International Scholars Journals

International Journal of Public Health and Epidemiology ISSN 2326-7291 Vol. 8 (8), pp. 001-010, August, 2019. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

Reasons for incomplete vaccination and factors for missed opportunities among rural Nigerian children

Abdulraheem I. S.[1]*, Onajole A. T.[2], Jimoh A. A. G.[3] and Oladipo A. R.[4]

[1]Department of Epidemiology and Community Health, College of Medicine, University of Ilorin, Kwara State, Nigeria.
[2]Department of Community Health College of Medicine, University of Lagos, Lagos, Lagos State, Nigeria.
[3]Department of Obstetric and Gynaecology, College of Medicine, University of Ilorin, Ilorin, Kwara State, Nigeria.
[4]Department of Epidemiology and Community Health, University of Ilorin Teaching Hospital, Kwara State, Nigeria.

Accepted 14 March, 2019

Mothers play an important role in immunization of their children. A target of 95% immunization coverage is necessary for the sustained control of vaccine preventable diseases. Partial immunization coverage against vaccine preventable diseases is a significant public health problem especially in rural areas in Nigeria. The reasons for partial immunization and factors responsible for missed opportunities are poorly understood and little data is available to explain the phenomenon that could support the decision making. This study aimed at finding out the reasons for partial immunization and factors responsible for missed opportunities for immunization in children less than one year of age. Mothers of children within one year of age were the study subjects using a cross-sectional study design. The immunization card was utilized to check for completeness and correctness of immunization schedule, and also for identifying the appropriate use of all available opportunities for immunization. About two-third (62.8%) of the children were not fully immunized by one year of age, 33.4% had experienced a missed opportunity for immunization and 36.4% were partially and incorrectly immunized. Parents objection, disagreement or concern about immunization safety (38.8%), long distance walking (17.5%) and long waiting time at the health facility (15.2%) are the most common reasons for partial immunization. Missed opportunities for immunization and partial immunization need to be avoided in order to enhance the fully immunized percentage for those children who reach the health facility, especially in rural areas where the immunization coverage is below the expected national coverage (minimum 80%).

Key words: Incomplete vaccination, reasons and factors, rural Nigerian children.

INTRODUCTION

Inadequate levels of immunization against childhood diseases remain a significant public health problem in resource-poor areas of Nigeria. The reasons for incomplete vaccination and non-uptake of immunization services are poorly understood. In Nigeria, the EPI targets eight diseases, namely tuberculosis, poliomyelitis, diphtheria, pertusis, tetanus, hepatitis B, yellow fever and measles. Nigeria operates the immunization schedule of the Expanded Programme on Immunization which prescribes five visits to receive one dose of Bacille Calmette Guerin (BCG), four doses of oral polio vaccine, three doses of diphtheria, pertussis and tetanus vaccine, and one dose of measles vaccine (Federal Ministry of Health, 1995). In 2004, the country included hepatitis B and yellow fever vaccines in its schedule, recommending the receipt of three doses of hepatitis B at birth, at six weeks of age, and at 14 weeks of age while yellow fever should be given at nine months of age, along with measles vaccine (World Health Organization, 2005). Previous assessments of full immunization did not include hepatitis B and yellow fever (Adeiga et al., 2005; Onyiriuka, 2005). The standard measure of vaccination coverage is the percentage of children who have received the requisite number of vaccine doses irrespective of the age at receipt of the vaccine (Luman et al., 2005). However, to

*Corresponding author. E-mail: ibroraheem@yahoo. Tel: +234-08033571854.

maximal protection against vaccine-preventable diseases, a child should receive all immunizations within recommended intervals (Glauber, 2003).

Receipt of vaccines at recommended ages and intervals ensures that the child is adequately protected from target diseases at all times. A previous study (Ayebo and Charles, 2009) from Nigeria provided some explanations for partial immunization and missed opportunities and these include late reporting for immunization, non-administration of simultaneous injections, longer interval between DPT3 and measles vaccine (three and a half months) compared to that between the other vaccines in the schedule (four weeks). It is also suggested that, as the number of weeks/months postpartum increase, mothers begin to be engaged in other activities such that they may forget and/or may not have time to make scheduled visits for immunizations. The prevention of child mortality through immunization is one of the most cost-effective public interventions in use in resource-poor settings like Nigeria. The Expanded Program on Immunization (EPI) aims at delivering the primary immunization series to at least 90% of infants (Challenges in global immunization and the Global Immunization Vision and Strategy, 2006 to 2015). However, inadequate levels of immunization against childhood diseases remain a significant public health problem in resource-poor areas of the globe (Mayinbe et al., 2005). Nonetheless, the reasons for incomplete vaccination and factors for missed opportunities are poorly understood. Childhood vaccines do much to provide lifetime immunity to certain diseases, but for other diseases, such as pertussis, additional doses of vaccine are now recommended to protect individuals with waning immunity (Centre for Disease Control and Prevention, 2009).

Nigeria like many countries in the African region is making efforts to strengthen its health system in general and routine immunization services in particular to reduce disease burden from vaccine preventable diseases (VPDs). This is against a backdrop of poor routine immunization coverage (12.7% National Average). According to 2003 National Immunization coverage Survey (Nigeria Immunization coverage survey, 2003), immunization coverage by antigen is shown in Figure 1. Routine immunization remains a particular concern for the Government of Nigeria and its development partners including WHO. The Government of Nigeria has put routine immunization high on the agenda and is committed to reverting this negative trend. It is anticipated that this effort will significantly contribute towards achieving the millennium development goal (MDG) of halving child mortality by 2015. A rate of 95% immunization coverage is necessary for the sustained control of vaccine preventable diseases (Glenda et al., 2004). The reported coverage of the basic EPI vaccines particularly DPT3 and OPV3 in the study area (Awe local government area, Nasarawa State, north central Nigeria) in 2008 were 65 and 73% respectively, but these figures include partial and and incorrect vaccinations. This may account for sporadic epidemics of vaccine preventable diseases like “poliomyelitis” and “measles” in Awe LGA. Furthermore, it has also been observed that immunization coverage is not uniform throughout the LGA, with difficult to reach rural areas presenting significantly lower coverage and, thus, contributing to the circulation of “wild polio virus” and “measles”. Parents’ beliefs about immunization risks and benefits may be the most common reason for partial vaccination (Allison et al., 2005). However, there are few data about this reason compared to other reasons such as medical contra indications or access issues (Bond et al., 1998; Hull et al., 2001; Yawn et al., 2001).

Quality of outreach services, cold chain, as well as linking community with health services are among the influencing factors of effectiveness of immunization programs in resource-poor setting like Nigeria. The relative effect of each one of the above factors may significantly vary according to geographical areas (Carr et al., 2000). Knowledge of local impediments to effective immunization programs is very important in the development and implementation of appropriate solutions. This study aimed at finding out the reasons for partial immunization as well as to identify factors that contributed to missed opportunities for vaccination in children less than one year of age in a rural area in the North-central geopolitical zone of Nigeria.

METHODS

Setting

This study was carried out in Awe LGA. It has Awe as its headquarter and a development area called Asara. The LGA has a landmass of 2,800 km^2 and is divided into 10 administrative wards (Akiri, Azara, Galadima, Jangaru, Madaki, Makangiji, Kanje Abuni, Ribi, Tunga and Wuse).The total population of the LGA is 138,670 with under five years population of 23,979 while its local economy is based on subsistence farming.

Study design

A cross sectional survey was conducted in 85 villages in all the 10 administrative wards of the LGA between Jan and June, 2008. The completeness and correctness of vaccination schedules were checked using standardised questionnaires. Factors leading to missed opportunities or incompleteness of vaccination were also sought. The child’s vaccination dates, number of doses and dates of visits to the health facility were extracted from the child’s routine immunization card. Information about child immunization history, mother’s knowledge on immunization and the National Program on Immunization and factors affecting compliance with routine immunization schedules was obtained through direct interview (oral interview) from the mothers. The data was collected through locally recruited trained data clerks who were fluent in local language (Hausa). The inclusion criteria are mothers with children between 0 to 11 months of age, residing in the area 18 months prior to the study, and also having the child routine immunization card. Mothers were sensitized for the study through the Officer-in-charge of the health facility for routine immunization. The traditional birth attendants, members of the community based organization and market women assisted greatly in mobilization of respondents through

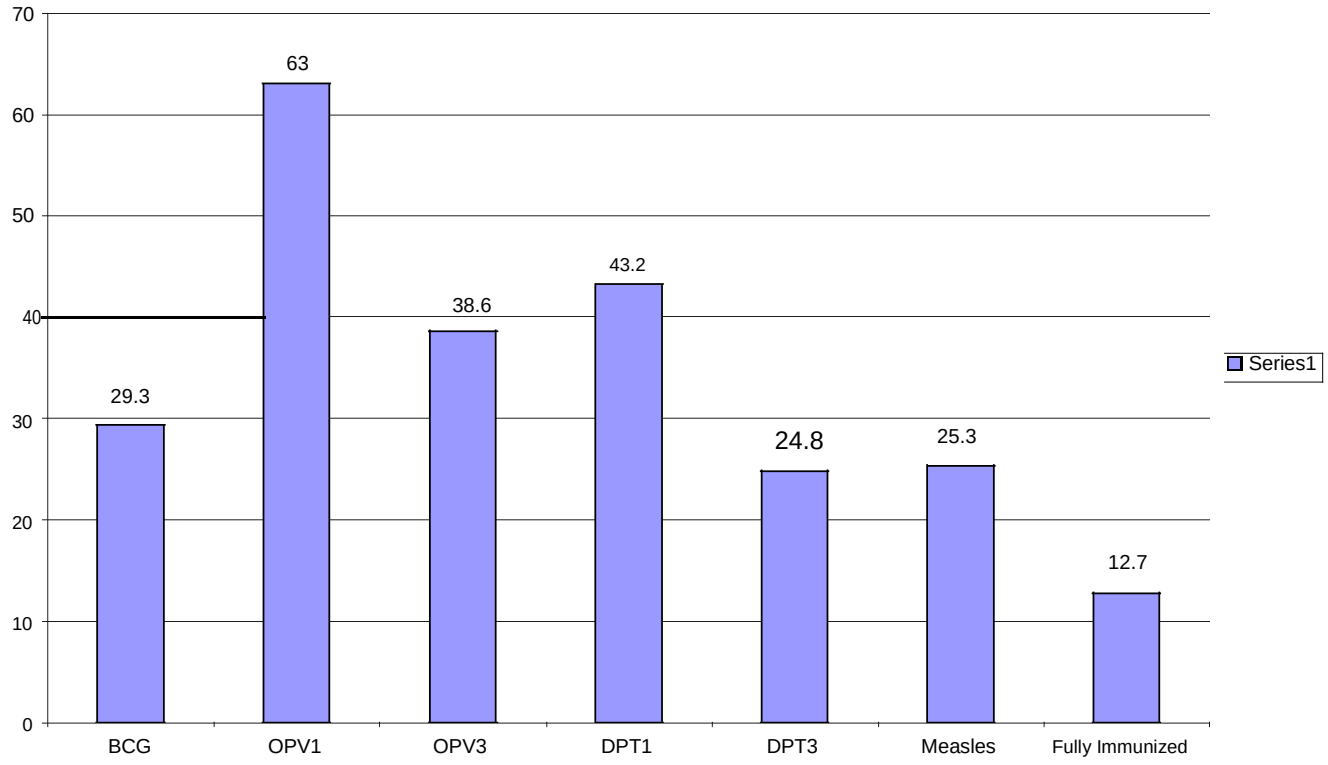

Figure 1. Immunization coverage by Antigen. (Source: Nigeria Immunization Coverage survey, 2003).

through information dissemination.

In order to guarantee a high response rate and ensure that mothers were available for the study, information about the study was spread through the locally recruited town announcers. Using the Fisher's formula, a sample size of 685 was obtained. To avoid bias and ensure equal representation of respondents from all the wards, a cluster sampling technique was used to determine the number of respondents from each administrative ward. Households with children under one year of age were selected by simple random sampling.

Data collection and analysis

Scrutinizing Immunization cards and taking careful history, data were collected on Immunization coverage, recent medical visits and recent illnesses. Households and health facilities were mapped to establish geographic contours of probability of immunization. Informed consent was obtained from the mothers through thumb impression/signature after explaining the aims and objectives of the study. All respondents were free to withdraw from the study at any time without any consequence. The data were screened for inconsistencies and missing values. The collected data were entered into computerized data base after coding using an EPI Info version 6.0 package and later converted to SPSS (version 16.0). The correct intervals for immunization were calculated comparing the dates of vaccination with the date of birth. The child was described as being "fully vaccinated" if he/she had a BCG scar and had received all the EPI vaccines within the minimum intervals of time as specified by Nigeria National Program on Immunization, that is DTP/OPV first dose not before six weeks of age with an interval of at least four weeks between doses and measles vaccine not before nine months of age. "Missed opportunity for immunization" is described as situation whereby a child came to a health facility or outreach site, and did not receive the vaccine for which he or she was eligible.

The respondents' verbal information on impression of the distance, time spent to reach the nearest vaccination site and the money spent on transport was used to measure accessibility to a health facility with immunization facilities. Vaccination status and missed opportunities for immunization were calculated by proportion. Differences in proportions were calculated using the Chi-square test with 5% significance level. The ANOVA test was used to compare mean values among subclasses. Associations between factors and missed opportunities or incomplete vaccination status were tested first by the chi-square test. In order to investigate relative importance of the variables in relation to the dependent factors and any confounding between them, they were fitted together in a binary logistic regression model.

Operational definitions

The following operational definitions were used:

Complete immunization

This is a situation whereby the child took all the recommended vaccines including BCG, DPT, polio, measles and hepatitis by one year of age.

Defaulter

This occurs when the child missed at least one of the recommended vaccine.

Dropout rate

This is the rate difference between the first and the last dose or the rate difference between the initial vaccine and the last vaccine.

Correct vaccination

The child was "correctly vaccinated" if it had a BCG scar and had received all the EPI vaccines within the minimum intervals of time as specified by national policy: DTP/OPV first dose not before six weeks of age with an interval of at least four weeks between doses and measles vaccine not before nine months of age.

Missed opportunity

If a child came to a health facility or outreach site, and did not receive the vaccination for which he or she was eligible, this was considered to be a "missed opportunity" for vaccination.

Accessibility

The accessibility to a health facility with immunization facilities was measured according to mothers' verbal information on impression of the distance, time spent to reach the nearest vaccination site and the money spent on transport.

Migration

Migration history was based on verbal information of prior movement of mothers from one place of dwelling to another over the last two years.

Religion

Religious believer was considered if the mother practiced any religion.

Schooling

Mother's schooling was considered independent of the number of years at school.

Ethical approval

Ethical clearance was obtained from the officer-in-charge of the health facility and Director of the Local Government Primary Health Care Department. Before data collection, written consent was obtained from the respondents.

RESULTS

One thousand, one hundred and fifty four houses were sampled of which 1117 (96.8%) fulfilled the inclusion criteria.

The total children (aged 0 to 11 months) sampled using multistage techniques were 685. The mean age of the children was 11.5 months (range 1 to 22). The sex distributions of the children were 367(53.6%) females and 318 (46.4%) males. Only 19 (2.8%) of the mothers lived in the area less than 6 months and they were excluded from the sample. The study area is very rural with no regular transportation system and the average walking time to the nearest health facility was 100 min (ranged from 90 min to 215 min). The socio demographic variables of the respondents are shown in Table 1.

Knowledge of mothers on immunization

The main sources of information on immunization were health workers (72.7%), town announcers (10.3%), radio (5.1%), family members (4.9%) and friends (3%). Only 97 (14.1%) knew that the vaccination against childhood killer diseases should be completed at the age of nine months with the yellow fever and measles vaccines. Less than one-fifth (12.8%) of mothers knew that BCG is being given at birth while only 41 (6%) new that Hepatitis B vaccine could also be given at birth and these mothers were the teachers and other educated staff of the LGA. Immunization was mentioned by 138 (20.1%) as a means of prevention against childhood killer diseases. Less than half (37.2%) of the mothers completed routine immunization schedules for their children by the age of 9 months.

Reasons for incomplete vaccination

Various reasons were adduced by the mothers for incomplete vaccination of their children (Table 2). These include long waiting time at the health facility (15.2%), lack of vaccine on the appointment day (3.5%), absence of personnel at the health facility (5.4%), child ill-health at the time of immunization (3.6%), lack of information about the days for vaccination (2.5%), forgetting the days of immunization(1.5%), long distance walking (17.5%), mother's illness on the day of vaccination (0.5%), social engagements (0.4%), lack of money (10.6%), schooling mothers (0.5%), parents objection, disagreement or concern about immunization safety (38.8%) and other miscellaneous reasons (3.5%). Understanding of the importance of vaccination, education and occupational status showed significant differences with respect to children with complete and incomplete vaccination status. Factors such as mothers' age, marital status, schooling level and gender of the child showed no significant differences with respect to vaccination completeness. Similarly, factors such as transportation need, physical accessibility, religious affiliations and knowledge about vaccination contraindication were confounders for incomplete vaccination status of the children and were found to be statistically non significant (p-value > 0.05). This study revealed an incorrect vaccination of about 36.4%.

Incorrect immunization in this study consists of less than 3 doses of DPT (10.2%), vaccination with measles

Table 1. Socio-demographic characteristics of respondents.

Variable	Frequency	Percentage	Significance level
Gender			
Female	685	100	
Tribe			
Hausa	663	96.8	
Igbo	17	2.5	0.093
Yoruba	5	0. 7	
Age of respondents (years)			
18 to 29	379	55.3	
30 to 39	241	35.2	0.520
40 to 49	56	8.2	
> or = 50	9	1.3	
Household income/month			
$ 0 to 100	616	90	
$101 to 200	64	9.3	0.024
$>200	5	0.7	
Education			
None	477	69.6	
Primary	158	23.1	0.076
Secondary	33	7.3	
House hold size			
1 to 2	113	16.5	
3 to 4	146	21.3	0.732
>4	426	62.2	

antigens after 9 months (12.8%), wrong immunization date (8.3%) and absence of BCG scar (5.1%).

Factors associated with missed opportunities

This study also examined a number of factors associated missed opportunities for vaccination and its associated risk factors. Missed opportunities for vaccination totally constitute 208 (33.4%) children. The mean number of missed opportunities for vaccination per child was 1.68±0.42. More than one-fifth (27.4%) of the children had 2 or 3 times missed opportunities for vaccination and 144 (69.2%) of the children could have completed their vaccination program if they had not missed the opportunity for measles vaccination. Children with missed opportunities for vaccination were more likely to have an incomplete vaccination status than children without missed opportunities P<0.05 (Table 3). Maternal reasons for missed opportunities included sickness (24.5%), social engagement (30.4%), traveling (14.6%), long distance walking (11.5%), and complications from previous injections (19%). Table 3 showed the significant difference between children with and without missed opportunities for vaccination.

DISCUSSION

Determinants of receipt of vaccination completion are complex and interwoven. This study identified several reasons affecting childhood immunization. Parents' objection, disagreement or concern about immunization safety (38.8%), long distance walking (17.5%) and long waiting time at health facilities (15.2%) are the most common reasons for incomplete vaccination/ immunization. This study showed that parental belief about immunisation safety is the major reason for incomplete immunisations among Nigerian children. Our estimate that 38.8% of parents object, disagree, or are concerned about immunisation is in contrast to a previous case control study from south ethopia (Hemoke et al., 2009) and that of telephone survey conducted in New South Wales (2001) This estimate (38.8%) extrapolates to a large

Table 2. Reasons given by mothers of incompletely vaccinated children who disagreed with or were concerned about immunization.

Reason	Percentage	OR (95% CI)	P to value	OR* (95% CI)	P value
Concern about vaccine safety					
Yes	266(38.8)	2.33 (1.43 to 1.67)	0.015	2.22 (1.63 to 1.86)	0.001
No	419(61.2)				
Long distance trekking/walking					
Yes	120(17.5)	1.88 (0.68 to 0.91)	0.028		
No	565 (82.5				
Long waiting time					
Yes	104(15.2)	2.45 (1.15 to 1.43)	0.035	1.74(0.68 to 0.83)	0.002
No	564(84.8)	1		1	
Lack of money					
Yes	73 (10.6)	1.78 (0.64 to 0.87)	0.039		
No	612(89.4)				
Absence of personnel					
Yes	37(5.4)	3.23 (2.46 to 2.88)	0.044	2.33(1.73 to 1910)	0.001
No	648(94.5)	1		1	
Chick sickness					
Yes	25(3.6)	1.82 (0.63 to 0.92)	0.045	2.67(1.55 to 171)	0.001
No	660(96.4)	1		1	
Lack of vaccine					
Yes	24(3.5)	2.39 (1.77 to 1.93)	0.045	2.11(1.89 to 2.23)	0.002
No	661(96.5)	1		1	
Lack of information about day of immunization					
Yes	17(2.5)	1.66 (0.83 to 0.95)	0.045	1.37(0.56 to 0.72)	0.002
No	668(97.5)	1		1	
Forgetting the day of vaccination					
Yes	10(1.5)	3.83 (2.42 to 2.85)	0.041	2.16(1.75 to 1.94)	0 .001
No	675(98.5)	1		1	
Mothers sickness					
Yes	3 (0.5)	2.46 (1.23 to 1.67)	0.042	1.53(0.83 to 1.22)	0.003
No	682(95.5)	1			
Mothers level of education					
Yes	3 (0.5)	2.46 (1.23 to 1.67)	0.042	2.55(1.77 to 1.89)	0.001
No	682(95.5)	1		1	
Social engagement					
Yes	2 (0.4)	2.22 (1.57 to 182)	0.041	2.66(1.51 to 193)	0.002
No	683(99.6)	1		1	

OR = Odds ratio, OR* = Adjusted odds ratio, % = percentage, *1 = reference variable C. I. = Coefficient interval. Only significantly associated variables ($p<0.05$) are shown in the table.

to a large number of children under the age of 5 years in the study area. This could be particularly important in terms of infectious disease outbreaks if concentrated in one geographic area; remembering that 95% immunization coverage rates must be achieved and maintained to prevent outbreaks (Hull and McIntyre, 2003). A perception

Table 3. Factors associated with missed opportunity for vaccination in children less than 1 year of age.

Bivariate analysis		Binary logistic		Regression analysis	
Factor	**%**	**OR (95% CI)**	**P-value**	**OR* (95% CI)**	**P-value**
Mother health status					
Sick	168 (24.5)	3.18 (2.32 to 2.67)	(0.025)	2.43 (1.82 to 1.90)	0.012
Healthy	517 (75.5)	1		1	
Social engagements					
Yes	71 (10.4)	2.73(1.45 to183)	0.031	1.78 (1.13 to 1.52)	0.003
No	614 (89.6)	1		1	
Traveling					
Yes	110 (14.6)	3.12 (2.56 to 2.89)	0.002	2.66 (1.75 to 1.87)	0.002
No	575 (85.4)	1		1	
Distance to the health facility					
Long (Far)	79 (11.5)	1.75 (0.78 to 098)	0.024	0.93 (0.89 to 1.25)	0.001
Short(Near)	606 (88.5)	1		1	
Complications from previous injections					
Yes	130 (19)	3.33 (2.55 to 2.72)	0.031	2.14 (1.76 to 1.85)	0.002
No	555 (81)	1	1		
Place of delivery					
Home	548 (80)	1.88 (2.77 to 2.94)	0.022	2.31 (1.79 to 193)	0.004
Health facility	137 (20)	1		1	
Information on NPI					
Yes	141 (21)	1.63 (2.42 to 2.69)	0.031	1.78 (2.65 to 2.88)	0.001
No	544 (79)	1		1	

OR- Odds ratio, OR*- Adjusted odds ratio, %- Percentage,*1 = reference variable, C.I.- coefficient interval, NPI- National Program on Immunization. Only significantly associated variables (p<0.05) are shown in the table.

perception of vaccine or immunization safety was a key finding in this study. The Health Belief Model is a theory that attempts to explain health-seeking behavior by examining how people perceive disease severity, their likelihood of contracting that disease, the benefits of taking preventive action, and the costs of taking preventive action (Strecher and Rosenstock, 1997). This theoretical framework is useful in helping to explain these findings.

If parents do not perceive vaccine-preventable diseases as severe enough to warrant preventive action or if they do not perceive any particular benefit to their child's health from vaccination, then they will be more likely to in completing immunization/vaccination doses for their children or oppose any law or policy that mandates such behavior. Of the socio demographic characteristics of the respondents, only monthly family income was found to be predictor of defaulting from completion of child immunization in this study (Table 1). A similar study by Renstein showed that income had consistently affected receipts of immunization (Renstein, 1990). Results of our study also showed that parents who reported lower household income were more likely to have children with incomplete immunization status than parents reporting higher household income. Family income has previously been associated with immunization coverage levels, and low family income is also a risk factor for low immunization (Klevens and Luman, 2001; Bates and Wolinsky, 1998; Zimmerman, 1996). Parents with lower household incomes are more likely to experience barriers, such as transportation or access to health care services that make staying up-to-date on immunizations difficult (Klevens and Luman, 2001). The low-income parents in this study who had incomplete immunization for their children may have done so because of similar barriers. Other socio-demographic variables were not associated with defaulting. Mothers who had negative attitude about health facility were two times more likely to have defaulter children than mothers who had positive attitude. Similar finding was obtained from

other study which showed that the barriers of completion of child immunization were poor knowledge, attitude and perception of health facility support (Coreil et al., 1989). This study had identified that maternal knowledge about immunization was one of the major reasons for defaulting.

Other literatures had similar findings elsewhere (Onyiriuka, 2005; Millman, 1993). Educating parents about vaccine preventable diseases, as well as the vaccines themselves, may be one way to impact the importance of vaccines to the health of their child. This study was conducted in a homogeneous rural community in North Central Nigeria. The majority (92.5%) of the interviewed mothers were from low socio- economic status with low or no formal education. As children were sampled from all the 10 political wards, it is unlikely that our results are biased. One limitation of our study is that the sample is composed primarily of poor women and children from one rural local government area. Because of the relative homogeneity of our sample, we might have probably underestimated the effect of socio-demographic characteristics such as education, income, and source of health care. If the beliefs and attitudes of this group are markedly different from higher socioeconomic and more fully vaccinated groups, then the effects of these beliefs also may be underestimated. Information about vaccination status of children taken from mothers' recall (47.8%) may be another limitation of our study. However, studies reporting that information about vaccination status of children taken from mothers' recall is accurate are available (Abdelsalam and Sokal, 2004). Our results showed that mothers were not motivated, did not understand the benefits of immunization and were not willing to walk long distances due to fear of constant health worker absence at the health facility. In the study area, the major occupation of mothers is subsistence farming with average monthly income of N1000 (USD 7).

Many of the mothers in the study area spent an average of USD 1.5 per trip to the health facility. Therefore, the direct travelling costs for obtaining all the EPI vaccines are approximately USD 7.5 per child, the equivalent of average monthly income. As the majority of the mothers were peasant farmers with no regular income, the money for the travelling costs came from assistance from family members and significant others. Our findings suggest there is a difference in vaccination coverage relative to the economic conditions of mothers. In rural areas, children in the highest economic quartile have a better immunization coverage rate and a greater probability (2.1 times) of being vaccinated. However, the ability to pay should not be reduced to incentive to immunize. The influence of economic factors remains more complex than ability to pay, as immunization services are offered free of charge in Nigeria. At the same time, it is also difficult to claim that all health centres are providing this free immunization service. Some of the reasons given by mothers for not participating in immunization exercises are that they did not have the money required (suggesting their belief that money is sometimes being demanded from them).

The indirect influence of economic factors on immunization at household levels is a more obvious explanation. When the mother/household is experiencing food and resource shortages, participating in an immunization exercise becomes a matter of lesser priority. A woman who participated in our discussion sessions gave a clear explanation:

“Under the circumstance of food shortage, as parents, you don't want children to wake up and find out that you do not have a solution for their hunger; they will look so depressed and cry. This problem can be one of the reasons for not respecting the appointment with the vaccination team.”

It may be difficult for health planners and decision makers to control the indirect influence of economic factors on immunization uptake. However, there remains a need to identify all the interactions between the health system and the poor communities. Thus, a large-scale communication about the free immunization services and careful monitoring of vaccination procedures should be undertaken to assist the poor communities. The results of this study also showed that the risk of incomplete vaccination status was high in Asara ward. The reasons for this are probably linked with difficult access (bad terrain) to the health facilities, scattered settlements and high cost of transportation. Accessibility as a function of distance and need for using transport were identified as confounder variables for incomplete vaccination. Long distance trekking involving approximately 1½ h (90 min) to reach the nearest health facility was seen as a strong non-motivating factor with a negative influence in completing vaccination schedules. A client-friendly health facility with a well planned and organized fixed and outreach activities that strongly involve the local community, would help to decrease the mothers’ expenses on transportation and the time spent for obtaining vaccination service. There was no evidence to support that child sex had any impact on vaccine uptake or in defining missed opportunities for vaccination in our study area.

In some societies with cultural discrimination against female children, boys have a greater chance to be vaccinated (Akesode, 1982). Marital status and age of the mothers were not seen to be associated with the use of immunization services. In other settings, both younger (Glenda et al., 2004) and older age of mothers (Akesode, 1982) has been reported to be associated with incomplete vaccination. Previous studies (Markland and Durand, 1976; Marks et al., 1979) revealed that educational status of mothers has a strong association with a high vaccine uptake. This study also confirms this assertion from previous studies (Markland and Durand, 1976; Marks et al., 1979). There is an association between

education status of mothers and missed opportunities for vaccination. More than two-thirds (70.4%) of mothers with missed opportunities for vaccination had either primary school education or no formal education. This finding is in support of a report from Turkey study (Altinkaynak et al., 2004) that education of mothers increases the vaccination chance of a child and reduces missed opportunity. In our study, 33.4% of the children under one year of age have not completed their vaccination program because of missed opportunities. Factors identified for missed opportunities in these children are long trekking distance with bad terrain (27%), high cost of transportation (33%), poor staff attitude (11%), quality of health services provided (9%), lack of personnel (15%) and vaccine out of stock (5%).

Previous studies have identified missed opportunities for vaccination and inappropriate use of contra indications as important factors inhibiting better EPI coverage (Cutts et al., 1990). Findings from seventy-nine missed opportunity studies (Brown et al., 1982) also showed that the quality of health services was an important cause of missed opportunities for vaccination. The high percentage of children without the BCG scar and vaccinated after nine months of age against measles is worrisome. Frequent posting of health care providers (due to political reason), high cost of transportation, irregular fixed and outreach sessions due to staff attitude, delivery and living outside the study area, were the factors that showed a stronger association with lower vaccination uptake. The high percentage of number of missed opportunities for vaccination in our study area indicates that immunization coverage would have improved if factors like poor staff attitude (11%), quality of health services provided (9%), lack of personnel (15%) and vaccine out of stock (5%) were prevented. Different strategies are needed to address the varying reasons for incomplete immunization and will be particularly centered on health workers. Although addressing parents' concerns about vaccine safety (guided by currently available resources) (National Health and Medical Research Council, 2003; Hall et al., 2001) will help parents make informed decisions, some parents view this type of education negatively (Sporton, 2001; Leask et al., 2000). Some parents, especially the tertiary educated, may be influenced by alternative methods of presenting information about immunisation risks and benefits such as decision aids (O'Connor et al., 2003) and internet-based resources. Health workers should address parents' concerns regarding the few appropriate side effects and medical contraindications to immunisation to help reduce unnecessary missed opportunity and often lengthy postponement due to mild illnesses (Burgess et al., 1998; Prislin et al., 2002). The concerns and experiences of previously compliant parents concerned after a child experiences minor anticipated vaccine side effects, or a more serious adverse event, should be addressed and managed appropriately (Prislin et al., 2002) including referral to a specialist immunization adverse events clinic if necessary (Wood, 2003; Gold et al., 2003).

IMPLICATIONS OF THIS STUDY FOR PUBLIC HEALTH PRACTITIONERS

i) Disagreement or concern, particularly about vaccine safety, is the major parent reported reason for incomplete immunization. Long distance walking is also common.

ii) Parents who disagree or are concerned about immunization, are significantly more likely to have low educational level and to have children who are completely unimmunized. Children not fully immunized due to illness or access reasons are likely to have started the immunization schedule.

iii) Up to 38.8% of the study parents do not immunize their children because they object, disagree or are concerned about immunization safety. Public health practitioners have an important role in identifying such parents and discussing their concerns with them.

Conclusions

This study identified the reasons for partial immunization and factors that contributed to missed opportunities for immunization in children less than one year of age in a rural area in Awe LGA, Nasarawa State, Nigeria. Less than half (37.2%) of the mothers completed routine immunization schedules for their children by the age of 9 months. The main reasons attributed by the mothers for partial immunization include, parents objection, disagreement or concern about immunization safety (38.8%), long distance walking (17.5) and long waiting time at the health facility (15.2%), (Repeated material could be deleted). Factors such as transportation need, physical accessibility, religious affiliations and knowledge about vaccination contraindication were confounders for incomplete vaccination status of the children and were found to be statistically non significant (p-value > 0.05).

Missed opportunities for vaccination totally constitute 208 (33.4%) children. Maternal reasons for missed opportunities included sickness (24.5%), social engagement (30.4%), traveling (14.6%), long distance walking (11.5%), and complications from previous injections (19%). Patronage of health facilities for immunization services in our study area is poor. If the factors contributing to partial immunization and missed opportunities for vaccination could be prevented mothers patronage for vaccination would improve. Mother should also be advised about the importance of vaccination and timely administration of vaccine.

Long distance trekking, poor staff attitude and high cost of transportation are limiting factors for mothers in completing immunization schedules for their children. If special attention is focused on staff attitude, a lot of missed opportunities would be averted and this will have positive impact on immunization coverage. Furthermore,

parents' poor patronage for immunization services as a result of long distances and quality of care provided has implications and deserves consideration for routine immunization program.

REFERENCES

Federal Ministry of Health (1995). National immunization policy and standard of practice. Abuja, Federal Ministry of Health, Nigeria, p.16 .

World Health Organization. WHO vaccine preventable diseases monitoring system. (2005) global summary. Immunization profile, Nigeria. Geneva: World Health Organization, 2005, p.333 (http://www.who.int/vaccines/globalsummary/immunization/countrypr ofileresult. cfm, accessed on 29 Nov 2008).

Adeiga A, Omilabu SA, Audu RA, Sanni FA, Lakehinde GF, Balogun O *et al* (2005). Infant immunization coverage in difficult-to-reach area of Lagos metropolis. Afr. J. Clin. Exp. Microbiol., 6: 227-317.

Onyiriuka AN (2005). Vaccination default rates among children attending a static immunization clinic in Benin city, Nigeria. J. Bio. Med. Res., 4: 71-77.

Luman ET, Barker LE, Shaw KM, McCauley MM, Buehler JW, Pickering LK (2005). Timeliness of childhood vaccinations in the United States. *JAMA.,* 293:1204-1211.

Glauber JH (2003). The immunization delivery effectiveness assessment score: a better immunization measure? Pediatrics., 112: 39-45.

Ayebo ES Charles O (2009) Eregie. Timeliness and Completion Rate of Immunization among Nigerian Children Attending a Clinic-based Immunization Service. J. Health. Popul. Nutr., 27 (3):391-395.

(2006). Challenges in global immunization and the Global Immunization Vision and Strategy 2006-2015 *Weekly* epidemiological record/ Health Section *of* the Secretariat of the League of Nations., 81(19): 190-195.

Mayinbe JC, Braa J, Bjunne G (2005). Assessing immunization data quality from routine reports in Mozabique. BMC Public Health, 5; 108.

Centre for Disease Control and Prevention. (2009). Recommended adult immunization schedule-United States, 2009. MMWR., 57 (53):Q-1-Q-4.

Nigeria Immunization coverage survey (2003).

Glenda LL, Brynley, Craina M, Peter BM (2004). Reasons for incomplete immunization among Australian Children.Australian Family Physician, 33.(7): 13-19.

Allison MK, Cedric JB, Deborah AG (2005). Vaccine Beliefs of Parents Who Oppose Compulsory Vaccination. Public Health Reports / May–June 120: 1-7.

Bond L, Nolan T, Pattison P, Carlin J (1998) Vaccine preventable diseases and immunisations: a qualitative study of mother's perceptions of severity, susceptibility, benefits and barriers. Aust. N. Z. J. Public Health., 22: 441-446.

Hull BP, McIntyre PB, Sayer GP (2001) Factors associated with low uptake of measles and pertussis vaccines: an ecologic study based on the Australian Childhood Immunisation Register. Aust N Z J. Public Health., 25: 405–410.

Yawn BP, Xia Z, Edmonson L, Jacobson RM, Jacobsen SJ (2000) Barriers to immunisation in a relatively affluent community. J. Am. Board. Fam. Pract., 13: 325–332.

Carr J, Martin M, Clements C, Ritchie P (2000). Behavioural Factors in Immunization. In Behavioural Science Learning Modules. World Health Organization Geneva, 1-10.

Hemoke T, Amare D, Mirkuze W (2009) Predictors of defaulting from completion of childhood immunization in south ethopia-Acase control study. BMC Public Health., 9: 150.

Anonymous (2002) New South Wales Child Health Survey 2001. New South Wales Public Health Bulletin., 13: 1-84.

Hull BP, McIntyre PB (2003). Mapping immunization coverage and conscientious objectors to immunization in NSW . New South Wales Public Health Bulletin. 14: 8-12.

Strecher V, Rosenstock I. The health belief model. In: Glanz K, Lewis FM, Rimer BK (1997). editors. Health behavior and health education: theory, research, and practice. 2nd ed. San Francisco: Jossey- Bass Publishers pp. 41-59.

Renstein (1990). Barriers to vaccinating preschool children. J. health. Care Poor. Underserved., (3)**:** 315-329.

Klevens RM, Luman ET (2001). U.S. children living in and near poverty: risk of vaccine-preventable diseases. Am. J. Prev. Med., 20 (4): 55-60.

Bates AS, Wolinsky FD (1998). Personal, financial, and structural barriers to immunization in socioeconomically disadvantaged urban children. Pediatrics, 101 (41): 591-596.

Zimmerman RK, Ahwesh ER, Mieczkowski TA, Block B, Janosky JE,Barker DW (1996). Influence of family functioning and income on vaccination in inner-city health centers. Arch Pediatr Adolesc Med.,150:1054-1061.

Coreil J, Augustin A, Holt E, Halsey NA (1989). Use of ethnographic research for instrument development in a case control study of immunization in Haiti. Int. J. Epidemiol.,18:33-37.

Millman ML (1993). Access tohealth care. Institute of Medicine. National Academic Press, Washinton, DC, p.69.

Abdelsalam HHM, Sokal MM (2004). Accuracy of parental reporting of immunization . Clin. Pediatr., 43**:** 83.

Akesode FA (1982) Factors affecting the use of primary health care clinics for children. J. Epidemiol. Community. Health., 36(4): 310-314.

Markland RE, Durand DE (1976). An investigation of socio-psychological factors affecting infant immunization. Am. J. Public Health., 66(2):168-170.

Marks JS, Halpin TJ, Irvin JJ, Johnson DA, Keller JR (1979) Risk factors associated with failure to receive vaccinations. Pediatrics 64(3): 304-309.

Altinkaynak S, Ertekin V, Guraksin A, Kilic A (2004). Effect of several sociodemographic factors on measles immunization in children of Eastern Turkey. Public Health,118: 565-569.

Cutts F, Soares A, Jecque AV, Cliff J, Kortbeek S, Colombo S (1990). The use of evaluation to improve the Expanded Programme on Immunization in Mozambique. Bulletin of the World Health Organization 68(2): 199-208.

Brown J, Djogdom P, Murphy K (1982). Identifying the reasons for low immunisationcoverage. A case study of Yaounde Cameroon Revue Epidemioloque et SantePublique 30: 35-47.

National Health and Medical Research Council. (2003). The Australian Immunisation Handbook. 8th eds. Canberra: AGPS, pp.303-316.

Hall R, O'Brien E, MacIntyre CR, Gidding H (2001). Immunisation myths and realities: responding to arguments against immunisation. A guide for providers. 3rd edn. Commonwealth Department of Health and Aged Care: Canberra: Available at: http://immunise.health.gov.au/ myths_2.pdf. Accessed 17/12/08.

Sporton RK, Francis SA (2001). Choosing not to immunise: are parents making informed decisions? Fam. Pract., 18: 181–188.

Leask JA, Chapman S, Hawe P (2000). Concerns about immunisation: facts are not enough [letter]. BMJ pp. 321:109.

O'Connor AM, Legare F, Stacey D (2003). Risk communicationin practice: the contribution of decision aids. BMJ, 327: 726-740.

Burgess MA, McIntyre PB, Heath TC (1998). Rethinking contraindications to vaccination. Med. J. Aust., 168: 476–477.

Prislin R, Sawyer MH, Nader PR, Goerlitz M, De Guire M, Ho S (2002). Provider-staff discrepancies in reported immunisation knowledge and practices. Prev. Med., 34: 554–561.

Wood N (2003). Immunisation adverse events clinics. New South Wales Public Health Bulletin., 14: 25–27.

Gold MS, Noonan S, Osbourn M, Precepa S, Kempe AE (2003) . Local reactions after the fourth dose of acellular pertussis vaccine in South Aust. Med. J. Aust., 179: 191-194.