Expanded Program on Immunization (EPI)

Introduction Vaccination has made enormous contribution to public health, including the eradication of one dreaded disease, small pox, and elimination of poliomyelitis from all but a handful of countries.

Simply, the vaccine gives us immunity against disease. It's a special kind of antigenic substances which provides active immunity to that particular disease. The vaccine is made from particular microbes, killed or weakened or its toxins, or one of its surface proteins. A notorious virus that has killed millions of people worldwide. Thanks to the vaccine, now it is eradicated.
Smallpox vaccine, the first successful vaccine to be developed, was introduced by Edward Jenner in 1796. He followed up his observation that milkmaids who had previously caught cowpox did not later catch smallpox by showing that inoculated cowpox protected against inoculated smallpox.

The practice of immunization dates back hundreds of years. Buddhist monks drank snake venom to confer immunity to snake bite and variolation (smearing of a skin tear with cowpox to confer immunity to smallpox) was practiced in 17th century China. Edward Jenner is considered the founder of vaccinology in the West in 1796, after he inoculated a 13 year-old-boy with vaccinia virus (cowpox), and demonstrated immunity to smallpox. In 1798, the first smallpox vaccine was developed. Over the 18th and 19th centuries, systematic implementation of mass smallpox immunization culminated in its global eradication in 1979.

Louis Pasteur's experiments spearheaded the development of live attenuated cholera vaccine and inactivated anthrax vaccine in humans (1897 and 1904, respectively). Plague vaccine was also invented in the late 19th Century. Between 1890 and 1950, bacterial vaccine development proliferated, including the Bacillis-Calmette-Guerin (BCG) vaccination, which is still in use today.

In 1923, Alexander Glenny perfected a method to inactivate tetanus toxin with formaldehyde. The same method was used to develop a vaccine against diphtheria in 1926. Pertusis vaccine development took considerably longer, with a whole cell vaccine first licensed for use in the US in 1948.

Viral tissue culture methods developed from 1950-1985, and led to the advent of the Salk (inactivated) polio vaccine and the Sabin (live attenuated oral) polio vaccine. Mass polio immunization has now eradicated the disease from many regions around the world

Attenuated strains of measles, mumps and rubella were developed for inclusion in vaccines. Measles is currently the next possible target for elimination via vaccination.

The past two decades have seen the application of molecular genetics and its increased insights into immunology, microbiology and genomics applied to vaccinology. Current successes include the development of recombinant hepatitis B vaccines, the less reactogenic acellular pertussis vaccine, and new techniques for seasonal influenza vaccine manufacture.

Molecular genetics sets the scene for a bright future for vaccinology, including the development of new vaccine delivery systems (e.g. DNA vaccines, viral vectors, plant vaccines and topical formulations), new adjuvants, the development of more effective tuberculosis vaccines, and vaccines against cytomegalovirus (CMV), herpes simplex virus (HSV), respiratory syncytial virus (RSV), staphylococcal disease, streptococcal disease, pandemic influenza, shigella, HIV and schistosomiasis among others. Therapeutic vaccines may also soon be available for allergies, autoimmune diseases and addictions.

Bacteria against which vaccines are available.

- Streptococcus pneumoniae
- Neisseria meningitidis
- Haemophilus influenzae
- Salmonella typhi
- Corynebacterium diphtheriae
- Clostridium tetani
- Bordetella pertussis
- Bacillus anthracis

- Mycobacterium bovis
- Francisella tularensi – Tularemia
- Vibrio cholerae
- Yersinia pestis
- Rickettsia rickettsiae
- Coxiella burneti

Viral Diseases:

- Measles
- Mumps
- Rubella
- Varicella
- Polio
- Influenza
- Hepatitis A
- Hepatitis B
- Rabies
- Rota virus
- Human Papilloma
- Yellow fever
- Japanese Enchephalitis
- Adenovirus

Vaccines *

Routine vaccination

- Diphtheria
- Hepatitis B
- Haemophilus influenzae type b
- Human papillomavirus

- Seasonal influenza
- Measles
- Mumps
- Pertussis
- Rubella
- Pneumococcal disease
- Poliomyelitis (Polio)
- Rotavirus
- Tuberculosis (TB)
- Tetanus
- Varicella

Selective use for travellers

- Cholera
- Hepatitis A
- Hepatitis E
- Japanese encephalitis
- Meningococcal disease
- Rabies
- Tick-borne encephalitis
- Typhoid fever
- Yellow fever

The World Health Organization (WHO) initiated the Expanded Program on Immunization (EPI) in May 1974 with the objective to vaccinate children throughout the world. The Expanded Program on Immunization (EPI) was established in 1976 to ensure that infants/children and mothers have access to routinely recommended infant/childhood vaccines. Six vaccine-preventable diseases were initially included in the EPI: tuberculosis, poliomyelitis, diphtheria, tetanus, pertussis and measles.

Ten years later, in 1984, the WHO established a standardized vaccination schedule for the original EPI vaccines: Bacillus Calmette-Guérin (BCG), diphtheria-tetanus-pertussis (DTP), oral polio, and measles. Increased knowledge of the immunologic factors of disease led to new vaccines being developed and added to the EPI's list of recommended vaccines: Hepatitis B (HepB), yellow fever in countries endemic for the disease, and Haemophilus influenzae meningitis (Hib) conjugate vaccine in countries with high burden of disease.

In 1999, the Global Alliance for Vaccines and Immunization (GAVI) was created with the sole purpose of improving child health in the poorest countries by extending the reach of the EPI. The GAVI brought together a grand coalition, including the UN agencies and institutions (WHO, UNICEF, the World Bank), public health institutes, donor and implementing countries, the Bill and Melinda Gates Foundation and The Rockefeller Foundation, the vaccine industry, non-governmental organizations (NGOs) and many more. The creation of the GAVI has helped to renew interest and maintain the importance of immunizations in battling the world's large burden of infectious diseases.

Epidemiology It is estimated that between two and three million child deaths are averted annually through vaccination against diphtheria, tetanus, pertussis and measles and many more future deaths averted in older groups (e. g. 600,000 future deaths prevented annually through hepatitis B vaccination). However, vaccine preventable diseases are still responsible for about 25% of the 10 million deaths occurring annually among children under five years of age. Infectious diseases responsible for 8.3 million of total 12.5 million deaths of under five children globally in the year 1990.In Bangladesh it has prevented an estimated 2 million deaths from 1987-2000, and continues to prevent approximately 200,000 deaths each year.2 One out of five infants worldwide, nearly 20% of children is still unprotected against vaccine-preventable illness and over 70% of these unreached children live in ten countries: Afganistan, Chad, The Democratic Republic of Congo, Ethiopia, India, Indonesia, Nigeria, Pakistan, The Philippines and South Africa. Notwithstanding in 2013, an estimated 21.8 million infants worldwide were not reached with routine immunization services, of whom nearly half live in 3 countries, viz. India, Pakistan

Bangladesh has made significant progress in recent times in many of its social development indicators particularly in health. This country has made important gains in providing primary health care since the Alma Ata Declaration in 1977. Infections are responsible for the majority of loss of life in children and vaccination has made enormous contribution to public health, including the eradication of one dreaded disease, small pox, and elimination of poliomyelitis from all but a handful of countries. Globally, immunization currently averts an estimated 2 to 3 million deaths every year. In Bangladesh it has prevented an estimated 2 million deaths from 1987-2000, and continues to prevent approximately 200,000 deaths each year. WHO introduced EPI (Expanded Programme on Immunization) in 1977 at Alma-Ata, the capital of Kazakhastan for the underdeveloped countries. Subsequently Bangladesh has launched EPI programme. Ten years later, in 1984, the WHO established a standardized vaccination schedule for the original EPI vaccines: Bacillus Calmette-Guérin (BCG), diphtheria-tetanus-pertussis (DTP), oral polio, and measles. Increased knowledge of the immunologic factors of disease led to new vaccines being developed and added to the EPI's list of recommended vaccines: Hepatitis B (HepB), yellow fever in countries endemic for the disease, and Haemophilus influenzae meningitis (Hib) conjugate vaccine in countries with high burden of disease.

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In Bangladesh EPI was formally launched on 7th April 1979 as a pilot project in eight thanas, is now the most successful programme of Bangladesh Government. At the outset in 1979, EPI started with six conventional vaccines- BCG, DPT, OPV, TT and Measles. As vaccination centre were few and were located mainly in health care facilities in urban areas, the EPI coverage remained less than 2% by 1984.1 In 1985, the People's Republic of Bangladesh committed to the

Global Universal Child Immunization Initiative (UCI), and began a phase-wise process of EPI intensification from 1985-1990. During this time period, EPI was intensified throughout 476 Upazila, 92 major Municipalities and 6 City Corporations. Finally EPI was made available to all target groups (infants and pregnant mothers) by 1990. EPI intensification consisted of establishing the cold chain system from EPI Headquarter to District and Upazila level and capacity to maintain cold chain down to the vaccination points in rural and urban areas, procuring and managing logistics needs for about 134,000 EPI outreach sites, and providing basic EPI training for thousands of mid-level managers, supervisors and field workers in the public and private.

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During the last few years, based on the data on disease burden, new vaccine for selected emerging diseases such as Hepatitis B (2003) and Hib Disease (2009) have been incorporated into the EPI schedule with GAVI (Global Alliance for Vaccines and Immunization) support in pentavalent formulation (DPT+HepB+Hib) that has added advantage of reducing shots for vaccination and minimize concern of mothers for use of injectable vaccine. In view of enhancing the injection safety AD (Auto Disable) syringes were introduced in to the programme from 2004.Then MR and MCV2 (Measles Containing Vaccine second dose) introduced in September 2012 and finally Pneumococcal Conjugate Vaccine (PCV) and Injectable Polio Vaccine (IPV) in March 2015. Since 1995 two days are set every year as National Immunization Days (NIDs) usually during the dry winter months to facilitate wide participation, were conducted with very high (around 90%) coverage in view of eradicating Polio and measles catch up campaign in 2005. Surveillance activity in EPI for Vaccine Preventable Diseases (VPDs) started in 1995 with AFP surveillance for Polio eradication. After that more diseases and issues have been

incorporated for surveillance in EPINT, Measles and AEFI. TT5 dose for WCBA started in 1993. AFP and NT surveillance started in 1997. As a result of many interventions like Maternal and Neonatal Tetanus (MNT) elimination campaign, Measles catch up campaign, NID for Polio eradication a commendable success has been achieved in immunization program. The country has achieved the threshold of NT validation from 2008. Since 2003 Bangladesh has strengthened measles surveillance. No laboratory confirmed measles outbreak has yet been detected since conduction of measles catch up campaign in 2005-2006 and measles follow-up campaign in 2010. So measles surveillance has been shifted from outbreak investigation to case based surveillance at facility level. The country is again maintaining polio free status from 22 November 2006 after experiencing importation.

Recently AD (Auto Disable) syringes and vaccination against Hepatitis B, H. Influenzae, Measles-Rubella (MR) and Pneumococcus has been introduced in vaccination programme. In Bangladesh, immunization coverage of DPT/PENTA3 was only 16% in 1988 increased significantly to 69% in 1990, 81% in 2000, 90% in 2011and 92% in 2013 which was higher than global coverage of 84% in 2013 and comparable to first world countries. EPI in Bangladesh has been recognized for its sustained high coverage and great contribution to the reduction of childhood morbidity and mortality and it received two 'GAVI best performance award' in 2009 and 2012, which is given as a recognition to achieving the Millennium Development Goals (MDG), particularly in reducing child mortality. Bangladesh received MDG award.

EPI schedule has 10 preventable diseases vaccine. They are listed below.

1. Childhood Tuberculosis
2. Polio
3. Diphtheria
4. A whooping cough
5. Tetanus
6. Hepatitis B
7. Hemophilus Influenza type Meningitis, Pneumonia
8. Measles
9. Rubella
10. Pneumococcal Pneumonia

Over-all Goal:

To reduce the morbidity and mortality among children against the most common vaccine-preventable diseases.

Specific Goals:

1. To immunize all infants/children against the most common vaccine-preventable diseases.
2. To sustain the polio-free status.
3. To eliminate measles infection.
4. To eliminate maternal and neonatal tetanus
5. To control diphtheria, pertussis, hepatitis b and German measles.
6. To prevent extra pulmonary tuberculosis among children.

Targeted People:

1. 0-11 Months old all babies
2. 15th-Month-old babies
3. 15 years old all girls
4. 15-49 years all child-bearing females.

EPI Schedule for child

Visit one: At first contact baby receive BCG and if it occur within 14 days, it also receive Oral Polio Vaccine(OPV). Oral Polio vaccine should be given after birth or within 14 days of birth. It is counted as Zero dose. The regular OPV vaccine schedule is counted from 42nd days or 6th week of age. If baby visit after 14 days, it receives only BCG. This is to maintain the minimum recommended distance between two doses of OPV.

Visit two: Baby receive Pentavalent vaccine dose one(Penta-1) and Pcv-1 ,fipv-1, OPV-1 in second visit. It should be paid at 6 weeks of baby's age.:

Visit three: In third visit (after completion of 10 weeks), baby receives second dose of pentavalent vaccine (penta-2), Pcv-2, and OPV-2.

Visit Four: In fourth visit (after completion of 14 weeks), baby receives third dose of pentavalent vaccine (penta-3), Pcv-3, fipv-2and OPV-3. Pentavalent vaccine and OPV are administered with a minimum gap of 4 weeks.

Visit Five: In fifth visit (after completion of 9 months), baby receives a injection containing vaccine against Measles and Rubella (MR-1 vaccine).

Visit Six: In sixth visit (after completion of 15 months), baby receives another Measles and Rubella (MR-2).

Table 1: EPI immunization schedule of Bangladesh for children 0 - 1 year of age

Vaccine	Disease	No. of Dose	Interval between doses	Starting time of doses	Route of Administration
BCG	Tuberculosis	1	-	After birth/ If not possible with Penta 1	Intra dermal
Pentavalent	Diphtheria, Pertussis, Tetanus, Hepatitis B, Haemophilus Influenza B	3	4 Weeks	6 weeks of age	IM
PCV	Pneumococcal Pneumonia	3	4 Weeks	6 weeks of age	IM
Fipv	Poliomyelitis	2	8 Weeks	6 weeks of age	ID
OPV	Poliomyelitis	4 (additional 0 dose at birth)	4 Weeks	6 weeks of age	Oral
MR	Measles Rubella	1	-	After completion of 9	Subcutaneous

Vaccine	Disease	No. of Dose	Interval between doses	Starting time of doses	Route of Administration
				months	
Measles	Measles	1	-	After completion of 15 months	Subcutaneous

For Girls Only:

A woman of reproductive age(15-49 years) should receive TT vaccine e in following schedule:

1. First dose of TT at first session. According to Government of Bangladesh instruction a girl of 15 years age(14 years 365 days)..
2. Second dose of TT- 4 weeks after the first dose.
3. Third dose of TT- 6 months after the second dose.
4. Fourth dose of TT- 1 year after the third dose.
5. Fifth dose of TT- 1 year after the fourth dose.

6. Table 2: EPI immunization schedule of Bangladesh for women of

TT schedule for woman age (15-49 years)

Vaccine	Disease	No. of Dose	Starting time of doses	Route of Administration
TT (Tetanus toxoid)	Tetanus	5	TT-1: At 15 years	IM
			TT-2: 28 days after TT-1	IM
			TT-3: 6 months after TT2	IM
			TT-4: 1 year after TT-3	IM
			TT-5: 1 year after TT-4	IM

Immunization and Vaccine Development (IVD) Programme of WHO Bangladesh has been providing techniical assistance to the Government of Bangladesh to strengthen immunization systems including Vaccine Preventable Disease and Adverse Events Following Immunization (AEFI) surveillance; eradicate poliomyelitis and measles, and eliminate neonatal tetanus; transfer appropriate technologies for EPI; strengthen National Regulatory Authority and ensure safe use of vaccines.

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