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Continuing Barriers to Optimum Immunization Uptake in Nigerian Children: the Role of Missed Immunization Opportunities and Inappropriately Timed Immunizations

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Abstract

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Introduction: Immunizations are effective means of disease prevention. Missed opportunities for immunizations and inappropriately timed immunizations have been shown to impact negatively on immunization coverage.

Objective: To evaluate the role of missed opportunities (MOs) and inappropriately timed immunizations to optimal immunization uptake in Nigerian children.

Methods: Records of 512 consecutive children attending an immunization clinic were reviewed. Data on the date of birth, and dates of immunization were extracted. The records were evaluated to determine the occurrence of MOs and that of inappropriately timed doses of vaccines.

Results: Ninety percent of the missed opportunities occurred during the first visit with 43.2 percent, 48.2 percent and 6.3 percent of children not receiving the requisite BCG, HBV and OPV. Ultimately, 6.3 percent of the children did not receive BCG at all. Many children required extra visits to receive vaccines. Only 20 percent of those who made five visits were fully immunized, while this was achieved by 78 percent of those who made six visits. Four point four percent of vaccine doses were inappropriately timed and resulted in 7.2 percent decrease in coverage when invalid doses were excluded.

Conclusion: Missed opportunities and inappropriately timed vaccinations remain barriers to optimal immunization uptake in Nigeria. As part of the strategy to strengthen routine immunization, training of health workers should stress the need to avoid MOs and inappropriately timed immunizations.

Introduction

IMMUNIZATIONS are among the most successful and cost-effective public health interventions.[1] Despite this, barriers to the optimal uptake of vaccines exist. Barriers to immunizations may be due to personal factors such as place of delivery, family size, educational level of the mother, maternal age, religion, socioeconomic status and maternal employment.[2-7] Provider factors such as vaccinating for only a few days in a week, long waiting queues and negative provider attitudes can also negatively impact on immunization uptake.[2,8]

Missed opportunities (MOs) for immunization have been known to cause undervaccination.[9] In a review of studies on MOs, a median of 32 percent (range 0-99 percent) of women and children surveyed had MOs.[9] Missed opportunities are said to occur when an individual who is eligible for immunization and has no contraindication visits a health facility but does not receive some or all of the vaccines for which he/she is eligible.[9] Missed opportunities can occur during curative care visits and during immunization visits when there is failure to administer simultaneous vaccines.[9] Immunization schedules define recommended ages for receipt of immunization and for immunizations with multiple doses they define minimum intervals between

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the doses.[15] These usually take into consideration immunological and epidemiological variables. The ultimate aim of vaccination is to induce immunity against target diseases. Inappropriately timed vaccinations (those received before minimal age recommendations or earlier than the minimal age interval) may result in suboptimal immunity against target diseases, and were reported to have contributed to 9 percent and 11 percent undervaccination in Conakry and Mozambique, respectively.[8] The Nigerian National Programme on Immunization (NPI) recommends one dose of Bacille Calmette Guerin (BCG) at birth, three doses of diphtheria-pertussis-tetanus (DPT) commencing at the age of six weeks, four doses of oral poliomyelitis vaccine (OPV) commencing at birth, three doses of hepatitis B vaccine (HBV) commencing at birth and one dose each of measles and yellow fever vaccines given at nine months.[11] The minimum interval between OPV and DPT doses is four weeks. The minimum interval between the first and second dose of HBV is four weeks while the interval between the second and third doses is eight weeks.

In the preliminary report of the national coverage survey in April 1991, Nigeria reported nine percent, 10 percent, 11 percent and 19 percent of needed BCG, DPT, OPV and measles respectively, as not given.[12] In a more recent study, Tagbo and Onwuasigwe reported missed opportunities of 15.1 percent in Enugu with 5.6 percent of the MOs occurring during preventive care visits.[13] They however did not explore the reasons for the occurrence of MOs in this setting. Although levels of immunization coverage in Nigeria have improved from the very low levels recorded in the 2003 immunization coverage survey, the levels are still not optimal.[14,15] Strengthening of routine immunization services has been identified as a sustainable option for improving coverage.[16] This should also include improvement in the quality of service vis-a-vis avoidance of MOs and inappropriately timed vaccinations.

The present study was carried out to evaluate the role of missed opportunities and inappropriately timed vaccinations as barriers to optimum uptake of vaccines among Nigerian children.

Subjects and Methods

Five hundred and twelve consecutive children who received their routine immunizations at the immunization clinic of the Institute of Child Health, University of Benin between September 2004 and March 2005 were the subjects of this study. Data on the date of birth, age at commencement of immunization, place of birth, mother's age, father's age and the dates of receiving various vaccines were retrieved from the clinic records of the children. Age in days, at receipt of immunization was calculated using the dates of birth and of vaccination. The number of visits made was also recorded. Valid doses of vaccines were defined as those received at, or after the minimum recommended age.[11,17] For vaccines with multiple doses, a subsequent dose was invalid if received at a date earlier than the minimal interval between the doses.[11,17] Invalid doses of vaccines (those received earlier than minimal age recommendations/minimal interval between doses) were regarded as inappropriately timed. A more lenient definition for validity was also used which defined an invalid dose as one administered prior to four days before the minimum acceptable age or interval.[18] This more lenient definition was adopted because some children might have received the immunization early to avoid a missed opportunity as the mothers might not have returned if the immunization was delayed to the correct age.

Uptake of vaccines was recorded as simple percentages. Full immunization was defined as receipt of BCG, three doses of OPV, three doses of DPT, three doses of HBV and one dose each of measles and yellow fever vaccines, respectively.

Missed opportunity for immunization was evaluated for each of the visits a child made to the clinic. If the child failed to receive any of the vaccines he/she was due for, on the given visit, a missed opportunity was recorded. MOs were also recorded for individual vaccines.

Results

There were 265 males and 246 females, while the sex of one child was not recorded. The mean age of the mothers was 28.35 ± 5.14 years with a range of 16 to 45 years, while that of the fathers was 35.4 ± 7.05 years with a range of 19 to 80 years. Table I shows the uptake of the various vaccines. Uptake was highest for BCG, OPV0 and HBV1 at 88.3 percent, 96.3 percent and 93.8 percent respectively while it was lowest for measles and yellow fever vaccines at 57.6 percent and 57.4 percent, respectively. Full immunization status was achieved in 227 (44.3 percent) children. A total of 5162 doses of vaccines were administered. With strict validity criteria, 226 (4.4 percent) doses were invalid, whereas with the more liberal criteria 160 (3.1 percent) were invalid. Table II shows the distribution of the invalid doses. About 35 percent of the invalid doses were OPV1. When invalid doses (according to strict validity

Table 1

Vaccine Uptake among 512 Children

Vaccine	*Uptake*	
	No	%
BCG	452	88.3
OPV0	493	96.3
HBV1	480	93.8
OPV1	449	87.7
DPT1	460	89.8
HBV2	432	84.4
OPV2	400	78.1
DPT2	416	81.3
OPV3	305	59.6
DPT3	356	69.5
HBV3	326	63.7
Measles	295	57.6
Yellow Fever	293	57.2

Table II

Distribution of Invalid Doses of Vaccines

Vaccine	*Strict Criteria*	*Liberal Criteria*
OPV1	77	57
OPV2	3	3
OPV3	2	1
DPT1	33	14
DPT2	14	12
DPT3	3	2
HBV2	19	15
HBV3	37	37
Measles	20	11
Yellow fever	18	8
Total	226	160

criteria) were excluded, full immunization status was achieved in 187 (36.5 percent) children. Using liberal validity criteria, 191 (37.3 percent) achieved full immunization status. Of those 227 children who had full immunization, 179 (78.9 percent) required six visits to achieve this. This also represents 86.5 percent of those who made six visits. Only 20 (18.9 percent) of those who made five visits and 23 (82.1 percent) of those who made seven visits had full immunization. All five children who made eight visits had full immunization. Forty one children made only one visit.

Only 51 (10.0 percent) children received all the requisite vaccines on their first visit. On the first visit, 221 (43.2 percent), 247 (48.2 percent) and 32 (6.3 percent) of the infants did not receive BCG, HBV1 and OPV, respectively. Missed opportunities also occurred at first contact for DPT1 in 28 (35.9 percent)

Table III

Distribution of Missed Immunization Opportunities during Immunization Visits

Vaccine	*Visits*					
	1st	*2nd*	*3rd*	*4th*	*5th*	*6th*
BCG	221	36	26	17	11	6
OPV	32	22	23	25	24	10
HBV	247	12	25	24	22	7
DPT	28	17	14	14	6	4
Measles/ Yellow fever		1	-	2	2	-

Figures represent number of children who did not receive the indicated vaccine on various visits

of 78 infants who had presented at six weeks or older. BCG was eventually not received at all by 32 (6.3 percent) children. Missed opportunities on subsequent visits are as shown on Table III. The number of children involved in these missed opportunities was 79, 72, 69, 57 and 22 on the 2nd, 3rd, 4th, 5th and 6th visits, respectively. Extra visits to receive vaccines occurred in 163, 162, 11 and two for BCG, HBV3, HBV1 and measles, respectively.

Discussion

In this study, we observed that many children did not receive the requisite vaccines for which they were due when they visited for immunizations. The major reason for the MOs in this study was failure to administer

immunizations simultaneously. This had previously been identified as a major reason for MOs in a review of studies on MOs.[9] Although most of the subjects eventually did receive the requisite vaccines, a finding consistent with previous reports, the children nevertheless were at risk albeit, temporarily. Such pools of susceptible children have been implicated in epidemics in the past.[18] Some of the children never came back for scheduled immunizations and these children might have remained permanently at risk for target diseases. Every visit for immunization should be optimized especially in such settings as these, where children may not be brought back for visits and where there are no established tracking/follow up mechanisms.

Immunization ultimately seeks to reduce morbidity and mortality from disease. This requires the administration of vaccines at specified ages and intervals. Suboptimal seroconversion may result when invalid doses of vaccines are administered. The reduction in coverage by between 7.2 percent and 7.8 percent depending on the criteria used for assessing validity was lower than those recorded in Conakry and Mozambique. Most of the invalid doses were OPV1 and HBV3. The invalid doses of OPV1 were mostly among children presenting after the age of two weeks. Having received OPV0 at the first contact, receiving OPV1 along with DPT1 at six weeks would make the OPV1 invalid as it would not have satisfied the minimum interval of four weeks. HBV3 also contributed to a significant proportion of invalid doses. This was also the result of late commencement of immunization (after two weeks of age), such that HBV2 is given with DPT2. HBV3 inadvertently given with DPT3 would also be invalid as it would not satisfy the eight-week minimal interval recommended between HBV2 and HBV3.

For children who received HBV2 with DPT2, extra visits were required to receive HBV3 in 162 of the 326 who received HBV3. A high proportion of children required extra visits to receive BCG also. The extra visits became necessary because of the clinic practice of giving BCG only once a week (Fridays) and also because the vials of BCG vaccine were not opened when too few children present for BCG. The result of this practice was that there was less than 100 percent uptake for the vaccine. Few patients required extra visits for measles/yellow fever vaccines which were also only given on Fridays. This is because as the last vaccine in the schedule, mothers attending the facility would already be familiar with the clinic practices.

The NPI schedule requires only five visits to complete the schedule but only about 20 percent of the children who had five visits in this study, had full immunization. Most children required six visits to complete the schedule, the sixth being for either BCG or HBV3. The high number of extra visits has implications for cost incurred by parents in terms of transportation and man hours lost in time spent attending the clinic. These factors may contribute to high dropout and failure to complete the schedule.

We conclude that missed immunization opportunities and inappropriately timed vaccinations remain significant barriers to optimal immunization in Nigeria. It is recommended that as part of the strategy to strengthen routine immunization, training of health workers should stress the need to avoid MOs and inappropriately timed immunizations. The study clinic in particular and immunization centres in general, will require reorganization to allow for daily administration of all vaccines.

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