Original Article

Timeliness of Vaccination among Children Attending Immunization Clinic at a Tertiary Hospital in South-East Nigeria

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Abstract

Background: Timely vaccination of children is one of the most cost-effective interventions that ensure childhood survival. We determined the proportion of children who received timely vaccination and examined the factors associated with timely receipt of Bacillus Calmette Guerin (BCG) and third dose of pentavalent vaccine (Penta 3).

Methodology: We conducted a cross-sectional survey among 599 caregivers-infant pair aged less than 24months, attending the immunization clinic of a tertiary hospital in Nigeria, selected using systematic sampling methods. Using a structured questionnaire, we access the proportion of children who received timely vaccination, the relationship between the timely receipt of BCG, Penta 3 vaccine and infant/caregiver characteristics was examined using chi-square and multiple logistic regression at a 5% level of significance.

Results: The mean age of the respondents was 30.1±5.0 years. The majority (73.8%) had attained tertiary education, lived in an urban setting (90.9%), had received antenatal care during pregnancy (99.3%) and was delivered in a hospital (97.0%). About half of the children (52.9%) were male. About 18% of the caregivers reported missing scheduled immunization visits, due to forgetfulness (18%), child illness (14%) and being busy (5%). About 88% (482) of the children got their BCG vaccines on time, 91.1% got timely OPV0, however, only 29.5% of the newborns got HBV0 within 24 hours of birth. Only 65.7% and 65.0% received the timely measles-containing vaccine and yellow fever vaccine. None of the factors examined predicted timely receipt of BCG and Penta 3 vaccines.

Conclusion: Interventions that remind caregivers about the immunization schedules, could improve timely vaccination.

Keywords: Bacillius Calmette Guerin; Immunization; Vaccination; Timeliness; Pentavalent Vaccine.

Introduction

Timeliness of vaccination is a term that describes the degree of adherence to the country's vaccination schedule concerning the age of a child. It is categorized into; early receipt, timely and delayed receipt[1,2]. Timely vaccination is a performance indicator of Expanded Program on Immunization (EPI). It is a measure of the administration of vaccines when due (recommended ages and intervals) to elicit age-appropriate immunity. Delayed vaccination is a recognized impediment of EPI performance in Africa needing evidence-based intervention since failing to adhere to vaccine schedule makes the child most vulnerable to targeted vaccine-preventable diseases (VPD).

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EPI Performance is most commonly assessed with vaccination coverage which is the proportion of children in a given population vaccinated in a given period[4]. Despite its use, it does not consider whether vaccines are given according to an age-appropriate schedule. Studies have shown that achieving high coverage for individual vaccines do not necessarily imply population immunity[5-7]. Hence, vaccination coverage is an important but, insufficient indicator of the quality of immunization programs aimed at preventing childhood diseases[8-12].

Age-appropriate vaccination, on the other hand, is an effective preventive public health intervention against vaccine-preventable diseases[13-15]. It averts an estimated 2-3 million deaths from diphtheria, tetanus, pertussis and measles annually. Under vaccination (delayed vaccination, incompletely vaccinated and unvaccinated) is a persistent public health problem in Nigeria with only 23% of children aged between 12 and 24 months being fully vaccinated, 37% and 40% incompletely vaccinated and unvaccinated respectively according to National Immunization Coverage Survey 2016/2017 report. However, there is no mention of the proportion of these 23% fully vaccinated children that adhered to the national schedule. Immunization schedules are usually country-specific, depending on the epidemiology of the targeted infections and the ability of a vaccine to induce the age-appropriate immune response. Therefore, delaying vaccination for whatever reasons could result in vulnerable children acquiring infection before the receipt of needed vaccines[17].

Nigeria's Expanded Program on Immunization (EPI) schedule is such that a child receives Bacillus Calmette Guerin (BCG), Polio and Hepatitis B vaccines at birth, three doses each of Polio, Pentavalent vaccine (diphtheria, tetanus toxoid, pertussis, Haemophilus influenza type b and hepatitis B) and Pneumococcal vaccines at 6, 10 and 14 weeks. A single dose of injectable polio is given at 14 weeks, thereafter; Measles and Yellow fever vaccines are given at 9 months of age.

Whereas in 2012, Ebonyi State was one of the three states in the federation with Diphtheria, Pertussis, Tetanus toxoid (DPT) coverage greater than 80%, though high, but the implication may differ when timeliness is considered within the same environment. There is a paucity of information on the timeliness of childhood vaccination and the barriers to timely vaccination in Nigeria as a nation and particularly Ebonyi State. This study serves to fill in this knowledge gap as Nigeria's EPI progress can be accelerated and significant disease burden reduced by a better understanding of timeliness and factors leading to delay in childhood vaccination. Advocating for timely vaccination even in areas with low coverage can be complementary and enhance the development of herd immunity.

Materials and Methods

Study Area

The study was carried out in the Institute of Child Health (ICH), Alex Ekwueme Federal University Teaching Hospital Abakaliki (AEFUTHA). Abakaliki is the capital of Ebonyi State, South-East Nigeria. AEFUTHA is the only tertiary teaching hospital in the state. Immunization was formerly handled by the post-natal care clinic of AEFUTHA until 2014 when the Community Pediatrics subspecialty unit of the Department of Pediatrics AEFUTHA took over and supervised such services under the umbrella of the Well baby clinic. By 2016, the Institute of Child Health (ICH) was established to handle immunization services, growth monitoring, health and nutrition education, counselling, outreaches and other preventive services.

The Institute ran twice-weekly (Tuesdays and Thursdays) immunization services and a Well-baby clinic for under-five children till April 2019 when they started running daily clinics.

The Institute serves an average of 30 children in each clinic per day and over 600 per month. All the National Program on Immunization (NPI) recommended vaccines are given at the Institute. Each child is given a “Road to health” card where the vaccines, dates of administration of vaccines and other demographic information of the child are recorded by the immunization officers. The cards are usually in the custody of the mothers or caregivers and are presented to the immunization officers at every clinic visit.

Study design and population

We conducted a cross-sectional study among mother or caregiver/child pairs with children aged less than 24 months attending the ICH AEFUTHA with 'road to health card' were recruited for the study. Children who are too sick to participate were excluded from the study.

Sample size

The minimum number of children to be studied to

estimate the timeliness of vaccination within 5% point level of precision is given by the formula[18]

$$n = \frac{Z\alpha^2 PQ}{d^2}$$

where 'n' is the minimum sample size

Zα is the standard normal deviant corresponding to a 2-sided level of significance of 5% =1.96

P is the proportion of children who were timely in their vaccination in a study in Benin by Sadoh et al = 61.5%

Q= 1-P = 38.5%

d is the desired level of precision = 4%

$$n = \frac{1.96^2 \text{ X } 0.615 \text{ X } 0.385}{(0.04)^2}$$

n = 569

Adjusting for non-response rate of 5%,

n = n / 1 - r

where 'r' is the non-response rate and n the sample size.

=569/1-0.05

=599

Therefore, the calculated minimum sample size of 599 children will be used for the study.

Sampling Technique

We used the systematic sampling method to recruit mother/caregiver-child pairs into the study. The clinic runs daily and sees an average of 30 children in each clinic day. We sampled 10 mother/child pairs for each clinic day. Using a sampling interval of 3, every 3rd mother/child pair was approached to participate in the study. The first sample is balloted from the first three mother /child pairs each morning and the subsequent 3rd mother/ child pairs were approached till the number for each day is achieved or the end of the clinic. This was continued till the desired sample size was achieved.

Data collection

A structured interviewer-administered questionnaire was used to record information on the parents' / caregivers socio-demographic characteristics, the child's biodata and immunization history. For children who forgot their immunization card and whose records are with the hospital, their records were extracted from the facility immunization register. The information on timelines of immunization were gathered from vaccination cards or the hospital records were available.

Data Analysis

The data collected were cleaned and entered into Epi Info version 7.2. The sociodemographic and household characteristics of the children and their parents were reported as proportions. Age at vaccination was recorded in days and was estimated using the formula.

Age at vaccination (in days) = date of vaccination – date of birth

A vaccine was considered given on time if it was received on or within 14 days of the scheduled date if it was received beyond 14 days of the scheduled date but still within 28 days of the scheduled date it was considered acceptable but if it was received beyond 28 days, it was considered delayed. Vaccines received earlier than the scheduled date was considered early[1]. For each vaccine, the child has to be age-appropriate to be considered. However, the birth dose of the hepatitis b vaccine received after 24 hours of birth was considered delayed, The relationship between the socio-demographic and household characteristics and the timely vaccination were assessed using Chi-Square. Those factors that were significant in the bivariate analysis were modelled in a multiple logistic regression to eliminate the effect of confounders and identify the independent predictors of timely vaccination among the study population.

Ethical consideration

The ethical approval was obtained from the Research and Ethics Committee (REC) of AEFUTHA. Permission was obtained from the management of ICH AEFUTHA. Informed consent was obtained from the participants. Confidentiality and privacy of the patients involved in the research were maintained at all times during and after the study.

Result

Out of 599 respondents recruited, 562 participated in the study giving a response rate of 93.8%. The mean age of the respondents was 30.1±5.0 years, 98% (551) were married and a majority (73.8%) had attained tertiary education. The mean age of their spouses was 36.7±5.1 years. The majority of their spouse had attained tertiary education (76.6%) and were urban dwellers (90.9%, Table 1). About half of the children are males (297, 52.9%) and 35.6% (200) of the children are the first child of their parent.

Almost all the women (558, 99.3%) received antenatal care services during the last pregnancy and these ANC services were accessed mainly from publicly owned (483, 86.6%) and tertiary (448, 80.3%) health facilities. Ninety-seven per cent (545) of the mothers delivered in a hospital setting most of which83.9% (468) delivered their babies in the same hospitals

where they received antenatal care. Three hundred and eighty-nine (69.2%) of the deliveries were through vaginal delivery and 25.3% (142) of the deliveries occurred during the weekends (Table 2)

The proportion of children who have received the various vaccines promptly declined as the child advanced in age (Table 3). About 18% of the caregivers failed to present their children for immunization on the scheduled date (Figure 1). The main reasons for missing scheduled appointments were mostly forgetfulness (18%), child illness (14%) caregiver being busy on the day of immunization (5%) and fear of complication following immunization (5%, Figure 2).

The timeliness of the various vaccines tends to decline for vaccines taken later compared to those taken close to the time of birth. About 88% (482) of the children got their BCG vaccines on time, 91.1% (484) got OPV0 promptly, however, only 29.5% (156) of the newborns got HBV0 within 24 hours of birth. Among the vaccines given at the 6th week of life 88.0% (449) received OPV1, 89.4% (448) received Penta1 and 88.8% (435) received PCV1 on time. For the vaccines received at 9 months of life, 65.7% (67/102) received the measles-containing vaccine and 65.0% (76/117) received the yellow fever vaccine on time (Table 4).

Table 1: Sociodemographic characteristics of the participants (n=562)

Variable	Frequency	Percentage
Mother's characteristics		
Age (years)		
15-24	67	11.9
25-34	388	69.1
35-44	104	18.5
45-54	3	0.5
Marital status		
Single	11	2.0
Married	551	98.0
Education		
No formal	1	0.2
Primary	12	2.0
Secondary	134	23.8
Tertiary	415	73.8
Father's characteristics		
Age (years)		
20-29	25	4.6
30-39	385	70.8
40-49	121	22.2
50 and above	13	2.6
Education		
No formal	1	0.2
Primary	9	1.6
Secondary	121	21.5
Tertiary	431	76.7
Family type		
Monogamy	560	99.6
Polygamy	2	0.4
Residence		
Rural	27	4.8
Semi-urban	21	3.8
Urban	551	90.9
Urban slum	3	0.5
Child characteristics		
Age (days)		
0-28	43	7.7
29-42	47	8.4
43-70	91	16.2
71-98	96	17.0
99-365	231	41.1
366-730	54	9.6
Sex		
Male	297	52.9
Female	265	47.1
Birth order		
1	200	35.6
2	145	25.8
3	102	18.2
4	72	12.8
5	29	5.1
>5	14	2.5

Table 2: Characteristics of the child's birth

Variable	Frequency	Percentage
Mother received ANC		
Yes	558	99.3
No	4	0.7
Type of facility received ANC		
Privately owned	75	13.4
Publicly owned	483	86.6
Facility level of care		
Primary	35	6.3
Secondary	75	13.4
Tertiary	448	80.3
Delivered at ANC facility		
Yes	468	83.9
No	90	16.1
Received immunization information during ANC		
Yes	475	85.1
No	83	14.9
Place of delivery		
Home	15	2.6
Traditional birth attendant	2	0.4
Hospital	545	97.0
Mode of delivery		
Assisted delivery	2	0.4
Caesarean section	171	30.4
Vaginal delivery	389	69.2
Day of delivery		
Sunday	67	11.9
Monday	65	11.6
Tuesday	82	14.6
Wednesday	94	16.7
Thursday	89	15.8
Friday	90	16.0
Saturday	75	13.4

ANC= Antenatal care

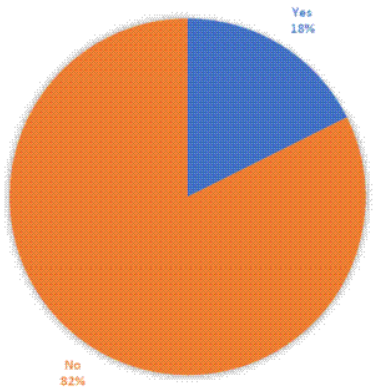

Figure 1: Proportion of caregivers who failed to present their children for immunization on the scheduled date

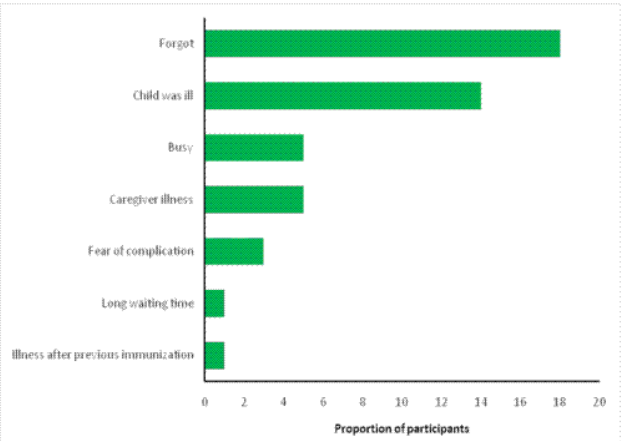

Figure 2: Reasons for failing to present the child for immunization on the scheduled date

Table 3: Distribution of the children who have received the various vaccine

Vaccine	Frequency	Percentage
BCG		
Yes	549	97.7
No	13	2.3
OPV0		
Yes	531	94.5
No	31	5.5
HBV0		
Yes	529	94.1
No	33	5.9
OPV1		
Yes	510	98.8
No	6	1.2
Penta 1		
Yes	501	97.1
No	15	2.9
PCV1		
Yes	490	95.0
No	26	5.0
OPV2		
Yes	413	97.4
No	11	2.6
Penta 2		
Yes	404	95.3
No	20	4.7
PCV2		
Yes	402	94.8
No	22	5.2
OPV3		
Yes	297	96.4
No	11	3.6
Penta 3		
Yes	293	95.1
No	15	4.9
PCV3		
Yes	293	95.1
No	15	4.9
IPV		
Yes	287	93.2
No	21	6.8
Measles		
Yes	102	79.1
No	27	20.9
Yellow fever		
Yes	117	90.7
No	12	9.3

OPV = oral polio vaccine, Penta = pentavalent vaccine (containing Hepatitis B vaccine, Diphtheria vaccine, pertussis vaccine, Haemophilus influenza type b vaccine and tetanus toxoid), IPV = inactivated polio vaccine, HBV = hepatitis b vaccine, PCV =pneumococcal conjugate vaccine, 0=given at birth, 1=given at 6 weeks of life, 2= given at 10 weeks of life, 3=given at 14 weeks of life.

Table 4: Timelines of vaccination among the participants

Variable	Frequency	Percentage	95% CI
BCG Timeliness			
Timely	482	87.8	84.8-90.3
Acceptable	39	7.1	5.2-9.6
Delayed	28	5.1	3.6-7.3
OPV0 Timeliness			
Timely	484	91.1	88.4-93.3
Acceptable	26	4.9	3.4-7.1
Delayed	21	4.0	2.6-6.0
HBV0 Timeliness			
Timely	156	29.5	25.8-33.5
Delayed	373	70.5	66.5-74.2
OPV1 Timeliness			
Early	31	6.1	4.3-8.5
Timely	449	88.0	84.9-90.6
Acceptable	10	2.0	1.1-3.6
Delayed	20	3.9	2.6-6.0
Penta 1 Timeliness			
Early	21	4.2	2.8-6.3
Timely	448	89.4	86.4-91.8
Acceptable	9	1.8	0.9-3.4
Delayed	23	4.6	3.1-6.8
PCV 1 Timeliness			
Early	21	4.3	2.8-6.5
Timely	435	88.8	85.7-91.3

Acceptable	10	2.0	1.1-3.7
Delayed	24	4.9	3.3-7.2
OPV2 Timeliness			
Early	16	3.9	2.4-6.2
Timely	361	87.4	83.9-90.3
Acceptable	23	5.6	3.7-8.2
Delayed	13	3.2	1.9-5.3
Penta 2 Timeliness			
Early	13	3.2	1.9-5.4
Timely	355	87.9	84.3-90.7
Acceptable	21	5.2	3.4-7.8
Delayed	15	3.7	2.3-6.0
PCV 2 Timeliness			
Early	13	3.2	1.9-5.4
Timely	345	85.8	82.1-88.9
Acceptable	22	5.5	3.6-8.2
Delayed	22	5.5	3.6-8.2
OPV3 Timeliness			
Early	7	2.4	1.0-4.8
Timely	254	85.5	81.0-89.3
Acceptable	21	7.1	4.4-10.6
Penta 3 Timeliness			
Early	5	1.7	0.6-3.9
Timely	252	86.0	81.5-89.8
Acceptable	21	7.2	4.5-10.8
Delayed	15	5.1	2.9-8.3
PCV 3 Timeliness			
Early	7	2.4	1.0-4.9
Timely	251	85.7	81.1-89.5
Acceptable	20	6.8	4.2-10.4
Delayed	15	5.1	2.9-8.3
IPV Timeliness			
Early	5	1.7	0.6-4.0
Timely	247	86.1	81.5-89.9
Acceptable	20	7.0	4.3-10.6
Delayed	15	5.2	3.0-8.5
Measles Timeliness			
Early	4	3.9	1.8-9.7
Timely	67	65.7	55.6-74.8
Acceptable	18	17.6	10.8-26.5
Delayed	13	12.8	7.0-20.8
Yellow fever Timeliness			
Early	7	6.0	2.4-11.9
Timely	76	65.0	55.6-73.6
Acceptable	24	20.5	13.6-29.0
Delayed	10	8.5	4.2-15.2

OPV = oral polio vaccine, Penta = pentavalent vaccine (containing Hepatitis B vaccine, Diphtheria vaccine, pertussis vaccine, Haemophilus influenza type b vaccine and tetanus toxoid), IPV = inactivated polio vaccine, HBV = hepatitis b vaccine, PCV =pneumococcal conjugate vaccine, 0=given at birth, 1=given at 6 weeks of life, 2= given at 10 weeks of life, 3=given at 14 weeks of life

Table 5: Factors associated with delayed BCG vaccination

Variable	Delayed BCG Vaccination Yes	No	COR (95%CI)	P-value
Child sex				
Female	15 (5.9)	240 (94.1)	1.35 (0.63- 2.90)	0.438
Male	13 (4.4)	281 (95.6)		
Mothers age				
<35	24 (5.4)	420 (94.6)		0.504
35+	4 (3.8)	101 (96.2)		
Mothers education				
Primary or less	2 (16.7)	10 (83.3)	3.93 (0.82 – 18.87)	0.066
Secondary or more	26 (4.8)	511 (95.2)		
Place of residence				
Rural	3 (12.0)	22 (88.0)	3.29 (0.91 – 11.92)	0.055
Urban	20 (4.0)	483 (96.0)		
Mode of delivery				
Caesarean section	8 (4.8)	160 (95.2)	0.90 (0.39 – 2.09)	0.811
Vaginal delivery	20 (5.3)	361 (94.7)		
Delivery at ANC				
Yes	22 (4.8)	437 (95.2)	1.03 (0.35-3.07)	0.955
No	4 (4.7)	82 (95.3)		
Received Vaccination health talk at ANC				
Yes	21 (4.5)	443 (95.5)	0.72 (0.26 – 1.97)	0.521
No	5 (6.2)	76 (93.8)		
Immunization at the place of delivery				
Yes	25 (5.4)	437 (94.6)	1.26 (0.38 – 4.35)	0.694
No	3 (4.3)	67 (95.7)		
Day of delivery				
Weekend	2 (3.1)	63 (96.9)	0.56 (0.13 – 2.41)	0.430
Weekday	26 (5.4)	458 (94.6)		

Table 6: Factors associated with timeliness of Penta 3 vaccination

Variable	Timely PENTA 3 Vaccination Yes	No	COR (95%CI)	P-value
Child sex				
Female	109 (81.3)	25 (18.7)	0.73 (0.40 – 1.35)	0.317
Male	143 (85.6)	24 (14.4)		
Mothers age				
<35	195 (83.0)	40 (17.0)	0.77 (0.35 – 1.68)	0.510
35+	57 (86.4)	9 (13.6)		
Mothers education				
Primary or less	3 (100.0)	0 (0.0)	-	0.443
Secondary or more	249 (83.6)	49 (16.4)		
Place of residence				
Rural	8 (72.7)	3 (27.7)	0.47 (0.12 – 1.85)	0.272
Urban	237 (85.0)	42 (15.0)		
Received Vaccination health talk at ANC				
Yes	221 (84.4)	41 (15.6)	1.39 (0.60 – 3.24)	0.443
No	31 (79.5)	8 (20.5)		
Immunization at the place of delivery				
Yes	208 (82.5)	44 (17.5)	0.56 (0.19 – 1.65)	0.284
No	34 (89.5)	4 (10.5)		

Discussion

Generally, the children received their vaccines on time. This is particularly so for the vaccines received early in life compared to those received later. A similar trend had earlier been reported[20].The availability of daily immunization services in the hospital could have contributed to the reduced likelihood of missed

opportunities for immunization. It has been reported that the inability to receive the service on daily basis is a cause of delay in presenting the child for immunization. The timely receipt of the vaccines among the children may not be unconnected to the urban location of the children with their parents being mostly educated and gainfully employed.

It was noted that among the birth vaccines, the proportion of children that received their vaccine on time was lowest for the birth dose of the hepatitis B vaccine. This delay in receipt of hepatitis b vaccine birth dose has earlier been reported[21]. The high proportion of delay noted in the receipt of the hepatitis b vaccine could be attributed to the narrow range of time available for an effective valid dose to be given especially in an area with high hepatitis b virus endemicity. It has been reported that poor knowledge of the mothers, poor coordination between labour ward and immunization clinics and non-availability of the vaccine had contributed to low coverage of hepatitis b vaccine valid birth dose[21]. A detailed examination is needed to examine the reasons for the low update of a valid birth dose of the hepatitis b vaccine in this setting. A Mongolian study reported that the proportion of children who received hepatitis B birth vaccine was above 90% although they used a 30-day window as opposed to 24 hours window used in our study.Unlike what was reported in Senegal[4] and Pakistan[23] where BCG's timely receipt was highest among the birth vaccines, BCG timely uptake in our study lags behindOPV0 timeliness. This is particularly so in our setting where a pool of newborns is needed to open a vial of BCG vaccine and if the required number is not attained, caregivers are asked to bring them back at a later date. This may have accounted for the 6% non-receipt seen in our study. Refusal of health workers to open vaccines because of an insufficient number of children has been reported as one of the vaccination barriers[24].There is a need to strike a balance between minimizing the missed opportunity for vaccination and vaccine wastage especially in areas with high childhood mortality and low vaccine uptake.

The proportion of children who received timely vaccines declined as the child grows. The lowest proportion of timely receipt of vaccine outside birth doses was seen in Measles and Yellow fever vaccines. . Similar findings had earlier been noted[1]. A possible explanation for this delay could be due to the increasing demand for work after childbirth. In the study area, mothers are entitled to paid maternity leave for the first three months post-delivery, as such mothers could present child their babies for vaccinations. However, with the resumption of duty after maternity leave, mothers are more likely to forget vaccination appointments due to responsibilities in their workplace.

About one in six of the caregivers reported that they could not present their children for immunization on the scheduled date. A lower proportion of caregivers missed the vaccination schedule in Ethiopia[25]. The main reason adduced by caregivers for missing scheduled vaccination appointments were mainly forgetfulness, child illness and being busy with other activities. These reasons have earlier been reported as reasons for not keeping to vaccination appointments[25]. Caregivers' forgetfulness, leading to the reasons for missing scheduled appointments emphasis the need for a phone call or text message reminders to improve timely receipt. This is important because if the missed/ delayed vaccination is unchecked, it may lead to a pool of at-risk children, thus increasing the risk for an outbreak of vaccine-preventable diseases.

None of the factors examined was found to be associated with timely receipt of the BCG and Penta 3 vaccine. Though attendance at antenatal care, mother's occupational and educational status, the age and birth position of the child and the father's level of education has been reported to be associated with delay in vaccination[26]. Neither mode of delivery nor weekend delivery influenced the timeliness of BCG vaccination. However, timely BCG vaccination has been reported to be associated with caesarean section[19,27] which has been attributed to the extended post-delivery stay and contact with the hospital services.

Our study was among the caregivers attending the immunization clinic of a tertiary hospital in an urban area so findings could not be generalizable to the general population. Recall bias is a possible limitation however, the facility immunization register, and the child immunization card was used to validate the responses where applicable.

Conclusion

The timelines of vaccination should be reported in conjunction with coverage to have a better picture of the effective vaccination. Intervention that could remind caregivers about the immunization schedules, counselling on the child illness and vaccination and

allow for flexibility of the caregiver's schedule could improve the rate of missed vaccination visits.

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Conflict of interest
The authors do not have any conflict of interest to declare

Highlights
- The proportion of children who received timely vaccines declined as the child grows
- 18% of the caregivers didn't present their children for immunization on the scheduled date
- Forgetfulness (18%), child illness (14%), being busy on the day of immunization (5%) were the main reason for missed immunization schedule
- BCG (88%), OPV0 (91.1%), OPV1 (87.7%), Penta1 (89.1%) PCV1 (88.4%), measles-containing vaccine (67.5%) received in a timely manner
- Only 29.5% of the new-borns got HBV0 within 24 hours of birth

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