Polio Eradication in India: A Journey From a Dream to Reality

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The unachievable task of preventing wild poliovirus (WPV) transmission has been achieved and sustained in India already for more than three years.1 Extensive and exhaustive search for WPVs among children has proved negative since January 13, 2011. On February 25, 2012, the World Health Organization (WHO) removed India from the list of ‘polio-endemic’ countries.2 India’s success has silenced critics who predicted that polio itself was non-eradicable; or that polio was not eradicable in India with its low standards of sanitation and hygiene; or that wild polioviruses (WPVs) cannot be eradicated using live oral poliovirus vaccine (OPV); or that polio was not worth eradicating as it was a low priority disease but with very high cost of eradication. Each view point had an element of rationale that had been long neglected by India’s policy makers, resulting in delays in interruption of WPVs, originally targeted for 2000, but achieved 11 years later.3

True polio eradication is zero transmission of not only WPVs but also vaccine polioviruses.4,5 The elimination of WPVs using OPV is the first phase, and elimination of vaccine polioviruses using inactivated poliovirus vaccine (IPV) is the second phase.6-8 This concept originated in India and WHO has very recently endorsed it.9 India will have to implement the second phase in the near future.

During the 1970s, 1980s and continuing into early 1990s, polio was hyperendemic in India, with 200,000 to 400,000 cases annually.10 Today we are free from WPVs. The earliest attempt to isolate poliovirus was by CG Pandit (Deshpande JM, personal communication, 2012). The second polio research unit in India was the Enterovirus Laboratory, established in 1964, in the Christian Medical College (CMC), Vellore, Tamil Nadu. Studies from both centres showed that the country was hyperendemic for poliovirus infection. In longitudinal community survey the prevalence of subclinical poliovirus infection in Vellore town was 242 per 100 child-years below 5 years.11 The incidence of paralytic polio in India was 24 cases/100,000 population/year, calculated annual incidence of clinical polio infection was >40/100,000 population.12 Thus, polio was a huge problem, both humanitarian and economic.13

The city corporation introduced polio immunization using imported OPV in Mumbai in 1964 and in Vellore by CMC in 1965. Low vaccine efficacy (VE) was corroborated by counting children developing poliomyelitis in spite of the recommended 3 doses of OPV.14 WHO launched EPI in 1974 and India adopted it in 1978. Even after introduction of OPV in EPI, the number of polio cases did not fall for about 10 years.15 In 1981, there was a nation-wide polio epidemic, in the background of already hyperendemic status. The next nation-wide epidemic was in 1987-1988. During this decade, after introduction of OPV in EPI, the estimated annual numbers of cases were 200,000 to 400,000; translated to daily averages, some 500 to 1000 children were developing polio paralysis each day. Assuming annual productivity loss of 50 per cent of per capita gross national product (amounting to INR 50,000), resulting in loss to national economy of INR 15 lakhs per paralyzed child, extended over 30 years of productivity, for 300,000 victims of polio, the total annual loss to the nation was INR 45,000 crore.15

Many cases of polio reported during the 1970s and 1980s were in children who had already taken 3 doses of OPV, on account of the low VE of OPV. In a visionary experiment, ‘pulse immunization’ using OPV was conducted in Vellore, making it the first Indian town to be polio-free; the concept and the name of pulse immunization were created in Vellore.16 The World Health Assembly (WHA) resolved in 1988 to target polio for global eradication by 2000 and India was a signatory in support of the decision.17 The four strategic components promoted by WHO were to reach and maintain high routine OPV coverage, to top up immunization with supplementary doses of OPV (Supplementary Immunization Activity, SIA), to establish systematic surveillance of polio with laboratory virological
support, and to use local area mop up OPV campaigns to interrupt any remaining chains of WPV transmission.\textsuperscript{18}

By 1990 when 80 per cent 3-dose OPV coverage was achieved, the burden of polio had begun declining in India. The estimated number of polio cases in 1994 was 50,000; that amounted to an average of 137 children getting paralyzed every day.\textsuperscript{19} Eventually, the number of reported cases of polio declined to 3,142 in 1995.\textsuperscript{20} India's efforts to implement it started on a national level only in 1995-1996. In 1995, the Global Polio Eradication Initiative (GPEI) spearheaded by WHO in partnership with UNICEF, Centers for Disease Control of USA and Rotary International designed a modus operandi for India giving rise to a joint project the National Polio Surveillance Project (NPSP). India had so far not managed to bring polio under control status, but expected to eliminate its transmission within the next 4-5 years. The two factors that stood in the way of control, namely ‘failure to vaccinate’ and ‘failure of vaccine’. However, polio eradication activities were conducted in parallel with UIP, as yet another vertical national project.

Pulse Polio Immunization (PPI) was later expanded nationally in 1995 during which a total of 88 million under-3 children were immunized. This resulted in further decline in number of polio cases to 1005 reported in 1996.\textsuperscript{21} Till 1998-1999, PPI consisted of vaccination of children at fixed booths on two National Immunization Days (NIDs), separated by six weeks, during the winter months. After the nation-wide PPI campaigns in 1995-1996, 1996-1997, 1997-1998 and 1998-1999, WPV 2 stopped circulating by October 1999. In view of missing goal of reaching zero incidence of polio by 2000, a plan to further intensify PPI was adopted in 2000. Four nation-wide PPI rounds were conducted in October, November, December of 2000 and January 2001, followed by two sub-national rounds in 8 States (Assam, Bihar, Gujarat, Madhya Pradesh, Orissa, Rajasthan, Uttar Pradesh and West Bengal) that had continuing polio and had low EPI coverage.\textsuperscript{22} It was obvious that as near 100 per cent children as possible had to be vaccinated repeatedly for success. During and since 2000, therefore, another tactic was applied: in addition to booth immunization, a house-to-house search of missed children and vaccinating them on the next 2-3 days following each national and sub-national PPI.\textsuperscript{22}

In 2000 and 2001 there were only 265 and 268 cases due to WPV 1 and 3, for more than 99 per cent decline in India from the 1980s. Thus polio was effectively controlled by 2000, but WPV transmission was not interrupted. WHO, in association with NPSP, strengthened several existing virology laboratories and networked them for virological surveillance of polio. Two consecutive-day stool samples were collected from each child with AFP and submitted to the designated laboratory under cold chain conditions. Each poliovirus isolate was analysed to distinguish vaccine virus from WPV. Only if WPV was detected was the child diagnosed with polio. By 2001, WPV circulation was limited essentially to the two northern States of UP and Bihar. GOI took polio eradication as an issue of national prestige, and declared 2005 as the target year in its National Health Policy. Yet, 2002 saw an outbreak with 1,600 cases, nearly 87 per cent of cases detected globally, mostly of type 1, and 1,363 (85%) cases in UP and Bihar alone.\textsuperscript{23} In 2003, the ‘under-served strategy’ was introduced as part of better communication efforts in Uttar Pradesh to reach out to and get support of marginalized sections of the society especially those living in poor Muslim communities, lacking access to basic sanitary and healthcare services, and were often missed in tOPV rounds, and thus were more likely to receive fewer doses.\textsuperscript{24} An improvement in poliovirus surveillance quality was seen in 2004. It became obvious that huge numbers of people migrate for employment, mostly seasonal, and their children by and large missed receiving tOPV doses in EPI and in PPI. So the ‘transit vaccination’ strategy was launched, with teams stationed at bus stands, railway stations, highways, markets and at congregation sites and provided polio vaccine to eligible children. Beginning in 2005, NPSP and GOI and partners intensified eradication efforts with careful monitoring and implementation of immunization and surveillance activities, with particular attention paid to detailed local level micro planning and by expanding the number of AFP reporting units throughout the country.

Many children got polio in spite of seven or 10 or even 15 doses of tOPV. In 2005, monovalent OPV type 1 (mOPV-1) and type 3 (mOPV-3) were licensed based on an early Indian study showing 2.5 to 3 times higher VE of mOPV-1 and mOPV-3 than that of tOPV.\textsuperscript{25} In December 2005, mOPV3 was first used in eradication activities in western UP, after detection of WPV3 in Moradabad district.\textsuperscript{26} The second problem was inadequate coverage of under-five children with OPV doses- ‘failure to vaccinate’. Routine vaccination coverage with 3 doses of OPV continued to be low in the polio-endemic States. To counter both factors, the number of PPI campaigns was increased to 10 each year from 2005 and the ‘under-served’ and ‘transit vaccination’ strategies were sustained. Yet, UP and Bihar remained the sites of ongoing WPV transmission in India. There was a polio outbreak in 2006, with 648 cases of type 1 and 28 of type 3, again most cases occurring in UP and Bihar. Based on recommendations of the Global Advisory Committee on Polio Eradication and IEAG, India prioritized elimination of WPV1 from 2006/2007.\textsuperscript{27} Moreover, the next anticipated WPV1 outbreak year was 2010 and IEAG wanted to ensure that such an outbreak would not occur in 2010. That seemed to have worked and
ultimately areas that previously had the highest incidence of WPV1 recorded lowest numbers in subsequent years and finally its transmission ceased in January 2011.

In November 2009, the IEAG declared that 107 blocks in western UP and central Bihar were holding the key to eradication in India. In late 2009, India had planned to conduct additional mOPV3 SIA rounds as needed to prevent further WPV3 outbreaks while continuing to use mOPV1 for most SIAs.28 Towards the end of 2009, while WPV1 had virtually disappeared, while WPV3 was still causing outbreaks in spite of intensive efforts over many years, repetitive and massive OPV campaigns, improved tactics and large expenditure. GOI proposed a reduction in the tempo of eradication efforts and to accept ‘control’ of WPVs as the realistic goal that could be achieved.29 Fortunately, IEAG guided the battle against polio with continued vigor. Only 42 WPV cases were detected in 2010. This emboldened the GOI to recommend responding to each case of polio as a public health emergency.30 Finally, there was only one case in 2011 and the responsive mop-up immunization was exemplary. The introduction of bOPV in SIAs beginning in January 2010 contributed substantially to the sustainment of simultaneous reduction in WPV1 and WPV3 cases. A clinical trial earlier had demonstrated the superiority of bOPV compared with tOPV and non-inferiority compared with mOPV1 and mOPV3.31 Thus it can be concluded that India has achieved polio free status in January 2011, and is maintaining it till date, but the battle is still not finished India need to focus on maintain its status as polio free country by implementing strategies for immunizing children through IPV (stage 2 of polio eradication) and treating each case as medical emergency.

REFERENCES