annual blood examination rate (ABER), 2008-2020

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Sparkline
Sherpur	1.63	1.87	1.57	1.77	1.92	1.56	1.95	2.29	3.07	3.26	5.80	7.50	7.50	
Mymensingh	3.16	3.89	2.57	1.85	1.91	1.49	1.56	2.06	2.84	4.16	5.89	7.13	7.13	
Netrokona	2.39	2.87	1.1	0.95	1.38	1.83	2.66	3.92	5.24	5.39	6.78	7.79	7.79	
Kurigram	1.99	2.85	1.59	1.01	1.21	1.61	1.96	3.42	3.90	4.50	6.00	6.79	6.79	
Sylhet	0.98	2.29	1.69	0.98	1.13	1.17	1.72	2.61	2.89	3.28	5.12	5.18	5.18	
Hobigonj	1.74	1.45	1.23	0.62	0.75	0.72	0.80	1.75	2.26	2.65	5.19	4.76	4.76	
Sunamgonj	0.91	1.46	1.23	0.97	1.06	1.15	1.67	2.66	3.14	3.40	4.91	5.16	5.16	
Moulvibazar	1.75	2.77	2.24	1.09	1.2	0.99	1.35	2.18	3.11	3.50	5.79	5.87	5.87	
Chittagong	1.91	2.67	1.41	1.08	1.18	0.83	1.65	2.36	3.06	3.13	4.45	5.35	5.35	
Khagrachari	15.6	18.8	17.2	12.6	11.3	9.73	14.60	15.28	18.39	14.83	16.11	21.10	21.10	
Rangamati	17.8	18.6	19.7	15.3	12.9	14.59	19.10	18.75	24.09	20.66	20.68	24.37	24.37	
Bandarban	22.3	27	28.3	20.2	18.2	15.64	23.57	25.13	29.22	26.71	24.70	30.52	30.52	
Cox's bazar	3.53	4.68	3.03	2.00	2.01	1.70	2.57	3.80	4.53	4.84	7.65	7.59	7.59	
Nationwide	4.04	5.05	4.21	2.94	2.81	2.51	3.72	4.56	5.67	5.54	7.19	8.18	8.18	

Source: NMEP, 2021

Malaria related mortality: Between 2008 and 2009 the malaria case fatality rate (CFR) dropped by 59% from 1.82 to 0.74 deaths per 100,000 cases, reflecting major improvements in access to early diagnosis and appropriate treatment (Figure-9). Since then, CFR has fluctuated between 0.74 in 2009 and 1.47 in 2020. Although the CFR increased in 2020 relative to 2019, there were only nine reported deaths.

Figure-9: Changes in the number of reported malaria cases and case fatality rates (CFR) during 2008-2020 (number of deaths are presented alongside CFR data points)



Source: NMEP, 2021

Table-11 presents annual fluctuations in severe case fatality rates by district. The high rates seen in few districts may be resulting from unusual data recording practices although strengthening of management of severe malaria in some healthcare facilities is being emphasized. Tertiary hospitals use stricter criteria for the classification of malaria severity than more peripheral health facilities. Within the more peripheral health facilities there is a high degree of variability in approach to the classification of malaria severity. Moreover, any severe case occurring at a tertiary hospital is linked to the district of that tertiary hospital rather than the district where the patient has come or is resident. The resulting data is therefore, interpreted

with caution. Between 2007 and 2020, there appears to be a weak positive correlation between caseload and the proportion of cases classified as severe. This is likely the result of a key confounding variable: progressively improved access to quality diagnosis and treatment during the period. Progressive improvements in reporting resulting in increasing reporting rates for malaria relative to the reporting rates for severe malaria may also have been a factor. In the absence of confounding variables, one might expect the severe case rate to increase as malaria burden falls to very low levels due to reduced clinical suspicion of malaria in cases with acute febrile illness resulting in late treatment of malaria. This could well account for the progressive increase in the proportion of cases classified as severe in Chattogram in recent years.

Table-11: Annual fluctuations in severe case fatality rates in districts reporting severe cases since 2008

Reporting Unit	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total severe cases
Sherpur	0.0%	6.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	43
Mymensingh	10.0%	42.9%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	56
Netrokona	0.0%	75.0%	5.0%	12.5%	0.0%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	59
Kurigram	10.0%	12.5%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	21
Sylhet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	51
Hobigonj	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4
Sunamganj	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	47
Moulvibazar	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	188
Chattogram	0.3%	0.0%	3.3%	0.0%	0.0%	3.5%	16.4%	10.3%	24.3%	14.0%	13.3%	11.1%	60.0%	900
Khagrachari	5.3%	1.9%	1.5%	1.7%	1.8%	4.3%	1.8%	0.0%	0.0%	0.0%	0.0%	1.3%	0.0%	4704
Rangamati	5.8%	4.0%	4.0%	2.0%	1.4%	3.0%	0.0%	0.0%	1.5%	0.0%	0.0%	0.0%	0.0%	1744
Bandarban	1.4%	0.2%	0.8%	0.8%	0.7%	0.6%	1.3%	0.6%	1.2%	0.2%	0.0%	0.8%	3.5%	8,334
Cox's Bazar	14.4%	0.8%	0.2%	0.7%	0.2%	0.0%	0.0%	0.0%	0.0%	1.5%	2.5%	1.5%	0.0%	3,805
Other districts	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	66.7%	100.0%	0.0%	6
Total	4.0%	1.4%	1.4%	1.2%	0.8%	1.3%	2.2%	0.9%	2.5%	1.9%	2.9%	2.0%	9.8%	19962

Source: NMEP, 2021

Amongst the 03 CHT districts, it is Khagrachari, the least endemic that has had the highest proportion of cases classified as severe during the last few years (2015-2019). The proportion of cases classified as severe in this district doubled in 2018 relative to the previous year while caseload dropped by 70 per cent. Further increase is noted in percentage of severe malaria in 2019 (Table-12). Maintenance of malaria awareness in doctors in districts where caseload has fallen or is falling to low levels is being emphasized. Further, most of the malaria cases reported from Chattogram are increasingly being referred from elsewhere (mainly from the CHT) to the Chattogram Medical College and Hospital. This explains high proportion of cases classified as severe in Chattogram in recent years. The same is true in Cox's Bazar, although to a lesser extent. The spark lines presented in the last column of Table-12 show that, with the exceptions of Chattogram, there has generally been a progressive if somewhat erratic reduction in the proportion of cases classified as severe during recent period. A more in-depth analysis of this dataset failed to reveal any obvious issues and is probably due to the quality of the data concerned, which is being improved. The programme is considering adoption of a more holistic approach to reporting severe malaria cases and malaria deaths, whereby the patient's place of origin, likely place of infection, place of diagnosis, places of treatment (and place of death) are all presented geographically. Such approach is expected to help identifying and addressing the causes of severe malaria.

Table-12. Caseload and % of cases classified as severe by select districts and by year (2008-19)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Sparkline
Khagrachari														
Reported cases	19673	15811	12348	12952	5997	4096	9896	3874	2038	1443	421	725	133	
% severe	5.13	4.05	7.15	6.86	5.49	3.98	4.59	3.28	3.19	2.77	5.46	11.03	1.5	
Rangamati														
Reported cases	28,371	14582	13949	13669	7981	7976	17166	13832	9624	8287	3014	6066	1390	
% severe	1.45	2.04	1.80	1.81	0.90	0.84	0.72	0.93	0.71	0.42	0.60	0.38	0.22	
Bandarban														
Reported cases	17782	15734	17259	16097	8461	9459	24418	18262	14186	17492	6104	9623	4166	
% severe	4.31	10.49	4.99	8.82	5.40	5.58	3.70	2.75	2.90	2.33	2.05	2.55	1.37	
8 elimination districts														
Reported cases	9029	7462	4282	2170	2096	1460	736	368	213	126	89	25	24	
% severe	1.62	1.37	1.10	2.17	3.96	1.23	1.09	2.72	0.94	2.38	0.00	8.00	4.17	
Chattogram														
Reported cases	3368	3233	1621	1415	1095	648	832	460	271	244	116	141	37	
% severe	8.73	3.50	1.85	2.61	0.46	8.80	18.27	12.61	13.65	20.49	25.86	19.15	27.03	
Cox'sbazar														
Reported cases	6467	7051	6414	5472	3888	3252	4432	2923	1404	1654	773	635	379	
% severe	6.43	6.85	10.20	8.32	13.14	9.90	9.52	6.77	6.13	8.04	5.17	10.39	5.01	
Nationwide														
Reported cases	84690	63873	55873	51775	29518	26891	57480	39719	27737	29247	10523	17225	6130	
% severe	3.59	5.15	4.88	5.98	4.94	4.30	3.59	2.58	2.42	2.29	2.27	2.58	1.5	

Source: NMEP, 2021

Success in malaria control towards elimination in Bangladesh is influenced by the following factors deserving to be maintained or enhanced:

- *Regarding progress towards the Global Technical Strategy (GTS) milestone, Bangladesh is on track to reduce the case incidence by 40% by 2020. Bangladesh reported a substantial decline (57%) in total reported cases between 2015 (39,719) and 2020 (6,130).*
- *The community point of care reports more than 80% of all cases.*
- *The decline in severe malaria cases from 1,023 (2015) to 444 in 2019 and only 92 (2020) indicating 91% decline in 2020 relative to 2015 and proving that the uncomplicated case management is on track.*
- *Increasing investment in interventions (leading to improved coverage with LLINs and community-based case management), expansion of RDT-based diagnosis, use of artemisinin-based combination therapy (ACT), intensifying surveillance and M&E, ACSM and community engagement, strengthening capacities and systems, enhancing partnerships, and others, complemented by advances in socio-economic status.*

Despite the progress, the disease is unstable and epidemic prone. Even in non-epidemic years, malaria remains a key health problem in forest and forest fringe communities, particularly in hard-to-reach and remote border areas. Further aggressive endeavours with adequate resources will be needed to address the hard to control 'residual malaria transmission' (RMT), which occurs because of vector and/or human behaviours that increase human-vector contact and undermine the effectiveness of control measures.

Furthermore, achievement of phased subnational malaria elimination will be aimed at towards countrywide elimination and prevention of re-introduction will require sustained commitments from the highest political level, strategic planning and effective and equitable targeting of interventions, robust surveillance and M&E, resilient systems and requisite capacities, inclusive focus on key and vulnerable populations, multi-sector participation, cross-border coordination, implementation research and sufficient funding; besides improvising strategy and its implementation to counter the impact of COVID-19 pandemic and any such crisis in the future.

CHAPTER-4 STRATEGIC FRAMEWORK

4. STRATEGIC FRAMEWORK

4.1 Vision

A malaria-free Bangladesh by 2030.

4.2 Mission

The mission is to achieve malaria elimination in phased manner with effective interventions in an equitable manner towards improving quality of life of at-risk populations and contributing to achievement of Sustainable Development Goals (SDGs).

4.3 Goals and Objectives

4.3.1 Goals

By 2025, reduce malaria annual parasite incidence (API) to less than 1 per 1,000 population at risk in three CHT districts compared to 2019, interrupt locdal transmission of and eliminate indigenous malaria in phased manner in 10 other endemic districts, determine malaria-free status of remaining 51 districts, and maintain malaria-free status in areas where malaria transmission has been interrupted and prevent re-establishment of local transmission.

4.3.2 Objectives

- Objective-1: To achieve and sustain universal coverage by early case detection and prompt treatment of all confirmed cases through 2025.
- Objective-2: To achieve and sustain universal coverage of population at risk with appropriate preventive interventions through 2025.
- Objective-3: To strengthen context-specific surveillance in all malaria settings and outbreak preparedness and response through 2025.
- Objective-4: To achieve universal coverage by Advocacy, Communication and Social Mobilization (ACSM) activities for uptake of preventive and curative interventions, optimal community engagement through 2025.
- Objective-5: To strengthen program management, monitoring & evaluation and partnership and coordination through 2025.
- Objective-6: To strengthen and expand research through 2025.

4.4 Key Strategic Elements

- Universal coverage by quality-assured prompt diagnosis and treatment for all at-risk populations including the key and vulnerable populations (mobile and migrant populations, ethnic minority groups, disadvantaged/underserved communities, communities in border and conflict areas, and refugees).
- Universal coverage by appropriate prevention interventions for all at-risk populations including the key and vulnerable populations.
- Strengthen epidemiological and entomological surveillance appropriate for different settings.
- Review and refine malaria stratification periodically based on data related to transmission risk, receptivity, and vulnerability for targeted interventions.
- Strengthen M&E and reinforce regular supportive supervision and feedback; initiate and strengthen DHIS2 based MIS; and emphasize data quality and its use especially at subnational levels.

- Build resilient and sustainable health systems, including improvement of health workforce capacity with requisite skillsets at all levels, and uninterrupted access to quality-assured commodities.
- Foster strengthening of community systems; and enhance participation and ownership through intensified community engagement endeavours.
- Address human rights and gender-related barriers and inequities related to service access, uptake especially meeting the needs of key and vulnerable population groups.
- Strengthen quality service delivery through public health facilities as well as community health workers & volunteers (including those with partner NGOs).
- Scale up private sector engagement to expand coverage of case detection, streamline case management protocol, ensure timely reporting.
- Foster multi-sector strategic coordination and collaboration (with health and non-health sectors, local governments as well as partner agencies).
- Gather evidence continually on efficacy of first-line antimalarial drugs for early detection of possible emergence of drug resistant *P. falciparum*.
- Initiate cross-border collaboration between Bangladesh and India, Myanmar to tackle malaria transmission potentials through population movement along international borders; and maximize service delivery, surveillance within national boundaries.
- Promote research for addressing programmatic challenges, needs and gaps.
- Advocate for malaria elimination and prevention of re-introduction at all levels and sufficient and sustained resources.

4.5 Programme Prioritization and Phasing

Malaria is a focal disease in Bangladesh. It is therefore essential to identify and stratify the areas and populations at risk to prioritize interventions through a targeted approach and to ensure effective use of limited resources.

4.5.1 Programme Prioritization

Malaria is a focal disease in Bangladesh exhibiting considerable heterogeneity. It is therefore essential to identify and stratify the areas and populations at risk according to the burden of malaria. This process will identify districts to prioritize interventions through a targeted approach (district is considered as the operational unit for all interventions). Deployment of specific interventions at the local level will help NMEP for effective utilization of available resources. The strategy prioritizes progressive transition of high burden areas to low burden and low burden areas to elimination and sustaining it by preventing resurgence of indigenous malaria besides determining 'non-endemic' status of rest of the districts. Based on these considerations, the priorities are set as follows:

- Accelerated and sustained reduction of malaria burden in 03 'endemic' districts (03 CHT districts: Bandarban, Khagrachari and Rangamati).
- Phased elimination of malaria from remaining 10 'endemic' districts and maintaining the status.
- Determination of rest 51 districts (and a few areas within endemic districts) as 'non-endemic' and maintaining the status.

4.5.2 Programme Phasing

Drawing from prioritization, programme phasing is envisaged, since malaria burden must be lowered before it is possible (and rational) to investigate and treat every case and because premature application of the elimination approach might be prohibitively demanding. Successful elimination vision requires a distinction between a transmission reduction phase, where a combination of interventions is applied in endemic areas, and an elimination phase, where these measures are targeted to remaining foci and case-based surveillance intensified with measures to rapidly detect and cure every case.

Overall, the country is stratified into 3 strata based on API (Table-13). The areas where API is more than 1 per 1,000 population is categorized as high transmission areas (stratum 3), while where API is less than 1 per 1,000 population are categorized as low transmission areas (stratum 2); and where API is equivalent to zero with receptive areas or with non-receptive areas are categorized as potential transmission areas (stratum 1). Accordingly, the national response is categorized into programme phasing (accelerated transmission reduction; elimination; and prevention of re-introduction) during the implementation period of the updated NSP (2021-2025) on the path to malaria elimination and maintaining the status (Figure-10):

- Accelerated Transmission Reduction Phase (control phase): Aims to bring malaria incidence to below 1 case per 1,000 population at risk[23]). Interventions aim to reduce transmission and have an impact on morbidity and mortality. This involves scaling up and sustaining universal coverage by effective preventive and curative interventions in three high transmission CHT districts, viz. Bandarban, Khagrachari, and Rangamati.
- Elimination Phase: Aims to interrupt local transmission and reduce indigenous malaria incidence to zero. Malaria case and entomological surveillance become the core interventions – every case is investigated and managed to avoid onward transmission. Based on the investigation, the focus of transmission is identified, appropriate antimalarial drug-based and vector control interventions are deployed to rapidly interrupt transmission in 10 low transmission districts. In addition, 'non-endemic' status of the rest 51 districts (and a few areas within endemic districts) is determined indicating no reported indigenous case from these districts through appropriate & strengthened surveillance system and capacity building.
- Prevention of Re-introduction Phase: Even after indigenous malaria cases have been reduced to zero, the health system and malaria case and entomological surveillance operations remain fully capable of preventing re-establishment of malaria transmission. At this stage, maintenance of malaria-free status will become the responsibility of the general health services, as part of their normal function in communicable disease control, in collaboration with other relevant sectors.

Appropriate implementation of interventions will be packaged for a particular stratum and phase tailored to the local epidemiology. Receptivity and vulnerability risk factors including the past and current intensity of transmission in an area, and the size and mobility of affected populations will be considered.

As malaria elimination is achieved at subnational levels, efforts will be made to prevent re-introduction and re-establishment of malaria transmission in malaria-free areas in terms of appropriate surveillance and response aligned with malariogenic potential of an area determined by receptivity and vulnerability of the area.

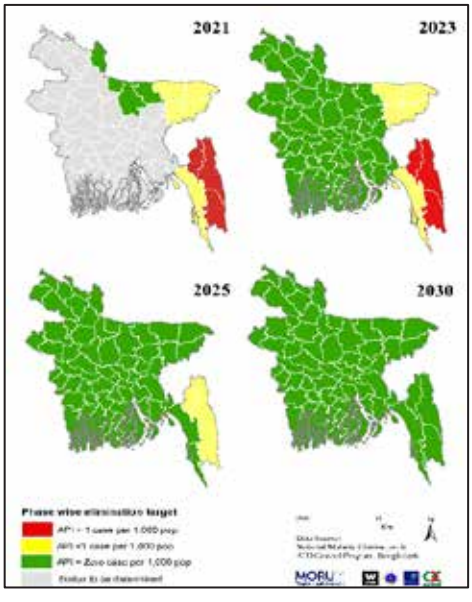
Table-13: Stratification and programme phase 2021-25: Malaria burden reduction and elimination.

Stratum	Criteria	Transmission status	Programme Phase	Zone and districts; Population at risk
3	API >1/1,000 population	High	Accelerated transmission reduction (control phase)	CHT (03 CHT districts) expecting reduction of API<1 by 2025 and local transmission interruption by 2030) [Population: 2,159,612 (1.32% of total population of country)]
2	API <1/1,000 population	Low	Elimination phase	Mymensingh (04 districts) expecting local transmission interruption by 2021 [Population: 20,80,972 (1.28% of total population of country)]
				Sylhet (04 districts) expecting local transmission interruption by 2025 [Population: 59,01,618 (3.62% of total population of country)]
				Chittagong and Cox's Bazar (02 districts) expecting local transmission interruption by 2025 [Population: 86,02,601 (5.28% of total population of country)]
1	API=0/1,000 population (no local transmission/to be determined)	Potential	Elimination phase (status to be determined)	'Non-endemic' [51 districts (and a few areas within endemic districts)] status to be determined by 2023 [Population: 14,43,01,370 (88.50% of total population of country)]

Source: NMEP, 2021

Note: Baseline API: 2019; Total population of Bangladesh: 163 million (2019); Population at risk: 1,87,44,803 (2019) million (11.50% of country population)

Figure-10: Programme phasing 2021-2030



Programme Phasing: NSP 2021-2025

Districts	021	022	023	024	025	026	027	028	029	030
3										
4										
6										
51										

Programme Phasing Key:

High transmission API > 1 case per 1,000 pop.
Low transmission API < 1 case per 1,000 pop.
Status to be determined
Interruption of local transmission API = Zero case per 1,000 pop.

4.6 Milestone and Targets

By 2021

- Bangladesh NSP 2021-2025 is officially launched nationwide.
- Empowered national Malaria Elimination Task Force (or similar body) in place.
- Stratification of malaria risk strengthened for targeted interventions.
- Universal coverage with long-lasting insecticidal nets (LLINs) for population at risk in target areas with particular attention to key and vulnerable populations.
- Universal coverage by quality malaria case management.
- Robust village level epidemiological surveillance strengthened in the CHT (03 districts).
- Case-based surveillance system established at national, district, Upazila levels in all other districts going into 'elimination' in phased manner.
- Local transmission has been interrupted and no indigenous case in 04 districts of Mymensigh zone.
- System, process to determine 'non-endemic' 51 districts (and a few areas within endemic districts) considered to be malaria free initiated.

By 2023

- 'Malaria free' status of 51 districts (and a few areas within endemic districts) determined.

By 2025

- Local transmission has been interrupted and no indigenous case in 04 districts of Sylhet zone; and Chattogram and Cox's Bazar.
- Annual Parasite Incidence reduced to <1 per 1,000 in 03 CHT districts.

By 2030

- Local transmission has been interrupted nationwide.

4.7 Objectives, Strategies, and Activities

In this section, objective-wise strategies and activities are described.

Objective-1: To achieve and sustain universal coverage by early case detection and prompt treatment of all confirmed cases through 2025.

Bangladesh is committed to universal coverage by quality-assured prompt diagnosis and treatment for all at-risk populations including the key and vulnerable populations (mobile and migrant populations, ethnic minority groups, disadvantaged communities, communities in border and conflict areas, and refugees). Universal coverage with early detection and effective case management will entail three channels of service delivery: public, community based and private. Diagnosis and treatment are provided free of cost by public sector and partner NGOs.

Early[24] case detection is essential component and the first stage in knowing the number of infected people in a given community. Universal coverage by early case detection based primarily on blood examination by RDTs or microscopy will be ensured for routine detection of malaria infections. Treatment for all confirmed falciparum and non-falciparum malaria will be based on national treatment guidelines developed in line with the WHO guidelines. Treatment will include primaquine to eliminate gametocytes, which are responsible for infecting mosquitoes with malaria and thus continuing transmission. In addition, QA of microscopy, RDT and antimalarials nationwide (for public, NGO, private sectors) with defined roles and responsibilities will be ensured. All cadres at facility and community levels will be trained in addition orientation of private sector. Achieving universal coverage of case-management requires the timely supply availability of quality assured RDT/microscopy and antimalarials at all service delivery points (public and community-based), which will be ensured. Private sector engagement will address largely unregulated case management and episodic reporting issues.

Strategy 1.1 Early Case Detection

ACTIVITIES:

1.1.1 Strengthen and expand RDT based diagnostic services:

Bangladesh has well-established free community-based malaria case management delivered by CCs in malaria endemic areas (Stratum 3 and 2) towards early diagnosis and prompt treatment (EDPT). The CCs are the lowest level public sector service delivery points at community level. In addition, partner NGOs are also involved in community outreach through a team of community-based workers (‘Shasthya kormi’) and volunteers (‘Shasthya shebika’). These workers and volunteers substantially complement and extend the reach of health services, particularly in rural and remote areas in 03 CHT districts (Stratum 3) and Cox's Bazar and Chattogram districts (Stratum 2), where health infrastructure tends to be weak or absent and/or malaria transmission tends to be high.

The coverage of health services is based mostly on population. However, overall population coverage in malaria endemic areas is still sub-optimal particularly in hard-to-reach areas in 03 CHT districts. Although consideration of distance has started, yet in some remote areas especially in the hilly hard-to-reach and problematic geographic settings, adequate number of CHCPs is required. Recently, the GoB has introduced multipurpose health volunteers (MHVs)[25] connected with CCs in selected districts under the Community Based Health Care (CBHC) Department of the MOHFW, which is expected to progressively support EDPT. The MHVs will be trained on diagnosis using RDTs (and treatment) at community level. In the CHT, villages are small clusters of households widely scattered across hilltops and islands (in the case of Rangamati). Therefore, the NMEP will advocate with the MoHFW for critical need for additional CCs as well as expansion of MHVs and retaining partner NGO services towards universal coverage by community-based malaria case management in CHT especially for key and vulnerable populations in hard-to-reach areas. Furthermore, the UNICEF has a community model of preventative care, which is centred around the Para Centres, which serve as the hub of the village life, providing myriad preventative basic social services in the areas of health, nutrition, education, protection, water, sanitation, and hygiene promotion. There are currently 4,000 Para Centres that would eventually reach a target of 5,000 Para Centres under the UNICEF Sustainable Social Services (SSS) CHT project. Capacity building of 4,000 SSS Para workers and 400 Field

organizers at community level will be initiated for malaria services (early case detection, referral, and enhancing community awareness and responsive behaviour through BCC/community engagement).

Use of RDTs is simple and effective to initiate prompt and effective treatment. Hence, RDT based diagnostic services for suspected cases will be used at community level. Where microscopy services are present, RDTs will only be used when microscopy is temporarily unavailable (example, outside office hours, emergencies, vacant positions, etc.). Approximately 80% of total parasitological tests will be done by RDTs in view of RDTs performed at community level by CCs as well as partner NGO health workers and volunteers, and the rest (20%) will be done by microscopy at health facilities (across all strata). This strategy shift (80:20) is envisaged to maximize case detection at community level. The shift will be supported by revisiting strategic positioning of the community health workers/volunteers, involving additional ones, such as, MHVs, UNICEF's SSS Para workers.

It is envisaged that approximately 20% of the total tests in 03 CHT districts (Stratum 3) and Chattogram, Cox's Bazar districts (Stratum 2 and 3) will be conducted in public sector health facilities and the rest 80% by partner NGOs. In Mymensingh and Sylhet zones with very few cases (Stratum 2), almost all tests will be done in public sector health facilities (excepting those being/to be conducted by private sector). Of total tests by public sector, 80% will be done by RDTs at respective CCs and the rest (20%) will be done by microscopy at various health facilities. In 51 'non-endemic' districts (and a few 'non endemic' areas within endemic districts) [Stratum 1], nearly all tests will be done in public sector health facilities (excepting those being/to be conducted by private sector in similar manner. The microscopy services at NGO laboratories in selected districts (03 CHT districts, Cox's Bazar, Chattogram) will supplement malaria diagnostics services at public sector (20%). [Currently, the reporting from CCs is aggregated within the report of public sector health facilities. From 2021 onwards, reporting from community-based CCs will be disaggregated from public sector health facilities after the DHIS2 based malaria MIS modules are rolled out.

Training to staff, health workers and volunteers will be provided, and this will be followed-up and monitored by supervisors with on-the-job training. The community-based service providers will meet regularly with supervisors for re-supply, data cross-checking and reporting. Performance-based incentive (for number of fever cases tested by RDTs, malaria cases treated, and various community mobilisation activities, etc.) will be provided to retain and motivate the MHVs and volunteers working with the partner NGOs.

RDTs will be made available (free of cost) at all service delivery points with public sector and partner NGOs (at all levels in the 13 endemic districts). Provision for free RDTs will also be made available for health camp-based activities in hard-to-reach areas, for mobile and migrant populations, FDMN camps. Efforts have already been initiated to provide RDTs and antimalarials down to Upazila level in 'non-endemic' districts, which will continue. Such provision will be revisited and reprioritised periodically as malaria risk mapping is initiated/updated for 51 'non-endemic' districts (and a few 'non endemic' areas within endemic districts).

Timely procurement of quality assured RDTs (with 25% buffer) through the GF PPM mechanism will be priority besides exploring domestic resources. Deployment reserve will be considered for hard-to-reach areas/border areas facing constraints related to timely replenishment for uninterrupted services especially monsoon period (coinciding with peak transmission season). In 51 'non-endemic' districts (and a few 'non endemic' areas within endemic districts) too, provision of RDTs will be made with the GoB resources.

1.1.2 Strengthen and expand microscopy-based diagnostic services:

Quality-assured microscopy-based diagnosis will be strengthened at Upazila (sub-district) and district levels in endemic districts (Stratum 3 and 2) and rolled out at district and tertiary level in 51 'non-endemic' districts (and a few 'non endemic' areas within endemic districts) [Stratum 1]. Microscopy-based diagnostic services will be operated by competent and skilled healthcare service providers at GoB and partner NGO facilities and will be supported by trainings, supportive supervision, and cross-checking. Microscopy has advantages regarding detection of gametocytes and determination of parasite density.

Capacity of laboratory technicians across public, NGO, private sectors will be strengthened using SOPs and QA manual to be developed/updated both in Bangla and English languages. New microscopists will be trained, and existing microscopists will receive need-based refresher training. Timely and adequate supplies of reliable equipment and quality reagents, etc. will be ensured. Periodic need assessment will guide further strengthening of microscopy-based diagnosis.

The NMEP periodically reviews and updates case management guidelines and related SOPs through consultation with the malaria technical committee, individual experts/key stakeholders, which will continue, as needed. The manuals will be disseminated to all public sector, NGOs (beyond partner NGOs) and private sector nationwide up to Union levels. Appropriate versions will be disseminated to CCs, health workers, and volunteers.

1.1.3 Screen pregnant women in high transmission areas/communities:

In endemic districts (Stratum 3 and 2), malaria screening of pregnant women by RDT will be introduced/reinforced through antenatal care (ANC) services including in areas where malaria in pregnancy is recognized as an issue (example, in tea gardens).

1.1.4 Screen members of the Armed forces, BGB, Police and other law enforcement agencies:

Microscopy/RDT-based screening of members of the uniformed service personnel before and after deployment to malaria endemic areas will continue according to the national guidelines (Stratus 3, 2 and 1). PCR-based screening will be utilized pre- and post-deployment to other malaria endemic countries. Medical/nursing staff of the Armed forces and other security/law enforcement agencies will be trained to use RDT and treat cases while in deployment to provide services to their cadres (pre- and post-deployment to endemic areas) as well as civilian population when the latter approach them/their facilities/camps.

1.1.5 Provide diagnostic services at identified district and international border-crossing points:

Drawing from the guidance provided in the WHO operational framework for cross-border collaboration, screening (and case management services) will be initiated through CCs at identified cross-border transit points (at identified national land/port border crossing points/migration and transit points), and weekly/monthly markets and or designated markets, as feasible and appropriate. Special emphasis will be given along the areas bordering with malaria endemic areas of India and Myanmar in 13 endemic districts as well as 51 ‘non-endemic’ districts (and a few 'non endemic' areas within endemic districts). Services will target ethnic minority groups, the Rohingya community, tourists, pilgrims, and other mobile and migrant populations. Support to the CCs will include the provision of training and supply of RDTs (and antimalarials).

1.1.6 Provide diagnostic services for mobile and migrant populations; and hard-to-reach areas:

Migrant and mobile populations are often difficult to reach due to remoteness, socio-economic characteristics, and even undocumented status of some. Improving their access to health services can be complex requiring multi-sector involvement. Providing early case detection (and prompt treatment) services for mobile and migrant populations going to & coming from endemic settings will continue through community-based service providers (Stratum 3 and 2). Elimination will not be achieved unless these population groups have access to free EDPT (and prevention interventions). It is envisaged that if the migrant/mobile population is a large group far away from the nearest community-based service providers, an individual among the group will be trained and supplied with RDTs for case management on site. Efforts will be taken to approach those registered/working through legal employers at first in coordination with relevant ministries/partner agencies (example, INGOs, etc.) before expanding such activities for all mobile and migrant populations including informal or even illegal labour, who mostly prefer to avoid any contact with public services. Management of these community-based services will involve systematic collection of information on migrants and mobile populations for which multi-sectoral coordination will be key element. Operational research will be done to map and understand the migrant and mobile populations for appropriate strategies for service delivery.

Mobile teams of the NMEP and partner NGOs will continue and strengthen outreach operations where populations are currently underserved. These teams will intensify case detection in high endemic hard-to-reach areas including forest and forest fringe areas especially in 03 CHT districts as well as in other endemic areas to reach out to reach out to mobile and migrant populations, and tea garden workers (Stratum 3 and 2). Support will be requested from the armed forces, BGB, Police and other law enforcement agencies to access the most hard-to-reach communities especially mobile and migrant populations and border areas. For settled populations, mobile services will be a temporary measure to fill any gap in provision of static community-based services. Furthermore, the partner NGO has recruited some special health workers in some selected Upazilas having mobile and migrant populations as well as ethnic monitory groups to increase malaria service coverage.

1.1.7 Provide follow-up testing for *P. falciparum* cases, where feasible:

Microscopy based follow-up of patients on day 28 or day 42 (depending on the ACT partner drug) will be introduced to detect potential recrudescent cases. Positive cases will be admitted to hospital for supervised second-line treatment. Where feasible, day 3 slide testing for *P. falciparum* may also be introduced to assess parasite clearance. Follow-up testing will focus on elimination districts initially (Stratum 2) but may expand to transmission reduction phase districts where feasible (Stratum 3). The CCs will implement the services through community level volunteers.

1.1.8 Introduce G6PD testing to improve management of *P. vivax* malaria:

The national treatment guidelines recommend primaquine – an 8-aminoquinoline based radical cure. A recent study (2020) concluded that there was a high prevalence of G6PD deficiency amongst the ethnic groups in the CHT, but this varied significantly between ethnic groups.[26] This indicates the need for introduction of G6PD testing (and robust pharmacovigilance), especially in 03 CHT districts (Stratum 3), where ethnic minorities predominate and incidence of *P. vivax* (and so treatment with Primaquine) is relatively high. G6PD testing will be rolled out gradually (once point of use tests become available). Following introduction, findings will support development of a longer-term policy on G6PD testing and primaquine use. Day 3 and day 14 follow-up for patients treated with PQ (to check for signs of haemolysis and to assess compliance, respectively) will be introduced.

1.1.9 Quality Assurance (QA) in malaria diagnosis

Quality assurance (QA) of diagnosis (and treatment) is important in both transmission reduction and elimination phases (across all strata).

Ensure Quality Assurance (QA) in Microscopy: QA of microscopy is particularly crucial in the elimination phase when microscopists see fewer and fewer positive slides and it becomes progressively more difficult for them to maintain their skills. The NMEP will strengthen QA of microscopy in support of elimination nationwide (across all strata). There will be strong collaboration between the NMEP, the Central Malaria Reference Laboratory (CMRL) and partner NGOs to revitalize and strengthen district and Upazila level laboratories (public, NGO, private) for the purpose. The NMEP will ensure an 'External Competency Assessment' (ECA) for senior microscopists at central level with technical assistance by the WHO. The NMEP will also carry out internal competency assessment for public sector laboratory technicians with and those with partner NGOs) at district/Upazila levels.

As malaria incidence falls, access to positive slides will become increasingly important for maintaining microscopist skills. At central level, a 'Slide Bank' will be established for use in activities related to QA of microscopy such as training, national competence assessment, and outreach training, supervision support and proficiency testing.

The NMEP will update QA of microscopy guidelines and SOPs with technical assistance by the WHO and disseminate to all health facilities in Bangla. 'Quality Assurance Guidelines for Malaria Diagnosis' based on the WHO QA manual will be developed in collaboration with the WHO. The QA Guidelines will ensure: (i) QA in Microscopy (and RDTs); (ii) QA in Case Management; and (iii) Monitoring of QA of Antimalarial

Drugs. The NMEP will also develop guidelines for maintaining slide banks, training materials/bench aids, provide basic and refresher training, assure the quality of testing, and support external QA in consultation with the Malaria Technical Committee, individual experts. Internal QA system (cross-checking) guidelines will be updated and disseminated in Bangla to all public/NGO/private laboratories. Cross-checking of slides will be 'blinded' at district level to ensure the validity of results; and only a representative sample of slides will be cross-checked at high level and such details will be included in the guidelines. This guidance will be included in trainings and review and planning meetings.

A core group of senior technicians and select technical staff from CMRL will provide supportive supervision (through field visits) for QA according to SOPs and provide support in training/re-training of microscopists and laboratory technicians (all sectors).

Ensure Quality Assurance (QA) in RDTs: QA of RDTs and their interpretation will be initiated (batch testing, testing of field samples, and supportive supervision). Guidelines for of QA of RDT will be developed with technical assistance by the WHO.

1.1.10 Other diagnostic methods

Diagnostic methods with a higher sensitivity than RDTs and microscopy, such as polymerase chain reaction (PCR) or other molecular-based techniques will be used in specific situations, for example, to resolve discordant results from microscopy QA and RDT versus microscopy, for distinguishing recrudescence versus reinfection during therapeutic efficacy studies (TES), and to confirm zero transmission in communities reporting zero cases.

Strategy 1.2 Prompt and Effective Treatment

ACTIVITIES:

1.2.1 Strengthen prompt and effective treatment at community level:

The NMEP is continuously striving to improve community-based malaria case management with special emphasis on hard-to-reach areas. The CCs provide free malaria treatment at community level (Stratum 3 and 2). It is envisaged that necessary pre-referral treatment [Artesunate suppositories (paediatric) and artesunate/artemether/quinine injections] will be made available for pre-referral treatment at CCs. Supervised treatment/DOT will be used to support patient adherence for ACT and for radical treatment for vivax malaria. The role of MHVs as well as partner NGO health workers and volunteers (and UNICEF's SSS Para workers) will be expanded at community level to cover/refer diarrhoea and acute respiratory tract infections for children under 5 (under integrated Community Case Management - iCCM) as well as a fever management for all age groups. This will ensure that communities continue to access community-based services even when malaria incidence falls to very low levels, and this will protect the malaria elimination related surveillance role of the iCCM intervention.

1.2.2 Strengthen prompt and effective treatment and management of severe malaria in health facilities:

All public sector health facilities as well as those with partner NGOs will provide free prompt and effective treatment (across all strata). Full adherence will be required for each malaria patient and health workers/volunteers will ensure proper follow up. Where possible, supervised treatment will be used to support patient adherence for radical treatment for vivax malaria, which requires 14 days. This will entail follow-up by a health worker or volunteer on days 4 and 15. In elimination districts (Stratum 2 and 1), where the number of cases is/will be few, directly observed treatment (DOT) for ACT, which has a 3-day regimen, may be applied. Until then, efforts will be made to maximize patients' adherence to their full treatment regimen. To interrupt transmission, as caseloads fall to manageable levels (example, 1 case per facility per week during peak season), all cases in all districts will be admitted, where possible, to ensure full treatment compliance and prevent onward transmission. The importance of treatment adherence will be emphasized during training/orientation sessions, review and planning meetings and supervision visits, and through BCC/advocacy/community engagement activities, etc.

Case management training and refresher training will be organized for all public sector health facility staff including clinicians, doctors, nurses at Upazila, districts, and tertiary hospitals nationwide covering differential diagnosis and management of uncomplicated as well as management of severe and complicated malaria. The staff in the Rural Dispensary/Union Sub-centers/Union Health & Family Welfare Centres (UH&FWCs) will also be trained/re-trained (MOs, SACMOs). The training will incorporate a module on inter-personal communication (IPC) aiming to improve patient compliance with malaria treatment regimens and other malaria related behaviour such as personal protection and prompt treatment seeking. The national treatment guidelines to be effective, the same will be available at all points of care in local language. During monitoring and supervision, treatment practices and compliance will be assessed. Responsible staff with partner NGOs as well as others (example, INGOs) will be oriented on national treatment guidelines.

Efforts will be made to maintain skills in management of severe malaria nationwide especially in the light of falling severe malaria caseload. Special training will be provided to doctors (at district level and above nationwide and at all levels in 13 endemic districts) on management of severe and complicated malaria. Facilities for biochemical examination and dialysis will also be made available, in each of the 03 CHT districts (where referral to tertiary facilities is particularly difficult).

Further, prompt and effective treatment of malaria will be integral part of case management for pregnant women visiting ANC clinics.

1.2.3 Provide prompt and effective treatment services in hard-to-reach areas; and at identified district/international border-crossing points:

In/amongst underserved hard-to-reach areas/populations, mobile and migrant populations especially in 03 CHT districts, treatment services will be provided by CCs and or heath workers/volunteers of partner NGOs. MHVs/UNICEF's SSS Parasitological workers will also be involved. Collaboration with armed forces, BGB, Police and other law enforcement agencies will be established for expanding the scope of case management in remote, hard-to-reach areas.

Mobile and migrant populations, tourists, pilgrims, other passengers with fever, at identified national land/port border crossing points/migration and transit points, as well as weekly/monthly markets and or designated markets in border areas (as feasible and appropriate) will be tested for malaria involving existing/future CCs and/or health posts. The NMEP will advocate for establishing CCs/health posts and or positioning health workers at border crossing points. Support to such service providers will include provision of training and supply of RDTs and antimalarials.

1.2.4 Provide prompt and effective treatment services within Armed forces, BGB, Police and other law enforcement agencies:

Armed forces, BGB, Police and other law enforcement agencies will follow the national treatment guidelines. In addition, the doctors and nurses will be trained on case management.

1.2.5 Introduce standby treatment in special circumstances:

Standby treatment (a full course of ACT) along with appropriate information will be provided to individuals or groups travelling to areas that are so isolated that this approach offers the only means of ensuring prompt treatment in the event of symptoms. This will be attempted in operational research mode to start with. Later, with evidence and experience, delivery of standby treatment will be integrated into continuous channels for the delivery of LLINs, as well as into the delivery of any other personal protection measures that might become available over time, as appropriate. Uptake of standby treatments will be closely monitored and evidence of inappropriate application by healthcare providers will be investigated. Action will be taken as necessary to minimize misuse.

1.2.6 Introduce Mass Drug Administration (MDA) in special circumstances:

The MDA is a strategy to reduce transmission of malaria in an elimination setting and during malaria epidemics and complex emergencies. It is also applied for rapid reduction of morbidity (to eliminate

parasite reservoirs within a short time) and mortality related to *P. falciparum* malaria, where the health system is unable to provide core malaria preventive and curative services. MDA may be introduced as per the WHO recommendations and or as an epidemic response or in the event of complex emergencies. In remote endemic communities, if the situation meets the criteria, MDA will be administrated.

1.2.7 Strengthen and monitor private sector case management services:

Private medical colleges as well as clinics, diagnostic centres supplement the public health system at all levels. At community level, besides CCs and community health workers/volunteers of partner NGOs, private sector health care service providers (both formal and informal service providers) are the primary contact for populations especially in hard-to-reach areas. Coordination with private sector providers is yet to take off in a systematic manner although efforts have been initiated in few areas to map, orient, and seek report from them. Further, although malaria is a notifiable disease, this is not yet enforced. Listing of private diagnostic centres in some malaria endemic areas has been done. In order to address involvement of informal private providers, orientation on malaria diagnosis and treatment is initiated at local level for village doctors, traditional healers and medicine sellers, in order to sensitize them on malaria symptoms and the risk of the disease so that they can refer the suspected cases to the appropriate malaria service providers.

Considering the recommendations of the assessment related to the role of the private sector conducted in 2019, the NMEP envisages expanded assessment to gather more evidence in 2021 including but not limited to understanding the knowledge and practices amongst them and determining or at least estimating the number of malaria cases being detected and treated by private sector. Drawing from this assessment, a private sector engagement strategy will be developed followed by mapping and maintaining database of private clinics and hospitals. A consultative process will be followed with key partners, potential partners from private sector, and development partners, individual experts. Additionally, other relevant public health programmes will also be consulted for sharing their experience, lesson learned and success. This process will bring more partners and possibly mobilize additional resources.

The NMEP with technical assistance by the WHO will start systematic engagement process with private clinics, private practitioners in four Upazilas where the 2019 survey was conducted. This pilot process will be developed in consultation with the Civil Surgeons at the district level and the UH&FPO, who will oversee the private sector engagement as part of their overall responsibility. The targeted private sector providers will be oriented/briefed on country's malaria elimination vision. In high endemic areas, the session will emphasize on malaria control while elsewhere elimination related activities will be explained. As necessary, additional resources (from the GoB/partner agencies) will be explored to initiate activities relating to private sector engagement.

The NMEP will not provide RDT and ACT to the private sector providers. However, the NMEP will make arrangement for any emergency requirement. The experience and lesson learned from this pilot private sector engagement will facilitate firming up private sector engagement and scaling up the scope of engagement in the coming years to expand coverage of case detection, streamline case management protocol and guidelines among private sector providers at all levels. It is also aimed that the coordination efforts with private sector might create a complementary service delivery channel to optimally reach the high-risk population groups in hard-to-reach areas. Moreover, quality, and efficient provision of malaria services will help to build stronger health system, which will benefit all communities in different geographic areas across the country.

The NMEP in coordination with partner NGOs, WHO and relevant others, will conduct training of private sector providers (formal and informal) in 13 endemic districts (Stratum 3 and 2) towards initiation and progressive expansion of malaria services according to national guidelines [and later in 51 'non-endemic' districts (and a few 'non endemic' areas within endemic districts)]. This will include but not limited to, diagnosis and treatment/referral, and timely and accurate reporting/notification malaria cases to the local health authorities within 24 hours of case detection as well as appropriate counselling to patients/families regarding EDPT, treatment compliance, adoption of personal protection measures, etc. In all districts

(across all strata), notification of malaria will be widely publicised and strictly enforced in coordination with relevant agencies. Engagement will also be extended to cover local pharmacies, drug vendors gradually. This will minimize long travel/transportation cost of patients and other incidental costs of treatment as well as maximize case reporting. Coordination with medical associations, hospital administrators/directors, owners of tea gardens with clinics, etc. will be strengthened for the purpose. Data collection using malaria MIS forms (including zero reporting) and/or DHIS2 based MIS will be initiated, implemented either through peripheral health workers/CCs or managed through some form of incentivized text messaging arrangement.

The NMEP will emphasize use of pre-qualified products at the time of sensitizing/orientation sessions. The NMEP will also attempt to develop a follow up mechanism and/or carry out random assessments using various methodologies. Coordination with the DGDA and other relevant agencies will be strengthened for use of quality antimalarials/eliminate any irrational use outside national guidelines.

1.2.8 Quality Assurance (QA) in malaria treatment

Ensure Quality Assurance (QA) in Case Management: Robust supervision is key to QA of patient care. Such QA will be applied for both public and private sectors with clear protocols in accordance with the national treatment guidelines. Clinical reviews will be carried out in underperforming health facility (based on reports or data analysis) and remedial measures will be put in place where appropriate (including special needs-based training/re-training for the clinical staff).

Ensure Monitoring of Quality of Anti-Malarial Drugs: For case management, it is critical that medicines are of good quality and that supplies are adequate. Monitoring of quality of antimalarials at health facilities and outlets (with focus on medicines not procured through the external support by the GF and/or the WHO) will be rolled out for testing using Minilab® test kits in collaboration with the DAD. Minilab® test kits and consumables will be procured, and staff will be trained. Supervision will be carried out periodically, both in sentinel sites and in additional spot-check sites. Confirmatory tests of selected samples will be carried out at central level. The NMEP will continue to improve supply management and update the Logistics Management Information System (LMIS) to reduce any shortages and prevent stock out in the public supply chain. The logistics issue, drug quality will be discussed in meetings relevant units within the MoHFW.

In addition, efforts to eliminate inappropriate, counterfeit, and sub-standard antimalarials being carried out by Directorate General of Drug Administration (DGDA) will be continued and enhanced. The MoHFW decision relating to banning import, manufacture, export, registration, re-registration, distribution, and sale of artemisinin monotherapy will be reinforced through identification of/communication with importers, manufacturers, exporters, wholesalers/distributors, pharmacies and drug sellers in coordination with the DGDA and concerned law enforcement agencies. The NMEP will coordinate with the DGDA and other concerned agencies, partner NGOs, private sector, NMEP, relevant research institutes, and law enforcement agencies, as appropriate, especially to:

- eliminate artemisinin monotherapy products and register only quality-assured medicines, and diagnostics;
- strengthen quality assurance during and after registration to prevent the manufacture and sale of substandard products;
- intensify routine surveillance to detect and eliminate the sale of oral artemisinin-based monotherapies, spurious, falsified, falsely labelled and counterfeit antimalarials, especially in border areas;
- enforce the ban on inappropriate antimalarials import, manufacture, export, registration, re-registration, distribution and sale of artemisinin monotherapy and inappropriate antimalarials (even cancelling licenses if inappropriate antimalarials are found);
- and improve national capacity for quality-control testing (NMEP in collaboration with DGDA will monitor quality of antimalarials at peripheral facilities and outlets using *Minilab*® test kits); and
- improve rational and responsible use of all malaria medicines to reduce unnecessary use that may contribute to resistance.

Objective 2: To achieve and sustain universal coverage of population at risk with appropriate preventive interventions through 2025.

Elimination of malaria requires reduction in human-vector contact by personal protection, longevity of vectors and vector density by use of anti-adult and or anti-larval measures. The selection of vector control interventions will be guided by an eco-epidemiological assessment informed by malaria case and entomological surveillance data. Bangladesh is committed to universal access to effective prevention, viz., distribution of LLINs amongst all at-risk populations including key and vulnerable populations (mobile and migrant populations, ethnic minority groups, disadvantaged communities, communities in border and conflict areas, and refugees). The NMEP will ensure quality of vector control measures and LLIN distribution. An integrated vector management (IVM) strategy drawing from the WHO guidance[27] will guide implementation based on the local context and transmission dynamics. Use of insecticidal interventions will follow technical recommendations provided in the WHO 'Global Plan for Insecticide Resistance Management in Malaria Vectors'. Entomological monitoring will be strengthened for any change in entomological indicators and for providing guidance for revisiting IVM strategy periodically.

Strategy 2.1 Malaria Prevention with Appropriate Vector Control Measures

ACTIVITIES:

2.1.1 Provide free LLINs for population at risk:

Long-lasting insecticidal nets (LLIN) are a highly effective measure of preventing malaria infection and reducing associated morbidity and mortality. LLINs (responding to the three-year effective duration and protection as per the WHOPES specification) remain a core malaria prevention measure in Bangladesh. The NMEP will ensure that 100% population in endemic areas (villages) will be protected and at least 90% of them will use LLIN effectively to reduce transmission and provide personal protection. The target coverage rate for large sized LLINs will be 1.8 people per net (in-line with the WHO standards to achieve 100% coverage).

Endemic villages (with cases in last three years) will continue to receive LLINs through periodic mass distribution. But in villages in 'endemic' districts, where all cases are imported, LLINs will be provided only to those at occupational risk of malaria (example, forest workers/goers, seasonal agricultural workers, etc.). The programme will thus move away from blanket LLIN coverage and move towards targeted approach to maximize cost effectiveness and sustainability. Malaria risk stratification will evolve to distinguish between indigenous and imported cases and thereby between endemic villages and villages where all cases are imported.

In the 03 CHT districts (Stratum 3), where the malaria burden is maximum, forest cover is still high and the primary vectors remain abundant, universal coverage will be maintained as an 'absolute priority' until the situation changes or until elimination phase is reached. Maximizing protection of key and vulnerable populations at high risk of malaria [example, forest goers/workers in formal/informal sector, jhum cultivators, seasonal agricultural workers, other mobile and migrant populations, camps associated with commercial projects, plantations (example, tea, food), construction project settlements] as well as pregnant women visiting ANC clinics in 'endemic' districts, will also be considered 'absolute priority' (Stratum 3 and 2). In addition, LLINs for confirmed transmission foci, outbreaks/other contingencies like natural calamities will be considered 'absolute priority'. Further, universal coverage by LLINs in FDMN camps will be 'absolute priority' as well.

Further, in non-CHT 10 'endemic' districts (Stratum 2), all Upazilas (API less than 1) will be subjected to village-level stratification whereby villages will be prioritized to receive universal coverage with LLINs if they have reported one or more indigenous malaria cases in last three years: i.e. villages that reported cases in each of the last three years (3/3) will be considered as 'high priority'; villages that reported cases in any two of the last three years (2/3) will be considered as 'medium priority' ; and villages that reported cases

only once in the last three years (1/3) will be considered as 'low priority'. Universal coverage in identified 'high' and 'medium' priority endemic villages will be attempted in the event of any resource constraints. Urban areas will be excluded except where forest cover is high, as in the CHT districts.

District and Upazila officials will conduct micro-level planning for LLIN distribution according to the LLIN distribution guidelines and in coordination with partner NGOs. Micro-level planning will take into consideration household sleeping patterns/socio-cultural behaviours to ensure 100% coverage without wastage. The LLIN distribution will use multiple delivery strategies at community level in coordination with relevant stakeholders to maximize coverage in targeted areas. This will be coupled with locally appropriate and gender sensitive BCC to ensure community mobilization and high and correct LLIN usage. External assessors (the GoB, NGO, research institutes or universities depending on the LLIN implementers) will conduct post-campaign LLIN coverage assessments in a representative random sample of targeted sites. Periodic study will be conducted on utilisation, physical integrity and bio-efficacy of LLINs in coordination with relevant research institutions.

2.1.1.1 Provide LLINs for established communities: Free LLINs will be provided to cover the entire population residing in established settlements [villages in 03 CHT districts (Stratum 3)], FDMN camps, and prioritized villages in non-CHT areas (Stratum 2)]. These LLINs will be distributed through mass distribution. The periodicity of the mass distribution will depend on the expected lifespan of the LLINs (every three years).

***2.1.1.2 Provide LLINs for use in forest/forest farms*:** Where appropriate, additional LLINs will be provided for use in forest/forest farms (targeting traditional *Jhum* cultivators and informal sector forest workers, viz. wood cutter and people gathering forest products) in endemic districts (Stratum 3 and 2). These LLINs will be delivered in targeted communities during mass distribution and/or during household visits (continuous distribution).

***2.1.1.3 Provide LLINs to pregnant women*:** Additional LLINs will be given to pregnant women in communities targeted for mass LLIN distribution in 'endemic' districts (Stratum 3 and 2). These nets will be delivered through ANC services in coordination with district and Upazila level health authorities (continuous distribution). This approach is expected to maximize LLIN coverage for pregnant women, infants, and positive impact on ANC attendance.

2.1.1.4 Provide LLINs to select employers to provide to their workers: LLINs will be provided to select employers in 'endemic' areas to provide to their workers (Stratum 3 and 2). At the same time efforts will be made to encourage employers to provide LLIN or other preventive services to their employees at their own cost. This intervention will target construction project settlements/camps (example, dams, bridges, mines, road/railway construction, large-scale logging); plantations (example, rubber, tea, food); forest workers in the formal sector (example, forest/wildlife protection services).

2.1.1.5 Provide LLINs to protect seasonal agricultural workers, fishermen, mine worker, night guards, tea garden workers: LLINs will be provided to farms in endemic areas (Stratum 3 and 2) to deliver to their seasonal workers when they will arrive and work.

2.1.1.6 Provide LLINs to protect people in new settlements: There will be special emphasis on providing LLINs to people in new settlements in target areas, example, FDMN (dispersed rather than residing in established camps) and other displaced populations, roadside economic migrants, settlements adjacent to construction projects (Stratum 3 and 2). New settlements will be identified through routine population surveillance conducted by local healthcare providers coordinated by district/Upazila focal points, partner NGOs.

2.1.1.7 Provide LLINs to address any LLIN attrition in-between mass distribution: Continuous distribution of LLINs will be considered to address any LLIN attrition in-between mass distribution (Stratum 3 and 2). LLINs will be stored at Upazila and district health facilities. Community-based

healthcare providers will distribute those LLINs and monitor and report on unusual population movements to allow the programme to respond in a timely manner to maintain LLIN coverage level.

2.1.1.8 Provide LLINs in the event of disasters and in response to outbreaks and confirmed transmission foci: In any event of disasters, outbreaks and confirmed transmission foci in endemic districts (Stratum 3 and 2), LLINs will be provided to anyone who has not already been covered.

2.1.1.9 Provide LLINs to Armed forces, BGB, police, and other law-enforcing agencies: LLINs will be provided to uniformed personnel while they are stationed in endemic areas (Stratum 3 and 2). LLIN distribution will be performed by their own channels, but oversight and technical support will be provided by the NMEP, as required.

2.1.2 Conduct focal responsive IRS:

Endophilic malaria vectors usually tend to rest indoors. Hence, the 'Indoor Residual Spraying' (IRS) of human dwellings with insecticides can be very effective. Vectors that are exophilic and endophagic, i.e., those tend to rest outdoor but tend to feed or rest indoors briefly, can also be controlled by IRS. Insecticides having residual effect are sprayed indoors, so that mosquitoes after biting an infected person will rest in the house and will pick up sufficient insecticide particles sprayed on the walls and other indoor surfaces and its longevity will be reduced so much so that it does not survive to become infective. In areas where vectors are strongly exophilic and/or exophagic, i.e., they rest and bite outdoors, other control methods will be considered.

As with LLINs, the effectiveness of spraying the walls and ceilings of houses and animal sheds with IRS is somewhat constrained by the early outdoor biting habit of key local vectors in Bangladesh. Nevertheless, IRS can have a significant impact on malaria transmission provided the construction of houses is sufficiently solid with enough sprayable surfaces.

Instead of routine IRS, the NMEP will conduct focal responsive IRS in the event of outbreaks in 03 CHT districts (Stratum 3) and/or in the event of confirmed transmission foci (active foci) in elimination districts [Stratum 2]. IRS will, however, only be applied in areas which have not been targeted for LLINs during the previous three years, except in special circumstances[28]. Areas that have received LLINs in the last three years will instead receive top-up LLINs, as required. In practice, the effectiveness of spraying depends on timeliness and quality coverage, adherence to the specified criteria of the insecticide and application procedure, community acceptance of spraying, availability of well-maintained equipment, adequately trained spraying personnel, effective supervision, and strong financial support. The NMEP will develop an IRS manual to guide all concerned to maintain the quality and increase the effectiveness of IRS. Further, in accordance with the national policy the choice of insecticide will consider safety, efficacy, cost, availability, existing susceptibility of vectors, and likely effect on susceptibility of vectors.

To be effective, IRS requires a well-organized operation by skilled spray-men and with very strong field supervision (field staff, Spray Supervisors/Team leaders). As with LLINs, IRS operations require careful planning at both the macro and the micro levels (including geographic reconnaissance to ensure the suitability of house numbers, house construction in target areas). Community mobilization, and BCC will be key to ensuring total community acceptance to achieve the high level of coverage (>80%) required to maximize impact. Emphasis will be placed on strengthening logistics to ensure timely and adequate supplies of consumables, equipment (spray pumps, replacement parts, personal protective equipment), vehicles and other means of transportation for supplies, equipment, and workforce besides funding. Attention will also be given to strengthen coverage assessments and documentation of IRS operations.

2.1.3 Conduct larval source management (LSM):

Larval Source Management (LSM) refers to targeted management of mosquito breeding sites, with the objective to reduce the number of mosquito larvae and pupae. LSM is only recommended as a supplementary malaria vector control measure; it will not be used to replace core vector control

interventions, such as LLINs/IRS. The NMEP will implement LSM through community mobilization where vector-breeding sites are 'few, fixed and findable', in identified areas as per the WHO guidance (Stratum 3). Effective management of larval habitats requires trained field personnel, entomologists, and public health professionals, with detailed knowledge of local malaria transmission and vector control. The approach will be managed by central and district level entomological teams. Guidelines will be developed for sound management of mosquito larval habitats.

2.1.4 Initiate innovative vector control and personal protection measures:

Spatial repellents (repellent cream, spray, oil) and attractive toxic sugar baits may have potential for reducing human-vector contact and controlling malaria transmission and disease in specific situations (example, early outdoor biting vectors such as *An. baimai*). Insecticide treated hammock nets for population who sleep outdoors will be considered besides other options as, long lasting impregnated blanket and top sheets; insecticide treated plastic sheet for hard-to-reach populations, where IRS is suitable but cost and house configuration will not allow IRS. The NMEP envisages operational research in coordination with relevant agencies for the purpose. Investigations into the effectiveness of personal repellents and insecticide-treated clothing for reducing residual malaria transmission (RMT) will be carried out. The outcomes will inform the integration of these tools into IVM strategy.

Objective 3: To strengthen context-specific surveillance in all malaria settings and outbreak preparedness and response through 2025.

Surveillance is a core intervention of malaria control and elimination. Malaria surveillance is the continuous and systematic collection, analysis and interpretation of malaria-related data, and the use of that data in the planning, implementation, and evaluation of public health practice. Improved surveillance of malaria cases and deaths helps the program determine which areas or population groups are most affected and enables the country to monitor changing disease patterns. Surveillance systems will be expanded and strengthened nationwide. The NMEP will lead and coordinate surveillance (and M&E) across all strata and all sectors. Strengthening of national capacity for surveillance (and M&E) will be priority. Routine surveillance will be strengthened in high endemic districts. In elimination districts, any single case will be investigated, classified, and notified and foci will be investigated followed by appropriate response. Concerned staff at all levels will be trained to examine and evaluate surveillance data and carry out appropriate responses. Capacities of health workers/volunteers with partner NGOs (and progressively MHVs, UNICEF's Para workers) will continue to be built/strengthened on programme data recording and reporting. An enhanced DHIS2 based MIS system will be in place. Further, early detection and response of outbreak will be done. In line with the WHO guidance, surveillance and response mechanisms will be reviewed and will be integrated into the broader health sector approach, as appropriate. Necessary resources will be identified. Mandatory notification of malaria cases by all sectors will be enforced through regular orientation, advocacy and communication and supervision and follow up.

Effective and comprehensive coverage of vector control interventions has contributed to reduction in malaria morbidity and mortality. It is reliant on knowledge of local vector species and their susceptibility to insecticides, as well as on vector and human behaviours that may allow mosquitoes to avoid contact with interventions and thereby maintain residual transmission. Entomological surveillance is essential to inform IVM strategy and evidence-based implementation to maximize their impact on malaria transmission

Strategy 3.1 Epidemiological Surveillance

ACTIVITIES:

3.1.1 Strengthen Routine and Case-based Surveillance Systems:

The NMEP set up a routine surveillance system to monitor the disease trend and analyse the epidemiological information for programme planning and implementation. The NMEP follows the guidance from the WHO [A Framework for Malaria Elimination (2017), Surveillance and M&E: A Reference Manual (2018), GTS

2016-2030 (2021), and others]. For strengthening of surveillance at field level, a surveillance manual is being developed with special emphasis on hard-to-reach areas. National elimination guidelines will be developed for comprehensive guidance on surveillance and other components as the country progresses towards elimination and prevention of re-introduction. Relationship with MoHFW HMIS will be defined besides revisiting data collection tools/reporting forms/registers, data aggregation levels, etc. The guidelines will also clearly articulate how data will be used for decision-making. Surveillance system will source data from DHIS2 based MIS as the platform will be launched nationwide.

The routine surveillance system collects malaria related information from 13 malaria endemic districts (Stratum 3 and 2); of which more than 90% of confirmed cases are reported from 03 CHT districts (Stratum 3). Routine reporting captures the data on the number of cases tested and treated. The dataset is further disaggregated into age, sex, type of parasitological examination, malaria species, type of antimalarials and treatment outcome. For 03 CHT districts in the transmission reduction phase, the surveillance system includes monthly aggregated reporting supplemented by outbreak monitoring, which will be strengthened.

In 10 non-CHT endemic districts in the elimination phase (Stratum 2), 'case-based' surveillance will be rolled out/strengthened whereby effectively every case will be investigated, classified for appropriate response. Reporting of malaria cases will be initiated in 51 'non-endemic' districts (and a few 'non endemic' areas within endemic districts) [Stratum 1]. With nationwide strengthening of surveillance system as well as launch of DHIS2 based MIS, case-based surveillance and real-time reporting will be initiated in 51 'non-endemic' districts (and a few 'non endemic' areas within endemic districts). The NMEP has initiated setting up the routine data collection for malaria cases including 'zero' reporting starting with advocacy meetings with District and Upazila health authorities [Civil Surgeons and Upazila Health & Family Planning Officers (UH&FPO)] in 51 'non-endemic' districts (and a few 'non endemic' areas within endemic districts) and capacity building through training as well as provisioning RDTs, antimalarials.

Malaria data is reported from both active case detection (ACD) and passive case detection (PCD). PCD will be strengthened nationwide (across all strata) starting from CCs through tertiary hospitals. ACD surveillance systems, with case detection, notification and investigation will be strengthened in elimination districts but will not substitute PCD. Community health workers/volunteers play a major role in ACD, while public sector health facilities conduct PCD. ACD is classified into proactive case detection (PACD) and reactive case detection (RACD). In hard-to-reach areas and areas/populations that are not reached through PCD (example, key and vulnerable populations), proactive case detection (PACD) will be important for early detection of symptomatic cases and asymptomatic cases in the community and confirming the existence of active local transmission in target areas/populations. House to house approach to detect all symptomatic cases not detected by PCD and asymptomatic cases in elimination districts will be initiated when the caseload is very low. The PACD will place emphasis on population with limited access to health facility. Mobile and migrant populations are a high-risk group and to improve targeting interventions for these groups, collation of information on population movement in endemic districts will be initiated in coordination with relevant partner agencies and service providers and community contacts (different ministries, NGOs, private companies, UN agencies etc.). Any unusual influx will be investigated and responded with PACD and other interventions like LLINs, as appropriate, thereby reducing the risk of transmission and possible emergence of drug resistance. In addition, PACD will be conducted intermittently by doctor, paramedics, health workers/volunteers, etc. through special health camps especially during peak transmission season targeting hard-to-reach areas in coordination with local stakeholders at district/Upazila levels. The NMEP will also collaborate with the Armed Forces and Border Guards for reaching the high-risk population in hard-to-reach areas. Such collaborative PACD effort will be carried out through mobile outreach activities and special health camps. In elimination districts (Stratum 2), case-based surveillance and RACD are practised when a malaria case is reported, which will continue. The case investigation form and SOPs exist, and the focal persons are trained by the NMEP central and district level staff. The medical officer from UHC usually leads the case investigation team and reports back the findings to the district Head and central team in Dhaka. The partner NGO supports the investigation process.

In burden/transmission reduction phase, an ABER of at least 10% of population at risk will be pursued in 03 CHT districts (Stratum 3). Chattogram and Cox's bazar, and 08 districts of Mymensingh and Sylhet zones (08 districts) [Stratum 2] will be in elimination phase where case-based surveillance will be initiated/strengthened. From 2021 onwards, in Chattogram and Cox's Bazar, 8% of population at risk will be tested and in Mymensingh and Sylhet zones (08 districts), 5% of population at risk will be tested.

The NMEP will carry out an assessment of surveillance system with technical assistance by the WHO periodically and ensure its accuracy, reliability, completeness, precision, timeliness, and integrity. Feedback will be provided to the health facilities and community health workers/volunteers and others under the malaria surveillance network through regular monitoring and on-job training. Surveillance guidelines will also be updated from time to time, as required.

As phase-wise elimination is achieved, efforts will be initiated to prevent re-introduction and re-establishment of indigenous malaria in malaria-free areas through appropriate surveillance systems [example, bringing all travellers, migrants (to and from endemic/malaria prone areas) under surveillance, finding their place of origin and tracking them]. All fever cases will be tested, and all malaria positive cases will be treated (through supervised/follow up mechanisms) and reported (integrated under overall health care service delivery system). Special emphasis will be given in malaria-free areas with receptivity and vulnerability including border areas.

Case & focus investigation and response: Besides enhancing and optimizing case management and vector control, the NMEP will strengthen surveillance systems to detect, investigate, classify each case in elimination districts (Stratum 2 and 1). It will be critical to find remaining infections and any foci of ongoing transmission and investigate, classify, and clear them with appropriate response (case management and appropriate vector control). This surveillance will be done through case and focus investigation and response. According to the WHO guidance, the malaria cases will be classified as indigenous, imported, introduced (if any); and the foci will be classified as active, residual non-active or cleared. Such classification has been initiated; however, systems and capacities will be strengthened to cover all elimination districts as well as 51 ‘non-endemic’ districts (and a few 'non endemic' areas within endemic districts).

Timeliness of the response to confirmed foci is key to effective control, and so, ‘1-3-7’ approach will be adopted, whereby: each case will be investigated within one day of detection – Day 1; investigation of suspected foci will be conducted within three days of detection – Day 3; and response actions will be taken within seven days of detection – Day 7. RACD will be initiated within a circumscribed area (around the malaria case) within 07 days of detection of the case. The scale of the RACD will be tailored by the team to fit the local situation and will cover ~500m around the index case. RDT-based diagnosis will be augmented by microscopy-based diagnosis to maximize sensitivity. RDT positive cases will receive treatment with DOT approach. Any slide positive patients detected subsequently will be provided follow-up treatment as soon as results become available. Community health workers/volunteers will assist, as necessary. In addition to RACD, entomological and ecological assessments will be carried out, and if appropriate, either LLINs will be given to those in need or focal responsive IRS will be applied by Day 7. Performance will be monitored against this 1-3-7 benchmark.

Public sector health facilities and partner NGOs (across all strata) will be trained to record and review every malaria case (based on travel history, ecological factors, and recent epidemiological data) and submit a ‘case investigation report', which will include an assessment of likelihood of local transmission, to their Upazila and district malaria focal points within 24 hours of detection. When a malaria case is detected, the service provider will immediately submit a ‘case notification report' to their Upazila and district malaria focal points. The report findings will be entered on the DHIS2 based MIS. Such approach has already been initiated in elimination districts (except Chattogram and Cox's Bazar) where reporting of malaria cases, their confirmation and investigation is conducted within 1 day and appropriate public health response to prevent further transmission are taken within 3 to 7 days. Case-based surveillance and response system will

be further refined according to the WHO guidelines and expanded to all elimination districts (Stratum 2) as well as 51 ‘non-endemic’ districts (and a few 'non endemic' areas within endemic districts) [Stratum 1]. In all elimination districts, training and supportive supervision will be strengthened and provision of equipment and supplies will be made. Case investigation will include group discussions and interviews (focusing on risk behaviour).

Once any suspected transmission focus notification reports are received, prompt investigation will be carried out. A team of health staff from district and Upazila level (and as necessary and possible from central level) will initiate an investigation within three days of detection. For timely response, the investigation report will be reviewed by the Civil Surgeon, in consultation with central level staff, and if a transmission focus is confirmed, its intensity and likely scale will be assessed, and an emergency plan will be developed. The scale of the response will be tailored to suit each specific situation. Foci will be classified as active, residual non-active or cleared. The details will be included in the surveillance manual for guidance to all levels especially subnational level, example, active foci will be defined as areas (ward) with reported indigenous cases in the current year, residual non-active foci will be defined as areas (wards) without indigenous cases for one to three years and cleared foci will be defined as areas (wards) with no indigenous cases for more than three years. Cleared foci will further be categorised as areas (wards) with no indigenous cases for more than three years but with vectors and with no vectors.

The NMEP will coordinate with the MoHFW to operationalize mandatory notification of malaria cases nationwide (malaria is a notifiable disease according to Bangladesh Gadget 2018, Number 61). The public sector health facilities will be required to report each malaria case immediately for review and assessment plus appropriate response. Likewise, partner NGOs, and others as well as private sector will also be required to report each malaria case immediately to their nearest public health facilities and/or DHIS2 based MIS.

3.1.2 Expand and strengthen the malaria information system:

The national malaria MIS will be expanded nationwide in support of malaria burden reduction and malaria elimination. A new system will support real-time case-based reporting, case investigation, focus investigation and focus response. Forms and registers will be standardized, as appropriate. More emphasis will be placed on data analysis and interpretation at district and Upazila level, and on the provision of timely and succinct practical feedback from central and district levels to Upazila teams and peripheral health staff for action. Capacity building will be emphasised to support the increased workload associated with elimination and involvement of additional staff as well as other sectors will be considered.

The current malaria MIS comprises paper-based data from the community level that is transmitted to the UHC every month. Subsequently, the UHC enters the data on web-based database and monthly aggregated data is transmitted to the central NMEP office in Dhaka for overall compilation and analysis.

Malaria data will continue to feed into the MoHFW ‘Health Information System’. A malaria information system based on ‘DHIS2’ is being piloted with technical assistance by the WHO involving a series of processes such as customization of the WHO malaria elimination dashboard within the DHIS2 based MIS and development of a case-based reporting and tracking system. The DHIS2 based MIS will be progressively rolled out to cover all levels in 13 endemic districts from 2022 and later 51 ‘non-endemic’ districts (across all strata), including community-based health workers/volunteers with partner NGOs and private sector providers. It will support all aspects of data collation including case notification, case investigation, case classification, focus investigation and focus response. Every health care service delivery point, viz., CCs with public sector has been equipped with a smartphone/tab for real-time recording/reporting. Likewise, the health workers with partner NGOs in 13 endemic districts have also been equipped. Capacity building of data management staff on software application, data reporting and analysis are being/will be carried out.

A malaria atlas for entire Bangladesh using [Geographical Information System (GIS)] will be developed and updated periodically. The smartphone/tab of health worker/volunteers will facilitate reporting of the

geographical position of all confirmed malaria cases starting with elimination districts. This will support planning, implementation, and monitoring.

3.1.3 Country stratification and malaria risk mapping:

The NMEP carries out district/Upazila level stratification periodically based on API across 13 endemic districts. As the surveillance system improves and transitions in-line with elimination requirements (with reliable case detection and recording and reporting of malaria cases through DHIS2 based MIS covering public sector, NGO, private sector), a ward-level stratification in each district will be initiated.

Stratification involving the extent of malaria transmission intensity and the population at risk will be done annually especially in elimination settings for effective and efficient planning and better targeting intervention-mix in line with the WHO guidance (viz., receptive versus non-receptive areas; receptive areas with and without malaria transmission because of interventions; receptive areas with widespread transmission and areas with transmission only in discrete foci; and areas with persistent transmission by transmission intensity to guide targeting of interventions).[29] Determinants for stratification will include: epidemiological, receptivity and vulnerability parameters [viz., climatic and geo-ecological variables (altitude, temperature and humidity, rainfall patterns, proximity to water bodies, land use], distribution of competent vectors, socio-demographic characteristics, and interventions (access to anti-malarial treatment and coverage of vector control); as well as population movement in terms of influx of infected individuals or groups who might bring in malaria, and/or infective anopheline mosquitoes). Together with concerned Government Departments and other agencies, the NMEP will attempt to map the movement patterns of mobile and migrant populations using relevant mapping tools. In consultation with the Malaria Technical Committee and relevant individual experts, operational definitions of malaria risk will be deliberated (viz., no risk, low, moderate, and high risk).

3.1.4 Outbreak preparedness, investigation and response:

According to the WHO guidance, malaria epidemic is defined as a sharp increase in the incidence of malaria in populations in whom the disease is rare, or a seasonal increase in areas of low-to-moderate transmission over and above the normal pattern. In addition, the NMEP will also follow the guidance regarding man-made/natural conditions that render populations vulnerable, viz., breakdown of prevention and treatment services, especially in highly receptive areas; migration of nonimmune people to areas with high malaria transmission; introduction of parasites and/or suitable vectors to receptive areas where transmission is low or not existent and where the population therefore does not have a high degree of immunity; increased population vulnerability after a long period of drought (and famine) with no malaria transmission, followed by intensive rainfall and creation of suitable environmental conditions for epidemics; and resistance of the vectors and parasites to insecticides and drugs, respectively.[30]

As the country is transitioning from burden reduction to elimination, the risk of outbreak increases. Therefore, outbreak preparedness is a priority (across all strata). Surveillance system will include forecasting, early warning, and early detection based on climatic and epidemiological parameters. Rapid seasonal increase in transmission in the month of June is a critical period for outbreak detection. Surveillance focal points in districts/Upazilas as well as peripheral health workers/volunteers will be on full alert during this period, with the NMEP standing-by to ensure additional support including drugs and commodities. Malaria cases will be analyzed daily/weekly/monthly to ensure early detection of any potential outbreak especially in elimination districts. Every suspected malaria case will be accurately diagnosed, and complete treatment of confirmed malaria cases will be ensured. In transmission reduction districts, accurate information on the geographical distribution of the disease will be maintained. Surveillance of this kind will be used to detect early signs of outbreak, so that timely response is initiated to prevent or limit its size. If an outbreak is suspected, then the health worker responsible will submit an SMS-based ‘suspected outbreak notification report' to their Upazila and district malaria focal points for prompt investigation. A team made up of staff from district and Upazila level will initiate an investigation. The investigation will cover parasitological (RDT and microscopy), entomological and socio-economic elements, and will also include group discussions and interviews focusing on risk behaviour, as well as

active case detection (ACD). The scale of the ACD will be tailored by the team to fit the local situation. The investigation team will submit an investigation report to the district Civil Surgeon and to central level within 24 hours of completing their investigation. The report findings will be entered on the DHIS2 based MIS. The investigation report will be reviewed by the Civil Surgeon in consultation with central staff and if an outbreak is confirmed, its intensity and likely scale will be assessed, and an emergency plan will be developed. The scale of the response will be tailored for each specific situation based on guidelines. RDT-positive cases will receive treatment on the spot and follow-up treatment will be provided for any RDT-negative slide-positive patients. Either LLIN will be given to those in need or IRS will be applied based on entomological and ecological assessments. The surveillance guidelines will include all aspects related to outbreak preparedness, investigation and response, and post outbreak assessment. The current threshold system for outbreak detection (based on 'mean monthly caseload for the last 3 years plus 2 standard deviations') will be revised to improve sensitivity considering reduction in caseload. The NMEP will update and disseminate outbreak preparedness and response guidelines; conduct trainings on outbreak preparedness, reporting and response at District, Upazila levels as well as orient peripheral staff and community health workers/volunteers.

Outbreak preparedness and response efforts will be the responsibility of district Rapid Response Teams (RRTs) [also responsible for other epidemic prone diseases]. Training and provision of equipment and supplies for these RRTs will be ensured. Buffer stock of LLINs, insecticide, RDTs and ACTs will be maintained at central and district level to deal with potential outbreaks (and natural disasters). Stock rotation with routine supplies will be applied to prevent expiry of such buffer stocks. In addition, the NMEP will discuss and agree with the WHO for arrangements to obtain ACT from outside the country, if necessary. Supportive supervision for all staff and volunteers will be conducted.

3.1.5 Epidemic Prediction/Forecast/Estimation:

The early warning system for detection of malaria outbreaks will be strengthened. Epidemic prediction for malaria outbreak will be attempted for identifying the areas and the population at risk of malaria. To support malaria epidemic prediction, the NMEP will use epidemiological and entomological data, meteorological data (rainfall, temperature, and humidity), and population movement. Because variation in rainfall with humidity is found to be the major factor associated with the seasonal and inter-annual variation of malaria incidences, coordination with the Bangladesh Meteorological Department (BMD) will be established for district-wise short-term outbreak prediction system based on daily rainfall levels. In order to get an early warning sign, the NMEP will also work with other government departments (Ministry of Agriculture, Ministry of Defense, etc.) both at central and district levels as well as international partner agencies (UNHCR, IOM, etc.) to ensure that it is fully informed regarding actual or expected movements of population (including larger-scale international travel) and major construction/development projects likely to impact on the malaria situation. The NMEP will advise government bodies reviewing impact assessments for major projects in endemic areas and will liaise with them and above-mentioned ministries/agencies on a regular and *ad hoc* basis. Major events will be reported immediately and there will be teleconferences between districts and the NMEP (at least quarterly). In addition, national contingency plans will be drawn-up in accordance with the most likely risk scenarios. These will specify the channels to be used to transfer emergency funding to ensure speedy mobilization of necessary resources.

3.1.6 Initiate cross–border surveillance:

Bangladesh has international border with India and Myanmar and therefore, spread of malaria and antimalarial resistance through population movement pose threat to elimination and may re-introduce transmission in malaria-free areas. Malaria surveillance will be strengthened (along international border areas within national boundaries). Drawing from the guidance provided in the WHO operational framework for cross-border collaboration (2018) as well as various cross-border meeting recommendations, the NMEP will initiate dialogue with countries sharing international border (India and Myanmar) with facilitation and support by the WHO for cross-notification of malaria cases (adjacent/non-adjacent border areas) and joint planning and implementation of appropriate responses (case management, vector control, communication). Imported cases will be separately recorded and reported and GIS will be used for mapping. Periodic

situation analysis at local levels will be emphasised including case upsurge/outbreaks and increases in vulnerability/receptivity and sharing of such information with neighbouring areas.

Importantly, case management, vector control as well as surveillance and response will be optimized within country (within national boundaries) along international as well as inter-district border areas especially in the elimination districts sharing border with high endemic CHT districts, example Bandarban. Since local importation pose a huge challenge for reaching elimination in low burden settings, inter-district notification of cases will be emphasised. A recent study[31] noted that the geographic distribution of clinical cases might not reflect patterns of transmission, particularly in areas hosting highly mobile populations, where importation of parasites is common. Identifying the true foci of transmission is particularly important in elimination settings. Whilst targeting interventions to forested areas is a key strategy for elimination, mixing between low transmission settings also needs to be addressed. In another recent study[32], the epidemiology of travel patterns of malaria patients in southeast Bangladesh was noted as complex with widespread temporal and spatial heterogeneity, presenting unique challenges for malaria control and needing targeted spatial interventions. The study approach demonstrated a framework for identifying key travellers' groups and their origins and destinations of travel in combination with knowledge of local epidemiology to inform malaria control and elimination efforts. Such studies will be planned in the future.

3.1.7 Drug Resistance Monitoring:

The NMEP will work together with the WHO and other relevant partners to monitor antimalarial drug resistance in-line with the latest WHO guidelines. First-line treatment efficacy will be monitored through Therapeutic Efficacy Studies (TES) annually. In addition to the six sentinel sites currently under biennial surveillance during alternate years, new sites may be established as necessary to ensure that TES results provide a representative overview of the situation nationally (example, new TES sentinel site will be established to assess drug resistance status in the Rohingya community). Staff will be trained, and equipment will be procured as necessary. Blood samples will be collected from hospitals nationwide for molecular monitoring of parasite populations (genetic epidemiology). Monitoring drug resistance in *P. vivax* will be carried out in parallel, where feasible. The NMEP will also carry out special clinical fieldwork in outbreak areas and in areas where treatment failure is suspected. Once the number of patients falls to low levels, it will no longer be possible to perform TES; instead, the focus will shift to attempting to follow up all patients (especially falciparum malaria patients) on the days specified in the WHO guidelines. Positive cases will be admitted to hospital for supervised second-line treatment. In consultation with the Malaria Technical Committee and the WHO, the NMEP will consider transition from TES to 'Integrated Drug Efficacy Surveillance' (iDES) to utilize routine surveillance system for monitoring antimalarial drug efficacy in elimination settings. Data will be collected for all cases, including asymptomatic cases and all species detected by PCD/ACD.

3.1.8 Strengthen Pharmacovigilance System:

The NMEP will work closely with the DGDA to strengthen existing pharmacovigilance system. This is especially important in the case of high dose primaquine used for the radical treatment of vivax malaria, particularly given the existence of G6PD deficiency in Bangladesh, which predominantly affects certain ethnic minorities. The NMEP will develop guidelines for a pharmacovigilance system.

3.1.9 Investigation/verbal autopsy of malaria death cases:

Verbal autopsy is regarded as an important technique to determine malaria-specific cause of death. Verbal autopsy will be used to assess the magnitude of malaria mortality, seasonal variation in mortality, age specific mortality, place of mortality, treatment seeking behaviour, treatment modality, treatment compliance, LLIN use, etc. nationwide when a death is reported. The NMEP will take initiative to update existing verbal autopsy tool (questionnaire) in line with the WHO guidance; conduct training on Verbal Autopsy for central, district and Upazila health staff/medical colleges and select members of partner NGOs, who will comprise the team to conduct verbal autopsy for malaria deaths.

3.1.10 Malaria Elimination Database

Systematic documentation of absence of indigenous malaria over time is one of the necessities of subnational/countrywide elimination process. The NMEP will establish a malaria elimination database for districts in the elimination phase. This sub-component of the MIS will serve as the national repository for all information related to malaria elimination, and will include:

- National malaria case register: a database of all individual case information from identified sources, allowing detailed analysis and synthesis of epidemiological information and trends for guidance to the elimination programme over time.
- Entomological monitoring and vector-control records: a central repository of information related to entomological monitoring and application of chosen vector-control interventions.

Technical guidance and oversight of the malaria elimination database will be the responsibility of the Malaria Technical Committee. Progress will be measured using multiple data sources, including routine information systems, household and health facility surveys, data quality audits, and longitudinal/cross-sectional analysis for key indicators as well as research.

Strategy 3.2 Entomological Surveillance

ACTIVITIES:

3.2.1 Establish and strengthen entomological surveillance and insecticide resistance monitoring:

Entomological surveillance provides information on vector species, their distribution and habitats, density, bionomics, and susceptibility/resistance to insecticides used for malaria control. Information collected through entomological surveillance techniques assist in understanding of the spatial and temporal changes in vector species, efficacy, and effectiveness of vector control measures. The NMEP will develop entomological surveillance and insecticide resistance (IR) monitoring guidelines in line with the WHO guidelines.

Currently, 03 sentinel sites are identified in Lama in Bandarban, Rajasthali in Rangamati district and Kalmakanda in Netrokona district for IR monitoring using standard WHO bioassays. Besides these, another 05 sentinel sites will be established in 03 CHT districts (Stratum 3) and rest of the 10 endemic districts (Stratum 2) based on eco-epidemiological representativeness. The surveillance will undertake incrimination and reconfirmation of vector, bio efficacy of LLINs, GIS mapping of the anopheline mosquito, besides monitoring of IR (in areas at high risk of IR, such as areas with high agricultural pyrethroid use), quality and household coverage of interventions (IRS), physical condition of LLINs and residual efficacy of insecticides with time. In elimination districts, entomological intelligence will be used later to evaluate risk of re-introduction. Entomological surveillance in hard-to-reach areas will be carried out by involving community volunteers after training on mosquito collection and preservation. Besides, the NMEP will constitute a rapid surveillance and response team to conduct prompt entomological surveillance in outbreak situation or any emergency. The NMEP will work with the WHO to establish a core group of highly trained entomologists at central level to manage entomological surveillance, make evidence-based recommendations about any necessary changes in interventions or delivery strategies, and to address any elimination-specific challenges. Decisions on the monitoring and management of insecticide resistance will be informed by national plans developed based on a comprehensive situation analysis.
Need-based entomological surveys will be conducted in elimination districts, as required. In addition, a baseline entomological survey will be conducted in 51 ‘non-endemic’ districts (and a few 'non endemic' areas within endemic districts) [Stratum 1] to understand malaria transmission and vector behaviour patterns.

3.2.2 Develop guidelines on public health insecticide management:

The NMEP will work with Ministry of Agriculture, the WHO, and relevant others to develop guidelines on public health insecticide management, such as insecticides/pesticides used in Agriculture, household pesticides, etc.

3.2.3 Establish entomology laboratory and insectaries:

Establishing and strengthening entomological surveillance and insecticide resistance monitoring supporting elimination need adequate capacity (infrastructure and HR). In addition to additional vector technicians, laboratories and insectaries will be established in Bandarban and Dhaka. Insectaries will generate the vector mosquitoes required for product testing and for QA of vector control operations. In addition, support from concerned/relevant research organization and universities will be sought.

Objective-4: To achieve universal coverage by Advocacy, Communication and Social Mobilization (ACSM) activities for uptake of preventive and curative interventions, optimal community engagement through 2025.

Evidence-based and context-specific ACSM activities/campaigns (for different settings) using a comprehensive strategy are essential elements of malaria control and elimination. Channel-mix/different approaches are imperative. Advocacy (political, administrative, media, multi-sector) will enhance commitments and well-coordinated, harmonized efforts by stakeholders and partners towards fostering conducive and enabling environment. Communication and social mobilization through community outreach programmes/mid-media, inter-personal communication, point of service promotion/branding, and advertising through mass media will improve community awareness and community participation, which in turn, will enhance community empowerment and social mobilization. ACSM activities will strive for responsive behaviour and community ownership of the malaria elimination.

Strategy 4.1 Community Awareness and Participation

ACTIVITIES:

4.1.1 Develop communication strategy for malaria elimination:

A communication strategy will be finalised to promote and facilitate social and behaviour changes drawing from various theories/models/frameworks and Comprehensive Social and Behaviour Change Communication (SBCC) strategy of MoHFW (2016) and an outline of communication strategy (2019). The NMEP will seek inputs from the Malaria Technical Committee, concerned staff; partner NGOs, national and/or international experts to finalise the strategy. The strategy will be printed and disseminated among key stakeholders in public/NGO sector and others regarding guidance on multifaceted ACSM activities/campaigns. The strategy will facilitate the delivery of consistent and harmonized messages on malaria, address the needs of key and vulnerable populations, encourage use of information and communication technology (ICT), and improve coordination. The strategy will be evidence-based and audience-centered and address socio-cultural, rights al barriers and inequities at individual, household and community levels and accordingly focus on changing behaviours towards realization of outcomes (example, optimal LLIN use, EDPT, treatment compliance, etc.) and impact (example, further burden reduction, elimination).

4.1.2 Enhance community awareness and participation:

Malaria interventions – EDPT, prevention must go hand in hand with community awareness and participation. Unless individuals, communities are aware and see the merits of preventing illness, even the best-designed strategies might not work. The NMEP together with MoHFW Health Education Department, partner NGOs and other relevant agencies, will enhance community awareness and community participation. Various community engagement activities will be carried out to motivate community people to understand their own health situation in general and malaria elimination in particular; and to initiate/scale up community level actions with their own initiative and creativity. Such initiatives will progressively strengthen social mobilization process to bring together all societal and personal influences to raise awareness of and demand for quality services, assist in the delivery of services, and promote sustainable individual and community involvement.

The NMEP together with partner NGOs and relevant agencies will involve community in 13 endemic districts for improving EDPT, treatment compliance, patient referral and follow up, LLIN distribution and

utilization, larval source management, etc. Activities (Stratum 3 and 2) with special emphasis on inter-personal & group communication will include but not limited to: health forum, group meetings (courtyard/market & other common place/tea stall meetings); orientation & involvement of school and college students, teachers, religious and local leaders, ward & union leaders, etc.; popular theatres; public announcements (miking) at local 'haat/bazar'. The activities will target key and vulnerable populations, viz., women, forest goers, farmers, fishermen, wood/bamboo cutter, coal mining worker, tea garden and construction workers, etc. Mobile and migrant populations visiting endemic areas (as well as border areas) will also be targeted. These activities will be complemented by improved service delivery including malaria case management for migrants visiting endemic areas, on arrival, during their stay and on their return to their home bases. A 'Malaria Matchbox' tool will be applied periodically to update understanding of community, rights and gender issues and addressing those through community engagement with key thrust on inclusiveness, equitable and gender sensitive approaches. In 51 'non-endemic' districts (and in a few 'non endemic' areas within endemic districts), efforts will be taken to enhance community awareness.

In order to further strengthen the malaria services and ownership at community level, a 'ward committee' is envisaged, which will involve community leaders like Karbari, Para Kormi/teacher/union council member/malaria patient, local influential person, NGO health workers/volunteers and 'village doctors' (Boidyo/Kabiraj/TBA). Their involvement can be helpful to identify the high-risk groups including migrant and mobile populations, new households, as well as pregnant women and under five children in the community, which will improve the LLIN utilization, early referral for blood tests and ensure required and complete treatment and help to ensure screening of the risk group after returning to the para. In coordination with local community/religious leaders and community health workers/volunteers, audio-visual presentations in local language/dialect will be made periodically to existing community groups/networks (during their own scheduled meetings) to update them on malaria related issues and desired responsive behaviour and seek their support for programme activities, as appropriate. Every year a large-scale community mobilization event will be held on World Malaria Day (25 April). Observance of such events will continue even in malaria-free areas.

Strategy 4.2 Programme Communication

ACTIVITIES:

4.2.1 Development of BCC materials:

The NMEP will develop and produce target-group-specific and locally appropriate BCC materials and methodologies for all high-risk groups, as well as for communities approaching elimination drawing from assessments/research. Materials are likely to include inter-personal communication (IPC) aids as well as mass media options. Products will be multilingual, as needed. Communication materials such as calendars, stickers, leaflets, brochures, folders, etc. will be developed and printed for endemic as well as non-endemic districts (all strata). Dissemination of IEC/BCC materials including traveller/tourist guidelines at community meeting places, bus and rail station, airport, land & seaports, ticket counter, ferryboat (*kheya ghat)*, hotels and in occasional national fair, etc. Where appropriate, material development will be carried out with support by a commercial advertising agency. Key messages will include but not limited to, daily & correct use of LLINs, care and washing practices; the importance of sleeping under an LLIN; the importance of LLIN use in the forest; the importance of early diagnosis and treatment; the dangers of fake, sub-standard and inappropriate antimalarials; the importance of compliance with the full course of treatment; availability of services (location of, and services provided by the CCs, health workers, volunteers of partner NGOs); information for tourists/migrants entering endemic areas; and, the importance of all cases receiving appropriate treatment.

4.2.2 BCC Implementation through channel-mix

Communication will be carried out through routine activities and campaigns (umbrella/localized campaigns) [across all strata]. A major focus will be on providing a steady flow of information on priority behaviour through channel-mix targeted to the right audiences and using the right tools at right times;

ensuring continuity, which is critical for recall; intensifying activities before and during transmission season; fostering positive messages/stories and countering negative ones; publicizing achievements and success stories. Health staff, community health workers and volunteers will work together to implement village-based BCC campaigns during mass LLIN distribution. In addition, they will deliver BCC messages through public announcement systems in selected high-risk villages. Local champions will be identified for message dissemination as well.

Interpersonal communication (IPC) in and outside the health facilities/house/school, is effective an– works best when there is one-on-one contact between the health worker/volunteer/peer and target group - individual/family, etc. IPC facilitates comprehension of concepts and demonstration of new practices. Over a period, if done consistently, this participatory method can result in adoption of interventions on a sustainable basis through mutual trust building at community level. IPC from peer to peer and/or family member to patient/family member and/or support groups/individual/family will be encouraged after necessary capacity building.

School-based initiatives being critical in creating change agents in the short- to long term, various programmes will be carried out. Child-to-Child/Child-to-Family communication for dissemination of messages will foster knowledge and awareness and responsive behavior among peer groups and family. The initiative will include: orientation for students, Principal, Teacher–; seminars/debates, message dissemination during morning assembly. In addition to holding competitions - Poster/Painting/Projects/Essay/Slogans/Drama on malaria; conducting classroom sessions on how to spread messages on malaria elimination will be prioritized. From time to time and on important days (World Malaria Day), processions by schoolchildren would be organized displaying BCC materials (placards). Incentives/prizes in terms of vouchers, samples, etc. may be sponsored through contests to encourage the audience to adopt a desired behavior.

Appropriate mass media/mega events/social media will be tapped at national and subnational levels for dissemination of messages and possible linkages with livelihood interests. Free opportunities, possible sponsorship/co-endorsements for will be explored. Mass media will include the following channels. In view of COVID-19 related restrictions, communication campaigns will make use of virtual platforms extensively.

- Broadcast/telecast: TV, radio (especially local cable TV network/community & FM radio) – commercials/spots, jingles, music/dance programmes, interactive programmes (phone-in programmes/talk shows/capsules within reality shows/quiz programmes);
- Multi-media: Motivational documentaries/short films;
- Mobile technology/telephone: mass messaging (sms)/calls [Mobile phone-based BCC messaging especially targeting key populations in specific geographical areas and mobile and migrant populations will be implemented. Messages will include details of services available and contact numbers for local health workers and volunteers. The NMEP will explore the feasibility of a fixed telephone number for volunteers, for which calls would be routed automatically to the nearest health worker/volunteer].
- Print: Newspapers, magazines; and booklets, brochures, gate folders, mailers and posters, pamphlets, leaflets, stickers, flip books, flash cards, bus tickets, OPD registration forms, calendars, and wall charts/information scroll, comic strip–/books, games.
- Outdoor publicity: Hoardings/billboard, Glow Signs, branding on wheels (bus, taxi, private car) - panel, blimps (including billboard/signboard/banner with malaria messages at border crossing points/FDMN camps/tourist places); Mobile film/video shows at local ‘haat/bazar’ (markets).
- Mega event [Football match, Celebrity (Music/movie/dance) show].
- Social media: Platforms like Facebook, twitter, etc.

Strategy 4.3 Advocacy for Strengthening Enabling Environment

ACTIVITIES:

4.3.1 Advocacy at different levels:

Strong political commitment is a prerequisite for embarking on elimination. Bangladesh has committed to achieve the SDGs and signed the APLMA Malaria Elimination Roadmap in 2015 and Ministerial Declaration on Accelerating and Sustaining Malaria Elimination in the South-East Asia Region in 2017, amongst others. Key elements include high-level political commitment irrespective of competing priorities, and adequate and sustained funding from both domestic and external sources; leadership commitment to malaria elimination at national and subnational levels (districts and other administrative units); and collaboration with other health sector programmes, institutions and systems, with other relevant non-health sectors & private sector, CSOs/NGOs/CBOs and others.

The NMEP will continue and strengthen advocacy activities for sustained political commitment from political leaders, policy makers, high level decision makers and administrators for malaria elimination. Such commitment is crucial for adequate financial support, development of appropriate policies and strategies, successful implementation at national, district and local levels and coordination of responses across multi-sector partners for collective action is also critical. An advocacy package will be developed targeting influencers at central, district and Upazila and below levels (for all strata). The NMEP will also document, consolidate, and disseminate best practices and successes for advocacy. Advocacy will be continued in malaria-free areas for sustaining commitments for and mobilisation of resources.

Advocacy at National Level: The NMEP will disseminate the NSP 2021-2025 to all levels starting from the MoHFW and various partners, donors, stakeholders at central level to district and Upazila levels. Since phased elimination journey is starting with zero indigenous cases in 04 districts in 2021, a mega advocacy event is envisaged with the gracious presence by the highest political level as Chief Guest, Guests of Honor as well as key stakeholders and partners.

The NMEP will also organize advocacy meetings and round-table discussions involving the high-level decision makers, media, and other stakeholders to capitalize commitment for support and resource mobilization. The NMEP will organize “World Malaria Day: 25 April”, every year on a large-scale, which is an important opportunity for advocacy (political, administrative, media) for raise awareness, reinforcing commitments and mobilizing resources. Television and radio talk shows, rallies and other events will be organized.

Advocacy at District/Division level (across all strata): The NMEP will organize advocacy meetings in 13 endemic districts involving district level health officials, NGO and private sectors, representatives of non-health ministries, CHT Council Member, religious leaders, and members of the business enterprises, etc. Various advocacy activities supported by appropriate materials will be organized on “World Malaria Day”. In addition, during monthly/quarterly meetings, review of such activities will be done. In 51 ‘non-endemic’ districts, advocacy activities will be carried out at Division and District levels involving key stakeholders.

Advocacy at Upazila Level: All endemic Upazila will organize advocacy meetings involving media people, local government official, local elected members, chairman, headman/karbari, religious leaders, teachers, and community.

Advocacy at peripheral level: Below Upazila level, Ward Committees will be formed in each ward of an endemic Upazila involving the Union and other local leaders, govt. staff, and other stakeholders. After initial orientation of these committees, advocacy will be continued especially on World Malaria Day.

Advocacy with corporate sector/various donors/funders beyond the GF: Advocacy meetings will be initiated with corporate sector for involvement in malaria elimination journey. Resource mobilization will be one of the key agenda. Such meetings will be planned with appropriate advocacy products.

4.3.2 Strengthen management and M&E of ACSM:

Expert management of advocacy as well as BCC, and community engagement efforts will be ensured. ACSM activities will be coordinated with other interventions (especially LLIN distribution), besides inclusion of ACSM component as an integral part of trainings at all levels. Besides considering dedicated BCC/Advocacy expert at NMEP, an ACSM technical working group with defined Terms of Reference will be constituted who will hold two meetings per year (integrated into routine NMEP review meetings), as necessary. Review of ACSM activities will also be conducted during periodic meetings and supervisory visits. Besides review, the NMEP will conduct an in-depth independent assessment of ACSM impact and revise strategy, as appropriate. Appropriate research will inform evidence based ACSM strategy.

Objective-5: To strengthen program management, monitoring & evaluation and partnership and coordination through 2025.

Successful malaria elimination depends on effective programme management, resilient and sustainable health systems, skilled, motivated, and well-supported staff, and service providers at all levels as well as appropriate policy, strategy, and guidelines, review and planning. Ensuring programme and data quality are extremely important and therefore, supervision and monitoring will be in place, and it will be ensured that the NMEP policy/strategy/guidelines are available at all levels and accordingly fully implemented, besides timely and accurate routine reporting and regular data quality audits. The NMEP will need to be responsive to the evolving needs in line with phased elimination to maximize impact. Strategic multi-sectoral collaboration at all levels will be a priority for harmonized collective action. Partners will provide support covering a broad range of programme areas and will work with the NMEP to strengthen the leadership and management capacity of the NMEP.

Access to quality-assured prompt malaria diagnosis and treatment as well as effective prevention will be emphasised in border areas within national boundary and criticality of effective cross-border collaboration and complementary responses, amongst others. Cross-border actions will draw from the WHO publication, 'An operational framework for cross-border collaboration for a malaria-free South-East Asia Region' (2018).

Strategy 5.1 Programme Management

ACTIVITIES:

5.1.1 Human Resources development and management:

The NMEP has direct responsibility for planning and implementing malaria control and malaria elimination. The NMEP has three main sections: Epidemiology; Entomology and Laboratory (Central Malaria Reference Laboratory - CMRL). The NMEP central unit will provide strong leadership, effective management and mentoring at all levels to enable rapid and high-quality implementation of the elimination strategy.

The NMEP will take initiative and coordinate with relevant departments/units to recruit new staff and fill-up the vacant posts. Efforts will be made to retain experienced staff. The NMEP will periodically conduct a comprehensive review of existing HR and identify gaps in relation to changing requirements from transmission reduction to elimination. Accordingly, a Human Resources (HR) Development Plan will be developed. with special emphasis on effective and efficient delivery of interventions and fulfilling other necessary responsibilities related to implementation management and M&E. Due to the necessity for robust surveillance and M&E systems and high-quality operations, HR needs to be increased through the introduction of suitable HR at central level and additional Surveillance Medical Officers at district level to

ensure that all endemic as well as non-endemic districts (all strata) are covered. The district/division level team will comprise epidemiologist, entomologist, and data manager. Additional support will also be required for strengthening training and quality as well as ACSM. In order to reach/maintain ABER and QA in diagnosis, HR in laboratories will be augmented. Efforts will be made to position appropriate number of community health worker/volunteer to cover all population at risk following comprehensive mapping of wards/villages per Upazila, with detailed information on geographical accessibility, number of households, which will be reviewed periodically. The requirements of staff/community health worker/volunteer and or retention will be justified in terms of absolute necessity to progress towards and reach elimination goal and advocacy will be carried out at high level. The NMEP will introduce new measures to strengthen staff, health worker/volunteer motivation based on non-cash incentives, such as formal recognition of accomplishments.

Knowledge and competence of health workforce will be enhanced through training/re-training including in-service training. Subsequent to nationwide training needs assessment especially in-line with elimination requirements, a comprehensive capacity building and strengthening programme of NMEP and general health staff, community health worker/volunteer will be implemented to strengthen quality services, surveillance and M&E. The training will be integrated with other capacity building programmes wherever practical to maximize cost effectiveness and efficiencies. Efforts will also include academic accomplishments (international/national doctorate/master's degrees) and in-service training/re-training. Access to higher-level courses will be competitive and merit based. The NMEP will organize training for Community Health Care Providers (CHCP), peripheral health workers/volunteers on EDPT, ACSM, supply management and recording/reporting. Specialized training will be supported for staff at central, district and Upazila levels (doctors, clinicians, epidemiologists, entomologists, laboratory technicians, ACSM specialists, M&E/MIS staff, management staff). Technical and managerial capabilities will also Be strengthened at these levels that will also include workshops/exposure visits organized both at national, regional, and international levels. Efforts will be taken to strengthen and maintain technical capacity within the NMEP in view of retirement of workforce, internal transfers, and even somewhat limited opportunities for high-level training. NMEP will also conduct training and workshop to foster effective leadership management and ownership at district and Upazila level.

5.1.2 Infrastructure (development, maintenance):

Infrastructure strengthening and maintenance will be supported with GoB resources. Buildings, equipment, vehicles will be maintained at all levels in addition to appropriately insuring those. Such infrastructure strengthening will be done at all levels especially prioritising hard-to-reach areas and functioning status will be ensured.

5.1.3 Procurement and Supply Chain Management (PSM):

The NMEP is responsible for procurement of health and non-health products and pharmaceuticals, viz. LLINs, RDTs, ACTs, inj. Artesunate as well as CQ/PQ, microscope, reagents, and non-health products like IT equipment with funding by the GoB and the GF. Product specifications are made by the NMEP. Procurement will continue to be carried out in strict accordance with the GoB guidelines as well as the Procurement SOP of the GF. The PSM plan especially for procurement of health/non-health products with the GF resources. A SOP for health product management is also in place, which will be updated. Stock registers will continue to be maintained at all store facilities and central, district, Upazila and local level.

Forecasting and deployment of health products and antimalarials will be strengthened in consultation with district, Upazila levels and partner NGOs. Overall technical guidance will be sought from the Malaria Technical Committee. The basis is the consideration-mix of previous consumption trend, technical requirements (assumptions involving caseload related indices/indicators and trend analysis), and requisite buffer and deployment reserve (example, RDTs required for targeting ABER need to be defined during forecasting). At times, the quantities are adjusted during implementation phase, as needed, with justification. Replenishment is done before stock out for commodities. Setting of thresholds will be revisited for minimum number of stocks of RDTs and drugs that each facility and warehouse will maintain especially

with changing disease trend. The timing of procurement will take both suppliers' expected lead-times and past delays into consideration. Necessary coordination will be maintained to anticipate and avert stock outs, and interrupted prevention, diagnostic and treatment services. and manage poor quantification of commodities and responsive redistribution of goods. The NMEP will ensure that there is always an adequate stock of malaria commodities in addition to necessary buffer stock so that it lasts malaria season and cater for unexpected epidemics and emergencies.

Regular evaluation of PSM, including forecasting and deployment will be done drawing from disease trend analysis, elimination and POR related requirements involving District/Upazila levels. A web based LMIS has been initiated, which aims to track the stock status of health products and antimalarials.

The NMEP will ensure quality of all health products including RDTs, drugs, reagents, and equipment. Quality assurance will be managed according to the SOPs. Currently, the LLINs are procured through the GF mechanism, which follow the required quality assurance procedures, which will continue. 'On receipt batch testing' for RDTs and antimalarials will be carried out. The samples will be sent for testing at the WHO collaborating centres prior to deployment to ensure that they are within the specifications set out in the manufacturer's product documentation. Sub-standard products will be rejected and returned to the supplier.

National quality control unit will be identified, and malaria commodity samples will be sent for testing during tendering and for batch quality control during supply and use. The cost of quality control will be borne by the suppliers, which will be included in tender specifications. Approved quality-controlled malaria commodities will be always maintained within the public sector and partner NGO malaria service delivery systems. As private sector engagement is rolled out, use of quality assured RDTs, antimalarials will be discussed with them for compliance. In addition, the NMEP will support the national regulatory authorities to collect samples from the private market to check for counterfeit and substandard products such as RDTs, antimalarial drugs, insecticides, etc.

The NMEP has developed distribution plan for all types of commodities for 13 endemic districts, which will be updated, as needed. There will be continuous efforts to improve storage and distribution facilities including but not limited to, maintaining standard temperature and humidity at district and Upazila warehouses/store house; ensuring uninterrupted and timely supply of necessary logistics including RDTs, antimalarials, reagents, and equipment, etc.; and to monitor all logistics on a regular basis to avoid stock out situation and avoid using expiry date products. The NMEP has also initiated provision of RDTs and antimalarials for 51 'non-endemic' districts, which will be revisited as malaria risk mapping, surveillance and M&E systems are initiated/strengthened (the same will be followed in the few 'non endemic' areas within endemic districts).

Supply systems will be strengthened through training, supervision, and system updates, as appropriate. Logistics strengthening workshops will be held periodically. The NMEP will provide strong supportive supervision from central level to ensure efficient supply chain management. A system for the collection and proper disposal of expired antimalarials will be established, wastage will be monitored, and mitigation measures will be put in place.

5.1.4 Financial Management:

The NMEP funding is sourced mainly from three sources: the GoB, funds from the World Bank on re-imbursement basis (RPA) and funds from the GF (DPA= Direct Project Assistance). There is also a contribution from the WHO for technical assistance. The GoB contribution is mainly for payment of salaries, training, and logistics as well as infrastructure and maintenance, various overheads; the GF for majority of programme implementation in 13 endemic districts; and the WHO for technical assistance and some studies. The management of external funding for malaria control and elimination in Bangladesh by the NMEP started in 2008 when the GF provided additional support to tackle malaria with implementation of the first NSP. The GF contribution is for commodities, viz. LLINs, RDTs, ACT (including the costs

incurred in the process of PSM), surveillance and M&E, capacity strengthening, etc. Contractual HR of the NMEP at central and district levels as well as programme management costs are supported by the GF. Since 2008, the GF support also initiated the adoption of a dual-track financing arrangement wherein funding is provided to the NMEP as well as partner NGOs complementing service delivery, surveillance, and M&E efforts at community level in 13 endemic districts. This arrangement will continue through the NSP 2021-2025 period, albeit on different scale and approach. The funding categories for partner NGOs include HR and trainings, laboratories, surveillance, and M&E, ACSM, implementation management, research.

The NMEP will continue to provide sound financial management in-line with national guidelines (and in-line with internationally recognized best practices). Besides the 4th HNPSP guidelines, the GoB financial rules and regulations, are followed. In addition, the NMEP has developed the Financial SOP for NMEP financial operations especially with regard to the GF grant, which is followed apart from the GF budget and audit guidelines.

The NMEP has the responsibility for overall programme audits and compliances relating to HNPSP OP according to national guidelines, in addition to the GF grant related audits and compliances. External and internal audits are/will be regularly done. Financial flows to public sector health facilities at district/Upazila level are limited mostly to training funds and travel/subsistence allowances. Few HR for surveillance and M&E is supported in selected endemic districts, whose salaries are paid directly from central office. Most health products procured with the GF support centrally and supplied to district and Upazila levels. Health products are also supplied to partner NGOs at subnational levels. Each expenditure is related to the approved work plan/activity plan and budget and is accompanied by supporting documents duly approved by the competent authority. The NMEP ensures proper control over expenditure against budget provision. The NMEP receives expenditure statement from districts (subnational level) monthly/quarterly. The NMEP consolidates all report using software for reporting to the GF through PU/PUDR and AFR. Internal control is exercised through financial, budgetary, and administrative controls.

An overview of fund inflow/outflow and audits and compliances is as under:

A. Fund Inflow (Receipt):

- Receipt of the GF grant the Director, Disease Control (for disbursement to the NMEP) through the approval of the Secretary, MoHFW to the CONTASA Account then transferred to a dedicated Bank Account maintained with Govt. scheduled Commercial Bank.
- Receipt of the GoB funding by the Director, Disease Control, which is maintained in a dedicated Govt. scheduled Commercial Bank account.
- Receipt of funding for technical support by DPM, NMEP, from the partners like the WHO, which maintained in a dedicated Govt. scheduled Commercial Bank account.

B. Fund outflow (Disbursement):

- Disburse fund in tranches (quarterly, semi-annually, or annually) at central level based on projected cash requirement, financial performance, and funding decision.
- Disburse fund to districts (subnational level) upon receipt of requisition and review of budget quarterly.
- Coordinate disbursement of fund to third parties by the GF on behalf of the NMEP under PPM upon receipt of the statement from IDA & PFSCM.
- Coordinate disbursement of fund to the WHO by the GF.
- Disburse fund to in-country third parties for specific services and technical support.

C. Audit and Compliances:

- Annual Audit: By Govt. FAPAD and internal audit by MoHFW; and by External Audit Firm (CA Firm).
- Periodical Review: By the Local Fund Agent (LFA) of the GF (PwC, India).
- Investigation and Periodical Review: By the GF Office of the Inspector General (OIG) and the GF Secretariat (the GF Internal Audit team).

- Financial SOP: Guidelines for NMEP financial operation including procedures of compliance.
- Procurement SOP: Guidelines for NMEP procurement of drugs, diagnostics & other materials.
- Govt. Public Procurement Rules (PPR 2008): For Procurement.
- Government. Financial Guidelines

The NMEP will continue to comply with the financial rules and regulations of the HNPSP of MoHFW as well as the GF requirements. The NMEP will remain liable to face audit of the GoB and donors and will continue to preserve relevant documents (bills, vouchers etc.) for the purpose. The partner NGOs too, follows financial rules and regulations of the organization including internal & external audit (based on country requirements, as applicable) as well as the GF.

Strategy 5.2 Monitoring and Evaluation, Strategy Development, and Planning

5.2.1 Monitoring Progress:

The NMEP will monitor implementation progress and provide supportive supervision for public, partner NGO and private sector health care providers. In addition, the NMEP will also build/strengthen capacities through trainings/re-trainings on M&E at all levels. M&E will focus on the following key elements:

- monitoring the operational aspects and quality of the programme, and measuring impact, outcome, output/coverage and process indicators to ensure that the activities are yielding desired results and moving the programme towards achieving its objectives;
- monitoring changes in epidemiological indicators resulting from the activities implemented;
- appropriately interpreting results and informing revisions in policies or strategies, when needed, to help ensure progress;
- building/strengthening of capacities at all levels, augmenting learning through supportive supervision, on job mentoring;
- coordinating M&E with relevant implementing entities and partner agencies; and
- documenting and disseminating progress towards malaria elimination.

An M&E Technical Working Group will be constituted and meet on a quarterly basis. An M&E plan is in the process of being updated in light of the NSP 2021-2025. An overview of the M&E plan is described in Chapter-7.

5.2.2 Annual, mid-term, end-term review:

There will be regular programme review for strategy development, update, and programme planning. A strong participatory approach will be encouraged and promoted to better coordinate malaria elimination efforts and facilitate resource mobilization.

The NMEP will conduct annual review to monitor the implementation progress. Mid-term review of the programme will be carried out by independent experts with facilitation and technical assistance by the WHO every three years. Both the annual and mid-term review findings will be shared with all programme personnel and implementing partners by organizing and conducting workshop at different levels. End-term review/evaluation with focus on inputs, outputs, outcomes, and impacts and will be conducted with technical assistance. The findings of the evaluations will be shared with members of the National Malaria Elimination Task Force (NMETF), Malaria Technical Committee, as well as implementing partners, development partners, donors, national and international organizations, media, as appropriate.

5.2.3 Development of/Updating strategies, guidelines, and standard operating procedures:

Strategies, guidelines, and SOPs will be reviewed periodically and developed and revised, as appropriate. Diagnosis and treatment guidelines will be revised, as necessary. Besides the SOPs for RDT and microscopy QA, epidemiological surveillance manual with detailed field guidelines as well as a national M&E plan will be developed. The NMEP will support periodical entomological studies on insecticide resistance of malaria vectors and action plans developed, as required. The NMEP will develop elimination guidelines for providing overall guidance on the requisite planning and actions related to initiation of

subnational elimination validation towards countrywide elimination certification and prevention of re-introduction in malaria-free areas. In addition, other relevant guidelines will be developed, example, private sector engagement guidelines.

NSP 2026-2030: After the end-term evaluation of NSP 2021-2025, a National Strategic Plan for Malaria Elimination and Prevention of Re-establishment 2026-2030 and related guidelines, operational plans and SOPs will be developed/updated.

Strategy 5.3 Partnership and Coordination

5.3.1 Partnership and coordination:

Strong partnership and coordination are instrumental for malaria elimination. The country will follow one NSP 2021-2025, one main authority (NMEP) to oversee, coordinate and harmonize implementation of strategies at all levels and across stakeholders & partners; and one M&E framework.

Concerted action will be priority involving multi-sector stakeholders across different sectors beyond the health sector. Strategic collaboration will be pursued with following partners: regulatory agencies; other government ministries; civil society; private sector; the WHO and other international organizations. The NMEP will involve key stakeholders at subnational level, including community leaders, hoteliers, major employers of development projects in endemic areas. Clear roles and responsibilities will be developed for all partners concerned. Representatives from various sectors (government and non-government) will be involved in planning and implementation of malaria elimination efforts, as appropriate. Partnership and coordination will continue to be strengthened through review and planning meetings with implementing and technical partners to exchange information, assess progress and address any issues. The NMEP will share its annual plans with implementing and technical partners and will require those partners to also share their plans related to malaria elimination. Training/orientation sessions and sharing of relevant information/advocacy and communication products will be emphasised. The NMEP will organize sessions for sharing of experiences and knowledge on malaria prevention and control measures, surveillance systems, treatment guidelines, and disseminate technical updates and research/survey/assessment findings, as appropriate.

The NMEP is currently supported by the WHO and the GF as well as partner NGOs. Key mechanisms for technical guidance and implementation coordination are:

- Malaria Technical Committee (MTC) chaired by the Director Disease Control and LD, CDC of the DGHS. It comprises malaria experts and multi-stakeholders from the GoB, research and academic institutions, partner NGO, the WHO and various other partner agencies, Armed Forces, private sector, and professional bodies. Mandate of the committee is to provide technical advice and review various technical aspects of programme implementation including review/update of strategy, policy, guidelines. The committee meets once a quarter or more, if required. Under the guidance of the Malaria Technical Committee, the NMEP will carry out an assessment to revisit different partnership and coordination mechanisms and propose effective institutionalized mechanisms.
- At district level, under the leadership of the Civil Surgeons multi-sector coordination meeting is held monthly as part of overall review of all disease control/elimination programmes. These meetings are attended by the by District hospital, UH&FPOs, UHC/CHCP, medical officer, statistician, and various health & non-health departments (viz., agriculture, fisheries, forest), partner NGOs, INGOs, representatives from development partner agencies, Armed Forces, and other law enforcement agencies (viz., BGB, police), municipality, private sector. This meeting is joined by the NMEP surveillance medical officers (SMOs) and relevant others from central level. Trend of malaria cases of different Upazila and programme interventions and needs, challenges are reviewed and guidance on critical issues are provided. This meeting also functions as multi sector advocacy platform.
- At Upazila level, under the leadership of the UH&FPO multi-sector coordination meeting is held monthly as part of overall review of all disease control/elimination programmes. These meetings are attended by the by District hospital, UH&FPOs, UHC/CHCP, medical officer, statistician, and various

health & non-health departments (viz., agriculture, fisheries, forest), partner NGOs, INGOs, representatives from development partner agencies, Armed Forces, and other law enforcement agencies (viz., BGB, police), municipality, private sector. This meeting is joined by the NMEP surveillance medical officers (SMOs) and relevant others from central level. Trend of malaria cases of different Upazila and programme interventions and needs, challenges are reviewed and guidance on critical issues are provided. This meeting also functions as multi sector advocacy platform.

- NGO/Civil Society Partnership: Partnership between the NMEP and partner NGOs has been recognized both nationally and internationally as an example of best practice in collaboration between government and NGO sector. It has strengthened implementation influencing both the quality and the timeliness of programme outputs/coverage and ultimately optimized outcomes and impact. Going forward, the NMEP will also attempt to involve NGOs beyond the current partner NGOs. The NMEP will continue to strategize and improve coordination and collaboration at community level involving government and non-government health workers/volunteers.
- Country Coordination Mechanism (CCM): The Bangladesh-CCM (BCCM) with the Honorable Minister for Health and Family Welfare in chair, is the key partnership and coordination mechanism in relation to the GF funding to fight HIV, Tuberculosis and Malaria. The BCCM ensures country-driven, coordinated, and multi-sectoral processes for leveraging and effecting additional resources. The members include, representatives from both the public and civil society and private sectors, multilateral or bilateral agencies and key affected populations (KAP) and people living with the diseases (PLWD) that coordinates the submission of one national proposal to the GF on the basis of priority needs. In addition, BCCM is responsible for overseeing the progress of program implementation.

In addition to the abovementioned partnership and coordination mechanism A National Malaria Elimination Task Force (NMETF) with the Honorable Health Minister in chair is envisaged for high-level advocacy for sufficient and sustained resource mobilisation for malaria elimination and prevention of re-introduction. A major focus will be on multi-sector coordination with key stakeholders and partners.

- Coordination within health sector CBHC, MNCAH, RMNCAH Departments; and division, district and sub-district levels (district and Upazila health officials);
- Coordination with partner NGOs and other NGOs including INGOs;
- Coordination with Armed Forces, BGB, especially focusing on strengthening of coordination at field level;
- Coordination with Ministries of Defence, Women and Children Affairs, Social Welfare, Road Transport and Bridges, Home Affairs, Agriculture, Information, Finance, Education, Foreign Affairs, Planning, Industries, Commerce, Chittagong Hill Tracts Affairs, Environment & Forest & Climate Change, Tourism, and relevant others;
- Coordination with CHT district council, Zila Parishad, Upazila Parishad and Union Parishad since these local governments are an important route for community engagement and reaching remote areas for augmenting and supporting surveillance and response, LLIN distribution, various vector control interventions, EDPT, message dissemination, community participation;
- Coordination with private sector including corporate/business houses (tea estates, agriculture/plantation, mining, tourism, transportation, telecommunication) as well as private sector providers (formal and informal), pharmacists, Tribal Cultural Institutes in the Hill districts with their philanthropic organizations, religious organizations;
- Coordination with the DGDA, especially for monitoring of antimalarial drug quality and counterfeit and substandard drugs;
- Coordination with A2i, a GoB programme supported by the UNDP that catalyses citizen-friendly public service innovations especially for community outreach programmes and communication.
- Coordination with the UNICEF for involvement of SSS Para workers; as well as other development partners for collectively addressing issues in high burden and elimination settings as well as FDMN camps;
- Coordination with IOM, UNHCR and other relevant agencies for addressing issues relating to mobile

and migrant populations, border areas and FDMN; and

- Coordination with research institutes, academic institutions and universities; viz., IEDCR, NIPSOM, BITID, as well as icddr, b, for supporting implementation of interventions, as appropriate as well as research.

In coordination and collaboration with relevant development partners and others, a special intervention package will be developed to address the Rohingya (FDMN) issues. This package will be discussed with partners for complementarity in service provision, harmonization, and possible resource sharing.

5.3.2 Technical Assistance (UN and International Agencies):

Technical assistance (TA) by the WHO has played and will continue to play vital role in development of policy, strategy, guidelines as well as QA, review and assessments, research, procurement and supply related issues. Other UN agencies as well as others will be consulted on relevant topics and support will be sought, as needed.

5.3.3 International Exchange and Cooperation:

The NMEP will continue to participate in and even host meetings, workshops, seminars, conferences of regional/global importance, as needed. In addition, study tours/exposure visits, exchange programmes will also be planned dependent on the need and resources. During such events, the NMEP will share success stories, best practices, as well as lessons learned and challenges besides taking note of experiences of other countries. Besides the WHO and the GF, cooperation and collaboration will be strengthened with various platforms/mechanism, viz. MEOC, RBM Partnership to End Malaria, SAARC, APLMA, APMEN, Greater Mekong Subregional (GMS) platform and South-East Asia Regional Coordinating Mechanism, relevant others.

5.3.4 Cross-border collaboration:

Six administrative units out of the eight in Bangladesh share border with India, namely, Chittagong, Khulna, Mymensingh, Rangpur, Rajshahi and Sylhet. Nearly half of Bangladesh's 64 districts (30 districts) are on the border facing these Indian states (spanning ~4000 km).[33] Of the 13 endemic districts, 11 districts have an international border with India. The remaining 51 districts bordering India (~19 in number) report no or sporadic malaria cases although many adjacent Indian districts are reporting indigenous cases and hence potential cross-border transmission of malaria remains a threat. A small part of Bangladesh (spanning ~300 km) is connected to Myanmar, viz. with the districts of Bandarban and Cox's Bazar.

Similar eco-epidemiological factors and challenges exist on both sides of the border. Moreover, there is cross-border population movement for tourism/trade/economic pursuits besides influx of Rohingya Refugees from Myanmar. This has created an urgency to deal with continued malaria transmission and even possible emergence of Artemisinin resistance. Moreover, zero transmission status that is being aimed at subnational levels may possibly get jeopardized with potentials risk of re-introduction until the border districts in India and Myanmar achieve the same status. Further, the border areas are fraught with complex geographies & difficult settings. Health and various social/welfare services along international borders are relatively weak and poorly staffed than in more central areas, in part because some of these areas are affected by security concerns and tensions. Moreover, many people living in border areas, especially in remote ones, are from socioeconomically vulnerable ethnic minorities, and disadvantaged in terms of access to health care & social services, and in instances they lack citizenship rights. Further, malaria risk amongst Rohingya refugees coming from endemic areas of Myanmar need to be addressed in coordination with all relevant agencies to minimize the risk of importation of resistant parasite strains.

Bangladesh has been participating in consultations (organized mostly by the WHO) for some time where the critical need for initiating cross-border collaboration has been continually expressed. In 2017, Bangladesh signed Ministerial Declaration on Accelerating and Sustaining Malaria Elimination in South-East Asia thereby committing to cross-border-border related strategic areas (amongst others): universal access to quality-assured prompt diagnosis and treatment, effective prevention to all vulnerable and at-risk

populations (including the disadvantaged communities, communities in border and conflict areas, and refugees and undocumented migrants); provision of adequate quality-assured supplies for malaria diagnosis, treatment (and vector control) through effective procurement and supply management; and criticality of effective cross-border-border collaboration and complementary responses.

Drawing from the WHO Operational Framework objectives (2018), and recommendations from various consultations/meetings, Bangladesh envisages several initiatives from 2021 towards initiating and strengthening cross-border collaboration to prevent and/or reduce transmission and disease burden, with special emphasis on minimizing risk of importation of malaria cases; prevent, and/or rapidly respond to, and control malaria epidemics; and prevent re-introduction of malaria transmission; and prevent antimalarial resistance.

1) Maximize cross-border coordination mechanisms that provide an enabling environment:

- Seek guidance from the Malaria Technical Committee
- Seek permission to initiate communication with India/Myanmar government counterparts
- Conduct situation analysis along Bangladesh-India and Bangladesh-Myanmar international border and update periodically
- High level and local level advocacy with India/Myanmar counterparts
- Develop roadmap for cross-border collaboration
- Organise meeting with designated focal persons from India/Myanmar for implementation of roadmap
- Review the progress of implementation

2) Maximize access to malaria intervention in border areas (within Bangladesh):

- Ensure universal access to quality-assured malaria diagnosis, treatment, and prevention interventions in border areas within national boundaries supported by appropriate trainings/re-trainings, IEC/BCC, community engagement as per plan
- Identify formal transit points and capacitate respective CCs
- Strengthen coordination with Armed Forces, Border Guard, other security agencies, relevant NGOs for malaria services as per plan
- Strengthen capacities of public, NGO, private sector entities as per plan

3) Maximize malaria surveillance and response as well as M&E in border areas:

- Reinforce case-based surveillance mechanism in malaria elimination districts as per plan
- Follow up of and response to every imported malaria case and real time recording/reporting
- Strengthen surveillance of antimalarial drug efficacy and drug resistance as per plan
- Strengthen entomological surveillance
- Conduct routine M&E and provide feedback

For the purpose, further consultations with in country and sub-regional/regional stakeholders and mechanisms will be held. Facilitation and technical assistance by the WHO will be instrumental including following up on cross-border actions; and resource support from them, and other donors/GoB will be explored. In 2020, a situation analysis has already been initiated with technical assistance by the WHO.

Whilst such cross-border efforts will be initiated and strengthened, Bangladesh will continue to be integral part of regional/sub-regional, global cross-border endeavours. Learning from various high burden, eliminating and malaria-free countries will be extremely imperative.

At the same time, strengthening of surveillance and M&E and universal coverage by interventions within national boundaries appropriate for transmission and burden reduction (in (Stratum 3) and in rest of the districts will be emphasized. The mobile teams (of GoB/NMEP, partner NGOs) will strengthen outreach operations in border areas with prompt diagnosis and treatment especially to serve key and vulnerable populations including ethnic minorities, mobile and migrant populations during peak transmission season.

Such health camps will also cover key migration transit points (including formal district and national border crossings). Furthermore, orientation of public health personnel (under other health programmes) posted in facilities along the border and/or health posts at ports of entry will be carried out as well as mapping and orientation of private health care service providers in border areas. Discussion within MoHFW and with relevant Departments will be initiated for considering establishment of health posts at select points of entry. Discussion on coordination and support has already been initiated with the Armed Forces, Bangladesh Border Guard (BGB), and other security agencies to access the most hard-to-reach communities especially along border areas. Their support will be sought while planning for special health camps. Besides, diagnosis and treatment are provided even to civilians through their health facilities located in areas close to the border, in coordination with NMEP-partner NGO, which will continue.

Objective-6: To strengthen and expand research, innovation through 2025.

Research agenda will be identified throughout the implementation of the NSP 2021-2025 to address programme needs and support and guide strategy/policy. Meaningful research questions are best generated for operational research as part of the process of implementation, when repeated barriers/gaps and failures in implementation are identified as 'problems'. Priority will be given to research that address the specific needs and gaps to effectively deliver services in hard-to-reach areas and amongst high-risk key and vulnerable populations (mobile and migrant populations, ethnic minority groups, jhum cultivators, forest goers, others). Research will aim to address operational bottlenecks and find innovative ways to address residual malaria transmission.

Strategy 6.1 Strengthen and Expand Research

ACTIVITIES:

6.1.1 Identify and expand operational research:

Operational research will be intensified for optimizing impact and cost-effectiveness of existing and new tools, strategies, and interventions; developing novel tools and approaches to respond to existing and new challenges, such as drug resistance, insecticide resistance, outdoor biting, and varying patterns of population mobility; take action to facilitate rapid uptake of new tools, interventions, and strategies. Special studies to evaluate the distribution and frequency of infections in the asymptomatic population in areas with intensified case management and vector control besides others will also be considered. Research priorities will be reviewed periodically. A list of research topics, that will likely to be pursued across all strata (as appropriate) is appended as Annex-3.

6.1.2 Conduct annual review of research:

The Malaria Technical Committee will support the NMEP to identify research agenda and as well as review of proposals/protocols, recommend funding, and then peer review the final reports (keeping the conflict of interest in mind). The NMEP will initiate yearly research meeting where all stakeholders involved in malaria research will present either completed work or so far done for appraisal. The NMEP will work in collaboration with the WHO and national and international experts and institutes to develop research capacity and improve the quality and relevance of research outputs. Programme strategies and research priorities will be updated as required. The NMEP will initiate a repository of research/papers published on malaria in Bangladesh. An open access research platform will be planned in coordination with technical partners for accessing topics of interest, including research proposal submission procedures, ethical regulations, potential funding sources, informal results, publications and a 'Questions & Answers' forum. Concerned senior management/Units within MoHFW will place special emphasis on moving proven new interventions and approaches quickly towards piloting and operational adoption. The NMEP will also initiate piloting and scaling up of private sector, NGO, research institution/University engagement in reviewing program & operational research for malaria elimination. Research will be carried out following approval by the Bangladesh Medical Research Council (Ethics Review Committee).

CHAPTER-5 IMPLEMENTATION FRAMEWORK

5. IMPLEMENTATION FRAMEWORK

5.1 Operational Plan

The NMEP will lead implementation of NSP 2021-2025 via an operational plan. An objective-wise and strategy-wise operational plan will be prepared, which will be reviewed and updated periodically. Preparation of operational plan will involve coordination within the MOHFW, and with partner NGOs, the WHO and other relevant partner agencies.

Overall, the malaria planning system follows and embedded within the HNPSP OP. Annual plans of NMEP are developed in consultation with districts, Upazilas for resource proposition and allocation. In addition, detailed work plan will be developed regarding the GF funding to steer implementation of interventions, capacity building, and M&E.

5.2 Implementation Arrangements

For planning, implementation, and oversight, the NSP 2021-2025 will build on bottom-up approach with the CCs and vast majority of community health workers, volunteers getting involved and influencing the design of locally appropriate implementation strategies. The WHO and other partner agencies will continue to provide technical assistance for critical areas of need.

Central level: At the central level, the NMEP under the CDC, DGHS, MoHFW, has direct responsibility for planning, implementing and coordinating malaria control and malaria elimination. The NMEP leads development of policy, strategy, guidelines, SOPs, QA/QC, and planning and implementation of interventions, procurement of health products/pharmaceuticals and supply to public sector health system and partner NGOs, besides leading M&E/MIS, oversight as well as partnership and coordination, research. The NMEP has three main sections: Epidemiology; Entomology and Laboratory (Central Malaria Reference Laboratory - CMRL). A surveillance and monitoring and evaluation system is in place for expanding and strengthening and assessing program performance nationwide.

The NMEP has been receiving support from the GF since 2008. The GF supported Program Management Unit (PMU) is set up at the central level, which supports and carries out overall planning, implementation, M&E of malaria programme. The PMU consists of technical and administrative staff at the central level.

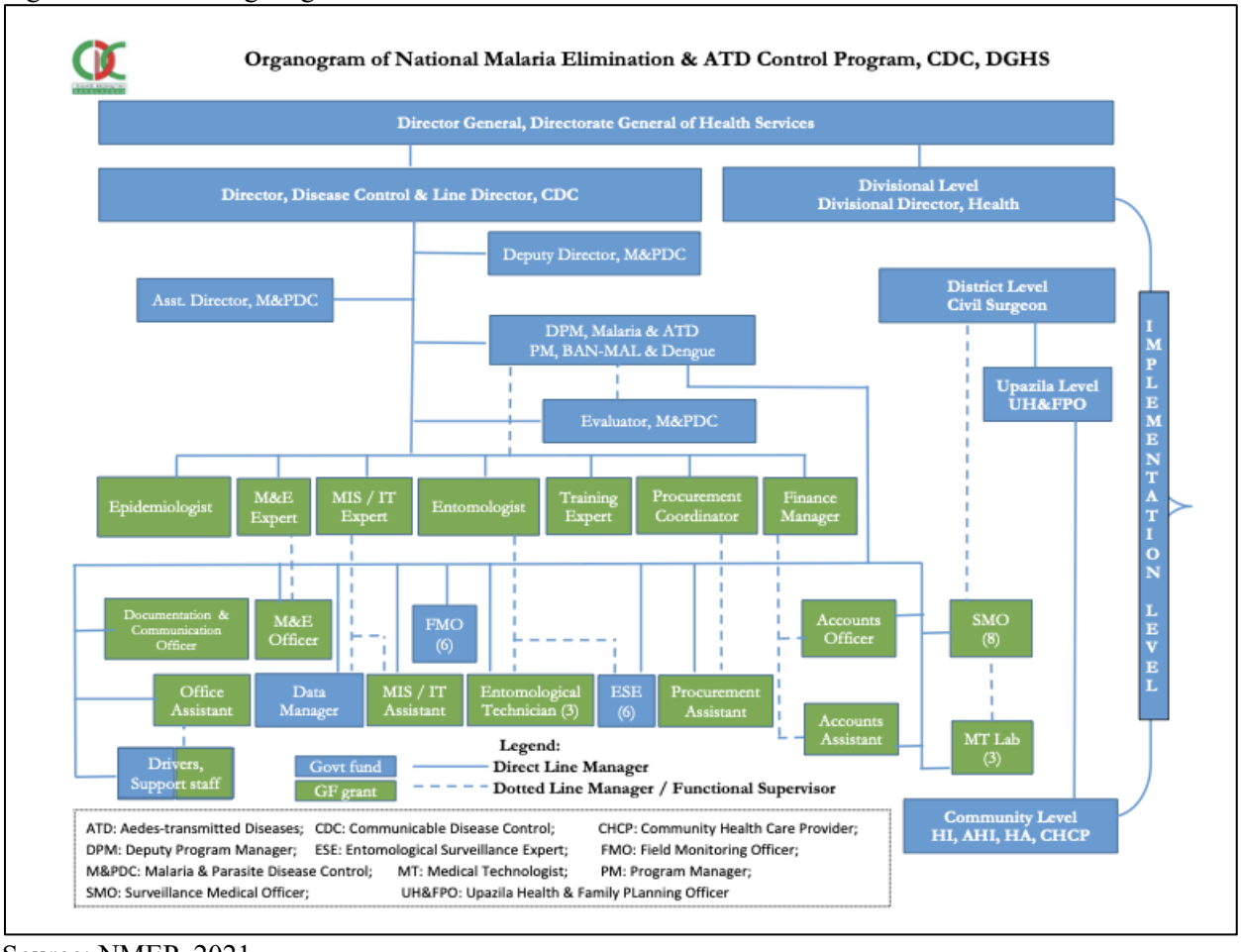
District, Upazila and Community level:
As mentioned earlier, the district health system consists of District Hospitals, Upazila Health Complex (UHC), Union Sub-centers, Union Health & FW Centers, EPI vaccination centres. Bangladesh has well-established free community-based malaria services delivered by CCs. The CCs are the lowest level public sector health facility, with target coverage of one for every 6,000 people and the first place, where public health facilities interface with respective communities. They provide basic outpatient services for communicable and non-communicable diseases, including malaria, through a team of two health workers - a community health care provider (CHCP) and a health assistant (HA). Recently, the GoB has introduced multipurpose health volunteers (MHVs)[34] connected with the CCs in selected districts under the Community Based Health Care (CBHC) Department of MOHFW, which is expected to progressively support EDPT. In order to support the NMEP and district/Upazila health authorities especially to expand and strengthen surveillance and M&E, surveillance medical officers are positioned in 13 endemic districts (with support by the GF). In addition, a few additional medical technologists (MT) are also positioned in selected districts having vacant positions (at the district level) to enhance diagnosis and QA.

At the district and sub-district (Upazila) levels in 13 endemic districts, malaria services are provided by the district Hospitals, Upazila Health Complexes (UHC), Union Sub-centers, Union Health & FW Centers, and CCs. In 51 'non-endemic' districts (and a few 'non endemic' areas within endemic districts), capacity building has been initiated, and systematic diagnosis and treatment, surveillance and M&E, and multi-sector coordination as well as cross-border collaboration will be rolled out.

As the malaria elimination related activities are initiated and intensified, the NMEP will progressively integrate malaria services with overall healthcare service delivery system maximizing synergies in elimination districts as well as in alignment with the National Health Sector Strategy that will provide funds and human resources for malaria elimination activities in the future.

The NMEP organogram from central to community level is illustrated in Figure-11 below.

Figure-11: NMEP organogram



Source: NMEP, 2021

Partner NGOs provides strong complementary support in 03 CHT districts and Chattogram and Cox's Bazar districts with resource support by the GF. Key activities include diagnosis and treatment of cases and surveillance and M&E at community level, LLIN distribution and ACSM activities, amongst others. They proactively coordinate with the NMEP as well as district/Upazila authorities and below levels for timely and quality implementation of interventions and reporting. In 08 elimination districts (Sylhet and Mymemsingh zones), limited HR are positioned with the GF support through partner NGO for providing support to the UHC for implementation coordination. The NMEP with support from the partner NGOs has initiated mapping of private sector health care service providers, viz. hospitals, clinics, laboratories in addition to individual formal and informal An assessment of private sector involvement in malaria case

management in 2019 with technical assistance by the WHO has been conducted and a private sector engagement strategy will be developed for systematic participation in national elimination programme in terms of case detection, case management and referral, reporting according to national guidelines. Implementation arrangements with the GF support is appended as Annex-4a, 4b.

The Armed Forces and other law enforcement agencies also contribute to malaria diagnosis, treatment, surveillance in their service areas in endemic districts; besides few international NGOs (INGOs) in FDMN camps. In addition, there are few research and academic institutions, which support the NMEP from time to time. Example, Bangladesh Institute of Tropical and Infectious Diseases (BITID), which has recently signed a MoU to support malaria surveillance and M&E in FDMN camps; and NIPSOM, IEDCR besides private sector institutions like iccdr, b.

CHAPTER-6 RISK MANAGEMENT AND MITIGATION

6. RISK MANAGEMENT AND MITIGATION

For successful NSP 2021-2025 implementation, some risks may be inevitable, which will possibly impede strategic or operational plan. The NMEP and partners will endeavour to understand the magnitude of, and management and mitigation of the risks. A non-exhaustive list of key risks that may occur during the implementation and possible mitigating actions is outlined in Table-14.

Going forward, the NMEP will strengthen risk identification, assessment, and mitigation through the NSP period. During implementation review, supervision, internal and external risks impacting targets and achievements will be assessed. Attempt will be made to create a risk-aware culture at all levels and rate the risks in terms of severity, materiality of the adverse outcomes and fix timelines for mitigation.

Table-14: Risk categories, key risks, mitigating actions

Risk Category	Key Risk	Mitigating actions	Timeline
Financial risk	Lack of adequate and sustained funding for malaria elimination from the GoB and partners, especially the GF; and unsuccessful efforts in mobilizing resources (from within and outside country) commensurate with the need for malaria elimination and prevention of re-introduction.	▪ Transform political commitment in terms of adequate and sustained domestic resources for malaria elimination. ▪ Advocate for vital continued support by the GF until elimination is achieved. Strong justification for sustained GF support beyond 2023 will be developed in collaboration with the WHO and other regional stakeholders. ▪ Advocate for funding for malaria elimination as an investment case for ending suffering and poverty and for achieving overall socio-economic development and SDGs to in-country corporate sector and others as well as to development partners.	From 2021
Financial & fiduciary risk	Issues relating to low absorptive capacity; suboptimal financial efficiency	▪ Efforts will be ongoing to accomplish all activities and regular review of progress. ▪ Likewise, efforts will continue exploring efficiencies.	Ongoing
Financial and extrinsic risk	COVID-19 pandemic (and/or such crisis in future) impacting timely and quality service delivery, re-purposing of funding and human resources, issues of safety of health workforce/volunteers	▪ Develop, adapt and implement appropriate guidelines in line with the WHO and other international/national guidelines to maintain uninterrupted essential services including health care service delivery with safety. ▪ Strategic planning and 'catch-up' plan to mitigate adverse impact of pandemic is ongoing drawing	Ongoing

Risk Category	Key Risk	Mitigating actions	Timeline
		guidance from the WHO, the GF, other partner agencies, as well as MOHFW and various health programmes, Malaria Technical Committee as well as regular engagement with implementation levels. ▪ Additional funding from the GF has been/will be mobilised for tackling the pandemic.	
Extrinsic risk	Natural disasters, cyclones, heavy rain and flash floods occur frequently in Bangladesh; and these affect timely implementation of interventions especially during monsoon and post-monsoon months, which also coincides with peak seasonal malaria transmission and adversely impacting malaria cases and deaths. Besides, diversion of efforts and resources to affected areas also affect implementation as per plan elsewhere.	▪ Buffer stock is incorporated into the procurement of key programme commodities (RDTs, antimalarials, LLINs). Deployment reserve with community level health workers/volunteers during monsoon and post-monsoon months, which also coincides with peak seasonal malaria transmission is envisaged especially in hard-to-reach areas. ▪ Community level health workers/volunteers will ensure that affected population is using the LLINs effectively.	Ongoing
Extrinsic risk	Massive influx of FDMN refugees.	▪ Advocate for resource mobilization for interventions from development partners including the GF. A costed package of interventions for FDMN camps has already been prepared for 2021-25. This includes prevention and case management interventions as well as buffers necessary for response to any outbreak; besides Artemisinin resistance monitoring. ▪ A request would be made to the WHO and the GF to consider inclusion of Bangladesh under GMS network. ▪ Potential additional grant may be considered to any key stakeholder/development partner engaged in service delivery/coordination, viz. WHO, UNHCR, IOM, others to minimize resource gap and coordinated response for FDMN humanitarian crisis.	Ongoing and as required

Risk Category	Key Risk	Mitigating actions	Timeline
Programmatic risk	Development and spread of ACT resistant falciparum malaria in Bangladesh.	▪ Close monitoring of drug resistance status would be maintained through TES in sentinel sites and through molecular studies analyzing samples collected nationwide. Resulting data would be shared with the WHO and technical partners. In the event of development of ACT resistance, a suitable response would be developed following the recommendations of the WHO.	Ongoing
Programmatic risk	Development and spread of operationally significant pyrethroids resistance in Bangladesh.	▪ Close monitoring of insecticide resistance will continue to be carried out at sentinel sites. Resulting data will be shared with the WHO and technical partners. If insecticide resistance is found, its operational significance will be assessed, and a suitable response will be developed as required in consultation with the WHO.	Ongoing
Programmatic risk	Access to timely interventions remain critical risk in view of extreme remoteness of some areas that is often compounded by poor physical infrastructure and lack of staff, particularly during the rainy season. Security issues also renders access difficult in certain areas of CHT districts. In addition, community, rights and gender barriers, and inequities, although waning over time, also pose risks for timely access to interventions.	▪ Community level health workers/volunteers who are often recruited locally would ensure that affected population is served effectively. The timing of visits as well as special health camps in remote areas would be planned to take seasonal constraints, remoteness into consideration. Deployment reserve with community level health workers/volunteers during monsoon and post-monsoon months, which also coincides with peak seasonal malaria transmission is envisaged especially in remote areas. ▪ Coordination and linkages with community systems, networks as well as local self-governments, tribal/ethnic heads/councils, have been and would continue to be strengthened. Local knowledge and experience and community-based presence of health workers/volunteers would facilitate learning to deal with such situation. For any delay/postponement of implementation of interventions that may be at times necessary in view of the local situation, efforts would made to resolve the problems. ▪ ACSM activities will be emphasised to address barriers and inequities.	Ongoing

Risk Category	Key Risk	Mitigating actions	Timeline
		Malaria matchbox tool will be used periodically to update understanding of community, rights and gender issues and addressing those through inclusion, equity, equality, and gender sensitive approaches.	
Programmatic risk	The new more stringent stratification, used for targeting LLIN delivery, may result in sub-optimal coverage with LLINs and focal resurgences of malaria transmission.	▪ The elimination-based surveillance system would result in a rapid response to any new transmission foci with LLIN delivery and/or IRS, as required. Buffer LLINs is proposed in the budget for the purpose. • Proactive action would be taken as and when there is rise in number of cases even if the rise does not reach "outbreak threshold". Each programme aims to reduce malaria cases so something must be done if there is no reduction of cases and not wait to reach the outbreak threshold.	Ongoing
Programmatic risk	Inherent weaknesses in the health systems often limit the quality of services.	▪ While overall improvements in health systems will be emphasized by the MoHFW, the NMEP will oversee capacity building/strengthening. Further emphasis on malaria services by capacitated CCs will be a key measure. Capacity building of recently recruited multi-purpose health volunteers in endemic areas will also help in minimizing the existing gap. Extensive use of volunteer networks of partner NGOs and collaboration with the Army and with Border Guards for malaria services in less accessible communities and areas with health system weaknesses will attempt to solve some of the issues associated with access and at the same time reduce the burden on overstretched health workers, particularly in the periphery. ▪ Some other potential mitigation actions are as under: - regular health system review including but not limited to, performance audit of staff involved in malaria programme and based on the results develop and implement quality improvement plan	Ongoing

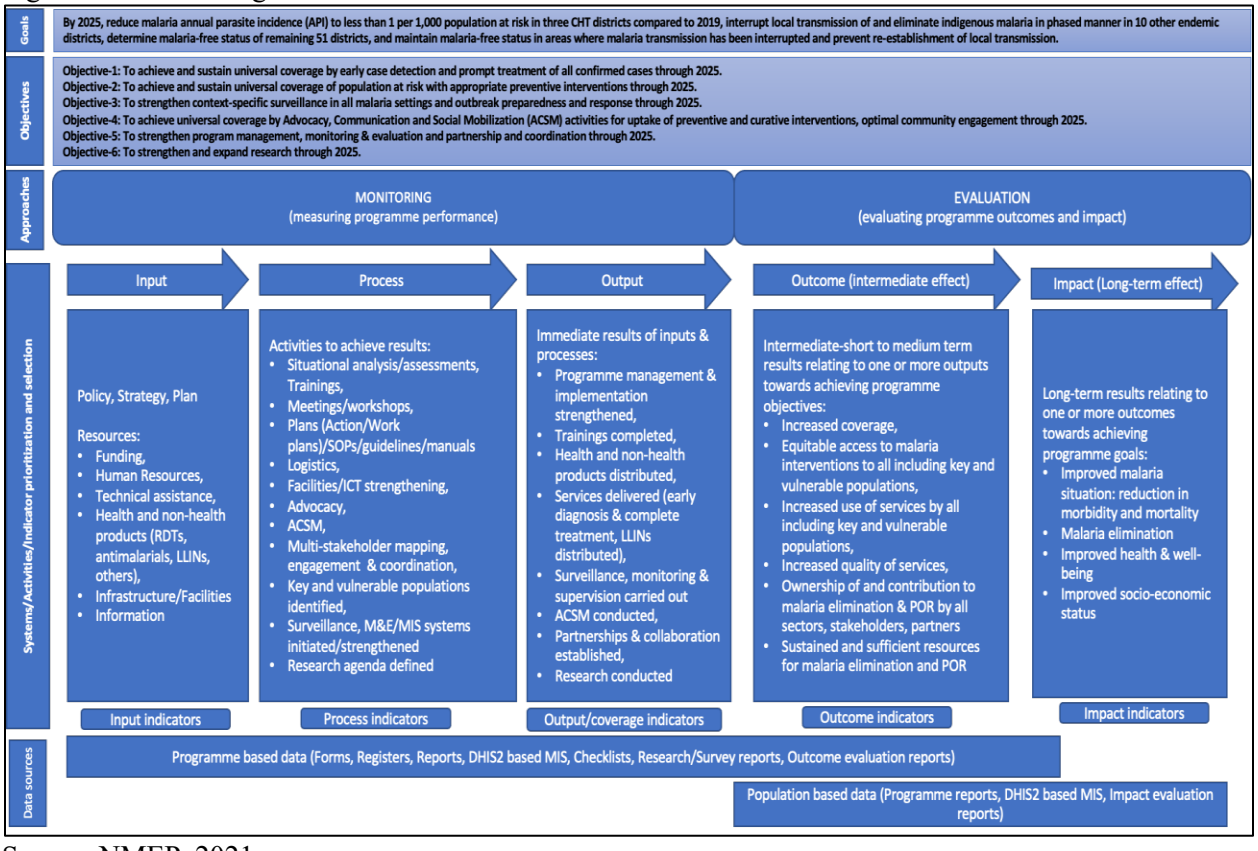
Risk Category	Key Risk	Mitigating actions	Timeline
		- strengthening supportive supervision and monitoring - ensuring ownership of the program by the district health authorities and empowering them to improve the quality of services - improving collaboration between district health authorities and partner NGOs - analysis and use of surveillance data for action at district level - development and implementation of mentoring system to develop specific skills / expertise - and many more actions depending on the key reasons for weaknesses in the health system that often limit the quality of services.	
Programmatic risk	Non-compliance of national guidelines by private sector as well as variable reporting from them	▪ Private sector engagement guidelines are being developed. In coordination with relevant sectors/agencies and Ministries, private sector involvement will be initiated.	From 2021 onwards
Programmatic risk	Timeliness and completeness of reporting and variable quality of data undermine programme management and implementation	▪ Data collection, collation, sharing is being progressively strengthened. With nationwide roll out of DHIS2 based MIS, the timeliness, completeness will be further streamlined. Malaria focal persons, SMOs and central M&E staff will carry out on site data verification, supervision at service delivery points regularly and send prompt feedback to the local levels.	From 2021 onwards
Programmatic risk	Supervision and monitoring for measuring progress and impact may miss out regular risk assessments and mitigation.	▪ Supervisory visits would be comprehensive with risk-aware focus. Trainings/re-trainings would also enhance requisite comprehension and skills.	Ongoing

CHAPTER-7 MONITORING & EVALUATION FRAMEWORK

7. MONITORING & EVALUATION FRAMEWORK

Monitoring & Evaluation (M&E) is a fundamental component of the NSP 2021-2025. Through M&E, the program's results at impact, outcome, output/coverage will be measured to provide the basis for accountability and informed decision making at both program and policy level. An overall M&E framework is outlined in Figure-12. M&E is also an essential feature of performance-based funding, through which the performance is periodically assessed for decision and allocation of resources by the GoB as well as external partners such as the GF. A 'Performance Framework' (PF) with impact, outcome, output/coverage indicators through which the programme performance is/will be periodically assessed, is appended as Annex-5. Indicators are drawn from a set of indicators recommended by the WHO and the GF.

Figure-12: Monitoring and Evaluation Framework



Source: NMEP, 2021

An M&E Plan will be prepared for NSP 2021-2025 involving experts and key stakeholders that will include key components, viz. M&E systems for routine data collection, analysis, reporting and feedback; data quality assurance; coordination; database storage; reviews, surveys, studies; supervision; and capacity development; in addition to the performance framework. The objectives will be to: provide guidance for timely, accurate and complete reporting through employing effective M&E system; build a mechanism to verify programme implementation and ensure accountability and data quality at national and subnational level; facilitate harmonization of malaria data collection, aggregation based on standardized definitions, tools and indicators; build capacities at all levels; ensure proper documentation at field level in generating the output/coverage of programme; and strengthen information sharing and use amongst health cadres and managers; and promote M&E coordination across partners.

An outline of M&E framework is presented in this document.

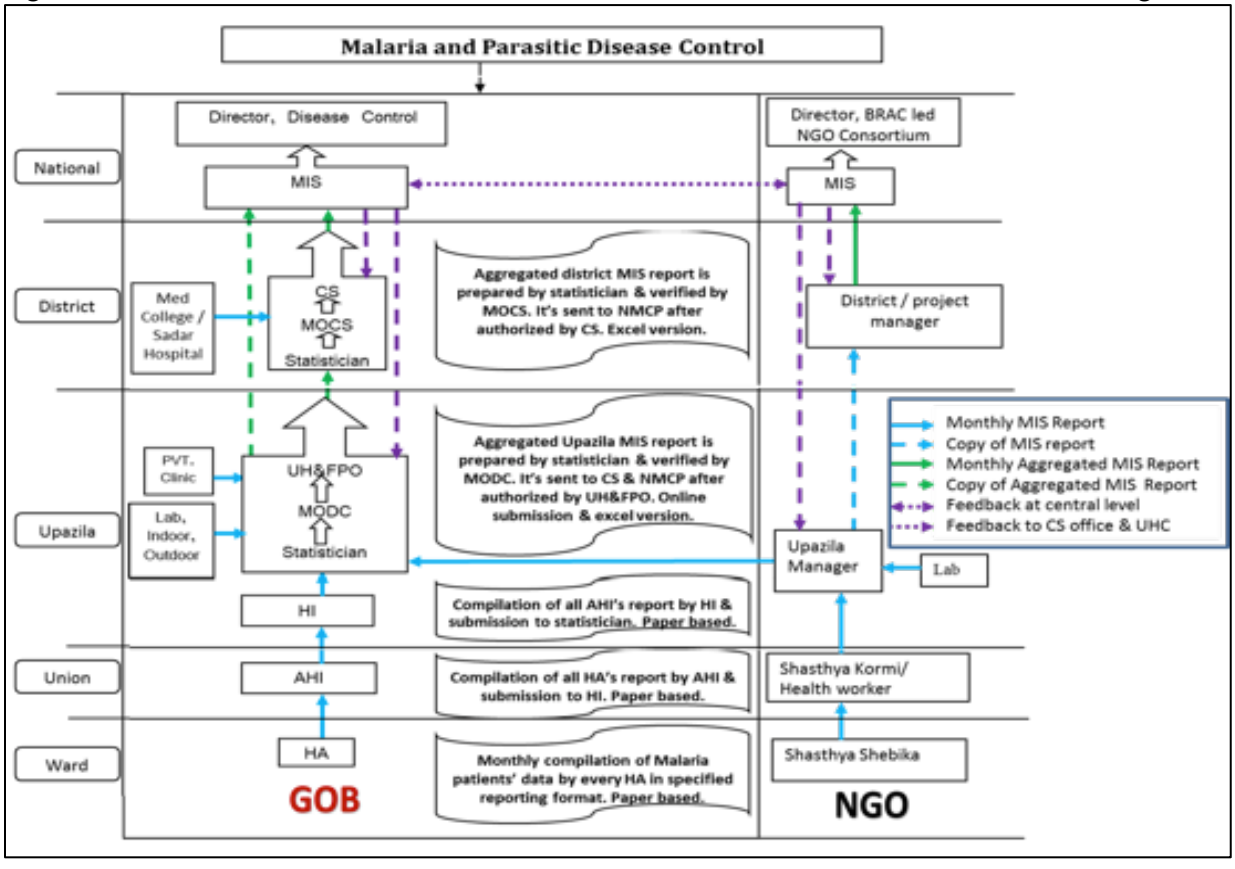
7.1 M&E Systems

M&E system ensures that quality data is collected, processed, and transformed into strategic information to allow informed decision-making at national, subnational, and local levels. The NMEP (and partner NGOs) already has a well-established network for M&E and MIS. Both NMEP and partner NGOs follow the national M&E/MIS, although the latter has independent MIS units for collecting, summarizing, analyzing and producing timely reports for sharing within the NMEP and the GF. The malaria MIS data is used to analyze trends in malaria by geographical area and to monitor progress towards programmatic targets, disease trend, besides quantifying the consumption of health products, antimalarials both for the public sector and partner NGOs. As mentioned earlier, the malaria MIS, is in the process of being revamped in-line with the requirements associated with real-time case-based reporting for malaria elimination and will transition to DHIS2 platform. The malaria module will be integrated into the national DHIS2 based HMIS.

7.1.1 Routine data collection, analysis and reporting

M&E system is in place to collect routine data for measuring programmatic performance indicators, and analysis, reporting and providing feedback. From 2021, routine data collection, aggregation, flow, analysis, reporting and feedback system involving public sector health facilities, CCs and partner NGOs in 03 CHT districts and Cox's Bazar, Chattogram will remain like the current system and will continue to be strengthened (Figure-13). In rest of the districts, routine data collection, aggregation, analysis, reporting and feedback will continue to be the responsibility of public sector only. Limited M&E coordination support will be provided at UHC level by partner NGO in 08 elimination districts. Efforts have been initiated for private sector reporting to public sector, which will be expanded nationwide.

Figure-13: Malaria MIS, data flow and feedback in 03 CHT districts and Cox's Bazar and Chattogram



Source: NMEP, 2021

Routine data collection: The NMEP MIS collects data from monthly MIS and logistics management information system (LMIS) reports that are consolidated at Upazila level. The consolidated malaria case data in the MIS is broken down by gender, age, and parasite species, type of case detection (ACD, PCD), severity of disease, and treatment outcome. In areas where case-based surveillance has been initiated, case investigation forms capture travel history and geographical origin of infection. In addition, LLIN distribution, ACSM and training related information are also uploaded on the MIS. The LMIS reports contain data related to stock, consumption, and expiry related status of diagnostics, antimalarials, and LLINs. The public sector peripheral healthcare workers [AHI/Health Assistant (HA)/Community Health Care Provider (CHCP)] who are involved in malaria diagnosis and treatment at community level keep registers for all suspected and confirmed cases. Health Assistants (HA) are supervised by the AHI. HAs and AHIs are deployed at ward and union levels, respectively. An AHI compiles monthly paper-based reports of all HAs under his/her supervision and submits a consolidated report to the Health Inspector (HI) stationed at Upazila level. In addition, CHCPs stationed at CCs also submit monthly reports to the HI. The HI then compiles a consolidated report and submits this to the statistician at the UHC. The statistician also collects reports from health facility laboratories, and from in-patients, outpatients, and emergency departments of the UHC and prepares a consolidated monthly report for the public sector.

The UHC statistician then inputs two consolidated reports (NMEP and private) and the partner NGOs submits NGO report on the web-based malaria MIS. In addition, a consolidated excel report is prepared combining these three reports. Upazila level monthly reporting is completed by the 15th of the month. This process will transition to DHIS2 based MIS from Upazila level. Reports at Upazila level are verified by the MODC and authorized by the Upazila Health and Family Planning Officer (UH&FPO).

The Civil Surgeon's (CS) Office at district level compiles the reports of all respective Upazilas under that district. District Hospitals and Medical Colleges located at district level also input their data into the web-based information system and send a copy of that report to the CS Office. The statistician at district level compiles an excel-based consolidated district report. The objective of preparing this report is to cross-check with reports that are submitted on the web-based system by the Upazila level statisticians. This compiled report is sent to the MIS department of NMEP at central level. Reports at district level are verified by the Medical Officer, Civil Surgeon and signed of by the CS.

During peak transmission season, malaria reports are collected and compiled weekly and transmitted upward from field level to central level for analysis at reporting levels and response. 'Zero-reporting' is practiced by service delivery points/reporting units at every level in 13 endemic districts. In some of the 51 'non-endemic' districts, reporting including zero reporting has been initiated, which will be strengthened across all districts (and a few 'non endemic' areas within endemic districts).

The partner NGO Upazila manager collects monthly reports from all NGO health workers and volunteers as well as reports from any NGO laboratories located in the community. All monthly reports are consolidated and reported to UHC by the 10th of the following month. As mentioned earlier, partner NGOs submit data online at Upazila level. Likewise, partner NGOs supporting programme implementation and M&E in FDMN camps submit data online by set timeline. A copy of the NGO consolidated report is submitted to the NGO district office. The NGO district office compiles the reports from their coverage areas and this compiled report is sent to the MIS department of partner NGO at central level. Necessary feedback is provided down the line.

Data collection from private sector providers has been initiated, albeit in 08 elimination districts, which will be expanded following implementation of private sector engagement strategy. Government (HI) or NGO (Upazila managers/PO) will collect data from collaborating private sector providers monthly. A consolidated monthly private sector report, based on data from the private clinics and private diagnostic centres will be submitted to the UHC statistician. Once private sector mapping and training are initiated, the service providers (reporting units) will be encouraged to upload information on DHIS2 based MIS.

All reports are cross-checked and verified by central level officers of NMEP and partner NGO. Necessary feedback is provided down the line.

Findings related to malaria case data (API), Districts with API < 1/1,000, Annual Blood Examination Rate (ABER), Number tested for malaria, ACT treatment rate, and others will be published by the NMEP annually within 3 months of the end of each year (once any late reports have been received).

Reporting by other entities. Malaria control operations are conducted by local NGOs under the guidance by NMEP and partner NGO. The NGOs report MIS and LMIS related malaria data to UHC monthly and data is entered on the DHIS2 based MIS by the UHC statistician. In Cox's Bazar, Statistician also consolidates the FDMN data into the excel-based consolidated district report. Reporting by selected international NGOs supporting health programme in FDMN camps has been initiated. Such data are compiled at Upazila level.

Information flow and feedback mechanisms: Reporting for non-health facility indicators (example, those relating to LLINs) are generally based on implementation reports. Data flows up from implementation teams to NMEP/partner NGO at central level, via the malaria focal points at district level. NMEP and partner NGO at central level compile the relevant data for health facility and non-health facility indicators for monitoring and reporting purposes.

Feedback is a process that helps to improve the quality of data and ensure data accuracy. Central-level staff conducts analysis of data whenever reports are received from district and Upazila. If they find any discrepancy, they inform the district/Upazila in question by phone or email and ask them to submit the corrected report within 05 working days. The corrected reports are identified as 'revised reports' and the original erroneous report is identified as the 'original report' and both are kept on record at Upazila level for review/audit purposes.

Data use for decision-making and communication: The NMEP will take overall responsibility for ensuring that data is analysed and interpreted appropriately, and that the resulting information is used effectively for necessary actions to maximize program performance and impact.

Communicating results (reporting, dissemination, and feedback): NMEP and partner NGO will document the lessons learned from malaria elimination related activities as well as disseminate to relevant partners (at national, district level). Results will be reported on a six-monthly basis and annually. Results for outcome indicators that are dependent on surveys for data collection will be reported in the annual report following survey. Both six-monthly and annual reports will be shared with MoHFW and with the WHO, donors, and other relevant partners. Additional information products based on the reported data will be considered on an *ad hoc* basis according to programmatic needs, viz., publications for dissemination amongst the scientific community, concept notes targeting donor agencies, briefing documents for political advocacy, and glossy brochures/folders, press releases or messaging for radio and television for behaviour change.

Infrastructure available for data capture and reporting: All data collection is primarily paper based at service provider level, and this approach will be maintained for auditing purposes. Internet and computers are available at Upazila level and above. Routine malaria as well as logistics data is entered into the computerized system at Upazila level electronically and then district level thereafter transfer data up the reporting chain through DHIS2 based MIS. Case-based surveillance for elimination and prevention of re-establishment is being rolled-out and related data will be entered on DHIS2 based MIS at service provider level by means of App- or SMS-based reporting/computer. At central level, data is stored on hard drives and 'cloud storage'. All financial data are maintained for eight years for review and audit purposes. All programmatic data are maintained indefinitely. The data management SOPs provides clear instructions on data management including storage.

7.1.2 Data quality assurance

Data quality assurance (DQA) system will validate the quality of data and thereby provide information on possible needs to improve the recording/reporting system. DQA will focus on the quality of the recorded, reported, and aggregated data and will seek to quantify any errors. There are different dimensions of data quality. To ensure appropriate targeting and planning, it is crucial that data are precise, complete, timely, reliable, and accurate. Furthermore, it is important that the data has integrity to be considered credible. Data will be thoroughly checked at every reporting level to ensure accuracy and completeness. Necessary clarifications will be sought, and corrections made as required and within the strict timeframes set out for reporting. The DQA system will consist of different components:

- Logical cross-check of data
- Supportive supervision visits by SMOs, NMEP and partner NGO
- On site data verification related field visit to service delivery points and selected beneficiaries
- Review and identification of training needs

Besides, the following activities will also support and inform DQA:

- Monthly meetings at the community, Upazila, district levels and quarterly meetings at central level with participation by the NMEP and partner NGOs, community health worker/volunteer, as appropriate.
- Joint annual monitoring visits by NMEP, partner NGO so that corrective measures are carried out through the course of implementation.
- External joint monitoring mission that is scheduled every 3 years.

7.1.3 National Health Data Warehouse

In 2009, the GoB launched an initiative to strengthen the then out-dated, fragmented and poorly functioning health information system (HIS). With the support of the development partners, MoHFW set about developing a central electronic data repository for national health data, called the National Health Data Warehouse. The system is based on the District Health Information System, version 2 ('DHIS2'). This is an open-source software platform for reporting, analysis, and dissemination of data for health programmes. The core development of the DHIS2 platform is supported by the GF (amongst others), the WHO and other UN agencies.

The system covers aggregated data (example, routine health facility data, staffing, equipment, infrastructure, population estimates), and event data (disease outbreaks, survey/audit data, patient satisfaction surveys, longitudinal patient records etc.). It supports the capturing of data linked to any level in an organisational hierarchy, any data collection frequency, and a high degree of customisation at both the input and output side. DHIS2 comes with easy-to-use analytics through tailored dashboards, charts, pivot tables and maps, and can be extended with Apps or used by third-party software through an open Web-Application Programming Interface.

The first fully functional component of Bangladesh's National Health Data Warehouse was rolled out in 2011. Since then, the system has been gradually expanded, and eventually it will cover all areas of the health sector. So far, the move to the DHIS2 based system has resulted in dramatically reduced administrative burden as more and more public sector health facilities now report most routine information electronically. It has also resulted in better services as health workers can now use individual records to track selected patients. The openly accessible electronic data repository, with multiple interoperable datasets from different departments and vertical programs, has greatly enhanced the work of health policymakers. The NMEP is now piloting a DHIS2 malaria module that will form a part of the National Health Data Warehouse. The DHIS2 based malaria module will facilitate real-time case-based reporting, case investigation, focus investigation and response. Case investigation forms are designed and disseminated in 10 elimination districts, the same and other forms/registers will be standardized and linked with DHIS2 based malaria module. Adequate skilled manpower for data analysis, interpretation, and feedback at NMEP level will be ensured.

7.1.4 Performance framework with indicators

A performance framework with SMART (specific, measurable, achievable, realistic, and time bound) indicators is developed for the NSP 2021-2025 (Annex-5). Relevant indicators are selected from considering the latest guidelines from global and regional malaria indicator frameworks developed by the WHO, the GF and other partners. It is envisaged that the national M&E Plan will include the list of indicators for measuring impact, outcome, and output/coverage with the following details: Indicator type, Indicator name, Definition (with Numerator, Denominator, Multiplier and Equation), Rationale/purpose, Interpretation, Data source (including method of measurement and measurement tool), Frequency of data collection/reporting, and Disaggregation, Entity responsible for data collection in addition to periodic targets for the NSP 2021 to 2025.

7.1.5 Programme review, survey, studies

Internal program review: Internal review meetings covering all aspects of the programme implementation are held quarterly and annually at central level.

Quarterly review and planning meeting at central level. Quarterly review meetings at central level are organized by the NMEP, which will continue. Civil Surgeons, UHFPO and partner NGOs and/or their designated representatives will attend. Programme activities like diagnosis and treatment and distribution of LLINs, as well as disease trends at district/Upazila level will be discussed. Progress related to implementation of action plans will be reviewed, and direction will be discussed on any issue, as required. These meetings will support further streamlining of programme planning, implementation, M&E at field level.

Annual review and planning meeting at Central level: An annual review and planning meeting at central level is organized by the NMEP. The participants include: Central NMEP Program staff, SMOs, District level malaria focal points, Upazila level MODC, partner NGOs, the WHO and representatives of other partner agencies. The key purpose of the meeting is to:

- review activities and reported data from public sector, partner NGOs as well as private sector
- share best practices, lessons learned; and identify gaps and strengthening measures
- review coordination and capacity building needs
- plan for the coming year

In addition, the NMEP also conducts monthly review meetings at central level involving mainly SMOs, partner NGOs and selected district and Upazila level officials.

Monthly review meeting at district level. Monthly meetings at the Civil Surgeon's Office are held at district level, which will continue. These meetings are chaired by civil surgeon and attended by DCS/MOCS, UHFPO, MODC, SMO, Statistician, Nurse, and HI, besides NMEP and partner NGO and other relevant stakeholders. Progress relating to the implementation of action plans will be reviewed and way forward is discussed.

Monthly review meeting at Upazila level. Monthly review meetings are held at Upazila level, which will continue. These meetings are chaired by UHFPO and attended by doctors, nurses, statisticians, HI, AHI, HA and CHCP as well as partner NGO representatives from Upazila level. Partner NGO will also organize monthly meetings at Upazila level attended by *Shasthya Shebika*/*Shathya Kormi* as well as the GoB representatives from various levels. Progress relating to the implementation of action plans will be discussed and sample reports checked against registers. Direction will be given on issues, as required.

Monthly, quarterly and annual review meetings are held by partner NGOs at Upazila, district and central levels. These review meetings are attended by the collaborating NGOs, concerned NMEP staff including SMOs, district and Upazila health authorities, as appropriate. In these meetings, programmatic achievements of NGOs as well as challenges and gaps will be presented and analysed.

External 'Malaria Program Review': A joint malaria programme review (MPR) conducted by a team made up of external experts (national, international) and programme stakeholders covering all aspects of the NMEP efforts (including a representative range of implementing partners) is conducted every 3-4 years. As with the internal reviews, an assessment of M&E forms an important component, amongst others. The external MPR is important for accountability purposes. Donors like the GF as well as partner agencies, place increasing emphasis on outcomes and impact achieved with domestic and external resources, demonstrated through MPR, as a condition for renewing grant allocation. The MPRs meet external demands for demonstrating quality, quality assurance and quality enhancement.

Surveys: Surveys are useful tools for gathering primarily quantitative information about target populations of interest, which are not otherwise available through routine reporting or surveillance. A survey may focus on opinions or factual information depending on its purpose, and many surveys involve administering open- or close-ended to individuals. They can be resource intensive if a large sample size is needed to ensure wide representation. Smaller surveys that are qualitative in nature are useful for obtaining answers to specific inquiries.

Population-based surveys are a key part of collecting some of the necessary data for many indicators, example, outcome indicators. The community and health facility-based surveys are designed by the NMEP in consultation with the WHO and partner NGOs, individual experts. The surveys are mostly conducted with technical assistance by the WHO and or contracted out to independent agencies with funding by the GF and/or NMEP.

Target population surveys include household surveys and surveys targeting high-risk groups such as mobile and migrant populations including cross-border migrants, forest/agricultural workers. Representative random samples of households/individuals are interviewed using specific questionnaire forms. Indicators measured by means of data collected through household surveys for example include: 'insecticide treated net utilization' (overall and amongst children and pregnant women) and 'LLIN coverage rate' as well as 'treatment seeking preferences', malaria related knowledge, attitudes and practices (KAP) amongst beneficiaries. Household surveys are conducted annually and will continue. Survey reports will be disseminated to key stakeholders and partners including the GF.

Health facility surveys are conducted periodically to answer specific questions as required. A representative sample of health facilities in target areas will be selected. Data collection forms and checklists will be developed to obtain accurate information on various indicators.

Special studies: *Insecticide resistance monitoring studies*. Existing information on the resistance status of the main malaria vectors in Bangladesh is patchy and countrywide comparable resistance data are required to make informed decisions on the correct use of insecticides for vector control. Close monitoring of insecticide resistance will continue to be carried out at sentinel sites. Every year the program will conduct regular entomological surveillance and insecticide resistance (IR) monitoring surveys in 3 of 6 sentinel sites (3 sites/year) and ad hoc surveys in additional sites in outbreak areas where IR may be responsible for the outbreak and in areas at high risk of IR (example, areas with high agricultural pyrethroid use). Resulting data will be shared with Malaria Technical Committee and the WHO. If insecticide resistance is found its operational significance will be assessed and a suitable response will be developed, as required.

In addition to regular IR monitoring, the residual efficacy of insecticide on LLIN and the durability of the nets themselves will be monitored. Bioassays will be conducted checking mortality amongst various target mosquito vectors exposed to insecticide-treated nets with technical assistance by the WHO.

Therapeutic drug efficacy monitoring studies. The program will conduct regular drug resistance monitoring for *P. falciparum* at sentinel sites each year as well as regular in vitro assessments of parasite sensitivity to a range of antimalarials. The program will also support drug resistance surveillance based on genetic epidemiology. Monitoring drug resistance in *P. vivax* will be carried out in parallel, where feasible. There

are currently 5 sentinel sites. They are being monitored every year by expert teams from NMEP and WHO. The program will also carry out special clinical fieldwork in outbreak areas and in areas where treatment failure is suspected. The data from these routine and ad hoc monitoring sites will provide essential information, which will feed into decision-making for updating the national treatment guidelines with technical guidance by the Malaria Technical Committee and the WHO.

Other special studies that are planned include drug outlet surveys and drug quality surveillance.

7.1.6 Supervision

Supportive supervision is a key component of M&E and feedback is an integral part of this supervision, which will continue.

Supervision from central and district level to public sector health facilities and community health care providers (health worker/volunteer) with CCs and partner NGOs as well as private sector will be strengthened to ensure the timeliness and completeness of reporting, analysis and use of data and the follow-up of recommended actions. During visits to health facilities and district offices, central/district level supervisors check that registers are kept up to date, with all fields completed; data on reporting forms correspond to the information in registers; core analysis graphs and tables are up to date; and discussions are held about interpretation of the trends and potential action to be taken. Public sector health facility staff will be encouraged to investigate all inpatient malaria cases as well as any malaria related deaths. Both GoB/NMEP and partner NGOs follow a planned supervision at field level with a checklist. Joint review and supervision by NMEP and partner NGO will be further improved.

District Level supervision. Within the public sector, the district level Medical Officer is the focal person responsible for oversight of malaria related supervision at field level. They visit health facilities, CCs as well as selected patients and provide any necessary technical and administrative support. In addition, he/she also oversees programme implementation by partner NGOs. The partner NGO District Manager is the key person responsible for supervision in their coverage areas at field level. The District Manager supervises the activities of the NGO Upazila Managers monthly using a checklist. They visit partner NGO facilities and laboratories to assess the completeness and accuracy of reporting at Upazila level, besides reviewing programme implementation. They also ensure that LLIN distribution is carried out according to guidelines and conduct spot-checks to assess the level of utilization by beneficiaries, especially by children and pregnant women. District Managers prepare quarterly reports and send them to the partner NGO central level with a copy to all concerned staff with partner NGO.

Upazila Level supervision. Upazila level health officials such as MODCs conduct supervisory visit in their assigned areas at regular intervals. They also monitor activities of partner NGO at community level. They visit program beneficiaries whenever possible and provide malaria related IEC/BCC. Partner NGO Upazila Managers and Program Organizers supervise the activities of peripheral health workers, *Shasthya Kormi* and *Shasthya Shebikas* at community level.

7.1.7 M&E Coordination Mechanisms

M&E coordination mechanisms at different levels are in place. The mechanisms present collaboration between NMEP and partner NGO and others and places the NMEP as the institution leading the overall malaria elimination efforts in Bangladesh. Mutual understanding among various partners, is brought about by regular meetings, frequent communication for problem solving and by sharing ideas and experiences.

Malaria Technical Committee. Malaria technical committee is chaired by the Director of Disease Control of the DGHS. It comprises malaria experts and stakeholders from the GoB, different research and academic institutions, clinicians, the WHO, partner NGO, Armed Forces, NMEP and other development partners. The committee guides, oversees and reviews strategy implementation, development of/updating policy, strategy, guidelines related to various technical aspects. The committee meets once a quarter and more, if required.

In addition, quarterly and annual review meetings at central level by the NMEP as well as monthly review meetings at district and Upazila levels by respective authorities (as mentioned earlier) are and will continue to be the platforms for strengthening M&E coordination. The participants will include: public health authorities/staff from various levels, partner NGOs, and relevant stakeholders and partners.

Monthly, quarterly and annual review meetings are held by partner NGOs at Upazila, district and central levels. These review meetings are attended by the concerned NMEP staff including SMOs, district and Upazila health authorities.

7.1.8 M&E Capacity development

Capacity development of staff, community health worker/volunteer on programmatic areas as well as M&E is an ongoing activity. The national training plan includes training/capacity building particulars for all levels using comprehensive curricula. M&E capacity will be reviewed through a rapid capacity needs assessment in all districts and at central level (for NMEP and partner NGO), and the findings will inform a needs-based M&E training plan for the various cadres/volunteers. The purpose is to institutionalize M&E capacity within the NMEP and its implementing partners. Subsequently, capacity building plan will be updated including learning objectives based on needs assessment, agenda, modules, facilitator guides, pre- and post-tests, checklists for overall assessment of training and trainers centrally and disseminated for use at district and Upazila levels. Necessary technical assistance will be sought from the WHO and other partner agencies, as appropriate.

The M&E training/re-training sessions will be tailor made for specific target groups. Overall, the learning areas will focus on the following:

- M&E fundamentals
- Indicator framework; Data sources and data collection/reporting tools
- Routine data recording, reporting, aggregation, analysis (computer assisted data entry and analysis)
- Data flow (vertical, lateral) within and across the public, NGO, private sectors
- Data quality assurance
- Data dissemination and use (generation and use of information products, cross learning workshops) for planning, decision making and resource allocation
- Evaluation, studies, and research
- National HMIS and NMEP malaria MIS (DHIS2 based)
- Challenges and way forward

All training related documents (example, attendance sheet, course outline with learning objectives, reports) will be kept safely and securely and made available for review and audit purposes. Feedback on M&E related training will be taken from trainees during routine review and planning meetings. These platforms will also be utilized for brainstorming to improve ongoing programmatic and M&E training programs. Coordination between NMEP and partners will be strengthened to ensure that training activities are not duplicated.

CHAPTER-8: COST OF NSP 2021-2025

8. COST OF NSP 2021-2025

The NSP 2021-2025 will be implemented under the MoHFW flagship programme HNPSP. The resource requirements for NSP 2021-2025 will be USD 131,792,587 (1 USD = 84.47 BDT). Much resource need is expected to be covered under the current GoB HNPSP OP 2017-2022 and upcoming OP for the next period. In addition, support by external partners, especially the GF will be extremely crucial. Technical assistance by the WHO will also be vital. The NMEP/GoB will continue to explore resources from all sectors to fulfil the resource needs for NSP 2021-2025. Table-15 presents summary of objective- and intervention-wise resource requirements for NSP 2021-2025. Percent resource requirements by objectives are: 1) objective 1: 35.2%; 2) objective 2: 18.1%; 3) objective 3: 11.2%; 4) objective 4: 6.8%; 5) objective 5: 28.3%; and 6) objective 6: 0.3%.

Estimation of resource requirements for malaria is challenging especially due to the complex malaria epidemiology as well as numerous considerations and assumptions keeping in mind the end game and the extreme difficulties to factor the last-mile and multi-dimensional approaches. More so since actual disease burden needs to be ascertained in view of limited private sector data and near absence of information from 51 'non-endemic' districts (and a few 'non endemic' areas within endemic districts). Therefore, the estimation of resource requirements will remain dynamic. Current NMEP budget (OP budget), current GF budget, previous estimations, actual expenditures, the GoB/the GF and market rates provided the basis for various estimations towards attaining the maximum coverage. Effort is also made for efficiencies, cost-effectiveness, and value for money. The estimates do not include costs for infrastructure and its maintenance, health workforce across all levels fully, which are covered by GoB sources.

Table-15: Year-wise estimated resource (budget) requirements for NSP 2021-2025

Objectives/ Strategy	Sum of Total Amount Year-1 (USD)	Sum of Total Amount Year-2 (USD)	Sum of Total Amount Year-3 (USD)	Sum of Total Amount Year-4 (USD)	Sum of Total Amount Year-5 (USD)	Sum of Total Amount Year 1-5 (USD)
Objective_1: To achieve and sustain universal coverage by early case detection and prompt treatment of all confirmed cases through 2025	**86,05,831**	**92,33,255**	**94,01,288**	**95,10,956**	**96,52,863**	**4,64,04,192**
Early Case Detection	**44,25,890**	**49,71,347**	**49,68,143**	**51,71,178**	**52,84,144**	**2,48,20,701**
Prompt and Effective Treatment	**41,79,940**	**42,61,909**	**44,33,145**	**43,39,778**	**43,68,719**	**2,15,83,491**
Objective_2: To achieve and sustain	**45,11,123**	**29,29,215**	**77,00,081**	**47,34,656**	**40,42,675**	**2,39,17,751**

Objectives/ Strategy	Sum of Total Amount Year-1 (USD)	Sum of Total Amount Year-2 (USD)	Sum of Total Amount Year-3 (USD)	Sum of Total Amount Year-4 (USD)	Sum of Total Amount Year-5 (USD)	Sum of Total Amount Year 1-5 (USD)
universal coverage of population at risk with appropriate preventive interventions through 2025						
Malaria prevention with appropriate vector control measure	**45,11,123**	**29,29,215**	**77,00,081**	**47,34,656**	**40,42,675**	**2,39,17,751**
Objective_3: To strengthen context-specific surveillance in all malaria settings and outbreak preparedness and response through 2025	**49,55,117**	**21,17,746**	**23,70,979**	**29,46,386**	**23,66,739**	**1,47,56,968**
Epidemiological Surveillance	**41,59,277**	**16,18,643**	**19,06,162**	**24,63,161**	**18,47,420**	**1,19,94,663**
Entomological Surveillance	**7,95,840**	**4,99,104**	**4,64,817**	**4,83,226**	**5,19,319**	**27,62,305**
Objective_4: To achieve universal coverage by Advocacy, Communication and Social Mobilization (ACSM) activities for uptake of preventive and curative interventions, optimal community engagement through 2025	**24,86,184**	**14,40,371**	**14,56,165**	**21,65,312**	**14,50,439**	**89,98,471**

Objectives/ Strategy	Sum of Total Amount Year-1 (USD)	Sum of Total Amount Year-2 (USD)	Sum of Total Amount Year-3 (USD)	Sum of Total Amount Year-4 (USD)	Sum of Total Amount Year-5 (USD)	Sum of Total Amount Year 1-5 (USD)
Community Awareness and Participation	**30,212**	**46,589**	**43,959**	**44,794**	**39,834**	**2,05,389**
Program Communicati on	**14,66,509**	**3,53,989**	**3,21,683**	**10,31,597**	**3,21,683**	**34,95,461**
Advocacy for Strengthening Enabling Environment	**9,89,463**	**10,39,793**	**10,90,523**	**10,88,921**	**10,88,921**	**52,97,620**
Objective_5: To strengthen program management, monitoring & evaluation and partnership and coordination through 2025	**73,70,497**	**73,72,848**	**82,64,852**	**68,63,221**	**73,86,177**	**3,72,57,596**
Program Management, Capacity building and Strengthening	**44,13,367**	**46,10,841**	**50,96,274**	**41,19,577**	**43,35,050**	**2,25,75,109**
Program review, M&E, Strategy and Planning	**29,46,713**	**27,51,068**	**31,68,578**	**27,43,645**	**30,51,127**	**1,46,61,131**
Partnership and Coordination	**10,418**	**10,938**	**-**	**-**	**-**	**21,356**
Objective_6: To strengthen and expand research through 2025	**1,13,970**	**77,066**	**80,920**	**1,04,734**	**80,920**	**4,57,610**
Strengthen and Expand Research	**1,13,970**	**77,066**	**80,920**	**1,04,734**	**80,920**	**4,57,610**
Grand Total	**2,80,42,722**	**2,31,70,503**	**2,92,74,284**	**2,63,25,265**	**2,49,79,813**	**13,17,92,587**

Annex-1: Key JMM4 recommendations

Thematic area 1: Malaria epidemiology and determinants of malaria

Recommendations:

- A better understanding of the micro-epidemiology of malaria in different transmission settings is needed to support evidence based targeting and accelerating progress. Efforts to delineate village boundaries to enable mapping of village level data using GIS should be supported and accelerated.
- Capacities should be built/strengthened to ensure use of data at and by sub national levels for local planning and actions.
- Peak season cross-sectional prevalence surveys (peak season) should be conducted in the most remote and at-risk communities in the CHT districts and resultant data should be used to elucidate the epidemiological situation (in collaboration with the military/paramilitary forces, as necessary).
- A detailed study on travel of the people from high endemic areas may be carried out to understand the malaria transmission dynamics, especially in view of large-scale influx of Rohingya people from Myanmar and increasing number of tourists and international organizations/NGOs from different parts of the country/world.

Thematic area 2: Malaria case management (diagnosis, treatment, referral), drug resistance

Recommendations:

- Availability of/access to early diagnostic and treatment services should be further improved. RDTs should be available at all health facilities and through community-based services in remote areas beyond reasonable reach of health facilities; while quality-assured microscopy should be available in reference laboratories/centres, hospitals and other designated laboratories.
- High-quality diagnosis should be ensured by optimising the national EQA/EQC for laboratory diagnosis of malaria covering both public and private laboratories all over the country. Microscopy guidelines and SOPs for the EQA/EQC should be updated and available in all health facility in Bangla. Conventional and innovative app-based approaches for slide banking should be considered prior to roll out of improved QA.
- Internal QA system (cross checking) guidelines should also be updated and disseminated in Bangla to all public/NGO/private laboratories. Only a representative sample of slides should be cross-checked at higher levels.
- QA of RDTs should be considered if suitable positive controls could be sourced.
- Management of malaria among the forest goers, jhum cultivators & other key populations needs emphasis. Diagnostic and treatment services should be strengthened in remote areas and at identified district and national border-crossing points. Case detection should be intensified in special situations and in areas currently underserved by mobile teams.
- Simple guidelines and follow up on case detection, recording & reporting of fever cases should be disseminated in non-endemic districts.
- Compliance to NTG by all sector including Army/BGB, private sector, NGOs should be ensured.
- Standby treatments (a full course of ACT) should be provided in special circumstances with appropriate information to individuals or groups travelling to remote areas and closely monitored. Screening of members of the armed forces pre- and post-deployment to endemic areas as well as pregnant women in high transmission settings should be considered.
- Broader range of diagnostics should be available at UHC/UHFWC for fever/common diseases other than malaria.
- MDA may be considered as per WHO recommendations as an epidemic response or in the event of complex emergencies.
- Standard treatment protocol for fever management should be developed for relevant diagnostics and antibiotics usage, especially for non- & low endemic districts. In addition, guidelines on admission of malaria cases should be disseminated for treatment compliance and prevention of onward transmission.

- TES should be conducted regularly. Microscopy based follow-up of patients on day 28 or day 42 should be introduced to detect potential recrudescent cases. Positive cases should be admitted to hospital for supervised second-line treatment. Day 3 slides for *Pf* to assess parasite clearance should be introduced.
- The NMEP should consider randomly selecting fever cases of unknown origin from FDMN camps and confirm by further molecular test (PCR) to see if there is any indication of ACT resistance entering through FDMNs to Bangladesh (K13 gene) [According to the recent WHO weekly report, over few thousand fever of unknown origin are noted in FDMN camps]. This should be done throughout the year.
- Collaboration and coordination with all agencies/organizations inside FDMN camps should be initiated for adherence to NTG as well as timely and quality reporting. Involvement of the WHO Sub office should be considered to play a facilitation role.
- Referral and management of severe malaria should be further improved. Training on pre-referral treatment for community health workers and on severe malaria by doctors at primary/secondary hospitals should be strengthened. Introduction of artesunate rectocaps for pre-referral treatment of young children should be considered.
- Analysis of G6PD status by ethnicity should be carried out and rolling out targeted point-of-care test for G6PD status should be considered prior to PQ treatment. Day 3 and day 14 follow-up for patients treated with PQ (to check for signs of haemolysis and to assess compliance respectively) should be introduced.
- A comprehensive pharmacovigilance system should be established.
- Issue of any inappropriate, counterfeit and sub-standard antimalarials should be addressed. Quality of antimalarials at peripheral facilities and outlets should be tested using Minilab® test kits in collaboration with the DAD.
- Adequate manpower should be deployed to ensure community outreach for diagnosis & treatment especially in remote areas of CHT districts. Multi-purpose health volunteers introduced in malaria endemic areas should be trained and equipped to provide malaria case management services and not only referral. Most of the field staff working at community level should be fully involved in the screening process of the malaria cases.
- Efforts for mapping and orienting private practitioners on quality assured diagnostic services, standard malaria treatment guidelines and reporting should continue in order to ensure early diagnosis, rational treatment and timely and accurate reporting of all cases.
- CHCPs are diagnosing the cases but sometimes referring to NGO partners for treatment. Drugs should be available at CC and treated there. Stock out of drugs, if any, especially at peripheral level facilities like community clinics should be addressed immediately. The Logistics Management Information System should be strengthened especially at local level to reduce any shortage & prevent stock out.
- Clinicians should be made aware of the possibility of *P. knowlesi* infections and understand that *P. knowlesi* infections (and *P. ovale* and *P. malariae* infections) are not detected by Pf/Pv RDTs.

Thematic area 3: Malaria entomology and vector control, insecticide resistance

Recommendations:

- The focus of the entomology department needs shift radically from control mode to elimination mode. Priority should be on epidemiology-led entomology for problem solving.
    - A core group of highly trained entomologists should be ensured at central level to manage epidemiology-led entomology for problem solving, make evidence based recommendations about any necessary changes in interventions or delivery strategies, address any elimination-specific challenges, monitor and manage insecticide resistance with support by the WHO. Capacitated entomologist resource pool should address malaria and other VBDs of public health importance.
- A detailed integrated vector management (IVM) strategy guided by an eco-epidemiological assessment and informed by malaria case and entomological surveillance data should be developed.
    - Tailored packages of proven and promising prevention measures should be considered to maximize protection of all those at occupational risk of malaria [construction project settlements (e.g. dams, bridges); camps associated with commercial projects (e.g. road/railway construction, large-scale logging); plantations (e.g. tea, food); forest workers in formal sector (e.g. forest/wildlife protection services); for forest workers in informal sector; seasonal agricultural workers; security forces.

- Vector profiling and mapping should be updated. Where feasible, geographical reconnaissance of vector mosquito breeding sites should be carried out to target interventions in active transmission foci.
- LLIN distribution campaigns should ensure sufficient nets for all householders based on sleeping patterns, rather than simply providing one LLIN for 02 people. Continuous distribution for pregnant women & any attrition in coverage should be ensured; incentives should be considered, as appropriate, to ensure that IRS and LLINs reach even the most inaccessible communities.
- A stockpile of LLINs and insecticide for IRS should be maintained at central level to respond to foci/outbreaks, including in districts that are classified as non-endemic. Stock-rotation with routine supplies should be carried out to avoid expiry of these stockpiles.
- The impact of LLIN in relation to transmission dynamics should be assessed. LLIN utilization surveys should be conducted by independent agencies.
- IRS with a non-pyrethroid insecticide should be ensured in focus, hot spot areas.
- Larval source management should be considered (as per WHO guidance), where feasible, after mapping of vector breeding sites.
- Innovative measures, such as repellents, insecticide treated hammock-nets, insecticide-treated clothing, ivermectin as an endectocide, should be explored as pilot, as appropriate.
- Entomology component needs investment in terms of manpower, technical capacity, laboratory space and equipment, up-to-date SOPs and training, and establishment of an insectary.

Thematic area 4: Malaria surveillance, M&E

Recommendations:

- Notification of malaria under the Infectious Disease Act 2018 should be ensured. Reporting from all organizations/agencies, private sector should be initiated.
- As a priority, appropriate malaria surveillance should be emphasized and strengthened to cover all areas especially moderate, low and non-endemic districts to progress towards phased elimination and certification. Comprehensive case & focus investigation should be done.
- Surveillance and M&E guidelines should be updated and disseminated. The NMEP should lead & coordinate surveillance and M&E across all settings and all sectors; strengthening of national capacity for surveillance and M&E should be continued across all settings; data at the local level should be analyzed to assess provider wise performance.
- Malaria risk stratification should be revised based on epidemiological data (including data on receptivity and vulnerability, where available) for optimal planning and effective targeting.
- Annual blood examination rate (ABER) of 10% should be aimed at including in receptive/endemic villages in elimination settings. The GoB & NGO partners should cover all at-risk population groups (forest goers, jhum cultivators, tea gardens, tribal habitation, mobile and migrant populations,) to achieve the desired ABER by subgroups & villages. An analysis of ABER at Upazila level should be carried out to assess whether ABER has reached appropriate levels in populations at risk.
- There should be cut off points to determine hot spot areas. There should be a SOP to manage the hot spot properly. Surveillance system should operate at village level using registries of mapped villages in malaria endemic areas to produce updated analyses with map of hotspots and identify which hotspots are stable over time. This needs on-going support to keep registries of villages up to date.
- Robust malaria surveillance should be initiated in all border areas including in non-endemic districts that are adjacent to endemic districts in neighbouring countries.
- Expatriate people those especially visiting/working in FDMN camps should take precautions against malaria by following the national guidelines. The NMEP may consider screening of expatriate people for diseases including malaria at airport, bus stations, other ports of entry as per national guidelines.
- Data quality audits should be further improved besides strengthening of associated data analysis and use especially to ensure that elimination efforts are well directed and monitored.
- Reporting against the indicator ‘Proportion of cases treated according to NTGs’ should be based on health facility audits conducted during routine programme monitoring. Besides the current outcome and output/coverage indicators in the performance framework, the GoB and BRAC may consider few additional relevant indicators relating to NSP 2017-2021 interventions.

- A holistic approach to report malaria deaths should be introduced (including patient's place of origin, place of infection, place of diagnosis, places of treatment and place of death, etc.). Similar analysis is recommended for severe cases at tertiary hospitals.
- The NMEP should move towards integrated disease surveillance through DHIS2 as quickly as is feasible, adopting a two-tiered approach: one for elimination and prevention of re-establishment settings and the other for control settings. The DHIS2 should cover all levels of case management provision, including community-based volunteers and private sector providers. It should also support elimination related data collection and aggregation (online malaria elimination database) including case notification, case investigation, case classification, focus investigation and focus response; while malaria data continue to be submitted to MoHFW HIS.
- The national Management Information System (MIS) is yet to evolve for real-time case reporting, case investigation, focus investigation. Appropriate ICT should be used for the purpose viz., SMS, geographical information system (GIS) that should be able to record the exact position of each patient for response.
- MIS forms should be revisited/updated including classification of cases by age-gender and even high risk occupational groups to support more meaningful analysis of data; 'zero' rather than 'dash' should be used to denote 'zero' values in data recording forms and 'dash' should only be used to denote 'no data'.
- Supervision and monitoring should be strengthened and cover all aspects with standardized checklist. Feedback mechanism and action taken should be improved. Routine NMEP supervision of BRAC Consortium should be institutionalized; Whilst internal periodic monitoring of programme activities continues, independent periodic monitoring should be initiated more frequently.

Thematic area 5: Malaria epidemic preparedness and response

Recommendations:
- Epidemic preparedness and response guidelines should be updated and SOPs should be developed and disseminated.
- RRT should be strengthened in every district. Such teams in low and non-endemic-districts especially those surrounded by endemic district and or close to the border should be oriented continually.
- The NMEP should guide and provide threshold charts at district & Upazila levels at the beginning of each year identifying outbreak reporting thresholds by week. Rapid seasonal increase in transmission in June is a critical period for outbreak and epidemic detection. All should be on full alert during this period with review of caseload at every health facility on daily basis through SMS/electronic means.
- Minimum threshold for stock at facilities/warehouses should be defined especially in view of low number of cases in non/low endemic/moderate endemic districts and potentials for stock out in any epidemic situation.
- A stockpile of LLINs and insecticide for IRS should be maintained at central level to address any focus/outbreak, including in districts that are classified as non-endemic.
- Support from and coordination with Army Medical Corps/BGB, others should be sought.

Thematic area 6: Programme management & service delivery at different levels

Recommendations:
- The NMEP should promote effective leadership and ownership of malaria elimination at District/Upazila levels.
- A comprehensive review of existing HR should be carried out and gaps should be identified in relation to changing requirements from transmission reduction to elimination. The HR development plan should include deployment of necessary skilled HR to ensure that all settings are adequately served.
- Urgent attention is needed to fill HR vacancies. Recruitment and deployment of adequate number of skilled health care providers (doctors, nurse, medical technologists, entomologist, laboratory technicians, community health workers) should be ensured in all settings. District & Upazila staff should

be motivated and empowered to proactively engage in health planning and coordinate integrated responses.

- Annual work plan and appropriate micro plan process should be strengthened and should be shared with all key staff at district level and below for action (medical and nursing and HA staff, etc.). More emphasis should be placed on local level planning by the NMEP and its NGO partners.
- There is a need to establish more community clinics in select areas. Number of health assistants should be increased and the number of their visits to Community Clinics should be more regular (two AHIs should be available on all days so that a three-person team could provide more comprehensive services). The NMEP should consider providing appropriate incentives (both financial and placement related) for them to ensure that health facilities in rural areas especially in the CHT districts are adequately staffed and retention is optimal.
- A training needs assessment should be carried out in the context of elimination. Coverage & quality of training for all different levels of health care providers and on job capacity assessments should be increased. As a priority, all doctors, SACMO, Nurses, AHI, CHCP, HA as well as for staff of BRAC Consortium should receive training/re-training.
- The Union Sub centres need a team of 2-3 staff including a doctor and nurses other than the SACMO for optimal functioning. It is only in such a context that it would be able to perform its role in surveillance and fever management, especially in low endemic settings.
- Procurement and supply chain management should make greater use of setting thresholds for minimum number of stocks of drugs and RDTs that each facility and warehouse should maintain in addition to records of consumption over a last few years. Forecasting and deployment should be strengthened based on caseload and trend analysis; and District/Upazila levels should also be engaged in the analysis/decision-making. The timing of procurements should take both suppliers' expected lead-times and past delays into consideration.
- All malaria related guidelines, SOPs, etc. on treatment regimen, trainings, M&E Plan, PSM Plan, should be available in all health facilities. Standard treatment protocols for fever management in addition to an antibiotic policy should be ensured in public and private sector especially in non- & low endemic settings.
- Resource support should be ensured from domestic & external sources (e.g. the GF). In addition, the NMEP should explore/adopt innovative mechanisms to mobilize resources for elimination in addition to existing resources besides strengthening advocacy with various sectors (viz., corporate sector/others).
- Issues relating to transportation and communication facilities should be addressed.
- The NMEP 'Malaria Technical Advisory Committee' should be considered to transform into a high-level multi-sectoral 'National Malaria Elimination Taskforce' with appropriate changes in ToRs, composition. Further, this Taskforce, as necessary, may constitute Technical Working Groups. The action taken reports relating to recommendations of JMM/other reviews should be reviewed at least biannually by this Taskforce, besides other agenda items.

Thematic area 7: Multi-sector collaboration within health sector and with other sectors; and engagement with the community, NGOs, civil societies

Recommendations:
Malaria is a notifiable disease (as mentioned previously as well). This should be widely disseminated and enforced.

- Comprehensive multi-sector collaboration plan should be developed with outcome-based approach. The NMEP may consider engaging a specialist/agency to support this activity.
- The GO-NGO collaboration (NMEP and BRAC Consortium) remains important. The NMEP and its NGO partners should place more emphasis on engaging with local government, leaders and communities (such as Upazila chairman/members, teachers, community & religious leaders, headman, karbari) in local level planning and response in order to more effectively map & address any gap in coverage/acceptance.
- Assessment should be done regarding how SK and SS of BRAC are combining and coordinating all expectations of service delivery, viz. maternal care, TB control and malaria elimination.

- Efforts should be made to engage/collaborate with other NGOs who are currently not involved directly in malaria programme implementation especially for dissemination of standardized malaria messages, preventive activities and for referral in their areas of operation.
- Strengthened engagement with the Defence, Border Guard, Police and other paramilitary forces is needed to booster service provision especially in peripheral areas of the CHT districts where security situation is currently preventing access by programme staff. These forces may extend cooperation as they work at the border and other high endemic underserved areas where their health facilities could be used and supplies of RDT/ACT/LLINs to them should be considered.
    - Their supportive role should be defined for special situations (e.g. in the event of any outbreak) as well. Relevant staff needs to be trained on specific skill development as well as adherence to NTGs.
    - Screening for members of the armed forces pre- and post-deployment to endemic areas should be considered.
- The NMEP should coordinate with the non-health Ministries (forest, labour, home affairs) to design specific strategies for forest goers, jhum cultivators, mobile and migrant populations, tea garden labour, etc. There should be coordination meetings with representatives of ministry of agriculture and forestry on how best to meet with and motivate jhum cultivators and forest goers on appropriate preventive actions and EDPT. Likewise, with Education Department, joint school education programs could be strengthened for malaria surveillance, uptake of preventive interventions and EDPT.
- Functional coordination mechanism should be institutionalized with medical departments of tea garden especially adherence to national guidelines and timely & quality reporting. A district level coordination mechanism should be in place with the tea-garden hospitals and the heads of the medical divisions of the tea garden estates. A certain minimum number of fever cases should be tested in their hospitals as part of the surveillance effort. If positive, they should have the skills and drugs to initiate treatment even as they refer. They could be part of the 1-3-7 strategy.
- The programme should actively engage with the private sector (as this is a prerequisite for the certification of elimination). For systematic engagement with private sector, a position/specialist agency/coordination cell should be considered at NMEP/DGHS level, which should also draw from experiences of other health programmes. Private practitioners and facilities need to be oriented on NTG.
- Tourist guidelines should be circulated to all hotels and other important offices. Further, a health communication focus for tourists is desirable. This would include billboards and signboard in tourist spot to ensure enhanced awareness about EDPT. Advocacy workshop for Hotel Managers of tourist areas (sub-districts/districts) should be held to ensure information on access to malaria diagnosis and treatment.
- The local governments should be sensitized and involved to promote malaria elimination as priority agenda. The NMEP should engage more with the CHT Council and local administration to accelerate control efforts overcoming security issues, where feasible.
- Collaboration with formal sector forest-goers as well as with informal sector forest-goers should be strengthened to ensure that they are promptly & fully protected, using incentives wherever necessary.
- Staff should be designated to advance effective & sustained multi-sector coordination & collaboration.

Thematic area 8: Behaviour Change Communication, Advocacy, Community Participation

Recommendations:

- The NMEP should develop national communication strategy. The evidence-based and locale- & context-specific communication strategy & its implementation should target high-risk population groups as well as general public in all settings. An operational guideline should be developed as well.
- Appropriate package of messages & materials should be designed for Jhum cultivators, forest goers, mobile and migrant populations, FDMN & host population in Cox's Bazar, indigenous populations working in tea gardens/elsewhere, tourists visiting endemic settings, etc. IEC/BCC package should be developed for border areas too to make the inhabitants aware about potential risk for malaria transmission.
- Malaria programme experiences, best practices, successes and lessons learnt should be documented and disseminated amongst stakeholders.

- Advocacy for and coordination with key influencers (political, administrative, media, corporate, community) should be optimized at central, district and Upazila levels & below with a customized advocacy package. A 'Malaria Elimination Road Map' should be designed as an advocacy tool towards strengthening response and sustained resource mobilization. The NMEP should conduct regular briefings to all stakeholders in all districts.
    - Advocacy workshops for hospitality industry at tourist spots (at sub-district/district level) should be held periodically to ensure traveller access to timely & appropriate malaria diagnosis and treatment.
    - In non-endemic & low endemic settings, where malaria cases are nil or a rarity, and yet malaria surveillance remains important, specific advocacy should be strengthened with doctors, nurses, SACMOs and CHCPs, HAs and AHIs of the government healthcare centers.
    - Advocacy with tea gardens and security forces should be strengthened for continued vigilance .
    - All stakeholders (viz. private sector tea gardens) and others should be oriented for harmonized communication initiatives led by NMEP.
- Staff with required skill sets should be designated to advance effective & sustained BCC, advocacy and community mobilization.
- M&E of BCC, advocacy, community mobilization activities should be ensured and standardized reporting forms should be developed. Impact of communication activities should be periodically evaluated by independent agency.

Thematic area 9: Cross-border collaboration

Recommendations:

- Situation analysis should be done including exploration of modalities to share information on geographic, malaria epidemiological, administrative information on either side of the international border with regular updates. Estimation of mobile and migrant populations and displaced population should be done.
- An action plan should be developed drawing from the guidance provided in the 2018 WHO operational framework on cross border collaboration
- Effective cross-border collaboration should be initiated with facilitation and support by the WHO starting with preparation of an action plan. The GF, other partners should also extend necessary support.
- Robust malaria surveillance should be introduced in border areas of non-endemic districts (within national boundaries) that are adjacent to high endemic districts of Bangladesh and of neighbouring countries. In addition, diagnostic and treatment services should be strengthened in border areas.
- Cross-border communication channel for notification of unusual situations should be established.

Thematic Area 10: Operational research

Recommendations:

- Operational research should be intensified to support programmatic activities. Research (to be led by NMEP) questions emanating from the current JMM4 are appended as Annex-8.
- A research advisory group should be considered to help Director CDC & NMEP to identify research agenda and provide support for call for proposals, approve proposals/protocols, recommend funding, and then peer review the final reports (who themselves would not be taking up questions). The NMEP should initiate yearly research event where all stakeholders involved in malaria research should present either completed work or so far done for appraisal.
- NMEP should initiate a repository of research/papers published on malaria in Bangladesh. This is very important for any researcher/others to look into the work already been done.
- The NMEP should consider an alternative approach – 'Structured Operational Research and Training Initiative (SORT IT)' that seeks to make countries "data rich, information rich and action rich" thereby contributing to improving health care delivery and outcomes. This has worked well in operational research in tuberculosis. It is a global partnership coordinated by TDR and implemented with partners to support countries and institutions to conduct operational research around their own priorities; build

sustainable operational research capacity; and make evidence-informed decisions for improving programme performance in a time-bound manner. The WHO may play facilitating/coordinating role. Priority should be given to research that address the specific needs of particular risk groups (jhum cultivators, forest goers, other mobile and migrant populations). Pilot projects with promising new tools (bundled together as appropriate) need to be initiated, and on a scale required to achieve programmatic impact. Given the elimination timelines, research needs to focus on 'learning by doing' rather than 'learning, then doing'.

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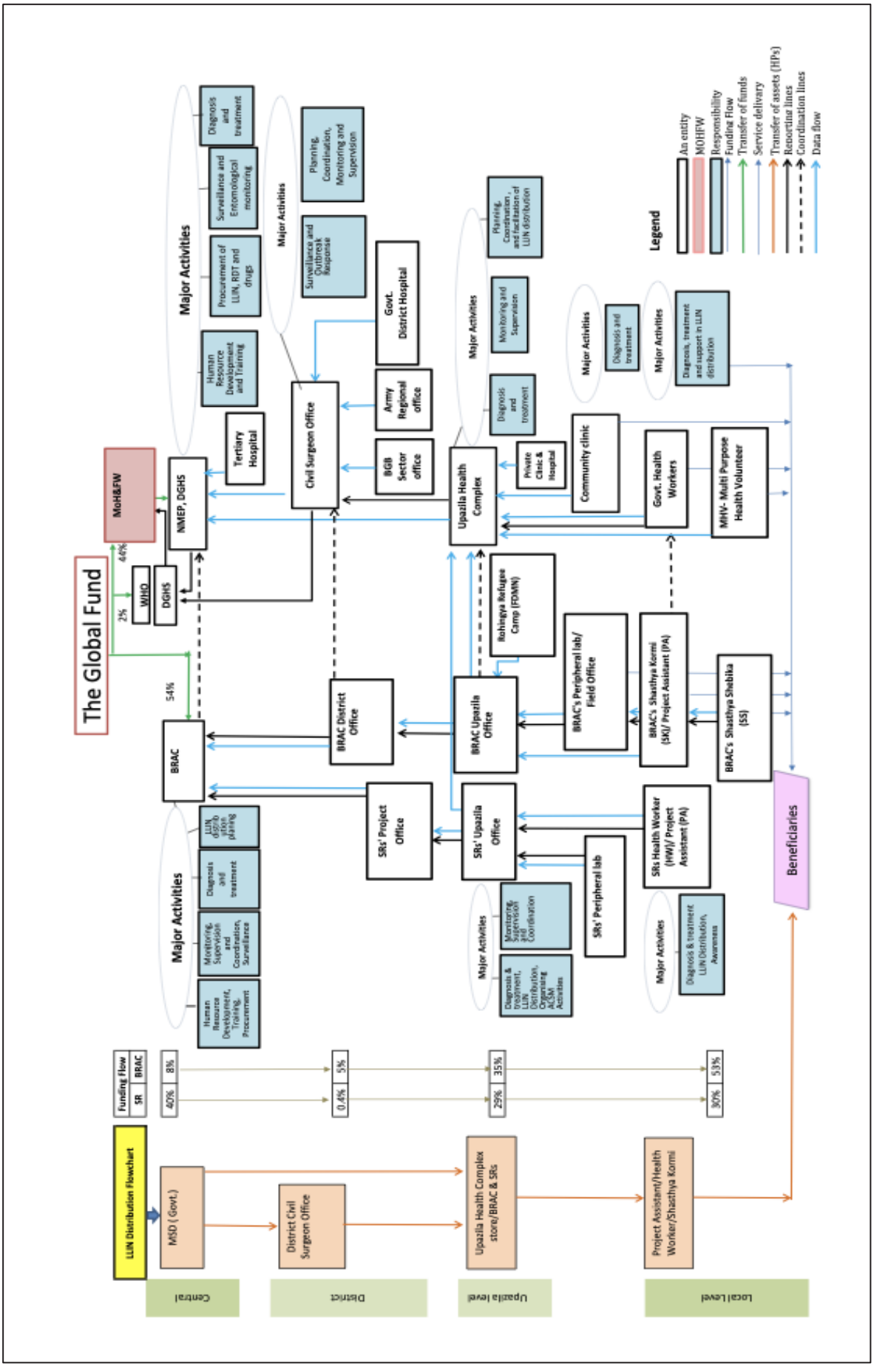
Annex-3: List of research topics (tentative)

- Malaria risk assessment and mapping.
- Assessment of systemic preparedness for elimination and POR.
- Epidemiological and entomological assessment of the impact of halting LLIN distribution in communities that have not had any malaria cases for 3 years or more [LLINs should be kept on standby in case of resumption of transmission].
- Understanding socio-demographic and disease dynamics, the vector within transmission hotspots with special emphasis on forest-based transmission.
- Introduction of innovative tools for vector control and personal protection (impregnated clothing, repellents, ivermectin, etc.).
- Conduct G6PD testing in sentinel sites and map G6PD status in endemic areas; and validation of G6PD test kit use at community level.
- Assessment of implementation of different programs at the level of community health worker and health volunteer and its impact on malaria service delivery and surveillance. [Currently, malaria control programme, maternal and child health programme, TB & HIV control programmes are operationalized through these cadres. There is almost no study of these community health workers, even in terms of profile and work hour allocation, challenges & barriers].
- Measures to strengthen access to relevant diagnostics and antimalarials at government primary care facilities - the UHC, the Union level health facility and the community clinics. Patterns of antibiotic prescription for undiagnosed fevers at district and sub-district healthcare facilities (DH, UHC, USC, CC) and its implications for case detection of malaria.
- Assessment of measures to effectively address HR issues in under-serviced areas to inform policy/strategy especially to attract and retain skilled healthcare professionals in such settings.
- Understanding through relevant tools the functioning of HAs, CHCPs, MHVs, their competence levels, and the workforce management and training needs of this cadre.
- Integrated vector management including source reduction measures through multi-sector participation (local bodies, community, others).
- Ways to strengthen HMIS to capture data from private healthcare providers In particular to document and use the epidemiological and public health relevant data emerging from tea estate health care facilities, other private hospitals.
- Survey to elucidate the role of the private sector in malaria case management.
- Comprehensive analysis of mobile and migrant populations and other high-risk groups to design specific intervention packages. In addition, collection & assessment of travel information from people with confirmed malaria to identify changing routes of importation of malaria and to identify likely transmission hotspots and sources and sinks of spread of malaria.
- Village level mapping of cases to identify hotspots (active foci) for targeting interventions.
- Net Retention and Utilization survey and overall KABP among different population groups in addition to bio efficacy of LLINs.
- Intervention studies for high-risk groups with promising tools bundled together, for example: Targeted drug administration with ivermectin as an endectocide; Chemoprophylaxis; Stand-by treatment (combined treatments for malaria and typhus); Topical insect repellent; Insecticide treated hammock nets; Permethrin treated clothing/bed sheets; Screening of forest-based dwellings with insecticide treated netting.
- Assess the benefits of attractive toxic sugar bait (ATSB) for vector control; larval source management.
- Collaborative implementation research on malaria-relevant cross-border population movements with emphasis on adapting innovative strategies for improved coverage.
- Genetic surveillance across endemic areas to identify parasites imported from other countries, in particular to: identify and quantify parasites with genetic markers of artemisinin and ACT-resistant *P. falciparum* from Myanmar in the CHT districts and Cox's Bazar. Where high prevalence of resistance markers are found, this can be followed up with a TES in the same location;

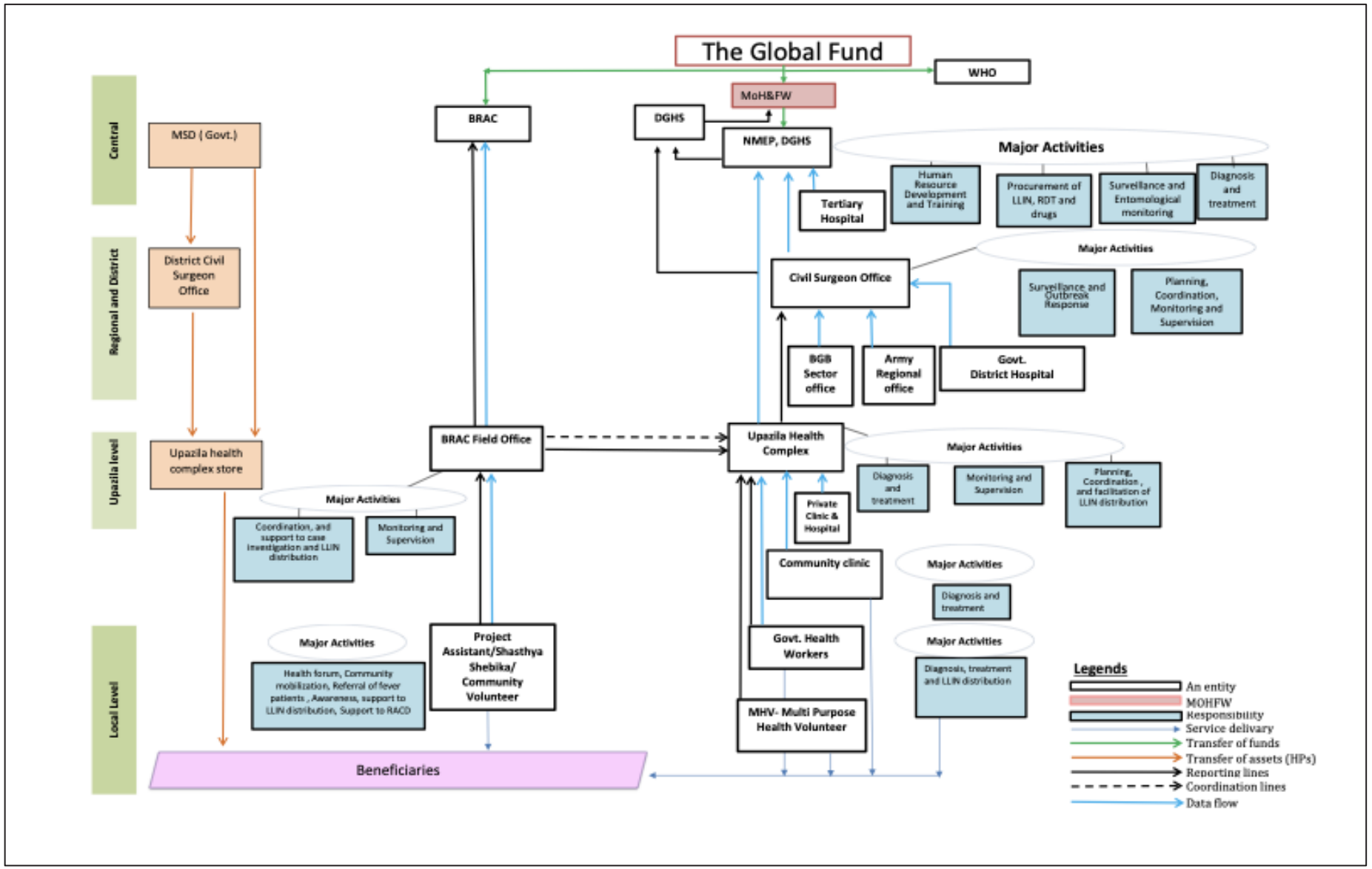
- Identify and quantify importation of any malaria parasites from India or Myanmar into Bangladesh.
- Quantify risk of future malaria epidemics in the FDMN camps in Cox's Bazar district to design package of interventions for response.
- Determine the prevalence of asymptomatic malaria infection. Molecular surveillance for asymptomatic malaria transmission in elimination areas.
- Assessment of 3-day course compliance of ACT; and tracking repeated malaria infection on same person even after taking full course.
- Assessment of delayed clinical response from field level to get early indications if ACT is adequately working or not.
- Conduct population-based surveys with PCR in selected sites in elimination settings.
- Assess treatment seeking behaviour and adherence to National Treatment Guidelines by health care providers and patients; and gender-related dynamics, decision-making, resource allocation and financial authority within households.
- New diagnostic technologies; new antimalarial regimens.
- Impact of MDA coupled with mass LLINs distribution followed by intensive surveillance and response in various settings.
- Remote sensing to assess risk for difficult to reach populations and barriers to access for high-risk groups.
- mHealth applications (mobile apps for health).
- Generate evidence (through formative research) for development of ACSM strategy, tools and materials; impact assessment of ACSM.

Annex-4a: Implementation arrangements in 03 CHT districts and Chattogram, Cox's Bazar



Source: NMEP, 2021

Annex-4b: Implementation arrangements in 08 elimination districts (in Mymensingh and Sylhet zones)



Source: NMEP, 2021

Annex-5: Performance Framework with Indicators

Indicator	Baseline			Annual Targets					Remarks
	Value	Year	Source	2021	2022	2023	2024	2025	
Impact									
Confirmed malaria cases (microscopy or RDT): rate per 1000 persons per year	0.92	2019	Malaria MIS report	0.64	0.48	0.31	0.18	0.09	Baseline population: 18.74 million. Numerator for baseline year (2019) is 17,225 cases. Numerator for target years (2021, 2022, 2023, 2024 & 2025) are 12,432, 9,403, 6,248, 3,604 and 1,777 cases, respectively. Denominator for target years (2021, 2022, 2023, 2024 & 2025) are 19.37, 19.69, 20.03, 20.37 and 20,72 million respectively. Data of 72 Upazilas from 13 districts will be considered for reporting of this indicator. Required disaggregation (age, species) will be reported. [The targets will be revisited after initiation of interventions including surveillance and M&E in systematic manner in 51 'non-endemic' districts as well as few 'non-endemic' areas within 13 endemic districts. Furthermore, targets may be reconsidered in the event the results change with any unusual epidemiological situation or any interruption in programme implementation due to unforeseen factors, despite programme strengthening as well as planning, implementation of mitigation measures].
Inpatient malaria deaths per year: rate per 100,000 persons per year	0.05	2019	Malaria MIS report	0.034	0.023	0.013	0.005	0.001	Baseline population: 18.74 million. Numerator for baseline year (2019) is 9 deaths. Numerator for target years (2021, 2022, 2023, 2024 & 2025) are 7, 5, 3, 1 and 0 deaths respectively. Denominator for target years (2021, 2022, 2023, 2024 & 2025) are 19.37, 19.69, 20.03, 20.37 and 20,72 million respectively. Data of 72 upazilas from 13 districts will be considered for reporting of this indicator. Required disaggregation (age) will be reported.

Indicator	Baseline			Annual Targets					Remarks
	Value	Year	Source	2021	2022	2023	2024	2025	
Annual parasite incidence: Confirmed malaria cases (microscopy or RDT): rate per 1000 persons per year (Elimination settings)	0.05	2019	Malaria MIS report	0.033	0.021	0.009	0.002	0.00	Baseline population: 16.59 million. Numerator for baseline year (2019) is 801 cases. Numerator for target years (2021, 2022, 2023, 2024 & 2025) are 573, 367, 158, 35 and 0 cases, respectively. Denominator for target years (2021, 2022, 2023, 2024 & 2025) are 17.13, 17.41, 17.69, 17.99 and 18,29 million respectively. Data of 47 upazilas from 10 elimination-targeted districts will be considered for reporting of this indicator. Required disaggregation (source of infection) will be reported. [The targets will be revisited after initiation of interventions including surveillance and M&E in systematic manner in 51 'non-endemic' districts as well as few 'non-endemic' areas within 13 endemic districts. Furthermore, targets may be reconsidered in the event the results change with any unusual epidemiological situation or any interruption in programme implementation due to unforeseen factors, despite programme strengthening as well as planning, implementation of mitigation measures].
Test positivity rate	3.05%	2019	Malaria MIS report	5.28%	3.95%	2.61%	1.50%	0.73%	Numbers of tests and cases for baseline year (2019) are 538,625 and 16,414 respectively. Numbers of tests for target years (2021, 2022, 2023, 2024 & 2025) are 224,408, 228,777, 233,246, 237,818 and 242,495 respectively. Targeted cases for the same years are 11,859, 9,037, 6,091, 3,569 and 1,777 respectively. Tests and cases of 3 CHT districts (control settings) will be considered for reporting of this indicator. [The targets will be revisited after initiation of interventions including surveillance and M&E in systematic manner in 51 'non-endemic' districts as well as few 'non-endemic' areas within 13 endemic

Indicator	Baseline			Annual Targets					Remarks
	Value	Year	Source	2021	2022	2023	2024	2025	
									districts. Furthermore, targets may be reconsidered in the event the results change with any unusual epidemiological situation or any interruption in programme implementation due to unforeseen factors, despite programme strengthening as well as planning, implementation of mitigation measures].
Number of active foci of malaria	N/A		Focus register	-	TBD	TBD	TBD	TBD	08 districts of Mymensingh and Sylhet zones (4 districts from each zone) and Chattogram, Cox'sbazar, will be in elimination phase from 2021 (altogether 10 endemic districts). Data of 47 upazilas from 10 elimination-targeted districts will be considered for reporting of this indicator. Ward, the lowest administrative unit of the country, will be considered as geographical boundary of a focus. No baseline data available as information on the status of focus is not collected in the routine reporting. Guideline / SOP will be developed on classification of focus status and reporting during the 1st year of NSP implementation. Focus register will be developed and made available for reporting. Target will be set during that time as well. [The targets will be revisited after initiation of interventions including surveillance and M&E in systematic manner in 51 'non-endemic' districts as well as few 'non-endemic' areas within 13 endemic districts. Furthermore, targets may be reconsidered in the event the results change with any unusual epidemiological situation or any interruption in programme implementation due to unforeseen factors, despite programme strengthening as well as planning, implementation of mitigation measures].

Indicator	Baseline			Annual Targets					Remarks
	Value	Year	Source	2021	2022	2023	2024	2025	
Outcome									
Proportion of population that slept under an insecticide-treated net the previous night	91%	2018	LLIN Utilization Survey	92%	92%	92%	93%	93%	Baseline data is from the survey "Exploring utilization, use gaps of Long Lasting Insecticidal Nets (LLINs), and health-seeking of the malaria patients of malaria endemic districts in Bangladesh - 2018". Baseline achievement of this indicator is already a huge success. Continuous efforts will be made to sustain this achievement.
Proportion of children under five years old who slept under an insecticide-treated net the previous night	96%	2018	LLIN Utilization Survey	96%	96%	96%	97%	97%	
Proportion of pregnant women who slept under an insecticide-treated net the previous night	95%	2018	LLIN Utilization Survey	95%	95%	95%	96%	96%	
Annual blood examination rate: per 100 population per year	8.04%	2019	Malaria MIS report	6.96%	6.96%	6.96%	6.96%	6.97%	Baseline population: 18.74 million. Numerator for baseline year (2019) is 1,507,230 that received a parasitological test for malaria (microscopy or RDT). Numerator for target years (2021, 2022, 2023, 2024 & 2025) are 1.35, 1.37, 1.39, 1.42 and 1.44 million tests, respectively. Denominator for target years (2021, 2022, 2023, 2024 & 2025) are 19.37, 19.69, 20.03, 20.37 and 20,72 million respectively. An ABER of at least 10% will be pursued in 03 CHT districts from 2021, whereas the target is 8% for Chattogram and Cox'sbazar and 5% - for 8 other elimination districts.

Indicator	Baseline			Annual Targets					Remarks
	Value	Year	Source	2021	2022	2023	2024	2025	
									Data of 72 upazilas from 13 districts will be considered for reporting of this indicator. Required disaggregation (case detection) will be reported. [The targets will be revisited after initiation of interventions including surveillance and M&E in systematic manner in 51 'non-endemic' districts as well as few 'non-endemic' areas within 13 endemic districts]
Proportion of households with at least one insecticide-treated net	99.6%	2018	LLIN Utilization Survey	99.6%	99.6%	99.6%	99.6%	99.6%	The baseline and targeted years refer to the LLIN possession status in the households of 3 CHT districts for reporting this indicator. Baseline achievement of this indicator is already a huge success. Continuous efforts will be made to sustain this achievement. [The targets will be revisited after initiation of interventions including surveillance and M&E in systematic manner in 51 'non-endemic' districts as well as few 'non-endemic' areas within 13 endemic districts. Furthermore, targets may be reconsidered in the event the results change with any unusual epidemiological situation or any interruption in programme implementation due to unforeseen factors, despite programme strengthening as well as planning, implementation of mitigation measures].
Proportion of detected cases that contacted health services within 48 hours of symptoms	32%	2019	Case Investigation report	50%	60%	60%	70%	70%	Data from 10 elimination-targeted districts will be considered for reporting of this indicator. 8, out of 25, investigated cases in the baseline year (2019) contacted health services within 48 hours of inset of fever.

Indicator	Baseline			Annual Targets					Remarks
	Value	Year	Source	2021	2022	2023	2024	2025	
									As cases will be progressively decreasing in the elimination areas, the passive surveillance system needs to be vigilant enough to detect and treat cases within the shortest possible time. This indicator also indicates the knowledge and awareness of people on malaria and responsive behaviour. For target years (2021 – 2025), the surveillance system will be strengthened in 10 elimination districts to progressively increase the rate of case detection within 48 hours of symptoms from 60% to 80%. [The targets will be revisited after initiation of interventions including surveillance and M&E in systematic manner in 51 'non-endemic' districts as well as few 'non-endemic' areas within 13 endemic districts].
Percentage of case reports received within 1 day after detection	N/A	2019	Case Investigation report	-	90%	100%	100%	100%	Data from 10 elimination-targeted districts will be considered for reporting of this indicator. Data for baseline year is not available, as case notification of all identified malaria cases in 08 districts from Mymensingh and Sylhet zones were sent by manual real-time SMS till 2020. From 2021 onwards, case investigation will be rolled out / strengthened in 10 elimination districts including Chattogram and Cox's bazar. Whilst the real-time SMS notification will be continued, case-based surveillance module will be developed in 2021 and reports will be collected from the elimination settings through DHIS2 following 1-3-7 method from 2022 onward.

Indicator	Baseline			Annual Targets					Remarks
	Value	Year	Source	2021	2022	2023	2024	2025	
									[The targets will be revisited after initiation of interventions including surveillance and M&E in systematic manner in 51 'non-endemic' districts as well as few 'non-endemic' areas within 13 endemic districts] The target of receiving case reports within 1 day after the detection has been set in alignment with the targeted case investigation in the elimination settings for 2022 – 2025 period. [The targets will be revisited after initiation of interventions including surveillance and M&E in systematic manner in 51 'non-endemic' districts as well as few 'non-endemic' areas within 13 endemic districts].

Indicator (Coverage/Output)	Baseline			Annual Targets					Remarks
	Value	Year	Source	2021	2022	2023	2024	2025	
Number of long-lasting insecticidal nets distributed to targeted risk groups through continuous distribution	56,851	2019	LLIN distribution report	137,820	140,433	143,101	145,827	148,610	High-risk groups will be covered through continuous distribution in 13 endemic districts: [Pregnant women (distribution by ANC and household visits), forest/forest farms including jhum cultivators /forest goers (supplementary nets delivered during routine mass distribution), and seasonal workers (seasonal agricultural /aquaculture workers), new settlements as well as in the event of transmission foci, and in response of disasters, outbreaks]. [The target population comprise: 4% of population of 03 CHT districts and of villages from 10 non-CHT districts with cases in at least one of the last three years]. [The targets will be revisited after initiation of interventions including surveillance and M&E in systematic manner in 51 'non-endemic' districts as well as few 'non-endemic' areas within 13 endemic districts. Furthermore, targets may be reconsidered in the

Indicator (Coverage/Output)	Baseline			Annual Targets					Remarks
	Value	Year	Source	2021	2022	2023	2024	2025	
									event the results change with any unusual epidemiological situation or any interruption in programme implementation due to unforeseen factors, despite programme strengthening as well as planning, implementation of mitigation measures].
Number of long-lasting insecticidal nets distributed to at-risk populations through mass campaigns	670,402	2019	LLIN distribution report	620,696	351,887	1,310,373	713,744	480,026	Mass distribution will be carried out in 03 CHT districts, Chattogram and Cox's Bazar. In 03 CHT districts aiming at burden/transmission reduction, universal LLIN coverage will be maintained as an 'absolute priority'. In Chattogram and Cox's Bazar districts (in elimination phase since 2021): --> Villages will be prioritized for coverage depending on the number of years in the last 3 years that they have reported malaria cases: i.e. Villages that reported cases in each of the last three years (3/3) – 'high priority'; Villages that reported cases in any two of the last three years (2/3) – 'medium priority'. In addition, coverage of villages

Indicator (Coverage/Output)	Baseline			Annual Targets					Remarks
	Value	Year	Source	2021	2022	2023	2024	2025	
									that reported cases only once in the last three years (1/3) as well as coverage of FDMN population will also be priority]. LLIN distribution aims at universal coverage (100%) (1 LLIN per 1.8 person) of targeted at-risk populations. Efforts and coordination will be made for procurement and distribution prior to transmission period. 08 elimination districts will not receive LLINs under mass distribution. If any malaria case is reported from there, LLINs are planned to be distributed following case investigation, and after identification of focus (and hence considered under continuous distribution. [The targets will be revisited after initiation of interventions including surveillance and M&E in systematic manner in 51 'non-endemic' districts as well as few 'non-endemic' areas within 13 endemic districts. Furthermore, targets may be reconsidered in the event the results change with any unusual epidemiological

Indicator (Coverage/Output)	Baseline			Annual Targets					Remarks
	Value	Year	Source	2021	2022	2023	2024	2025	
									situation or any interruption in programme implementation due to unforeseen factors, despite programme strengthening as well as planning, implementation of mitigation measures].
Number of suspected malaria cases that receive a parasitological test nationally	1,507,230	2019	Malaria MIS report	1,420,117	1,443,129	1,466,723	1,499,975	1,533,847	Baseline and target refer to 13 endemic districts. From 2021 onwards, only 03 CHT districts will remain in burden reduction phase. An ABER of at least 10% will be pursued in 03 CHT districts from 2021. [In 2019, more than 10% ABER was achieved in 03 CHT districts]. 08 districts of Mymensingh and Sylhet zones (4 districts from each zone) and Chattogram, Cox'sbazar, will be in elimination phase where case-based surveillance will be initiated/ strengthened. 2021 onwards, it is assumed that 8% population with fever (fever cases) from Chattogram and Cox'sbazar, and 5% population with fever (fever cases) from Mymensingh and Sylhet zones (08 districts), will be tested for malaria.

Indicator (Coverage/Output)	Baseline			Annual Targets					Remarks
	Value	Year	Source	2021	2022	2023	2024	2025	
									Required disaggregation (test type, age, gender) will be reported. [The targets will be revisited after initiation of interventions including surveillance and M&E in systematic manner in 51 'non-endemic' districts as well as few 'non-endemic' areas within 13 endemic districts. Furthermore, targets may be reconsidered in the event the results change with any unusual epidemiological situation or any interruption in programme implementation due to unforeseen factors, despite programme strengthening as well as planning, implementation of mitigation measures].
Proportion of suspected malaria cases that receive a parasitological test at public sector health facility	100%	2019	Malaria MIS report	100%	100%	100%	100%	100%	Baseline and target refer to 13 endemic districts. 100% of tests done in public sector health facility will be reported; 20% of targeted total tests nationally will be done in public sector health facility. Required disaggregation (test type, age, gender) will be reported.

Indicator (Coverage/Output)	Baseline			Annual Targets					Remarks
	Value	Year	Source	2021	2022	2023	2024	2025	
									[The targets will be revisited after initiation of interventions including surveillance and M&E in systematic manner in 51 'non-endemic' districts as well as few 'non-endemic' areas within 13 endemic districts. Furthermore, targets may be reconsidered in the event the results change with any unusual epidemiological situation or any interruption in programme implementation due to unforeseen factors, despite programme strengthening as well as planning, implementation of mitigation measures].
Proportion of suspected malaria cases that receive a parasitological test at community	100%	2019	Malaria MIS report	100%	100%	100%	100%	100%	Baseline and target refer to 13 endemic districts. 100% of tests done in community will be reported; 80% of targeted total tests nationally will be done in community. [The targets will be revisited after initiation of interventions including surveillance and M&E in systematic manner in 51 'non-endemic' districts as well as few 'non-endemic'

Indicator (Coverage/Output)	Baseline			Annual Targets					Remarks
	Value	Year	Source	2021	2022	2023	2024	2025	
									areas within 13 endemic districts] Required disaggregation (test type, age, gender) will be reported. [The targets will be revisited after initiation of interventions including surveillance and M&E in systematic manner in 51 'non-endemic' districts as well as few 'non-endemic' areas within 13 endemic districts. Furthermore, targets may be reconsidered in the event the results change with any unusual epidemiological situation or any interruption in programme implementation due to unforeseen factors, despite programme strengthening as well as planning, implementation of mitigation measures].
Proportion of suspected malaria cases that receive a parasitological test in private sector sites	N/A	2019	Malaria MIS report	-	TBD	TBD	TBD	TBD	No baseline data is available. Feasibility assessment and a pilot on private sector engagement will be conducted in 2021. Based on the outcome of the study, target of private sector reporting will be defined for 2022 onward.

Indicator (Coverage/Output)	Baseline			Annual Targets					Remarks
	Value	Year	Source	2021	2022	2023	2024	2025	
									Required disaggregation (test type, age, gender) will be reported. [The targets will be revisited after initiation of interventions including surveillance and M&E in systematic manner in 51 'non-endemic' districts as well as few 'non-endemic' areas within 13 endemic districts]
Proportion of confirmed malaria cases that received first-line antimalarial treatment at public sector health facility	100%	2019	Malaria MIS report	100%	100%	100%	100%	100%	Baseline and target refer to 13 endemic districts. 100% of malaria cases detected in public sector health facility will be treated and reported. 20% of projected total cases nationally are expected to be diagnosed and treated in public sector health facility. Required disaggregation (species, age, gender) will be reported. [The targets will be revisited after initiation of interventions including surveillance and M&E in systematic manner in 51 'non-endemic' districts as well as few 'non-endemic' areas within 13 endemic districts. Furthermore, targets

Indicator (Coverage/Output)	Baseline			Annual Targets					Remarks
	Value	Year	Source	2021	2022	2023	2024	2025	
									may be reconsidered in the event the results change with any unusual epidemiological situation or any interruption in programme implementation due to unforeseen factors, despite programme strengthening as well as planning, implementation of mitigation measures].
Proportion of confirmed malaria cases that received first-line antimalarial treatment at community	100%	2019	Malaria MIS report	100%	100%	100%	100%	100%	Baseline and target refer to 13 endemic districts. 100% of malaria cases detected at community will be treated and reported. 80% of projected total cases nationally are expected to be diagnosed and treated at community. Required disaggregation (species, age, gender) will be reported. [The targets will be revisited after initiation of interventions including surveillance and M&E in systematic manner in 51 'non-endemic' districts as well as few 'non-endemic' areas within 13 endemic districts. Furthermore, targets may be reconsidered in the event the results change with

Indicator (Coverage/Output)	Baseline			Annual Targets					Remarks
	Value	Year	Source	2021	2022	2023	2024	2025	
									any unusual epidemiological situation or any interruption in programme implementation due to unforeseen factors, despite programme strengthening as well as planning, implementation of mitigation measures].
Proportion of confirmed cases fully investigated and classified	3.12%	2019	Case Investigation report	80%	90%	100%	100%	100%	Till 2020, case investigation was conducted in Mymensingh and Sylhet zones (08 districts) but not in Chattogram and Cox's Bazar. However, from 2021 onwards, case investigation will be rolled out/strengthened in 10 elimination districts (except 03 CHT districts). So, whilst the baseline numerator is number of malaria cases investigated in 08 districts in 2019, the baseline denominator is number of malaria cases in 10 elimination districts including Chattogram and Cox's Bazar in 2019. For target years (2021 – 2025), predicted cases of 10 elimination districts are considered: Chattogram, Cox's bazar, in addition to 08

Indicator (Coverage/Output)	Baseline			Annual Targets					Remarks
	Value	Year	Source	2021	2022	2023	2024	2025	
									districts from Mymensingh and Sylhet zones. The case investigation will be progressively strengthened in these districts from 80% to 100%. [The targets will be revisited after initiation of interventions including surveillance and M&E in systematic manner in 51 'non-endemic' districts as well as few 'non-endemic' areas within 13 endemic districts]
Timeliness of facility reporting: Percentage of submitted facility monthly reports (for the reporting period) that are received on time per the national guidelines	100%	2019	Malaria MIS report	100%	100%	100%	100%	100%	Baseline and target refer to 13 endemic districts. Total reporting units: (GoB 85 (72 UHC & 13 DH or Medical College Hospital) + partner NGOs 45 Upazila units in 05 districts. [The targets will be revisited after initiation of interventions including surveillance and M&E in systematic manner in 51 'non-endemic' districts as well as few 'non-endemic' areas within 13 endemic districts]

Indicator (Coverage/Output)	Baseline			Annual Targets					Remarks
	Value	Year	Source	2021	2022	2023	2024	2025	
Completeness of facility reporting: Percentage of expected facility monthly reports (for the reporting period) that are actually received	100%	2019	Malaria MIS report	100%	100%	100%	100%	100%	Baseline and target refer to 13 endemic districts. Total reporting units: (GoB 85 (72 UHC & 13 DH or Medical College Hospital) + partner NGOs 45 Upazila units in 05 districts. [The targets will be revisited after initiation of interventions including surveillance and M&E in systematic manner in 51 'non-endemic' districts as well as few 'non-endemic' areas within 13 endemic districts]

[1] Confirmed by population-based reporting from facilities with known catchment areas, very high and reliable case notification and, ideally, full participation of the private sector.

[2] Sample Vital Registration System. Bangladesh Bureau of Statistics. May 2021.

[3] Health Bulletin (2018). Management Information System (MIS), Directorate General of Health Services (DGHS), MoHFW, GoB.

[4] Assessment of Private Sector's Role, Readiness and Performance for Malaria Elimination. NMEP, GoB, Bangladesh. 2019. [Unpublished report].

[5] https://datacatalog.worldbank.org/dataset/world-development-indicators;

[6] DGHS (2018). Health Bulletin 2016. Management Information System (MIS), DGHS, Mohakhali, Dhaka-1212. www.dghs.gov.bd

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[9] The GDP growth was 2.38% in 2020.

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[11] Chaudhury, Dipanjan Roy (3 November 2018). "At current pace, Bangladesh to end extreme poverty by 2021". *The Economic Times*. Retrieved 6 November 2018.

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[14] https://dashboards.sdgindex.org/profiles/bangladesh/indicators

[15] apps.who.int/nha/database

[16] http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/BGD.pdf

[17] Report of Community consultations on human rights and gender-related barriers to access in the context of malaria in Bangladesh. NMEP. 2020. (Unpublished).

[18] http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/BGD.pdf

[19] https://covid19.who.int/region/searo/country/bd

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[21] Data anomalies due to the misinterpretation of Pf/Pan-specific rapid diagnostic tests in Bangladesh between 2014 and 2016. Annex 2. National Strategic Plan for Malaria Elimination 2017-2021. NMEP, Bangladesh.

[22] The 2014 malaria outbreak in Bangladesh. Annex 3. ibid.

[23] Confirmed by population-based reporting from facilities with known catchment areas, very high and reliable case notification and, ideally, full participation of the private sector.

[24] Ideally diagnosis should be within 25 hours of onset of symptoms.

[25] http://www.communityclinic.gov.bd/admin/content_uploads/CHW%20strategy.pdf

[26] Ley B, Kibria MG, Khan WA, Auburn S, Phru CS, Jahan N, et al. (2020) Wide range of G6PD activities found among ethnic groups of the Chittagong Hill Tracts, Bangladesh. PLoS Negl Trop Dis 14(9): e0008697. https://doi.org/10.1371/ journal.pntd.0008697.

[27] IVM is a rational decision-making process for the optimal use of resources for vector control. The approach seeks to improve the efficacy, cost-effectiveness, ecological soundness and sustainability of disease-vector control [http://www.who.int/neglected_diseases/vector_ecology/ivm_concept/en/].

[28] Example, in communities where coverage is high, but utilization is low, IRS with a non-pyrethroid insecticide may be applied.

[29] A framework for malaria elimination. Geneva: World Health Organization; 2017. Licence: CC BY-NC-SA 3.0 IGO.

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[31] Chang et al. eLife 2019;8:e43481. DOI: https://doi.org/10.7554/eLife.43481

[32] Sinha et al. Mapping the travel patterns of people with malaria in Bangladesh. BMC Medicine (2020) 18:45 https://doi.org/10.1186/s12916-020-1512-5.

[33] Bangladesh and India share a 4,156-kilometre-long international border, the fifth-longest land border in the world, including 262 km in Assam, 856 km in Tripura, 180 km in Mizoram, 443 km in Meghalaya, and 2,217 km in West Bengal. Six Bangladesh divisions of Mymensingh, Khulna, Rajshahi, Rangpur, Sylhet, and Chittagong are situated along the border. A number of pillars mark the border between the two states. Small demarcated portions of the border are fenced on both sides. https://en.wikipedia.org/wiki/Bangladesh%E2%80%93India_border.

[34] http://www.communityclinic.gov.bd/admin/content_uploads/CHW%20strategy.pdf

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