

Universal Immunization Program and Polio Eradication in India

POLIO ERADICATION COMMITTEE, INDIAN ACADEMY OF PEDIATRICS (PEC, IAP)

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INTRODUCTION

The Indian Academy of Pediatrics (IAP) continues to fully support the polio eradication initiative (PEI) of the Government of India (GoI). While IAP is as disappointed as the GoI regarding India's delay in realizing the goal of eradication, and is deeply concerned about the consequent cost escalations, IAP also believes that the GoI had not paid full attention to the professional advice given from time to time by IAP in good faith.

IAP has a special Polio Eradication Committee (PEC) which convenes periodic meetings of experts of IAP to review the progress of the PEI and to assist the GoI to achieve the goal efficiently. PEC and IAP experts met in New Delhi on 24 and 25 November 2007 to review progress and plan for the future. It was resolved to articulate IAP's formal stand regarding PEI and Universal Immunization Programme (UIP) in a Strategic Position Paper.

While India had the potential to be the leader of UIP and polio eradication in the SE Asia Region, the national policies, strategies, tactics and achievements have not matched that potential. On the contrary, India's UIP remains one of the weakest and India is the only country in the Region with no effective measles control program and the only one that did not achieve polio eradication by the year 2000. We believe there is a nexus between poorly performing UIP and the delays to achieve polio eradication. We also believe that with political will and well-designed action plan India can rapidly improve UIP. A high-performing UIP will be essential to sustain polio eradication in the long

term after interruption of transmission of wild polioviruses is achieved.

The unsatisfactory performance of UIP is not due to technical problems or financial constraints, or due to the reluctance of parents to get their children immunized. It is, in fact, due to managerial, administrative and governance-related inadequacies that should be addressed with no more delay. India does have unprecedented resources which should be applied for children's survival, health and well-being. IAP pledges its full support to the GoI in this endeavor, at both the planning and the implementation stages.

The Expanded Programme on Immunization (EPI), the earlier version of UIP, was established 30 years ago. The GoI has had ample time and experience to understand the problems leading to poor performance and the necessary steps to respond to them. Indeed there are a few states in India that have efficiently running UIP and several that do not. All but two states have achieved the interruption of wild poliovirus transmission. The success and failure factors of the respective states must be identified in order to ensure equitable provision of disease prevention opportunities to all children, no matter which state they happen to live in.

While PEI and UIP are intimately intertwined, it was indeed unfortunate that PEI was virtually de-linked from UIP in terms of technical issues while burdening UIP managers with additional workload. The long term sustainability of PEI and the protection of the enormous investments made to date for PEI will rest in future on an efficiently

functioning UIP. The purpose of this Strategic Position Paper on UIP and PEI is to bring home this message, to offer IAP's full support and assistance in the journey towards a totally polio-free India, in which our children are fully protected from all vaccine-preventable diseases through renovating and reinvigorating UIP.

INDIA'S POLIO ERADICATION INITIATIVE (PEI)

In 1988 the Government of India committed the nation to the goal and program of global polio eradication by the year 2000, by voting in the relevant resolution in the World Health Assembly of the World Health Organization (WHO). In nature, wild polioviruses (WPV) types 1, 2 and 3 cause polio. Two vaccines are available to protect against polio and retard transmission of WPV, the live oral poliovirus vaccine (OPV) and the inactivated poliovirus vaccine (IPV). The live vaccine containing the 3 types of viruses is called trivalent OPV (tOPV); if it contains individual types, it is called monovalent OPV (mOPV). IPV is a mixture containing antigens of the 3 types. Scientific studies in India had shown clearly that the protective efficacy (vaccine efficacy, VE) of tOPV was very low for types 1 and 3 but satisfactory for type 2. Large numbers of children developed polio in spite of 3 doses of tOPV every year. Indian studies had also shown very high efficacy of IPV for all three types(1-2).

The vaccine viruses in OPV may occasionally cause polio (called vaccine-associated paralytic polio, VAPP), the incidence of which varies in different countries. The WHO had recommended that every country that opts to use OPV should establish effective surveillance for VAPP(3). India did not comply and did not measure either the annual burden of cases of vaccine failure polio or VAPP.

Vaccine viruses are shed by the vaccinated children and they may occasionally infect other children in contact, causing in them either silent infection or "contact VAPP". If vaccine viruses continue to transmit in further generations, they acquire genetic and phenotypic changes that reverse the property of attenuation and so become wild-like

in both neurovirulence and ability to circulate widely. Such viruses cause outbreaks of VAPP and are called circulating vaccine-derived polioviruses (cVDPV) or vaccine-derived wild-like (VDWL) polioviruses. The first such episode was detected in Egypt in 1988, in which VDWL type 2 poliovirus had circulated for about 5 years (and continued to circulate for 5 more years). The next such episode occurred in the Caribbean, in which VDWL virus type 1 emerged in 1998, was detected in 2000, and with intense vaccination with tOPV, stopped in 2001(4). OPV protects against VDWL viruses better than it does against WPV. Since 2001, about 1 to 2 episodes of outbreaks due to VDWL viruses are being detected every year somewhere in the world and each one is stopped using tOPV or mOPV (http://www.polioeradication.org/content/publications/AnnualReport2007_ENG5.pdf). India remains vulnerable to the emergence of VDWL polioviruses. So far India has escaped from them due to overuse of OPV, as vaccine viruses protect against VDWL poliovirus transmission more efficiently than that of wild viruses.

For the above reasons the definition of polio eradication proposed by national experts of IAP is zero incidence of poliovirus infection, wild or vaccine. On the other hand, the definition adopted by the GoI is zero incidence of only WPV infection. While OPV administration, VAPP and VDWL viruses are accepted within the GoI definition, the use of OPV is incompatible with eradication as defined above. Countries that used IPV achieved complete eradication straightaway, but countries that eradicated wild viruses using OPV had to go through a second phase to eliminate vaccine viruses, for which many have switched to IPV from OPV from the 1980s onwards. It appears inevitable that India will have to achieve polio eradication in 2 stages, first interrupt wild viruses using OPV and later eliminate vaccine viruses using IPV. This approach has ethical problems, is more expensive in the long run, and less expensive only during just the initial phase of upscaling vaccine use. The current experience seems to indicate that even this short term economic advantage has not been realized on account of the inordinate delays in achieving the interruption of wild viruses. In spite of these

ideological differences in the definition and tactics of eradication, IAP has fully supported the PEI in order to save large numbers of children from polio expeditiously without creating disharmony among ourselves.

Ignoring the drawbacks of low efficacy and incomplete safety of OPV, both the World Health Organization (WHO) and the GoI have promoted the exclusive use of OPV in UIP and in PEI. The strategy of eradication of WPV proposed by the WHO(5) and adopted by GoI consisted of four parts:

1. Sustained high routine immunization (RI) coverage with OPV through UIP
2. Surveillance of polio (clinical and virological) for monitoring progress
3. Large scale (country/state/district-wide) supplementary immunization activities (SIA)
4. Locally targeted 'mop up' vaccination to interrupt last chains of WPV transmission.

In the implementation of PEI strategy, the very first component was neglected, the consequences of which have been highly detrimental. The time target set in 1988 to complete polio eradication in India was the year 2000, but it has not yet been achieved even in the last quarter of 2007. The neglect of UIP is the 'mother of all reasons' for this delay. Infants below 6 months of age are efficient 'amplifiers' and 'transmitters' of WPV and should be well-immunized for achieving interruption of WPV transmission; UIP offers 4 doses of tOPV by age 4 months-providing an early platform of immunity to be topped up with further doses in pulse campaigns. It is gratifying to note that a new tactic of registering and tracking newborns is now being applied in Uttar Pradesh (UP) and Bihar in order to provide sufficient number of doses of OPV early in life; this indeed was the intended but neglected function of UIP.

Much progress has been achieved by PEI, from which timely lessons should have been learnt. WPV type 2 was eliminated in 1999. It had been shown by several Indian studies that the vaccine efficacy (VE) of tOPV was satisfactory against type 2 WPV, but

not against WPV types 1 and 3 (1,2,6). Thus, it was obvious by 1999 that the very low VE of tOPV against WPV types 1 and 3 was another important contributory reason for the delay in polio eradication. Again, it is gratifying to note that in 2006, after a long and avoidable delay, the GoI finally accepted the problem of 'failure of vaccine' (of tOPV) as a major reason for the delay to eradicate WPV types 1 and 3 and remedial steps have been undertaken. Had UIP been efficient, this fact (frequent primary vaccine failure) would have been detected in the 1980s, thus enabling GoI to take remedial steps to overcome the problem of failure of vaccine over 20 years ago.

A study in India some 30 years ago had shown that mOPVs had more than twice the VE against types 1 and 3, than that of tOPV (7). However, only since 2005 has the PEI included the use of mOPV-1 and mOPV-3 in repeated campaigns. The lack or delay in application of research findings in India and the reluctance or delay of the PEI to take appropriate and revised tactical decisions have contributed to loss of time and money consequent to the long delay in eradication.

The annual burden of polio disease (presently due to WPV types 1 and 3) has been reduced by more than 99 percent (compared to pre-1988 data) during recent years, which in itself is encouraging. However, it is at an enormous cost, sufficient for the reduction of the burden by 100 per cent repeated again and again. Continuing endemic WPV transmission, with periodic outbreaks, has been restricted to just 2 states, Uttar Pradesh (UP) and Bihar. From these states, WPV have been repeatedly 'exported' to several polio-free states in India and polio-free countries in Asia and Africa. Eradication requires 100 percent reduction. In these 2 states the UIP is among the least efficient in India, the VE of tOPV is among the lowest in India and the force of transmission of WPV among the most intense in India. The conjunction of three adverse factors – very low UIP coverage, low VE of tOPV and high speed and force of WPV transmission (with extremely high basic reproductive rate, R_0) – is the reason for the delay in interrupting transmission in UP and Bihar. This peculiarity was ignored by the PEI, and no research had been

conducted to recognize/confirm these problems or design remedial interventions. This was the consequence of the lack of a technical supra-structure to guide and direct the PEI, a fourth adverse factor.

Although predictions are risky, we hope that the transmission of WPV can be interrupted using mOPV-1 and mOPV-3 in tandem or concurrently. This approach carries the risk of allowing fall off of type 2 immunity among children, which may lead to the emergence and evolution of VDWL type 2, which may then set the polio eradication clock back. In recent years, VDWL poliovirus type 2 have emerged repeatedly in Northern Nigeria where concerted efforts to interrupt transmission of type 1 WPV resulted in reduced immunity levels against type 2 in the community. This is a warning signal to India's own PEI. Therefore high type 2 immunity level must be maintained and currently, in the absence of IPV, tOPV is the only tool for achieving it. Thus, India faces a precarious scenario in which WPV 1 and 3 and VDWL 2 have to be addressed simultaneously but by using 3 vaccines. IPV has the advantage of being one tool against all three.

In future, even after interrupting WPV types 1 and 3, the tempo of vaccination against them has to continue to preempt the evolution of VDWL types 1 and 3. However, from the moment the last case of polio due to WPV is recorded every case of polio will be VAPP, sporadic or epidemic. When the number of VAPP cases exceeds WPV polio, the ethics of continued use of OPV will become unacceptable. This situation has already become real for type 2 in all states and types 1 and 3 in all but 2 states. Plans to overcome this crisis have to be made now; it is already very late. Thus, the GoI will have to stop using OPV sooner than later. Gradual withdrawal of OPV is highly risky since it creates a milieu conducive for the emergence of VDWL viruses. Similar risks exist with abrupt stopping of OPV also. It is highly inadvisable to reduce the tempo of vaccination with OPV without taking steps to preempt the evolution of VDWL polioviruses. The safest approach is to use IPV, achieve high (>85%) coverage, and then only withdraw OPV. The longer this step is delayed, the more will be the numbers of VAPP; but the

deliberate induction of VAPP is highly unethical. Thus, IAP urges GoI to take urgent steps to revamp UIP, include IPV in the routine schedule, and plan to stop OPV when IPV coverage reaches over 85%.

THE NATIONAL UNIVERSAL IMMUNIZATION PROGRAM (UIP)

Obviously the neglect of UIP has cost us dearly. The GoI embarked on the mission of PEI as if eradication should be achieved first, and improvement of UIP could be attempted later. It will be extremely unwise to postpone the reconstruction of the damaged UIP system – a likely temptation in view of the fact that WPV types 1 and 3 may be eradicated using mOPVs. As alluded to earlier, an efficiently functioning UIP including IPV in its schedule will be essential for preempting the development of VDWL polioviruses and thus to enable the safe withdrawal of OPV under immunity cover of IPV. The question is not when or whether it is important to reconstruct UIP, it is imperative to do so and do so now. It cannot be postponed. The only question is 'how'?. IAP once again pledges its full support to the GoI in the process of protecting all children through an efficient UIP – by preventing morbidity, disability and death in our infants and children, due to vaccine-preventable infectious diseases.

The important question of how to reconstruct UIP must be addressed systematically and professionally. For identifying the elements of success in well-performing states and elements of failure in poorly-performing states, a systematic process of investigations and analysis is essential. IAP strongly recommends to GoI that such a systematic process be initiated without delay. We remind the GoI that such a recommendation had already been made in the National Technical Advisory Group on Immunisation.

Although vaccination is a medical intervention, the vaccination program, UIP, is not simply a medical modality – it is a management-dominant modality. The UIP is a "system", with inputs, processes and output. The sooner the GoI appreciates this critical fact, the earlier will the nation be able to progress towards a successful UIP. In addition, we need to examine the management

structure, the lines of authority and control, the accountability of those responsible, the sharing of responsibilities between Union, State and Local Governments, the degree of local ownership and accountability, the method(s) of monitoring and evaluation, and fund utilization.

For a systems analysis of UIP, inputs include all elements provided to vaccinate children, including budgetary expenses, staff, cold chain, vaccines, transportation tools, injection equipment, buildings (infrastructure), *etc.* Processes include management (suprastructure), purchase, storage, distribution and quality assurance of vaccines and injections, the actual clinics and sessions, vaccination, documentation, collection of data and analysis and collation of vaccine coverage data, *etc.* Currently the monitoring consists of coverage assessments – unfortunately the internally generated coverage figures are inflated and unreliable and every other investigating agency comes out with their own disparate coverage data. The more important item to be monitored is the impact or output. Output (outcome) consists of disease reduction and demand creation. The neglect to monitor and measure the outcome is the most glaring defect in the UIP system.

Outcome measurement by disease surveillance is essential to evaluate the success of UIP and to assess input efficiency. For example, if DPT coverage is 90% but diphtheria and pertussis continue to occur in the community, obviously the coverage could not be that high – or if it indeed was so high, then the vaccine was not of satisfactory quality. Diphtheria, pertussis and measles cases are rampant in states like UP, Bihar and several others. There is no surveillance system under which cases can be reported. When conscientious pediatricians do report cases, they are subjected to harassment so that they would refrain from further reporting. Many health officials assume that reporting cases is to detect their failure – they must be taught that reporting cases is actually the beginning of success of disease control activity.

In any system, output should be commensurate with inputs. It appears that in India, full budgeting is made available for 100% coverage of infants with

all vaccines. Yet, coverages are reportedly about 50% only and the target diseases continue to occur. This is not only a colossal waste, but also gross neglect of child health and survival. Moreover, there is no reliable management information system to develop coverage data from vaccine utilization. In these days of electronic data management, it should be fairly straightforward to capture the vaccination data and convert the same to coverage information. However, it requires design, application of the mind, supervision, local ownership and accountability, and ‘external’ monitoring (auditing) on a periodic basis.

It is no longer acceptable to IAP that the UIP system does not monitor, in real time, the distribution, determinants and burden of childhood diseases targeted for control under UIP. Model systems of disease surveillance appropriate for the nation’s need already exist, but not introduced widely(8). The currently ongoing project of ‘integrated disease surveillance’ is neither integrated with UIP nor focused on UIP target diseases. It is also not suitable to provide diseases incidence data on many other diseases for which vaccines are already available but are not within the UIP list. Another approach recently undertaken by the GoI is to add measles surveillance to the AFP surveillance. Although this is a practical step forward, there is severe limitation to the number of diseases that could be brought under vertical disease-specific surveillance. What India needs is a general disease surveillance for the purposes of effective public health control of all important infectious diseases, both vaccine preventable and others such as vector-borne and food and water-borne infectious diseases. However, UIP can seize the opportunity and establish a surveillance system for all important childhood infectious diseases which can later be expanded to include adult diseases as well.

There is urgent need to examine the success-factors in well-performing states and failure-factors in poor-performing states. As states are given input targets (in terms of vaccination coverage), they report very high coverage levels. However hardly any one believes the data and various organizations such as WHO, UNICEF, ICMR and International

Institute for Population Sciences conduct occasional or periodic independent surveys and come up with their own results which do not tally with the UIP program generated data. This state of affairs is no longer acceptable in the 21st century.

Obviously we need clarity of roles and responsibilities of the three levels of Governance – Union, state and local (city and district panchayat). This issue has come during discussions repeatedly in NTAGI but the GoI has not taken adequate steps to bring in clarity. The IAP demands that urgent action is taken to re-design and re-define the roles and responsibilities and, working relationships among the three levels. IAP believes that the best level to achieve and monitor disease control by vaccinations is local – sub-district level, supervised and coordinated at district level. In other words, the UIP system must be district-based in terms of inputs, output and monitoring/evaluation. Any occurrence of even a single case of the target disease – progressive primary TB, diphtheria, pertussis, tetanus, and measles, must be investigated by the district staff and reported to the state as well as the within-district health personnel. Every “case” detected under UIP is evidence of the success of the monitoring process as well as evidence for suboptimal output of UIP or low quality vaccine, requiring repair.

The state is too large to be the working unit; every state consists of component districts (and cities). The responsibility of the state should be clearly defined and should be supervisory and quality-ensuring in nature. Where deficiencies are detected, the responsibility of improvement must be placed at the local level; remedial measures – in terms of better performance – must be at the local level. Such accountability should be clearly visible and enforced.

While the GoI has a central or pivotal role in UIP, it should not be presented or perceived as a “centrally managed” scheme, in which case the ownership, accountability and responsibility rest with the GoI, not the state or local governments/administration which act as the implementing agencies. The states and local functionaries thus escape from accountability. The GoI is the best

agency to centrally procure vaccines and supplies so that bulk (large volume) purchases will ensure the lowest of prices; and to establish protocol of procedures, monitoring and evaluation; and external (auditing) monitoring of the whole system. The GoI level management supra-structure of UIP deserves appropriate strengthening for this expanded role.

After redesigning and redefining the exact roles and responsibilities at the three levels, a close look at the exact staff structure and number at various levels must be made. Any deficiencies should be corrected as early as possible. IAP is willing and happy to assist the GoI and states Governments in achieving these functions. We strongly recommend that the NTAGI be charged with taking immediate steps to provide the necessary design to re-engineer centre-state and state-district/city interactions in UIP.

EPILOGUE

India has taken rapid strides in innumerable fields and has grown into one of the world’s largest economies. The population profile of India is still a ‘young-dominated’ one. Children and growing adolescents and adults form one of the world’s most precious human capital. Education and health are the two elements that will enrich the human capital. India has neglected to advance on both fronts – here we focus on disease-prevention through UIP. IAP urges the GoI to correct this deficiency expeditiously.

The need for high vaccination coverage with all UIP vaccines pre-existed the era of PEI. The importance and need for efficient UIP will outlive PEI. The need to monitor the progress of control of diseases under UIP has not been realized; one element of the poor performance of UIP is precisely this lack of monitoring. Targeting polio for eradication before controlling diphtheria, pertussis and measles would have been justified only if high UIP vaccination coverages were achieved against these diseases under the banner of PEI for which the first principle was to attain and sustain high RI coverages. The need for UIP for maintaining polio eradication does not seem to be appreciated by the GoI. Achieving as well as sustaining polio eradication in India requires high performance of UIP.

IAP believes that eradication is not only applicable to wild polioviruses but also to vaccine viruses. India chose to eradicate only wild-virus-polio by using OPV. Eventually vaccine-virus eradication will be necessary using IPV. VAPP is an inevitable problem while using OPV and it raises serious ethical questions. Under the exclusive OPV policy, children with VAPP are to be identified, honored and compensated, as they have suffered serious adverse consequences for the benefit of society and without freedom of choice. We urge the GoI to identify every child with VAPP and provide full treatment and rehabilitation and assured future employment, in order to fulfill the minimum ethical call as the disease is the consequence of the deliberate policy to use OPV exclusively.

To achieve and maintain high coverage of IPV, the vaccine has to be used systematically by age-based schedule, which of course is the method of UIP. Fortunately IPV is UIP-friendly whereas OPV is not – it has to be given in campaigns as each child has to be given 15-30 doses in the high risk states of UP and Bihar. In summary, building up of UIP system is of paramount importance to achieve and sustain polio eradication even in the short to medium term. As mentioned above the nation already spends 100% of the necessary budget for achieving success in UIP. As the output remains below par, we are losing the benefits of funds expended and such loss is unnecessary. Thus the process is wasteful.

In every country the most important and trusted advocates of child health are in the Governments – in the Ministries of Health, Social Welfare, Education and Finance. The next most important advocates for children are the Associations/Societies/Academies of Pediatrics and Child Health. Thus, it is important that in India the Governments (Union and state) and the Indian Academy of Pediatrics join hands to ensure that India's children receive their fair share of preventive medicine and health care. Polio eradication must be seen in this light – namely in the best interests of India's children. When we examine PEI from this angle, there is no escape from the fact that India has been failing its children. India, with

one of the largest economies in the world, with high technical achievements in atomic energy and nuclear sciences, in information technology, biotechnology, pharmaco-technology, advanced surgical and high technology medical care, should not tolerate the below standard performance in the arena of protecting children's life and health.

Thus, UIP and PEI are to be implemented synergistically at all levels – policy, planning, implementation, monitoring. The Indian Academy of Pediatrics pledges its full support and participation in this journey.

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