European Journal of
Health Sciences
(EJHS)

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European Journal of Health Sciences
ISSN 2520-4645 (online)
Vol.7, Issue 2, pp 47 - 58, 2022

www.ajpojournals.org

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Abstract

Purpose: This study assessed effects of educational intervention and telephone-reminders on appointment-keeping for immunization among mothers with under-5 children in Oyo state, Nigeriao state, Nigeria.

Methodology: The study utilized a quasi-experimental design which comprised two experimental groups and one control group using the quantitative approach. Health education intervention was delivered to the one experimental group, Health education intervention and Telephone-reminder SMS was delivered to the experimental group two at 6th and 10th week of their immunization appointment and no intervention was delivered to the control group. The educational intervention was for a duration of 2 weeks which was in three sessions, lasting for an average of 120 minutes. At baseline, data were collected before the intervention, at 2weeks immediately after the intervention, and at 8th weeks post-intervention in both the experimental and control groups. Data was analyzed using IBM SPSS version 23 to generate descriptive and inferential results.

Findings: Results showed that at baseline, there was no significant difference $p<0.05$ in the mean score of appointment-keeping practices in Intervention 2 (5.30±1.40), Intervention 1 (5.40±3.30), and control group (5.53±1.20). Between baseline and immediate post intervention, there was increase in the mean score of appointment-keeping practices in Intervention 2 (from 5.30±1.40 to 14.73±1.40, ES= 1.70), Intervention 1 (from 5.40±1.11 to 14.60±2.12, ES= 1.13). The level of appointment-keeping increased significantly between baseline and 8th-weeks follow up in Intervention 2 (from 5.30±1.40 to 16.75±2.15, ES= 4.24); Intervention 1 (from 5.40±3.30 to 14.80±2.04, ES= 2.37). However, there was no significant ($p>0.05$) difference in the CG at baseline and post intervention (from 5.53±1.20 to 5.61±1.40, ES= 0.14) also baseline and 8-weeks follow up (from 5.53±1.20 to 5.60±1.66, ES= 0.13). Intervention 2 results were significantly higher. In conclusion, the combined health education and telephone-reminder intervention was a more effective approach than the health education approach in increasing the appointment-keeping practices of mothers with under-5 children.

Recommendation: The study recommend that telephone-reminder be incorporated in health education strategies for mothers of under-5 children for effective control and prevention of vaccine preventable diseases.

Keywords: *Appointment-keeping, Educational intervention, Immunization, Telephone-reminders, Mothers of under-5.*

Introduction

Globally, over 3 million children under 5 years die yearly from infectious diseases, and a great number of these deaths are preventable by vaccine (World Health Organization, 2015). Since the inauguration of the Expanded Program on Immunization, immunization coverage has largely improved (W.H.O, 2014), yet in Africa about 25% of infant still do not receive immunizations (W.H.O, 2015). The poor child health indices in Nigeria are supposedly connected with low immunization appointment-keeping, which is amongst the lowest globally (Olorunsaiye, & Degge, 2019; Ophori, Tula, Azih, Okojie, & Ikpo, 2014). Immunization is the process whereby a person is made immune or resistant to an infectious disease, typically by the administration of a vaccine (W.H.O, 2015). Vaccines stimulate the body's own immune system to protect the person against subsequent infection or disease. It is one of the most cost-effective health interventions; with proven strategies that make it accessible to even the most hard-to-reach and vulnerable populations (W.H.O, 2014).

Appointment-keeping for immunization is critical in the control and prevention of vaccine preventable diseases and reduction of associated complications (Anderson, 2014). However, appointment-keeping rates are still low among mothers of under-5 children in Nigeria (Azih, Ophori, Tula, Okojie, & Ikpo, 2014). A number of interventions which have either been health education or telephone reminder have been conducted in Nigeria to provide understanding of the dynamics and factors associated with immunization appointment-keeping (Adedire et al, 2019; Olorunsaiye et al., 2019). Literature has shown that these interventions singly are effective but could be much more effective when combined (Dustin et al. 2019). In spite of this, Nigeria is yet to sufficiently reflect this combined approach in immunization efforts (Azih, et al., 2014; Olorunsaiye et al., 2019). Tengiz, Mariam, Ana, Revaz & Beka, (2019) in a study observed that quality education intervention which consist of providing information about vaccine preventable disease state without reminder had little influence on the appointment keeping practice. This situation maybe far worse among mothers of under-5 children in Nigeria where the healthcare system is highly over-burdened with mothers of under-5 and not as highly organized as united states or Europe. Cellphone-based reminder interventions in PHC settings in low-resource contexts, such as Nigeria, has not been adequately evaluated (Oladepo, Dipeolu & Oladunni, 2020).

Health education is a way to empower mothers of under-5 children; it offers them the opportunity to participate in activities that affect them and to access the information and services that they need to protect their health (Adedire et al., 2019). The study sought to highlight the impact of health education intervention in arousing infants' mothers' conscious awareness of benefits of vaccination of their children in routine immunization that enables them to express willingness and make conscious efforts to adhere to their children routine immunization schedule (Adedire et al., 2019. As mobile phone access and ownership continue to increase, opportunities exist to leverage mobile health technologies to tackle demand-side barriers, such as forgetting vaccination appointments, not knowing the vaccine schedule (Dustin et al. 2019). Several studies have established the effectiveness of reminding mothers about scheduled immunizations and prompting clients who have missed a scheduled immunization appointment in improving vaccination rates (Jacobson & Szilagyi**,** 2020; Stockwell et al, 2012). Reminder interventions have been found to be effective in various settings including family practices (Jacobson et al., 2020), pediatric clinics (Jones & Walton-Moss 2013; Stockwell et al, 2012), and public health centers. Hence, the purpose of the study was to determine the effects of educational intervention and telephone-reminders on

appointment-keeping for immunization among mothers with under-5 children in Oyo state, Nigeria.

Methodology

Study Design

The study utilized a quasi-experimental design which comprised two experimental groups and one control group using the quantitative approach. Health education intervention focused on Immunization-related knowledge was delivered to the one experimental group, Health education intervention and Telephone-reminder which focused on Immunization-related knowledge and telephone-reminder SMS was delivered to the experimental group two and a placebo was delivered to the control group. The intervention was for a duration of 2 weeks which was in three sessions, lasting for an average of 120 minutes. At baseline, data were collected before the intervention, at 2weeks immediately after the intervention, and at 8^{th} weeks post-intervention in both the experimental and control groups.

Study Area

The study was conducted in three (3) primary health centres that were selected from three local government areas (LGAs) in Oyo State, which are Akinyele, Oluyole and Ogo-oluwa local government respectively. The primary health centres employed for this study were Akinyele, Bare and Elega PHC, where the indigenes are mostly traders and farmers.

Study Population

The study population were mothers of under-5 children attending immunization clinics in the Primary Healthcare Centres (PHCs).

Inclusion and Exclusion Criteria

Mothers of under-5 children who were registered in the antenatal clinic during the study and agreed to partake in the study. Mothers who have cell phone with no underlying medical conditions. Those excluded where mothers of under-5 children who were not registered in the antenatal clinic of the health centres of interest. Mothers who do not have cell phone. Mothers with underlying medical conditions.

Sampling Procedure

Multistage random sampling technique was used for the selection of mothers of under-5 children in Oyo State. Out of the three senatorial districts in Oyo State, Oyo central was purposively selected. This is because it has the highest under-5 children in Oyo State. Three LGAs were selected using the random sampling technique from Oyo central senatorial district by balloting, and were assigned into three groups. Three primary health centres were randomly selected for the intervention groups and for the control group from selected LGAs.

Sample size Determination

The sample size computed for the intervention study was 27 participants each for the two experimental groups and same applicable for the control group. Using 95% level of significance, ($Z\alpha$= 1.96) 80% for $Z\beta$ which is equivalent to 0.84, Prevalence level at 50% which is also equal to 0.5, P, which is the desired level of outcome at 80% (0.8). However, sample size was increased to 30 participants to minimize the margin of error.

$$N = \frac{(Z\alpha + Z\beta)^2 x \ P_0(1 - P_0)}{(P_1 - P_0)^2}$$

N= Minimum sample size

Zα = Normal standard variate at 95% confidence level (1.96)

Zβ = Statistical Power at 80% confidence level = 0.84

P= Prevalence of immunization = 50%

P_1= 80% (desired level of outcome variable

$$N = \frac{(1.96 + 0.84)^2 \times 0.5(1 - 0.5)}{(0.8 - 0.5)^2}$$

$$\frac{7.84 \times 0.25}{(0.3)^2} \qquad N = 21.77 \approx 22$$

Attrition rate 20% of sample size 22+4.4= 26.4 ≈ 27

Researcher increased the sample size to 30 so as to minimize the margin of error.

Total sample size is (30 x 3) = 90

Based on the computation a total number of 90 participants from the three selected primary health centres were enrolled for this study (representing 30 people per group).

Instrument for Data Collection

A quantitative approach consisting of close-ended questions that covered all aspects of the study was used for this research. The instrument was a semi-structured, participant administered questionnaire that solicited information on socio-demographic characteristics, immunization-related knowledge and appointment-keeping practice among mothers with under-5 children from selected primary health centres in Oyo State. The same instrument was administered at baseline, immediate post-intervention, and 8-weeks follow-up.

Study Variables

The educational interventions and telephone reminders were the independent variables while appointment-keeping for immunization among mother was the dependent variable.

Validity and Reliability of Instrument

Face validity was adopted in validating the questionnaire to be used for the study. This was looked at by the supervisor and lecturers in the department. Item validity was also adopted by ensuring that the items in the instrument were carefully and thoughtfully selected in order for them to operationalize each of the variables they fall under. Construct validity using the conceptual framework (PRECEED Model) was adapted and variables in the instrument were selected based on the objectives of the study using the model.

To ascertain the reliability of the instrument, a pilot test was conducted for internal consistency of the instrument using 10% of the anticipated sample size from another primary health centre not included in the study, but with same characteristics as the study participants, to check for clarity and understanding. Twelve of the questionnaires were pre-tested among twelve students. The responses that were provided after the pilot study was fused into the instrument. The data collected from the respondents was statistically analyzed using the Cronbach's alpha standard score to test its reliability. The reliability score generated was 0.84.

Ethical Considerations

The study obtained ethical approval from the ethical committee of the university—Babcock University Health Research and Ethics Committee (BUHREC), and also from the Ministry of Health Research Ethics Review Committee, Oyo State, Nigeria, in order to conduct the study. Informed consent was obtained from all respondents and their parents/guardians before administering the questionnaires. Confidentiality of every information provided was duly kept discrete and the instrument was administered to participants anonymously without requiring the names of the respondents.

Statistical Analysis

Data were collected, revised, coded and fed to the statistical software IBM SPSS (Statistical Package for the Social Sciences) version 23. Descriptive statistics including frequency distribution and percentages were performed. For quantitative variables, mean and standard deviation were calculated. Inferential statistics include *t*-test, and Cohen d effect size. The two tailed tests, alpha error of 0.05, and p-value less than 0.05 were considered significant.

Results

Table 1: Socio-demographic Characteristics of the Participants.

Variables	**CG**	**EC1**	**EC2**
	F (%)	**F (%)**	**F (%)**
Age group			
20-39 years	3(10.0)	3(10.0)	2(6.7)
30-39 years	26(86.7)	25(83.3)	26(86.7)
40-49years	1(3.3)	2(6.7)	2(6.7)
Mean± SD	32.90 ± 3.8	31.97± 4.9	34.0 ± 3.3
Marital Status			
Single	2(6.7)	2(6.7)	4(13.3)
Married	27(90.0)	27(90.0)	25(83.3)
Separated	1(3.3)	1(3.3)	1(3.3)
Occupation			
Unemployed	9(30.0)	10(33.3)	5(16.7)
Self-employed	6(20.0)	8(26.7)	12(40.0)
Civil-servant/private organization	13(43.3)	10(33.3)	12(40.0)
Retired	2 (6.7)	2(6.7)	1(3.3)
Religion			
Christianity	21(70.0)	19(63.3)	22(73.3)
Islam	8(26.7)	10(33.3)	7(23.3)
Traditional Belief	1(3.3)	1(3.3)	1(3.3)
Ethnicity			
Yoruba	20(66.7)	19(63.3)	24(80.0)
Igbo	7(23.3)	5(16.7	4(13.3)
Hausa	3(10.0)	6(20.0)	2(6.7)

From table 1. Description of the Socio-demographic Characteristics of the Participants showed participants mean age at pre-intervention in experiment group 1, 2, and control group the groups were as follows: 31.9± 4.9years, 34.0 ± 3.3 years and 32.9± 3.8 years. Majority of the participants in three groups were within ages 30-39 years. Most of the participants in all the groups were married. More than half of the participants in all the group were civil servants. For the religion of the participants most of the participants in all the groups were of Christian faith. Also, most of the participants in all the groups were from Yoruba ethnic group.

Table 2: Baseline Knowledge and appointment keeping practice of mothers of under-5 children

	Experimental group 2	Experimental group 1	Control group	Statistics t=value	p-value
Knowledge of appointment-keeping practices					
Measured on a 33points rating scale					
Mean ± SD	8.93 ± 0.94	7.70 ± 1.46	9.60 ± 2.67	1.23	0.34
Appointment-keeping practices					
Measured on a 18 points rating scale					
Mean ± SD	5.30 ± 1.40	5.40 ± 1.11	5.53 ± 1.20	0.87	0.76

Baseline Knowledge and appointment keeping practice of mothers of under-5 children

The mean ± SD scores for the mothers' of under-5 level of knowledge on appointment-keeping practices in the experimental group 2, experimental group 1 and control groups were 8.93 ± 0.94, 7.70 ± 1.46and 9.60 ± 2.67 respectively. When the mothers' of under-5 mean scores of levels of knowledge on appointment-keeping practices measured in this study were compared with the control and experimental groups at baseline, independent t-test computation showed that there was no significant difference (P >0.05) as shown in table 2. Furthermore, the appointment-keeping practice mean scores and standard deviations for the experimental group 2, experimental group 1 and control groups were 5.30 ± 1.40, 5.40 ± 1.11and 5.53 ± 1.20 respectively. When appointment-keeping practice mean score measured in this study was compared with the control and intervention groups at the baseline.

Table 3: The Effects of the Training Program on Mothers' of under-5 Knowledge and Appointment-keeping Practices

	Experimental group 2		p-value	Experimental group 1		p-value	Control group		p-value
	Post intervention	Follow-up		Post intervention	Follow-up		Post intervention	Follow-up	
Knowledge of appointment-keeping practices									
Measured on a 33 points rating scale									
Mean±SD	18.06 ± 3.51	24.03 ± 1.30	0.00	15.67 ± 1.56	21.80 ± 3.50	0.00	8.83 ± 2.36	8.97 ± 1.97	0.34
Appointment-keeping practice									
Measured on a 18 points rating scale									
Mean±SD	14.73 ± 2.22	16.76 ± 0.39	0.00	14.60 ± 2.12	14.80 ± 2.04	0.00	5.61 ± 1.40	5.60 ± 1.66	0.56

Effects of the Training Program on Mothers' of under-5 Knowledge and Appointment-keeping Practices

The effects of the training program are summarized in Table 3. Overall, the intervention group showed a significantly higher mean knowledge score than the control group at immediate post intervention and at follow up period (P<0.05). The experimental group 2, experimental group 1 and control groups were 18.06 ± 3.51, 15.67 ± 1.56 and 8.83 ± 2.36 respectively at immediate post intervention. At the follow-up period, the experimental group 2, experimental group 1 had mean score of 24.03 ± 1.30 and 21.80 ± 3.50 while there was no increase in the mean knowledge score of the control group (8.97 ± 1.97). Furthermore, the appointment-keeping practice mean scores and standard deviations for the experimental two and experimental one increased significantly at immediate post intervention (14.73 ± 2.22) and (14.60 ± 2.12) compared with the control group mean score (5.61 ± 1.40; p<0.05). Also, there was a significant increase in appointment-keeping practices of the experimental group two and experimental group one compared with the control group at follow-up period (p<0.05).

Table 4: Comparison of the Effect of the Mean Score of Mothers' of under-5 Knowledge and Appointment-keeping Practices between the Baseline and the Follow-up Period

Knowledge	Experimental group 2		ES	Experimental group 1		ES	p-value	Control group		ES	p-value
	Baseline	Follow-up		Baseline	Follow-up			Baseline	Follow-up		
Knowledge of appointment-keeping practices											
Measured on a 33 points rating scale											
Mean±SD	8.93 ± 0.94	24.03 ± 1.35	7.54	7.70 ± 1.46	21.80 ± 3.57	4.12	0.000	9.60 ± 2.67	8.97 ± 1.97	0.44	0.14
Appointment-keeping practice											
Measured on a 18 points rating scale											
Mean±SD	5.30 ± 1.40	16.76 ± 0.39	3.14	5.40 ± 1.11	14.80 ± 2.04	2.11	0.000	5.53 ± 1.20	5.60 ± 1.66	0.13	0.66

*ES: Effect size

Effect of the Mean Score of Mothers' of under-5 Knowledge and Appointment-keeping Practices between the Baseline and the Follow-up Period

Evaluating the impact of the intervention on Mothers' of under-5 level of knowledge on Appointment-keeping Practices, by comparing the baseline and the 8th weeks follow-up means scores for the experimental group two and experimental group one using paired sample t-test, revealed that there was a statistically significant difference in the mean scores and the effect size computed, indicating that the magnitude of the difference in mean scores between the baseline and the 8th week follow-up period was significant. The intervention group two and intervention group one had an effect size of 7.54 and 4.12 with a p-value of 0.000. However, the control group had no effect size since there was no difference in the mean scores between the baseline and 8th weeks follow-up period (ES=0.44) as shown in tables 4 and 5.

In addition, evaluating the impact of the interventions on Mothers' of under-5 Appointment-keeping practice, by comparing the baseline and the follow-up mean scores for the

experimental group two and experimental group one using paired sample t-test, revealed that there was a statistically significant difference in the mean scores and the effect size computed, indicating that the magnitude of the difference in mean scores between the baseline and the follow-up period was significant. The intervention group two and intervention group one had an effect size of 3.24 and 1.56 with a p-value of 0.000. However, the control group had no effect size since there was no difference in the mean score between the baseline and the follow-up period (ES=0.13) as shown in tables 4 and 5.

Table 5. Paired T-Test Analysis Showing the Difference in Mean between mothers' Level of Appointment-keeping practice between Baseline and at 8th week Follow Up

Group	x(SE)	SD	Mean Difference	ES	Df	p-value
Health education and Telephone-reminder Group						
Baseline	5.40 (0.23)	1.40				
8th weeks follow-up	16.76 (0.12)	1.11	11.36	3.24	18	0.00
Health education Group						
Baseline	5.40 (0.17)	1.11				
8th weeks follow-up	14.80 (0.19)	2.04	9.40	1.56	18	0.00
Control						
Baseline	5.53 (0.10)	1.20				
8th weeks follow-up	5.60 (0.11)	1.66	0.07	0.13	18	0.651

*ES: Effect size

Discussion of Findings

In this study the participants were within ages 20-49 years and their mean age was 32.9± 3.8 years. This is similar to the finding of the study of Awadh et al, (2014) in Malaysia where they reported similar age range and mean age. This similarity in finding may be because the participants were within the reproductive age. However, this finding is at variance with the mean age reported by Obi-Jeff et al, (2021) in Northern Nigeria where they reported higher age range and mean age. This difference in result may be due to the fact that this present study focused on mothers of under-5 while their study focused on the general population that comprises of both males and females outside the reproductive age. Also, this study revealed that less than half of the participants had secondary education. This finding corroborates the results of Obi-jeff et al (2021**)** in Northern Nigeria and Oladepo et al, (2020) in rural Nigeria where they reported similar level of education among their study participants. These similarities in results may be because both studies were conducted in Nigeria where education up to secondary school was being encouraged. Also, this can enhance their ability to read SMS message.

This study showed that mothers' knowledge of routine immunization and appointment-keeping was low and this in line with the study of (Oladepo et al., 2020). This finding was similar to

those from other studies in which mothers had limited knowledge of childhood immunization (Larson et al 2018; Rainey et al., 2011). This difference may be because most had given birth to more than one child. This suggests that educational messages from the clinic's health workers may not adequately equip them with adequate knowledge about the different diseases and vaccinations. This study revealed that given health education intervention to mothers in antenatal clinic is an effective and practical approach to increase mothers' knowledge about childhood immunization. Some of the barriers to immunization appointment-keeping reported by participants in this study corroborate with those results in other studies. These studies equally identified, vaccine efficacy, side effects, prior negative experience with vaccination, long-distance walking, and long waiting times at the health facility as major barriers to uptake of immunizations (Abdulraheem et al, 2011; Harmsen et al 2013).

This study finding showed a significant increase in mothers' level of knowledge about immunizations compared to baseline results, thus indicating that the health education intervention was an effective way to improve mothers' knowledge about childhood immunization. Studies had reported that mothers' knowledge has a great impact on the children's immunization rate, immunization appointment-keeping, and maintaining up-to-date immunization status (Favin et al., 2012; Sheika et al., 2013; Esposito et al., 2014, Sheikh et al., 2013). Also the intervention group two that received the health education and SMS message had higher increase in knowledge as compared with intervention one that had the health education alone and the control group.

This study showed that the immunization appointment-keeping increased significantly after the intervention in the intervention groups. This finding is in line with the finding of Romance et al, (2019) in Côte d'Ivoire, Oladepo et al., (2020) in Nigeria and Donewell et al., (2015) in Zimbabwe. However, this finding is in contrast with the finding of Nwokeukwu et al., (2015) in South Eastern (Umuahia) Nigeria were they reported that telephone call should also follow with SMS message to improve immunization appointment-keeping. Similarly, appointment-keeping of routine immunization by Intervention group two was significantly higher than the control group, and intervention group two which can be attributable to the reminder messages intervention. Similar results have been reported in Pakistan by Kazi et al., (2018) and Bangure et al, (2015) in Zimbabwe. Sending the SMS reminder nearer to the immunization appointment date has been establish to be essential, this will help to deal with forgetfulness. Furthermore, Romance et al, (2019) reported that providing mothers mobile phone message reminders was a potentially effective strategy for improving immunization and vaccination coverage.

Conclusion

This study showed that providing health education about the importance of immunization, and the immunization schedule, supporting it by sending one-way reminder text SMS messages to mothers of children under-5 years of age with a phone promotes immunization appointment attendance. The study thus adds to the evidence based on the effectiveness of phone reminders via health text messaging for improved childhood immunization appointment-keeping. The results also provided reliable evidence for decision-making for child immunization appointment- keeping and added to the body of literature, which is currently scarce. Finally, it led to a better understanding of the ways through which m-health technology supports health care delivery.

Recommendation

It is with the foregoing conclusion in mind that the following recommendations are made. These have taken into consideration both practical issues in program, design, policy

implications and logistics of modification of existing health education to accommodate the following recommendations:

1. Since the study revealed unsatisfactory levels of knowledge about immunization appointment-keeping among participants at baseline, and the intervention applied improved these knowledge, there is an urgent need to modify how mother's immunization education is implemented at clinics. Therefore, the study recommends that there should be more focused health education at clinics rather than the casual general health-talk model that is usually presented at antenatal.
2. Since one of the identifying characteristics that defined the effectiveness of the interventions appear to be in the benefits of the role played by telephone-reminders offered in facilitating appointment-keeping, this study therefore recommends that telephone-reminders be incorporated in patient education strategies for effective control of vaccine preventable diseases.
3. Expanding this research to build a national evidence base with a broader geographic spread to other states in Nigeria to increase national immunization coverage

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