



Effect of Mobile Phone Reminders and Recalls on Missed Immunisations among Infants in Two Health Facilities in Abakaliki, Nigeria

N. C. Eze^{1*}, B. N. Azuogu¹ and I. L. Okoronkwo²

¹*Department of Community Medicine, Federal Teaching Hospital Abakaliki, Nigeria.*

²*Department of Health Administration and Management, University of Nigeria, Nsukka, Nigeria.*

Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJPR/2018/v1i228803

Editor(s):

(1) Dr. Ahmed El-Nawawy, Professor, Department of Pediatric, Faculty of Medicine, Alexandria University, Egypt.

Reviewers:

(1) Prashant Sharma, Seoul National University, South Korea.

(2) Mohamed M. Ibrahim, University of Zawia, Libya.

Complete Peer review History: <http://www.sciencedomain.org/review-history/27478>

Original Research Article

Received 13 September 2018

Accepted 22 November 2018

Published 29 November 2018

ABSTRACT

Background: Missed immunisation (MI) may contribute to low immunisation coverage in diverse settings, especially developing countries. Receipt of vaccines at the recommended ages and intervals will ensure that children are adequately protected from target diseases at all times. Immunisation reminder and recall (RR) systems are cost-effective methods of improving adherence to recommended immunisation schedules. This study, therefore, determined the effect of immunisation reminders and recalls on reducing missed immunisations in Abakaliki.

Materials and Methods: This is a quasi-experimental study conducted among caregivers of infants in rural health facilities in Abakaliki. Mile-Four and St. Vincent hospitals located in Ebonyi and Izzi Local Government Areas (LGA) respectively in Ebonyi State were selected purposively. Mile-Four was assigned intervention group and St. Vincent as control group. The sample size was determined using the formula for comparing two proportions. Caregiver-child pair was recruited during the infants' BCG or Pentavalent vaccines 1 immunisation visit and followed till the final scheduled immunisation visit for each child. Data was collected using a questionnaire, proforma and checklist. Statistical Package for Social Science (SPSS) version 22.0 was used for analysis. Ethical approval was obtained from the Research and Ethics Committee (REC) of the Federal Teaching Hospital Abakaliki (FETHA).

*Corresponding author: Email: ezenelson24@gmail.com;

Results: A greater proportion of respondents in the intervention group (8.3%) missed vaccination at the 6th and 10th weeks when compared with the 4.1% and 6.9% for the above mentioned weeks respectively in the control group. In the control group, a greater proportion (22.1%) missed vaccination than the intervention group (8.9%) at the 14th week, a difference in the proportion that was significant ($p=0.04$). Relative to female caregivers, male caregivers are 6.2 times more likely to miss immunisation in the intervention group. They are 2.3 times more likely to miss immunisation than the female ones in the control group. Those at older age (≥ 30 years) are 1.2 times more likely to miss immunisation than those of younger age group.

Conclusion: Mobile phone reminders and recall has proven effective in reducing childhood missed immunisations and non-compliance in Abakaliki. Implementation of immunisation reminders and recall systems is therefore recommended in immunisation clinics in developing countries especially in Nigeria for immunisation timeliness and completion.

Keywords: Mobile phone reminders and recalls; missed immunisations; infants; Abakaliki.

1. INTRODUCTION

Immunisation is a powerful and cost-effective public health intervention. It prevents debilitating childhood illnesses and disabilities and saves millions of lives yearly.

Access to communication is one of the important factors in the improvement of maternal and child health services [1]. Health care services that require repeated visits to the health facility due to timed scheduling of care are faced with the challenges of poor compliance and attrition. Clients receiving such care could and indeed have to be reminded by mobile phone calls which have great potential for improving compliance with or adherence to childhood immunisation schedules as the number of subscribers' increase [1].

Immunisation reminder and recall systems (RR) are cost-effective methods whereby infants who had come for vaccination but fail to continue or come for subsequent vaccinations are identified and contacted to come to the immunisation clinic or physician's office for its completion. It is cost-effective method of improving adherence to recommended immunisation schedules [2-5]. Reminder system tracks future immunisation appointments, whereas recall system tracks missed immunisation appointments and prompts clients to return to the clinic to receive the recommended or needed overdue immunisations [3]. A "reminder" is the postcard, letter, short message services [SMS] or telephone call reminding clients of immunisations before they are due. A "recall" is the postcard, letter, short message services or telephone call after clients missed an immunisation appointment or when an individual has fallen behind on scheduled immunisations prompting

them to return to the clinic to receive the recommended immunisations [6].

Use of mobile phone technology to aid clients' compliance with and adherence to healthcare guidelines represents an advance in public health care delivery system, especially in developed countries. Different methods exist such as chart reminders, mail reminders, postcards, telephone calls, short message service (SMS), home visits, computerised immunisation alert systems, standing orders, expanding clinic hours, card file and clinical assessment software application (CASA). However, no one method suits all facilities. The appropriateness of a method is dependent upon personnel's capacity to utilise the selected method and fine-tune it to meet the specific needs of the practice and locale.

Abakaliki (study area) has a large number of rural dwellers with a low level of education, and this has been found to be one of the factors influencing immunisation uptake with decreasing expectations about the performance of primary health care system. Consequently, low immunisation coverage and high childhood immunisation drop-out rate are the attendant health problems [7]. Effective communication is therefore imperative for the delivery and receipt of adequate maternal and child health care services especially in such areas [1]. This study therefore determined the effect of immunisation reminders and recalls on reducing missed immunisations in Abakaliki.

2. MATERIALS AND METHODS

This is quasi-experimental study conducted among mothers/caregivers accessing childhood immunisation services at Mile-Four Hospital and

St.Vincent Hospital Ndubia in Ebonyi State. The minimum sample size of 145 respondents was determined using the formula for comparing two proportions [8,9] as shown by $n = \frac{[Z\alpha + Z_{1-\beta}]^2 [P_1(1 - P_1) + P_2(1 - P_2)]}{[P_1 - P_2]^2}$ where n = minimum sample size in each group.

$Z\alpha = 1.96$ which is the critical ratio or standard normal deviate at significance level of 5%.

$Z_{1-\beta} = 0.84$ which is the critical ratio or standard normal deviate at desired power of 80%.

P_1 anticipated change in the study group, ie the proportion of drop-out rate after intervention; taken as 14% [10].

P_2 control group response.ie the proportion of drop-out rate before intervention; taken as 21% [10].

Respondents were selected using systematic sampling technique. The reminders and recalls were received by parents/caregivers in the intervention group. The intervention consisted of immunisation reminders to keep future immunisation dates and immunisation recalls for missed immunisation dates. Research assistants were selected based on knowledge about research and interest in health service research especially in primary health care. They were trained on how to administer questionnaire during participant recruitment and make comprehensive list of the participants, how and when to make the mobile phone calls (reminders and recalls), how and when to use the observational checklist as participants come for immunisation uptake, and the information to be documented in the immunisation register. Questionnaire was pilot tested at Mater hospital Afikpo in Ebonyi State. Phone calls were made 48-24 hours prior to appointment date reminding the parents/caregivers that immunisation date for a named child was that date at the intervention facility. One month (4 weeks) after the last recall following missed 3rd dose of pentavalent vaccines, data on missed immunisation was extracted from immunisation register and checklist into the proforma for data entry into SPSS. Data on caregivers was also obtained using pilot tested questionnaire. Chi-squared test was used to determine association or differences between proportion of the variables and the level of statistical significance was set at $p < 0.05$ and confidence level at 95%. Ethical approval for this study was obtained from the Research and Ethics Committee (REC) of the Federal Teaching

Hospital Abakaliki (FETHA), Ebonyi State, Nigeria. Consent was obtained from the respondents.

3. RESULTS

Table 1 showed socio-demographic characteristic of the infants in both the intervention and control groups. High proportions of the infants were in the age group of 0-2 weeks, a difference that was not significant ($p=0.31$).

Fig. 1 showed the proportion of respondents who missed each vaccine in both groups. A greater proportion of respondents in the intervention group (8.3%) missed vaccination at the 6th and 10th weeks when compared with the 4.1% and 6.9% for the above mentioned weeks respectively in the control group. This difference in proportion was statistically significant ($p=0.02$). In the control group, a greater proportion (22.1%) missed vaccination than the intervention group (8.9%) at the 14th week, a difference in proportion that was also significant ($p=0.04$). Table 2 compared pre-intervention and post-intervention missed immunisations. Out of 82 infants who missed immunisations in pre-intervention phase, 28% missed immunisations post-intervention. Similarly, out of 69 infants who missed immunisations at the beginning of study, 30.4% missed immunisations at the end of study in the control group. The differences in their proportions in pre- and post-intervention phases and in the beginning and end of study in control groups were not statistically significant ($p>0.05$).

Table 3 showed within group comparison between sex of the infants and missed immunisation. More males (27.4%) than female (23.6%) infants missed immunisations in the intervention group when compared with control group. The difference in their proportion was not significant ($p>0.05$).

In Table 4, the proportion of respondents who missed immunisations pre- and post-interventions was compared with the control groups. Out of 406 infants studied during pre-intervention phase, 39.7% missed immunisations when compared with 25.5% who missed immunisations post-intervention. The difference in their proportions was statistically significant ($p=0.02$). In the control group, 48.4% of the infants missed immunisations at the beginning of the study when compared with 33.1% who

missed immunisation at the end of the study, a difference in their proportions was also statistically significant ($p=0.01$).

In Table 5: Relative to female caregivers, male caregivers are 6.2 times more likely to miss immunisation in the intervention group. The employed are 2.2 times more likely to miss immunisation than the unemployed even when

not statistically significant. In Table 6, none of the factors was found as predictor of missed immunisation in the control group. However, male caregivers are 2.3 times more likely to miss immunisation than the female ones. Those at older age (≥ 30 years) are 1.2 times more likely to miss immunisation than those of younger age group.

Table 1. Socio-demographic characteristics of infants in the study and control groups

Variables	Intervention (n =145) Freq. (%)	Control (n=145) Freq. (%)	χ^2	p-value
Sex				
Male	73 (50.3)	72 (49.7)	0.01	0.90
Female	72 (49.7)	73 (50.3)		
Age group (weeks)				
0-2	103 (71.0)	93 (64.2)	3.43	0.31
3-5	21 (14.5)	26 (17.9)		
6-8	21 (14.5)	26 (17.9)		
Vaccines received at recruitment			0.42	0.51
BCG, OPV0, HB0	125 (86.2)	121 (83.4)		
OPV1, PENTA1, PCV1	20 (13.8)	24 (16.6)		

Table 2. Within group comparison between pre-intervention and post-intervention missed immunisation

Variables	Intervention group (n=145)				Control group (n=145)				
	Post-intervention missed immunisation			χ^2 (p-value)	Post-intervention missed immunisation			χ^2 (p-value)	
	Yes Freq. (%)	No Freq. (%)	Total		Yes Freq. (%)	No Freq. (%)	Total		
Pre-intervention missed immunisation									
Yes (n=82)	23 (28.0)	59 (72.0)	82 (100)	0.63 (0.42)	Yes (n=69)	21 (30.4)	48 (69.6)	69 (100)	0.42 (0.51)
No (n=63)	14 (22.2)	49 (77.8)	63 (100)		No (n=76)	27 (35.5)	49 (64.5)	76 (100)	

Table 3. Within group comparison between Sex of infants and missed immunisation post-intervention

Variables	Intervention group (n=145)				Control group (n=145)			
	Missed immunisation			χ^2 (p-value)	Missed immunisation			χ^2 (p-value)
	Yes Freq. (%)	No Freq. (%)	Total		Yes Freq. (%)	No Freq. (%)	Total	
Sex of infants								
Male	20 (27.4)	53 (72.6)	73 (100)	0.27 (0.60)	23 (31.9)	49 (68.1)	72 (100)	0.08 (0.76)
Female	17 (23.6)	55 (76.4)	72 (100)		25 (34.2)	48 (65.8)	73 (100)	

Table 4. Effect of mobile phone reminders and recall on missed immunisation pre- and post-intervention

Variables	Intervention group			Control group		
	Pre-intervention Freq. (%)	Post intervention Freq. (%)	(p-value)	Beginning of study Freq. (%)	End of study Freq. (%)	(p-value)
Number who missed immunisations						
Yes	161 (39.7)	37 (25.5)	0.02*	136 (48.4)	48(33.1)	0.01*
No	245 (60.3)	108 (74.5)		145 (51.6)	97(66.9)	
Number who missed each vaccine						
OPV1	60 (14.8)	12 (8.3)	<0.05*	22 (7.8)	6 (4.1)	<0.01*
Penta1	11(2.7)	12 (8.3)	0.09	5 (1.8)	6 (4.1)	0.07
PCV1	26 (6.4)	12 (8.3)	<0.03*	7 (2.5)	6 (4.1)	0.0
OPV2	89 (21.9)	22 (15.2)	0.01*	57(20.1)	10(6.9)	0.06
Penta2	80 (19.7)	22(15.2)	1.00	58(20.6)	10(6.9)	0.01*
PCV2	99 (24.4)	22 (15.2)	0.04*	57(20.3)	10(6.9)	0.06
OPV3	152 (37.4)	19 (13.1)	0.06	136(48.4)	32(22.1)	0.02*
Penta3	146 (36.0)	19 (13.1)	0.05	135(48.0)	32(22.1)	0.02*
PCV3	161(3.7)	19 (13.1)	0.08	136(48.4)	32(22.1)	0.02*

*Statistically significant. McNemar χ^2 was used for this comparison

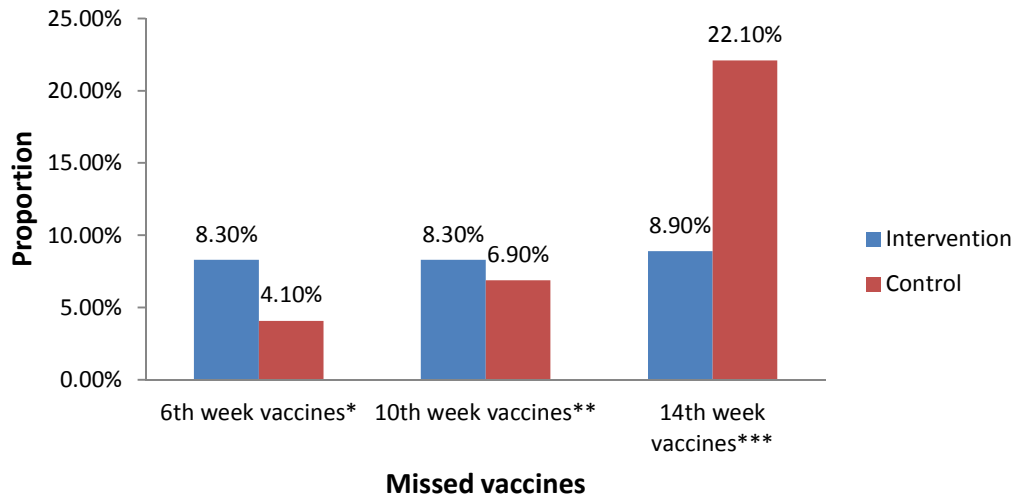


Fig. 1. Proportion of infants who missed each vaccine on each schedule post-intervention

*OPV1, Pentavalent1 and PCV1

**OPV2, Pentavalent2 and PCV2

***OPV3, Pentavalent3 and PCV3

4. DISCUSSION

A comparable proportion of respondents in the intervention group (25.6%) and control group (33.1%) missed immunisations at the end of the study. A higher proportion of respondents in the intervention group missed the 6th and 10th week vaccines when compared with the control group, while a significant proportion in the control group

(22.1%) than the intervention group (8.9%) missed the 14th week vaccines. No infant missed BCG, OPV0 and HB0 in both groups. The more infants miss immunisation among a given population, the more compromised the herd immunity of such population could be and are such prone to vaccine preventable diseases with attendant morbidity and mortality [11]. It is noteworthy that these vaccines are the ones

given at birth. Although this study however did not explore the place of birth of these infants, it is therefore likely that most of these infants were delivered in the facility (study area) or presented immediately for immunisation probably on the day they were born which made them stand the chance of being immunised with BCG, OPV0 and HB0 vaccines before discharge. The fewer

proportion of respondents in the intervention group (9%) who missed the 14th week vaccines may be explained by the fact that as the caregivers kept receiving phone reminders and recalls they saw the need for timeliness and promptness in immunising their children, hence fewer number of missed immunisations.

Table 5. Predictors of missed immunisation in the intervention group

Variables	Missed immunisation Intervention group		
	AOR	95% CI of AOR	P-value
Sex			
Female	1		
Male	6.20	1.28-15.89	0.05**
Employment			
Unemployed	1		
Employed	2.15	-0.89-4.54	0.09
Forgot date			
No	1		
Yes	4.83	-0.77-8.78	0.99
Travelled			
No	1		
Yes	7.48	-0.77-14.77	0.99
Busy with work			
No	1		
Yes	1.04	-0.78-2.56	1.00

***Predictor
AOR =Adjusted odd ratio
CI = Confidence interval*

Table 6. Predictors of missed immunisation in the control group post-intervention

Variables	Missed immunisation control group		
	AOR	95% CI of AOR	P-value
Sex			
Female	1		
Male	2.32	-0.99-6.20	0.99
Age group (years)			
<30	1		
≥30	1.21	-0.58-2.55	0.66
Marital status			
Not married	1		
Married	1.23	-0.15-9.56	0.86
Forgot appointment date			
No	1		
Yes	4.22	-0.99-11.12	0.99
Travelled			
No	1		
Yes	3.97	-0.78-9.56	1.00
Difficult getting transport fare			
No	1		
Yes	3.97	-0.78-9.56	1.00
Baby's sickness			
No	1		
Yes	3.47	-0.99-8.3	0.99

There was a significant relationship between respondent's age and marital status and missed immunisation in the control group and none in the intervention group.

In the study area, infants who visited on a day immunisation was not scheduled were asked to go back home without been vaccinated. Refusal to vaccinate on an unscheduled day may increase the mothers' total cost of transportation as stated by some caregivers, thus dampening their enthusiasm to attend vaccination clinics with loss of confidence in the immunisation system [12]. Health care providers should spend more time to communicate to mothers/caregivers on immunisation schedules and have constant training on vaccine management. In Texas, USA the reminder messages were effective in reducing missed immunisation appointment compared with the control. The content of reminder messages was also suggested to be an important factor in the reduction of missed immunisation appointments [13].

In addition, opened vaccine vials when not completely used should be preserved in the immunisation stations by the use of Cold chain/refrigerator. This will enable the health workers to open a new vial of vaccine when there are few children in the immunisation clinic instead of sending them home unvaccinated. A recall system may be more effective among caregivers showing attitude as the incriminating factor for missed immunisations. The recall would then act as a motivator for those concerned.

The following independent factors influenced missed immunisation in the intervention group: gender, employment, while in the control group, gender, age group, marital status influenced missed immunisations.

5. CONCLUSION

Mobile phone reminders and recall has proven effective in reducing childhood missed immunisations and non-compliance in Abakaliki. Immunisation reminders and recall system is therefore recommended in immunisation clinics in developing countries especially in Nigeria for immunisation timeliness and completion.

CONSENT

Consent was obtained from the respondents.

ETHICAL ISSUE

Ethical approval for this study was obtained from the Research and Ethics Committee (REC) of the Federal Teaching Hospital Abakaliki (FETHA), Ebonyi State, Nigeria.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Jordan ET, Ray EM, Johnson P, Evans WD. Text4baby. Using text messaging to improve maternal and newborn health. *Nursing for Women's kHealth*. 2011;15(3): 206-212.
2. Nnonyelu AN, Nwankwo IU. Social determinants of differential access to health services across five states South-East Nigeria. *Europ. Scientific J*. 2014;3:1857-7881. SPECIAL/Edition.
3. Vaccine Reminder Recall Systems: A Practical Guide for Pediatric Practices. Available:<http://practice.aap.org/content.aspx?aid=2674> (Accessed on 10th of April 2015)
4. Stinchfield PK. Practice-proven interventions to increase vaccination rates and broaden the immunisation season. *Am J Med*. 2008;121(7):S11-21.
5. Vora S, Verber L, Potts S, Dozier T, Daum RS. Effect of a novel birth intervention and reminder-recall on on-time immunisation compliance in high-risk children. *Hum Vaccin*. 2009;5(6):395-402.
6. American Academy of Pediatrics. Immunisation reminder/recall systems. Available:<https://www2.aap.org/immunisation/pediatricians/pdf/ReminderRecall.pdf> (Accessed November, 2010)
7. Ebonyi State Ministry of Health, Health management information system unit; Ebonyi State Health Systems Development Project. 2015:27.
8. Araoye MO. Research methodology with statistics for health and social sciences. 1st Edition. Ilorin: Natadex. 2003;69:107, 118-122.
9. Onwasigwe CN. Principles and methods of epidemiology. 2nd Edition. Enugu: EL Demark publishers. 2010;147-148.
10. Nwokeukwu HI, Emma-Ukaegbu U, Ajuogu E, Osunkwo D, Asinobi A. Use of telephone calls in reduction of dropout rate

- of routine immunisation in a tertiary health facility in Southeastern Nigeria. *European Journal of Preventive Medicine*. 2015;3(3): 39-43
11. Balogun MR, Sekoni AO, Okafor IP, Odukoya OO, Ezeiru SS, Ogunnowo BE, Campbell PC. Access to information technology and willingness to receive text message reminders for childhood immunisation among mothers attending a tertiary facility in Lagos, Nigeria. *Afr JCH*. 2012;6(3):76-80.
 12. Ubajaka FC, Ukegbu AU, Okafor NJ, Ejiofor O. The prevalence of missed opportunities for immunisation among children utilising immunisation services in Nnamdi Azikiwe University Teaching Hospital, NNEWI, *Journal of Biology, Agriculture and Healthcare*. 2012;2(6): 113-111.
ISSN 2224-3208 (Paper)
ISSN 2225-093X (Online)
 13. Walji MF. Does the message matter? Enhancing patient adherence through persuasive messages. *UT SBMI Dissertations*. 2006;6:3.

© 2018 Eze et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
<http://www.sciencedomain.org/review-history/27478>