Original Research Article

Mothers' preference for routine immunization appointment reminders in Gombe, Gombe State, Nigeria

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ABSTRACT

Background: Globally, under-5 children account for three-quarter of the two million annual deaths caused by vaccine preventable diseases (VPD). The VPD is comparatively higher in developing countries, and in particular, Nigeria where 1 in 5 childhood deaths is VPD-related. This higher mortality has been attributed to inequitable uptake of immunization variably caused by low education, confusion and forgetfulness among others. The millennium mobile phone proliferation has made it a useful reminder tool. We therefore explore access to mobile phone, willingness and predictors of willingness to receive reminder by mothers.

Methods: Semi-structured questionnaire was deployed in this cross-sectional study to obtain relevant information from 384 mother-child pairs at the immunization clinic (cluster) over 9 months.

Results: A total of 372 (96.9%) and 379 (98.7%) mothers had access to personal and husbands' phone respectively while 339 (88.3%) mothers showed willingness for a reminder. The factors significantly associated with willingness for immunization reminder were mother's tertiary education ($p=0.008$), mother's unemployment ($p=0.011$), father's occupation as senior public servant ($p=0.001$) and mother's access to personal phone ($p=0.015$). Adjusting for confounders, the factors predictive of willingness for immunization reminder were access to personal phone (aOR 11.1, 95% CI 3.160-390.08) and mother's tertiary education (aOR 2.9, 95% CI 1.822-5, 302).

Conclusions: Access to personal phone and improved education are significant tools in enhancing immunization coverage.

Keywords: Immunization appointment, Mobile phone, Willingness for reminder

INTRODUCTION

Vaccine remains the most cost-effective public health intervention in reducing morbidity and mortality worldwide, and enhances economic growth via improved physical, cognitive and educational performance.^{1,2} Worldwide, about 2 million deaths are caused by vaccine

preventable diseases (VPDs) and 75% of these deaths occurs in under-5 children.³

Whereas VPDs cause 15% of under-5 mortality worldwide, higher mortality has been attributed to VPDs in resource-scarce countries like Nigeria where 1 in 5 childhood deaths is VPDs-related.^{3,4} This is as a result of

the low uptake of immunization. Of the estimated 19.7 million children under the age of one year that did not receive basic vaccine in 2019, more than 60% live in developing countries.⁵ This inequitable uptake of immunization in developing countries has been associated with low education, socio-economic status, and living in rural areas, fear, confusion and forgetfulness.⁶ The confusion and forgetfulness of immunization by the caregivers have been variably attributed to varying intervals between immunization schedule visit, untimely receipt of vaccines, and reduced attendance at immunization.⁷ This is because according to National Programme on immunization (NPI) schedule in Nigeria, a caregiver should bring an infant for five immunization sessions; at birth, six weeks, 10 weeks, 14 weeks and nine months of age. The shortest interval between visits being four weeks and the highest, 25 weeks may culminate in confusion and forgetfulness.⁸

Despite the established effectiveness of immunization as a strategic tool for reducing the morbidity and mortality of vaccine preventable diseases, the coverage in resource-limited countries such as Nigeria remains lower than the accepted target.⁹ This forgetfulness and confusion may be addressed by a reminder system with overall improved immunization coverage. Currently, the commonly available reminder system is mobile phone which can be used in form of a text message or phone voice calls. The use of this mobile phone has continued to increase in Sub-Sahara Africa and indeed, in Nigeria, as 148 million subscribers of the Global System for Mobile Communications (GSM) were reported by the end of March, 2016.¹⁰ With this increased usage, deployment of mobile technology such as phone calls and Short Message Service (SMS) texts is a useful reminder strategy for improving vaccination uptake in developing countries. These reminders, however, need to be agreeably received by the mother for the reminder strategy to be effective as the participation and co-operation of the caregiver is required. It is, therefore, important to identify whether it is acceptable, and suitable for the caregiver who will be the recipient of the reminder. Thus, the study will be conducted to identify determinants of mothers' willingness to receive either phone call or text message reminders for immunization appointments in Gombe, North-East Nigeria. Determining the caregiver's accessibility to phone, willingness to receive either phone call or SMS text and associated factors may be useful in deploying the phone/SMS text in enhancing the immunization coverage in children.

METHODS

Study area

The study was conducted at the immunization unit of the Federal Teaching Hospital, Gombe (FTHG), North-East Nigeria. The FTHG is a tertiary institution that serves as referral centre for other facilities and has an

immunization unit that is managed by Primary Health Care Development Agency (PHCDA) in Gombe. The average number of new-borns that attends routine vaccination is 141 new-borns per months (FTHG immunization record).

Inclusion criteria

Care givers that brought their newborns for the first round of vaccine who had telephone contact numbers (either personal/ spouse/relative staying in same house) and who gave consent to participate in the study.

Exclusion criteria

Caregivers who had no contact telephone number, or whose babies previously received the first group of vaccines.

Sample size determination

The sample size (384) was determined using the Fischer's formula.^{11,12}

Study design and sampling technique

This was a cross sectional study and the immunization clinic was considered a cluster. The study lasted 9 months from August 2019 to April 2020. All mother- child pair who visited the clinic and fulfilled the inclusion criteria were selected and studied. This was done until the sample size was reached.

Data collection

A semi-structured interview-based questionnaire were used to obtain relevant information. The socio-demographic details of the mother-child pair presenting for vaccination such as gender of child, age of mother, religion, marital status, level of education and occupation of the child's parents were recorded in the study proforma. The socio-economic class was determined using Oyediji Classification.¹³ Details of antenatal care (ANC) attendance and place of birth for the index child, and the birth order of the child were recorded. Responses on mothers' willingness to receive reminders for immunization appointments was recorded as either yes or no. All mothers were educated on the importance, number and timing of each immunization appointments. Ethical approval was obtained from the Research and Ethics committee (REC) of FTHG.

Data analysis

Data was analysed using the IBM® SPSS version 23.0 (IBM corporation, Virginia, U.S.A.). Continuous variables (mother's age) was expressed as mean and standard deviation (SD), while the infant's age was skewed and presented as median with interquartile range. The categorical variables were expressed as frequency

and percentage. Chi-square (χ^2) was used to determine factors associated with willingness to receive reminder for immunization. Variables with a p-value less than 0.05 on bivariate analysis (Chi-square) were included in the binomial logistic regression models and results presented as adjusted Odds ratio with 95% confidence interval. determined to identify factors that predicted willingness to receive reminders compared with none. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 384 children-mother pair were recruited for the study. The median age (interquartile range [IQR]) of the infants was 1 (1-65) day, while the mean age (SD) of the

mothers was 28.43 ± 5.41 years. The male infants were 189 (49.2%), and females were 195 (50.8%).

Most (230; 59.9%) of the children were immunized within 24-hour of life and were born to mothers mostly (205; 53.4%) in the age group 20-29 years. Most of the mothers were of Islam faith (290; 75.5%), in a polygamous family setting (234; 60.9%), married (383; 99.7%), and high socio-economic class (157; 40.8%) (Table 1).

Out of the 384 children-mother participants recruited, 339 (88.3%) mothers showed willingness for reminder of immunization appointment (Table 1).

Table 1: Socio-demographic factors associated with respondents' willingness to receive reminder for immunization appointment.

Variable	Total (n=384) (%)	Willingness (n=384) (%)	No willingness (n=339) (%)	P value
Gender				
Male	189 (49.2)	158 (41.1)	31 (8.1)	0.452 [^]
Female	195 (50.8)	169 (44.0)	26 (6.8)	
Child's birth order				
First	111 (28.9)	94 (24.5)	17 (4.4)	0.180 [^]
Second and above	273 (71.1)	245 (63.8)	28 (7.3)	
Religion				
Islam	290 (75.5)	249 (64.9)	41 (10.7)	0.716 [^]
Christianity	94 (24.5)	84 (21.9)	10 (2.6)	
Family setting				
Monogamy	150 (39.1)	127 (33.1)	23 (6.0)	0.970 [^]
Polygamy	234 (60.9)	212 (55.2)	22 (5.7)	
Marital status				
Married	383 (99.7)	339 (88.3)	44 (11.5)	0.121 [*]
Divorced	1 (0.3)	0 (0.0)	1 (0.3)	
Educational status				
None	5 (1.3)	3 (0.8)	2 (0.5)	0.176 [*]
Primary	10 (2.6)	8 (2.1)	2 (0.5)	
Secondary	137 (35.7)	119 (31.0)	18 (4.7)	
Tertiary	220 (57.3)	197 (51.3)	23 (6.0)	
Socio-economic class				
Low	107 (27.9)	93 (24.2)	14 (3.6)	0.312 [#]
Middle	120 (31.3)	103 (26.8)	17 (4.4)	
High	157 (40.8)	143 (37.2)	14 (3.6)	
Child age group				
<1 day	230 (59.9)	196 (51.0)	34 (8.9)	0.707 [#]
1-<2 days	26 (6.8)	21 (5.5)	5 (1.3)	
2-<3 days	45 (11.7)	39 (10.2)	6 (1.6)	
>3 days	83 (21.6)	70 (18.2)	13 (3.4)	
Mother's age group				
<20 years	12 (3.1)	8 (2.1)	4 (1.0)	0.158 [*]
20-29	205 (53.4)	182 (47.4)	23 (6.0)	
30-40	161 (41.9)	143 (37.2)	18 (4.7)	
>40	6 (1.6)	6 (1.6)	0 (0.0)	
Mother's age (mean$\pm$SD)	28.43 $\pm$ 5.41	28.55 $\pm$ 5.31	27.40 $\pm$ 5.80	0.178 ⁺

[^]Continuity correction; ^{*}Fischer's Exact; [#]Pearson Chi Square; ⁺Independent T-test

Table 2: Socio-economic class and willingness to receive reminder for immunization appointment.

Variable	Total N (%)	Willingness N (%)	No willingness N (%)	P value
Mother's education				
None	5 (1.3)	2 (0.5)	3 (0.8)	0.008*
Primary	10 (2.6)	8 (2.1)	2 (0.5)	
Secondary	143 (37.2)	125 (32.6)	18 (4.7)	
Tertiary	226 (58.9)	203 (52.9)	23 (6.0)	
Father's education				
None	3 (0.8)	2 (0.5)	1 (0.3)	0.112*
Primary	4 (1.0)	4 (1.0)	0 (0.0)	
Secondary	59 (15.4)	48 (12.5)	11 (2.9)	
Tertiary	318 (82.8)	284 (74.0)	34 (8.9)	
Mother's occupation				
Senior public servant	82 (21.4)	74 (19.3)	8 (2.1)	0.011*
Intermediate public servant	44 (11.5)	42 (10.9)	2 (0.5)	
Junior public servant	2 (0.5)	1 (0.3)	1 (0.3)	
Messenger	37 (9.6)	27 (7.0)	10 (2.6)	
Self/(un) employed	219 (57.0)	190 (49.5)	29 (7.6)	
Father's occupation				
Senior public servant	237 (61.7)	207 (53.9)	30 (7.8)	0.001*
Intermediate public servant	61 (15.9)	57 (14.8)	4 (1.0)	
Junior public servant	4 (1.0)	1 (0.3)	3 (0.8)	
Messenger	82 (21.4)	70 (18.2)	12 (3.1)	

*Fischer's Exact; **Significant.

Table 3: Accessibility to phone and Willingness to receive reminder for immunization appointment.

Variable	Total	Willingness	No willingness	P value
Access to personal phone				
Yes	372 (96.9)	331 (86.2)	41 (10.7)	0.015*
No	12 (3.1)	8 (2.1)	4 (1.0)	
Access to husband's phone				
Yes	379 (98.7)	329 (85.7)	50 (13.0)	0.114*
No	5 (1.3)	3 (0.8)	2 (0.5)	

*Fischer's Exact; **Significant.

Most mothers (226; 58.9%) and fathers (318; 82.8%) had tertiary education. Most fathers were senior public servant (237; 61.7%) while most mothers were unemployed/worked from home (219; 57%). There was a significant difference in the willingness for immunization reminder among mothers with tertiary education compared with others ($p=0.008$), among mothers who were unemployed/worked from home compared with others ($p=0.001$), and among fathers who were senior public servant compared with others ($p=0.001$) (Table 2).

Majority (372; 96.9%) of the mothers had access to personal phone. Mothers who had access to personal phone showed significant willingness for reminder of

immunization appointment compared with mothers without access to personal phone, ($p=0.015$). Most mothers (379; 98.7%) similarly had access to husband's phone (Table 3).

The factors significantly associated with willingness for immunization reminder were mother's tertiary education ($p=0.008$), mothers working from home/unemployed ($p=0.011$), father's occupation as senior public servant ($p=0.001$) and mother's access to personal phone ($p=0.015$). After controlling for confounders, the factors predictive of willingness for immunization reminder were access to personal phone (aOR 11.1, 95% CI 3.160-390.08) and mother's tertiary education (aOR 2.9, 1.822-5,302) (Table 4).

Table 4: Multivariate analysis of factors associated with willingness to receive reminder for immunization appointment.

Variable	Categories	OR	95% CI	aOR	95% CI
Access to personal phone	Yes	6.244	1.621-24.911	11.109	3.160-390.08
	No	1			
Mother's education	Tertiary	9.075	1.089-75.639	2.880	1.822-5.302
	Secondary	2.141	0.429-10.697	1.173	0.086-15.941
	Primary	1.269	0.671-2.500	1.139	0.377-3.440
	None	1			
Mother's occupation	SP servant	1			
	IP servant	0.787	0.340-1.824	0.556	0.116-2.664
	JP servant	0.347	0.079-1.521	0.000	0.000-0.000
	Messenger	7.280	0.441-120.095	0.365	0.003-47.065
	Self/(un)employed	2.696	1.167-6.229	1.305	0.325-5.241
Father's occupation	SP servant	0.799	0.384-1.663	1.056	0.296-3.773
	IP servant	0.409	0.125-1.338	1.099	0.201-6.012
	JP servant	17.50	1.678-182.50	44.53	0.560-4512.5
	Messenger	1			

OR: Odds ratio; CI: Confidence interval; aOR: adjusted odds ratio; Ref-reference. SP: senior public; IP: Intermediate servant; JP: junior public.

DISCUSSION

In this study, more than three-quarter of the mothers had access to personal phone and greater proportion had access to husband's phone. This is probably a reflection of increase use of mobile phone in the Sub-Sahara Africa and Nigeria in particular.¹⁰ Thus, mobile phone remains a veritable tool that may be utilised in the healthcare delivery, especially in the Sub-Saharan Africa.

Although most mothers showed willingness for immunization appointment reminder, this willingness was significantly higher in mothers with tertiary education compared with mothers who had lower educational degrees. This may be a reflection of better understanding of importance of immunization among those with higher level of education. This further supports the fact that low knowledge about significance of immunization practice in children which is a common phenomenon in developing countries, is still an impediment in actualising good immunization coverage.¹⁴ Thus, there is a need for a reminder system especially targeted at mothers with either low or no education. The benefits of mobile phones, if made accessible and acceptable, cannot be overemphasised in enhancing immunization coverage. Interestingly, mothers who were working from home/unemployed showed significant willingness for reminder. This may be because mothers who were working from home/unemployed stays mostly at home and has ample time to care for the children. This is a reflection of busy job schedule among employed mothers and the need to avoid perceived on-job distraction with consequent penalties from the Chief Executive Officers.¹⁴⁻¹⁵ This finding is consistent with the observed broad adverse health challenges faced by the children of long-hour working mothers.¹⁶ Mother-child pair whose

husband(father) were senior public servant also showed significant willingness for reminder. This probably reflects the overall effect of wealth or socioeconomic index on the acceptability of immunization as reported by Obinna et al.¹⁷

Mothers who had access to personal phone showed significant willingness for immunization. This shows that women empowerment, such as owning personal phone, working from home (self-employed) will enhance childhood immunization coverage. The need for personal phone was further supported by observation in this study where the access to husbands' phones was not associated with increased mother's willingness for the reminder.

Our study was limited for being a single centre study in the state, and carried out at immunization post at tertiary health facility. Hence, some of the findings may not be applicable to mothers who attended the primary or secondary health facilities, whose socio-demographics may differ.

In conclusion, factors predictive of the mothers' willingness for immunization reminder were access to personal phone and mothers' tertiary education. Women self-employment, access to personal phone, and advanced education are critical tool in improving childhood immunization coverage, especially in developing countries.

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