

Introduction Strategy of a Second Dose Measles Containing Vaccine in India

SATISH KUMAR GUPTA, STEPHEN SOSLER*, PRADEEP HALDAR[†], HENRI VAN DEN HOMBERGH AND ANINDYA SEKHAR BOSE*

UNICEF, New Delhi; *World Health Organization, New Delhi, India; and, [†]Ministry of Health and Family Welfare, New Delhi, India.

Correspondence to: Satish Kumar Gupta, Health Specialist, UNICEF, 73 Lodi Estate, New Delhi, INDIA. sgupta@unicef.org

Measles continues to be a major cause of childhood morbidity and mortality in India. Although the true burden of measles is difficult to quantify, only a small proportion of cases seek treatment in the formal health sector, infection with measles virus is ubiquitous throughout the country. A recent review of Indian published literature shows the median case fatality ratio (CFR) of measles to be 1.63% (range: 0%-30.0%) [1]. Deaths from measles occur mainly in infants and young children and are primarily due to complications of the infection such as pneumonia and diarrhea. Malnutrition and young age at infection are risk factors associated with measles mortality. Recent studies estimate that 80,000 Indian children die each year due to measles and its complications amounting to 4% of under-5 deaths [2]. The distribution of these deaths is not homogenous but is concentrated in states with the poorest performing immunization programs [3-5].

GLOBAL PROGRESS TO REDUCE MEASLES ASSOCIATED MORTALITY

Remarkable progress has been made globally during the past 10 years to reduce measles mortality. By 2008, the annual number of measles associated deaths occurring worldwide had reduced by 78% from 733,000 in 2000 to 164,000 [6]. Sub-Saharan Africa in particular, has demonstrated the impact of increasing routine vaccine coverage while also providing a second opportunity for measles vaccination through measles catch-up campaigns [7]. From 2000 to 2008, measles deaths in Africa declined by 92%. Progress, however, has not been

uniform between countries or regions of the world. South East Asia disproportionately accounts for more than three-fourths of the remaining measles deaths globally and the majority of these are in India. It should be noted that prior to 2010, India was the only country in the world that had not introduced a second dose of measles vaccine in its national immunization program [3-5].

RATIONALE FOR SECOND DOSE MEASLES CONTAINING VACCINE (MCV2)

Measles vaccination was introduced into India's Universal Immunization Program in 1985. As per national guidelines, measles vaccine is given to children at 9-12 months of age. Although coverage with single dose measles vaccine has steadily risen over the years, it is estimated to be only 70% nationally [8-10], with considerable variation in coverage both between and within states. The combination of historically low routine vaccination coverage and primary vaccine failure (measles vaccine effectiveness is estimated to be 85% when given at 9 months of age) results in a substantial number of susceptible children in successive birth cohorts which fuels measles virus transmission. A crude but useful calculation demonstrates the number of susceptible children that result each year with successive birth cohorts. With 70% routine measles vaccination coverage and 85% vaccine effectiveness with a single dose given at 9 months of age, real protection to measles is only 60% ($0.70 \times 0.85 = 0.60$) and thus approximately 40% of India's annual birth cohort of 26 million children remain susceptible to measles. At this rate, the accumulation

of susceptible children in successive annual birth cohorts would reach the epidemic threshold level every 2-3 years [11].

The rationale for providing a second opportunity for measles vaccination is thus two-fold. The immunological rationale is to immunize the primary vaccine failures – those children who failed to respond to the first dose, while the programmatic rationale is to vaccinate those children who were missed by routine services. Most children who have failed to respond to the first dose of MCV respond well to a second dose [12]. MCV2 can be delivered either through existing routine services or through measles catch-up immunization campaigns, the choice is determined by the strategy that would attain the highest levels of coverage. In weak program settings, organized catch-up vaccination campaigns that benefit from specific planning and intense communication and coordination efforts have been proven to effectively achieve high coverage levels in all socio-economic strata [4,6]. Furthermore, numerous studies from a range of development settings have found two doses of measles vaccine to be highly cost effective [12]. In settings of low immunization coverage, the campaign approach has also been found to be more equitable across wealth quintiles [13].

INDIA'S DECISION TO INTRODUCE MCV2

Building on global experience and recognizing that measles represents a significant source of preventable child mortality, the Government of India announced in May 2010 its decision to implement the National Technical Advisory Group on Immunization (NTAGI) recommendation to introduce MCV2 [3,14]. As recommended by the NTAGI, the implementation strategy of MCV2 at the state level is determined by the underlying performance of the routine immunization (RI) program. In total, 14 states with measles coverage less than 80% (Arunachal Pradesh, Assam, Bihar, Chattisgarh, Gujarat, Haryana, Jharkhand, Madhya Pradesh, Manipur, Meghalaya, Nagaland, Rajasthan, Tripura and Uttar Pradesh) will introduce MCV2 through catch-up vaccination campaigns. In the remaining 21 states with better performing routine immunization systems (i.e., $\geq 80\%$ routine measles coverage)

17 will introduce MCV2 for children aged 16-24 months through the routine program. The remaining four states and union territories (Delhi, Goa, Puducherry and Sikkim) already use a second dose of measles vaccine in their RI programme (as mumps-measles-rubella vaccine) financed with state resources [15].

MEASLES CATCH-UP IMMUNIZATION CAMPAIGN

Measles catch-up immunization campaigns benefit from the extensive experience, human resources and planning templates available from polio vaccination campaigns. Similar to pulse polio activities, measles campaigns require meticulous micro-planning, effective vaccine storage and handling practices as well as appropriate and consistent advocacy with media, key influencers and social mobilization interventions.

However, measles is an injectable vaccine and as such, catch-up campaigns with this vaccine present unique challenges that differ from polio eradication efforts that utilize oral vaccines. Measles vaccine must be administered by qualified, trained personnel, the reporting and management of adverse events following immunization (AEFI) must be improved and expanded, and the injection waste system should be sufficiently robust to properly dispose of the large

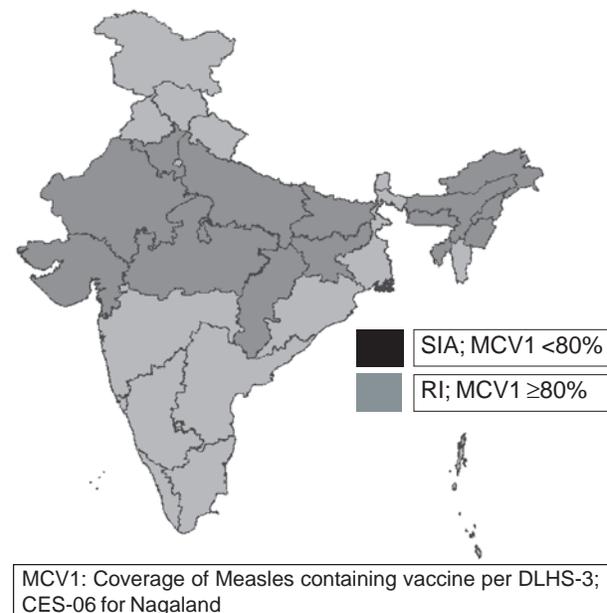


FIG. 1 2nd opportunity of measles vaccine: State specific delivery strategies.

volume of injection waste to be generated. In addition, measles catch-up vaccination campaigns target school-aged children with vaccination taking place at schools and other fixed sites and not door-to-door. This requires strong inter-sectoral coordination between the Ministry of Health and Family Welfare, the Ministry of Education, and the Ministry of Women and Child Development.

Available surveillance data demonstrates that 90% of confirmed measles cases occurring in outbreak settings in states with low MCV1 coverage (<80%) are among children less than 10 years of age [5,15]. Hence, measles catch-up campaigns target 134 million children 9 months to 10 years of age in the 14 states (children who have celebrated their 10th birthday are not eligible), irrespective of previous vaccination status or measles disease history. The Government of India is providing full financial support for these activities including the procurement of vaccine, diluents, injection materials and the operational costs associated with the human resources, and logistics required to conduct the 3-4 week activity in each state.

As this is a new intervention in India, Government of India decided to conduct catch-up measles campaign in a phased manner, with the initial phase targeting 45 districts in 13 states (1 district in each of the Northeast states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Nagaland and Tripura, 5 districts in the states of Bihar, Gujarat, Haryana, Jharkhand, Madhya Pradesh and Rajasthan, and 9 districts in Chhattisgarh). This approach aims to establish local best practices and document important lessons learned to be applied during larger subsequent phases.

CONCLUSION

The landmark decision to introduce a second opportunity for measles vaccination is aligned with the draft comprehensive Multi Year Strategic Immunization Plan of the Government of India (cMYP 2010-2017) that has among other aims, the target to reduce measles related mortality by 90% by 2013 compared to 2000 [5,15]. Phase 1 measles catch-up campaign commenced in November 2010 and will be completed by March 2011. Given the

immunosuppressive impact of measles infection that renders children more susceptible to secondary pneumonia and diarrheal diseases, the primary causes of under 5 child mortality in India [16], the provision of MCV2 to the lowest performing, highest measles burden states will contribute to a reduction in under-five child mortality and thus provide a needed boost towards achievement of Millennium Development Goal 4 [17]. Accelerated measles control remains one of the “best buys” in public health [18].

Competing interests: Authors are staff members of United Nations Children Fund, World Health Organization* and MoHFW, Government of India[†].

Funding: Nil

REFERENCES

1. Sudfeld CR, Halsey NA. Measles case fatality ratio in India: A review of community based studies. *Indian Pediatr.* 2009;46:983-9.
2. Black RE, Cousens S, Johnson HL, Lawn JE, Rudan I, Bassani DG, *et al.* Global, regional, and national causes of child mortality in 2008: a systematic analysis. *Lancet.* 2010;375:1969-87.
3. John J, Choudhury P. Accelerating measles control in India: opportunity and obligation to act now. *Indian Pediatr.* 2009;46:1-5.
4. van den Ent M, Gupta SK, Hoekstra E. Two doses of measles vaccine reduce measles deaths. *Indian Pediatr.* 2009;46:933-8.
5. Strategic pathways for control of measles: Recommendations of expert consultation 26-28 October 2009. Public health Foundation of India; New Delhi.
6. Global reductions in measles mortality 2000-2008 and the risk of measles resurgence. *Wkly Epidemiol Rec.* 2009;84: 509-16.
7. Progress in global measles control and mortality reduction, 2000-2006. *Wkly Epidemiol Rec.* 2007;82:418-24.
8. Coverage Evaluation Survey 2006, All India Report. New Delhi: UNICEF; 2006. Available at http://www.unicef.org/india/Coverage_Evaluation_Survey_2006.pdf. Accessed on February 18, 2011.
9. District Level Household Survey, 2007-2008. Available at <http://www.rchiips.org/ARCH-3.html>. Accessed on February 17, 2011.
10. World Health Organization, United Nations Children's Fund. WHO/UNICEF immunization summary: A statistical reference containing data through 2009. Available at http://www.childinfo.org/files/32775_UNICEF.pdf. Accessed February 17, 2011.
11. de Quadros CA, Olive JM, Hersh BS, Strassburg MA, Henderson DA, Bennett DB, *et al.* Measles elimination in the Americas. *JAMA.* 1996;275:224-9.
12. World Health Organization, Measles vaccines: WHO position paper. *Wkly Epidemiological Rec.* 2009; 84:

- 349-60.
13. Vijayaraghavan M, Martin RM, Sangrjee N, Kimani GN, Oyombe S, Kalu A, *et al.* Measles supplemental immunization activities improve measles vaccine coverage and equity: Evidence from Kenya, 2002. *Health Policy*. 2007;83:27-36.
 14. Minutes and Recommendations of National Technical Advisory Group on Immunization (NTAGI), 16th June 2008, Ministry of Health and Family Welfare, Government of India. Available at <http://mohfw.nic.in>. Accessed on 18th February 2011.
 15. Measles Catch Up Immunization Campaign- Guidelines for Planning and Implementation. June 2010 Ministry of Health and Family Welfare, Government of India.
 16. The million death study collaborators. Causes of neonatal and child mortality in India: a nationally representative mortality survey. *Lancet*. 2010;376:1853-60.
 17. Millennium Development Goals, Goal 4 Reduce Child Mortality. Available at <http://www.un.org/millennium-goals/childhealth.shtml>. Accessed February 18, 2011.
 18. World Health organization, Meeting of the Strategic Advisory Group of Experts on Immunization, November 2010 – summary, conclusions and recommendations. *Wkly Epidemiol Rec*. 2011;86:1-16.
-