# Accelerating Measles Control in India: Opportunity and Obligation to Act Now

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Two major milestones in the history of measles control have recently been achieved. Since November 2002, measles is no longer endemic in the Western Hemisphere(1) and the 2005 goal set by the World Health Assembly (WHA) to halve measles deaths worldwide (compared to 1999 levels) was achieved on time(2). The main intervention that led to these achievements was the tactical scaling-up of measles vaccination.

In May 2005, the WHA welcomed the goal of reducing measles deaths by 90% by 2010 compared to 2000 levels, as part of the Global Immunization Vision and Strategy (GIVS)(3). This global goal was endorsed unanimously by the WHA in May, 2008. This editorial explores the potential impacts of measles control strategies on child survival in India and on the global goal of reduction in measles mortality.

## MEASLES IN INDIA

Measles continues to be an important cause of childhood morbidity and mortality in many states in India. At a workshop convened jointly by Government of India (GoI), WHO, and UNICEF on measles, in May 2007, it was estimated that between 100,000 and 160,000 children die from measles in India each year and that over 90% of deaths occur in 10 states – Uttar Pradesh (UP), Bihar, Rajasthan, Madhya.Pradesh, Jharkhand, Assam, West Bengal, Andhra Pradesh (AP), Orissa and Gujarat (preliminary results from a workshop held at National Polio Surveillance Unit, New Delhi, May 2007).

A recent (2006) vaccination coverage survey in India showed overall 71% coverage for measles vaccine (given during 9 to 12 months of age)(4). Accepting 85% vaccine effectiveness for vaccination at 9 months, actual protection was offered to only 60% of annual birth cohorts (71% × 85% = 60%). In other words, 40% remained susceptible to measles. Coverage of measles vaccine was less than 50% in UP, Bihar, Assam and Nagaland and between 50% and 80% in 13 other states(4). Worldwide, of the estimated 26.2 million infants who missed receiving their first dose of measles vaccine by age 12 months through routine immunization services in 2006, 10.5 million were in India(5).

Six states (AP, Gujarat, Karnataka, Kerala, Tamil Nadu, West Bengal) conduct measles surveillance through clinical and laboratory outbreak investigations. In these states, nearly 80% cases occur in children less than 10 years old (data available at National Polio Surveillance Project [NPSP], New Delhi). Even in the states with moderate routine immunization coverage, many under-five children with measles had not been given measles vaccine (*e.g.* West Bengal 72%, Karnataka 38%, Gujarat 35%). According to the Registrar General and Census Commissioner of India, UP, Bihar and Assam together had 114 million children under 15 years of age, in 2006(6). More than half of them had not received measles vaccine – providing fertile ground for continued intense transmission of measles virus.

Studies in India have shown median case-fatality ratio (CFR) of 3.8% (range: 0% to 30%) among children with measles(7). UP had recorded measles CFR of 4.1% in 1996, through routine reporting(8). Actually the present surveillance method tends to under-report measles deaths.

Given the formidable challenges of wide inter-regional disparities of immunization coverage, a huge unvaccinated child population and the large disease burden, can India reduce its enormous measles morbidity and mortality?

## MEASLES CONTROL STRATEGIES

Since 2000, almost all countries with high mortality from measles in the past have implemented, under diverse conditions, control strategies recommended by WHO and UNICEF. Although several factors had contributed to high measles mortality, experience with implementing these strategies has taught us that measles deaths can be drastically reduced even in settings of poverty, malnutrition, and overall high child mortality rates. The current WHO/UNICEF strategy to reduce measles mortality consists of four components:

(*i*) achieving and maintaining high coverage (>90%) with the first dose of measles vaccine in every district, delivered through regular immunization services;

(*ii*) ensuring that all children receive a second dose of measles vaccine delivered either through periodic supplementary immunization activities (SIAs)[†] and/or routine services;

(*iii*) effective laboratory-backed surveillance (of disease and outbreaks) and monitoring of immunization coverage; and

(*iv*) appropriate clinical measles case-management, including the provision of vitamin A.

### Strategy 1: Strengthening regular immunization system

Strengthening immunization system from the block level up must remain top priority for improved measles control in India. Only 4 states (Tamil Nadu, Kerala, Himachal Pradesh, Goa) and 4 Union Territories (Puducherry, Chandigarh, Lakshadweep, and Daman and Diu) have achieved one-dose measles vaccination coverage of more than 90%. However, improvement in routine immunization alone will not reduce the susceptible pool of older children who had missed measles immunization, owing to underperformance of the system in previous years.

### Strategy 2: Providing a second dose of measles vaccine

The average seroconversion rate with measles vaccination at 9 months is 85% (range 70%-98%)(9,10). Thus, approximately 15% of vaccinated children remain susceptible in spite of receiving one dose. As the level of 'herd immunity' needed to significantly impact measles transmission is in the range of 93-95%, even 100% coverage with a single dose of measles vaccine administered at 9 months of age will not prevent the accumulation of a susceptible pool and consequent periodic measles outbreaks. Seroconversion rate improves to >95% when the vaccine is given after one year of age, but the first dose has to be given earlier to protect infants. Field investigations of recent measles outbreaks in developing countries have found that, while some cases occurred in previously vaccinated children (*i.e.,* vaccine failure), most cases occurred in unvaccinated children, indicating that program failure was the predominant reason.

For these reasons, WHO and UNICEF recommend that all national immunization programs provide 2 doses of measles vaccine for all children(11). The purpose of the second dose is to protect children who received their first dose but failed to respond. In addition, the second opportunity provides one dose to those who missed the first dose. In settings with low to moderate routine vaccination coverage (<80%), SIAs are the preferred method of delivering the second dose, as they usually achieve coverage levels of >90%. SIAs reach children who lack access to health services, and have been shown to rapidly reduce measles incidence. In settings with high routine vaccination coverage (*i.e.*, ≥80% for 3

[†]*SIAs are generally carried out in two phases. An initial, nationwide catch-up SIA targeting 90% of susceptible populations has the goal of eliminating or drastically reducing the susceptible pool. Periodic follow-up SIAs then target all children born since the last SIA. They are conducted nationwide every 2-4 years, with the goal of eliminating susceptibility in recent birth cohorts*

or more consecutive years), the second dose may be delivered through routine services(12).

**Strategy 3: Measles case surveillance with laboratory confirmation**

Effective surveillance system for measles is critical to monitor programme impact and to adopt appropriate immunization tactics to control outbreaks, if any. Surveillance should be backed by proficient laboratory support. When measles is widely endemic, reporting of aggregated data to track and investigate outbreaks and to identify underserved areas is the appropriate approach. Once the measles incidence is low, for example after conducting an SIA targeting a wide age range (*e.g.* 1-14 years), it is appropriate to establish case-based surveillance with investigation and laboratory testing of suspected measles cases and outbreaks(13).

In 2006-2007, building on the acute flaccid paralysis reporting sites and laboratory network for polio eradication, the Government of India initiated outbreak-based measles surveillance in six states (named above) with technical assistance from NPSP. This system is already providing essential information needed to define the basic epidemiology of measles in those states. An added function of the laboratory is to support vaccination coverage monitoring through measuring antibody prevalence by age.

**Strategy 4: Appropriate treatment including vitamin A**

High dose of vitamin A has been shown to decrease severity of illness and CFR in young children hospitalized with measles in developing countries. Therefore WHO currently recommends vitamin A for all children with acute measles.

Experience in applying the above strategies in various settings has shown that countries with low to moderate levels of routine immunization coverage can quickly bring down measles mortality through successful catch-up campaigns as observed in 19 African countries and Nepal(14,15). Worldwide, their implementation has resulted in 74% reduction in estimated measles deaths (from 750,000 in 2000 to 197,000 in 2007)(5). The greatest reduction was in African and the Eastern Mediterranean Regions (where measles mortality decreased by 89% and 90%, respectively). WHO estimates that approximately two-thirds of the global burden of measles deaths, namely 136, 000 (range 98,000 to 180,000), occurred in the SEA Region in 2007, with most of them occurring in India. From 2000 to 2007, approximately 613 million children aged 9 months to 14 years received measles vaccine through campaigns in the 47 countries with the highest burden of measles, except in India. Pakistan completed the catch-up campaign in early 2008. Thus, in 2009, India remains the only country in the world that has not systematically introduced a second dose of measles vaccine.

## THE ROADMAP FOR INDIA

The Government of India convened a group of national and international experts (India Technical Advisory Group on Measles, ITAGM) for advice on the most appropriate immunization and surveillance strategies to reduce measles mortality in the country. During its first meeting (2008) ITAGM noted the results of the measles disease-burden workshop (May 2007), especially the finding that ten states in India accounted for over 90% of all measles deaths and the surveillance data indicating that nearly 90% of the measles cases are under 10 years of age. The ITAGM recognized and emphasized the urgency to start accelerated measles mortality reduction activities in India including conducting measles catch-up vaccination campaigns in one or more of the medium to high burden states. In addition, the main ITAGM recommendations called for:

(*a*) strengthening of immunization services with particular attention to states with low coverage, as this would be critical for sustaining disease reduction that follows catch-up campaigns; and

(*b*) expansion of the outbreak-based measles surveillance supported by WHO accredited laboratories – to help plan optimum catch-up campaigns and assessment of their impact.

At the June 2008 meeting of the National Technical Advisory Group on Immunization (NTAGI), the recommendations from ITAGM were

discussed and accepted in principle. NTAGI, after reviewing data on measles epidemiology and CFR, has recommended the following:

- A second dose of measles vaccine should be introduced in the Universal Immunization Programme (UIP) at the time of DPT booster dose (at 18 months of age) in states with ≥80% evaluated coverage with the first dose of measles vaccine;
- Catch-up measles vaccination campaigns should be implemented for children up to age 10 years in states with <80% evaluated coverage with the first dose of measles vaccine and that detailed action plans for these SIAs should be finalized immediately in states with low coverage and high measles mortality burden;
- A study to determine measles CFR in high burden states should be conducted to enable better estimation of the number of measles deaths in India; and
- Measles surveillance should be enhanced in high burden states to assist with planning of catch-up campaigns and to establish baseline data.

The categorization of the states by NTAGI (below and above 80% coverage) was proposed to provide the broad framework on which national and state programme managers can draw up operational plans quickly for the second dose of measles vaccine.

## CHALLENGES FOR INDIA

With the defined roadmap for accelerated measles control, what are the barriers (perceived and real) to implementation?

*Impact on UPI*. Concerns have been expressed regarding potential adverse impact of accelerated measles control activities, especially the catch-up campaigns, on UIP. Evidence from experience in other countries showed no such adverse impact. Between 2000 and 2006 — the period of intense measles control activities through catch-up campaigns in the African region, routine coverage with first dose of measles vaccine actually rose from 56% to 73%; in the Eastern Mediterranean region, from 73% to 83%; and in the Western Pacific region, from 86% to 93%. During the same period, coverage in countries of the South East Asian Region other than India, rose from 77% to 85%(16).

*Will injection safety be compromised during vaccination campaigns?* Actually such campaigns in other countries have served as an opportunity for promoting injection safety, including safe waste disposal and management of adverse events following immunization (AEFI), and for raising standards of training of vaccinators and improving the cold chain for vaccine storage and transport. Social mobilization efforts by volunteers have been instrumental for the success of campaigns by providing information to and creating demand from target populations, especially the hard-to-reach and marginalised(14-16).

*Adverse effects.* In 2008, serious AEFI (adverse events following immunization) were reported resulting in death in a few children after giving measles vaccine. So there is apprehension among some in India that campaigns might lead to serious AEFI. Actually death was due to programmatic errors at local level. Careful planning, sound training, close monitoring and an efficient AEFI management system during measles vaccination campaign can effectively mitigate all such risks as demonstrated repeatedly during measles vaccination campaigns in many countries around the world.

*Impact on polio eradication.* Will accelerated measles control activities now distract attention from the current priority of polio eradication and add to 'campaign fatigue'? Each of the other remaining polio endemic countries has already implemented measles control strategies; such activities, including campaigns increased community demand for vaccination(16). Many other countries had implemented measles vaccination campaigns during their active phase of polio eradication, taking advantage of the already trained and mobilized work force with updated maps, local implementation micro-plans, and a functioning monitoring system.

Measles vaccination campaigns targeting millions of children from 9 months to 10 years of age in many states of India will be a huge undertaking.

This will require firm commitment of state governments, careful advance planning, implementation in manageable phases and full gearing up of the public sector health system at the sub-district, district, state and national levels. If public-private participation is desired, it can be locally designed and managed.

## SUMMATION

Without drastic measles mortality reduction in India, the global goal to reduce measles mortality by 90% by 2010 will not be met. Implementation of the NTAGI recommendations for accelerating measles control in India represents an opportunity to rapidly reduce measles mortality thereby contributing to achievement of the 4th Millennium Development Goal (reduce under-5 child mortality by 2/3 by 2015). It is also an obligation on the part of the Government for the provision of equitable services to the children of all states.

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