Joint National/International Expanded Programme on Immunization and Vaccine Preventable Disease Surveillance Review

Bangladesh, 28 July – 6 August 2018

World Health Organization
REGIONAL OFFICE FOR South-East Asia

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Contents

Page

Annexes

List of Tables

List of Figures

Acronyms

AEFI	adverse events following immunization
AFP	acute flaccid paralysis
CES	Coverage Evaluation Survey
cMYP	comprehensive multi-year plan
CRS	congenital rubella syndrome
DHIS-2	district health information system
DTP3	third dose of diphtheria-tetanus-pertussis vaccine
EPI	Expanded Programme on Immunization
Gavi	Gavi, The Vaccine Alliance
GoB	government of Bangladesh
HBV	hepatitis B virus
HepB	hepatitis B vaccine \
HPV	human papilloma virus
HTR	hard-to-reach
IBD	invasive bacterial disease
IPV	inactivated poliovirus vaccine
JE	Japanese encephalitis
MCV1	first dose of measles antigen containing vaccine
MCV2	second dose of measles antigen containing vaccine
MNTE	maternal and neonatal tetanus elimination
MOHFW	Ministry of Health and Family Welfare (of Bangladesh)
MR	measles-rubella vaccine
NCCPE	National Certification Commission for Polio Eradication
NCIP	National Committee for Immunization Practices
NITAG	national immunization technical advisory group
NITAGs	national immunization technical advisory groups
NRA	National Regulatory Authority
NT	neonatal tetanus

NVC	National Verification Committee (for measles and rubella/CRS elimination)
PCV	pneumococcal vaccine
polio	poliomyelitis
SBCC	social and behavior change communication
SEAR	South-East Asia Region
SIMO	surveillance and immunization medical officer
SIMOs	surveillance and immunization medical officers
SWAp	Sector-Wide Approach program
UNICEF	United Nations Children's Fund
VPD	vaccine preventable disease
VPDs	vaccine preventable diseases
WHO	World Health Organization

Executive summary

Background and methodology

The World Health Organization's South-East Asia Regional Technical Advisory Group on Immunization recommends that each country should conduct periodic joint national/international programme reviews in addition to its own regular internal programme monitoring. Joint national/international Expanded Programme on Immunization (EPI) reviews conducted in the South-East Asia Region, including this one, have three broad objectives:

- To provide a snapshot to public health programme directors and public health policy makers on the status of the EPI and vaccine preventable disease surveillance,
- To assess progress in meeting key national, Regional and global goals, and
- To provide an opportunity to share lessons learned with other countries sharing the same goals for preventing and controlling vaccine preventable diseases.

The following areas of focus for the 2018 Expanded Programme on Immunization and Vaccine Preventable Disease Surveillance Review in Bangladesh were agreed upon:

- Government support to immunization with emphasis on the following areas:
  - Advisory and oversight bodies (composition and functioning),
  - Advocacy and communications activities/strategies,
  - The status of human resources, including capacity, numbers, training and retention,
- Ways in which equity of immunization coverage can be further promoted, with particular emphasis on the urban poor,

- Examination of the current factors affecting data quality, with particular attention to denominators, and recommendations as to how data quality can be improved,
- Whether or not the country is on track to reach or maintain elimination or control of targeted diseases in terms of vaccination policy and surveillance at national and district levels. The relevant diseases are:
  - Poliomyelitis (polio),
  - Measles and rubella,
  - Maternal and neonatal tetanus,
  - Hepatitis B,
  - Japanese encephalitis,
- Whether laboratory–supported vaccine preventable disease surveillance is adequate to detect outbreaks and support verification of elimination and control targets at both national and district levels,
- The process for and experience with introduction of new and under-utilized vaccines.

A review team of Bangladeshi nationals and internationals addressed the core questions through a desk review of relevant policies and guidelines; secondary analysis of available data; interviews with key stakeholders, policy makers, and programme staff; visits to hospitals and direct observation of programme implementation at field sites in Bangladesh

Findings and recommendations

Government support

Key findings

National oversight bodies

The National Committee on Immunization Practices, the National Committee for the Certification of Polio Eradication and National Verification Committee (for measles and rubella/congenital rubella syndrome elimination) have all played valuable roles in moving the EPI forward. However, the National Committee on Immunization Practices is no longer fully aligned with minimum standards of functionality or with current recommendations of the Regional Technical Advisory Group on Immunization. The National Committee for the Certification of Polio Eradication does not yet fulfil the South-East Asia Region Vaccine Action Plan 2016-2020 indicator of conducting quarterly meetings. The activities of the National Verification Committee (for measles and rubella/congenital rubella syndrome elimination) under the new chairman are being reconfigured to align with the Terms of Reference for National Verification Committees outlined in the Guidelines on Verification of Measles Elimination and Rubella/Congenital Rubella Syndrome Control in the WHO South-East Asia Region.

Demand generation

Despite high vaccination coverage among children in Bangladesh, survey results and field observations support a need for more demand generation

Human resources

The key human resources related finding from the review was the persisting high number of field worker and supervisor vacancies under EPI due to no recruitments taking place over the last 5-6 years. Other important findings were:

- City corporations do not have dedicated manpower and depend on non-governmental organizations. Manpower shortages and

high turnover affect both the quality of immunization services and the vaccination coverage achieved in urban areas,

- In addition to health worker vacancies, the sanctioned posts were inadequate considering present population size,
- High staff turnover was observed in managerial positions, and
- There was incomplete orientation and re-training of staff.

Urban immunization

While recognizing the challenges of urban poor and hard to reach populations, and the inclusion of plans in the 4th Health, Population and Nutrition Sector Programme to reach these populations, the current system confronts numbers of challenges, the most critical of which are the complex institutional set-up in urban settings, the lack of dedicated infrastructure and staff of city corporations for EPI or basic health, lack of adequate human resources, and discontinuation of the hard to reach budget.

Key recommendations

National oversight bodies

National Committee on Immunization Practices

- Ensure that all members declare conflicts of interest and recuse themselves as appropriate,
- Review the composition of the National Committee on Immunization Practices to ensure the independence of the committee's advocacy and monitoring functions,
- Provide ongoing programmatic oversight to the EPI,
- Participate in capacity building, as per Regional Technical Advisory Group on Immunization recommendations for national technical immunization advisory groups, and
- Review the committee's terms of reference and update as appropriate.

National Committee for the Certification of Polio Eradication and National Verification Committee (for measles elimination and rubella/congenital rubella syndrome control):

- Increase the frequency of meetings (the National Committee for the Certification of Polio Eradication should meet quarterly as per the South-East Asia Region Vaccine Action Plan 2016-2020 recommendations),
- Provide oversight to the polio and the measles elimination and rubella/congenital rubella syndrome control programmes, and
- Encourage the development of committee work plans.

Demand generation

- Develop a robust multi-channel demand generation strategy for defined participant/audience groups to consistently and continuously reach hard to reach and too high to reach populations. This strategy should identify under-immunized communities and develop specific communication strategies for each of these communities. This would also include a strategy to promote EPI branding in creative ways,
- Revise existing social and behaviour change communication materials and revise old materials based on behaviour and appetite analysis, including any information available from knowledge, attitude and practices surveys.

Human resources

- The Ministry of Health and Family Welfare of the government of Bangladesh should accelerate field worker recruitment. Additionally, government should consider sanctioning new positions, thus reducing the health worker to population ratio,
- Advocate for EPI-dedicated staff in city corporations and municipalities,
- Create positions of medical officer disease control for surveillance and EPI both at *upazila* and district level, as per the poliomyelitis transition plan,

- Minimize turnover in key leadership positions to promote familiarity with the programme and a long-term vision.

Urban immunization

- Endorse the Urban Immunization Strategy and ensure necessary human and financial resources for full and immediate implementation. Actionable recommendations that can be made immediately include:
  - Establishing coordination mechanisms at city, zone and ward levels, including a coordination committee led by the mayor with participation of the Deputy Director of Health Services, Deputy Director of Family Planning, Civil Surgeon, Community Health Organization, and non-governmental organization representatives. In addition, establishing an inter-ministerial committee to improve coordinated service delivery,
  - Filling vacant staff positions,
  - Ensuring that private sector protocols/procedures for service delivery, surveillance, and reporting are in place, including standardized contractual mechanisms and performance agreements with non-governmental organizations,
- Develop an advocacy plan to target high level political officials to ensure sustained commitment to EPI.

Data quality and surveillance systems

Key findings

Data quality

There is a good foundation for a strong monitoring system with the move to the integrated electronic system represented by the District Health Information System. Data are summarized and used across all levels. However, to sustain high coverage levels in the environment of increasing urbanization, it will be necessary to look at data more critically. This can be done by triangulating data from different sources to identify and reach un- and under-immunized populations.

Surveillance for adverse events following immunization.

The adverse events following immunization surveillance system in Bangladesh demonstrates strong capacity in detecting, investigating, classifying and responding to serious adverse events following immunization identified in public facilities or vaccine safety events which concern the general public.

Key recommendations

Data quality

- Strengthen the District Health Information System and promote use by EPI staff at all levels through
  - Promoting long-term sustainability and national ownership for the EPI component of District Health Information System, and
  - Training EPI staff for data entry and system use.
- Resolve denominator inconsistencies through
  - Conducting an in-depth review in selected *upazilas* to determine the reasons for discrepancies between the denominator generated through national projections and that generated through data derived from micro plans, and
  - Data triangulation between supply and administered dose data,
- Assess numerators for any potential over reporting.

Progress in meeting global and Regional goals

Key findings

Polio

Bangladesh has maintained its polio free status through high immunization coverage and meets certification standards for the cardinal surveillance indicators. However, high dependence on the World Health Organization's surveillance and immunization medical officer network for basic surveillance functions remains a challenge. Capacity building of government

health workers and sustaining the World Health Organization's surveillance and immunization medical officer network for the next 3-5 years is required.

Maternal and neonatal tetanus elimination

Bangladesh continues to report high national and sub-national coverage for the third dose of diphtheria-tetanus-pertussis vaccine and two doses or more of tetanus toxoid. Neonatal tetanus surveillance is well integrated into vaccine preventable disease surveillance and a community response to reported cases is carried out, including vaccination of the mother of the reported neonatal tetanus case. However, risk factors for maternal and neonatal tetanus during deliveries and post-natal care at home remain, requiring high levels of protection through universal tetanus toxoid vaccination. The opportunity of adding diphtheria protection is yet to be realized. As no tetanus booster doses are included in the national immunization schedule, the full benefit of tetanus toxoid immunization does not yet apply to males and females equally. Ultimately, the most equitable and sustainable approach is to ensure tetanus protection over the life course for all members of the population.

Measles, rubella and congenital rubella syndrome

Bangladesh has made progress toward the 2020 elimination goals. Overall immunization levels are high with both first and second dose of measles containing vaccine. A follow up measles campaign is due to be conducted, but the actual dates have not yet been set. Most surveillance and laboratory indicators are met, although the indicator for surveillance sensitivity is not consistently met at sub-national levels. However, the country has not yet initiated fever and rash surveillance. The country was among the first six in the South-East Asia Region deemed to have controlled rubella.

Hepatitis B

High national and sub-national hepatitis B vaccine coverage (>90%) has been sustained for several years. Regular monitoring of vaccination coverage at the national and sub-national levels will be important to ensure that the gains are sustained and areas are identified where improvements will be needed. Although there is little evidence from Bangladesh that children whose first dose of hepatitis B vaccine was delayed until the sixth

week of age were at increased risk of hepatitis B virus infection, it remains prudent to vaccinate children in Bangladesh at the first opportunity.

Key recommendations

Polio

- Bangladesh should initiate implementation of the transition plan beginning with more ownership of local government health staff in surveillance activities. This would require building the capacity of government staff in surveillance,
- The surveillance and immunization medical officers' network should be sustained at the current levels over the next 3-5 years. This network is critical to maintain high quality acute flaccid paralysis surveillance as well as supporting other activities such as measles elimination and rubella/congenital rubella syndrome control, vaccine preventable disease surveillance, strengthening immunization and new vaccine introduction.

Maternal and neonatal tetanus elimination

- Maintain high immunization coverage with tetanus toxoid containing vaccine in pregnant women, women of childbearing age and infancy,
- The national EPI and National Committee on Immunization Practices to review and optimize the tetanus toxoid immunization schedule to ensure full and early protection against tetanus with booster doses for both genders during childhood and adolescence,
- Implement tetanus toxoid replacement with tetanus-diphtheria vaccine in light of waning immunity to diphtheria following the primary series and with pregnant women disproportionately affected.

Measles, rubella and congenital rubella syndrome

- Use campaigns to
  - Achieve >95% coverage with measles-rubella vaccine consistently and uniformly, and

- Strengthen routine immunization by
  - Updating micro plans,
  - Mapping all settlements, and
  - Rationalizing immunization session locations and periodicity,

- Include the second dose of measles rubella vaccine in the definition of a fully immunized child,
- Ensure that pre-measles rubella vaccine supplementary immunization activity readiness assessment and post-campaign coverage assessments are integral parts of supplementary immunization activity planning and implementation,
- Transition to rash fever surveillance following the supplementary immunization activity, when the number of cases should have decreased substantially.

Hepatitis B

- Maintain the third dose of hepatitis B vaccine coverage nationally and sub-nationally ≥90%,
- Review 2018 Regional Technical Advisory Group on Immunization recommendations on
  - Catch up or patch up vaccination with hepatitis B vaccine in children aged <5 years; to be considered based on coverage evaluation survey results, and
  - Hepatitis B vaccine birth dose introduction based on the epidemiological situation of hepatitis B virus infection.

New and under-utilized vaccine introduction

Key findings

The Ministry of Health and Family Welfare has set an ambitious agenda for new and under-utilized vaccine introduction which has, overall, been successfully implemented, both in terms of the introduction of vaccines into the routine programme and through the use of vaccination campaigns. New vaccine introductions have been supplemented by developing protocols for

and expanding capacity to manage adverse events following immunization. Minor difficulties in new and under-utilized vaccine introduction are linked to systemic challenges, for example, lack of clarity regarding the true size of target populations, inequities between rural and urban health care, and challenges in communicating with hard to reach populations.

Expansion of the cold chain will be required to accommodate introduction of Japanese encephalitis, human papilloma virus and rotavirus vaccines into the EPI. Funding from Gavi, the Vaccine Alliance's second and third Health System Strengthening grants is foreseen to cover the required expansion. As Bangladesh transitions to a lower middle income country, the amount of co-financing it will need to pay for vaccines will increase.

Key recommendations

- Ensure that the National Regulatory Authority is able to support the licensing of vaccines produced by different manufacturers,
- Ensure that the National Committee on Immunization Practices makes evidence based decisions which take into account both epidemiology and financial considerations to guide political decisions.
- Promote policies to achieve ownership of the programme across ministries (Ministry of Finance, Ministry of Local Government, Rural Development and Co-operatives, Ministry of Education) and among stakeholders such as professional associations, civil society and development partners.

1. Introduction

The Expanded Programme on Immunization (EPI) in Bangladesh has achieved considerable success in preventing and controlling vaccine preventable diseases (VPDs).[1] The country has seen a reduction of more than 90% in cases of diphtheria, pertussis and tetanus when compared to the period prior to the implementation of the EPI. Bangladesh achieved maternal and neonatal tetanus elimination (MNTE) in 2008 and, with the rest of the World Health Organization (WHO) South-East Asia Region (SEAR), was certified poliomyelitis (polio) free in 2014. Recent years have seen the successful introduction of measles-rubella vaccine (MR), inactivated poliovirus vaccine (IPV), bivalent oral poliovirus vaccine and pneumococcal vaccine (PCV). Reporting of the EPI target diseases (polio, measles, rubella, diphtheria, pertussis, neonatal tetanus (NT)) is mandatory and based on clinical and/or laboratory evidence.

Bangladesh subscribes to the key strategic objectives of the Global Vaccine Action Plan and the global goals of the Decade of Vaccines (2011-2020)[2]: (1) achieve a world free of polio, (2) meet vaccination coverage targets, (3) reduce child mortality, (4) meet global and Regional elimination targets, and (5) develop and introduce new vaccines. Bangladesh also subscribes to the Regional goals of eliminating measles and controlling[3] rubella and congenital rubella syndrome (CRS) by 2020, as well as accelerating the control of hepatitis B and Japanese encephalitis (JE). In line with the WHO SEAR Vaccine Action Plan, the country also seeks to strengthen routine immunization systems and services and accelerate the introduction of new vaccines.[4]

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[1] *Sarkar et al (2015), Expanded Programme on Immunization in Bangladesh: A Success Story, Bangladesh Journal of Child Health 2015; vol 39 (2).*

[2] *Global Vaccine Action Plan. World Health Organization. 2013.* http://www.who.int/immunization/global_vaccine_action_plan/en/ *. Accessed 26 September 2018*

[3] *Defined as a 95% reduction of rubella and CRS as compared with the 2008 baseline nationally and for the Region*

[4] *South-East Asia Regional Vaccine Action Plan 2016-2020. World Health Organization Regional Office of South-East Asia. 2016:* http://www.who.int/immunization/global_vaccine_action_plan/regional_vaccine_action_plans/en/. *Accessed 26 September 2018.*

The South-East Asia Regional Technical Advisory Group on Immunization recommends that each country should conduct periodic joint national/international programme reviews in addition to its own regular internal programme monitoring. The last international EPI review in Bangladesh was conducted in 2012.

Joint national/international EPI reviews conducted in SEAR, including this one, have three broad objectives:

- To provide a snapshot to public health programme directors and public health policy makers on the status of the EPI and vaccine preventable disease (VPD) surveillance,
- To assess progress in meeting key national, Regional and global goals, and
- To provide an opportunity to share lessons learned with other countries sharing the same goals for preventing and controlling VPDs.

This document reports on the findings and recommendations of the Joint National-International Expanded Programme on Immunization and Vaccine Preventable Disease Surveillance Review held in Bangladesh from 28 July to 06 August 2018. Recommendations are found at the end of each topic area.

2. Background

2.1 General

Bangladesh, a South-East Asian country, shares boundaries with India and Myanmar. The country has a tropical climate with a monsoon season during which flooding occurs frequently. The country has three major regions: the fertile Ganges-Brahmaputra delta, the northwest and central plateaus, and evergreen hill ranges in the northeast and southeast.

Figure 1. *Map of Bangladesh*

In 2016, the population of Bangladesh was estimated at 163 million, with a 2018 birth cohort of 3 million children. With the exception of a few small city states, it is the mostly densely populated country in the world. In 2016, approximately 35% of the population was aged 0-14 years. In recent decades, the total fertility rate has decreased markedly and in 2017 it was 2.1 while life expectancy at birth was 72 years. In 2017, mortality for children aged less than 5 years was estimated at 32 deaths per 1000 live births.[5] The male literacy rate in those aged 15-24 years was 91.5% and the female literacy rate for the same age group was 94.4%. However, looking at all individuals aged 15 years and above, literacy is lower at 72.9%. Sixty-four percent of the population is considered to be rural.[6] Ninety-eight

[5] *The World Bank database (online database). Washington: World Bank; 2018* *http://databank.worldbank.org/data/views/reports/reportwidget.aspx?Report_Name=CountryProfile&Id=b450fd57&tbar=y&dd=y&inf=n&zm=n&country=BGD accessed 27 September 2018*

[6] *United Nations Educational, Social and Cultural Organization database (online database). http://uis.unesco.org/country/BD accessed 27 September 2018.*

percent of the population of Bangladesh are Bengalis, and 1.1% of the total population is composed of smaller indigenous groups, many of whom live in the Chittagong Hill Tracts. Bengali is the mother tongue of most of the population, although the indigenous minority groups have their own languages. Islam is the official religion of Bangladesh and is followed by approximately 89% of the population, with 10% of population being Hindu.[7]

Bangladesh is considered a lower middle income country with a gross domestic product in 2017 of US$ 249.72 billion and an annual gross domestic product growth rate that year of 7.3%.[8] Following internal conflicts in Myanmar in 2017, approximately 700 000 Rohingya peoples fled Myanmar to Bangladesh. Since that time, they have been accommodated in refugee camps in Cox's Bazar. However, these refugee camps were not part of the EPI and VPD surveillance review.

2.2 Health services and EPI in Bangladesh

Policy and implementation frameworks

A policy framework for health system organization is provided by the Government Vision 2021, the Government Perspective Plan 2010-2021, the National Health Policy 2011, the National Population Policy 2012, and the National Nutrition Policy 2015. The National Health Policy 2011 recognizes health as a right of citizens and advocates for equitable access to care. The government of Bangladesh (GoB) approved the Fourth Health, Nutrition and Population Sector Programme in 2017; this encompasses the health sector and has as a major goal to ensure equity and effectiveness of health, population and nutrition services to all.

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[7] *Encyclopaedia Brittanica. https://www.britannica.com/place/Bangladesh/Ethnic-groups accessed 27 September 2018*

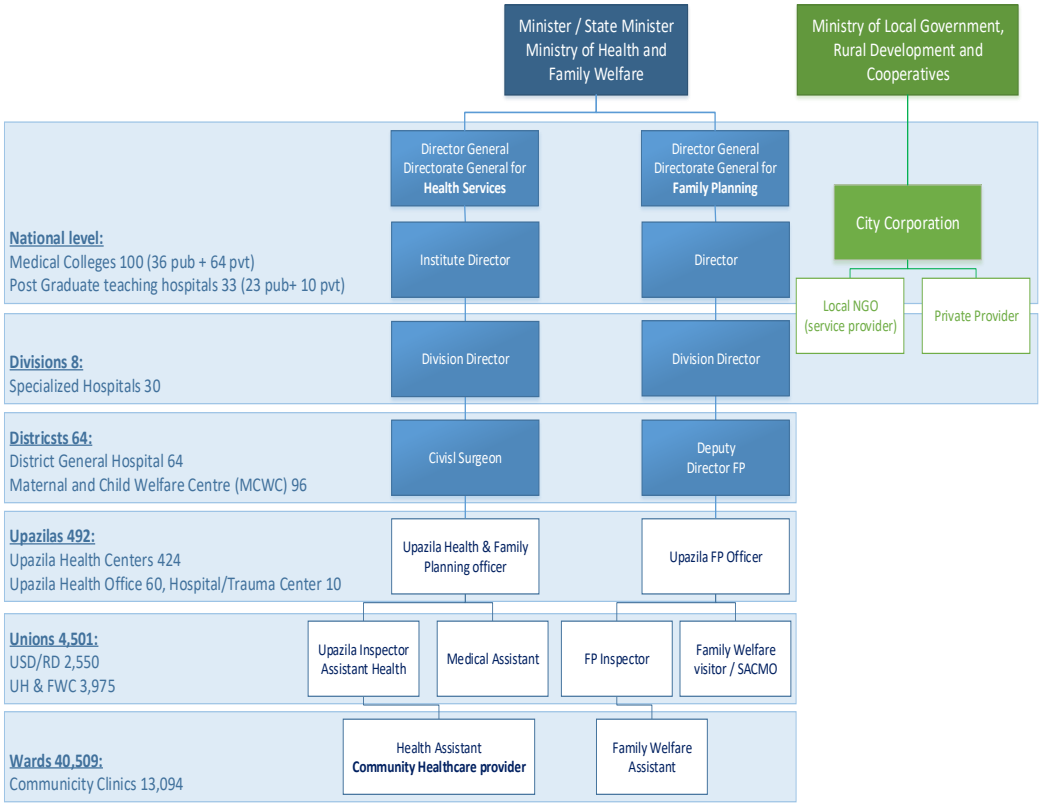
[8] *The World Bank database (online database). Washington: World Bank; 2018 http://databank.worldbank.org/data/views/reports/reportwidget.aspx?Report_Name=CountryProfile&Id=b450fd57&tbar=y&dd=y&inf=n&zm=n&country=BGD accessed 27 September 2018*

Leadership and management

The Ministry of Health and Family Welfare (MOHFW) of Bangladesh is responsible for the implementation, coordination, management and regulation of health related national health, nutrition and family planning policies, programmes and activities. This Ministry has two main Divisions: the Division of Health Services, and the Medical Education and Family Welfare Division. The MOHFW manages health and family planning service delivery through hospitals, health complexes, health and family welfare centres and community clinics with the level of services provided dictated by administrative level. In urban areas, the Ministry of Local Government, Rural Development and Cooperatives is responsible for family planning service delivery and primary health care, largely delivered through contracted non-governmental organizations (Fig. 1) Responsibility for national and sub-national implementation of the EPI sits within the Division of Health Services. Overall management of the EPI is provided by the Line Director of the Maternal Neonatal Child and Adolescent Health Services Operational Plan. Day to day management of the EPI is handled by the EPI Programme Manager who is assisted by four Deputy Programme Managers. Monitoring of the Fourth Health, Nutrition and Population Sector Programme includes a number of immunization-related indicators:

- Measles-rubella coverage among children under 12 months (target 90% by 2022),
- Percentage of children fully immunized by 12 months,
- Percentage of <1 year old children vaccinated against measles,
- Maintaining polio free status,
- Maintaining MNTE
- Proportion of women aged 15-49 years who received doses of tetanus toxoid (TT) vaccine
- Proportion of all under 1 children who received all antigens at the right time at the right interval

Figure 2. *Health service delivery facilities and administrative arrangements, Bangladesh*



Source: Government of the People's Republic of Bangladesh. Draft Comprehensive Multi-Year Plan 2018-2022 for National Immunization Programme of Bangladesh

Health care financing

Historically, Bangladesh has relied heavily on donor support for public health funding, with approximately 25% of the current budget donor funded. Since 1998, most of this donor funding has been provided through the government's Sector-Wide Approach programme (SWAp). Due to Bangladesh's increasing prosperity and the evolution of several major donors, it is expected that health-related donor funding to Bangladesh will fall in coming years. Government funding for health has increased in absolute terms, but the budget of the MOHFW as a percentage of the national budget has declined from over 6% in fiscal year 2010/2011 to 4.31% in fiscal year 2015/2016.

Service delivery

Division of responsibility within the Ministry for provision of services is described above. The provision of health services is divided by tier 1 (community level), tier 2 (union level), tier 3 (*upazila* level) and tier 4 (district level). Tier 1 services include domiciliary services, satellite clinics, EPI outreach services and community clinics. Facilities each have a designated number of staff of different types (e.g., a community clinic should be served by a community health care provider, a health assistant, and a family welfare assistant). Private and non-governmental organization associations provide a significant portion of health service delivery. However, lack of capacity for oversight and monitoring by the government of these facilities leads to a lack of regulation of the services offered.

Utilization of antenatal care (defined by at least four visits during pregnancy) has risen from 5.2% in 1993 to 19.9% in 2011, while the percentage of births attended by skilled personnel increased from 9.5% to 27.7% in the same period. Data from 2007 show that 50% of deliveries in the wealthiest population quintile had skilled attendance, while this was true of only 5% of deliveries in the poorest quintile.[9]

EPI

The EPI was launched in Bangladesh in 1979. A comprehensive multi-year plan (cMYP) for immunization covers 2018-2022, and provides an exhaustive situational analysis and in-depth planning for this five-year period, including identification of programme objectives, strategies and main activities. This plan has the following objectives and strategies:

- Improved full immunization coverage among children under one and women of childbearing age,
- Maintain polio free status,
- Maintain MNTE status,
- Elimination of measles, rubella and CRS by 2022,

[9] *World Bank. Health Equity and Financial Protection Datasheet. 2012 http://documents.worldbank.org/curated/en/532561468014461072/pdf/719370BRI0REVI0Box0377304B00PUBLIC0.pdf acccessed 27 September 2018*

- Enhance prevention of diseases protected by new and under-used vaccines,
- Sustain operation of critical immunization system components while transitioning from foreign to domestic sources of financing.[10]

In 2014, Bangladesh conducted an analysis of health care system bottlenecks, the results of which are summarized in Figure 3.

Figure 3. *Results of analysis of healthcare system bottlenecks to immunization, Bangladesh, 2014*

Interventions for Health System Strengthening through the Gavi Alliance	Health System Building Blocks						
	Leadership and Governance	Health Financing	Health Workforce	Essential Medical Products and Technologies	Health Service Delivery	Health MIS	Community Ownership and Partnership
Vaccine Introduction			*	*	*	*	*
Vaccine Security							
Service Delivery							
Surveillance							
Cold Chain and Effective Vaccine Management							
Data improvement							
*Depicted as significant because the group listed these as Major/Significant/Mild							
Not a bottleneck	**Mild Bottleneck**		**Significant Bottleneck**		**Major bottleneck**		

Source: Government of the People's Republic of Bangladesh. Draft Comprehensive Multi-Year Plan 2018-2022 for National Immunization Programme of Bangladesh

In addition to the internal analysis and planning process which is summarized in its cMYP, 2018-2022, in the past five years Bangladesh has had a series of reviews relevant to the immunization system. These include an evaluation for effective vaccine management in 2014 which resulted in a plan for effective vaccine management improvement[11] (currently being implemented), a post-introduction evaluation for PCV and IPV in 2015[12], a

[10] *Government of the People's Republic of Bangladesh. Draft Comprehensive Multi-Year Plan 2018-2022 for National Immunization Program of Bangladesh. 2018.*

[11] *cEVM 4 year Improvement Plan. Bangladesh: v4.0 (Nov 2014)*

[12] *World Health Organization Regional Office for South-East Asia. Post-Introduction Evaluation (PIE) of Pneumococcal Conjugated and Inactivated Poliomyelitis Vaccines. Report of the joint national/international mission Bangladesh, 26 November – 6 December 2015.*

Gavi, The Vaccine Alliance (Gavi) Joint Appraisal in 2016[13], and a CRS surveillance review in 2017.[14]

Bangladesh has been the recipient of a second health system strengthening grant of USD 33.9 million from Gavi for the period 2016-2019. The objectives of this grant are to:

- Strengthen VPD surveillance and its integration into the Health Management Information System.
- Improve cold chain and supply chain management system performance and programme management.

National EPI schedule

The current EPI schedule in Bangladesh is as summarized below.

Table 1. ***EPI schedule, Bangladesh, 2018***

Vaccine	Age of administration
Bacille Calmette-Guerin vaccine (BCG)	Birth
DTP-Hib-HepB*	6 weeks, 10 weeks and 14 weeks
Oral poliovirus vaccine (OPV)	6 weeks, 10 weeks and 14 weeks
Pneumococcal vaccine (PCV)	6 weeks, 10 weeks and 18 weeks
Inactivated poliovirus vaccine (IPV)	14 weeks
Measles rubella vaccine (MR)	38 weeks and 15 months
TT	Females 15 to 49 years (5 doses with an interval of + 1 month, + 6 months, + 1 year and + 1 year with preceding dose)
Vitamin A	6 to 59 months (not given through EPI)

*DTP: diphtheria-tetanus-pertussis vaccine; Hib: Haemophilus Influenzae b vaccine; Hep B: hepatitis B vaccine. These are administered as a pentavalent vaccine

Source: WHO/UNICEF JRF 2016 http://www.searo.who.int/immunization/data/bangladesh_2017.pdf. Accessed July 7 2018

[13] *Gavi, The Vaccine Alliance. Joint appraisal report. Bangladesh. 2016.*

[14] *World Health Organization Regional Office for South-East Asia. Congenital Rubella Syndrome Surveillance Review in Bangladesh, May 2017.*

EPI service delivery

Service delivery in rural areas is done through EPI outreach sites where services are provided monthly for a catchment population of approximately 1000. In theory, these vaccination services are provided by a health assistant assisted by a family welfare assistant (employees of the MOHFW). Field workers are instructed to conduct home visits prior to the day of the vaccination session both to register newborns in the EPI registration book and to invite the parents to bring the relevant children for vaccination.

Historically, medical services in urban areas were focused on secondary and tertiary care, and little was developed in terms of a primary care infrastructure. As noted above, the responsibility for providing urban primary and preventive health services rests with the city corporations and municipalities. EPI services are largely delivered through partner non-governmental organizations. In principle these non-governmental organizations have mutually exclusive catchment areas, but in practice this is not always the case. Non-governmental organizations' EPI services are generally delivered by contract workers, who are recruited against explicit professional standards but often have a high rate of turnover.

Financing of immunization programme

Financial indicators reported to WHO for years 2015, 2016 and 2017 are below.

Table 2. ***Financial indicators reported to WHO, Bangladesh, 2015-2017 (all fund amounts in US$)***

Indicator	2017	2016	2015
Are there line items in the national budget specifically for the purchase of vaccines used in routine immunizations?	Yes	Yes	Yes
Is there a line item in the national budget for the purchase of injection supplies (such as syringes, needles and safety boxes) used in routine immunization?	Yes	Yes	Yes

Indicator	2017	2016	2015
What amount of government funds are spent on vaccines?	105 350 753	115 183 6288	91 061 380
What is the total expenditure (from all sources) on vaccines used in routine immunization	30 720 038	33 735 195	24 185 517
Percentage of total expenditure on vaccines financed by government funds	29	29	27
What amount of government funds are spent on routine immunization?	90 465 662	90 663 357	79 777 258
What is the total expenditure (from all sources) on routine immunization?	24 700 000	24 500 000	19 944 101
Percentage of total expenditure on routine immunization financed by government funds?	27	27	25

Source: WHO Immunization Financing Indicators (online database) 2016. WHO. (http://www.who.int/immunization/programmes_systems/financing/data_indicators/en/ accessed 29 September 2018)

EPI is implemented within the Fourth Health, Population and Nutrition operations plan, with financing provided from the approved budget for maternal, neonatal, children and adolescent health operations plan. Although historically operations were directly funded through EPI and partners, initial plans with the 4th SWAp by the GoB were to pool external funds and use these through SWAp. However, following negotiations with the GoB, a portion of Gavi funds are channelled directly to improve EPI performance with a particular emphasis on under-served populations.

Currently, the United Nations Children's Fund (UNICEF) and WHO have identified funding for all planned aspects of EPI through 2019, following which responsibility will pass to GoB and be funded through SWAp.

EPI performance and equity

WHO and UNICEF best estimates for vaccine coverage in Bangladesh show consistently high coverage for the past five years (Table 3).

Table 3. ***WHO UNICEF estimates of vaccination coverage. Bangladesh, 2013-2017***

Vaccine*	2017	2016	2015	2014	2013
BCG	99	99	99	99	99
DTP1	99	99	99	99	98
DTP3	97	97	97	97	96
HepB3	97	97	97	97	96
Hib3	97	97	97	97	96
IPV1	13	7	47		
MCV1	94	94	94	94	91
MCV2	96	93	83	83	70
PCV3	97	97	48		
Pol3	97	97	97	97	96
RCV1	94	94	94	94	91
TT2+	97	96	98	98	96

*Vaccine acronyms as follows: BCG: Bacille Calmette-Guerin; DTP1: first dose of diphtheria-tetanus-pertussis vaccine; DTP3: third dose of diphtheria-tetanus-pertussis vaccine; Hib 3: third dose of Haemophilus influenzae b vaccine; IPV1: first dose of inactivated poliovirus vaccine; MCV1: first dose of measles containing vaccine; MCV2: second dose of measles containing vaccine; PCV3: third dose of pneumococcal vaccine; Pol3: third dose of poliovirus vaccine; RCV1: first dose of rubella-containing vaccine; TT2+: second or higher dose of tetanus toxoid.

Source: WHO Vaccine-Preventable Diseases: Monitoring System. 2017 Global Summary (online data base). Data in black are WHO-UNICEF estimates; data in blue are official country estimates (no WHO-UNICEF estimates available)
http://apps.who.int/immunization_monitoring/globalsummary/countries?countrycriteria%5Bcountry%5D%5B%5D=BGD (accessed 219 September 2018)

Data from WHO show reasonable equity in immunization coverage, as demonstrated in the table below.

Table 4. ***Immunization equity, Bangladesh, 2013 -2017***

	2017	2016	2015	2014	2013
Total number of districts in country	64	64	64	64	64
Number of districts with DTP3* coverage > 80%	64	64	64	64	63
% of districts with DTP3 coverage > 80%	100	100	100	100	98
Number of districts with MCV1** coverage > 95%	62	63	64	49	49
% of districts with MCV1 coverage > 95%	97	98	100	77	77

* DTP3: third dose of diphtheria-tetanus-pertussis vaccine

** MCV1: first dose of measles containing vaccine

Source: WHO vaccine-preventable diseases: monitoring system. 2018 global summary. Available at http://apps.who.int/immunization_monitoring/globalsummary/countries?countrycriteria%5Bcountry%5D%5B%5D=BGD accessed July 7 2018.

Despite these data, unpublished data from the Coverage Evaluation Survey (CES) 2016[15] show greater inequities. According to this survey, although equity of immunization services improved from 2014–2016, in 2016 27 (42.2%) of 64 districts achieved coverage with the third dose of diphtheria-tetanus-pertussis vaccine (DTP3)of 90% or more. Differences in coverage between districts are marked: in the case of the first dose of measles containing vaccine (MCV1), the highest district coverage was 96.5% and the lowest 74.7%,. The percentage of fully vaccinated children in a district varied from a high of 92.6% to a low of 68.4%. There is also a significant urban/rural split with full vaccination of children in urban areas (77.1%) below that in rural areas (83.5%). Urban areas in Dhaka City Cooperation North and South have the lowest performance in the country, with fully vaccinated child coverage of 67-68%, although the coverage survey showed no real difference between slum and non-slum areas. Reasons identified through the CES 2016 for low coverage in urban areas were

- Mothers too busy (17%),

[15] *Expanded Programme on Immunization (EPI). Directorate General of Health Services (DGHS). Bangladesh EPI Coverage Evaluation Survey 2016*

- Lack of information about vaccination of subsequent doses (14%),
- Sickness of child at time of vaccination (16%).[16]

Pockets of under- and unimmunized children are also found in geographically hard to reach areas. These areas are concentrated in Sylhet and Chittagong. Indigenous groups living in the Chittagong Hill Tracts are of particular concern with regard to access to health services, including immunizations. Three key bottlenecks in these areas identified through an EQUIST[17] analysis are:

- Geographical accessibility,
- Financial affordability,
- Sociocultural acceptability.

The conclusion of this analysis was that human resource and sociocultural gaps need to be addressed to increase immunization coverage in these areas.

There are no significant gender inequities between male and female children at national or sub-national level, while the gap in MCV1 coverage according to the CES between richest and poorest quintile in 2016 was .2 percentage points (86.6% as opposed to 86.8%). According to the Demographic Health Survey, in 2014 the poorest quintile had a MCV1 coverage of 73.4% while the wealthiest quintile had coverage of 93.6%.

VPD surveillance

Several surveillance systems currently exist in Bangladesh.

- Notification and reporting of acute flaccid paralysis (AFP) and VPD in public hospitals and 787 public health facilities:
  - Passive reporting (including ZERO) reporting on a weekly basis,

[16] *Expanded Programme on Immunization (EPI). Directorate General of Health Services (DGHS). Bangladesh EPI Coverage Evaluation Survey 2016*
[17] *For a further description of EQUIST, see http://www.equist.info/*

- Active case searches for AFP, NT, measles and CRS from 162 selected facilities on a weekly basis,
- EPI disease reporting is conducted on a monthly basis, as well as through the Health Management Information System.

Surveillance is supported by the national laboratory, which is accredited by WHO.

Status of VPDs

VPDs reported to WHO for 2013-2017 are summarized below.

Table 5. ***Vaccine Preventable Diseases Reported to WHO, 2013 – 2016***

Disease	2017	2016	2015	2014	2013
Diphtheria	4	2	6	13	2
JE	1548	1294	76	183	23
Measles	3594	972	240	289	237
Mumps	-	-	-	-	-
Pertussis	-	1	11	12	1
Polio	0	0	0	0	0
Rubella	299	165	189	381	3034
CRS	146	87	89	66	19
NT	95	110	117	-	108
Tetanus (total)	352	441	559	-	508

Source: WHO vaccine-preventable diseases: monitoring system. 2018 global summary. Available at http://apps.who.int/immunization_monitoring/globalsummary/countries?countrycriteria%5Bcountry%5D%5B%5D=BGD

3. Review Objectives

After desk review of relevant data and consultation with the GoB and the WHO Country and Regional Offices, and in consideration of the other evaluations that have been conducted in the relatively recent past as well as

the objectives of the SEAR Vaccine Action Plan and the detailed analysis of the cMYP 2018-2022, the following areas of focus for the review were agreed upon:

- Government support to immunization with emphasis on the following areas:
  - Advisory and oversight bodies (composition and functioning),
  - Advocacy and communications activities/strategies,
  - The status of human resources, including capacity, numbers, training and retention,
- Ways in which equity of immunization coverage can be further promoted, with particular emphasis on the urban poor,
- Examination of the current factors affecting data quality, with particular attention to denominators, and recommendations as to how data quality can be improved,
- Whether or not the country is on track to reach or maintain elimination or control of targeted diseases in terms of vaccination policy and surveillance at national and district levels. The relevant diseases are:
  - Polio,
  - Measles and rubella,
  - Maternal tetanus and NT ,
  - Hepatitis B,
  - JE,
- Whether laboratory – supported VPD surveillance is adequate to detect outbreaks and support verification of elimination and control targets at both national and district levels,
- The process for and experience with introduction of new vaccines.

4. Methodology

The MOHFW, the WHO Regional Office for South-East Asia and the WHO Country Office collaborated to assemble a review team of Bangladeshi nationals and internationals, including representatives from WHO headquarters and Regional offices, UNICEF, the US Centers for Disease Control and Prevention and Gavi (Annex 1) and a representative of the SEAR Immunization Technical Advisory Group. The team addressed the core questions through a desk review of relevant policies and guidelines; secondary analysis of available data; interviews with key stakeholders, policy makers, and programme staff; visits to hospitals and direct observation of programme implementation at field sites in Bangladesh.

During 29 July–03 August 2018, nine joint field teams, most with one international staff, one or more Bangladeshi staff from the national level, and varying numbers of Bangladeshi staff from division or district health services conducted field visits as well as reviewing national functions.

In consultation with the WHO Regional Office, the GoB and the WHO Country Office selected the areas and the facilities for site visits. These sites included urban and rural locations, areas with high and areas with low coverage, hard to reach areas, and areas with recent outbreaks of VPDs, in addition to primary, secondary and tertiary health care facilities.

Upon returning to Dhaka, the field teams presented their findings and assessments relative to the core topic areas to each other through extensive discussions on 4-5 August. The consensus conclusions and recommendations were shared on 6 August at a forum attended by government public health programme directors and policy makers from the national levels as well as other key stakeholders.

5. Limitations

A two-week review can only reveal a relatively limited view of a country's EPI. Sites visited may not be fully representative of all immunization sites. In such a short period of time, international reviewers cannot hope to fully appreciate the subtleties of Bangladesh's approach to public health and immunization. In addition, specific topics may require more analysis than is possible being given the breadth of the review. Nonetheless, such a review

can provide assistance in identifying programme gaps, bring new perspectives and experience from other settings, and identifying topics that merit more in-depth follow up.

6. Findings and Key Recommendations by Topic Area

6.1 General

EPI has been a flagship programme in Bangladesh's primary care system. According to WHO-UNICEF estimates, at national level the programme has succeeded in maintaining coverage for many antigens over 95% for the past five years. Coverage for PCV, a vaccine introduced in 2015, has risen from 48% to 97% in only three years. Coverage for the second dose of measles-containing vaccine has risen from 83% in 2015 to 96% in 2017.[18] In August 2018, Bangladesh was among the first six countries in the SEAR considered to have controlled rubella and CRS.[19] Nonetheless, in order to maintain excellence and continue to improve, the programme must confront a number of challenges. Financially, it remains heavily dependent on external funding, but has now entered the preparatory transition phase for funding from Gavi and is projected to enter accelerated transition in 2021; it will need to fully fund its EPI vaccines as of 2026. Frontline staff is overburdened in the face of sanctioned but vacant posts; while programme leadership has experienced high turnover and does not always have the experience or qualifications which would be optimal for the position. Raising coverage among the urban poor to that seen elsewhere in the country will require new approaches and commitment. Uncertainties around target population sizes present difficulties in terms of calculation of administrative coverage and ordering of vaccines. Despite successes in

[18] *WHO Vaccine-Preventable Diseases: Monitoring System. 2017 Global Summary (online data base). Data in black are WHO-UNICEF estimates; data in blue are official country estimates (no WHO-UNICEF estimates available)* http://apps.who.int/immunization_monitoring/globalsummary/countries?countrycriteria%5Bcountry%5D%5B%5D=BGD *(accessed 219 September 2018)*

[19] *WHO Regional Office for South-East Asia. DPR Korea, Timor-Leste eliminate measles, six countries in WHO South-East Asia achieve rubella control. SEAR/PR/1693.* http://www.searo.who.int/mediacentre/releases/2018/1693/en/ *accessed 3 October 2018.*

rubella control, it is unlikely that the 2020 measles elimination target will be met. Review findings and key recommendations are outlined below.

6.2 Government support

Background

Government support is critical to a well functioning immunization system. Government support includes high level advocacy for the programme; dedicated and adequate funding; strong governance and policies; vaccine licensing, procurement and management; demand generation; and support for service delivery. Because health financing and EPI costs are extensively reviewed in the draft cMYP and is a focus of Gavi Joint Assessments, this area was not focused on during the review and no relevant recommendations were made. However, as the country's health care financing picture is critical to the EPI, an overview is given below.

Findings

Health financing and expenditures and costs of the EPI

In 2014, Bangladesh's total health expenditure was 2.82% of gross domestic product, of which private health expenditures made up 72%. Total health expenditure per capita was USD 31, up from USD 20 in 2009. Although the government allocation to health has increased in absolute terms in recent years, the percentage of General Government Expenditures represented by the General Government Health Expenditure declined between 2009 and 2014 from 7.8% to 5.7%. Total health expenditure as a percentage of gross domestic product and total health expenditure per capita are between two other countries in the Region at a similar income level[20...21] Health financing is very relevant to the overall financing of the immunization programme.

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[20] *In Nepal THE for 2014 represented 6% of GDP and had a per capita value of US$ 40; In 2014, Myanmar's THE was 2% of GDP, and THE per capita was US$ 20.*

[21] *Global Health Expenditures. NHA Indicators. On line database. WHO. (http://apps.who.int/nha/database/ViewData/Indicators/en, accessed October 2018*

Costs and financing of EPI

Projected total costs for Bangladesh's national immunization programme, including the EPI portion of the shared health costs, for the period 2018–2022, are summarized in Table 6. As a point of comparison, this table includes expenditures for 2016.

Table 6. ***National immunization programme costs summary by system components and years – basic scenario – historical (2016) and projected 2018-2022). Bangladesh***

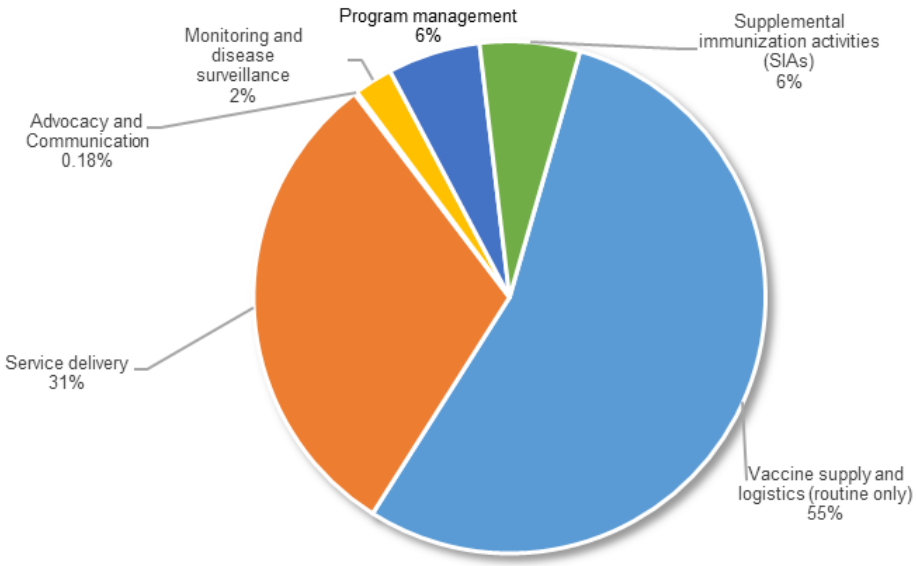
Immunization system components	Expenditures	Future resource requirements					
	2016	2018	2019	2020	2021	2022	Total 2018 - 2022
Vaccine supply and logistics (routine only)	95,253,945	80,784,584	96,077,357	88,223,877	86,361,461	86,616,071	**438,063,351**
Service delivery	48,712,080	49,061,131	49,353,840	49,378,160	49,214,883	49,227,638	**246,235,651**
Advocacy and Communication	225,786	115,466	390,500	314,085	259,085	384,085	**1,463,221**
Monitoring and disease surveillance	2,786,287	6,813,930	3,033,181	3,262,367	3,094,472	3,371,787	**19,575,737**
Program management	3,276,922	10,537,634	10,535,602	5,537,407	10,168,583	10,298,235	**47,077,460**
Supplemental immunization activities (SIAs)	0	24,704,682	0	0	0	26,073,567	**50,778,249**
Total immunization Immunization costs	**150,255,020**	**172,017,428**	**159,390,480**	**146,715,895**	**149,098,484**	**175,971,383**	**803,193,670**
Shared Health Systems Costs (EPI Portion)	93,095,290	93,098,934	93,102,650	93,106,440	93,110,306	93,114,250	**465,532,579**
Total immunization resource requirements	**243,350,310**	**265,116,361**	**252,493,130**	**239,822,335**	**242,208,790**	**269,085,633**	**1,268,726,249**

Source: Government of the People's Republic of Bangladesh. Draft Comprehensive Multi-Year Plan 2018-2022 for National Immunization Programme of Bangladesh

The anticipated allocation of these costs over the 2018-2022 period is summarized in Figure 4. Major cost drivers are vaccine supply and logistics for the routine immunization programme, as well as service delivery. More detailed projections are available in the draft cMYP 2018-2022.[22]

[22] Government of the People's Republic of Bangladesh. Comprehensive Multi-Year Plan 2018-2022 for National Immunization Program of Bangladesh

Figure 4. *Allocation of future resource requirements (shared costs excluded), national immunization programme, Bangladesh 2018-2022.*



Source: Government of the People's Republic of Bangladesh. Draft Comprehensive Multi-Year Plan 2018-2022 for National Immunization Programme of Bangladesh

When shared costs are included, the GoB is expected to bear the majority (65%) of costs, as portrayed in Figure 5, with Gavi contributing 34% of costs. Of total costs, 85% are secured. Gavi's contribution is expected to be channelled in the following ways (all figures inclusive of shared costs):

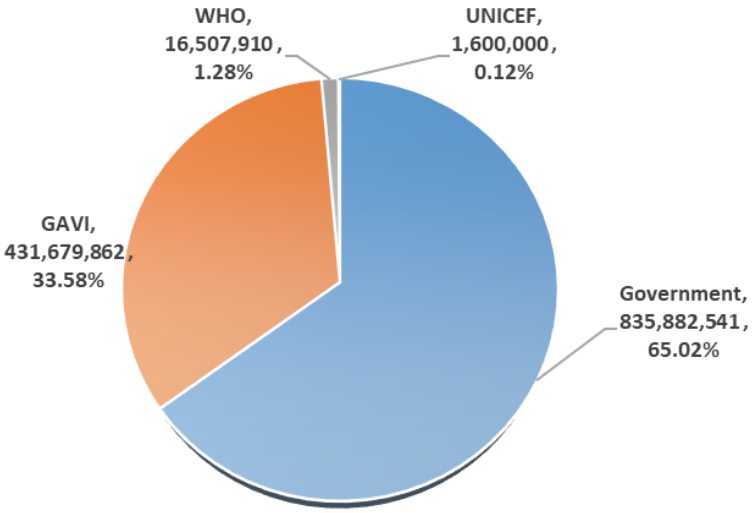
- New vaccine support (27%),
- Health system strengthening, second grant (1.3%),
- Health system strengthening 3 cash support (4%), channelled through direct project aid. This includes funding for the Cold Chain Equipment Optimization Platform,

In addition, the health system strengthening 3 cash support grant will contribute approximately USD 50 million to be channelled through SWAp.

Major concerns related to future financing that are articulated in the draft cMYP 2018-2022 are:

- Historic reliance on partner agencies for funding of the nationwide surveillance system,
- Anticipated phase-out of development partners from the country associated with changing strategic priorities of these partners,
- Cumbersome GoB bureaucracy limiting rapid response to challenges,
- Complex bureaucratic mechanisms to initiate and sustain substantial structural change,
- Limited health care budget and fiscal space in the central budget for allocating additional funds to EPI,
- High operational costs of the EPI due to heavy reliance on outreach services, high cost of vaccines and expensive infrastructure.

Figure 5. *Distribution of programme costs, shared costs included, secured and probable funds. National immunization programme. Bangladesh. 2018-2022*



Source: UNICEF Country Office

Policy and governance

Bangladesh's EPI operates within a policy and legislative framework established by the Government Vision 2021, the 7th Five Year (Government Perspective) Plan, the National Health Policy 2011, the

National Population Policy 2012 and the National Nutritional Policy 2015. The National Health Policy 2011 recognizes citizens' right to health and advocates for equitable access to health care. These documents have been foundational in developing The Health, Nutrition and Population Sector Programme 2017-2022, the main goal of which is to ensure equity and effectiveness in delivery of services, with the eventual goal of universal health care. Implementation plans include a sector investment plan which includes improving equitable access to and utilization of health services as an objective, a sector programme implementation plan (which includes EPI as a content of the Essential Package of Services, as well as financial sustainability of EPI as a priority intervention), and the Maternal, Neonatal, Child and Adolescent Health Operational Plan which includes seven detailed EPI objectives.

National Oversight and Advisory Bodies

National oversight and advisory bodies include the National Committee on Immunization Practices (NCIP), the National Committee for the Certification of Polio Eradication (NCCPE), the National Polio Expert Review Committee, National Polio Laboratory Containment Committee, the (National Verification Committee (NVC) (for measles and rubella/CRS elimination), and the National Adverse Event Following Immunization (AEFI) Expert Review Committee. Of these, the NCIP, NCCPE, and NVC were assessed while the functioning of the National AEFI Expert Review Committee was considered in the context of the AEFI surveillance overall.

National immunization technical advisory group (NITAG)

National immunization technical advisory groups play a critical role in providing "independent, evidence-informed advice to health authorities on all policy-related issues for all vaccines across all populations".[23] Minimum criteria for functionality are[24]:

[23] *WHO. SAGE April 2017 National Immunization Technical Advisory Groups Background Paper.pp 3 http://www.who.int/immunization/sage/meetings/2017/april/1_NITAGs_background_document_SAGE_April_2017.pdf accessed 4 October 2018.*

[24] *WHO. SAGE April 2017 National Immunization Technical Advisory Groups Background Paper. http://www.who.int/immunization/sage/meetings/2017/april/1_NITAGs_background_document_SAGE_April_2017.pdf accessed 4 October 2018.*

- Legislative or administrative basis for the advisory group,
- Formal written terms of reference,
- At least five different areas of expertise represented among core members,
- At least one meeting per year,
- Circulation of the agenda and background documents at least one week prior to meetings, and
- Mandatory disclosure of any conflict of interest.

The 2018 SEAR Immunization Technical Advisory Group also made the following specific recommendations for NITAGs:

- The composition of NITAGs should be reviewed to ensure their independent advisory and monitoring role,
- WHO should continue to build the capacity of NITAGs, including considering an orientation workshop for NITAGs,
- The NITAGs should intensively monitor the achievements of goals of the SEAR Vaccine Action Plan and progress against recommendations of the SEAR Immunization Technical Advisory Group.
- NITAGs should continue to share their findings with national programmes and policy makers for appropriate actions; and monitor follow-up actions being taken.
- NITAGs should continue to report to the SEAR Immunization Technical Advisory Group on an annual basis

Bangladesh's NCIP functions as its NITAG under the umbrella of Memo Public health-2/EPI-4/regulations/2008/225. It has formal written terms of reference, but these are general in nature. Currently it has more than 30 members which encompass at least five areas of expertise, and is chaired by the Secretary, MOHFW. It meets at the request of the EPI to take decisions about introduction of vaccines (primarily handled by a scientific sub-group), or to provide recommendations on a specifically requested topic but does not have routine meetings scheduled. It is not routinely involved in monitoring or providing ongoing advice to the EPI,

including monitoring of progress toward SEAR goals or SEAR Immunization Technical Advisory Group recommendations. Meeting agendas and materials are not routinely shared with NITAG members at least one week prior to meetings. No formal process to ascertain conflicts of interest exists.

In summary, although the NCIP has provided valuable guidance to the EPI in Bangladesh, it is no longer completely aligned with current indicators of minimum functionality or with the recent SEAR Immunization Technical Advisory Group recommendations.

NVC

The Guidelines on Verification of Measles Elimination and Rubella/Congenital Rubella Syndrome Control in the WHO South-East Asia Region outline the terms of reference of the NVC. These are to:

- Advise the Ministry of Health, National Immunization Programme and VPD Surveillance Programme on requirements for verification,
- Compile and review information to monitor progress,
- Conduct field visits,
- Supervise and guide development of the annual report,
- Review and validate the validation report, and
- Provide programmatic guidance consistent with verification criteria and lines of evidence.

The NVC was formed in 2016 and has 10 members, selected to ensure a range of experience. Meetings have historically been held annually to prepare the report for the Regional Verification Committee. To date, the NVC has not conducted field visits nor been involved in providing programmatic guidance. However, the new chairperson intends to increase the frequency of meetings, conduct site visits, and promote the provision of programmatic guidance from the NVC to the immunization programme; with these activities (as well as the review and validation of the validation report) the NVC will fulfil the terms of reference set forth in the verification guidelines.

NCCPE

The SEAR Vaccine Action Plan 2016-2020 outlines key indicators for maintaining polio free status in the Region. One of these is quarterly oversight meetings held by the NCCPE.[25]

The NCCPE comprises 9 members, two of whom are government officials. The chairperson was appointed 8 months prior to the review, and the terms of reference have recently been rewritten. There is routine interaction with the national polio programme, as well as with other oversight and advisory bodies. Frequency of meetings has been less than quarterly.

Conclusions

The EPI in Bangladesh is underpinned by a strong policy and legislative framework. The NCIP, NCCPE and NVC have all played valuable roles in moving the programme forward. However, the NCIP is no longer fully aligned with minimum standards of functionality or with current SEAR-Immunization Technical Advisory Group recommendations. The NCCPE does not yet fulfil the SEAR Vaccine Action Plan indicator of conducting quarterly meetings. The activities of the NVC under the new chairman are being reconfigured to align with the terms of reference outlined in the verification guidelines.

National Regulatory Authority (NRA)

Bangladesh's NRA was not included in this review. However, its status is relevant to the review as the agency has not yet been approved as functional by WHO. As a result, the numerous vaccines produced in Bangladesh are not prequalified for purchase by UNICEF. With the transition of Bangladesh's immunization system to domestic support and the introduction of new vaccines, prequalification of vaccines produced in Bangladesh may become increasingly helpful.

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[25] *World Health Organization. Region al Office for South-East Asia. South-East Asia Regional Vaccine Action Plan 2016-2020. http://www.searo.who.int/indonesia/topics/immunization/south_east_asia_regional_vaccine_action_plan_2016_2020.pdf*

Vaccine licensing, procurement, and management

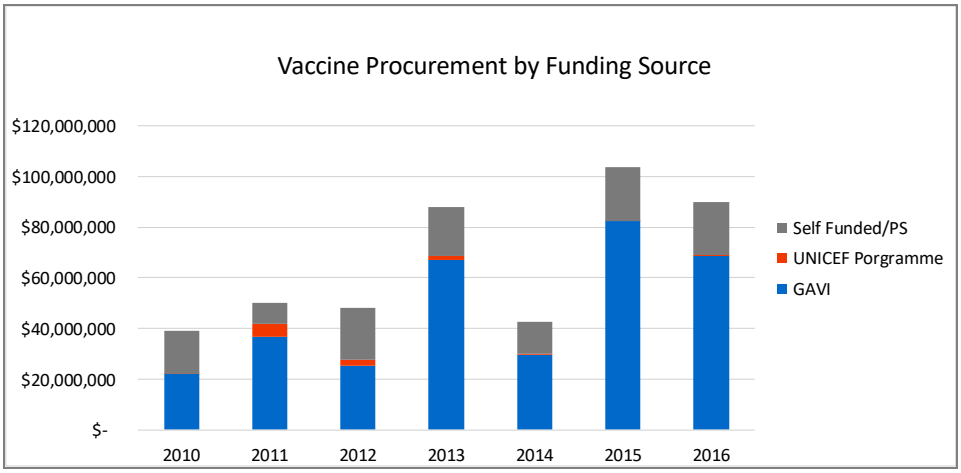
Vaccine licensing

EPI vaccines are purchased through UNICEF and, as such, are prequalified. Prequalified vaccines are given a waiver by the NRA and do not require licensing in Bangladesh.

Vaccine procurement and funding

All EPI vaccines, regardless of funding source, are procured through UNICEF. The allocation of donor funding by year is described in Figure 6.

Figure 6. *Vaccine procurement by funding source*



Source: UNICEF Country Office, Bangladesh

Historically, Gavi funding has been used to procure devices, etc. necessary for vaccine administration. At the time of the review, allocation and channelling of funding for devices, particularly auto-disable syringes, remained under discussion.

Immunization supply chain

The MOHFW, with support from UNICEF, conducted an effective vaccine management assessment in 2014. The aggregate performance of the country in this assessment was 82%, 10% higher than the norm. In response to the findings of this assessment a comprehensive effective vaccine

management improvement plan was developed through a consultative process and is in the process of implementation. Major components of this plan are:

- The management framework required to ensure timely implementation and monitoring of progress,
- Material needs to address the needs of immunization supply chain system expansion, innovation and obsolescence,
- Physical and transport infrastructure improvements,
- Financial and operational measures to ensure sustainability, including human resource and capacity building,
- Information management, to ensure timely and accurate flow of critical information and to respond to monitoring and evaluation indicators, and
- Synergies with the cMYP, health system strengthening, etc. [26]

Due to the extensive work done in this area already, the review team did not include cold chain review in field visits; however the central team visited the central cold store. Current central cold store is inadequate to accommodate the new vaccines foreseen for introduction. The location and funding for a large central cold store have been secured, but reportedly building approval delays have resulted in delays in building.

Conclusions

The country's current vaccine licensing, procurement and storage systems meet the country's immediate needs. A comprehensive effective vaccine management improvement plan is being implemented to ensure cold chain is adequate for future needs.

[26] *The Government of Bangladesh. cEVM 4 year Improvement Plan. Bangladesh: v 4.0 (Nov 2014)*

Demand generation

Background

Demand generation plays an important role in ensuring high vaccination coverage among target populations. This topic was reviewed largely due to concerns raised by the results of the CES 2016 regarding lack of knowledge by some caregivers regarding immunization.

National level

Social and Behaviour Change Communication (SBCC) for EPI sits under the umbrella of the SBCC Strategy 2016, developed by the MOHFW in 2016 to ensure a research based, consultative communication process to improve health outcomes. A facilitating factor for SBCC in Bangladesh is high media coverage. The National Media Survey of 2015 found that 80% of the population could be reached through media, whether television, radio, community radio or print. In addition, cell phone coverage is high (151 million users) as is internet use (87.8 users). [27]

Despite the existence of the SBCC Strategy 2016, there has not been a comprehensive EPI-focused communication and SBCC strategy or capacity building in the recent past. This lack of emphasis is reflected in the EPI budget, only 1% of which was spent on demand generation over the past 5 years.

Despite the overall high vaccination coverage achieved among children in Bangladesh, the CES 2016 found that among children surveyed, 1% had never been vaccinated and 5% had been only partially vaccinated. Reasons cited by caregivers for never vaccination included fear of side effects (18.2%), lack of awareness of vaccination services (14%), and lack of belief in vaccination (10.4%). Reasons cited for partial vaccination included lack of awareness of MCV1 (15.2%), lack of awareness of the need for the second or third dose of pentavalent vaccine (4.2%), and fear of side effects (9%). Evaluation of the 2016 measles and rubella campaign showed that, among caregivers of children who were not vaccinated, 17% were unaware

[27] *Please visit website of Bangladesh Telecommunication Regulatory Commission for further information at* http://www.btrc.gov.bd/content/mobile-phone-subscribers-bangladesh-june-2018

of the campaign.[28] These results demonstrate that, despite overall high acceptance of vaccines by the population, there remains work to be done in terms of demand generation.

Field level

A series of open ended questions related to SBCC was developed to gather first hand information and inform recommendations for SBCC. Teams noted how dedicated leaders and field staff helped to generate demand, despite having no specific training in SBCC. Teams also observed the use of innovative communication methods to generate demand, including the use of social media, the participation of the local imam and tracking the vaccination of children through specific cell phone apps. In one setting, a dialogue with factory owners on the cost-effectiveness of vaccination resulted in allowing mothers to access EPI services during working hours. In Chittagong, the involvement of indigenous leaders in promoting vaccination was noteworthy.

Field teams also observed inadequate pre- and post-vaccination counselling in some settings, which may be partially explained by shortages of EPI staff. No government sponsored SBCC trainings were reported to have been organized either for frontline or for EPI managers, although several civil society organizations had organized customized behaviour change communication trainings at least once as part of staff orientation to a new organization. Communication campaigns targeting hard to reach, too high to reach, floating and socially excluded groups remain limited, and no designated or dedicated staff for demand generation at field level was identified. EPI service points and rooms were not decorated in a standardized way, and many materials seemed cluttered with too many messages. In addition, EPI materials were not "branded" in a way which allowed them to be easily identifiable as being EPI specific.

[28] *Uddin et al. BMC Infectious Diseases (2016), Evaluation of impact of measles rubella campaign on vaccination coverage and routine immunization services in Bangladesh.*

Figure 7. *Example of cluttered poster*

Finally, participation from elected representatives at lower levels remained largely ceremonial, for example limited to the launching of a vaccination campaign, despite high commitment from national leadership. After the events, political leaders disengaged themselves from the subsequent campaign and monitoring activities.

When asked about the most effective way to motivate caregivers to bring children for vaccination, respondents indicated interpersonal communication (for example, face to face and community meetings).

Conclusions

Despite high vaccination coverage among children in Bangladesh, survey results and field observations support a need for more demand generation.

Human resources

Background

Any EPI needs to be adequately staffed with skilled human resources to meet programme objectives and goals. The EPI Review-2014, cMYP 2014-2018 and draft cMYP 2018-2022 recognize that filling vacant positions of field workers, including supervisors, and providing appropriate in-service training for all EPI staff, including mid-level managers, are persistent challenges being faced by the programme.

National level

At the central level, vacancies against sanctioned posts were few (Annex 1). The staff at the national laboratories had good retention. Overall, the staff at the central level was found to be a highly trained resource pool.

The review noted a high turnover in some leadership positions. A reliance on external consultants and development partners was observed, for example, VPD surveillance, health management information systems and the development and implementation of the district health information system (DHIS-2). The training programmes for human resources are dependent upon donor funding and support during implementation.

Field Level

The major strength of EPI in Bangladesh is the rural health infrastructure with the health assistant and family welfare assistant as the main asset for service delivery in rural areas and vaccinator from non-governmental organizations in urban areas.

A long-standing challenge faced by the EPI is the insufficient number and inadequate distribution of health service providers across the country. There is an overall shortage of nearly 20% health workers against the sanctioned positions. There has been no recruitment of field staff since 2011-2012 due to a freeze on new hiring by the legal authority. The details of the various filled/vacant positions are shown in Annex 2. Vacancies against key field staff are as follows: health assistant - 23%; Assistant Health Inspector - 15%; Health Inspector - 57%; Statistician - 33%.

The draft cMYP 2018-2022 has analyzed the situation and shown that the shortages of health manpower would substantially worsen if norms for sanctioning various positions were applied against adjusted population in 2015 (Table 15).

Table 7: ***Sanctioned posts and estimates of adjusted sanctioned posts***

#	Health Workforce Category posted at Primary Level	Current Sanctioned Posts	Estimated Adjusted Sanctioned Posts *
1	Health assistant	20,877	40,083
2	Assistant health inspector	4,205	9,100
3	Health inspector	1,399	2,275
4	Family practice inspector	4,500	4,550
5	Family welfare assistant	23,500	40,950
6	Community health care practitioners	13,861	26,722
7	SACMO*	7,811	11,994
8	Midwife	1,200	5,612

*sub-assistant community medical officer

Source: Government of Bangladesh. Draft cMYP 2018-2022

Observations and data collected

The review commended the health work force including mid-level managers, medical technologists, EPI and other field staff at various levels for their dedication, which has resulted in high overall EPI coverage in most districts.

The field observations confirmed the desk review findings. There were a high number of vacant posts especially of health assistants with variations across the *upazilas*. The requirement of having three health workers at an EPI session was often not being met in rural areas due to staff shortages. Multiple responsibilities for health assistants such as devoting three days each week to community clinics left them with insufficient time for mobilization of the population for vaccination. In the urban areas where EPI services are provided through non-governmental organizations, the front-line service providers did not have appropriate qualifications.

Supervisors for EPI such as the assistant health inspector and the health inspector filled in for the health assistants to ensure EPI sessions took place despite staff shortages. This in turn affected supervision of EPI

activities. High turnover of staff in managerial positions under the government and among health workers deployed by non-governmental organizations in urban areas was observed.

In the urban city corporation areas, a shortage of non-governmental organization supervisors and vaccinators coupled with high turnover led to inadequate provision of routine services and work overload. Vacancies of medical officers at *upazila* health centres coupled with the need to provide curative services additionally affected supervision. Medical officer vacancies at tertiary care hospitals have made VPD surveillance dependent on the surveillance and immunization medical officer (SIMO) network. Surveillance and immunization medical officers (SIMOs) were observed to be the backbone of VPD surveillance. The SIMO network partially compensates for the weak supervision that exists and plays a pivotal role in on the job and other trainings.

The reviewers noted that the programme does not have a plan for regular refresher training on basic aspects of EPI, surveillance, or data analysis and use.

Best Practices

The following best practices were appreciated by the review:

- Rajshahi City Corporation stood out for employing dedicated staff for EPI, leading to improved EPI coverage which has been sustained,
- Adequate time allotted for a comprehensive training to health workers on different programmatic aspects during new vaccine introductions,
- Monthly meetings at *upazila* and district are being used to address identified programme gaps.

Conclusions

The key human resource related finding from the review was the persisting high number of field worker and supervisor vacancies under EPI due to no recruitments taking place over the last 5-6 years. Other important findings were:

- City corporations do not have dedicated manpower and depend on non-governmental organizations. Manpower shortages and high turnover affect both the quality of immunization services and the vaccination coverage achieved in urban areas,
- In addition to health worker vacancies, the sanctioned posts were inadequate considering present population size,
- High staff turnover was observed in managerial positions, and
- There was incomplete orientation and re-training of staff.

Urban immunization

Background

Bangladesh currently faces a number of challenges with regard to urban immunization. The CES 2016 demonstrates inequity in urban (77.1%) and rural (83.5%) fully-immunized child coverage. Of 11 city corporations, seven (64%) have fully immunized child coverage less than 80%. Thirty-three percent of Bangladesh's population (53 million) is urban; this is projected to grow to 50% by 2028 (that is to say, approximately 80 million). At present, EPI services are offered through a complex institutional set-up. Due to the absence of sufficient quality of permanent health workforce/infrastructure, most primary health care is provided through internationally funded, contracted non-governmental organizations. The Ministry of Local Government, Rural Development Co-operatives and City Corporations is responsible for urban health services while the MOHFW is responsible for vaccines and supplies; this results in supply-side constraints and service rationing. There are 11 city corporations and 310 municipalities (2015) with diverse local challenges. As outlined above, there is a shortage of human resources with 20% post vacancies. In addition, the skills of front-line service providers and mid-level managers are inadequate; 84% of the urban population depends on private, informal providers with no professional training. Finally, training programmes and the VPD surveillance network are largely dependent on external funding.

The Urban Immunization Strategy was developed in 2014 and 2015 after literature review and consultations with Chief Health Officers in two Dhaka City Corporations, development and United Nations agencies, non-governmental organizations, and the MOHFW, and the Ministry of Local

Government, Rural Development Co-operatives and City Corporations. The goal of the Urban Immunization Strategy (which has not yet been endorsed) is: "a revitalized urban health care system that is capable of providing quality, equitable immunization and related health care services to the urban population in a sustainable manner". The Urban Immunization Strategy goal is to be accomplished through annual plans of action developed with stakeholder input in each urban jurisdiction in the strategic areas of: (1) governance, innovations, and sustainability; (2) systems development; (3) demand side strategy; and (4) service delivery. It is to be adapted to the local context/needs and adapted through the development of annual action plans in each local area. Micro plans from below ward level should be incorporated into larger plans at zonal and municipal levels to ensure adequate resources are mobilized to reach hard to reach populations.[29]

National level

The GoB recognizes the challenges of urban poor and hard to reach (HTR) populations. The 4th Health, Population and Nutrition Sector Programme includes plans to reach the urban poor and HTR populations.

Good cooperation exists between city corporations, non-governmental organizations and SIMOs. Pragmatic approaches have been developed to solve programme weaknesses.

Despite these strengths, the current system contends with a number of weaknesses. These include:

- A complex institutional set-up, as described above. Non-governmental organization contracts have expired with no payment of staff since March 2018.
- No dedicated infrastructure or staff of city corporations for EPI or basic health.
- Micro plans not costed; unclear need of actual EPI operational costs.

[29] *Urban Immunisation Strategy Bangladesh. Draft 3 Feb 9th 2015. (Document for review and revision).*

- 20% staff vacancies, which impacts the ability to conduct EPI best-practices.
- Lack of clear understanding of target population numbers hamper target setting and monitoring.
- No ongoing disaggregated data analysis (only CES).
- No health care worker vaccination requirements, no school immunization policies, and immunization is not provided free of charge in children aged 2 years or more.

Field level

At the field level, the urban poor and HTR populations are identified in micro plans. City corporations plan late evening immunization sessions. Urban non-governmental organizations are implementing programmes in slum locations, which ensures maximum EPI coverage. There exists a HTR-specific vaccine distribution plan for monsoon and post-monsoon period.

At the field level, the review noted the following weaknesses:

- Utilization of maps for migratory population and HTR is limited or non-existent.
- Absence of specific communications strategy for HTR and socially excluded groups.
- Human resources inadequate leading to challenges in vaccine distribution, vaccination, and supervision.
- HTR budget discontinued after June 2017.

Conclusions

While recognizing the challenges of urban poor and hard to reach populations, and the inclusion of plans in the 4th Health, Population and Nutrition Sector Programme to reach these populations, the current system confronts numbers of challenges, the most critical of which are the complex institutional set-up in urban settings, the lack of dedicated infrastructure and staff of city corporations for EPI or basic health, lack of adequate human resources, and discontinuation of the HTR budget.

Recommendations

National oversight bodies

NCIP

- Provide the agenda and relevant materials to NCIP members at least one week in advance of meetings,
- Ensure that all members declare conflicts of interest and recuse themselves as appropriate,
- Review the composition of the NCIP to ensure the independence of the committee's advocacy and monitoring functions,
- Provide ongoing programmatic oversight to the EPI,
- Participate in capacity building, as per SEAR Immunization Technical Advisory Group recommendations for Regional NITAGs, and
- Review the committee's terms of reference and update as appropriate.

NCCPE and NVC

- Increase the frequency of meetings (the NCCPE should meet quarterly as per SEAR Vaccine Action Plan recommendations),
- Provide oversight to the polio and the measles, rubella and CRS elimination programmes, and
- Encourage the development of committee work plans.

NRA

- As possible, encourage ensuring a regulatory agency competent to oversee licensing of domestically-produced vaccine.

Vaccine licensing, procurement and management

- Expedite necessary approvals for building of new central cold storage.

Demand generation

- Develop a robust multi-channel demand generation strategy for defined participant/audience groups to consistently and continuously reach HTR and too high to reach populations. This strategy should identify under-immunized communities and develop specific communication strategies for each of these communities. This would also include a strategy to promote EPI branding in creative ways,
- Revise existing SBCC materials and revise old materials based on behaviour and appetite analysis, including any information available from knowledge, attitude and practice surveys,
- Provide media training on risk communication for AEFI,
- Evaluate pilot software to track children for vaccination; roll out as appropriate,
- Consider approaching Access to Information to encourage innovative approaches to demand generation.

Human resources

- The MOHFW should accelerate field worker recruitment. Additionally, government should consider sanctioning new positions, thus reducing the health worker to population ratio,
- Advocate for EPI dedicated staff in city corporations and municipalities,
- Create positions of medical officer disease control for surveillance & EPI both at *upazila* & district level, as per the polio transition plan,
- Minimize turnover in key leadership positions to promote familiarity with the programme and a long-term vision,

- Develop and implement a plan for regular training and orientation of mid-level managers,
- Place mid-level managers in duty stations for at least three years,
- Motivate workers through awards.

Urban immunization

- Endorse the Urban Immunization Strategy and ensure necessary human and financial resources for full and immediate implementation. Actionable recommendations that can be made immediately include:
  - Establishing coordination mechanisms at city, zone and ward levels, including a coordination committee led by the mayor with participation of deputy director of health service, relevant health officials, and non-governmental organization representatives. In addition, establishing an inter-ministerial committee to improve coordinated service delivery,
  - Filling vacant staff positions,
  - Ensuring that private sector protocols/procedures for service delivery, surveillance, and reporting are in place, including standardized contractual mechanisms and performance agreements with non-governmental organizations,
  - Using non-governmental organization contracts to implement and monitor best-practice delivery and reporting strategies, (for example, hiring dedicated EPI staff, developing micro plans for HTR, conducting separate coverage and performance HTR analysis, coordinating defaulter tracking (EPI, local leaders, non-governmental organizations), and mapping of HTR areas and migratory patterns),
  - Budgeting and aggregating micro plans to identify funding sources and gaps and enable effective resource mobilization,
  - Evaluating and broadly implementing innovative, successful pilot studies (for example, mobile reminders, evening sessions, satellite mapping),

- Developing a robust multi-channel demand generation strategy for the HTR and too high to reach to ensure consistent, continuous communication,

- Developing an advocacy plan to target high level political official to ensure sustained commitment to EPI.

6.3. Data quality and surveillance systems

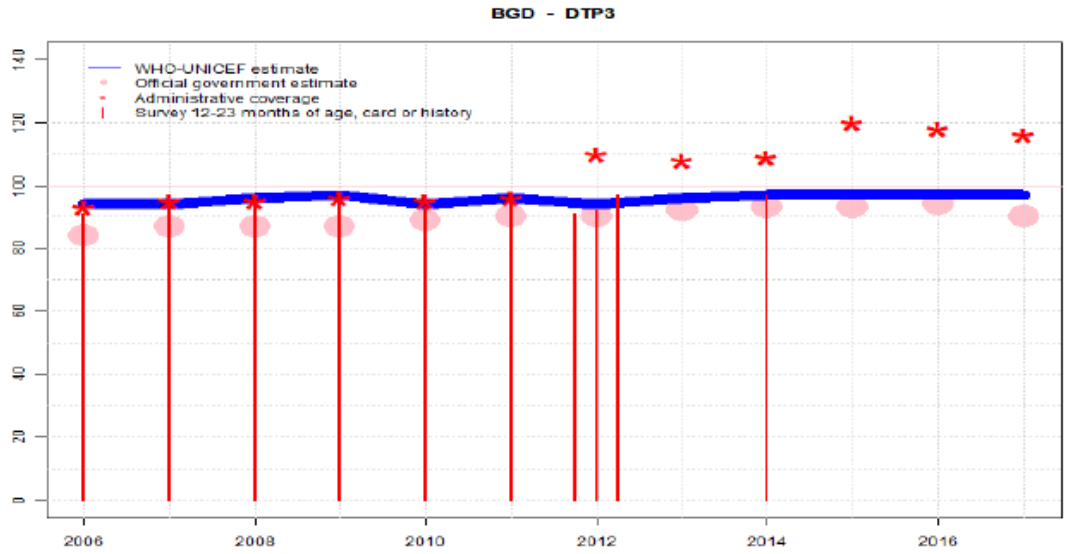
Data quality

Background

Bangladesh has a strong immunization programme resulting in high immunization coverage. However, since 2012 there have been significant discrepancies between the data generated from the administrative reporting system and CES results, with administrative coverage over 100% reported from national and sub-national levels (Figure 9). The difference between administrative and CES coverage results can partially be explained by large discrepancies between target population data produced by the EPI, which is based on micro plans, and the national statistical office estimates, which are based on census projections. As a result, one area of focus for the review was improving data quality. This was done by looking at factors affecting data quality with special attention to the denominator.

In the setting of high vaccination coverage, accurate data and data triangulation from different sources are required to identify pockets of unimmunized children. It is equally important to have a reliable estimate of the target population as this forms the basis for microplanning and vaccine supply management. If the need for vaccine is under-estimated, stock outs can occur while over-estimates can lead to vaccine wastage. This issue is gaining in importance as the price of fully vaccinating a child increases with expensive new vaccines added in the schedule.

Figure 8. *Pentavalent coverage from different sources, 2004 to 2017*



Source: https://www.who.int/immunization/monitoring_surveillance/data/bgd.pdf Accessed March 18 2019

National level

Two reviews of data quality have taken place in Bangladesh since 2015: – a review by an external consultant demographer, [30] and a data quality self-assessment report (2015–July 2016). The former report notes that demographic evidence indicates that the number of Bacille Calmette-Guerin vaccinations given by the EPI in Bangladesh exceeds the number of births in the country by more than half a million annually. Findings from the 2015-16 district level data quality self-assessments suggest that the weakest performance of recording and reporting occurs at ward level, that is to say, closest to data generation.

The field team assigned to the national level reviewed the Bangladesh Health Sector DHIS-2 system, an integrated health information system which includes immunization coverage and vaccine stock; there are plans to also integrate VPD surveillance data into this system.

[30] *Feeney G. Estimating Denominators for Routine Immunization in Bangladesh, 4 June to 6 July 2017. (report of a consultancy for WHO Country Office in Bangladesh)*

At national level, the data management system demonstrates many strengths, including

- DHIS-2, a visionary and sophisticated electronic health information system currently in use but undergoing further development,
- An excellent national communication network across all administrative levels with timely data flow,
- Annual CES with national and sub-national results, and
- A draft data quality improvement plan building on recent reviews.

Nonetheless, the programme currently has weaknesses at national level, some of which limit the usefulness of data. These weaknesses include:

- Heavy reliance on donor funding and external consultants to roll out and further develop DHIS-2,
- Discrepancies in denominators from different sources, and
- Under-utilization of the possibilities that DHIS-2 offers for detecting data quality issues.

Field level

All field teams found recording and reporting tools available, staff trained for recording and reporting, and display of data summaries across all levels of visited sites, indicating that data are both recorded and compiled systematically.

Figure 9. *Photograph of monitoring tools posted on a bulletin board at Moheshpur Health Centre*

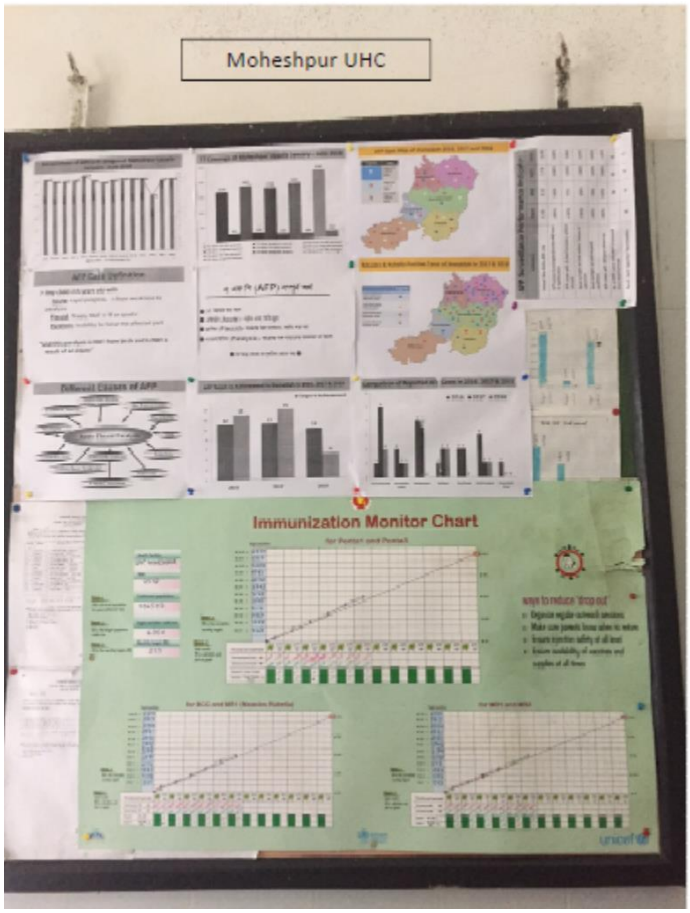


Photo: Sigrun Roesel

At field level, strengths of the system that were noted by visiting teams were:

- Systems in place for recording and reporting,
- Monitoring charts available and completed at all visited sites,
- Summary graphs and maps with reported VPD cases displayed at all visited sites,

- DHIS-2 providing data summaries (coverage and supply) down to the *upazila* level, and
- A high level of card retention among clients at observed immunization sessions.

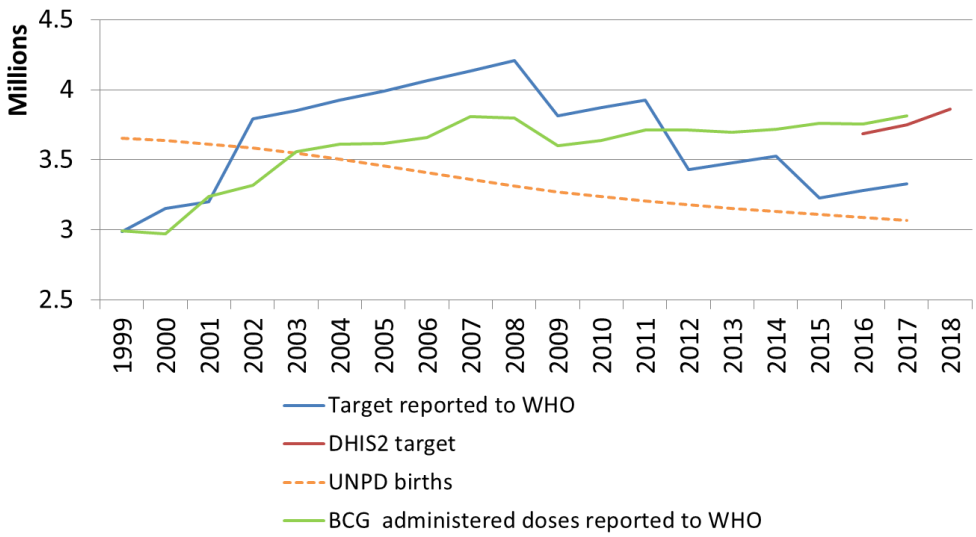
However, teams also observed a number of weaknesses. These included:

- Lack of clarity around the calculation of denominators. Most frequently, the denominator was calculated by using the total number of Bacille Calmette-Guerin or first dose of diphtheria-tetanus-pertussis vaccine to which are added children identified as having been left outs with this total then adjusted by the expected growth rate to define the target,
- EPI staff not trained in the use of DHIS-2,
- Data entry performed by a statistician rather than by EPI staff. This results in a lack of familiarity with and ownership of the EPI data, leading to decreased likelihood of EPI staff using
- EPI data,
- No computer dedicated to EPI,
- First line supervisors not checking tally sheets to prepare union (in other words, administrative level) reports,
- Data analysis performed by SIMOs rather than EPI staff. This has implications for ownership of the data and the long-term sustainability of the system.

Observations and data collected

While it is true that the latest CES suggests high coverage, coverage reported through the administrative system is over 100% in more than half of all districts. In addition, demographic evidence as reviewed by Feeney suggests an inflated target for EPI.

Figure 10. *Target population from different data sources, 1999-2018*



Although data from United Nations Population Division estimates suggest that annual births in Bangladesh are decreasing[31], data aggregated up from micro plans (that is to say, DHIS-2 targets) suggest increases as high as 3% annually. This increase is higher than in any of the neighbouring countries and cannot be explained by the latest fertility rate.[32] For an immunization programme, it is critical to have reliable estimates of target populations at district level and lower for micro plans. In addition, vaccine supplies are based on the national target figure, which currently results in vaccine shortages. Therefore, it is crucial to review Bangladesh's current target population and adjust it, if needed. Based on the review results, a standard methodology for target population calculation for micro planning should be developed.

Review teams found summary charts and maps available in all visited sites and completed immunization monitoring charts. However, data analysis was found to be largely done by WHO SIMOs. This could be

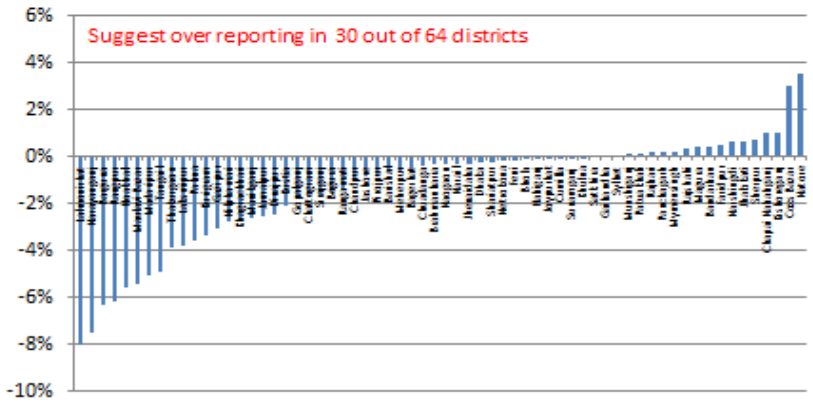
[31] *United Nations Population Division. 2017. World Population Prospects: The 2017 Revision. Publications and files available at esa.un.org/unpd/wpp/, accessed March 19 2019.*

[32] *Feeney G. Estimating Denominators for Routine Immunization in Bangladesh, 4 June to 6 July 2017. (report of a consultancy for WHO Country Office in Bangladesh)*

anticipated to result both in a lack of capacity building and of data ownership at lower levels.

DHIS-2 provides a wonderful opportunity to monitor immunization programme performance and to diagnose any potential data quality issues. However, in order to take full advantage of this system, EPI staff needs to be trained in the use of DHIS-2 for data entry and data analysis functions and in interpretation of the data.

Figure 11. *Comparison of administered doses and pentavalent vials used, Bangladesh, 2018 (data as of August 5, 2018)*



Data source: DHIS2 as of 5 August 2018

Conclusions

There is a good foundation for a strong monitoring system with the move to the integrated electronic system represented by DHIS-2. Data are summarized and used across all levels. However, to sustain high coverage levels in the environment of increasing urbanization, it will be necessary to look at data more critically. This can be done by triangulating data from different sources to identify and reach un- and under-immunized populations.

AEFI surveillance

Background

The ability to detect, report, and respond to AEFI is important for an immunization programme.

National level

In 2014, the MOHFW issued the third edition of guidelines for AEFI[33]; these were aligned with WHO recommendations. The Drug Policy of 2016 mentions the need for pharmacovigilance. A 2018 Drug Act which specifically mentions surveillance for AEFI has been submitted and is awaiting cabinet approval. Currently there is no dedicated budget for vaccine safety in the MOHFW budget, although all key activities are carried out by government staff. The key national authority implementing AEFI surveillance is the MOHFW through the Immunization Programme, and the National AEFI Expert Review Committee on which a representative of the NRA sits. The Programme Manager, EPI and the Manager, EPI are responsible for overseeing AEFI reporting and relevant training.

AEFI surveillance is both community- and facility-based; 876 sites for passive AEFI surveillance exist in the country. All AEFIs notified by a parent, caregiver or health care provider must be reported within 24 hours. The reporting lines differ according to the setting (rural, municipal or city corporation). Health facilities must engage in weekly line lists of AEFI, including 'zero reporting'. The local disease focal person assisted by the local surveillance medical officer is tasked with initially reporting and investigating AEFIs. Serious AEFIS, that is to say deaths, hospitalizations, clusters of events and AEFI of parental or community concern must be reported immediately by telephone to the designated authority, which must immediately initiate investigations and report to EPI headquarters. AEFI investigation teams at local levels have received both basic and refresher training. EPI headquarters compiles data on a monthly basis and shares this with the NRA. In the event of a serious AEFI, EPI headquarters assists in responding to the AEFI and communicates with the local health authority. If

[33] *The Government of Bangladesh. Expanded Programme on Immunization. Directorate General of Health Services. Guideline for AEFI Surveillance (Third Edition).*

needed, EPI headquarters can request assistance from the National AEFI Expert Review Committee. This Committee conducts causality assessment and received training on WHO's new guidelines for causality assessment in 2017. The National AEFI Expert Review Committee meets on a quarterly basis, more frequently if necessary. Active surveillance is conducted at the suggestion of the AEFI Expert Review Committee.

No compensation is given to individuals or the families of individuals who have suffered from AEFI, however an AEFI management fund exists to cover any costs for necessary medical care and follow up.

The WHO Country Office through the SIMO network assists the EPI in providing feedback to lower administrative levels. In addition, during the quarterly division level multi-sectoral meetings, EPI headquarters provides feedback. Finally, EPI headquarters personnel provide feedback on an ad hoc basis.

Advance preparations for risk communication and interaction with the media have been made with designated individuals acting as spokespersons at different administrative levels.

The AEFI surveillance guidelines outline how to communicate with the media, how to prepare key messages, how to prepare a press statement, and how to face a hostile interviewer. Technical support is offered by WHO Technical Officers and SIMOs. The MOHFW monitors the media on a daily basis for any reports of AEFI.

In 2017, the AEFI surveillance system in Bangladesh responded to a cluster of reported adverse events following immunization with pentavalent vaccine. This cluster initially involved five infants who had received pentavalent vaccine and developed dark induration which resolved spontaneously at the injection site. Further investigation identified three lots of pentavalent vaccine implicated; 213 419 children from two zones had been vaccinated and 499 (0.23%), all from one zone, had developed areas of dark induration. The investigation reviewed transportation, storage and administration methods for the vaccine and concluded that there was a defect in vaccine quality.

In 2018, the annualized reported rate of AEFI in Bangladesh was 55 per 100 000 surviving infants, exceeding the 10 cases per 100 000 considered by WHO to be the benchmark for sensitivity of surveillance.

Field level

A field evaluation of the AEFI surveillance system was not conducted.

Conclusions

In summary, the AEFI surveillance system in Bangladesh demonstrates strong capacity in detecting, investigating, classifying and responding to serious AEFI identified in public facilities or vaccine safety events which concern the general public.

VPD surveillance

Background

Highly sensitive VPD surveillance systems are essential for the immediate detection of and response to VPD outbreaks. In addition, a sensitive surveillance system is required to guide Bangladesh's EPI by indicating programmatic areas which require strengthening. Finally, highly sensitive VPD surveillance systems are critical as the country strives to maintain polio-free status and MNTE while reaching measles elimination and rubella and CRS control by 2020.

Bangladesh has a well-developed VPD surveillance network. Surveillance of AFP began in 1996. NT and measles surveillance were integrated with AFP surveillance in 2002 and, in collaboration with WHO, JE surveillance was added in July 2017. VPDs are reported weekly from *upazila* health complex/static health facilities to civil surgeons/chief health officers who, after compilation, send these data to the national EPI headquarters on a weekly basis. Acute meningo-encephalitis syndrome surveillance started in 2008 and is conducted at four medical college hospitals. The Institute of Epidemiology, Disease Control and Research, in collaboration with the International Centre for Diarrhoeal Disease Research, Bangladesh have established hospital based rotavirus and intussusception surveillance in seven sites across the country since July

2012. Bangladesh has had four sentinel surveillance sites and a population-based surveillance site for invasive bacterial disease (IBD) surveillance since 2012 supported by WHO and Gavi.

National level

The review confirmed a generally well-established surveillance network system built on polio and expanded to measles, rubella, CRS, NT and acute meningo-encephalitis syndrome; with outstanding IBD sentinel site and rotavirus surveillance network. There are close linkages between the national EPI and the national polio and measles/rubella reference laboratories which are highly functional.

The VPD surveillance system is, however, heavily reliant on the WHO SIMO structure and dependant on partner funding with no clear plans at present to transition case based surveillance to the Government of Bangladesh. A shortage of manpower and high turn-over at hospitals also affects surveillance functions which are further hampered by inadequate institutionalized continuous training. Private sector participation remains incomplete.

Despite these challenges, AFP surveillance continues to reach the required quality standards. However, further improvements are required for measles and rubella elimination goals; it was observed that fever/rash surveillance is not yet fully implemented, non-measles/rubella discard rates are <2/100 000 target population and timely receipt of measles samples at the laboratory has decreased from 87% in 2015 to 69% in 2017. Gender disparities are observed in reported suspected measles cases, which may indicate under-reporting of cases overall. CRS and acute meningo-encephalitis syndrome surveillance both remain challenging as each involves specialist clinicians who may have a high work load.

Field level

Health personnel at all levels were found to be aware of VPD reporting requirements, with basic surveillance definitions understood and acted upon. There was good display of surveillance definitions and information, education and communication materials and very good record keeping. Active case searches were documented, patient registers were maintained with provisional diagnoses and regular weekly reporting mechanisms were

in place along with immediate notification of suspected cases as per standard case definitions. Many health staff interviewed had received orientation on disease surveillance and demonstrated good response capacities and strong collaboration with SIMOs.

Nonetheless, in some instances passive surveillance reporting was not done regularly, cases at active surveillance sites were missed (for example, measles cases associated with pneumonia or encephalitis) and doctors and nurses seemed to have inadequate knowledge in VPD surveillance.

Conclusions

Bangladesh has well-functioning VPD surveillance which focuses on AFP, measles and NT. Surveillance findings are used for action. Particular strengths include

- Adequate sample collection and management.
- AFP indicators maintained at global standards.
- Highly functional AFP and measles/rubella national laboratory with close linkages between the national polio and measles laboratories and EPI.
- A regular weekly reporting mechanism along with immediate notification of suspected cases.
- Excellent paper-based record keeping.
- A good display of surveillance definitions and information, education and communication materials.

Health personnel at all levels are aware of VPD reporting requirements. Surveillance guidelines are being followed and there is strong collaboration with SIMOs.

However, staff shortages affect VPD surveillance. Many disease surveillance officers are burdened with other tasks and not all have been adequately trained. A shortage of manpower and high turn-over among staff is particularly observed in hospitals. CRS and acute meningo-encephalitis syndrome surveillance remains challenging as surveillance for these diseases involves clinical specialists who may have a high work load.

Overall, the participation of the private sector in VPD surveillance remains incomplete. Of concern is the large reliance on SIMOs which has implications for long-term sustainability and local ownership.

The number of diseases which are routinely laboratory confirmed is still limited while measles surveillance does not yet meet key indicators (see above).

Laboratory

VPD surveillance is supported by the National Polio, Measles and AMES Laboratory, located at the Institute of Public Health in Dhaka. The laboratory performs virus isolation and detection and is supported for virus isolation and detection by the Regional Reference Laboratory in Thailand. The national laboratory is fully accredited by WHO for measles, rubella and polio. Samples from patients with suspected JE are tested in a second laboratory.

IBD sentinel site surveillance is supported by the microbiology laboratory at the Dhaka Shishu Hospital. This lab has played an important role in demonstrating burden of disease from IBDs in Bangladesh and is world renowned for its research.

Disease specific laboratory findings and disease specific recommendations are described below under the relevant diseases.

Recommendations

Data quality

- Strengthen DHIS-2 and promote use by EPI staff at all levels through
  - Promoting long-term sustainability and national ownership for the EPI component of DHIS-2, and
  - Training EPI staff for data entry and system use.
- Resolve denominator inconsistencies through
  - Conducting an in-depth review in selected *upazilas* to determine the reasons for discrepancies between the

denominator generated through national projections and that generated through data derived from micro plans, and

- Data triangulation between supply and administered dose data.

- Assess numerators for any potential over reporting.

Of note, a data quality improvement plan has already been drafted and addresses the findings of the EPI review.

Surveillance for AEFI

- Provide media training on risk communication for AEFI, as per demand generation recommendations.

VPD Surveillance

Disease specific recommendations related to global and Regional goals are included in Section 6.4. Other recommendations are below.

- Fill staff positions with surveillance responsibilities and provide logistics (transportation),
- Continue periodic orientation of all health personnel,
- Pursue the gradual transition of case investigations, response activities and performance analysis from WHO SIMOs to EPI staff,
- Transition from paper to electronically based data management; this will require an assessment of training and information technology equipment requirements,
- Complete the planned integration of the VPD surveillance system with DHIS-2,
- Diphtheria
  - Establish diphtheria case based surveillance; update national guidelines on diphtheria surveillance and outbreaks in line with the Regional/global VPD surveillance guidelines,
  - Assess laboratory needs for diphtheria diagnostics.
- JE

- Ensure high quality laboratory supported JE surveillance in line with SEAR JE surveillance guide.

- Consider long term plans for IBD and rotavirus surveillance.

6.4 Progress in meeting global and Regional goals

Background

Bangladesh's draft cMYP 2018-2022 has the following disease specific goals:

- To maintain polio free status and MNTE,
- To achieve elimination of measles, rubella and CRS by 2020.

In addition to targeting polio, MNTE, and measles and rubella/CRS, Regional goals articulated in the SEAR Vaccine Action Plan include accelerated control of hepatitis B and JE.

The situational analyses presented below are based on a review of national documents and observations of the field teams.

Findings

Polio

Background

Bangladesh has a significant Global Polio Eradication Initiative funded surveillance and immunization infrastructure. SIMOs are the backbone of this infrastructure. The SIMO network has played an important role in polio eradication, MNTE, progress towards achieving measles, rubella and CRS elimination goals, and strengthening the routine immunization health system in the country.

The purpose of reviewing the status of polio related activities in Bangladesh during this EPI review was to review the maintenance of critical polio functions during the ramp down of Global Polio Eradication Initiative funding and the sustainability of these functions, considering the need for

the continuation of a high level of polio surveillance and other activities related to the implementation of the polio endgame strategy until global polio eradication certification and beyond.

National level

Bangladesh has sustained its polio free status and there has been no case of wild poliovirus since 2006. No vaccine-derived polioviruses have been detected in Bangladesh. Bangladesh has maintained high oral polio vaccine coverage. The national coverage with the third dose of oral polio vaccine is 90% (CES 2016) and all the districts have ≥80% coverage. The country introduced IPV into its immunization programme in March 2015 and has switched to intradermal IPV from December 2017.

The cardinal AFP surveillance indicators meet global standards. The non-polio AFP rate was 2.73 per 100 000 under 15 population and the adequate stool sample collection was 99%. All 64 districts and 11 city corporations meet the non-polio AFP rate of >2 per 100 000 in children less than 15 years of age. Surveillance is sensitive enough to quickly and reliably detect wild polio virus and vaccine-derived poliovirus transmission should it occur.

To supplement AFP surveillance, Bangladesh has initiated environmental surveillance in four selected sites from September 2015. Considering the massive influx of forcibly displaced Myanmar nationals in Cox's Bazaar, four additional temporary environmental surveillance sites have been set up and are functional.

The National Polio Laboratory of Bangladesh is accredited by WHO and is maintaining accreditation status.

Bangladesh does not store wild poliovirus type 2 / vaccine-derived polio virus type 2 potentially infectious material. Laboratory containment is in progress as per the WHO Global Action Plan to minimize poliovirus facility-associated risk after type-specific eradication of wild polioviruses

and sequential cessation of oral polio vaccine use (GAPIII) requirements.[34] The national inventory of laboratories has been prepared.

The polio outbreak preparedness and response plan was available and it has been reviewed and approved by the NCCPE. However, simulation exercises based on the updated plan have not been conducted. One meeting of the NCCPE was held in 2017.

Bangladesh has developed its polio transition plan. This prepares for a phased transition of financial and human resources to national ownership, keeping in mind the programmatic risks involved following ramp down of Global Polio Eradication Initiative funding. The national polio transition plan has been endorsed by the GoB.

Field findings

The field teams concluded that there was good awareness of AFP surveillance including case definition, reporting and specimen collection in all districts. All AFP surveillance indicators are maintained per global norms in all divisions that were visited.

It was observed that there exists an excellent reporting mechanism and record maintenance at field and in laboratory. However, it was observed that the national laboratory is not reporting results of environmental surveillance in the SEAR standardized reporting form.

The AFP surveillance system is highly dependent on the WHO-SIMO network especially for case investigation, active surveillance visits and data analysis. This high dependence is leading to sustainability and local ownership issues.

There was a temporary stock out of IPV following global shortage towards late 2016 but IPV supply has now been restored. The children, up to 23 months of age, that were missed are being immunized by a single dose of IPV through the existing routine immunization system.

[34] WHO. WHO Global Action Plan to minimize poliovirus facility-associated risk after type-specific eradication of wild polioviruses and sequential cessation of oral polio vaccine use. GAPIII http://apps.who.int/iris/bitstream/handle/10665/208872/WHO_POLIO_15.05_eng.pdf. accessed 18 October 2018.

Conclusions

Bangladesh has maintained its polio free status through high immunization coverage and meets certification standards for the cardinal surveillance indicators. However, high dependence on the WHO-SIMO network for basic surveillance functions remains a challenge. Capacity building of government health workers and sustaining the WHO-SIMO network for next three to five years is required.

MNTE

Background

MNTE in Bangladesh, validated in 2008, is considered to be a public health success, particularly given the high incidence of NT prior to the introduction of immunization. The contribution of NT elimination to reducing neonatal mortality is substantial, given the large proportion of neonatal deaths caused by NT in the pre-immunization era. In order to accelerate movement towards the global elimination goal (defined as <1 case NT/1000 live births), the MOHFW, with the support of WHO and UNICEF, implemented supplementary immunization activities, mostly at the sub-district level, to deliver tetanus toxoid to unimmunized and under-immunized women of childbearing age in high-risk areas.

In addition, improvements were made to facilitate access to clean deliveries; through expansion of emergency obstetric care, training for skilled birth attendants, establishment of satellite clinics at peripheral health units where trained female welfare visitors provide antenatal care and postnatal care services and strengthening of social mobilization through the use of field workers. Surveillance was upgraded at all health facilities and integrated with surveillance for other VPDs.

Findings

Since MNTE validation in 2008, efforts have been focused on routine immunization of women of childbearing age. In 2017, the reported national coverage with two or more doses of tetanus toxoid was 66% while the best official estimate was 97%.

The 2016 CES found that the national valid vaccination coverage with a second dose of tetanus toxoid was 96.8 percent. Valid tetanus toxoid coverage was defined as the coverage a woman received when the EPI recommended tetanus toxoid vaccination schedule was followed. However, the valid coverage rate was found to drop to 89.2 percent for the third dose of tetanus toxoid, 73.2 percent for the fourth dose, and 52.3 percent for the fifth dose.

The urban-rural analysis showed that coverage with valid doses of the second dose of tetanus toxoid to the fifth dose of tetanus toxoid coverage was higher in rural areas than in urban areas. With the exception of Sylhet City Corporation, 90 percent or more of women in all city corporations received valid second doses of tetanus toxoid.

Nationally, 91% of children were protected against tetanus at birth, with a subtle difference between rural and urban children in this context (91.2 % of rural children as opposed to 91.0 % for their urban counterparts).

CES 2016 findings revealed that, nationally, 50.9% of deliveries were made at a health facility, while 49.1% were at home. Among the health facility deliveries recorded, 14.1% were conducted at public health facilities, 34.5% at private hospital/ clinics, and 2.3% at nongovernmental organization clinics. Increased use of public health facilities for delivery has been moderate, compared to that of private hospitals/clinics.

Sustaining sensitive NT surveillance is assisted by formal and informal orientations on AFP and VPD surveillance for all surveillance sites up to the district level. These are conducted periodically (≥once a year) while re-orientation needs at sub-district level are based on surveillance performance. In 2016 and 2017, a total of 110 and 96 NT cases were reported respectively but no district had rates above 1 NT / 1000 live births.

The numbers of reported tetanus cases which were not neonatal were 441 in 2016 and 325 in 2017. There are currently no tetanus toxoid containing vaccine booster doses in the national schedule.

Conclusion

Bangladesh continues to report high national and sub-national coverage for DTP3 and two or more doses of tetanus toxoid. NT surveillance is well integrated into VPD surveillance and a community response to reported cases is carried out, including vaccination of the mother of the reported NT case. While a large percentage of deliveries still take placed at home without a skilled birth attendant, there is growing emphasis on using clean instruments to cut the umbilical cord. The practice of applying substances to the umbilical cord may, nonetheless, continue. As such, risk factors for maternal and neonatal tetanus during deliveries and postnatal care at home remain, requiring high levels of protection through universal tetanus toxoid vaccination. The opportunity of adding diphtheria protection is yet to be realized. As no tetanus booster doses are included in the national immunization schedule, the full benefit of tetanus toxoid immunization does not yet apply to males and females equally. Ultimately, the most equitable and sustainable approach is to ensure tetanus protection over the life course for all members of the population.

Measles and Rubella

Background

In September 2013, WHO's Regional Committee of South-East Asia resolved to eliminate measles, and control rubella and CRS by 2020. In June 2016, the SEAR Immunization Technical Advisory Group recommended that countries that had introduced MR set an elimination (as opposed to control) goal by 2020 for rubella. The purpose of reviewing the measles, rubella and CRS elimination programme in Bangladesh was to assess progress towards and next steps to reach the elimination goals.

In 2005–2006, Bangladesh conducted a two-phase catch-up campaign targeting children aged 9 months – 9 years with measles vaccine. A follow-up campaign targeting children aged 9 months – 59 months was conducted in 2010. In 2014, Bangladesh conducted its first MR campaign targeting 9 month – 14 year old children. An independent coverage survey found the campaign achieved 90% coverage and that children who attended school were 18% more likely to be vaccinated than those who did not, showing the success of the school-based delivery approach. The first

dose of MR and the second dose of measles-containing vaccine (MCV2) were introduced in 2012. Rubella- vaccine was included with the second dose of measles containing vaccine in 2015, so that the country offered first and second dose MR. The NVC was formed in 2016. The NVC submits annual reports for review by the Regional Verification Committee, resulting in specific programmatic recommendations made by the Regional Verification Committee. The most recent review was for 2017; the recommendations below supplement those made by the Regional Verification Committee.

National level

The official estimates of coverage at national level were 92% for MCV1 and 83% for MCV2 in 2017. The WHO-UNICEF estimates of coverage are slightly higher at 94% and 96% respectively. The proportion of districts with MCV1 coverage more than 95% is 97% (62 of 64 districts) and for MCV2 coverage is 95% (61 of 64 districts). In terms of immunization, several areas of weakness exist. With the most recent MR catch-up campaign conducted in 2014, the next follow-up campaign is due but has not yet been conducted. Although planning for this is ongoing, the dates for this have not yet been fixed. In addition, there is no policy in force for immunizing health care workers or for school entry immunization checks.

The surveillance of measles and rubella cases is health facility based. Case investigation forms are filled out, followed up and reviewed for each case. Most surveillance indicators are met or exceeded. The linkage with the laboratory is strong and laboratory results are available for all specimens sent to the laboratory. The laboratory functions at a very high level, generally meeting the indicators for timeliness and completeness. Although supply of enzyme-linked immunosorbent assay testing materials is usually adequate, in 2017 (during which Bangladesh experienced a large increase in measles cases) kits were temporarily unavailable, resulting in delays in reporting back laboratory test results, as reflected in measles surveillance indicators. The laboratory is fully accredited by WHO. Rubella specific surveillance does not exist; instead rubella antibody testing is conducted on measles antibody negative samples collected from individuals with suspected measles. A CRS surveillance review was conducted in 2017, and specific recommendations to improve CRS surveillance were made at that time. In 2017, the number of confirmed measles cases reported through the national VPD surveillance system was 3594 with genotypes B3 and D8, of confirmed rubella cases was 299 and of confirmed CRS cases was 152.

In 2018, the Regional Verification Committee declared Bangladesh to be one of the first six countries in the Region to have controlled rubella and CRS.[35]

Fever and rash surveillance has not yet been implemented, affecting the sensitivity of case detection adversely. This lack of sensitivity is demonstrated in a discard rate for non-measles, non-rubella cases which was below the target: of more than 2 per 100 000 in 40% of second administrative level units in 2017. Review of surveillance indicators shows that the proportion of laboratory-confirmed chains of transmission with specimens adequate for detecting measles virus collected and tested in an accredited laboratory fell from 27% in 2016 to 8% in 2017 against a target of 80%; while the same indicator for rubella was reported as "not applicable" against a target of 80%. Although the Regional Reference Laboratory has 150 records of measles genotypes from Bangladesh, these have not been routinely entered in the Measles Nucleotide Surveillance database. No rubella genotypes originating from Bangladesh have been reported.

Gender disparities were observed in reported measles cases, with more cases being reported among male children than female children, raising the question of under-reporting of cases in females. Although outbreaks are detected and children who have not been vaccinated against measles and rubella are located and vaccinated, the ability to conduct high quality outbreak investigations is unclear. As with polio, case based measles and rubella surveillance are heavily dependent on donor funding and there are no clear plans yet to transition this surveillance to the GoB.

Field level

Overall, coverage levels of both the first and second dose of MR were fairly high in all divisions visited. However, despite overall high coverage, pockets of sub-optimal coverage remain. In Cox's Bazaar district in particular, the sudden influx of more than 700 000 persons from Myanmar whose immunization levels are sub-optimal has added to the pool of susceptible children in this district and put a severe strain on the health service delivery system.

[35] *World Health Organization Regional Office for South-East Asia. Press release 1693. New Delhi, 3 August 2018.*

Conclusions

In conclusion, Bangladesh has made progress toward the 2020 elimination goals. However, the programme needs to address a number of weaknesses both in terms of immunization and in terms of surveillance in order to continue to move forward. Recommendations have been received from the Regional Verification Committee and further recommendations are below.

Hepatitis B

Background

Hepatitis B vaccine was introduced to the EPI in Bangladesh in a phased manner during 2003–2005, using the WHO-recommended schedule at 6, 10, and 14 weeks of age. The hepatitis B vaccine (HepB) birth dose has not been introduced into the national childhood vaccination schedule; 71% of births in Bangladesh occurred at home in 2011, which is a logistic barrier to administering a timely birth dose of HepB.

The risk of progression to chronic hepatitis B virus (HBV) infection is inversely related to the age at infection. Chronic HBV infection develops in 90% of infants infected before 1 year of age, 25-50% of children infected at 1-5 years of age, and 5-10% of persons infected after 5 years of age[36] HBV infection is preventable through vaccination and WHO's Strategic Advisory Group of Experts on Immunization recommends that all infants receive HepB at birth, ideally within 24 hours. However, if this is not feasible, the birth dose can be given up to the time of the next dose of the primary schedule although with diminished efficacy, especially when given more than 7 days after birth. The birth dose should be followed by two or three additional doses during infancy.

The Global Health Sector Strategy on Viral Hepatitis[37] sets a 2020 goal of reaching ≤1% prevalence of hepatitis B surface antigen among 5 years old children which was endorsed by the 2016 SEAR Immunization Technical Advisory Group. The Global Health Sector Strategy on Viral

[36] *World Health Organization. Hepatitis B vaccines: WHO position paper – July 2017.WER No 27, 2017, 92, 369–392, Available at https://www.who.int/immunization/policy/position_papers/hepatitis_b/en/ Accessed March 19 2019.*

[37] *Available at https://www.who.int/hepatitis/strategy2016-2021/ghss-hep/en/. Accessed March 19 2019.*

Hepatitis also calls for a 30% reduction in new cases and a 10% reduction in mortality by 2020.

In order to evaluate the impact of the HepB introduction in Bangladesh by comparing prevalence of hepatitis B surface antigen among children born before and after vaccine introduction and to estimate the risk of vertical transmission of HBV infection from mother to infant, a nationally representative survey was conducted in 2011/2012. The results show that the EPI was highly successful in reducing chronic HBV infection among children. In the pre-vaccine birth cohort, chronic HBV infection prevalence was 1.2%, and in the vaccine birth cohort, chronic HBV infection prevalence was 0.05%, a 96.3% (95% CI: 93.0–97.8%) reduction in hepatitis B surface antigen prevalence. The survey also found that the programme achieved high vaccination coverage (94.2%) with three doses of HepB, similar to previous estimates by WHO and UNICEF.

Findings

The national administrative coverage with the third dose of HepB in 2017 was 116% while the official estimate was given at 90%; similar coverage levels had been reached in previous years. All provinces reported coverage with the third dose of HepB to be over 100% in 2017 while official estimates ranged from 89-94%. At district level the lowest coverage with the third dose of HepB was 83.3% (official estimate).

As HepB is provided as pentavalent formulation and no birth dose is given, there were no specific findings at the field level and one should refer to the routine immunization sections of this review report.

Conclusions

High national and sub-national HepB coverage (>90%) has been sustained for several years. The 2011/2012 study provided important data demonstrating the success of the hepatitis B infant immunization programme in Bangladesh. Regular monitoring of vaccination coverage at the national and sub-national levels will be important to ensure that the gains are sustained and areas are identified where improvements will be needed. Although the survey found little evidence that children whose first dose of HepB was delayed until the sixth week of age were at increased risk

of HBV infection, it remains prudent to vaccinate children in Bangladesh at the first opportunity.

JE

A discussion of issues related to JE is found in Section 6.5 of this report.

Recommendations

Polio

- Bangladesh should initiate implementation of the transition plan beginning with more ownership of local government health staff in surveillance activities. This would require building the capacity of government staff in surveillance.
- The SIMO network should be sustained at the current levels over the next 3-5 years. This network is critical to maintaining high quality AFP surveillance as well as supporting other activities such as measles and rubella/CRS elimination, VPD surveillance, strengthening immunization and new vaccine introduction.
- The global standard operating procedures for responding to a polio event or outbreak will soon be released. The country should review the 2017 outbreak preparedness and response plan and update it if required. Simulation exercises should be conducted based on the latest plan and with WHO guidance.
- The standardized WHO SEAR reporting format for environmental surveillance should be used.
- The NCCPE should meet at least quarterly to provide regular programme oversight and risk assessment,
- The national AFP surveillance guidelines should be reviewed and aligned with the 2017 SEAR VPD surveillance guide
- The country should prepare and submit to the NCCPE a final report on the WHO Global Action Plan to minimize poliovirus facility-associated risk after type-specific eradication of wild polioviruses and sequential cessation of oral polio vaccine use

phase 1 implementation, including documentation of the destruction of infectious materials

MNTE

- Maintain high immunization coverage with tetanus toxoid containing vaccine in pregnant women, women of childbearing age and infancy.
- The national EPI and NCIP to review and optimize the tetanus toxoid containing vaccine immunization schedule to ensure full and early protection against tetanus with booster doses for both genders during childhood and adolescence.
- Implement tetanus toxoid replacement with tetanus-diphtheria vaccine in light of waning immunity to diphtheria following the primary series and with pregnant women disproportionately affected.
- Maintain sensitive NT surveillance in every district to confirm an annual NT rate below 1/1000 live births.
- The NCIP should engage with the EPI and maternal child health programme to regularly conduct national reviews of indicators related to MNTE status and recommend corrective actions as required.
- A post-elimination validation assessment should be conducted in the near future as per WHO guidance.

Measles, rubella and CRS

- Use campaigns to:
  - Achieve >95% coverage with MR consistently and uniformly, and
  - Strengthen RI by
    - Updating micro plans,
    - Mapping all settlements, and
    - Rationalizing immunization session locations and periodicity,

- Include the second dose of MR in the definition of a fully immunized child,
- Ensure that pre-MR supplementary immunization activity readiness assessment and post-campaign coverage assessments are integral parts of supplementary immunization activity planning and implementation,
- Consider school entry record checks or mandatory immunization at school entry,
- Ensure health care workers are protected against measles and rubella,
- Transition to rash/fever surveillance following the supplementary immunization activity, when the number of cases should have decreased substantially,
- Initiate community based surveillance,
- Ensure adequate and timely rubella and measles genotyping and appropriate reporting,
- Conduct further investigations to find the causes of
  - Reported non-measles/rubella rates sub-nationally, and
  - Gender disparities in suspected measles cases.

Hepatitis B

- Maintain coverage with the third dose of HepB nationally and sub-nationally ≥90.
- Review 2018 Immunization Technical Advisory Group recommendations on
  - Catch-up or patch-up vaccination with the third dose of HepB in children aged < 5 years; to be considered based on CES results, and
  - HepB birth dose introduction based on the epidemiological situation of HBV infection.
- Consider HepB vaccination for health care workers.

- Apply for verification of the control goal status once the relevant WHO SEAR Office mechanism in place.

JE

The introduction of JE vaccine is discussed under in Section 6.5.

6.5 New and under-utilized vaccine introduction

Background

The SEAR Vaccine Action Plan and the draft cMYP include, among their goals, accelerating the introduction of new vaccines and related technologies. As outlined above, Bangladesh has introduced many new vaccines in the recent past: the first dose of MR (2012), MCV2 (2012), the second dose of MR (2015); IPV (2015); PCV (2015); bivalent oral polio vaccine (2016); and fractional IPV (2017).

A post-introduction evaluation report for PCV and IPV was conducted in 2015. This evaluation concluded that the introduction of PCV and IPV had gone smoothly overall, but had a number of specific technical recommendations. [38] Many of these recommendations (for example, monitoring the ramp up of PCV coverage, expanding cold chain capacity) have been followed up on; some are not yet completely addressed (for example, improved waste management, providing regular refresher trainings to health care workers, underperforming urban areas like Dhaka City Corporation). The PCV and IPV introduction were also included in Gavi´s Full Country Evaluation report for 2015 and 2016 which monitored the constant coverage improvements of PCV. The coverage of the IPV programme was considerably affected by the global shortage of this vaccine until 2017 and still suffers from irregular supply.

A Gavi funded human papilloma virus (HPV) vaccine pilot was conducted in 2016. The target group was school girls of grade 5 and girls not enrolled in school. Thirty thousand girls aged 10 years in District

[38] *WHO. Regional Office for South East Asia. Post-Introduction Evaluation (PIE) of Pneumococcal Conjugated and Inactivated Poliomyelitis Vaccines. Report of the joint national/international mission. Bangladesh, 26 November -6 December 2015.*

Gazipur were vaccinated with two doses of HPV vaccine separated by an interval of six months. A joint national/international post-introduction evaluation was conducted in October 2016 with WHO support. Coverage was 94%. Observation and interviews were undertaken by teams at all levels of the health service, including EPI offices, vaccine stores, and vaccination sessions. The evaluation concluded that "Bangladesh successfully demonstrated that HPV vaccine could be scaled-up for the entire country…Most of the components required for HPV introduction are in place and all stakeholders are prepared for an HPV vaccine nationwide introduction." GoB has been reviewing the findings and recommendations of this evaluation, as well as other study reports, to ensure evidence based decision making about nationwide HPV vaccine rollout. The decision as to whether this will be pursued is still pending. However, the submission of an application to Gavi is feasible in late 2019. Nationwide introduction of HPV vaccine will, in the case of a successful application, be delayed beyond 2020 due to production shortages.

In 2017, Gavi approved Bangladesh's application for support for introduction of rotavirus, scheduled for 2019 but now postponed due to supply constraints to 2020. Further discussion regarding the introduction of JE vaccine is contingent on the results of JE surveillance to establish burden of disease.

Findings

The MOHFW has set an ambitious agenda for new and under-utilized vaccine introduction which has, overall, been successfully implemented, both in terms of the introduction of vaccines into the routine programme and through the use of vaccination campaigns. This demonstrates the operational strength of the programme at both national and sub-national levels. Concrete evidence of this is the fact that coverage with the third dose of PCV (introduced in 2015) was able to reach that of DTP3 by 2017. The programme also made a successful switch to fractional IPV in April 2018. New vaccine introductions have been supplemented by developing protocols for and expanding capacity to manage AEFI. Minor difficulties in new and under-utilized vaccine introduction are linked to some of the systemic challenges noted above, for example, lack of clarity regarding the true size of target populations, inequities between rural and urban health care, and challenges in communicating with HTR populations.

Expansion of the cold chain will be required to accommodate introduction of JE, HPV and rotavirus vaccines into the EPI. Gavi health

system strengthening funding is foreseen to cover the required expansion. As Bangladesh transitions to a lower middle income country, the amount of co-financing it will need to pay for vaccines will increase: .it is projected to enter accelerated transition in 2021 and will need to fully fund its EPI vaccines as of 2026.

Recommendations

- Ensure that the NRA is able to support the licensing of vaccines produced by different manufacturers.
- Ensure that the NCIP makes evidence based decisions which take into account both epidemiology and financial considerations to guide political decisions.
- Promote policies to achieve ownership of the programme across ministries (Ministry of Finance, Ministry of Local Government, Rural Development and Co-operatives, Ministry of Education) and among stakeholders such as professional associations, civil society and development partners.
- Ensure operational readiness for vaccine introductions through
  - Implementing the cold chain improvement plan with funding from Gavi's health system strengthening grants to expand the cold chain capacity in order to accommodate JE and HPV vaccine and rotavirus vaccine introduction,
  - Ensuring that AEFI protocols and trainings are updated as needed (for example, for the introduction of rotavirus),
  - Developing vaccine specific communications.
- Continue to supplement administrative coverage with coverage surveys (including after supplementary immunization activities); this is of particular importance given difficulties ascertaining the true target population.

7. Conclusion

In conclusion, Bangladesh has a national immunization programme which is a flagship for the country and the Region. It has successfully maintained high coverage as measured both by survey and administratively and has proactively and successfully introduced a number of new vaccines in recent

years. The country maintains a high standard of VPD surveillance and has a noteworthy IBD surveillance network. Nonetheless, the country faces important challenges which will need to be met in order to maintain and build on its existing programme. The most critical of these is a shortage of human resources, coupled with high turnover in key national leadership positions. The second is a high dependence on donors in the face of anticipated declines in donor support. This dependence is particularly great in surveillance, but also exists in vaccine procurement. Inequities in vaccine coverage between urban and rural dwellers reflect fragmented provision of vaccination services in urban areas; this issue, if not addressed, will become increasingly important as the percentage of the total population which is urban increases. Finally, lack of clarity regarding target populations results in unreliable administrative coverage figures and difficulties in ensuring adequate supplies without wastage. As the programme looks to the future, plans to meet these challenges are critical.

Annex 1

List of Participants

Name	Position and Organization
	Reviewers from Bangladesh
Dr Rezaul Rahman Khan	PM in Charge, MOHFW
Dr Altaf Hossain	Ex. PM EPI, MOHFW
Dr Moklasur Rahman	DPM IMCI, MOHFW
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Dr Faruk Ahmed	DPM P&S, MOHFW
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Dr Md Salequzzaman, UNICEF	Health Officer, UNICEF Country Office, Bangladesh

Dr Chiranjit, WHO	Technical Officer, WHO Country Office, Bangladesh
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International Reviewers	
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Dr Dirk Gehl	Senior Country Officer, Country Programmes, Gavi, the Vaccine Alliance, Geneva, Switzerland
Dr Robb Linkins	Chief, Accelerated Disease Control and VPD Surveillance, Centers for Disease Control and Prevention, Atlanta, USA
Dr Pankaj Bhatnagar	NPO & Deputy Team Lead (NPSP), India
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Dr Sigrun Roesel (Mission Coordinator)	Technical Officer – VPD/IVD WHO-SEARO, New Delhi, India

Annex 2

Vacancy status of EPI-related field personnel

Sl. No	Designation	Sanctioned Posts	Filled Posts	% Posts Vacant
1	Deputy Director (EPI)	1	1	0%
2	Asstt. Director (EPI)	1	1	0%
3	Upazila Health & Family Planning Officer(UH&FPO)	479	462	4%
4	District EPI Superintendent	64	60	6%
5	Assistant Health Inspector	4220	3577	15%
6	Community Health Care Provider	13454	12122	10%
7	Health Assistant	20908	16008	23%
8	Health Inspector	296	127	57%
9	Health Superintendent	5	1	80%
10	Medical Officer (EPI)	4	1	75%
11	Medical Technologist (BCG*/EPI)	497	472	5%
12	Medical Technologist (EPI)	2	0	100%
13	Statistician	584	394	33%
	Overall	40515	33226	18%

*BCG: Bacille Calmette-Guerin. Source: Government of Bangladesh, DGHS website accessed on 28 July 2018

Annex 3

Quality of Measles Performance Indicators, Bangladesh, 2013-2017

Measles/Rubella	Target	2013	2014	2015	2016	2017
Proportion of surveillance units reporting measles and rubella data to the national level and on time	≥80%	85%	89%	91%	97%	98%
Reporting rate of non-measles non-rubella cases at national level	≥2/100,000	1.1	1.4	1.8	1.9	2.3
Proportion of second administrative level units reporting at least two non-measles non-rubella case per 100 000 population	≥80%	19%	18%	36%	44%	60%[13]
Proportion of suspected cases with adequate investigation initiated within 48 hours of notification	≥80%	87%	90%	92%	94%	94%
proportion of suspected cases with adequate specimen collection for detecting acute measles and rubella infection collected and tested in a proficient laboratory	≥80%	84%	90%	98.5%	100%	100%
Proportion of specimens received at the laboratory within 5 days of collection	≥80%	99%	99%	99.8%	99.4%	99.3%
Proportion of laboratory-confirmed chains of transmission (defined as one or more confirmed measles cases) with specimens adequate for detecting measles virus collected and tested in an accredited laboratory[14]	≥80%	0% (0/77)	6% (9/143)	22% (35/158)	27% (165/619)	8% (228/2709)
Proportion of measles and rubella network laboratories that are WHO-accredited for serologic and, if relevant, for virologic testing	100%	100%	100%	100%	100%	100%
Proportion of laboratories in the country (government and private) that	100%	No Data	No Data	No Data	No Data	No Data

Measles/Rubella	Target	2013	2014	2015	2016	2017
conduct measles diagnostic testing that have adequate quality assurance mechanisms in place						
Proportion of serology results reported by the laboratory within 4 days of specimen receipt	≥80%	82%	99%	87%	94%	69%[13]
Proportion of virus detection and genotyping results (where appropriate) that are completed within two months of receipt of specimen	≥80%	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

CRS	Target	2013	2014	2015	2016	2017
Annual rate of suspected CRS cases at the national level	≥ 1 per 10,000 live births	0.10	0.28	0.37	0.45	0.46
Proportion of suspected CRS cases with the key data points completed[15]	≥80%	100 %	100 %	100 %	100 %	100 %
Proportion of suspected cases with adequate blood specimen tested for laboratory confirmation (IgM/ IgG, PCR) in an accredited laboratory	≥80%	94%	99%	98%	98%	99%
Proportion of confirmed cases with adequate specimen tested for virus detection	≥80%	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Proportion of confirmed cases with at least two negative tests for virus detection/isolation after three months of age, with at least a one-month interval between tests	≥80%	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Proportion of confirmed CRS cases detected within three months of birth	≥80%	32%	39%	31%	49%	33.3 %
Proportion of specimens (serologic or virologic) received at the laboratory within 5 days of collection	≥80%	100 %	100 %	98%	100 %	98%
Proportion of serologic results reported by the laboratory within 4 days of receiving the specimen	≥80%	84%	88%	87%	90%	67%[13]

Source: National Verification Committee for Measles Elimination and Rubella/CRS Control report. Bangladesh. Submitted to 3rd Regional Verification Committee Meeting, New Delhi, India. 2018

A joint national/international review was conducted by 9 field teams in Bangladesh on 28 July to 6 August 2018 to assess the national immunization programme and share lessons learnt for preventing and controlling vaccine preventable diseases. This report summarizes the findings and recommendations made during the review.

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SEA-Immun-127