



Editorial

World Immunization Week 2018: What lessons for India?

The concept of immunization, with its products and practices, is a unique and invaluable contribution of scientific medicine to humanity. Left to Nature, we are vulnerable to many infections - several causing diseases, some killing many, especially the young. Some infections are inevitable - everyone catches them some time or the other during life. Their pathogens are air-borne, highly infectious and actually contagious. The force of infection (transmission) is measured as 'basic reproduction number' - R_0 - that stands for how many would get infected from one infected person; if all contacts were non-immune, hence susceptible¹.

The higher the R_0 , the greater the speed of spread, and younger the median age of infection. Consider *Corynebacterium diphtheriae*, *Haemophilus influenzae* b (Hib), rotavirus and viruses of measles, poliomyelitis, rubella and varicella that are highly contagious, catching children young. Less contagious agents with lower R_0 spread more slowly, infecting only a few at a time, although infants, children and adults are at risk. Median age of infection shifts to older children or adults. Influenza and mumps are examples as was smallpox.

Vaccines as game changer

All of the above diseases, which were qualified as inevitable, are today vaccine preventable. So are several more infectious diseases, but there is a difference - the listed inevitable infectious diseases can be prevented only with immunization, while others with intermediary transmission channels other than air can also be prevented by environmental manipulations. Think of cholera, typhoid fever, tetanus, hepatitis A, Japanese encephalitis (JE), human papillomavirus, etc. - theoretically, these can be prevented through other means, but in reality, vaccines offer the easiest, predictable and lasting, hence the best, prevention.

Smallpox vaccination, proved effective in the late 18th century, provided proof of principle of disease prevention by vaccines. Smallpox eradication by vaccination, without the need to change socio-economic circumstances, attested to the power of vaccines to prevent diseases wholesale. The Expanded Programme on Immunization (EPI) was designed by the WHO against six childhood diseases - childhood tuberculosis (TB), diphtheria, measles, pertussis, polio and tetanus². The design was simple enough for all countries at any stage of socio-economic development to adapt and protect children from disease, disability or death, from these diseases.

Subsequently, the WHO, through its Scientific Advisory Group of Experts (SAGE), recommended newer vaccines against Hib, hepatitis B, rotavirus and pneumococci in EPI and more are likely to be included³. Using tactical management of immunization, polio is nearing global eradication and measles and rubella are targeted for eradication.

Expanded Programme on Immunization (EPI) designed for equity

Immunization in healthcare setting is individual-centric. Only the well-to-do could afford paying for vaccines. Expanding immunization in public health mode, namely EPI, was for equity, for all children to have equal opportunity to avail of the benefits. To that end, immunization under EPI is free of charge. Equitable distribution of immunization was needed to achieve high level of population immunity, leading to community control of target diseases. Yet, there remains inequity of distribution, between nations, and within our own nation between States. Within States, there is inequitable immunization coverage according to social factors. The more urban, educated and richer the parents, the better covered are their children⁴.

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Parental motivation is an important determinant of EPI coverage. For many families, the immediate priority is daily income for living; taking time off to reach EPI clinics and to wait their turn is simply not a priority. Moreover, the benefit from EPI is deferred and invisible - need for food is immediate. Furthermore, there is no systematic method to inform all mothers about the benefits of immunization, enumerating vaccines that are offered free, schedules of vaccine doses and exactly where and when children should be presented for immunization. For these and similar reasons, the 'fully immunized' coverage under EPI in India has hovered around 70 per cent for many years⁴.

EPI was launched in 1974 by the WHO. Even today, equity continues to elude EPI in many countries in Asia and Africa. To make children catch up with recommended vaccines, the WHO proposed that annually a week be set apart for EPI campaigns when families need spend less time and get all deficit vaccines. In 2012, the World Health Assembly passed a resolution to earmark the last week of April every year as the World Immunization Week⁵. The purpose is to plan and provide public messages on the importance of immunization, as well as to open up access to immunization in campaign mode, thus reducing gaps in immunization coverage in all member countries. The theme for this year is 'Protected together, #Vaccines Work'.

India has taken a cue from World Immunization Week

India launched EPI in 1978. Four decades later, equitable distribution still eludes us. Hence, on December 25, 2014, the Government of India launched its own immunization catch up programme in campaign mode in low-performing districts, under the catchy name of Mission *Indradhanush*⁶. The goal was to increase full immunization coverage from 65 per cent to at least 90 per cent⁶. In 2015, in its first phase, 201 districts were targeted with week-long campaigns each month, during four months - April-July. In the second phase, 352 districts were covered. Phase 3 was essentially a repeat of phase 1 activities in 216 districts. Phase 4 is ongoing in the form of Intensified Mission *Indradhanush*, as an inter-departmental effort, involving departments under 11 ministries^{6,7}. Concentrated efforts to reach unreached children through Mission *Indradhanush* have made a difference - improving coverage of fully immunized children by about seven per cent (personal communication, Dr Pradeep Haldar, MoHFW).

Despite four decades of experience with EPI in India, and with a few states achieving and sustaining more than 85-90 per cent full immunization coverage, why is our national average coverage only below 70 per cent⁴. In spite of the fact that though EPI children, families, and community benefit immensely, why do we have to resort to episodic campaigns of immunization to improve coverage? The answer is partly that the real benefit of immunization by way of true quantum of reduction in disease incidence is not monitored in real time. EPI does not know what it has actually achieved quantitatively by way of disease reduction, the true outcome intended of EPI. Consequently, neither the taxpayer community nor the science correspondents of media nor the parents of children get validated information on the actual achievements of EPI. Hence, immunization remains as a ritual for the provider and for the people.

EPI needs a research and development wing

EPI faces more problems other than low coverage alone. Not being able to reliably quantify the disease reduction outcome and its economic value is highlighted above. Anecdotally, one hears about outbreaks of diphtheria, measles and JE as well as high incidence of childhood TB continuing to occur in different States, in spite of community-wide immunization. Low coverage does not explain this problem. As children who had been vaccinated according to schedule are reportedly getting these diseases, one needs to know if the quality of vaccines is at fault or if the schedule is not good enough for best possible vaccine effectiveness.

How many children have been protected from hepatitis B infection, chronic carrier state and clinical hepatitis B after the vaccine was included in EPI? How many cases of Hib meningitis and pneumonia have been prevented annually after vaccine introduction? EPI must justify itself by quantifying disease prevention and by calculating the economic returns on investment. Immunization-protected children register better physical growth and higher cognitive development, both helping to increase earning capacity and wealth creation⁸. Polio eradication in India has not been widely recognized as a wealth-creating enterprise⁹. We invested some 10,000 crores of rupees and gained 75 lakh crores by way of productivity gains⁹.

Why are we not preventing other high incidence diseases that are vaccine preventable, such as typhoid fever, cholera, hepatitis A, varicella and influenza? Is not prevention of many if not all of them cost-beneficial

from economic analysis? EPI does not have, but urgently deserves, a research and development arm to ask and answer all these questions.

Globally, EPI deserves a transformational change

The basic reason to establish EPI was to partly overcome the lack of access to healthcare for the vast majority of children in the developing countries in the 1970s. The spinoff benefit would be control of vaccine-preventable diseases (VPDs). Immunization is one common and crucial element of both individualized healthcare and public health. Developed countries stood out for their effective public health infrastructure and their equitable primary health care. They did not need EPI - only developing countries needed EPI. A fundamental flaw in the design of EPI was that there was no sunrise plan - a stairway towards the creation of both public health and equitable healthcare, in that order of priority. We in India have a great opportunity to build on the successes of EPI and transform EPI into a national programme for the control of all VPDs and then expand it to control non-vaccine-target diseases of children and address adult infectious diseases as well and thus become a world leader among developing countries¹⁰.

Disease prevention: The function of public health infrastructure

India must urgently transform EPI from a mere vaccine delivery platform into a comprehensive disease control programme^{10,11}. The first step in disease control is public health surveillance¹². Once public health surveillance is established to monitor VPDs, immunization campaigns can be tailored to the needy targets in terms of geography, disease-specific vaccines and age groups, thus conserving resources instead of going nationwide with all vaccines.

Surveillance and need-based and timely responses should be the responsibility of the district level local staff under a decentralized health management scheme^{12,13}. That will help us to avoid large-scale, nationwide immunization campaigns that are of transient benefit as new birth cohorts are born all the time.

Only after converting EPI from vaccine delivery platform to disease control programme it will be known if the schedules being used for various vaccines are optimal or not. Is nine months of age ideal to give the first dose of measles vaccine, or the age should be 12 months? Are two doses of currently used JE vaccine sufficient for full protection? Should diphtheria and pertussis immunization continue into adolescence?

Two outstanding achievements in India, applying nationwide surveillance and targeting intensified immunization guided by surveillance information, were the eradication of smallpox and eradication of wild polioviruses. These illustrate that we can achieve ambitious goals once we set objectives, design comprehensive strategy, ensure community participation and provide necessary resources.

Both Mission *Indradhanush* and the World Immunization Week are stimuli and signposts for us to explore why some countries need them and what India can provide as a lasting solution for the inequities in India and in developing countries of the world, regarding prevention and control of infectious diseases.

Conflicts of Interest: None.

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