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National Equity Strategy on Expanded Program on Immunization

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Prepared by:

Nahid Akhter Jahan

Moriam Khanam

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Study Team

Principal Investigator:
Professor Nahid Akhter Jahan, Institute of Health Economics (IHE), University of Dhaka
Moriam Khanam, Assistant Professor, Institute of Health Economics (IHE), University of Dhaka

Expandad Program on Immunization:
Dr. Md. Tofazzal Hossain, Assistant Director, EPI & Surveillance, DGHS

Planning Monitoring and Research wing DGHS:
Professor Dr. Mazharul Islam, Director Health, Mymensingh division & Former Line Director, PMR, DGHS
Dr. Arafatur Rahman, Deputy Program Manager, PMR, DGHS
Dr. Gayatree Biswas, UH&FPO, Sadar, Munshiganj

UNICEF:
Maya Vandenent, Riad Mahmud, Jucy Merina Adhikari, Jannatul Ferdous, Zahid Hassan, Md. Jahid Hossen Shahed

Research team:
Md. Ashadul Islam, Fariha Kadir, Muhammad Ihsan-Ul-Kabir, Mahfujur Rahman, IHE , University of Dhaka

Acronyms

AHI	Assistant Health Inspector
AHO	Assistant Health Officer
BCC	Behaviour Change Communication
BDHS	Bangladesh Demographic and Health Survey
BNA	Bottleneck Analysis
CC	City Corporation
CES	Coverage Evaluation Survey
CHCP	Community Health Care Provider
DEPB	District Evidence-Based Planning and Budgeting
DGHS	Directorate General of Health Services
DPT	Diphtheria, Pertussis and Tetanus
EPI	Expanded Programme on Immunization
FPI	Family Planning Inspector
FWA	Family Welfare Assistant
FWV	Family Welfare Visitor
GAVI	Global Alliance for Vaccines and Immunization
HA	Health Assistant
HI	Health Inspector
HR	High-risk
HTR	Hard-to-reach
IEC	Information, Education and Communication
ILR	Ice Lined Refrigerator
IPC	Interpersonal Communication
IPV	Inactivated Polio Vaccine
MHV	Multipurpose Health Volunteer
MODC	Medical Officer Disease Control
MT	Medical technologist
NGO	Non-governmental Organization
SBCC	Social and Behavior Change Communication
SOP	Standard Operating Procedure
UHC	Upazila Health Complex
UNICEF	United Nations Children's Fund
VPD	Vaccine Preventable Disease
WHO	World Health Organization

Executive Summary

Background and context

Childhood immunization is a cost-effective intervention to improve the health, well-being and survival of children (Lindstrand *et al.,* 2021; WHO 2016, WHO, 2018). Globally, the Expanded Programme on Immunization (EPI) is considered one of the most successful public health programmes, which has significantly contributed to the reduction of vaccine-preventable diseases (VPDs). Over the last few decades, Bangladesh achieved commendable progress in increasing childhood immunization coverage and reducing the under-five mortality rate since the Expanded Programme on Immunization (EPI) started as a pilot project in 1979 (Sarker et al. 2019; Hossain et al. 2021). Reported immunization coverage rates remained over 90% for more than ten years and more than 80% of children under 12 months of age were fully immunized (Hassan et al. 2019). Despite the remarkable success, the immunization coverage in several districts/city corporations, some hard-to-reach/high-risk areas and among a few socioeconomic groups lies below the country's target of vaccination coverage of more than 95%. According to CES 2019, the crude full vaccination coverage by the age of 23 months was the highest in the Barisal division (98.5%) and the lowest in the Mymensingh division (93.1%). The valid full vaccination coverage was the highest in the Barisal division (91.1%) and the lowest in the Mymensingh division (80.5%). The crude full vaccination coverage by age of 23 months was highest in Mymensingh city corporation (96.1%) and lowest in Sylhet city corporation (87.6%). Valid full vaccination coverage by age of 12 months was highest in Rajshahi city corporation (92.4%) and lowest in Sylhet city corporation (63.8%). A critical challenge for Bangladesh is now to improve equity in immunization by reaching the pockets of unvaccinated and unprotected children and women of reproductive age living in rural and urban areas. The main objective of this assignment is to develop an equity strategy with recommended strategic interventions which can address inequities and bottlenecks, in achieving the country's target of vaccination coverage of more than 95 %. The specific tasks of this assignment are

- Review of documents (strategy, research/survey papers, situation reports) and summarize the existing revealing inequities and bottlenecks for immunization coverage
- Observe planning workshops of selected districts and CCs to identify the underlying causes of inequity and suggested measures to improve equity in immunization
- Review the DEPB plans on EPI of the low-performing districts and CCs to analyze the hindrances to immunization and the suggested remedies
- Key informant interviews to learn barriers on both the demand and supply sides and provide recommendations/strategies to overcome the barriers
- Conduct national BNA workshops using the Tanahashi model to identify obstacles to immunization of low-coverage districts and CCs
- Finalization of the equity strategy document with the recommendation of evidence-informed strategies

Methods of developing the strategy

The process of developing the equity strategy on EPI included several methods:

- A desk review of the existing policies, strategies, surveys, evaluations, research and studies was conducted to better understand the prevailing inequity in childhood

vaccination, the barriers to childhood vaccination, the root causes behind the dropouts and suggested measures to overcome the obstacles in both rural and urban areas.

- The study team attended and observed the planning workshops organized by EPI, DGHS in 4 districts and 2 city corporations. The planning workshops included rigorous bottle-neck analysis to identify the root causes of never/partial childhood vaccination using the Tanahashi model. The study team also reviewed the bottleneck analysis and DEPB plans of the rest of the districts and CCs.
- Key Informant Interviews (KIIs) with the managers (UHFPO) and service providers (MT-EPI, HI) were carried out in the selected 4 districts and 2 city corporations in which the planning workshops were observed. In each district/CC, the KIIs were done in one high-performing and one low-performing upazilas/zones. KIIs were also carried out at the central level to grasp the views of the managers and policymakers.
- Two central-level workshops were organized under the leadership of PMR, DGHS covering six low-performing districts and three city corporations. One low-performing upazila/zone and one high-performing upazila/zone in each of the districts/CCs were selected for participating in the workshops.

Inequity in immunization and its determinants: a review of literature

- Mother's age was found to be a significant predictor of vaccination coverage in Bangladesh. A study found that the non-coverage of full vaccination was greater among mothers from lower age groups compared to children of mothers from higher age groups (Srivastava et al., 2022).
- Several studies in Bangladesh found mother's education level as a significant predictor of immunization coverage (CES 2019; Boulton et al., 2018; Hanifi et al., 2018; Sheikh et al., 2018; Sarker et al., 2019; Banerjee et al., 2021; Hossain et al., 2021; Srivastava et al., 2022).
- Boulton et al. (2018) found that children of mothers who could take decisions for health care had greater odds of receiving full vaccination coverage compared to children whose mothers did not have that autonomy.
- Some recent studies in Bangladesh did not find gender to be a significant factor in childhood immunization (Sheikh et al., 2018; Sarker et al., 2019; Srivastava et al., 2022, CES 2019).
- Srivatava et al. (2022) reported that if a child was delivered at a health facility, he/she had lower odds of not receiving full vaccination compared to children delivered at home.
- Mothers' number of ANC visits was found as having a positive influence on the likelihood of receiving vaccines in Bangladesh (Sheikh et al., 2018).
- Wealth status was found to be a significant factor behind childhood vaccination in several other studies in Bangladesh and the South Asian region (Boulton et al., 2018; Sarker et al., 2019; Banerjee et al., 2021; Srivastava et al., 2022; CES 2019).
- Several studies identified household size as an important predictor of childhood immunization. A study in Bangladesh found that children from medium-sized households had greater odds of having full immunization coverage compared to larger households (Sarker et al., 2019).

- Children of unemployed mothers had a significantly greater likelihood of failing to receive the BCG and measles vaccines (Sheikh et al., 2018).
- Distance to health facilities has a negative influence on childhood vaccination uptake in Bangladesh (Vyas, Kim and Adams, 2019).
- According to the SBCC strategy 2019, migration is one of the major causes of dropouts from immunization in slum areas. Mothers also feel discouraged to take their children for vaccination if they lose the vaccination cards (SBCC 2019).
- Only vaccination of those who come for a visit and the absence of active follow-up was found to be important barriers to immunization among Bedey communities (Parvin, 2019)
- Lack of human resources was identified as a bottleneck for childhood vaccination in Bangladesh (Grundy, Rakhimdjanov and Adhikari, 2016; Shaik et al., 2018).
- The attitude of vaccinators was also found to be a barrier to childhood vaccination in CES 2019. The vaccinators suggest mothers visit on the next schedule if there are not enough children for one vial (SBCC 2019).
- Weak supervision and high turnover in human resources create challenges for vaccination coverage (Grundy, Rakhimdjanov and Adhikari, 2016).

Barriers and strategies: observation of district/CC-level BNA workshop

Bottlenecks are identified in the domain of 'availability' and 'accessibility' of the Tanahashi model in all the low-performing districts/CCs. The key reported barriers to reaching the targets of EPI in the low-performing districts/zones are

- Inadequate human resources and vacant posts of HA, AHI, HI, FWV and FWA
- Inadequate refresher training for the Health workers /vaccinators and supervisors in both rural and urban areas
- Insufficient budget and lack of transports to carry vaccines to the outreach centres
- Shortage of pentavalent vaccine for a few months in some districts and staggered supply of vaccines and other logistics
- Shortages of vaccine carriers, BCG syringes, EPI cards, tally books and registration books in some upazilas
- Shortage of outreach centres in a few upazilas
- Inadequate monitoring and supervision of activities of EPI
- Inadequate IPC before EPI sessions, especially in hard-to-reach areas
- Some ethnic community are facing a language barrier in some upazila
- The parents are busy during harvesting seasons in haor areas
- During the rainy season, it is difficult to reach the vaccination centre by half an hour's walk
- Lack of waste disposal facilities in some upazilas and in all City Corporations
- Inadequate skilled human resources in urban areas and lack of government/NGO health facilities in some wards
- Lack of proper environment and appropriate logistics for women and children-friendly outreach centres for immunization in all zones of City Corporations.
- Inadequate coordination meetings among local leaders, NGOs and city corporation authority/officials

- Inadequate supply of vaccine carrier, cold box, vaccination card, moni flag, moni cloths and other logistics in some CCs
- EPI sessions are held during the working hours of parents
- Inadequate budget for monitoring and supervision
- Lack of IEC and BCC materials for awareness raising for immunization

The suggested measures to achieve the EPI targets in the low-performing districts/zones are

- Reduce vacancy of HA, HI, FWV and FWA
- Refresher training for the supervisors, Health Workers/vaccinators and volunteers in both rural and urban areas
- Ensure availability of local health workers in a few upazila
- Increase number of porters in each upazila and the daily allowances of the porters
- Enhance IPC by the health workers and vaccinators before the day of EPI sessions
- Additional budget/boat fare for vaccinators from May to October
- Need based crash programs for EPI to reach dropout and zero dose children in some upazilas
- Establish more outreach sites in addition to 8 traditional sites considering population and HTR areas
- Ensure Solar freezers in hard-to-reach areas where it is necessay
- Additional funds for transport costs for monitoring and supervision for 1st line supervisors
- Ensure holding of monthly meeting regularly and effective way for feedback on data analysis by health workers and ward to identify low-performing areas
- Provide training to and involve the social/religious leaders in awareness raising
- mikingRaise awareness and motivate parents/guardians to vaccinate their children through mosque miking and courtyard meetings
- Advocacy meetings with the social leaders, union parishad, headman, karbari, and members
- Ensure brick walled pit or incinerator in a safe place for waste disposal and follow SOP in both rural and urban areas
- Sufficient human resources (volunteers and vaccinators) should be ensured in all zones
- Ensure availability of government vaccinators at the ward level where there is a shortage of NGO health facilities in urban areas
- Vaccination/outreach centres with proper sitting arrangements and hygiene at the ward level
- Quarterly coordination meetings among local leaders, NGOs and city corporation authority
- Ensure adequate supply of vaccine carrier, cold box, vaccination card, safety boxeswaste bins and other logistics
- Facilitate an E-tracking system for reducing dropouts and invalid doses
- Awareness-raising activities like mosque miking, television shows, advertisements in newspapers, billboards and door-to-door visits by the volunteers

One participant in the workshop in Comilla stated, *"Electronic tracking system is required for improving monitoring and supervision of the activities of EPI to reduce the dropouts and invalid doses"*

Barriers and strategies: findings from the central-level BNA workshop

Two central-level BNA workshops were organized to cover six low-performing districts (twelve upazilas) and three low-performing city corporations (four zones). The key reported barriers to reaching the targets of EPI in these districts/CCs are

- Shortage of HA, AHI, HI, FWV, FWA and vaccine porter
- Difficulties in fixation of target : Target children are estimated using the population growth rate of the population census 2011
- The current organogram of HR is very old. Over the time period, the ~~The~~ population has increased substantially without any increase in the sanctioned posts of HR for EPI and other health services. Moreover, the available sanctioned posts are lying vacant.
- Shortages of Vaccines (pentavalent vaccine and IPV) for a few months in some upazilas and zones
- Minimal ~~of~~ coordination between HA and FWA
- Shortages of syringes, tally sheets and other EPI logistics in some months
- Inconvenient location of the outreach centres in some upazilas
- Lack of acceptability of the Unwilingness to receive vaccines among some populations (Shaontal community in Pirganj upazila and Bedey community in Tala Upazila)
- Inadequate IPC for raising awareness in the community and reducing the drop-outs
- ~~Povert~~Transportation cost to reach the vaccination center is a barrier in the HTR areas in Hatia upazila, especially in Ghassar char
- There are no permanent residents on some islands because of river erosion in Hatia upazila
- Quality of service delivery may reduce when the vaccinators and supervisors are overburdened with work
- Mass communications are not properly designed and utilized
- Insufficient monitoring and supervision by the 1st line and 2nd line supervisors
- Fear of elephants in two hilly unions in Sribordi upazila
- Lack of proper waste disposal system in both rural and urban areas
- Vacant posts of vaccinators in all zones of city corporations
- Inadequate budget for vaccine transportation and distribution from upazila/zone to outreach centres
- Spot registration of children without any IPC in urban areas
- High rate of migration in export processing zone (EPZ) and slum areas in Cumilla city corporation

One participant from the Faridpur district stated, *"It is not possible to conduct IPC regularly due to the shortage of human resources."*

One participant of Narayanganj city corporation stated, *"We conduct spot registrations without any door-to-door visits and IPC. This is a barrier in estimating the targets of EPI."*

Suggested measures to overcome the barriers in low-performing districts/CCs are

- Reduce vacancy of HA, HI, AHI, FWV, FWA and FPI
- Recruitment of volunteers from the ethnic community~~y~~ies like 'Shaontal" in Pirganj upazila
- Regular refresher training to improve the skills of the health worker/vaccinators and supervisors
- Timely and adequate supply of vaccines and logistics
- Increase overtime allowances for ~~to~~ MT-EPI~~, HAs and HIs~~
- Relocation of the outreach centres through consultation with the local community leaders to ensure access to EPI sessions within half an hour's walk in Nalitabari upazila
- Ensure Supervision by the UH&FPO/MODC/designated personnel (randomly reviewing some vaccination centres and cross-checking to ensure proper IPC)
- Ensure planning and implementing ~~S~~sufficient and effective IPC with the parents/caregivers in both rural and urban areas
- Ensure allocation of funds to engage mass communication media (Local News Paper, Community Radio etc) according to the local context
- Need based Crash program for low-coverage union/ward
- Adequate budget for proper waste disposal systems in both rural and urban areas
- Involvement of local government in arranging additional fund and HR in urban areas
- Financial incentives for the parents/guardians of fully vaccinated children in urban areas
- Incentives for the vaccinators based on performances
- Ensure holding of regular monthly coordination meetings with the health workers/vaccinators and supervisors
- Involvement of the ward councillors, community leaders and religious leaders in awareness-raising activities

One participant from the district said, *"The current reporting system of Sherpur district is underestimating the targets of EPI. There is a significant difference between the reports of HA and CHCP. So, it is necessary to conduct proper IPC to reduce the gap between the data from different sources."*

One participant of Pirganj upazila added, *"It is necessary to raise awareness through miking, festoon and banner. Involvement of local government in raising awareness, regular courtyard meetings, dramas, and door-to-door inter-personal communication will reduce drop-outs and invalid doses of immunization."*

Barriers and strategies: views of the key informants

Enabling environment

Inadequate monitoring and supervision of EPI activities are a few of the major causes of dropouts from immunization and invalid doses of vaccinations in rural and urban areas. Exiguous human resources, lack of motivation, and inadequate budget for visiting the outreach centres are the principal causes behind the weak monitoring and supervision.

According to the key informants, there are also shortages of EPI supervisors in urban areas. The EPI supervisors are the staff of city corporations and there is an absence of constructive coordination between city corporations and NGO partners.

Some online tracking systems are already being piloted and the respondents have suggested scaling up these online tracking systems with improvements in the skills and capacity of service providers. Furthermore, a few respondents have suggested adopting a holistic approach to online registration of pregnant women, childbirth and immunization.

Supply-side determinants

Human resources (HR)

Shortages of human resources for EPI were relayed by all the key informants as a barrier to universal immunization coverage in both rural and urban areas. The central-level respondents remarked that there are shortages of human resources for EPI at the central, divisional, district, upazila and union levels. The key informants have urged the need for the recruitment of HAs post-haste. The key informants propounded that there should be at least one HA for the 6000 population. A long-term HR plan should be prepared for EPI.

The findings of KIIs show that the lack of an adequate number of vaccine porters for EPI is common in almost all sample upazilas.

NGO partners, under the supervision of city corporations, are the key service providers of EPI in urban areas. Most of the key informants have suggested that the government should provide vaccinators at the ward level in urban areas.

Training of HR

Most of the upazila-level respondents emphasized the necessity of refresher training for the health workers/ vaccinators and supervisors. They opined that training should be provided to the health workers/ vaccinators at regular intervals on the maintenance of the cold chain, appropriate vaccination, reducing wastage and increasing IPC with the parents or guardians of the children.

Vaccines and other supplies

Currently, all the vaccines of EPI are imported or donated by GAVI. Central-level key informants emphasized the need for producing vaccines within the country. Shortages of pentavalent vaccines were experienced for a few months in some upazilas in Netrokona, Sunamganj and Comilla districts. Some upazilas/zones also experienced shortages of , syringes, and EPI cards.

The key informants suggested building dry warehouse in the districts.

Travel time and travel cost in HTR areas

Long travel time and high travel costs to reach the distribution points and outreach centres are significant barriers to achieving the targets of the EPI in low-performing districts. One respondent said, *"It takes five days to reach some HTR areas in Baghaichhari Upazila. Although there are community clinics in those areas, it is not feasible for us to conduct EPI campaigns due to the longer travel times. Therefore, we are only able to conduct EPI campaigns in those areas that we can reach within three days."*

Infrastructure in urban areas

The key informants stated that the outreach centres are often not appropriate for providing childhood vaccination with insufficient hygiene and furnishings. They have suggested making the outreach centres women-friendly with appropriate logistics.

Demand side determinants

The key informants stated that the lack of knowledge among mothers and caregivers is a barrier to immunization in rural areas. One respondent stated, *"Religious and social stigmas, ignorance of parents, lack of social awareness, long working hours during harvesting time and migration in search for work are the main demand-side barriers for universal child immunization in Derai upazila."* Migration is a great challenge for universal immunization coverage due to the manual registration of vaccination of children immunization in urban areas, especially among slum dwellers. A holistic approach to electronic birth registration and vaccination of children is expected to reduce dropouts and invalid doses due to migration. Key informants suggested strengthening the SBCC to decrease the demand side barriers to immunization.

Key strategies and interventions to reduce inequity in immunization coverage

Strategies	Interventions	Timeline
Strategies for enabling environment		
Strengthening governance and coordination among stakeholders for EPI	Strengthening monitoring and supervision of activities of EPI in both rural and urban areas	Short term
	Preparing more robust micro plans and improving the quality of data	Medium term
	Involving communities and local government in the activities of EPI	Short term
	Effective coordination needs to be ensured between the city corporations and NGO partners	Short term
	Conduct quarterly performance review meetings in both rural and urban areas towards achieving EPI desired coverage	Short term
	Arrange advocacy meetings with the ward councillor in city corporations	Short term
Strategies on supply-side determinants		
Strengthening the supply of vaccines and other logistics	Adequate and timely supply of vaccines and other logistics should be ensured	Medium term
	Establish electronic vaccine logistic management information system	Medium term
	Bundling of vaccine & syringe to the immunization sessions from upazila/CC/municipalities	Short term
Strengthening infrastructure at districts level for dry goods	Ensure sufficient space at districts to accommodate all EPI logistics including cold chain equipments.	

Strategies	Interventions	Timeline
Ensuring the availability of adequate and skilled HR for EPI	Deployment of adequate human resources for EPI should be available at the national, district, Upazila, union and ward levels by filling up vacant posts. ~~in rural areas~~	Medium term
	The vacant posts of HA, AHI, HI, FWVs, and FWA should be filled up to reduce the shortages of human resources for EPI service delivery.	Medium term
	Regular refresher training should be arranged for the EPI health workers /vaccinators and supervisors in both rural and urban areas.	Short term
	Number of porters should be increased in some geographically HTR areas (hill tracks districts, haor areas and large upazilas) ~~More vaccine porters should be hired~~ so that there is one vaccine porter per union in some rural areas	Short term
	The allowances for the vaccine porters should be increased to cover the high transportation costs in hard-to-reach areas.	Short term
Improve transportation system for vaccines	Sufficient insulated vans/freezer vans should be provided to transport vaccines in both rural and urban areas.	Long term ~~Medium term~~
Strengthening Immunization supply chain management	Establishing vaccine logistics Management information system for real time visibility of stock and temperature.	
	Boats or other transport facilities (bikes/bicycles) should be arranged in hard-to-reach areas to carry vaccines from the UHC to the vaccination centres.	Medium term
Establishing government primary health care facilities with adequate HR for EPI in urban areas	Establishment of government primary health care facilities in urban areas	Medium term
//	Recruitment of government vaccinators in urban areas	Long term

Strategies	Interventions		Timeline
	Provide or rent appropriate space for outreach centres in urban areas		Short term
	Recruitment of health volunteers in every zone/ward for door-to-door visits to reduce dropouts and reach every child for vaccination		Short term
	Organize evening/holiday EPI sessions for children with working parents/caregivers		Medium term
Improve communication systems in both rural and urban areas	E-registration and electronic reporting systems for immunization should be implemented and strengthened countrywide.	Medium term	
Strategies on demand-side determinants			
Strengthening SBCC in rural areas	Strengthening IPC by the HA to reduce dropouts and reach every child for vaccination at the ward level ~~districts~~, especially in the hard-to-reach areas		Medium term
	Home visits by the community health workers to reduce dropouts and to reach every child for vaccination		Short term
	1st line supervisor must ensure that HA/vaccinators conduct household level IPC the day before the outreach session through physical visit or online tracking system	Short term	
	Arrange miking and courtyard meetings, and involve social/religious leaders in raising awareness	Short term	
Demand side financing	Incentives should be provided to the parents of the fully vaccinated children		Medium term

Strategies	Interventions	Timeline
Strengthening SBCC in urban areas	Increase awareness by utilizing miking, newspapers, and informative cartoons/animations on TV for the children in city corporations	Short term
Strategies on quality		
Improve waste management system for EPI	Allocate adequate budget for proper waste management system	Short term
Structured supervision & Mentoring support to Cold Chain Technician, MT-EPI and Health Assistant.	Planned & regular visit to Cold chain points and session site for supportive supervision and mentoring	
Immunization Review	Review 6 monthly at national and monthly at district level with key indicators	

1. Background and context

Childhood immunization is considered a key strategy to improve the health, well-being and survival of children (WHO, 2018). Over the last few decades, remarkable progress has been made in immunization coverage and reduction in under-five morbidity and mortality in many low- and middle-income countries including Bangladesh (Sheikh *et al.*, 2018; Sarker *et al.*, 2019). Immunizations reduced child mortality and morbidity radically and were found to be very cost-effective health interventions (Lindstrand *et al.,* 2021; WHO 2016). Globally, the Expanded Programme on Immunization (EPI) is considered one of the most successful public health programmes, which has significantly contributed to the reduction of vaccine-preventable diseases (VPDs), including a decrease in maternal and child mortality and morbidity. Since the establishment of EPI in 1974, global vaccination coverage increased gradually and the inequity in vaccination coverage among different socioeconomic groups decreased. Access to a wider range of live savings vaccines in the poor countries of the world increased with the establishment of GAVI in 2000. At least 37 million deaths were averted between 2000 and 2019 by enhancing protection against an increasing number of vaccine-preventable diseases (Lindstrand *et al.,* 2021). Despite this remarkable progress, however, still, approximately 13 million children in low- and middle-income countries do not receive the first dose of diphtheria, pertussis and tetanus (DPT) containing vaccine each year. The number of 'zero doze' children increased to 17 million in 2020 during the COVID-19 pandemic (Wendt *et al.,* 2022). Furthermore, about 700000 under-five children died due to vaccine-preventable diseases in 2018 and most of them are from low- and middle-income countries (Frenkel 2021). Therefore, special measures should be taken to increase the immunization coverage to the 'zero dose' children in low- and middle-income countries and reduce the number of deaths of under-five children due to vaccine-preventable diseases. This is very crucial for achieving sustainable development goals (SDGs).

Over the last few decades, Bangladesh achieved commendable progress in increasing childhood immunization coverage and reducing the under-five mortality rate since the Expanded Programme on Immunization (EPI) started as a pilot project in 1979 (Sarker et al. 2019; Hossain et al. 2021). The overall objective of EPI was to vaccinate all children by 1990 for vaccine-preventable diseases (Hossain et al., 2021). The immunization coverage DPT/Penta3 was only 16% in 1988 and it increased to 69% in 1990 and 90% in 2011 (Sarkar et al. 2015). Reported immunization coverage rates remained over 90% for more than ten years and more than 80% of children under 12 months of age were fully immunized (Hassan et al. 2019). According to the most recent Coverage Evaluation Survey (CES 2019), the crude full vaccination coverage by age of 23 months was 95.4% and the valid full vaccination coverage by age of 12 months was 83.9%. Drop-out rates have reduced substantially during recent years. Drop-out from Penta 1 to Penta 3 declined from 11% in 2001 to 1.3% in 2019, and Penta 1 to MR1 from 19% to 4.6% in 2016. Despite the noteworthy success, the immunization coverage in several districts/city corporations, hard-to-reach areas and among some socioeconomic groups lies below the country's target of vaccination coverage of ≥ 95%. More emphasis should be given to overcoming the demand and supply side barriers and reinforcing

the interventions among the vulnerable population to reach zero-dose children and achieve the national targets. Rises in measles cases in some areas previously thought to eradicate this disease is raising concerns and urging for further strengthening of the immunization program for universal coverage. According to CES 2019, the crude full vaccination coverage by the age of 23 months was the highest in the Barisal division (98.5%) and the lowest in the Mymensingh division (93.1%). Rangpur division secured the second position with vaccination coverage of 95.5%. The valid full vaccination coverage was the highest in the Barisal division (91.1%) and the lowest in the Mymensingh division (80.5%). The survey also reported that only 8 out of 64 districts achieved over 90% of full vaccination coverage. There was one district achieving less than 75% MR1 coverage, and five districts with less than 75% full vaccination coverage. Moreover, the survey found that valid full vaccination coverage was 2.5 percentage points lower in hard-to-reach areas compared to non-hard-to-reach areas (81.6% versus 84.1%). Findings from the survey showed that the full vaccination coverage was slightly higher for those children whose families had mobile phones (84.2%) compared to those who did not (81.87%). Furthermore, this survey found a slight gender gap in terms of immunization coverage. Similarly, a minor difference in vaccination coverage was observed between rural and urban areas.

The childhood vaccination coverage was lower in urban areas than the national average. In the urban area, the crude full vaccination coverage by age of 23 months was 93.3% and the valid full vaccination coverage by age of 12 months was 79% (CES 2019). The crude full vaccination coverage by age of 23 months was highest in Mymensingh city corporation (96.1%) and lowest in Sylhet city corporation (87.6%). Valid full vaccination coverage by age of 12 months was highest in Rajshahi city corporation (92.4%) and lowest in Sylhet city corporation (63.8%). The main driver for low immunization coverage in urban areas is inadequate knowledge among target communities about the benefits of immunization. The reasons for partial vaccinations were mothers/caregivers were too busy, lack of information about vaccination of subsequent doses, and sickness of the child at the time of vaccination. This analysis illustrates the critical importance of targeted and focused communication for caregivers to improve vaccination coverage in urban areas (CES 2019).

The results of the bottleneck analysis using the Tanahashi model in 11 low-performing districts and 3 city corporations show that human resources are still a major impediment to accessible coverage and utilization of immunization. In addition, access barrier becomes a problem, especially during the rainy season. For effective coverage, there is irregular monitoring and poor quality of supportive supervision by first and second-line supervisors which is a supply-side barrier (Grundy, Rakhimdjanov and Adhikari, 2016). Vyas, Kim and Adam (2019) found that a child living in an area that is accessible only by a seasonal path or road or which is away from Upazila Health Complex (UHC) has a lower likelihood of being fully vaccinated.

The priority action for Bangladesh EPI is required now identification and detailing of revealing inequities and bottlenecks that need urgent focused interventions to reach out to the underserved groups, protect them against vaccine-preventable diseases (VPD) and prevent

potential outbreaks. The development of an equity strategy for immunization is important to guide the implementation of priority interventions over the next five years so that no child is missed to receive a full valid dose of vaccines and every child's rights are protected. The main objective of this assignment is to develop an equity strategy document with recommended strategic interventions which can address inequities and bottlenecks, in achieving the country's target of vaccination coverage of ~~more than~~ ≥ 95 %.

The specific tasks of this assignment are

- Review of documents (strategy, research/survey papers, situation reports) and summarize the existing revealing inequities and bottlenecks for immunization coverage
- Observe planning workshops using the District Evidence-Based Planning and Budgeting (DEPB) tool of selected districts and CCs to identify the underlying causes of inequity and suggested measures to improve equity in immunization
- Review the DEPB plans on EPI of the low-performing districts and CCs to analyze the hindrances to immunization and the suggested remedies
- Key informant interviews to learn barriers on both demand and supply sides and provide recommendations/strategies to overcome the barriers
- Conduct national Bottle Neck Analysis (BNA) workshops using the Tanahashi model to identify obstacles to immunization of low-coverage districts and CCs revealed through analysis of CES survey results
- Finalization of the equity strategy document with the recommendation of evidence-informed strategies

2. Methods of developing the strategy

The process of developing equity strategy on EPI included several methods: desk review, observation of district/city corporation-level planning workshops, key informant interviews, facilitating central-level BNA workshops, and review of the BNA and DEPB plans of the low-performing districts.

Desk Review

A desk review of the existing policies, strategies, surveys, evaluations, research and studies was conducted to better understand the prevailing inequity in childhood vaccination, the barriers to childhood vaccination, the root causes behind the dropouts and suggested measures to overcome the obstacles in both rural and urban areas. The equity analysis and identification of the determinants of childhood vaccination used the data from the Coverage Evaluation Survey (CES 2019), Bangladesh Demographic and Health Survey 2017-18 (BDHS 2017-18), Social and Behaviour Change Communication (SBCC) Strategy 2019, scientific journal publications and research reports.

Observation of district/city corporation-level planning workshops

Planning workshops were organized on EPI using the District Evidence-Based Planning and Budgeting (DEPB) tool in low-performing districts and city corporations in 2022 under the

leadership of EPI, DGHS. The study team attended and observed the planning workshops in 4 districts and 2 city corporations. The list of the selected districts and city corporations is presented in table 1. The planning workshops included rigorous bottle-neck analysis to identify the root causes of never or partial childhood vaccination using the Tanahashi model. The barriers to immunization were identified under five domains of the Tanahashi model: availability, accessibility, utilization, adequate coverage and effective coverage. The participants reported the difficulties in immunization in the locality and suggested corrective actions of the problems.

Table 1: Selected districts and city corporations for observing planning workshops and selected upazilas/zones for KII in each district/city corporation

District/ City Corporation	Type of upazila/zone	Upazila/Zone
Sunamganj	Low performing	Bishawmvapur
	High performing	Derai
Rangamati	Low performing	Rangamati Sadar
	High performing	Baghai Chhari
Netrokona	Low performing	Khaliajuri
	High performing	Mohanganj
Comilla	Low performing	Barura
	High performing	Laksham
DNCC	Low performing	Zone 2
	High performing	Zone 1
DSCC	Low performing	Zone 2
	High performing	Zone 5

Key Informant Interviews (KIIs)

Qualitative research was conducted to collect information on the barriers to the utilization of services provided by the EPI, the drivers of inequity in immunization and strategies to improve equity to supplement the data collected through the observation of the district/CC-level bottleneck analysis. Key Informant Interviews (KIIs) with the managers (UHFPO) and service providers (MT-EPI, HI) were carried out in the selected 4 districts and 2 city corporations in which the planning workshops were observed. This enabled us to triangulate the information collected through KII with the data collected through district/city corporation-level planning workshops using the DEPB tool. In each district, the KIIs were done in one high-performing upazila and one low-performing upazila. This helped to capture the variations in supply and demand side indicators, if any, in the high-performing and low-performing upazilas. The high-performing upazila and low-performing upazila were chosen based on the routine data. Similarly, one high-performing zone and low-performing zone were selected in each CC for pursuing the KIIs. The list of the selected upazilas and zones is presented in table 1.

Key informant interviews were also carried out at the central level to grasp the views of the managers and policymakers regarding the causes behind the inequity in childhood

immunization and the pathway to universal immunization coverage in Bangladesh. The respondents were from EPI, DGHS, UNICEF and WHO.

Facilitate central-level bottleneck analysis workshops

Two central-level workshops were organized under the leadership of PMR, DGHS covering six low-performing districts and three city corporations. Six districts having less than 84% coverage of valid full vaccination by age of 12 months according to the CES 2019 and not partaking in the planning workshops on EPI using the DEPB tool were selected for the bottleneck analysis workshops. One low-performing upazila and one high-performing upazila in each of the districts were selected for participating in the workshops. Therefore, a total of twelve upazilas of six districts were chosen for the two bottleneck analysis workshops. The list of the districts and upazilas is presented in table 2. Likewise, three low-performing city corporations and four zones were selected for the bottleneck analysis workshops. One low-performing zone and one high-performing zone were chosen from one city corporation. The other two city corporations only had one zone each which was taken for the bottleneck analysis workshops. Thus, a total of twelve upazilas and four zones were selected for the two workshops. The list of the city corporations and zones is shown in table 2.

Table 2: Selected districts and city corporations and selected upazilas/zones for central-level bottleneck analysis workshops

District/ City Corporation	Type of upazila/zone	Upazila/Zone
Faridpur	Low performing	Faridpur Sadar
	High performing	Nagarkanda
Lalmonirhat	Low performing	Kaliganj
	High performing	Patgram
Noakhali	Low performing	Hatiya
	High performing	Kabirhat
Rangpur	Low performing	Mitha pukur
	High performing	Pirganj
Sherpur	Low performing	Sreebardi
	High performing	Nalitabari
Shatkhira	Low performing	Kaliganj
	High performing	Tala
Narayanganj CC	Low performing	Zone 1
	High performing	Zone 2
Mymensingh CC		
Cumilla CC		

Review the BNA and DEPB plans of low-performing districts and CCs

The planning workshops were held in low performing sixteen districts and four CCs using the DEPB tool. As mentioned earlier the study team observed six out of the nineteen planning workshops. The study team also reviewed the bottleneck analysis and DEPB plans of the rest of the districts and CCs to gather information on the supply side and demand side barriers to

immunization in these low-performing districts and CCs. In addition, the corrective measures to overcome the hitches were also analyzed through an intensive review of the BNA spreadsheets.

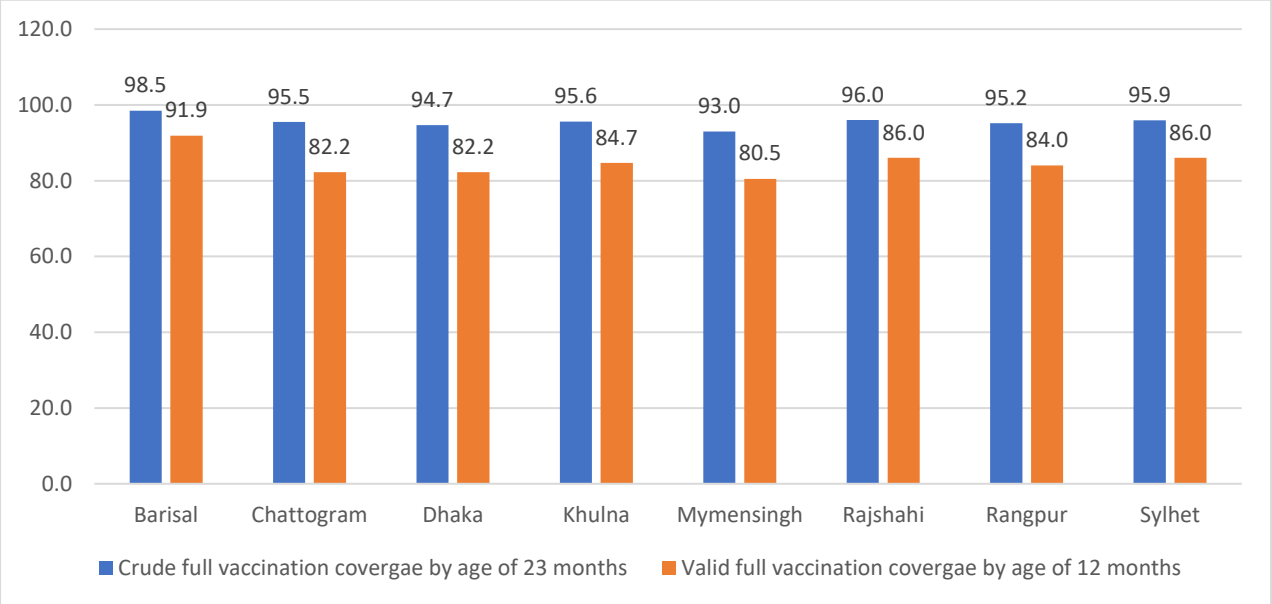
3. Inequity in immunization and its determinants: a review of literature

This section presents the findings of an intensive review of the literature on geographical inequity in childhood vaccination coverage, the dropout rates, the demand and supply side determinants of childhood vaccination, and the suggested measures for childhood immunization in Bangladesh.

Geographical inequity in childhood vaccination coverage in Bangladesh

Geographical inequity in childhood vaccination exists in rural areas of Bangladesh. According to the EPI coverage evaluation survey 2019, the crude full vaccination coverage by age of 23 months was highest in the Barisal division (98.5%) and lowest in the Mymensingh division (93 %). Similarly, valid full vaccination coverage by age of 12 months was highest in the Barisal division (91.9%) and lowest in the Mymensingh division (80.5%). Nationally, the crude full vaccination coverage by age of 23 months was 95.4% and the valid full vaccination coverage by age of 12 months was 83.9%. The valid full vaccination coverage was 85% in rural areas. The vaccination coverages were found to be moderate in Khulna, Rajshahi, Rangpur and Sylhet divisions and low in Dhaka and Chattogram divisions (Figure 1).

Figure 1: Crude full vaccination coverage by age of 23 months and valid full vaccination coverage by age of 12 months by divisions

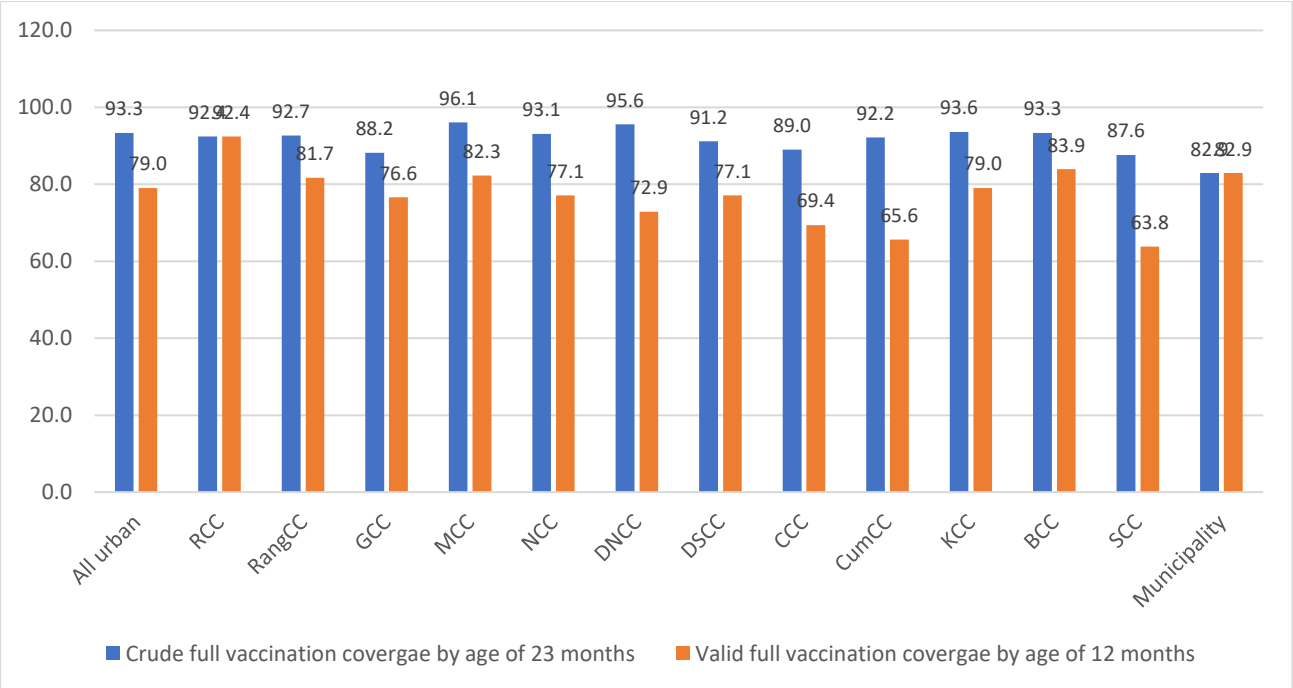


Source: CES 2019

Sarker et al. (2019) found that compared to the Sylhet division, the full immunization coverage was significantly higher among all other administrative divisions. Another study by Hossain et al. (2021) found a significantly lower coverage of full vaccination in the Sylhet region compared to the Barisal division. Sheikh et al. (2018) reported similar findings which stated that children from the Sylhet division were at greater risk of failing to receive the vaccine. This study also highlighted that the Sylhet division is generally a hilly and riverine area, and the communication system is more unstable compared to other divisions (Sheikh *et al.*, 2018). Srivastava et al. (2022) reported a positive contribution of rural residences in inequalities in vaccination coverage in 2007, however, the magnitude of contribution declined in 2017-18 in Bangladesh.

The childhood vaccination coverage was lower in urban areas than the national average. In the urban area, the crude full vaccination coverage by age of 23 months was 93.3% and the valid full vaccination coverage by age of 12 months was 79%. However, the results of a survey in Dhaka city show that the proportion of fully-immunized children in slums aged 12 months was only 54% (Uddin et al. 2010). This indicate a difference in immunization coverages in slum and non-slum areas. The data from the EPI coverage evaluation survey 2019 show that there is also geographical inequity in the coverage of childhood vaccination in urban areas. The crude full vaccination coverage by age of 23 months was highest in Mymensingh city corporation (96.1%) and lowest in Sylhet city corporation (87.6%). Valid full vaccination coverage by age of 12 months was highest in Rajshahi city corporation (92.4%) and lowest in Sylhet city corporation (63.8%). Dhaka North city corporation had more than 95% coverage of crude full vaccination. The crude full vaccination coverages were found to be moderate in Dhaka South, Khulna, Barisal, Cumilla, and Rangpur city corporations and

Figure 2: Crude full vaccination coverage and valid full vaccination coverage by age and by city corporations



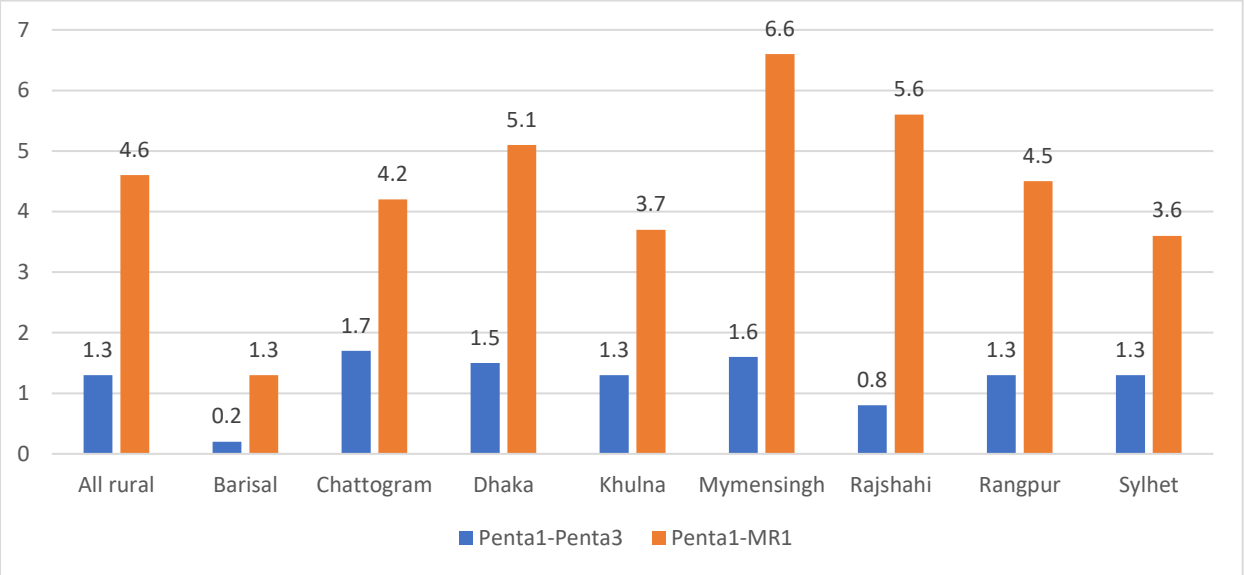
Source: CES 2019

low in Gazipur and Chattogram city corporations. The valid full vaccination coverages were found to be moderate in Dhaka South, Khulna, Barisal, Gazipur, and Rangpur city corporations and low in Dhaka North, Cumilla and Chattogram city corporations.

Dropouts in childhood immunization

Nationally, the BCG and Penta1 coverages were 99.7% in 2019. The drop from Penta1 coverage to Penta3 coverage (93.4%) was 6.3 percentage points. The drop from Penta3 coverage to MR1 coverage (88.3 %) was 5.1 percentage points. High dropout rates and administering invalid doses contributed to the low national valid vaccination coverage (83.9%). The data on dropout rates by rural divisions show that the Penta1-Penta3 dropout rate was highest in the Chattogram division (1.7%) and lowest in the Barisal division (0.2%). However, the Penta1-MR1 dropout rate was highest in the Mymensingh division (6.6%) and lowest in the Barisal division (1.3%). The Penta1-Penta3 dropout rate was 1.3% and the Penta1-MR1 dropout rate was 4.6% in rural areas (CES 2019).

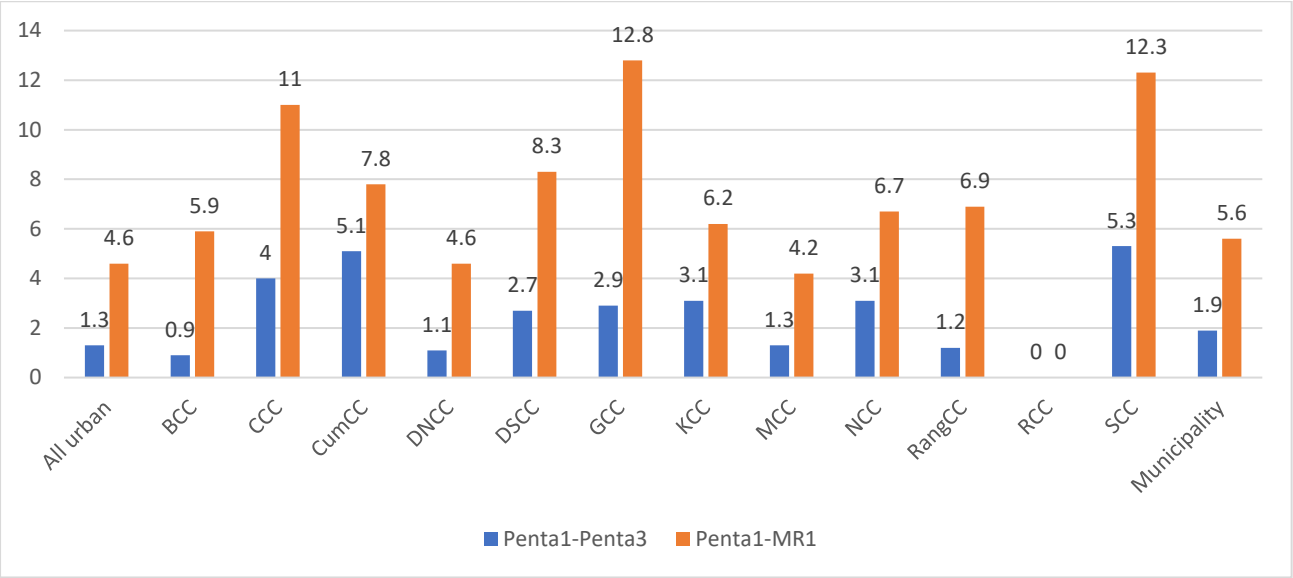
Figure 3: Vaccination dropout rates (%) from Penta1-Penta3 and Penta1-MR1 in rural areas by divisions in 2019



Source: CES 2019

Among the city corporations, the Penta1-Penta3 dropout rate was highest in Sylhet city corporation (5.3%) and lowest in Rajshahi city corporation (0.0%) in 2019. However, the Penta1-MR1 dropout rate was highest in Gazipur city corporation (12.8%) followed by Sylhet city corporation (12.3%). Rajshahi city corporation also observed no Penta1-MR1 dropout rate in 2019 (CES 2019). Rajshahi city corporation has been implementing the electronic immunization registration since 29 April 2019 with the support of National EPI and WHO Bangladesh. Over 300 health workers, paramedics, nurses and medical doctors were trained to use electronic registration in Rajshahi city corporation (WHO 2022).

Figure 4: Vaccination dropout rates (%) from Penta1-Penta3 and Penta1-MR1 in urban areas by city corporation and municipality in 2019



Source: CES 2019

Demand side determinants

A study by WHO (2018) found that both boys and girls have a similar likelihood of being vaccinated in most low- and middle-income countries. Similarly, some recent studies in Bangladesh did not find gender to be a significant factor in childhood immunization (Sheikh et al., 2018; Sarker et al., 2019; Srivastava et al., 2022). However, a study in a rural setting in Bangladesh compared the immunization coverage between boys and girls using data from the Chakaria Health and Demographic Surveillance System (HDSS). The study found that overall, the gender disparity was very low at 3% (Hanifi et al., 2018). The EPI coverage evaluation survey 2019 also found very little variation (0.2%) invalid vaccination coverage by age of 12 months by gender (CES 2019).

Mother's age was found to be a significant predictor of vaccination coverage in Bangladesh. A study found that the non-coverage of full vaccination was greater among mothers from lower age groups compared to children of mothers from higher age groups (Srivastava et al., 2022). Sheikh et al. (2018) found that children of mothers from lower age groups had a greater likelihood of incomplete vaccination compared to children of higher age group mothers in Bangladesh. Another study reported that children of mothers from higher age groups had a greater likelihood of being immunized compared to children of lower age group mothers in India, Pakistan, and Afghanistan (WHO, 2018). This might be because mothers in the younger age group usually have less knowledge about providing basic health care to their children (Srivastava et al., 2022).

Several studies in Bangladesh found mother's education level as a significant predictor of immunization coverage (CES 2019, Boulton et al., 2018; Hanifi et al., 2018; Sheikh et al., 2018; Sarker et al., 2019; Banerjee et al., 2021; Hossain et al., 2021; Srivastava et al., 2022).

Compared to children of mothers with higher education, children of mothers who had no formal education had a primary level of education, and had completed a secondary level of education were more likely to have failed to receive multi-dose vaccines. It might be attributed to educated mothers' having better knowledge about the immunization of children and its schedules than non-educated parents (Banerjee et al., 2021).

Mothers' autonomy in decision-making for health care had a significant influence on childhood vaccination in Bangladesh (Boulton et al., 2018; Sarker et al., 2019). Boulton et al. (2018) found that children of mothers who could take decisions for health care had greater odds of receiving full vaccination coverage compared to children whose mothers did not have that autonomy. Likewise, another study by Sarker et al. (2019) found that a child was more likely to be fully immunized if the mother was the decision-maker for the child's health care. The reasoning might be that mothers are more aware of their child's health than fathers (Sarker et al., 2019). A study with children from Bedey communities also identified a lack of mothers' decision-making power as a barrier to children's vaccination (Parvin, 2019).

The place of delivery of the child was found as an important predictor in some studies in Bangladesh. Srivatava et al. (2022) reported that if a child was delivered at a health facility, he/she had lower odds of not receiving full vaccination compared to children delivered at home. Similarly, Sheikh et al. (2019) found that children who were delivered at home had higher chances of not receiving the Pentavalent vaccine timely compared to children who had institutional deliveries. Another study in Afghanistan also found that children who were born at any health facility had greater relative risks of having full vaccination compared to children who were born at home (Aalemi, Shahpar and Mubarak, 2020). Mothers' number of ANC visits was found as having a positive influence on the likelihood of receiving vaccines in Bangladesh (Sheikh et al., 2018). Vyas, Kim and Adams (2019) conducted a study to understand the spatial and contextual factors influencing intraregional differences in vaccination coverage among children in Bangladesh. The study found that the differences in immunization coverage were influenced by individual-level factors such as the mother's age, education, and wealth status. Moreover, community-level factors were found as significant predictors of the differences in coverage (Vyas, Kim and Adams, 2019).

Wealth status was found to be a significant factor behind childhood vaccination in several other studies in Bangladesh and the South Asian region (Boulton *et al.*, 2018; Sarker *et al.*, 2019; Banerjee *et al.*, 2021; Srivastava *et al.*, 2022, CES 2019). Some studies concluded that children who were in the lowest wealth quintile were less likely to be vaccinated in Bangladesh (Boulton *et al.*, 2018; Sheikh *et al.*, 2018). Other studies in Bangladesh found a positive association between improved wealth status and childhood vaccination coverage (Sarker *et al.*, 2019; Hossain *et al.*, 2021). Another study found that the odds of immunization coverage were greater among children belonging to the richest households compared to the poorest in Afghanistan, India, and Pakistan (WHO, 2018). Several studies identified household size as an important predictor of childhood immunization. A study in Bangladesh found that children from medium-sized households had greater odds of having full immunization

coverage compared to larger households (Sarker et al., 2019). Another study by sheikh et al. (2018) identified that children from households of smaller sizes had a higher likelihood of not receiving the recommended BCG vaccine schedule as compared to larger households.

A study in urban slums of Dhaka found that children whose mothers work outside the home had a lower likelihood of receiving the BCG vaccine (Alam et al., 2021). According to the coverage evaluation survey 2019, the main reasons for never vaccinating children in urban areas were mothers/caregivers were not at home (22.1 %), lack of knowledge about childhood vaccination (19.1 %) and lack of trust in childhood vaccination (14.4). The reported main reasons for never vaccinating children in rural areas were fear of side effects (16.4 %), lack of trust in childhood vaccination (13.0 %) and lack of knowledge about childhood vaccination (12.7 %). The involvement of mothers in household chores was the most common reason for partial vaccination of the children. About one-fifth of the mothers/caregivers residing in rural areas and 17.2 % in urban areas reported that their involvement in household chores was the reason for partial vaccination of their children. About sixteen per cent of mothers/caregivers in rural areas and 13.2 % in urban areas reported that they were not aware of the schedule of MR1 doses. The other main causes of partial vaccination were sickness of children during EPI sessions, mothers/caregivers forgetting the EPI schedule and fear of side effects (CES 2019).

Knowledge of mothers/caregivers about the number of visits required for completion of the childhood vaccination varied in both rural and urban areas. Across the rural divisions, the percenage of mothers knowing about the five required visits was highest in the Sylhet division (68.4 %) and lowest in the Rangpur division (42.4 %). Among the city corporations, percentage of mothers knowing about the five required visits was highest Sylhet division (73.6 %) and lowest in the Barisal division (26.3 %) (CES 2019). According to the SBCC strategy 2019, the mothers reported that the vaccination card is an important source of information on the childhood vaccination schedule. However, more than half of the mothers did not read the information on the vaccination cards. Rather many of them found the mice announcements as a very useful reminder for the EPI session (Hassan *et al.* 2019).

The equity analysis using Equitable Impact Sensitive Tool (EQUIST) conducted in 2017 in Chattogram and Sylhet divisions show that the demand side barriers included high transport costs due to long distance in Sunamganj and other hard-to-reach areas, and difficulty in accepting vaccination due to social norm, language barriers, beliefs and attitude, low literacy, and weak social support for healthy practices among some indigenous population. Inadequate awareness of mothers/caregivers about the quantity and interval of the required visits to complete the immunization schedule is also a barrier to universal childhood vaccination. Alam et al. (2021) found that infants of mothers with higher educational attainment had a greater likelihood of receiving the first vaccine closer to the recommended age. Infants with normal birth weight, who received birth-dose BCG, and infants free from infections since birth had a significantly greater likelihood of receiving the vaccines at the recommended age of six weeks in urban slums in Dhaka (Alam *et al.*, 2021).

According to the SBCC strategy 2019, migration is one of the major causes of dropouts from immunization in slum areas. In many cases, pregnant women go to their parent's houses for delivery and children receive their first dose of the vaccine in rural locations. After returning to the urban locations the children are dropped out from vaccination. Mothers also feel discouraged to take their children for vaccination if they lose the vaccination cards (SBCC 2019).

Supply-side determinants

Distance to health facilities has a negative influence on childhood vaccination uptake in Bangladesh (Vyas, Kim and Adams, 2019). The study found that child living in an area which was accessible only by a seasonal path or road, or which was distant from an Upazila Health Complex, was less likely to be fully immunized. In addition, the study found that the presence of microfinance organizations in the community had a strong positive association with vaccination coverage. On the supply side, restricting responsibility that is only to vaccinate those who come for a visit and the absence of active follow-up were found as important barriers to immunization in slum areas of Mumbai, India (Singh et al. 2019). A study in Bangladesh with children from Bedey communities also found to be similar barriers (Parvin, 2019)[1].

Lack of human resources was identified as another bottleneck for childhood vaccination in Bangladesh (Grundy, Rakhimdjanov and Adhikari, 2016). In addition, the study identified that weak supervision and high turnover in human resources create challenges for vaccination coverage. According to the SBCC strategy 2019, many mothers and caregivers were afraid that vaccinators might get angry as they missed the EPI session and required additional visits for completing the required doses. The attitude of vaccinators was also found to be a barrier to childhood vaccination in CES 2019. The vaccinators suggest mothers visit on the next schedule if there are not enough children for one vial (SBCC 2019).

A study in India found that staff were arriving late, lack of on-the-job training of staff and supportive supervision were major barriers (Singh et al. 2019). Another literature review-based study in Pakistan also identified that there are under-skilled personnel and the ratio of EPI vaccinators to the public is too low (Butt *et al.*, 2020). Shaik et al. (2018) a
lso identified deficient manpower and a lack of training initiatives for EPI management as supply-side barriers in Bangladesh. Poor infrastructure for the storage of vaccines and other logistics was found as an important bottleneck on the supply side in India (Singh et al. 2019).

The equity analysis using Equitable Impact Sensitive Tool (EQUIST) conducted in 2017 in Chattogram and Sylhet divisions show that the supply-side barriers in childhood vaccination were shortages of vaccine card and vaccine syringes, insufficient outreach posts and lack of human resources in some outreach posts, lack of service provider's skill in appropriate

[1] The study found that only 52% of the Bedey children received one dose of BCG compared to 96% non-Bedey children. This indicates that a large number of Bedey children never accessed any vaccine. The proportion of unreached children in rural Bedey was 62% while the corresponding figure in urban Bedey was 42%. However, this rate was only 3 % among both rural and urban children in the comparison group (Parvin, 2019).

vaccination techniques, and inadequate management of cold chain. Weak supervision and monitoring were found as supply-side barriers in Pakistan (Shaikh *et al.*, 2018). A field trial in Bangladesh also identified that a lack of clarity in roles and responsibilities at different tiers of the government resulted in poor governance and weak stewardship at decision-making levels (Grundy, Rakhimdjanov and Adhikari, 2016).

Some mothers in urban areas reported that service providers are collecting user fees for vaccination and they had to pay for it. NGOs providing services in urban settings are charging user fees for other services and might have charged for vaccination as well. The lack of dedicated government health staff in city corporations might be the reason behind this anomaly (SBCC 2019).

Suggested measures for increasing coverage of childhood vaccination program

The Social and Behaviour Change Communication (SBCC) Strategy (2019) suggested some measures to improve the coverage of childhood immunization in Bangladesh. According to the strategy the health care providers need to be trained and properly supervised for appropriate vaccination techniques. Support should be given to planning, implementation and monitoring of innovative outreach strategies to cover the children who are excluded or beyond the reach of immunization services, such as hill tracts, urban slums, high-rise apartments in urban settings, tea estates etc. it is suggested to involve local leaders and community health workers in the provision of vaccination services both in rural and urban areas. Demand-side financing could be initiated to offer incentives to offset individual costs for complying with immunization schedules, such as facilitating transportation, off-work leaves etc. Another measure could be to increase and sustain public education and mass media campaigns about immunization schedules and the safety of childhood vaccination.

4. Barriers and strategies: observation of district/CC-level BNA workshops

Planning workshops were organized on EPI using the District Evidence-Based Planning and Budgeting (DEPB) tool in low-performing districts and city corporations in 2022 under the leadership of EPI, DGHS. The study team observed bottleneck analysis using the DEPB tool and the preparation of the plan for EPI in four districts and two city corporations. The districts are Sunamganj, Rangamati, Netrokona and Cumilla and the city corporations were Dhaka South City Corporation and Dhaka North City Corporation. This section presents the key barriers to immunization identified during the workshops and the suggested measures to overcome the barriers. The study team also reviewed the results of the BNA analysis and DEPB plan of the remaining districts and CCs. The findings of the review are presented in the annex.

Sunamganj district

Bottlenecks are identified in the domain of ‘availability’ and ‘accessibility’ of the Tanahashi model in all upazilas of Sunamganj. The key reported barriers to reaching the targets of EPI are

Inadequate human resources, especially vaccinators and vaccine porters for EPI service delivery and vacant posts of health workers /vaccinator

- Inadequate refresher training for the health workers/ vaccinators and supervisors
- Insufficient budget for transportation of vaccines in HTR areas and inadequate daily wage for the vaccine porters
- Staggered supply of vaccines in all upazilas in Sunamganj
- Shortages of vaccine carriers, BCG syringes, EPI cards, tally books and registration books in Derai and Tahirpur upazilas
- A bottleneck in the domain of 'accessibility' due to hard-to-reach areas surrounded by haors
- Insufficient physical infrastructures at the union and ward level
- Lack of transports to carry vaccines to the outreach centres
- Inadequate budget for repair of bicycle/motorbike
- Insufficient training and IT knowledge of the service providers
- Inappropriate waste disposal system
- Inadequate IPC due to lack of health workers/vaccinators
- Absence of an online tracking system
- Lack of community awareness regarding the immunization
- Low literacy rate and
- The parents are busy during harvesting seasons in haor areas

Suggested measures to overcome the barriers in Sunamganj district are

- Fill up the vacant posts of health workers/vaccinators
- Additional budget for the transportation of vaccines in HTR areas and increase the wage for vaccine porters to BDT 700-1000 per day
- Regular supply of syringes, EPI card, tally book and registration book in all upazilas
- Monthly coordination meetings of all stakeholders with effective feedback and routine and surveillance data analysis
- Courtyard meetings in each ward at regular intervals
- Allocate budget for miking once a month in each ward
- Training for and involvement of the social/religious leaders in awareness raising in Santiganj and Chattak upazilas
- Ensure brick walled pit or incinerator in a safe place for waste disposal and follow SOP

Rangamati district

Bottlenecks are identified in the domain of ‘availability’ and ‘accessibility’ of the Tanahashi model in all upazilas of Rangamati. The key reported barriers to reaching the targets of EPI are

- Inadequate human resources, especially health workers/ vaccinators and porters for EPI service delivery and vacant posts of health workers/ vaccinators. Service providers do not have updated knowledge on immunization including cold chain
- A bottleneck in the domain of 'accessibility' due to hard-to-reach areas
- Long travel time to carry vaccines to the outreach centres and inadequate budget to transport vaccines for EPI sessions in hard-to-reach areas
- Difficult to maintain cold chain in hard-to-reach areas
- Lack of mobile network and IPC in hard-to-reach areas
- The ethnic communities like ‘Murong' are facing a language barrier in Belaichhari upazila
- Lack of community awareness regarding the immunization
- The low literacy rate among the ethnic communities especially 'Murong', ~~especially~~ in the Barhatali union in Belaichari
- Difficult to conduct mobilization activities including enlisting and tracking by the health workers at HTR areas due to remoteness and difficult geographical terrain
- Inadequate monthly monitoring and supervision by 1st line supervisors in each centre

The suggested measures in the Rangamati district are

- Reduce vacancy of health workers/ vaccinators by recruitment.
- Refresher training for the health workers /vaccinators, especially in Baghaichari and Belaichari upazilas and recruitment of local health workers in Belaichari upazila
- Additional porters in the Kawkhali upazila and volunteers in Naniarchar upazila
- Sufficient budget for transportation of vaccines for EPI sessions in hard-to-reach areas
- Need based crash programs for EPI in Barkal, Jurachari and Kawkhali upazilas
- Provide solar freezers in hard-to-reach areas
- Arrange umbrellas and raincoats to the health workers/ vaccinators
- Improve the waste disposal system
- Awareness raising programs among ethnic communities and ensure awareness creation materials like billboards, lift lets/brouchers etc.
- Organize advocacy meetings with the social leaders, union parishad, headman, karbari, and members.
- Engage volunteers to conduct mobilization activities including enlisting and tracking of vaccine eligible children, and miking at HTR areas in Langadu upazila

Netrokona district

Bottlenecks are identified in the domain of ‘availability’ and ‘accessibility’ of the Tanahashi model in all upazilas of Netrokona. The key reported barriers to reaching the targets of EPI are

- Shortage of pentavalent vaccine for a 1-2 months in all upazilas

- Inadequate health workers /vaccinators and porters in all upazilas and vacant posts of HA, AHI, HI, FWV and FWA
- Lack of transports to carry the vaccines during the rainy season and inadequate daily allowances for the porters
- A bottleneck in the domain of 'accessibility' due to hard-to-reach areas
- During the rainy season, it is very difficult to reach the vaccination centre by half an hour's walk
- Inadequate IPC before the day of EPI sessions by the health workers, especially in hard-to-reach areas
- Inadequate monitoring and supervision in Khaliajhuri Upazila by the 1st line supervisors
- Inadequate waste management system in all upazilas
- Lack of awareness about immunization
- Floods during rainy seasons

The suggested measures in the Netrokona district to achieve the EPI targets are

- Reduce vacancy of HA, AHI, HI, FWV and FWA
- Provide refresher training to the health workers/vaccinators in Kalmakanda, Mohanganj and Khaliajuri upazilas
- Arrange additional porters and increase the daily allowances of the porters
- Enhance IPC before the day of EPI sessions by the health workers
- Additional budget/boat fare for vaccinators from May to October
- Additional funds for transport costs for monitoring and supervision
- Ensure brick walled pit or incinerator in a safe place for waste disposal and follow SOP.
- Arrangement of miking to raise awareness and motivate parents/guardians to vaccinate their children
- Courtyard meetings in hard-to-reach areas

Comilla district

Bottlenecks are identified in the domain of ‘availability’ and ‘accessibility’ of the Tanahashi model in all upazilas of the Comilla district. The key reported barriers to reaching the targets of EPI are

- Shortage of human resources in all upazilas and knowledge gap among the vaccinators
- Shortage of pentavalent vaccine and other logistics in Homna, Barura, Chauddagram, Daudkandi, Muradnagar and Comilla Sadar South upazilas
- Inadequate budget for transportation of vaccines especially in HTR areas, like Meghna and Monohorganj upazilas
- Shortage of outreach centres in Homna and Debidwar upazilas
- Insufficient budget for monitoring and supervision and irregular monitoring, poor supervision and follow-up in Titas and Daudkandi Upazilas

- Poor coordination among the service providers in HTR areas
- Lack of waste disposal facilities in Barura, Burichang, Chauddagram, and Nangolkot upazilas
- Lack of awareness and incorrect perception about vaccination among the parents/guardians of the children
- Lack of social mobilization in Burichang and Comilla Sadar South upazilas

The suggested measures in the Comilla district to achieve the EPI targets are

- Reduce vacancy of Health Inspector, Assistant Health Inspector and Health Assistant
- Recruit additional vaccine porters
- Refresher training for the health personnel
- Adequate and timely supply of vaccines and other logistics in Barura, Homna, and Cumilla Sadar South upazilas
- Adequate budget for transportation of vaccines
- Establishing more outreach centres in Homna and Debidwar upazilas
- Arrange speed boats or troller boats for the transportation of vaccines in Meghna and Monohorganj upazilas
- Adequate budget for proper monitoring, supervision and follow-up in Daudkandi upazila
- Involve the local dignitaries, elected representatives, and political leaders in vaccine administering in Comilla Sadar South upazila
- Advocacy meetings with the local stakeholders
- Ensure brick walled pit or incinerator in a safe place for waste disposal and follow SOP in Barura, Burichang, Chauddagram, and Nangolkot upazilas

One participant in the workshop in Comilla stated, *"Electronic tracking system is required for improving monitoring and supervision of the activities of EPI to reduce the dropouts and invalid doses"*

Dhaka North City Corporation

Bottlenecks are identified in the domain of 'availability' and 'accessibility' and 'effective coverage' of the Tanahashi model in all zones of Dhaka North City Corporation. The key reported barriers to reaching the targets of EPI are

- Inadequate vaccinators and some wards do not have any NGO health facilities
- Lack of women and children-friendly vaccination outreach centres for childhood vaccination in all zones
- Lack of skilled human resources and inadequate knowledge of the vaccinators
- Inadequate effective coordination meetings among local leaders, NGOs and city corporation authority
- Inadequate supply of vaccine carrier, cold box, vaccination card, moni flag, moni cloths and other logistics

- No vehicles are available for the transportation of vaccines from zone to wards and wards to EPI centres
- Lack of resources for mobile team/evening team and evening/holiday sessions
- Lack of awareness regarding the number of visits for childhood vaccination
- Inadequate monitoring and supervision in case of dropout/left out and lack of electronic device and Wi-Fi router for E-tracking
- No allocation for cell phone bills for follow-ups and dropout identification
- Lack of effective waste management system
- Inadequate IEC and BCC materials for awareness raising for vaccination
- The EPI sessions are held during the working hours of parents
- Some parents are declining the vaccination of children based on religious beliefs in zone 2, zone 4 and zone 6

The suggested measures in Dhaka North City Corporation to achieve the EPI targets are

- Ensure sufficient human resources (volunteers and vaccinators) for immunization in all zones
- Arrange government vaccinators at the ward level where there is a shortage of NGO health facilities and refresher training for the supervisors, vaccinators and volunteers
- Ensure proper vaccination/outreach centres with proper sitting arrangements and hygiene at the ward level
- Arrange quarterly coordination meetings among local leaders, NGOs and city corporation authority
- Provide vaccine carrier, cold box, vaccination card and other logistics in zone 1, zone 5, zone 6 and zone 8.
- Arrange vehicles for transportation of vaccines from zone to ward and ward to EPI centres
- Allocate additional budget and provide resources for mobile team/evening team and holiday/Friday sessions for childhood vaccination in all zones
- Strengthening the monitoring and supervision by increasing travel allowances for the supervisors
- Strengthened an E-tracking system for reducing dropouts and invalid doses
- Ensure proper waste management system at the ward level by supplying safety boxes and waste bins
- Arrange awareness-raising activities like miking, television shows, advertisements in newspapers, billboards and door-to-door visits by the volunteers

Dhaka South City Corporation

Bottlenecks are identified in the domain of ‘availability’ and ‘accessibility’ and ‘effective coverage’ of the Tanahashi model in all zones of Dhaka South City Corporation. The key reported barriers to reaching the targets of EPI are

- Inadequate number of vaccinators and volunteers in all zones, especially in zones 6-10
- Insufficient vaccination centres and some wards do not have any NGO health facilities
- Low daily allowance for master roll vaccinators and volunteers
- Inadequate orientation and refresher training for supervisors, vaccinators and other field workers
- Inadequate and inappropriate space for outreach centres for vaccination in all zones
- Inadequate coordination between city corporations and NGO partners
- Lack of transports for carrying vaccine from EPI headquarter to zones and inadequate budget for transportation of vaccines from zone to wards and wards to EPI centres in remote areas
- Inadequate supply of vaccination card and other logistics
- The EPI sessions are held during the working hours of parents
- Inadequate budget for monitoring and supervision
- Lack of effective waste management system
- Lack of IEC and BCC materials for awareness raising for immunization in zone 3

One participant in the workshop at DSCC stated, "*Some wards in DSCC do not have any NGO health facilities. Therefore, conducting the activities of EPI in those wards is of great challenge.*"

The suggested measures in Dhaka South City Corporation to achieve the EPI targets are

- Arrange sufficient human resources (volunteers and vaccinators) for childhood vaccination and refresher training for AHO, EPI supervisors, and vaccinators in all zones
- Ensure proper satellite spots or rent rooms for childhood vaccination at the ward level in all zones
- Ensure adequate vaccination card and other logistics
- Vehicles for the transportation of vaccines from the central level to zones and zones to wards
- Regularl coordination meetings between city corporations and NGO partners
- Motorcycle for the supervisors in zone 3
- Additional funds for monitoring and supervision by AHOs and EPI supervisors
- Ensure tab, laptop, desktop computers and modem for E-tracking
- Allocate budget for mobile phone bills for monitoring and supervision
- Arrange evening EPI sessions for the children of working parents
- Arrangement of miking and distribution of BCC materials
- Increase IPC and arrange courtyard meetings with the mothers

5. Barriers and strategies: findings from the central-level BNA workshops

Two central-level BNA workshops were organized to cover six low-performing districts and three low-performing city corporations. The districts and city corporations were chosen using the data of CES 2019 and routine immunization data. The selected districts were Lalmonirhat, Noakhali, Faridpur, Rangpur, Sherpur and Shatkhira. The selected zones were Cumilla, Mymensingh and Narayanganj. One high-performing upazila and one low-performing upazila were selected from each district for the bottleneck analysis of EPI using the Tanahashi model. This section presents the key barriers to immunization identified during the workshops in the selected upazilas and city corporations. It also put forwards the suggested measures to overcome the barriers.

Patgram upazila, Lalmonirhat district

The key reported barriers to reaching the targets of EPI in the upazila are

- Shortage of AHI, HI, FWV, FWA and vaccine porter
- The target children are estimated using the population growth rate of population census 2011
- Inadequate budget to reach the zero-dose children
- The field-level staffs of family planning (FWA) are not willing to participate in the activities of EPI
- Inadequate IPC for raising awareness in the community and reducing the drop-outs

Suggested measures to overcome the barriers in Patgram upazila are

- Reduce vacancy of vaccinators and arrange additional budget for EPI for incentives to the service provider
- Ensure involvement of FWAs in EPI activities and arrange refresher training to the field-level staff
- Improve the quality of the data for estimating the targets of the EPI in the upazila
- Increase IPC for raising awareness in the community and reduce the drop-outs

Kaliganj Upazila, Lalmonirhat district

The key reported barriers to reaching the targets of EPI are

- Shortages of HI, AHI, FWV and FWA, and inadequate refresher training for the vaccinators
- The current organogram of HR is very old. The population has increased substantially without any increase in the sanctioned posts of HR for EPI. Moreover, the available sanctioned posts are lying vacant.
- Lack of involvement of FWA in the immunization program
- Inadequate budget for transportation of vaccines to 6 outreach centres in the upazila

- A shortage of 2 porters makes the transfer of vaccines and logistics to the distribution centres difficult
- Staggered supply of vaccines and logistics
- Inadequate IPC due to shortage of HR
- Vaccine-eligible people are facing high transportation costs to reach the vaccination centre
- The performance of the Kakina union is low due to the existence of char areas

Suggested measures to overcome the barriers in Kaliganj upazila are

- Design a new organogram and create additional posts for HA
- Reduce vacancy of HAs and FWAs and arrange regular refresher training to the vaccinators
- Ensure participation of FWA in the immunization program
- Additional porters for carrying vaccines to the distribution points and boats for the transportation of vaccines
- Ensure the supply of adequate vaccines, vaccine cards, and tally shits
- Ensure adequate IPC before the day of EPI sessions

Hatia upazila, Noakhali district

The key reported barriers to reaching the targets of EPI are

- Vacant posts of HA , AHI, HI and Volunteer
- There are only 3 porters to cover 11 unions
- Shortages of pentavalent vaccines for one month in the upazila
- It requires more than six hours to transport vaccines from the district to upazila
- Geographical inaccessibility and high transportation cost is the main problem in the upazila and inadequate budget for transportation of vaccines and logistics
- It is required to rent boats or trawlers to transport vaccines from one island to another.
- Lack of coordination between HA and FWA and involvement of FWA in the immunization program
- Inadequate supply of vaccine cards and forms
- High transport cost is a barrier in the HTR areas in this upazila, especially in Ghassar char
- There are no permanent residents on some islands because of river erosion
- It becomes difficult for the parents/guardians to bring the children to the vaccination centres during the rainy season
- Currently, one HA is available to cover the population of a ward. However, the population varies from ward to ward.

- Inadequate IPC due to shortages of HR
- Absence of central waste disposal system

Suggested measures to overcome the barriers in Hatia upazila are

- Reduce vacancy of HA, AHI, HI and volunteers
- Ensure timely and adequate supply of vaccines and logistics, and budget for the transportation of vaccines
- Ensure participation FWAs in the EPI activities
- Adequate budget for porters and volunteers
- Increased monitoring and supervision of EPI activities
- Enhanced IPC to raise awareness among the community
- Increase awareness to preserve the vaccination card to reduce the drop-outs due to river erosion
- Ensure adequate budget for waste management

One participant from Hatia upazila said, *"The Ghassar char is detached from the mainland and people regularly migrate from this area due to river erosion. No EPI sessions are held in this area. The parents take their children to other areas for vaccination. Therefore, the immunization coverage is low in this area and will increase if routine EPI sessions are conducted in Ghassar char."*

Kabirhat upazila, Noakhali district

The key reported barriers to reaching the targets of EPI in this upazila are

- Vacant posts of HA, AHI, FWA, FWV and FPI
- Inadequate budget to transport the vaccines to the hard-to-reach areas
- Shortages of vaccine logistics like vaccine cards, syringes, and tally sheets
- Lack of coordination between health and family planning staff
- Poverty is a barrier to immunization in in Dhan Shalik and Dhan Siri unions. People in these areas migrate regularly.
- Lack of knowledge of parents/guardians regarding the total visits required to complete the childhood vaccination and the needed gap between two doses of vaccines
- Superstition and religious stigma against immunization in Dhan Shalik and Dhan Siri unions
- Low literacy rate in Dhan Shalik and Dhan Siri unions
- Improper IPC due to a shortage of human resources
- Inadequate provisions for proper waste management

The suggested measures to overcome the barriers in Kabirhat upazila are

- Reduce vacancy of vaccinators and supervisors and allocate budget for recruiting volunteers
- Ensure the availability of vaccine logistics like vaccine cards, syringes, and tally books
- Counselling and raising awareness to reduce superstition and beliefs
- Increase coordination between the health and family planning department
- Organize refresher training for the vaccinators and supervisors
- Establish a sub-depot in Danshiri to transport vaccines easily
- Arrange additional sub-blocks in Dhan Shiri and Dhan Shalik
- Ensure adequate and effective IPC the day before the EPI sessions
- Ensure proper supervision and monitoring by the 1st and 2nd line supervisors
- Engage the community, e.g. religious leaders, teachers, and local leaders, in raising awareness for immunization
- Arrange proper incineration of waste of EPI

One participant said, *"The Dhanshiri and Dhanshalik unions in Kabirhat upazila are facing challenges in immunization due to low literacy rates and religious stigma."*

Faridpur Sadar upazila, Fairdpur district

The key reported barriers to reaching the targets of EPI in this upazila are

- Vacant posts of HA and AHI , lack of skilled personnel and nadequate porters and volunteers
- Shortages of pentavalent vaccine for two months in the upazila
- Inadequate supply of vaccine card (child card/ TT card)
- Shortage of daily/monthly vaccine report card/book
- Transportation of vaccines is difficult in some areas due to char areas
- There are some villages where it is not possible to access outreach centres within half an hour's walk
- Lack of proper waste management

One participant from the Faridpur district stated, *"It is not possible to conduct IPC regularly due to the shortage of human resources."*

Suggested measures to overcome the barriers in Faridpur Sadar upazila are

- Reduce vacancy of vaccinators and arrange efresher training for the vaccinators
- Ensure an adequate supply of vaccines
- Ensure sufficient budget for transportation of vaccines in hard-to-reach areas
- Ensure availability of logistics (child card/TT card/daily vaccine report book/ monthly vaccine report book)
- Ensure brick walled pit or incinerator in a safe place for waste disposal and follow SOP

Nagarkanda upazila, Fairdpur district

The key reported barriers to reaching the targets of EPI are

- Vacant posts HA and AHI and shortage of porters
- Shortage of logistics like vaccine cards
- The targets of the micro plan are estimated using the old census data
- Lack of support from local government institutions
- Shortage of IEC and BCC materials
- Lack of preservation of the vaccine card by the parents/guardians
- Poor/ HR groups are unable to access vaccination due to financial constraints
- Lack of social mobilization
- Lack of budget for an appropriate waste management system

One participant of Nagarkanda upazila stated, "The mothers could not recall whether their children were vaccinated or not due to not preserving the vaccination card."

Suggested measures to overcome the barriers in Nagarkanda upazila are

- Reduce vacancy of HA and AHI
- Involved local government in accelerating immunization in low-performing areas
- Ensure adequate IPC before the day of vaccination session
- Ensure enlisting and tracking of vaccine eligible children and enhance social mobilization activities

Ensure brick walled pit or incinerator in a safe place for waste disposal and follow SOP

Pirganj upazila, Rangpur district

The key reported barriers to reaching the targets of EPI are

- Vacant posts of HA , FWV, HI, AHI, FPI and FWA
- Lack of skilled health personnel for vaccination
- Shortages of syringes, tally sheets and other logistics
- Inadequate awareness-raising activities in the community
- Lack of acceptability of the vaccines among the ethnic population (Shaontal community)
- Lack of knowledge about the benefits of vaccination among the ethnic population (Shaontal community)
- Inadequate IPC with the parents and guardians
- The incinerator of the upazila is out of order and waste of EPI is disposed of through pit burning

The participant added, *"It is necessary to raise awareness through miking, festoon and banner. Involvement of local government in raising awareness, regular courtyard meetings, dramas, and door-to-door inter-personal communication will reduce drop-outs and invalid doses of immunization."*

Suggested measures to overcome the barriers in Pirganj upazila are

- Reduce vacancy of HA, HI, AHI, FWV, FWA and FPI
- Ensure adequate and timely supply of essential commodities (syringes and tally sheets)
- Ensure availability of volunteers from the ethnic community 'Shaontal"
- Arrange regular refresher training to improve the skills of the vaccinators and supervisors
- Ensure sufficient supply of syringes, tally sheet and other logistics
- Ensure adequate and effective monitoring and supervision
- Strengthened IPC with the parents/guardians
- Ensure adequate awareness-raising activities
- Arrange financial incentives for the parents/guardian to cover the travel costs to vaccinate their children
- Ensure adequate budget for proper waste disposal system and incinerator

Mithapukur upazila, Rangpur district

The key reported barriers to reaching the targets of EPI are

- Vacant posts of HA, HI, AHI, FWV, FPI and FWA
- Inadequate budget for fuel and overtime for MT (EPI) for transportation
- Lack of motorcycles for HI for supervision and monitoring
- Lack of funds for the tri-monthly review meetings
- Inadequate fund for stationary
- Shortage of pentavalent vaccines for one month this year
- BCG and IPV syringes are frequently out of stock throughout the year
- Acute shortage of EPI vaccine cards
- Large land areas and inadequate porters make the supply of vaccines to the distribution points difficult
- Inadequate IPC the day before the EPI session with the parents/guardians to reduce drop-outs and invalid doses
- Quality of service delivery may reduce when the vaccinators and supervisors are overburdened with work
- Inadequate provision of mass communication
- Lack of proper waste disposal system with appropriate human resources

Suggested measures to overcome the barriers in Mithapukur upazila are

- Reduce vacancy of HA, HI AHI, FWV, FWA and FPI, and increase vaccine porters
- The budget for fuel for MT-EPI should be increased
- Arrange motorcycle for HI and MODC with sufficient funds for fuel and maintenance
- Allocate budget for tri-monthly review meetings

- Increase the overtime allowance for MT-EPI and budget for stationaries
- Ensure timely and adequate supply of vaccines and logistics
- Ensure sufficient and effective IPC with the parents/guardians
- Mass communication according to the local context
- Crash program for low coverage union/ward according to need
- Additional fund for waste disposal

Tala upazila, Satkhira district

The key reported barriers to reaching the targets of EPI are

- Vacant posts of HA, HI, FWV, FWA and FPI
- Low allowances for the field-level staff
- Lack of weekly meetings of the vaccinators and supervisors
- Inadequate supply of vaccines and logistics
- The Bedey community is not willing to vaccinate the children
- Inadequate IPC with parents/guardians to reduce drop-outs and invalid doses

Suggested measures to overcome the barriers in Tala upazila are

- Reduce vacancy of HA, HI, FWV, FWA and FPI and increase overtime allowances to MT-EPI, HAs and HIs
- Organize weekly meetings with MODC
- Ensure the adequate and timely supplies of vaccines and logistics
- Proper counselling of the Bedey community regarding the benefits of vaccination
- Ensure sufficient IPC with the parents and guardians
- Adequate and effective 1st line and 2nd line supervision and monitoring

Kaliganj upazila, Satkhira district

The key reported barriers to reaching the targets of EPI are

- Vacant posts of HA, HI, AHI, FWV, FWA and FPI and inadequate overtime allowances for vaccinators and volunteers
- Lack of skilled health personnel and regular refresher training for them
- Insufficient outreach centres for immunization
- Lack of weekly meetings with vaccinators and supervisors
- Inadequate involvement of MODC in supervision and monitoring (cross-checking and reviewing the activities of EPI)
- Shortage of pentavalent vaccines and IPV for a few months in the upazila
- Inadequate supply of syringes, vaccine cards, temperature charts, and EPI bag
- Absence of online tracking for immunization
- Inadequate IPC with parents/guardians for ensuring continuity of vaccination

Suggested measures to overcome the barriers in Kaliganj upazila are

- Reduce vacancy of HA, HI, AHI, FWV, FWA and FPI and increase overtime allowances
- Allocate budget for transport allowances for each outreach centre
- Weekly meetings with vaccinators and supervisors
- Ensure supervision by the MODC (randomly reviewing some vaccination centres and cross-checking to ensure proper IPC)
- Ensure adequate supply of pentavalent and IPV
- Ensure adequate and timely supply of syringes, vaccination cards, temperature charts, and EPI bags
- Arrange incentives or gifts for the vaccinators based on their performances
- Miking in the community for social mobilization
- Ensure proper IPC with the parents and guardians before each EPI session

Nalitabari upazila, Sherpur district

The key reported barriers to reaching the targets of EPI are

- Shortage of HA, HI, FWV, FWA, and FPI
- Lack of adequate budget for transportation of vaccines and supervision and monitoring
- Inappropriate location of the outreach centres
- Shortage of availability of essential commodities/inputs for immunization programme especially, vaccine card
- The estimated target of EPI varies between different sources (HA and CHCP)

Suggested measures to overcome the barriers in Nalitabari upazila are

- Reducedvacancy of HA, HI, FWV, FWA and FPI
- Ensure adequate budget for transportation of vaccines, and supervision and monitoring
- Relocation of the outreach centres through consultation with the local community leaders to ensure access to EPI sessions within half an hour's walk
- Ensure timely and adequate supply of EPI logistics
- Strengthening supervision and monitoring of EPI activities
- Increased coordination between HA and CHCP in estimating the targets of EPI

One participant from the district said, *"The current reporting system of Sherpur district is underestimating the targets of EPI. There is a significant difference between the reports of HA and CHCP. So, it is necessary to conduct proper IPC to reduce the gap between the data from different sources."*

Sribordi upazila, Sherpur district

The key reported barriers to reaching the targets of EPI are

- Vacant posts of HA, HI (, FWV and FWA Insufficient and delayed budget for transportation of vaccines and supervision and monitoring
- Inadequate supply of vaccines and logistics
- In some areas, the outreach centres are not within half an hour's walk
- Low literacy rate
- Lack of knowledge and awareness regarding the benefits of vaccination
- Working mothers and the floating population are unable to continue to attend the routine EPI sessions
- Fear of elephants in two hilly unions
- Absence of incinerator for waste disposal system

Suggested measures to overcome the barriers in Sribordi upazila are

- Reducevacancy of HA, HI, FWV and FWA
- Holiday sessions for vaccinating the children of working mothers
- Adequate budget for transportation of vaccines and travel allowances
- Ensure adequate and timely supply of vaccines and logistics
- Relocation of the outreach centres so that it is within half an hour's walk
- Awareness-raising activities among the illiterate mothers
- Ensure proper waste disposal system

Cumilla city corporation

The key reported barriers to reaching the targets of EPI are

- Vacant posts of vaccinators
- The workload distribution of HR is not equal
- Lack of transport for EPI
- Lack of adequate budget for vaccine transportation and distribution
- High rate of migration in export processing zone (EPZ) and slum areas
- No tracking system for immunization
- Poverty is a barrier to immunization in slum areas

Suggested measures to overcome the barriers in Cumilla city corporation are

- Reduce vacancy of vaccinators and increase the number of vaccinators with equal distribution of workload
- Fund allocation for immunization activities and ensure quick disbursement of this fund
- Financial support for transportation for the population in slum areas
- Develop a system for reminder through SMS and follow-up over the telephone
- Introduce an electronic registration system for immunization

Mymensingh City Corporation

The key reported barriers to reaching the targets of EPI are

- Vacant posts of vaccinators and inadequate training of the vaccinators
- Inadequate budget for HR, vehicle, and miking
- Very difficult to reach the children of the high-rise buildings
- Shortage of vaccine cards, tally book, and freezer
- Inadequate supervision and monitoring
- Lack of electronic tracking of immunization to get the regular message about vaccination date
- Insufficient IPC to raise awareness and reduce drop-outs
- Inadequate provision for appropriate waste management system

Suggested measures to overcome the barriers in Mymensingh city corporation are

- Reducevacancy of vaccinators and regular refresher training for vaccinators and supervisors
- Involving local government in arranging additional budget and HR
- Ensure adequate supply of logistics
- Adequate and effective monitoring and supportive supervision
- Online registration for immunization
- Tracking system for vaccinators
- Setup of waste management zone

Narayanganj City Corporation

The key reported barriers to reaching the targets of EPI are

- Shortage of vaccinators and supervisors
- Shortage of pentavalent and IPV for one month in the city corporation
- Inadequate supply of syringes and other logistics
- Spot registration of children without any IPC
- Irregular monitoring and poor supervision by the field-level staff
- No transport allowance for first-line supervisors
- Inadequate IPC with the parents/guardians

One participant of Narayanganj city corporation stated, *"We conduct spot registrations without any door-to-door visits and IPC. This is a barrier in estimating the targets of EPI."*

Suggested measures to overcome the barriers in Narayanganj city corporation are

- Reduce vacancy of HR based on the organogram
- Transport allowances for the first-line supervisors
- Ensure adequate and timely supply of vaccines and logistics
- Ensure proper IPC before the EPI sessions
- Incentives/gifts to the vaccinators based on performances
- Arrange monthly coordination meetings with the vaccinators

- Arrange social mobilization programs using projectors in the historical places of the low-performing wards
- Ensure adequate and effective monitoring and supervision
- Involve the councillors, community leaders and religious leaders in awareness-raising activities

6. Barriers and strategies: views of the key informants

This section presents the findings from the key informant interviews. Information collected through key informant interviews was triangulated with the information gathered during the BNA workshops and desk review. The upazila/zone level key informants were UHFPOs, EPI technicians and health inspectors in rural areas and AHOs, EPI supervisors and NGO clinic managers/project managers in urban areas. The central level key informants were Line Directors, programme managers, deputy programme managers, and representatives of development partners.

Enabling environment

Inadequate monitoring and supervision of EPI activities are a few of the major causes of dropouts from immunization and invalid doses of vaccinations in rural and urban areas. HIs and AHIs are responsible for the monitoring and supervision of the EPI activities in the rural areas and there are vacancies for HI and AHI posts in all sample Upazilas. Exiguous human resources, lack of motivation, and inadequate budget for visiting the outreach centres are the principal causes behind the weak monitoring and supervision. For instance, the monitoring and supervision of the EPI service delivery are hindered due to the shortage of HI/AHI in Khaliajuri upazila.

According to the key informants, there are also shortages of EPI supervisors in urban areas. The EPI supervisors are the staff of city corporations and there is an absence of constructive coordination between city corporations and NGO partners. Quarterly meetings between city corporations and NGO partners should be organized to review the progress in immunization and monitoring and supervision. The key informants suggested involving ward councillors in identifying the zero-dose children, especially in hard-to-reach, high-to-reach and high-risk areas. Regular advocacy meetings with all the stakeholders shall help to overcome the barriers to childhood vaccination.

The key informants opined that nationwide online registration for immunization is expected to strengthen monitoring and supervision. It shall also reduce dropouts and the number of invalid doses of vaccines in both rural and urban areas. Some online tracking systems are already being piloted and the respondents have suggested scaling up these online tracking systems. However, they also recommended improving the skills and capacity of service providers and enhancing their IT knowledge before scaling up the online registration system

for immunization nationwide. Furthermore, a few respondents have suggested for adopting a holistic approach to online registration of pregnant women, childbirth and immunization.

Supply-side determinants

Human resources (HR)

Shortages of human resources for EPI were relayed by all the key informants as a barrier to universal immunization coverage in both rural and urban areas. The central level respondents remarked that there are shortages of human resources for EPI at the central, divisional, district, upazila and union levels. There are also shortages of programme managers at the central level. One medical officer dedicated to EPI should be appointed at the district level and one at the upazila level to reinforce the supply chain management and monitoring and supervision of the activities of EPI.

Health assistants (HAs) work as EPI vaccinators and health inspectors (HIs) and assistant health inspectors (AHIs) work as EPI supervisors in rural areas. HAs are also responsible for the IPC with the parents and guardians of the children and are supposed to make door-to-door visits before the EPI sessions to reduce dropouts and invalid doses in addition to ensuring continuity in immunization. The HAs prepare a list of the vaccine eligible children and women. The central level key informants emphasized the need for improving the quality of the data used in preparing the micro-plans. The HAs prepare micro plans which are essentially the sessional plans for the next year and are updated throughout the year through IPC if necessary. However, these activities are encumbered due to shortages of HAs in all sample upazilas, especially in the hard-to-reach areas. In some districts, additional EPI vaccinators and porters are provided by the development partners. The key informants have urged the need for the recruitment of HAs post-haste. The population covered by each HAs in each subblock increased significantly over the years. Additional posts of HAs should be created to meet the needs and ensure quality service delivery. A long-term HR plan should be prepared for EPI.

The findings of KIIs show that the lack of an adequate number of vaccine porters for EPI is common in almost all sample upazilas. More porters are required in all upazilas to ensure the uninterrupted distribution of vaccines. The respondents have suggested hiring additional vaccine porters according to need and increasing the daily allowances of the porters.

NGO partners, under the supervision of city corporations, are the key service providers of EPI in urban areas. However, there are many wards in both DNCC and DSCC where any NGO partners or primary health care facilities are absent. In these wards, increasing childhood immunization is of great necessity but it is proving to be particularly strenuous. Most of the key informants have suggested that the government should provide their own vaccinators at the ward level in urban areas.

Training of HR

Most of the upazila-level respondents emphasized the necessity of refresher training for the vaccinators and supervisors. They opined that training should be provided to the vaccinators at regular intervals on the maintenance of the cold chain, appropriate vaccination, reducing wastage and increasing IPC with the parents or guardians of the children. Central-level key informants also added that regular refresher training of the vaccinators and supervisors is expected to increase EPI coverage and reduce dropouts of immunization.

One respondent in Mohanganj stated, *"To increase the EPI coverage, it is necessary to improve the interpersonal skills of the HAs and raise awareness and participation of the community."*

Vaccines and other supplies

Currently, all the vaccines of EPI are imported or donated by GAVI. Central-level key informants emphasized the need for producing vaccines within the country. This will help achieve long-run financial sustainability and ensure an adequate supply of vaccines without any interference. The EPI is also facing challenges in the supply of vaccines as different surveys are providing different target populations for EPI. This anomaly should be resolved to ensure need-based resource allocation for EPI.

According to the upazila-level key informants, usually, an uninterrupted supply of vaccines was ensured in all the sample upazilas. However, shortages of pentavalent vaccines were experienced for a few months in Mohanganj and Khaliajuri in Netrokona. Scarcity of vaccines and syringes was also observed once in Biswamberpur and Derai upazila in Sunamganj in 2021. There were shortages of the pentavalent vaccine for a month in Barura, Comilla. Some upazilas also experienced shortages of freezers, ILR, syringes, and EPI cards. The respondents in urban areas also reported the inadequacy of EPI cards, IPV syringes, tally sheets, Moni cloths, and Moni flags. The respondents at the central level and in urban areas stated that the cold chain system improved due to an increase in capacity due to the vaccination of Covid-19.

The transportation of vaccines from the central level to districts and from districts to the upazilas is hampered due to inadequate vans/freezer vans. The key informants beseeched to arrange more vans/freezer vans for the transportation of vaccines in rural areas. They also suggested building cold storage and warehouse in the districts. Transportation of vaccines is also a challenge in urban areas as city corporations do not have any freezer vans to carry vaccines. The respondents suggested that the city corporations should allocate resources for their own freezer vans.

For improving vaccination coverage, equitable vaccine supply and quality of vaccine, the real time visibility of vaccine stock and storage temperature is essential. There is a provision to update monthly stock by District and Upazilla in DHIS 2.0 but there is a gap of updation at all level. No real time tracking system available in district and Upazilla level by which some

Upazilla have more than required vaccine stock, some have very low stock and some have stockout. There is also no rationality of vaccine supply to the district by central store. Similarly the syringe supply and upadation is not optimum. No bundling supply chain practice of syringe and vaccine in all three levels.

Aa per the National EVM 2.0 2021 assessment, the aggregate national immunization supply chain score was 84%, but there were some key categories like Stock management, Waste management, MIS & infrastructure where recommendation given to strengthen.

Travel time and travel cost in HTR areas

The findings of the KIIs show that long travel time and high travel costs to reach the distribution points and EPI centres are significant barriers to achieving the targets of the EPI in low-performing districts. An estimated ten to twenty percent of vaccines are wasted due to the long distances and travel time.

One respondent said, *"It takes five days to reach some HTR areas in Baghaichhari Upazila. Although there are community clinics in those areas, it is not feasible for us to conduct EPI campaigns due to the longer travel times. Therefore, we are only able to conduct EPI campaigns in those areas that we can reach within three days."*

Distribution of vaccines becomes difficult during the rainy season in haor areas. Boats become the only mode of transport to reach the EPI centres in some hard-to-reach areas during the rainy season and floods. This poses a critical hurdle for organizing routine immunization sessions during the rainy season in haor areas.

One respondent in Bishwamberpur said, *"There are HTR areas in the upazila. The vaccine distribution becomes challenging during the rainy season and the floods. Walking on soft clay soil during the autumn and late autumn time period is more arduous. Vehicles, such as bikes, bicycles and boats, are required to conduct the immunization program efficiently."*

Infrastructure in urban areas

The NGO health facilities and service providers are carrying out the activities of EPI in urban areas. The outreach centres generally are rented spaces as there is a lack of infrastructure for primary health care service delivery in urban areas. The key informants stated that these centres are often not appropriate for providing childhood vaccination with insufficient hygiene and furnishings. They have suggested making the outreach centres women-friendly with appropriate logistics. Moreover, some wards in both DNCC and DSCC lack any NGO health facilities. The key informants also recommended establishing government primary health care facilities in urban areas.

Demand side determinants

The key informants stated that the lack of knowledge among mothers and caregivers regarding the total number of visits required for completion of childhood vaccination and the

interval between the two doses of vaccines is one of the major causes of dropouts and invalid vaccine doses in both rural and urban areas. Due to this ignorance, they fail to take their children timely to the EPI sessions. Parents having to work long hours during harvesting seasons in haor areas is a barrier to the continuity of immunization. Also, language barriers exist among some ethnic communities in the Rangamati district. The respondents reported that some communities still resist home visits by health workers for IPC. Migration is also a great challenge for universal immunization coverage due to the manual registration of vaccination of children. A holistic approach to electronic birth registration and vaccination of children is expected to reduce dropouts and invalid doses due to migration. The key informants suggested strengthening the SBCC to decrease the demand side barriers to immunization.

One respondent stated, *"Religious and social stigmas, ignorance of parents, lack of social awareness, long working hours during harvesting time and migration due to poverty are the main demand-side barriers for universal child immunization in Derai upazila"*

According to the key informants NGO health facilities charge user fees for providing health care in urban areas. This has created a misconception that mothers have to pay for immunization and thus feel discouraged to take their children for vaccination. Steps should be taken to eliminate this misconception. In addition, it is difficult for working parents to vaccinate their children during working hours. Therefore, the key informants suggested organizing evening or holiday sessions for children with working parents.

7. Key strategies and interventions to reduce inequity in immunization coverage

The key strategies and interventions for improving equity in immunization by increasing the coverage in low-performing districts and city corporations are discussed below. The strategic interventions are expected to be implemented in three time bound periods: short term, medium term and long term. Short-term is the period of the next 1-2 years, medium-term is 3-5 years and long-term is 6-8 years.

Strategies for enabling environment

Strengthening governance and coordination among stakeholders for EPI

- **Strengthening monitoring and supervision of activities of EPI in both rural and urban areas.** Weak monitoring and supervision are a hurdle to universal immunization coverage in both rural and urban areas. Necessary steps should be taken to improve monitoring and supervision by increasing communication chains between vaccinators and supervisors. **Enhanced accountability, motivation and dedication of the 1st line**

and 2nd line supervisors shall reinforce improved monitoring and supervision. This is expected to be implemented in the short term.

- **Preparing more robust micro plans and improving the quality of data.** The micro-planning process uses the existing data to prepare the session plans and set yearly targets for EPI. Steps should be taken to improve the quality of the data to grasp the actual need for immunization and to estimate the target population. This is expected to be implemented in the medium term. In the bottleneck analysis using the Tanahashi model during the planning workshops, it was revealed that the quality of the data needs to be improved to get a stronger analysis.

- **Involving communities and local government in the activities of EPI.** Communities and local governments should be involved in identifying the zero-dose children and ensuring the continuity of immunization in rural areas. The local government allocates a fund for health in each upazila. This fund could be utilized for EPI according to the local need. The community groups (CGs) and community support groups (CSGs) should be involved in awareness raising for universal immunization coverage and thus reaching every child for vaccination. This is expected to be implemented in the short term.

- **Effective coordination needs to be ensured between the city corporations and NGO partners.** There is a lack of coordination between city corporations and NGOs providing the services of EPI. Quarterly coordination meetings should be arranged involving all stakeholders to ensure effective coordination between city corporations and NGO partners. This is expected to be implemented in the short term.

- **Conduct quarterly performance review meetings to identify low-performing areas.** Identifications of the low-performing areas and implementation of necessary measures are crucial for improving equity in immunization. Therefore, quarterly performance review meetings should be organized with the service providers to find out the pockets with low immunization coverage, the causes behind the inequity and the required measures. This is expected to be implemented in the short term.

- **Arrange advocacy meetings with the ward councillor in city corporations.** The ward councillors could play a crucial role in providing space and other logistics for immunization and in raising awareness through BCC. Meetings with ward councillors should be organized at regular intervals to take necessary measures in the low-performing areas in the zones. This is expected to be implemented in the short term.

Strategies on supply-side determinants

Strengthening the supply of vaccines and other logistics

- **Supply of adequate vaccines and other logistics should be ensured.** The proper planning and estimation/forcasting are most crucial for edequate supply of vaccine & logistics. 2nd ly the real time visibility of stock at all levels is essential to supply vaccine at right time. Therefore, a robust real time VLMIS must be established to strengthen the immunization supply chain system. The supply system should be strengthened by reinforcing the need-based resource allocation for immunization, especially in the areas that are lagging behind. An adequate supply of vaccines and other logistics is crucial for uninterrupted service delivery and should be ensured to achieve the targets of EPI. A plan should be made to produce the vaccines within the country to achieve long-run financial sustainability. This is expected to be implemented in the medium term.
- Ensuring storage of vaccine in recommended Temperature: The vaccine stored in WIC, WIF, ILR & DF. All these cold chain equipment shall be equipped with remote temprature monitoring device so that real time temperature tracking could be done .
- **Bundling of Vaccine, Syringe & other logistics**: It is evident that, on Immunization days only vaccine is being suppyed to wards and syringe & other logistics are being supplied monthly/quarterly/as when received from district. Therefore, no rationality of vaccine & syringe supply and availability at session site. For effective management, vaccine and syringe and other logistics shall be supply to the sessions from Upazila as per microplan.
- **Storing of dry goods:** at national & district level syringe other dry goods along with cold chain equipments atored in verandas due to lake of space. Therefore infrastructure would be upgraded to have sufficient dry space to accommodate.

Ensuring the availability of adequate and skilled HR for EPI

- **Manpower for EPI should be increased at the national, district, upazila and union levels in rural areas.** There are inadequate human resources for EPI in central, district, upazila and union levels. Human resources should be improved at the central level and a medical officer dedicated for EPI should be appointed at the district or upazila level. The number of vaccinators should be increased in all districts and vaccinators should be assigned based on the population covered, not the number of wards. This is expected to be implemented in the medium term.

- **The vacant posts of HA, AHI, HI, FWVs, and FWA should be filled in to reduce the shortages of human resources for EPI service delivery.** There are also shortages of EPI vaccinators and supervisors in all of the low-performing districts. These vacant posts of HA, AHI, HI, FWV, and FWA should be filled in to ensure improved IPC, increase immunization coverage and reduce dropouts. The vacant posts could be filled in as temporary basis, specially in HTR areas. This is expected to be implemented in the medium term.

- **Regular refresher training should be arranged for the EPI vaccinators and supervisors.** Inadequate training of the HAs and HIs was identified in the BNA workshops as one of the significant barriers to achieving effective immunization coverage. Therefore, quarterly refresher training should be arranged for HA and HI on vaccination, maintaining the cold chain and reducing wastage. The refresher training is expected to improve the skills and performances of the vaccinators and supervisors. This is expected to be implemented in the short term.

- **More vaccine porters should be hired so that there is one vaccine porter per union in some rural areas (hill tracks districts, haor areas and large upazilas).** Most of the upazilas of the low-performing districts face shortages of vaccine porters. The inadequate number of vaccine porters in the hard-to-rich areas hinders the distribution of the vaccines as it is difficult for one vaccine porter to cover two or three unions due to long travel time. There are some large unions/upazilas like a union in Hatia upazila in Noakhali district and Mithapukur upazila in Rangpur district. It is difficult for the existing vaccine porters to cover the large area of the upazila. Therefore, more vaccine porters should be employed per upazila so that there is one porter to cover each union in the hard-to-reach areas. This is expected to be implemented in the short term.

- **The allowances for the vaccine porters should be increased to cover the high transportation costs in hard-to-reach areas.** During the harvesting season, it is tough to get vaccine porters because of the low allowances per day. The allowance for the vaccine porters is currently BDT 400 per day and it should be increased to a competitive level as the travel cost is very high in hard-to-reach areas. This is expected to be implemented in the short term.

Improve transportation system for vaccines

- **Sufficient freezer vans should be provided to transport vaccines in both rural and urban areas.** There are shortages of freezer vans to transport vaccines from districts/CCs to upazilas/zones. Transporting the vaccines in freezer vans is essential to maintain the quality of the vaccines. **Suffucient insulated vaccine van shall be provided below national level and temperature monitoring device should be used with all cold boxes to track the temperature for ensuring quality of vaccine.** Funds should be allocated for maintenance and fuel cost of the vans. At National level refrigerated vaccine vans are available to meet the demand. This is expected to be implemented in the medium term.
- **Boats or other transport facilities (bikes, bicycles, etc.) should be arranged in hard-to-reach areas to carry vaccines from the UHC to the vaccination centres.** Routine EPI is not sufficient for attaining universal immunization coverage in hard-to-reach areas. Special efforts should be made and seasonal transport arrangements should be

provided in these areas. Boats or other transport facilities (bikes, bicycles, etc.) should be arranged to carry vaccines from the UHC to the distribution points and vaccination centres so that the vaccines reach the beneficiaries timely. This is expected to be implemented in the medium term.

Establishing government primary health care facilities with adequate HR for EPI in urban areas

- **Establishment of government primary health care facilities in urban areas.** Government primary health care facilities should be established in urban areas, especially in those areas where there is no NGO providing services currently. The national urban immunizatrion strategy Bangladesh 2019 suggested to establish one primary health care centre per 50,000 population or per one urban ward. This is expected to be implemented in the long term.
- **Recruitment of government vaccinators in urban areas.** There are no government health workers in the city corporations. This absence of government vaccinators is a bottleneck for the activities of EPI in urban areas. Posts of government vaccinators should be created and should be filled up to increase immunization coverage in urban areas. The national urban immunizatrion strategy Bangladesh 2019 suggested to staff each primary health care centre by 6 vaccinators and 2 immunization supervisors. This is expected to be implemented in the medium term.
- **Provide or rent appropriate space for outreach centres in urban areas.** Appropriate space and other women-friendly facilities are vital for continuity of immunization and increasing EPI coverage in urban areas. Therefore, appropriate space and other istics should be allocated for outreach centres in urban areas. This is expected to be implemented in the short term.
- **Recruitment of health volunteers in every zone for door-to-door visits to reduce dropouts and reach every child for vaccination.** Health volunteers could supplement in raising awareness, IPC, reducing dropouts and reaching the zero-dose children. As there are shortages of human resources in city corporations, hiring health volunteers could help to reduce the burden on vaccinators in urban settings. Home visits by community volunteers could also reduce dropouts and help reach every child for vaccination in urban areas. This is expected to be implemented in the short term.
- **Organize evening/holiday EPI sessions for the children with working parents.** It is difficult for working parents to vaccinate their children during working hours in urban areas. Evening/holiday sessions will enable them to maintain their children's vaccination schedule and thus will reduce dropouts. This is expected to be implemented in the medium term.

Strategies on demand-side determinants

Strengthening SBCC in rural areas

- **Strengthening IPC by the HA to reduce dropouts and reach every child for vaccination in the districts, especially in the hard-to-reach areas.** HAs must ensure home visits and counselling prior to the vaccination schedules. Interpersonal Communication (IPC) with the parents or guardians of the children should be reinforced and strengthened to identify the zero-dose children and reduce the dropouts to achieve the EPI targets. To improve equity in immunization coverage, special efforts should be made to track the children eligible for vaccination and communicate with parents before the immunization schedule, especially in hard-to-reach and high-risk areas. This is expected to be implemented in the medium term.

- **Home visits by the community health workers to reduce dropouts and to reach every child for vaccination.** Community health workers can play an important role in identifying the children for vaccination and counselling the parents and guardians through home visits. They can conduct the IPC in areas that have inadequate HAs due to long distances and long travel times. For example, multipurpose health volunteers (MHVs) are performing some duties of HAs in Pirganj upazila of Rangpur district. Special arrangements should be made in the pockets with low immunization coverage in addition to the routine immunization program due to geographical adversities. This is expected to be implemented in the short term.

Performance based financing

- **Incentives should be provided to the parents of the fully vaccinated children.** Demand-side financing could be an option to increase immunization coverage by providing incentives to parents or guardians of the fully vaccinated children. This initiative shall inspire the parents and guardians to follow the schedule of immunization and fully vaccinate their children. This is expected to be implemented in the medium term.

Improve communication systems in both rural and urban areas

- **E-registration and electronic reporting systems for immunization should be strengthened.** An integrated and holistic approach should be adopted for electronic pregnancy, birth and immunization registration. Therefore, electronic registration and reporting systems like, e-tracker and eMIS, should be strengthened and scaled up with improvements in the capacity of the service providers and their knowledge on information technology (IT). This is expected to be implemented in the medium term.

Strengthening SBCC in urban areas

- **Increase awareness by utilizing miking, newspapers, and informative cartoons/animations on TV for the children in city corporations.** Community awareness should be raised to reach the zero-dose children by miking in high-risk areas. Advertisements in newspapers and informative cartoons/animations on television shall help to increase immunization coverage in high-to-reach and high-risk areas and thus reduce dropouts in urban areas. This is expected to be implemented in the short term.

Strategies on quality

Improve waste management system for EPI

- **Allocate adequate budget for proper waste management system.** Proper waste management systems are absent in both rural and urban areas. An additional budget should be allocated to provide incinerators and establish standard waste management systems in both rural and urban areas. This is expected to be implemented in the short term.

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Annex: Findings from the review of the plans

Bandarban district

Bottlenecks are identified in the domain of 'availability' and 'accessibility' of the Tanahashi model in all upazilas of the Bandarban district. The key barriers to immunization in the Bandarban district are

- Shortage of human resources in Bandarban municipality, and Rowangchhari and Bandarban Sadar upazilas
- Vacant posts of HA, HI and AHI
- Knowledge gap among the vaccinators in Lama, Thanchi, Ruma, Alikadam, Naikhongchhari, Rowanchhari, Bandarban Sadar upazilas and Bandarban Municipality
- Inadequate budget for transportation, especially in HTR/HR areas in Lama, Thanchi, Rowangchhari, Ruma, Alikadam, Naikhonchari, and Bandarban Sadar upazilas
- No vaccine store in Bandarban Municipality
- Insufficient budget for monitoring and supervision in Lama, Thanchi, Ruma, Alikadam, Naikhongchhari, Rowangchhari upazilas and Bandarban Municipality
- Lack of knowledge about the number of required visits for vaccination among the 'Muroong' community in Lama, Ruma, Rowangchhari, and Bandarban Sadar upazilas
- Lack of awareness about vaccination among 'Mro' and 'Khumi' communities in Thanchi, Alikadam, Naikhongchhari, and Bandarban Sadar upazilas

The suggested measures to overcome the barriers are

- Fill up the vacant posts of HA, HI and AHI in Bandarban Municipality and Rowanchari upazila
- Organize refresher training for the vaccinators and supervisors in all upazilas and municipality
- Provide adequate budget for transportation of vaccines in Lama, Thanchi, Alikadam, Naikhongchhari, and Rowangchhari upazilas
- Establish a vaccine store along with providing necessary human resources in Bandarban Municipality
- Provide a sufficient budget for proper monitoring and supervision in all upazilas and municipality
- Organize advocacy meetings with local stakeholders like the chairman, local elected members, teachers, karbari, headman, NGO workers, and parents of all upazilas and municipality

Habiganj district

Bottlenecks are identified in the domain of 'availability' and 'accessibility' of the Tanahashi model in all upazilas of the Habiganj district. The key barriers to immunization in the Habiganj district are

- Shortage of HA, HI and AHI in Ajmeriganj, Baniachang, Habiganj Sadar, and Nabiganj upazilas
- Inadequate allowances for vaccine porters in Chunarughat, Habiganj Sadar, Lakhai, and Madhabpur upazilas
- Staggered supply of vaccines from the district level in Chunarughat, Habiganj Sadar, and Madhabpur upazilas
- High workload due to the shortages of human resources (Chunarughat, Habiganj Sadar, Lakhai, Madhabpur)
- Absence of real-time monitoring system (Chunarughat, Habiganj Sadar, Lakhai, Madhabpur)
- Shortage of syringes, vaccine cards, child tally book, vaccine carrier/ freezer/ ILR in Ajmeriganj upazila
- Knowledge gap among the vaccinators in Baniachang upazila
- Insufficient budget for monitoring and supervision in Ajmeriganj, Habiganj Sadar, and Lakhai upazilas
- Absence of proper waste disposal facilities in Ajmeriganj and Lakhai upazilas
- Shortage of outreach centres in Chunarughat upazila
- Inadequate budget for transportation of vaccines in Baniachang, Chunarughat, and Lakhai upazila
- Inadequate IPC before the EPI sessions in Chunarughat, Madhabpur and Ajmeriganj upazila
- Irregular monitoring, poor supervision and follow-up in Ajmeriganj and Habiganj Sadar upazilas
- Presence of social and religious stigma regarding vaccination in Chunarughat and Lakhai upazila

The suggested measures to overcome the barriers are

- Fill up the vacant posts of Health Assistant, Assistant Health Inspector in all upazilas
- Introducing monthly incentives for the best health workers in Chunarugat
- Providing overtime allowances in Habiganj Sadar, Lakhai, and Madhabpur upazila
- Organizing refresher training for HAs and HIs in Baniachang upazila
- Increase allowances for porters in Chunarughat, Habiganj Sadar, Lakhai, and Madhabpur upazilas
- Ensure adequate and timely supply of vaccines and other logistics in Chunarughat, Habiganj Sadar, Ajmeriganj, and Madhabpur upazila
- Provide a sufficient budget for the transportation of vaccines in Baniachang, Chunarughat, and Lakhai upazilas

- Establishment of a real-time monitoring system in Chunarughat, Habiganj Sadar, Lakhai, and Madhabpur upazila
- Engaging local cable network channel for IEC and BCC in Chunarughat upazila
- Provide sufficient budget for proper monitoring, supervision and follow-up in Ajmeriganj, Habiganj Sadar, and Lakhai upazilas
- Organize advocacy meetings with all stakeholders like local dignitaries, elected representatives, religious leaders, teachers and parents in Ajmeriganj, Chunarughat, Lakhai, Madhabpur, and Madhabpur upazilas
- Ensure proper waste disposal facilities in Ajmeriganj and Lakhai upazilas

Dhaka district

Bottlenecks are identified in the domain of 'availability' and 'accessibility' of the Tanahashi model in all upazilas of the Dhaka district. The key barriers to immunization in Dhaka district are

- Shortages of human resources and vacant posts of HA, HI and AHI in Savar, Nawabganj, Keraniganj, and Dhamrai upazilas
- Insufficient budget for transportation of vaccines and porters in Savar upazila
- Knowledge gap among the vaccinators
- Insufficient budget for monitoring and supervision in Savar and Dohar upazila
- Difficulties in the transportation of vaccines to some wards during monsoon in Nawabganj, Dohar and Dhamrai upazilas
- No allocation for safe waste management in Savar upazila
- Absence of ILR, dry store/storage room in Savar and Dhamrai upazila
- Lack of awareness about vaccination among parents in Dohar upazila
- Inadequate community participation in Dohar upazila

The suggested measures to overcome the barriers are

- Fill up the vacant posts of Health Assistant, Health Inspector, and Assistant Health Inspector in Savar, Nawabganj, Keraniganj, in Dhamrai upazilas
- Organizing refresher training for HA, HI and AHI
- Provide an adequate budget for transportation in Savar upazila (e.g., for buying bicycles)
- Improving transportation or providing extra transport allowance in Savar, Dohar, and Dhamrai upazilas (e.g., bike or speed boat instead of bicycle)
- Ensuring adequate funds for waste management in Savar upazila
- Allocation of budget for ILR and building dry store/store room in Savar and Dhamrai upazilas
- Provide a sufficient budget for proper monitoring and supervision in Savar and Dohar upazilas

- Organize advocacy meetings with all stakeholders like the chairman, local elected members, religious leaders, teachers, and parents in Dohar upazila
- Strengthen health education campaign using postering, roadside banners, festoons, and billboard

Cox's Bazar district

Bottlenecks are identified in the domain of 'availability' and 'accessibility' of the Tanahashi model in all upazilas of Cox's Bazar district. There are no HTR/HR areas in Kutubdia and Ukhia upazilas. The key barriers to immunization in Cox's Bazar district are

- Inadequate budget for transportation
- Lack of awareness about vaccination, especially among the coastal communities (Chakaria, Moheshkhali, Cox's Bazar Sadar and Pekua)
- Shortage of human resources
- Knowledge gap among the vaccinators
- Insufficient budget for supervision

The suggested measures to overcome the barriers are

- Adequate budget for transportation
- Recruitment of health workers for the vacant posts (e.g. health workers, support staff)
- Arrange refresher training for health personnel (e.g., 30 EPI personnel)
- Sufficient budget for proper monitoring and supervision every two months (Cox'sBazar Sadar, Ramu, Moheshkhali)
- Organize advocacy meetings with all stakeholders like the chairman, local elected members, teachers, headman, NGO workers, and parents (Chakaria, Pekua, Moheshkhali, Kutubdia and Cox's Bazar Sadar)

Narail district

The key barriers to immunization in the Narail district are

- Shortage of human resources
- Shortage of logistics
- Insufficient budget for monitoring and supervision
- Inadequate overtime allowance for MT-EPI
- No allocation for safe waste management
- Need for the renovation of the cold room
- Lack of awareness about vaccination among parents

The suggested measures to overcome the barriers are

- Fill up the vacant posts of Health Assistant, Health Inspector and Assistant Health Inspector
- Provide sufficient budget for proper monitoring and supervision and printing checklist for this purpose
- Ensure adequate budget for laptops, printers, modems, bags, umbrellas, raincoats, and bicycle
- Monthly overtime allowance for MT-EPI
- Ensure sufficient funds for waste management
- Fund allocation for renovating the cold room
- Organize advocacy meetings and health education campaigns involving all the stakeholders like the chairman, local elected members, teachers, and parents.

Jamalpur district

The key barriers to immunization in the Jamalpur district are

- Inadequate logistics support for immunization staff
- Inadequate review of activities, current challenges and way forward on the immunization program
- Inadequate review of local immunization data and plan, no separate HTR and Non-HTR data analysis
- Inadequate porter to supply EPI vaccine to the outreach centre
- Insufficient supply of vaccines and logistics
- Inadequate budget for transportation, especially to HTR areas
- Knowledge gap among the vaccinators
- Inadequate review of EPI microplanning and reporting
- Inadequately skilled volunteer to support the EPI program
- Insufficient social mobilization
- Inadequate IPC at the field level
- Insufficient budget for monitoring and supervision
- Lack of proper waste management facility

The suggested measures to overcome the barriers are

- Yearly provision of raincoat, boot and umbrella for the porter to work in the HTR area
- Yearly advocacy on EPI with stakeholders to review the activities, current challenges, and way forward
- Monthly meeting through EPI standard reporting format, analysis of union-based (micro-level) immunization data analysis, gap analysis, HTR/HR session-based coverage analysis
- Recruitment of additional porters
- Provision of periodic maintenance of supplying materials

- Adequate budget for transportation
- Organize refresher training for health personnel
- Quarterly microplanning, EPI e-tracker and DHIS-2 based reporting review meeting, EPI coverage review meeting
- Yearly EPI volunteer training for capacity development
- Facilitate CSG meetings to strengthen community mobilization in community clinics
- IPC at field level by the worker as per recommendation from EPI
- Ensuring proper waste management facility
- Sufficient budget for proper monitoring and supervision
- Organize advocacy meetings involving all stakeholders like the chairman, local elected members, teachers, headman, NGO workers, and parents

Annex II

One participant in the workshop in Sunamganj district stated, *“During six months of the year the porters can reach the distribution point by bicycle and the other six months only by boat in Jamalganj.”*

ne participant in the workshop stated, *"We faced difficulties in supply chain management due to a shortage of pentavalent vaccine for a few months"*

One participant in the workshop in DNCC stated, *“We are facing challenges in transportation of vaccines as the city corporations do not have any freezer vans”.*

One respondent from Patgram upazila stated, *“The local level stakeholders like teachers and religious leaders can play important roles in conducting IPC within the community that will increase immunization coverage in the upazila.”*

One participant stated, *“Regular IPC is necessary to reduce the invalid doses. Inadequate human resources is a barrier to conducting IPC regularly in Hatia upazila."*

Another participant stated, *"To increase the coverage of the routine EPI sessions an app for online registration and tracking should be developed like the Surokkha.”*

The participant also stated, *”There are invalid doses of immunization due to lack of knowledge regarding the appropriate interval between the two doses of vaccines.”*

One participant of Faridpur Sadar stated, *"The government should recruit human resources in the vacant posts. At the same time, it is necessary to provide refresher training regularly to improve their performance."*

One participant stated, *"The local government should be involved in the EPI campaign. They can provide funds for transportation of vaccines."*

Another participant of the upazila said, *"There is no budget to carry the waste. If the safety bags are provided to carry waste, it will help to manage the waste safely."*

The participant added, *"The local government has a fund for health. If this fund could be used for activities of EPI then the vaccination coverage will increase."*

One participant from Pirganj upazila stated, *"As the ethnic community are not willing to take vaccines due to lack of knowledge and language barriers, it is necessary to recruit vaccinators from the tribal community to increase the immunization coverage."*
The participant added, *"The UHC of Mithapukur received allocation to build a waste disposal pit and built it. But there is no budget for burning the waste. Though the municipality is responsible for burning the waste, this upazila has no municipality. So, it is necessary to provide a budget to the UHC to burn the waste."*

One participant in the workshop stated, *"The field-level staff of the upazila are not performing their assigned duties properly. The UHC can arrange a monthly meeting to encourage the field level staff about how to motivate the people regarding vaccination and provide gifts based on their performance."*

One participant from the upazila stated, *"If the MODC and UHFPO supervise the field level staff through the digital system, it will increase the motivation of field level staff."*

One participant of the workshop stated, *"There are some floating and poor people in the Cumilla city corporation. So, immunization coverage will increase if transport allowances are given to bring their children for vaccination."*