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Measles Control in Nigeria: the Case for a Two-dose Vaccine Policy

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Summary

Nnebe-Agumadu U. Measles Control in Nigeria: the Case for a Two-dose Vaccine Policy. *Nigerian Journal of Paediatrics* **2005; 32: 41.** Despite all the efforts expended on routine immunization since the era of Expanded Programme of Immunization (EPI) later called the National Programme of Immunization (NPI), measles remains a disturbing cause of morbidity and mortality in Nigeria and other developing countries. Currently, measles is the commonest cause of vaccine preventable deaths in Africa. Complications of measles such as encephalitis, as well as auditory and visual impairment cause permanent disabilities in patients, thus reducing their quality of life. Measles vaccine coverage of 59 percent in infancy in 1988 and 35 percent in 2003 remains low in Nigeria. The WHO and UNICEF have highlighted the need to improve vaccine coverage and effectiveness to at least, 95 percent for protective herd immunity and effective measles control. This can be facilitated through a two-dose measles vaccine policy as is being practised by most western and some African countries who are pursuing measles control and elimination programmes. A second dose of measles vaccine given either as routine or as a supplement is expected to offer a second opportunity to children who missed their first dose at nine months, while serving as a booster to previously vaccinated children with vaccine failures. In this communication, the need for a review of the current NPI schedule for measles vaccine is stressed. Such a review may contribute towards reaching the 4th millennium development goal of reducing by two thirds, the mortality rate among under-five children by the year 2015.

Introduction

WHEN the life attenuated measles vaccine became available in 1963, the world welcomed it with joy and enthusiasm, believing that measles, like small pox of old, would soon be eradicated or at least, controlled.[1] This enthusiasm stemmed partly from the fact that since measles shared a lot of features with small pox[2] that was almost eradicated, measles control and eventual eradication should also be possible. The shared features include (a) a characteristic rash with seasonal occurrence, (b) no vector or animal reservoir with a transmissible latent virus, (c) only one serotype, and (d) availability of an effective vaccine. In spite of these, measles eradication seems elusive for now. It does appear that the dissimilarities between measles and smallpox, which tend to favour poor control of the former, play a more influential role in our environment. Prominent among these factors is the fact that children are predominantly affected by measles and like most issues involving chiidren, adequate attention may not be given to it. Children do not constitute a pressure group hence, responding to their needs is not usually an issue of priority for policy makers in most developing parts of the world, Nigeria inclusive. The American, European and Eastern Mediterranean regions have adopted elimination targets while Africa, South East Asia and Western Pacific regions are still at the measles control stage.[3]

Measles control is the earliest stage in measles eradication and involves reductions in mortality and morbidity.

Measles elimination follows control programmes and involves a large geographical area in which neither endemic nor sustained transmission of measles virus can occur following occurrence of an imported case. In both elimination and control programmes, continued intervention strategies are required to maintain the status. Eradication is the total successful elimination efforts in all countries.[3] Many Asian and African countries, including Nigeria are at the level of measles control. The issue is how much of this control has been achieved in Nigeria.

According to the National Programme of Immunization (NPI) schedule, children are vaccinated against measles at the age of nine months in Nigeria. When, for various reasons including exposure or

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during epidemics, infants are immunized before nine months, the NPI advocates a second dose of measles vaccine at the age of nine months, and at least four weeks from the first dose, in view of the uncertainty of sero-conversion in this age group (NPI desk reference). However, there are others who receive the measles vaccine at the age of nine months and still develop clinical measles. Would a second dose of measles have been of use to them too? This paper focuses on possible answers to this question.

Measles Morbidity and Mortality: Current Status

Measles causes about one million deaths annually with 98 percent (50 percent from Africa)occurring in the developing world.[4,5] It is reported to be the leading cause of vaccine preventable deaths among children in Africa, with an estimated one child dying from measles every minute.[4,6] The measles virus may ultimately be responsible for more child deaths than any other single disease such as tuberculosis, AIDS, and malnutrition through the complications of pneumonia, diarrhoea and malnutrition.[7] Morbidity and mortality figures on measles in Nigeria are still uncomfortably high. In 1985, Nigeria reported 3.6 million cases of measles with 108,000 deaths and 54,000 disabled. The commonest complications were malnutrition, particularly kwashiorkor, pneumonia and diarrhoea and the main disabilities were blindness and deafness. Indeed, measles accounted for 50 percent of deaths from vaccine preventable diseases and 26 percent of disabilities,[8] including blindness of which measles is a recognized cause.[9,10] High measles mortality results from a combination of these complications.[5]

Measles vaccine coverage in Nigeria has fluctuated from 55 percent in 1981 through 59 percent in 1988 to 35 percent in 2003.[11] The current morbidity and mortality situation has probably remained largely unchanged from what it was in 1985. Mortality rates from measles reported from various parts of Nigeria have ranged from 14–34 percent[12-15] compared to values of less than one percent in developed countries.[1,16] The high morbidity and mortality following measles infection in Nigeria appear to be related to gross vaccine underutilization arising from

a. inaccessible and suboptimal accine programmes.
b. poor vaccine coverage and effectiveness (primary and secondary vaccine failure)
c. inadequate monitoring and evaluation of immunization programmes

These are age-long problems in our environment which are yet to be appropriately addressed. Until this is done, measles may remain a significant threat to child health in Nigeria. Globally, there are also other issues that constitute barriers to the control of measles. They include:

a. high infectivity of the measles virus
b. immune blockade of vaccine by maternal antibodies when given early.
c. need for two doses of the vaccine to maintain herd immunity
d. lack of strong political and financial commitment

Need for a 2nd Dose of Measles Vaccine

In the WHO/UNICEF "strategic plan 2001-2005 for measles mortality reduction",[3] suggested strategies for reducing measles mortality included:

1. high routine immunization (1st dose) as well as provision of a second opportunity for measles vaccination for children
2. improved management of complicated cases
3. measles surveillance and research.

Most of these strategies are yet to receive adequate attention in this country. Routine immunization remains the bedrock of measles control. Hence effective control demands an improvement in both coverage and quality of immunization services. Ideally, a high population immunity which is necessary for good control, can be achieved with a minimum coverage of 90 percent of the vulnerable population and a vaccine sero-conversion rate of 95 percent. Practically, with one dose of the Schwartz vaccine given to infants at the age of nine months or shortly thereafter, average coverage is 80 percent, while sero-conversion is about 85 percent.[3] These values are probably lower in Nigeria and other developing countries where malnutrition, immune modulating infections (e.g. malaria) and poor immunization services may hamper effective sero-conversion and coverage.[17]

A two-dose measles vaccine policy is increasingly being reported in developed and developing countries as an indispensable tool for effective measles control and elimination.[3,5,8,10,18-20] Lessons from the experience of the developed world can be of immense help to the developing world. Even with the highly established immunization practices in the developed world, achieving desirable herd immunity for effective measles control through good coverage and sero-conversion was difficult. Reaching the susceptible infant population as well as primary and secondary vaccine failure were issues to contend with.[8] Epidemics of measles still occurred in school age population with high vaccination coverage (though with little mortality and morbidity), between 1985 and 1988 in the USA.[8] The outbreaks were more often reported in unvaccinated than vaccinated children, implying that children who received only one dose of vaccine were not always protected from

the disease. This led to the recommendation of a second dose for children between five and 19 years in the US to ensure protection for those who had not developed immunity from the first dose.[8]

As global routine vaccine coverage kept falling from 80 percent in 1990 to 74 percent in 1999, the need for a second dose of measles vaccine became more obvious, so that by the year 2000, more countries had adopted the two-dose policy[3,8] either as routine schedules or through supplemental campaigns. Subsequent reviews showed that the countries with the single dose policy reported lowest routine coverage.[3] Another disturbing issue is the occurrence of measles in previously vaccinated children. This has been observed in both developing and developed countries.[8,18,21-23] In Nigeria, as early as 1972, Williams[21] reported the occurrence of measles in 49 previously vaccinated children among 242 measles cases admitted during the period of study. Subsequently, various workers within and outside Nigeria[12,18,20,22,23,24-28] have made similar observations and proffered various reasons for this vaccine failure which include ineffective vaccines, poor immune response following blockade by passively transferred maternal antibodies in young infants, malnutrition and infection by immune modulating organisms.[17,28]

After the first dose of measles vaccine, which is given at nine months, a second dose has been recommended by WHO/UNICEF to offer a second opportunity to children who missed their first dose while serving as a booster to previously vaccinated children who responded poorly to the first dose. The overall effect of a second dose of measles vaccine is increased effectiveness of measles vaccination programme, resulting in:

1 extended duration of immunity thereby preventing vaccine failure later in life
2 improved individual protection and herd immunity
3 prevention of early measles in infancy
4 reduction of outbreaks of measles infection in the long run.

The importance of vaccine effectiveness in measles control cannot be overemphasized. Good coverage becomes useful only when it results in effective vaccination. Vaccine coverage is neither equivalent to vaccine effectiveness nor population immunity. The average sero-conversion rate of 85 percent following a single dose of the vaccine at nine months,[3] which is the recommended strategy for routine immunization in developing countries, like Nigeria, probably leaves a significant proportion of children unprotected and therefore susceptible to measles. Moreover, the routine delivery systems in many developing countries have left many children unvaccinated at nine months as a result of poor coverage.[3,8] This implies that the 94-97 percent coverage needed for a protective herd immunity and elimination may never be attained by a single dose of measles vaccine in our environment. A second dose policy will guarantee effectiveness resulting in good individual protection and a high herd immunity.[7,19] With high population immunity, an upward shift in age of measles incidence will likely occur hence preventing early measles cases (before nine months), which is also a problem in our environment. The Gambian experience where the average age of measles incidence was raised through the use of effective vaccine and high coverage, is worthy of emulation.[29] The option of early immunization at six months as a means of preventing measles in young infants may result in later vaccine failure and susceptibility to measles infection.[28] Disruption of immunization programmes may occur following parental disenchantment with immunization[28] as has been reported in Oyo state of Nigeria[22] and Yaounde, Cameroun.[13]

The WHO/UNICEF strategic plan for measles mortality reduction and regional elimination programme has portrayed the importance of a two-dose measles policy for all children as an important strategy for measles control.[3] This implies an endorsement of new recommendation on measles vaccination and should be embraced with optimism by all countries where measles constitute a public health problem. The strategic plan had set some targets of

1. reducing the number of measles mortality by half by 2005, and
2. assessing the feasibility of global measles eradication at a global consultation in 2005

The strategy also seeks that "by the end of 2004, countries with high measles mortality ought to have administered at least one dose of measles vaccine to at least 90 percent of children aged nine months to four years, in a strategy to be sustained over time".[3] Where does Nigeria fit into this programme? 2005 is the year of global review of progress. Are there structures already on ground since 2001 to reduce measles mortality by half by 2005? Have 90 percent of children aged nine months to four years received one dose of measles vaccine? The fourth millennium development goal seeks to reduce by two-thirds, the mortality rate among children under five by 2015.[30] Measles vaccine coverage in infancy is one of the outlined indicators of this goal. Is vaccine coverage in infancy already on the increase? If answers to these questions are in the negative, then now is the time to act. The national child health policy (May 2005)[31] stated as part of its objectives:

- to improve access to immunization services for all under fives irrespective of place of residence
- to maintain optimal immunologic protection against vaccine preventable diseases including booster doses.

With current total vaccine coverage of 13 percent for children aged 12-23 months in Nigeria (NDHS 2003),[31] the need to actualize these objectives becomes imperative. Measles, as the leading cause of vaccine preventable deaths in Africa[6] should receive priority attention. Measles initiative, a joint effort of WHO/ UNICEF, the American Red Cross, the US Centres for Disease Control and Prevention and the United Nations Foundation to fight measles in Africa through vaccination has reported a remarkable reduction in measles death from 1999 to 2002, using a two-dose measles policy although routine coverage has only increased from 52 percent to 59 percent.[6] By the end of 2002, measles mortality had declined by 35 percent within one year of onset of the programme. The vaccination was given through mass campaigns in addition to the routine measles immunization previously given. Zambia and many southern African countries are already benefiting from this initiative. Cuba, a developing country, adopted this and has interrupted transmission since the late 80s, while neighboring Haiti, Venezuela and Columbia joined by the year 2002.[19]

When and how is the 2nd dose to be given?

When and how to administer the 2nd dose of measles vaccine varies from one country to another and is dependent on the (a) peak age of infection, (b) pattern of waning immunity after 1st dose of vaccine, and (c) other prevailing epidemiological factors. Studies are needed to define these factors. However, we should appreciate the problem of vaccine coverage in infancy when we have to depend on relations to bring children for vaccination. Vaccine coverage in infancy of over 95 percent, which is required for herd immunity, may never be attained. Coverage has been shown to be higher if vaccine is also given at school entry in a country with high school enrolment.[8] By 1989, Nigeria had a primary school enrolment of 97 percent for males and 85 percent for females.[8] These values would probably be higher now especially with the introduction of the universal basic education, which ensures affordability and accessibility of primary education. The 2nd vaccine can be given as part of a routine immunization or supplement programmes such as mass campaigns. It has been shown that countries with poor vaccine coverage and unstable immunization programme tend to benefit more from supplemental mass programmes than incorporating the vaccine into the routine immunization programme.[3] This implies that mass campaign strategies may be more fruitful in the Nigerian setting. Another important consideration in the implementation of a two-dose vaccine policy is the cost implication. Experience in centres implementing the two-dose policy show that the benefits far outweigh the cost. Benefit-to-cost ratios of 4.5/1, 5.7/1 and 9.6/1 have been reported in Israel, West Bank and Gaza respectively.[8,32] Benefits accruing from an effective second dose result from reduction in both outpatient and in-patient attendance and services, reduced morbidity and mortality with a general upliftment of quality of life.

Conclusion

Nigeria has made a considerable impact on measles control since the pre-EPI era with some reduction in mortality and morbidity. However, this current status does not justify continuation of a one-dose policy. If we are to ever achieve a good measles control and join the rest of the world in measles elimination programme, then a two-dose policy is inevitable. A combined effort of the Nigerian government and world partners in measles control can see a two-dose measles policy through in Nigeria. Eradication may appear far-fetched for now, but one day, they say, begins a long story. Starting now is still early enough. A two-dose policy alone does not constitute a comprehensive control programme. To be effective, it must be seen as part of a strategic measles control plan, which includes

a. overcoming all obstacles to vaccine coverage
b. improving vaccine effectiveness through
   - avoidance of suboptimal products
   - proper vaccine preservation and use
   - establishment of quality control checks
c. establishment of effective surveillance for measles and monitoring of vaccination coverage
d. encouragement of research into measles epidemiology
e. improved political and financial commitment at governmental level.

Some centres in Nigeria are already giving either a two-dose vaccine or early immunization at six months because of measles in young infant or previously vaccinated children. There is need for a unified programme of immunization if effective measles control is to be achieved in Nigeria. Together, we can make a difference in the life of our children. Let us give a two-dose policy a chance.

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References

1. CDC. National Immunization Program. Measles History. April 15, 2004.
2. Maldonado Y. Measles. In: Behrman, Kliegman, Janson, eds. Nelson Textbook of Pediatrics. Philadelphia: Saunders, 2003: 1026-30.
3. WHO/UNICEF. Measles mortality reduction and regional elimination. Strategic Plan 2001-2005. Geneva, WHO, 2001.1 OMS/UNICEF.
4. UNICEF Immunization Plus: Reducing measles mortality. www.unicef.org/immunization/index_measles.html 2003.
5. WHO/State of the art of new vaccines: research and development; Intiative for vaccine research www.who.int/vaccine_research/documents/new_vaccines/en/index9.html 2005;1-2.
6. WHO. Wkly Epidemiological Record (January 16, 2004). 2004;**79**:13-24.
7. WHO. Measles technical working group: strategies for measles control and elimination. Report of a meeting. Geneva, 11-12 May 2000.
8. Tulchinsky TH, Ginsberg GM, Abed Y, Angeles MT, Akukwe C, Bonn J. Measles control in developing and developed countries: the case for a two-dose policy. *Bull World Health Organ* 1993; **71**: 93-103.
9. Onabolu OO. Post measles keratopathy: a recurring problem in Nigerian children. *Nig J Paediatr* 1999; **26**: 41-3.
10. Ogunmekan DA, Bracken P, Marshall WC. A seroepidemiological study of measles infection in normal and handicapped persons in Lagos, Nigeria. *J Trop Med Hyg* 1981; **84**:175-8.
11. State of the World's Children, 2005
12. Olowu AO, Obasa OT. Clinical presentation of measles in Sagamu. *Nig Med Pract* 1991; 21;5:5 et al.
13. Obi JO. Measles in hospital practice in Nigeria. *J Trop Paediatr Environ Child Health* 1979; 25:30-2.
14. Effiong CE. Immediate prognosis of severe cases of measles admitted to University College Hospital, Ibadan. *J Natl Med Ass* 1975; **67**:455-60.
15. Osinusi K, Oyejide CO. Measles at the University College Hospital, Ibadan: an update. *Nig J Paediatr* 1986; **13**:53-7.
16. CDC. Measles; www.cdc.gov/nip/publications/pink/meas.pdf. 2004:115-33
17. Bautista-Lopez N, Vaisberg A, Kanashiro R, Hernandez H, Ward BJ. Immune response to measles vaccine in Peruvian children. *Bull World Health Organ* 2001; **79**:1038-46.
18. Asindi AA, Ani OEO. The pattern of measles in Calabar. *Nig J Peadiatr* 1984; **11**:115-9.
19. de Quadros CA. Can measles be eradicated globally? *Bull World Health Organ* 2004; **82**: 134-8.
20. Shuk Kwan C, Yu lung Lau, Wei Ling Lim, *et al.* Mass measles immunization campaign: experience in the Hong Kong special administrative region of China. *Bull World Health Organ* 2002; **80**: 585-91.
21. Williams GA. Measles infection following immunization: a report of forty nine cases in Lagos, Nigeria. *Afr J Med Sci* 1972; **2**:159-63.
22. Asuzu MC, Onadeko MO. Immunization status of children with measles: experience with the Oyo State expanded programme of immunisation. *Nig J Paediatr* 1984; **11**:13-7.
23. Singh J, Gupta RS, Bora D, *et al.* Epidemiologic consequences of moderate coverage levels of measles vaccine in a district headquarter town (Alwar) in India, 1996. *J Trop Pediatr* 1998; **44**: 369-71.
24. Mgone JM, Mgone CS, Duke T, Frank D, Yeka W. Control measures and the outcome of the measles epidemic of 1999 in the Eastern Highlands Province. *PNG Med J* 2000; **43**: 91-7.
25. Bharti B, Bharti S. Measles in a hilly hamlet of northern India. *Indian J Pediatr* 2002; **69**:1033-5.
26. Van Mazjik J, Pinheiro FP, Black FL. Measles and measles vaccine in isolated amerindian tribes. I. The 1971 Trio (Tiriyo) epidemic. *Trop Geogr Med* 1982; **34**: 3-6.
27. Weeks RM. Barenzi JF, Wayira JR. A low-cost, community-based measles outbreak investigation with follow-up action. *Bull World Health Organ* 1992; 70:317-21.
28. Stanfield JP. Immunization. In: Stanfield P, Brueton M, Chan M, Parkin M, Waterston T. Diseases of Children in the Subtropics and Tropics. London: Arnold, 2001:81.
29. Williams PJ, Hull HF. Status of measles in the Gambia, 1981. *Rev Infect Dis* 1983; **5**:391-4.
30. United Nations. Millennium development goals (MDG) 2000: www.un.org/millenium goals
31. Federal Ministry of Health, Nigeria. Child Health Policy, May, 2005
32. Ginsberg GM, Tulchinsky TH. Costs and benefits of a second measles inoculation of children in Israel, the West Bank, and Gaza. *J Epidemiol Community Health* 1990; **44**: 274-80.