Factors contributing to delay in commencement of immunisation in Nigerian infants

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Abstract: Delay in receipt of immunisation may result in a child being susceptible to vaccine preventable diseases for prolonged periods. Identification of factors which contribute to delay in receipt of immunisation will help in developing targeted interventions. This study examined prospectively factors contributing to delay in the commencement of infant immunisation in Benin City, Nigeria. This was a cross-sectional descriptive study of 153 consecutive mothers of infants presenting for their first immunisation at the Institute of Child Health Child Welfare Clinic of the University of Benin, Benin City. Reasons for not presenting in the first 24 hours were ascertained and associations between various factors and delay in commencement of immunisation were examined. Of the 153 mothers only 2 (1.3%) brought their babies for immunisation within 24 hours of birth while 66 (43.1%) brought their babies in the first week of life. The most cited reason (30.3%) for not presenting within 24 hours of birth was that BCG, one of the immunisations that should be given at birth is given only on a specific day. Mothers who did not know that immunisation should commence at birth (*P*=0.0054), those from low socioeconomic class (*P*=0.0056) and those with less than 12 years of schooling (*P*=0.0001) were significantly less likely to bring their babies for immunisation in the first week of life. Delivery outside of health facilities was also associated with later presentation for immunisation (*P*=0.0069). In conclusion, there is significant delay in the receipt of birth doses of immunisation. Change in clinic practices to enable daily immunisation as well as education of health care personnel on the importance of timely commencement of immunisation will ensure timeliness of receipt of birth doses of vaccines.

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Keywords: factors, delay, commencement, immunisation, infants, Nigeria

Introduction

Timeliness in the receipt of immunisation ensures that children are protected as early as possible from vaccine preventable diseases (Luman *et al*., 2002).Delay in commencement of immunisation results in children being susceptible for varying periods of time and they may acquire vaccine preventable infections before they commence immunisation. Such pools of susceptible individuals have been known to contribute to epidemics (NVAC, 1991). Delay in the commencement of an immunisation series may also lead to delays in the completion of the series (Yusuf *et al*., 2000; Sadoh & Eregie, 2009a). Delays in the commencement of child immunisation have been reported globally. In the United States of America studies have shown that even though vaccination coverage rates are high only few children receive their vaccination on time (Luman *et al*., 2005). In another study in the same country, 12.6% of the studied children were identified to have started immunisation late (Feemster *et al*., 2009). A study of timeliness of childhood vaccination in 31 low and middle income countries reported substantial vaccination delays (Akmatov & Mikolajczyk, 2012). In Uganda less than half of all children received all vaccines within the recommended time (Babirye *et al*., 2012).

In Nigeria it is recommended that infants receive the first dose of hepatitis B, Oral Polio and BCG vaccines at birth (NPHCDA, 2009). Failure of timely initiation of vaccination in infants has been reported in Nigeria (Odusanya, 2000; Sadoh & Eregie, 2008; Olusanya, 2010). Odusanya (2000) reported wide variations in age at receipt of BCG of between 0 and 225 days and in that study only

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26% of children received all their vaccines within the recommended period. Sadoh & Eregie (2008) reported that only 2 of 512 children studied received the first dose of hepatitis B vaccine in the first day of life and 17.8% in the first week of life. In another study that examined the causes of delay in the receipt of BCG, about one-third of the studied infants were delayed beyond 3 months for the receipt of BCG (Olusanya, 2010). In that study the factors associated with delay in commencement of BCG immunisation were being born outside of hospital, under nutrition, lack of antenatal care and multiple gestations. Severe neonatal jaundice was associated with decreased odds of delay in the receipt of BCG (Olusanya, 2010).

Some studies have suggested that timeliness of receipt of vaccines be a part of the assessment of immunisation programmes (Hull & McIntyre, 2006; Luman *et al.*, 2005; Akmatov *et al.*, 2008). In fact, the World Health Organization suggests that the timely delivery of the birth dose of hepatitis B vaccine be a performance indicator for hepatitis B immunisation programmes (WHO, 2009a). For appropriate and targeted interventions to be developed to improve timeliness in the initiation and receipt of vaccines it is important to identify the contributing factors. These factors may vary between countries and between regions in the same country. In Nigeria earlier studies on timeliness were either retrospective (Sadoh & Eregie, 2009a) or did not inquire from mothers the reasons for delay (Olusanya, 2010). The objective of this study was to prospectively assess the factors that contribute to delay in commencing immunisation among children in Benin City in Nigeria.

Materials and Methods

Study area
The study was carried out at the Child Welfare clinic of the Institute of Child Health, University of Benin, Benin City between December 2010 and June 2011. The Child Welfare clinic of the Institute of Child Health offers services to the inhabitants of Benin City, the capital of Edo State, Nigeria. The services offered include immunisations, growth monitoring, nutrition education and general health education. About 1,000 babies receive their immunisations in this facility yearly.

Sample size and data collection
The respondents were mothers of infants being evaluated for serological markers of hepatitis B. The sample size was determined using the formula

$$n= \frac{z^2 pq}{d^2}$$

where: n= the desired sample size; z= the standard normal deviate set at 1.96 which corresponds to 95% confidence interval; p= the proportion in the target population estimated to be positive for the hepatitis B surface antigen(estimated to be 10.8% using the prevalence found in an earlier study (Abiodun & Okolo,1991) in Benin City, Nigeria, the study locale); q= 1.0-p; d= degree of accuracy desired which is 0.05. This gave a minimal sample size of 148.03.

Consecutive mothers of infants presenting for their first immunisation who consented to participate in the study were interviewed. Socio-demographic data such as date of birth of the infant, sex of the infant, maternal age, paternal age, maternal education, paternal education, maternal occupation, paternal occupation, parity of mother receipt of antenatal care for the index child and place of delivery were obtained. The outcome variable was the age in days at presentation for first immunisation. Determinant factors included the knowledge of mothers about recommended age for commencement of childhood immunisation, the source of such knowledge and socio-demographic factors. Mothers who did not bring their infant for immunisation within 24 hours of birth were asked the reason(s) for the delay.

Data analysis

Data was entered into an SPSS version 13 spreadsheet. Analysis was done using the same soft ware and Graphpad Instat 3. Data was summarized into frequency distribution tables. Associations between categorical variables were tested using Chi square test and Fisher's exact test as appropriate. Level of significance was set at p<0.05. Socioeconomic class was determined using the educational level and occupation of both parents of each child as described by Oyediji *et al.* (1985). Scores were awarded for the occupation and the educational level of the parents. The mean of the four scores (two for the mother and two for the father) to the nearest whole number was the social class assigned to the child. The minimum mean score was 1 corresponding to social class 1 while the maximum mean score was 5 corresponding to social class 5.

Ethical considerations

Ethical clearance for the study was obtained from the University of Benin Teaching Hospital Ethical Review committee.

Results

A total of 153 mother infant pairs were studied. There were 81 (52.9%) boys. The mean, median and modal ages at presentation were 14.3 ±15.6 days, 9 days and 6 days, respectively with a range of 1-90 days. Only two (1.3%) children presented within 24 hours of birth while 66 (48.1%) presented in the first week of life (Table1).

Table 1: Socio-demographic characteristics of the study population

Variable	Response	Number	Percent
Sex	Male	81	52.9
	Female	72	47.1
Age at presentation(in days)	1-7	66	43.1
	8-14	42	27.5
	15-21	23	15.0
	22-28	6	3.9
	≥29	16	10.5
Place of Delivery	Health facility	124	81.1
	Outside Health Facility	29	18.9
Receipt of Antenatal care	Yes	141	92.2
	No	12	7.8

Table 2: Reasons for not presenting early for first immunisation

Reason	No. of respondents	Percent
Waiting for the day when BCG is scheduled	47	30.3
Mother's ill health	19	12.3
Baby's ill health	18	11.6
No reason/forgot	16	10.3
Did not know immunisation commences at birth	15	9.7
Wants to rest	9	5.8
Public holiday/strike	7	4.5
Wanted to circumcise first	5	3.2
Vaccine not available	2	1.3
No money for transport	2	1.3
*Miscellaneous	15	9.7

*Did not know place of immunisation, husband not around to transport her, lost her way, moved house, too busy, twin was sick, was in the village, too few children to open vaccine vial, immunisation post too far

The age of the mothers ranged between 18 and 42 years (mean=29.6 ± 5.6 years). The mean age of fathers was 36.0±7.4 years (range = 19-59 years). The mean parity of the mothers was 2.7±1.7 with a range of 1 to 10. Of the 153 mothers, 141(92.2%) received antenatal care. Of the 148 mothers who responded to the question on why the children were not brought for immunisation earlier, 47 (30.3%) said they had to wait for the day when BCG is given at the immunisation clinic (BCG is given only on Fridays in the immunisation clinic) (Table 2).

Of the mothers studied 41(26.8%) knew that immunisation should commence at birth while 74(48.4%) felt immunisation should commence within the first week of life. About a third of the mothers 32 (20.9%) did not know the age at commencement of immunisation for infants. Mothers who knew that immunisation should commence at birth were more likely to present within the first week of life than those who didn't have the knowledge (*P*=0.0054) (Table 3).

Table 3: Relationship between age at presentation for first immunisation and different parameters

Variable	Response	Age (days) at presentation for first immunisation				
		≤7		>7		P-value
		N	%	N	%	
Age at presentation	Birth	27	65.9	14	34.1	
	<7	16	35.1	48	64.9	
	Others	1	20.0	4	80.0	0.0054[a]
	Don't know	11	34.4	21	65.6	
Socioeconomic class	I	9	75.0	3	25.0	
	II	13	52.0	12	48.0	
	III	30	50.0	30	50.0	0.0056[a]
	IV	11	25.0	33	75.0	
Place of delivery	Health facility	60	48.4	64	51.6	
	Outside health facility	6	20.7	23	79.3	0.0069[b]
Sex	Male	28	34.6	53	65.4	
	Female	38	52.8	34	47.2	0.0332[b]
Maternal education	>12 years	29	69.0	13	31.0	
	<12 years	37	33.3	74	66.7	0.0001[b]

[a] Chi square [b] Fishers Exact test

Of the 111 mothers who responded to the question on source of information 64 (57.7%) got their information from the health care system (Table 4). Of these 64 who got their information from the health care system, the different settings in the health care system and health care personnel from whom the information was obtained included 18 (28.1%) nurse, 13 (20.3%) during antenatal care sessions, 11 (17.2%) during immunisation sessions, 3 (4.1%) unspecified health care worker, 1 (1.6%) the doctor and 10 (15.6%) unspecified activity within the health care system. Eight (12.5%) mothers who were also classified as having received their information from the health care system were health care workers. The source of the information about age at commencement of immunisation was not significantly associated with whether the infants received their first immunisation in the first week of life or later (*P*=0.5588).

Nine (75%) of the babies in socioeconomic class (SEC) 1 presented within the first week of life compared to 13 (52%) of 25 in SEC 2, 30 (50%) of 60 in SEC3 and 11 (25%) of 44 in SEC 4. The difference in presentation based on SEC was significant (*P*=0.0056).

Table 4: Relationship between source of information on when to commence immunisation and age at presentation for first immunisation

Age at presentation (days)	Health care system		Intuition		Media/Books		Family/Friends		P-value
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	
≤7	30	46.9	11	39.3	3	75.0	6	40.0	
>7	34	53.1	17	60.7	1	25.0	9	60.0	0.5588[a]
Total	64		28		4		15		

[a]Chi square

Of the mothers delivering in a health facility, 50% brought their infants for immunisation within the first week of life compared to 20.7% of those who delivered outside a health facility. This difference was statistically significant (*P*=0.0069). Mothers who had beyond secondary education were more likely to bring their infants for immunisation in the first week of life compared to those with secondary or below secondary education (*P*=0.0001).

Discussion

In this study a significant proportion of the children were presented late for immunisations scheduled to be received at birth. This finding is similar to previous findings although there was a reduction in the number of children presenting after the fourth week in this study compared to earlier studies (Sadoh & Eregie, 2009a; Olusanya, 2010). The median age at presentation was 9 days (1.3 weeks) which is less than the 2.1 weeks reported for low and middle income countries (Akmatov & Mikolajczyk, 2012). There has been progress in immunisation activities in many of these countries (Machingaidze *et al.*, 2013) such that the reported median may no longer be representative. The mean age at presentation in this study was lower than the 26 days from an earlier study in Benin City suggesting an improvement in timeliness (Sadoh & Eregie, 2008). Majority of the children presented within the first two weeks of life. The national guidelines (NPHCD, 2009), recommend that the birth dose of oral polio vaccine must be given before 2 weeks of life. This may have been misinterpreted and misunderstood by mothers. There is thus a need for emphasis on the receipt of birth doses soon after birth.

The implication of delays in receipt of immunisation is that the children may acquire the target infections before the infant receives the requisite immunisation. This is especially important for vertical transmission of hepatitis B which is preventable by prompt administration of the birth dose within 24 hours of birth (WHO, 2001).

The vaccination schedules in health facilities contributed to delays in commencement of vaccination in this study. Although this may be justified for vaccines whose vials may be used once after opening, there is a need to address this situation including increasing the number of days in a week for vaccination with particular vaccines (such as BCG). BCG is given only on Fridays in the immunisation clinic where the study was carried out. In most other immunisation clinics in Benin City BCG is given only on specific days. Although 80% of the babies were born in health facilities only two infants commenced immunisation before leaving the hospital where they were born. They had only received BCG and not hepatitis B. This means that health care workers are not immunizing infants born in their facilities. Similar observation has been reported previously (Sadoh & Eregie, 2009b). This does not only contribute to the observed delays but also to missed immunisation opportunities in some infants as their birth in a health facility may be their only contact with the formal health care setting. This study also showed that babies delivered in a health facility were more likely to commence immunisation in the first week of life. This seeming incongruence is probably attributable to a lack of emphasis on timely administration of vaccines at birth while promoting immunisation.

Lack of knowledge on the age at which immunisation should commence and the place of immunisation suggest that health care workers are not providing adequate information at antenatal clinics and maternity wards as over 90% of the mothers received antenatal care while over 80% of the mothers had their deliveries in health facilities. In a review of the grey literature (WHO, 2009b), health workers were noted to "often communicate little and poorly with mothers so that many leave not knowing when to return." Some of the mothers in this study also did not seem to appreciate the importance of immunisation as they gave such excuses as wanting to rest and waiting to circumcise the infant as reasons for the delay in bringing their infants for immunisation. Waiting to circumcise male infants (usually done on the seventh day of life) may have contributed to females being brought earlier for immunisation. Health care workers can correct such impressions by emphasizing the importance of immunisation during contacts with mothers either antenatally or post delivery and during immunisation sessions. It is important that mothers obtain correct immunisation information as they may disseminate such information especially to mothers who neither receive antenatal care nor deliver in a health facility.

The role of husbands in the care of children was brought to the fore as a few mothers indicated the absence of their husbands as the reason for presenting late for immunisation. Some of the delay was also due to maternal illness. Fathers could have brought the infants for immunisation in these instances. Encouraging fathers to be more involved in child care may improve the timeliness of uptake of immunisation.

Several factors were found in this study to be associated with delay in receipt of birth doses of immunisation. Mothers who did not know that immunisation should commence at birth were less likely to bring their infants for immunisation in the first week of life. High socioeconomic status, having a maternal education above secondary school and delivery in a health facility were significantly associated with receiving immunisation in the first week of life. These factors have previously been identified as being associated with timeliness of receipt of immunisation (Luman *et al.*, 2005; Feemster *et al.*, 2009; Akmatov & Mikolajczyk, 2012; Babirye *et al.*, 2012).

Since timeliness of immunisation especially birth doses is important in the prompt and effective prevention of some perinatal infections, it is important to proffer solutions to mitigate delays. Appropriate health education with emphasis on receipt of birth doses within 24 hours of birth should be carried out. The importance of immunisation should also be emphasized in such health education activities. The importance of antenatal care and immunisation session health education activities as well as health care workers as sources of health care information is demonstrated in this study as majority of the mothers got their information from health care related sources. This finding is similar to that of a study from south western Nigeria where about two thirds of the mothers studied obtained information on immunisation from the antenatal clinics (Adeyinka *et al.*, 2009). In Libya more than half of mothers of completely immunized children got immunisation information from a health worker (Bofarraj, 2011). Mothers who got their information from the media and books (although small in number) also tended to bring their babies early for immunisation. This finding is similar to that in a multilevel analysis of factors associated with low immunisation coverage in Sub-Saharan Africa which showed that access to the media reduced the odds of the child being unimmunized. (Wiysonge *et al.*, 2012).

Studies have shown varying effects of education on immunisation coverage. In a study from the United States of America, maternal college education was positively associated with timeliness (Luman *et al.*, 2005). This is in keeping with findings in this study. Education of the girl child beyond secondary level is important. Also the content of such education should include important health topics such as immunisation, receipt of antenatal care as well as delivery with a skilled birth attendant.

It is possible that some factors contributing to delay in initiation of immunisation may not have been explored because this study is facility based. A major strength of this study is that it is prospective thus reducing the possibility of recall bias. Also this study ascertained from mothers the reasons for delay and not just examining association of factors with delay.

This study has shown that many of the studied infants did not commence immunisation early with resultant delays in receipt of birth doses of recommended vaccines. A major contributory factor is in the implementation of immunisation activities such that certain immunisations are only given on specific days. It is recommended that health care personnel be educated on the need to organize immunisation activities to allow for daily immunisations. The need for immunisation of babies born at health facilities at birth should also be emphasized.

Conflict of Interest

None declared

Acknowledgements

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