



# Acceptability of Reminders for Immunization Appointments via Mobile Devices by Mothers in Ilorin, Nigeria: A Cross-sectional Study

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## ABSTRACT

**Objectives:** Immunization coverage in Nigeria remains low despite the protection it confers. Reminders via mobile phones may be deployed as a means of improving vaccination coverage but requires the participation and cooperation of the caregiver. Therefore, we evaluated the acceptability of reminders for immunization appointment by mothers in Ilorin, Nigeria. **Methods:** This descriptive cross-sectional study recruited 526 mothers from two public hospitals in Ilorin. Semi-structured questionnaires were used to collect information on ownership and access to phones, willingness to receive reminders, household, antenatal, and delivery characteristics. **Results:** The majority (92.7%) of mothers had a personal phone, and all willingly provided contact details. Over half (69.0%) of mothers were willing to receive reminders. Postsecondary education (odds ratio (OR) = 1.958; 95% confidence interval (CI): 1.232–3.111) and antenatal care attendance by mothers (OR = 8.381; 95% CI: 2.495–28.170) were significant determinants of mothers willingness to receive reminders. Mothers with less than or equal to four children had a three-fold increased odds of wanting reminders. Artisan mothers were less likely to want reminders compared with unemployed mothers (OR = 0.506; 95% CI: 0.291–0.847). **Conclusions:** Most mothers are willing to receive reminders on immunization appointments via their mobile phone. Determinants of maternal willingness to receive reminders include mothers with less than four children, postsecondary education, and antenatal care attendance. Program planners should consider utilizing reminders as a strategy to increase the immunization uptake with access to contact details making this feasible.

Immunization is an important, cost-effective strategy deployed by various countries to reduce the morbidity and mortality associated with infectious childhood diseases. The current National Programme on Immunization (NPI) schedule in Nigeria provides vaccines that protect against diseases such as tuberculosis, diphtheria, pertussis, hepatitis B, tetanus, measles, yellow fever, and recently invasive *Haemophilus influenzae* type b and pneumococcus. Despite the benefits of immunization, the immunization coverage of children in many parts of Nigeria remains low.<sup>1-4</sup>

Traditionally in Nigeria, the time of appointment for the next vaccine of the baby is recorded on the immunization card, with the expectation that the caregiver would remember to check the date of the next scheduled immunization and bring the

child as and when due. The immunization schedule has a time interval between four and 25 weeks for the various vaccines. Missed opportunities for vaccinating a child could occur because the mother forgets the date or is not available to keep the scheduled appointment for immunization.<sup>2,5,6</sup> Therefore, there may be a need to provide reminders to caregivers about the scheduled immunization appointment before the due date, with prompting to keep the appointment, which could be done via the use of telephones. Indeed, some studies have shown that immunization reminders have been effective in increasing childhood immunization rates.<sup>7-10</sup> The use of mobile communication technology is a fast-growing sector of the communications industry in developing countries including Nigeria.<sup>11</sup> Thus, the telephone may be used for the reminders.

Deployment of reminders as a means of improving vaccination coverage requires the participation and cooperation of the caregiver. Thus, the objectives of the study were to identify the willingness of mothers to receive reminders for immunization appointments, as well as the factors associated with willingness of mothers in Ilorin, Nigeria to receive reminders.

## METHODS

This descriptive, cross-sectional study was conducted at the two public hospitals, owned and run by the state, located in Ilorin West Local Government Area, Ilorin, Kwara State. Ilorin is the capital city of Kwara State, situated in the North Central geopolitical zone of Nigeria, with a population of 854 737 according to the 2006 census. The inhabitants belong mainly to the Yoruba, Fulani, Nupe, and Kanuri tribes.

Each hospital has an immunization unit that gives vaccinations on working days and attends to an average of 80 newborns every month. Other services offered at the immunization unit include nutrition and general health education.

The formula used for estimating the minimum sample size required for the study was " $n = (z^2pq)/d^2$ " where "p" (the percentage of the study phenomena in population) was estimated at 62.6% from a previous study,<sup>12</sup> and an observed difference of 5% or more taken as being significant. Therefore the minimum sample size calculated was 360. However, a total of 526 mother-child pairs were recruited.

Mothers/caregivers bringing their newborn for their first set of vaccines, who had a contact telephone number (personal/spouse), and who gave their consent to be enrolled in the study were included. Those with no contact telephone number, refused to give consent, or whose babies had already received the first group of vaccines were excluded from the study.

Ethical approval was obtained from the Ethical Board of the Kwara State Ministry of Health. The participants gave their informed verbal consent.

Purposive sampling of every mother-child pair who fit the inclusion criteria was done, and the mother-child pairs were recruited over four months (15 August to 15 December 2016) as part of another study. Two research assistants deployed a semi-structured interview-based questionnaire. The sociodemographic details of each child brought for

vaccination was recorded. The parents occupation was grouped into five categories according to Oyedeji: (I) professionals, owners of large business; (II) secondary school teachers, owners of medium-sized business; (III) artisans, primary school teacher, clerks; (IV) petty traders, laborers; and (V) students, unemployed, housewives.<sup>13</sup> Questions were asked about antenatal care (ANC) history, such as the location and number of visits. The delivery details of the infant, including date and place of birth, were also recorded. Previous vaccination for a child and whether it was completed was also noted. Responses on the ownership of a phone by the mother or father, as well as willingness to have the phone number recorded for reminders, were noted and recorded if applicable. The mother's opinion about whether she would want a reminder for subsequent vaccines was sought and recorded. Responses to reasons for either wanting or not wanting reminders were also recorded. If mother answered in the affirmative, answers on the type of reminder, and the preferred language for communication were sought.

Data was analyzed using SPSS Statistics (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.). Continuous variables were expressed as the mean and standard deviation (SD) and categorical variables as number and percentage. After the generation of frequency tables and simple proportions, the chi-square test was used to identify significant differences for categorical variables. Variables with a *p*-value less than 0.050 on bivariate analysis were included in the binomial logistic regression model to identify factors that predicted willingness to receive reminders. A *p*-value of less than 0.050 was considered statistically significant.

## RESULTS

The mean age of all mothers recruited was  $28.5 \pm 4.8$  years, and the age range of mothers recruited was between 17 years and 45 years old. Of the 526 children enrolled, 267 (50.7%) were male, and 259 (49.2%) were female. Islam was the religion of 380 (72.2%) mothers, and 146 (27.7%) mothers were Christians. The major occupation of the mothers and fathers were artisans accounting for 318 (60.4%) and 257 (48.8%) of participants, respectively. Ten (1.9%) mothers were single, and 516 (98.0%) mothers were married. Other sociodemographic features are

**Table 1:** Household, antenatal, and delivery characteristics of the mother-child pairs recruited in the study.

Variable	Frequency, n	Percentage, %	Cumulative, %
<b>Mothers' occupation</b>			
I	11	2.0	2.1
II	57	10.8	12.9
III	318	60.4	73.4
IV	22	4.1	77.6
V	118	22.4	100
<b>Mothers' education level</b>			
None/primary	8	1.5	1.5
Secondary	186	35.3	36.9
Postsecondary	332	63.1	100
<b>Fathers' occupation</b>			
I	74	14.0	14.1
II	163	30.9	45.1
III	257	48.8	93.9
IV	8	1.5	95.4
V	24	4.5	100
<b>Fathers' education level</b>			
None/primary	3	0.5	0.6
Secondary	126	23.9	24.6
Postsecondary	397	75.4	100
<b>Mothers' monthly income, Nigerian Naira</b>			
0–18 000	229	43.5	43.5
18 001–50 000	120	22.8	66.3
50 001–100 000	28	5.3	71.7
>100 000	2	0.3	72.1
Not stated	147	27.9	100
<b>Fathers' monthly income, Nigerian Naira</b>			
0–18 000	18	3.4	3.4
18 001–50 000	98	18.6	22.0
50 001–100 000	64	12.1	34.2
> 100 000	13	2.4	36.7
Not stated	333	63.3	100
<b>Place of ANC</b>			
Government hospital	421	80.0	80.0
Private hospital	71	13.4	93.5
None	34	6.5	100
<b>Place of delivery</b>			
Home	24	4.4	4.6
Traditional birth attendants	5	0.9	5.5
Private hospital	58	11.0	16.5
Government hospital	420	79.8	96.4

**Table 1:** Household, antenatal, and delivery characteristics of the mother-child pairs recruited in the study.

*-continued*

Variable	Frequency, n	Percentage, %	Cumulative, %
<b>Place of delivery</b>			
Faith home	19	3.6	100
<b>Number of children</b>			
One	219	41.6	41.6
Two	140	26.6	68.3
Three	89	16.9	85.2
Four	57	10.8	96.0
Five	21	3.9	100

ANC: antenatal care; I: professionals, owners of large business; II: secondary school teachers, owners of medium-sized business; III: artisan, primary school teacher, clerks; IV: petty traders, laborers; V: students, unemployed, housewives.

shown in Table 1. The majority of mothers had ANC and delivery at a government-owned facility (n = 421, 80.0% and n = 420, 79.8%, respectively). Most mothers (41.6%) had one child, with a decrease in the proportion recorded with an increasing number of children [Table 1].

Previous immunization experience was recorded for 299 (56.8%) mothers while 227 (43.1%) mothers had no experience taking a child for immunization. Information about the NPI schedule on the number of visits and the infant's age at each visit was identified correctly by 273 (51.9%) mothers and wrongly by 253 (48.0%) mothers.

Four hundred and eighty-eight (92.7%) mothers had a personal phone. Of the 488 mothers who had a personal phone, 484 willingly provided their phone number while four provided only the phone number of their spouse. All (100%) fathers had a phone, and the mothers willingly provided the phone numbers of the 526 fathers.

A positive response on willingness to receive reminders for immunization visits was given by 363 (69.0%) mothers and a negative response by 163 (30.9%) mothers. Forgetfulness of the date of the next scheduled visit was the main reason mothers opted for reminders. Of the 163 who opted out of receiving reminders, 73 (44.7) reported that they would remember the date of the next scheduled visit given verbally by the healthcare worker while 90 (55.2%) reported they would check the immunization card for the date of the next visit.

Of the 363 mothers who were willing to receive reminders, 189 (52.0%) chose text messages as the

**Table 2:** Factors associated with willingness to receive immunization reminders.

Variables	Willing to receive reminder		X <sup>2</sup>	p-value
	Yes n = 363	No n = 163		
<b>Sex of child</b>				
Male	181	86	0.378	0.539
Female	182	77		
<b>Religion</b>				
Islam	262	118	0.003	0.959
Christianity	101	45		
<b>Occupational group of mother</b>				
I and II	50	18	20.614	0.001
III	197	121		
IV and V	116	24		
<b>Maternal education</b>				
None/primary/secondary	110	84	21.781	0.001
Postsecondary	253	79		
<b>Occupational group of father</b>				
I and II	171	66	4.288	0.117
III	167	90		
IV and V	25	7		
<b>Paternal education level</b>				
None/primary/secondary	77	52	6.944	0.008
Postsecondary	286	111		
<b>Maternal age group, years</b>				
≤ 20	18	6	1.675	0.433
21–35	320	141		
> 35	25	16		
<b>Marital status</b>				
Single/separated	8	2	FET	0.731
Married	355	161		
<b>Number of children</b>				
1–2	268	93	21.312	0.001
3–4	88	56		
5	7	14		
<b>Previous immunization experience</b>				
Yes	184	115	18.092	0.001
No	179	48		
<b>Knows NPI schedule</b>				
Correct	169	104	13.404	0.001
Wrong	194	59		
<b>ANC attendance</b>				
None	11	23	22.842	0.001
Yes	352	140		
<b>Place of delivery</b>				
Outside hospital	27	21	4.022	0.045
In hospital	336	142		

X<sup>2</sup>: chi-square.

FET: Fisher's exact test; NPI: National Programme on Immunization;

ANC: antenatal care.

**Table 3:** Binomial logistic regression analysis of factors associated with maternal willingness to receive reminders for immunization appointments.

Variables	B <sup>#</sup>	p-value	OR (95% CI)
<b>Previous immunization experience</b>			
None	0.441	0.217	1.554 (0.772–3.129)
Yes*			
<b>Maternal education level</b>			
Postsecondary	0.672	0.004	1.958 (1.232–3.111)
Secondary*/Primary/None			
<b>Paternal education level</b>			
Postsecondary	-0.057	0.826	0.945 (0.570–1.566)
Secondary*/Primary/None			
<b>Occupation classification mother</b>			
Group I, II	-0.503	0.177	0.622 (0.291–1.256)
Group III	-0.700	0.010	0.506 (0.291–0.847)
Group* IV, V			
<b>Number of children</b>			
1–2	1.245	0.016	3.474 (1.258–9.596)
3–4	1.124	0.029	3.077 (1.123–8.433)
≥ 5*			
<b>ANC attendance</b>			
Yes	2.126	0.001	8.381 (2.495–28.170)
None*			
<b>Place of delivery</b>			
In a hospital	-0.954	0.071	0.383 (0.136–1.079)
Out of a hospital*			
<b>Knows NPI schedule</b>			
Yes	-0.161	0.638	0.851 (0.436–1.663)
No*			

\*Reference category; #Estimated logistic co-efficient.

OR: odds ratio; 95% CI = 95% confidence interval; NPI: National Programme on Immunization; I: professionals, owners of large business; II: secondary school teachers, owners of medium-sized business; III: artisan, primary school teacher; clerks; IV: petty traders, laborers; V: students, unemployed, housewives.

preferred reminder type, while 174 (47.9%) mothers preferred phone calls. English was the preferred language for reminders for 194 (53.4%) mothers while the remaining mothers preferred their native language. A total of 206 (56.7%) mothers were willing to pay for the reminders.

On bivariate analysis, the educational level of parents, maternal occupation, number of children in the family, previous immunization experience, knowledge of the immunization schedule, and place of ANC and delivery were factors significantly associated with the acceptance of reminders [Table 2].

The multivariate logistic regression model of these factors had a goodness of fit measure which was



statistically significant (chi-square = 68.013, df = 10,  $p < 0.001$ ) with an R-square of 17.1. Table 3 shows mothers with children less than or equal to four in number had a three-fold increased odds of wanting reminders. Postsecondary education and ANC in a hospital increased the odds of wanting reminders by two- and eight-fold, respectively. The chances of those not willing to receive reminders were increased in mothers with group III occupation compared to those with group IV and V occupational class.

## DISCUSSION

The current study found that 93% of the mothers owned a phone, and all had access to a phone in the household. This finding is similar to the proportion of maternal phone ownership of 92.6% and 100% access reported in Benin,<sup>12</sup> but lower than that reported in Ibadan<sup>14</sup> (98.9%) and Lagos (98%).<sup>15</sup> All mothers in the study were willing to provide contact information (either their own or spouses) as reported in previous studies.<sup>12,14-16</sup> Contact details are needed for reminders, and thus the fact that mothers were willing to provide the contact details would be of aid in utilizing reminders to improve vaccination coverage.

Most mothers (69.0%) responded positively to accepting immunization reminders, which is slightly higher than the value of 62.6% reported in Benin,<sup>12</sup> but lower than that reported from Lagos<sup>15</sup> and Ibadan<sup>14</sup> (77.0% and 95.1%, respectively). Mothers who were not willing to receive reminders believed that the appointment date provided on the vaccination card would serve as a sufficient reminder thus buttressing the importance of the vaccination card. The finding of a majority preference for text messages compared to phone calls in the current study differs from the findings reported in Benin, Lagos, and Ibadan where phone calls were preferred.<sup>12,14,15</sup> The majority preference for text messages may be supported by the fact that majority of the mothers had at least a secondary school level education and would be able to read the text messages.

Postsecondary maternal education was an important maternal household characteristic that determined the mothers' willingness to accept reminders. Studies have identified maternal educational level as an important determinant of reminders for immunization.<sup>12,14</sup> This earlier finding

supports the current study findings for maternal education but differs from the paternal education finding, which was not significant.

Typically, the mother takes the child for immunization (as demonstrated by 100% maternal presentation at immunization clinic); therefore, an educated mother is better able to understand the information provided on vaccination, which is needed to ensure complete immunization status. Indeed, the role of maternal education in completion of child immunization is important as reported previously.<sup>1,17-19</sup>

ANC attendance was a significant predictor of mothers who were willing to receive reminders. This finding may be attributable to the health education (including the benefits of immunization) provided by the healthcare worker (usually nurses) during ANC visits. The health talk, reinforced at all ANC visits, serves as a source of information, especially to first-time mothers, who may lack or have inadequate knowledge about childhood immunization. This current study finding can be supported by studies that have reported ANC as an accessible source of information on immunization,<sup>20,21</sup> as well as a determinant of complete childhood immunization.<sup>3,22</sup> Therefore, improvement in maternal access to health care services during pregnancy and delivery may be a step towards improving vaccination uptake.

Total number of children and previous immunization experience were important predictors of willingness to receive reminders as mothers who had no previous experience and fewer (< 4) children were more likely to be willing to receive reminders than mothers with previous immunization experience and had five or more children. Reasons for this finding could probably be attributed to lack of confidence and also fear of failure to remember an appointment on the part of the mother with no previous immunization experience and fewer children. Also, this is supported by the findings of the current study of a higher proportion of mothers who could not correctly identify the NPI schedule being willing to receive reminders. An earlier study had reported mothers with fewer children as being more willing to receive reminders.<sup>12</sup>

Mothers who were students or housewives were more likely to want reminders compared to those who worked as artisans, junior clerks, or primary school teachers. This finding is similar to the reports from Benin.<sup>12</sup> The fact that the former group of mothers

wanted reminders may be attributable to the fact that they may have limited experience with taking a child for immunization and are yet to develop confidence in childrearing. This could be adduced from the fact that majority of these unemployed mothers were also mothers with only one or two children. Thus, they would benefit from the reminders prompting them to take the children for vaccination. Indeed, an earlier Nigerian study had identified unemployed mothers as those likely to complete the immunization of their children.<sup>17</sup>

## CONCLUSION

Mothers have ready access to mobile phones, and most are willing to receive reminders about immunization appointments. Determinants of maternal willingness to receive reminders include mothers with less than four children, postsecondary education, and ANC attendance. Program planners should consider utilizing reminders as a strategy to increase the immunization uptake as accessibility to contact details will make it feasible.

### Disclosure

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