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Leading Article

Introducing Conjugate Pneumococcal Vaccine at EPI Schedule in Bangladesh - Impact on Sustainable Development Goal

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Introduction

Tremendous progress has been made over the past 20 years towards development of effective national immunization programmes throughout the world. The major contributor to this success is the Expanded Program on Immunization (EPI) of the World Health Organization (WHO), usually implemented through UNICEF. Bangladesh Government also achieved MDG successfully by 2015. Now, Bangladesh Government is committed to achieve SDG by 2030 with a continuous look after. In Global Sustainable Development Goal (SDG) there are 17 goal where number 3 is health & Immunization. Global leaders lauded Bangladesh's overall progress saying 'Bangladesh is a development surprise.[1] The EPI was created in 1974 as a worldwide alliance of collaborating nations whose goal was to expand immunization services and coverage. The programme currently consists of vaccination against eight childhood diseases: polio, measles, pertussis, tetanus, diphtheria, tuberculosis, Rubella and Pneumonia in Bangladesh. Top priority was given to developing countries because the seriousness of these diseases and the problem of immunization service delivery were more severe in these areas. A recent estimate suggests that immunization programmes annually prevent 3.2 million child deaths, and represent one of the most cost-effective health interventions.[2] Bangladesh officially initiated EPI activities in 1979, but EPI efforts were seriously considered only after 1985 when the country made its commitment at the United Nations to reach universal child immunization by 1990. The programme received strong support and assistance from multiple partners, including Non-Governmental Organizations, donor agencies, commercial enterprises and community volunteers. During the mid-1980s major steps were taken by the programme in many areas, with particular emphasis on establishment and improvement of the infrastructure for immunization, such as procurement of improved cold chain equipment, vaccination tools and portable vaccination kits, training of immunization teams, development of strategies for effective immunization delivery, and subsequently promotion of demand for immunization through various communication media and health education campaigns. Immunization motivation and education are provided during household visits by health workers.[3]

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Objective

The overall objective of the EPI is reduction of mortality and morbidity from the eight EPI diseases by offering immunization services. With this objective, the programme started in Bangladesh in 1978.

Specific objectives of the Programme are as follows[4]:

- Achievement of 90 % immunization coverage by 2016
- Elimination of Pneumonia by 2025
- Maintain Maternal & Neonatal Tetanus Elimination status.
- Elimination of Measles by 2016.
- Maintain Polio free status.
- Reduction of VPDs morbidity & mortality by 2/3rd by year 2015 as compared to 2000 as per MDG-4.
- Ensure Safe injection practices and waste disposal.

5 years of age 27% of deaths group are due to vaccine Preventable Diseases. Eighty percent children of world are being protected against childhood TB.Three million children & 19.5 million child-bearing-age (CBAs) are being protected against eight vaccine preventable diseases and tetanus respectively. The global target of the Programme is to immunize over 95% of infants and child-bearing-age females. Pneumonia is the

commonest cause of childhood mortality, particularly in countries with the highest child mortality and it has been identified as the major "forgotten killer of children" by the United Nations Children's Fund (UNICEF) and WHO. Almost all (99.9%) child pneumonia deaths occur in developing and least developed countries, with most occurring in sub-Saharan Africa (1 022 000 cases per annum) and South Asia (702 000 cases per annum). Of all pneumonia deaths, 47.7% occur in the least developed countries. Most of which are eligible to get support for the purchase of vaccines and development of their immunization programmes through the Global Alliance for Vaccine & Immunization (GAVI).[5] Although various pathogens may cause pneumonia, the available evidence suggests that two bacteria are the leading causes: *Haemophilus influenzae* type b (Hib) and *Streptococcus pneumonia* (pneumococcus). WHO estimates that in 2000, Hib and pneumococcus together accounted for more than 50% of pneumonia deaths among children aged 1 month to 5 years.[6] Several effective vaccines are available for the prevention of childhood pneumonia, including two vaccines provided in immunization programmes in all countries, *Bordetella pertussis* and measles vaccines, and two relatively new vaccines, Hib conjugate vaccine (HibCV) and Pneumococcal conjugate vaccines (PCVs).

Pneumococcal Conjugate Vaccine: A newer vaccine available in Bangladesh

Streptococcus pneumoniae, or pneumococcus, causes pneumonia and infections of the brain and blood that is responsible for mortality in children under five years. Pneumococcal diseases are a major public health problem worldwide. *S. pneumoniae* is a Gram-positive encapsulated cocci. Based on differences in the composition of the polysaccharide capsule, about 90 serotypes have been identified.[7] The capsule is an essential virulence factor. The majority of cases of pneumococcal diseases in infants is associated with a small number of these serotypes, which are vary by region. Pneumococci are transmitted by direct contact with respiratory secretions from patients and healthy carriers. Pneumococcal resistance to essential antimicrobials such as penicillins, cephalosporins and macrolides is a serious and rapidly increasing problem worldwide. Facilities for laboratory diagnosis of *S. pneumoniae*, based on growth in traditional culture media, are available in laboratories for routine clinical microbiology, whereas serotyping is performed only in reference laboratories.

S. pneumoniae is responsible for 15-50% of all episodes of community-acquired pneumonia, 30–50% of all cases of acute otitis media and a significant proportion of bacterial meningitis and bacteremia.[6,8] However, based on available data, acute respiratory infections kill an estimated 2.6 million children less than five years of age annually. *S. pneumoniae* kills at least one million children under the age of five every year, a sum that is more than malaria, AIDS and measles combined. More than 70% of the deaths are in developing countries. Pneumoniae is by far the most common cause of pneumococcal death worldwide. Out of 90 serotypes of *S. pneumoniae,* a handful is responsible for most cases of invasive pneumococcal disease (IPD). Serotypes 1, 2, 3, 4, 5, 6A, 6B, 7F, 8, 9A, 9N, 9V, 10A, 12F, 14, 15B, 18C, 19A, 19F and 23F are responsible for 85% of invasive pneumococcal disease in the developed world.[4] Children under the age of 2 years are at greatest risk for invasive pneumococcal disease. Results of the Invasive Bacterial Infection Surveillance (IBIS) study in patients with invasive pneumococcal disease (IPD) indicate that serotypes 1, 2, 3, 4, 5, 6A, 6B, 7F, 8, 9A, 9N, 9V, 10A, 12F, 14, 15B, 18C, 19A, 19F and 23F are the most prevalent, with serotypes 1 and 5 accounting for 30% of invasive pneumococcal disease. It is also known that the serotypes causing pneumonia and otitis media differ from those causing invasive pneumococcal disease and usually reflect those serotypes present in nasopharyngeal carriage. Studies conducted in many parts of the developing world have consistently shown the two leading causes of bacterial pneumonia to be *S. pneumoniae* (pneumococcus) and *Hemophilus influenzae* type b.[7,9] Perhaps more importantly, pneumonia remains the leading killer of children in India. A recent UNICEF publication estimated that 410,000 children under age 5 years die of pneumonia each year in Bangladesh, and a recent data shows that an estimated 25% of all child deaths in India are due to pneumonia.[10]

In 2011, coverage of routine vaccination was 83% now in 2014 it decreased to 78%. Ninety five percent of children whose mothers completed secondary or higher education are fully vaccinated,compared with 74 percent of children whose mothers have no education. Between the 1989-1993 and 2010-2014 periods, infant mortality declined by from 87 deaths per 1,000 live births to 38 deaths per 1,000 live births. Even more impressive are the 71 percent decline in post-neonatal mortality and the 65 percent decline in

under-5 mortality over the same period. As a consequence of this rapid rate of decline, Bangladesh has achieved its MDG-4 target for under-5 mortality of 48 deaths per 1,000 live births by 2015.Bangladesh Government developed a process and timeline for introducing pediatric pneumococcal vaccine.Meta-analysis of four high-quality, randomized, controlled trials of pneumococcal conjugate vaccines suggests that about 30-40% of all severe pneumonia in children are likely to be pneumococcal in origin.[11] Based on the available data and policy options before it, Bangladesh can take several important steps to prevent pneumonia and improve child survival through the expanded use of life-saving pneumonia vaccines.

Recommendations for Pneumococcal Conjugate Vaccines PCVs in Bangladesh

The burden of pneumococcal disease is the greatest among the underprivileged children in Bangladesh. The PCVs are thus of public health importance and ideally should be available to all children. However the high cost of PCVs and the limited coverage of the currently available vaccine are impediments. Global Alliance for Vaccine & Immunization (GAVI) has offered to supply PCV at a cost of 0.15-0.3 USD/dose to Bangladesh for inclusion in the national immunization schedule and commits to extending this support until the year 2025.

Schedule for Pneumococcal Conjugate Vaccine

Bangladesh Health Ministry & Bangladesh Pediatrics Association(BPA) recommends 3 doses at 6, 10 and 14 weeks with a booster at 15 month. Infants receiving their first dose at age <11 month should receive 3 doses of PCV10 at intervals of approximately 4 weeks with a booster at 15 month. Children aged 12-23 months should receive 2 doses with an interval of at least 8 weeks between doses.[12] The risk of invasive pneumococcal disease is significantly lower in healthy children above the age of 2 years and vaccination with single dose of PCV vaccine may be considered in children aged 2-5 years.[13] Pneumococcal vaccination in not recommended in children aged 5 and above. The recommended dosage for is 0.5mL, and the vaccination route is intramuscular.

Vaccine Safety

The safety of PCV10 was assessed in 10 studies and it contains 10 different serotypes of pneumococcus. Where over 30,000 healthy infants were aged under 7 month administered at least 1 dose of PCV10 and over 24,000 children aged 6-16 month received at least 1 dose of PCV10 with other routine pediatric vaccines. The most commonly reported (more than 20% of subjects) adverse reactions were injection-site reactions, fever, decreased appetite, irritability, and increased or decreased sleep. The frequency and severity of local reactions at the injection site (pain/ tenderness, redness of the skin, and induration/ swelling) and systemic reactions (irritability, drowsiness/increased sleep, decreased appetite, fever and restless sleep/decreased sleep) were similar in the PCV10.[14,15]

Achievements of EPI in Bangladesh[16,17]

- In Bangladesh 78% (0-11 months) children fully immunized (BDHS-2014) and 41.8 million children immunized against measles & Rubella through special campaign in 2013.
- TT Immunization to target women (15-49 yrs.) in 6 high risk Districts in rural area.
- The coverage for the penta-valent and polio vaccines is 97 percent each for the first dose and 91 percent each for the third dose.
- Only 2 percent of children age 12-23 months has not received any vaccinations.
- Vitamin-A supplementation-twice a year with coverage >95%.
- Storage capacity enhanced for the buffer stocks of all vaccines for the period of 3 months.
- Improved monitoring & supervision through provision of 59 single cabin vehicles for DO(H) under Global Alliance for Vaccine & Immunization (GAVI).
- Provisions of 3652 motorcycles to EPI staff were given by GAVI.
- Provision of cold chain equipment to 8 flood hit districts.
- Capacity building of health managers and EPI staff (17,804).
- Orientation training workshops for medical officers, LHVs, LHWs etc.
- Training of health personnel for cold chain repair and maintenance.
- Training workshops for vaccine stock management carried out in all districts during 2010 & 2011.
- Introduction of Rota virus vaccine within 2016.

Conclusion

Currently, vaccines against nine diseases are being administered to children under 1 year. The full coverage is more than 85 percent, an achievement

that helped Bangladesh to become one of the six countries in the world that achieved MDG on child mortality before the 2015 deadline. Global Alliance for Vaccine & Immunization (GAVI) also awarded Bangladesh twice for the best coverage in the world. As pneumonia causes 20,000 deaths of children under five every year, introducing the pneumococcal vaccination will save many lives. Starting PCV is a great achievement of Bangladesh Government. This indicates that we are not too much far from 2022 vision. If our government keep this sustainable progression in health sector we can easily achieve our goal.

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