



# Effect of Mobile Phone Reminders and Recalls on Pentavalent Vaccines Drop-out Rate among Caregivers Accessing Childhood Immunisation Services in a Developing City, Southeast Nigeria

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## Authors' contributions

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

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## ABSTRACT

**Background:** Immunisation drop-out rate measures the effectiveness of the immunisation programme. When drop-outs exceed 10 percent it indicates a problem of utilisation of services. 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 pentavalent vaccination drop-outs in Abakaliki.

**Materials and Methods:** This is a quasi-experimental study among caregivers of infants in rural health facilities in Abakaliki, Nigeria. Mile-Four and St. Vincent hospitals in Izzi and Ebonyi Local Government Areas (LGA) of Ebonyi State were selected purposively. Mile-Four was assigned the phone reminder/recall intervention group and St. Vincent as a control group. The sample size was

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determined using the formula for comparing two proportions. Caregiver-child pair was enrolled into the two groups during the infants' BCG or Pentavalent vaccines 1 immunisation visit and followed till the final scheduled immunisation visit for each child. Data were collected using questionnaire forms, 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), Nigeria.

**Results:** The mean age of respondents were 26.6 ±4.9 years and 27.1±4.2 years in the intervention and control groups respectively. Thirty five point seven percent (35.7%) of infants dropped out of pentavalent vaccination 3 in pre-intervention phase when compared with 5.5% post-intervention. This difference in their proportions was found statistically significant ( $p < 0.01$ ). In the control group, 47.7% dropped out of pentavalent vaccination 3 at the beginning of the study when compared with 22.1% at the end of the study, a difference that was statistically significant ( $p = 0.02$ ). Out of 145 infants who received pentavalent vaccines 1 in both groups, 137 (94.5%) infants received pentavalent vaccines 3 in the intervention group while 113 (77.9%) infants received pentavalent vaccines 3 in the control group. Far distance to health facility predicted immunisation drop-out in the control group. It is 2.8 times more likely to cause immunisation drop-out than near distance to health facility. No predictor was found in the intervention group.

**Conclusion:** Mobile phone reminders and recall has proven very effective in reducing pentavalent vaccines drop-out rate in Abakaliki. Implementation of immunisation reminders and recall systems are therefore recommended in immunisation clinics in developing countries especially in Nigeria for improved immunisation coverage in order to achieve Sustainable Developmental Goal 3 (SDG 3).

*Keywords: Phone reminders and recall; pentavalent vaccines; drop-out rate; infants; Abakaliki.*

## 1. INTRODUCTION

Immunisation drop-out and coverage rates at primary health care (PHC) level indicate the level at which communities utilise the preventive services and thus serve as a measure of the strength of the public health system. They also measure the effectiveness of the immunisation programme [1]. Immunisation drop-outs refer to infants who have used or missed immunisation services and do not return for subsequent vaccinations [1]. When drop-outs exceed 10 percent, it indicates a problem of utilisation of services [1]. In most settings where full immunisation coverage is low, most infants receive at least one dose of Pentavalent vaccines, but the proportion that receive the needed second and third doses drops significantly. Drop-out rates are calculated as the percentage point difference between successive doses of a vaccine, expressed as a percentage of the first dose [1].

Immunisation reminder and recall (RR) systems 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 a cost-effective method of improving adherence to recommended immunisation schedules [2,3]. Reminder system tracks future immunisation

appointments, whereas recall system tracks missed immunisation appointments and prompts clients to return to the clinic to catch up on needed overdue immunizations [2]. 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 miss an immunisation appointment or when an individual has fallen behind on scheduled immunisations prompting them to return to the clinic to receive the recommended immunizations [4]. 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 [2]. 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 [3]. Different methods exist such as chart reminders, mail reminders, postcards, telephone calls, SMS, home visits, computerised immunisation alert systems, standing orders, expanding clinic hours, card file and clinical assessment software application (CASA) [4]. 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 [4].

Abakaliki (study area) has large number of rural dwellers with 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 [5]. Effective communication is therefore imperative for the delivery and receipt of adequate maternal and child health care services especially in such areas [6]. This study therefore determined the effect of immunisation reminders and recalls on pentavalent vaccines drop-outs in Abakaliki.

## 2. MATERIALS AND METHODS

This is a quasi-experimental study among mothers/caregivers accessing childhood immunisation services at Mile-Four Hospital and St.Vincent Hospital Ndubia, all in Abakalki. The minimum sample size was determined using the formula for comparing two proportions [7,8]. Respondents were selected using systematic sampling technique. The reminders and recalls were given to parents/caregivers in the intervention group. The intervention consisted of immunisation reminders to keep future

immunisation dates and immunisation recalls for missed immunisation dates. Phone calls were made 24-48 hours prior to next 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 3<sup>rd</sup> dose of penta-valent vaccines, data on immunisation drop-out was extracted from immunisation register and checklist into the proforma for data entry into SPSS. Data was collected using questionnaire, proforma and checklist. Chi-squared test was used to determine association or differences between the 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 Federal Teaching Hospital Abakaliki (FETHA), Ebonyi State, Nigeria.

## 3. RESULTS

The mean age of respondents were 26.6  $\pm$ 4.9 years and 27.1 $\pm$ 4.2 years in the intervention and control groups respectively. The difference in the proportion for gender in the two groups was not statistically significant ( $p=0.90$ ).

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

Variables	Intervention (n=145) Freq. (%)	Control (n=145) Freq. (%)	$\chi^2$	p-value
<b>Sex</b>				
Male	5 (3.4)	4 (2.8)	FT	0.73
Female	140 (96.6)	141 (97.2)		
<b>Age group (years)</b>				
15-19	11 (7.6)	9 (6.2)	6.38	0.16
20-24	50 (34.5)	37 (25.5)		
25-29	48 (33.1)	68 (46.9)		
30-39	36 (24.8)	31 (21.4)		
<b>Marital status</b>				
Married	137 (94.5)	134 (92.4)	2.44	0.69
Single	8 (5.5)	11 (7.5)		
<b>Education</b>				
Primary	10 (6.8)	17 (11.7)	3.67	0.15
Secondary	88 (60.7)	93 (64.1)		
Tertiary	47 (32.4)	35 (24.1)		
<b>Employment</b>				
Paid employment	25 (17.2)	21 (14.5)	2.75	0.25
Self employment	56 (38.6)	70 (48.3)		
Unemployed	64 (44.1)	54 (37.2)		
<b>Religion</b>				
Christianity	142 (97.9)	143 (98.6)	FT	1.00
Others	3 (2.1)	2 (1.4)		

FT= Fisher's exact test

In Table 2, high proportions of the infants were in the age group of 0-2 weeks, a difference that was not significant (p=0.31).

Table 3 shows that more females (6.9%) than male infants (4.1%) had immunisation drop-outs in the intervention group. More female infants also had immunisation drop-outs in the control group. The difference in their proportions was not significant (p>0.05).

Table 4 shows the proportion of respondents who dropped-out of OPV3, Pentavalent vaccines 3 and PCV3 in pre- and post-intervention phases when compared with those in the beginning and end of study in the control group. Thirty five point seven percent (35.7%) of infants in pre-intervention phase dropped out of pentavalent vaccines 3 when compared with 5.5% post-intervention. This difference in their proportions was found statistically significant (p<0.01). In the control group, 47.7% dropped out of pentavalent vaccines 3 at the beginning of the study when compared with 22.1% at the end of the study, a difference that was statistically significant (p=0.02). Out of 145 infants who received Pentavalent vaccines 1 in both groups, 137 (94.5%) infants received Pentavalent vaccines 3 in the intervention group while 113 (77.9%)

infants received Pentavalent vaccines 3 in the control group.

In Table 5, far distance to health facility was a predictor of immunisation drop-out in the control group. It is 2.8 times more likely to cause immunisation drop-out than near distance to health facility.

#### 4. DISCUSSION

A significantly lower proportion of respondents in the intervention group (5.5%) dropped out of vaccination when compared with the 22.1% of respondents who dropped out in the control group. This difference could be explained by the persistent and consistent reminders and recalls which made caregivers see the need for completion of their children's immunisation to avoid vaccine preventable diseases [9,10]. There were no reminders and recalls for the control group, consequently caregivers may not have been motivated to complete the vaccine doses as revealed in this study. Such pools of susceptible children have been implicated in epidemics in the past [11]. Some of the children never came back for scheduled immunisation and these children might remain permanently at risk for vaccine preventable diseases.

**Table 2. Socio-demographic characteristics of infants in the study and control groups**

Variables	Intervention (n=145) Freq. (%)	Control (n=145) Freq. (%)	$\chi^2$	p-value
<b>Sex</b>				
Male	73 (50.3)	72 (49.7)	0.01	0.90
Female	72 (49.7)	73 (50.3)		
<b>Age group (weeks)</b>				
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)		
<b>Vaccines received at recruitment</b>				
BCG, OPV0, HB0	125 (86.2)	121 (83.4)	0.42	0.51
OPV1, PENTA1, PCV1	20 (13.8)	24 (16.6)		

**Table 3. Within group comparison between Sex of infants and immunisation drop-out post-intervention**

Variables	Intervention group (n=145) Immunisation drop-out				Control group (n=145) Immunisation drop-out			
	Yes Freq. (%)	No Freq. (%)	Total	$\chi^2$ (p-value)	Yes Freq. (%)	No Freq. (%)	Total	$\chi^2$ (p-value)
<b>Sex of infants</b>								
Male	3 (4.1)	70 (95.9)	73 (100)	FT (0.49)	15 (20.8)	57 (79.2)	72 (100)	0.12 (0.72)
Female	5 (6.9)	67 (93.1)	72 (100)		17 (23.3)	56 (76.7)	73 (100)	

FT=Fisher's exact test

**Table 4. Effect of mobile phone reminders and recall on Penta-valent vaccines drop-out 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)
<b>Number who dropped-out vaccines</b>						
Yes	145 (35.7)	8 (5.5)	<0.01*	134 (47.7)	32(22.1)	0.02*
No	261 (64.3)	137(94.5)		147 (52.3)	113(77.9)	
<b>Number who dropped-out each vaccine</b>						
OPV3	147 (36.2)	8 (5.5)	<0.01*	134(47.7)	32(22.1)	0.02*
Penta3	145 (35.7)	8 (5.5)	<0.01*	134(47.7)	32(22.1)	0.02*
PCV3	152 (37.4)	8 (5.5)	<0.001*	136(48.4)	32(22.1)	0.02*
<b>Drop-out rate</b>	35.7%	5.5%		47.7%	22.1%	0.01*

\*Statistically significant. McNemar  $\chi^2$  was used for this comparison

**Table 5. Predictors of immunisation drop-out post intervention**

Variables	Immunisation drop-out Control group		
	AOR	95% CI of AOR	P-value
<b>Marital status</b>			
Not married	1		
Married	4.31	-0.89-10.51	0.09
<b>Educational status</b>			
<Secondary	1		
≥Secondary	0.79	-0.39-1.61	0.59
<b>Far distance to health facility</b>			
No	1		
Yes	2.78	1.47-6.76	0.05**

AOR = adjusted odd ratio

\*\*Predictor

A comparable proportion of females (6.9%) and male infants (4.1%) dropped-out of vaccination post intervention. Similarly, a comparable proportion of female (23.3%) and male (20.8%) infants in the control group dropped-out of vaccination at the end of the study. This finding is consistent with a study in Umuahia, Nigeria where the drop-out rate was virtually the same for both male (51%) and female (49%) [12]. Increase in dropout rate among the control group demonstrates higher risk of attack of this pool of infants by vaccine preventable diseases. Low immunisation coverage puts a substantial number of children at risk of death and disability from vaccine preventable diseases [9]. It, therefore, demonstrated equal parental love and care for male and female children in the present day society.

It is also interesting to note that this study demonstrated average drop-out in both males

and females infants with that of the males being marginally lower though not statistically significant. The magnitude of its public health importance cannot be over-emphasised. For every child recalled for immunisation, so much has been done to prevent disease, morbidity and mortality in that child, prevent disabilities as well as disease transmission to many others who might have gotten infected through the child and also boosting herd immunity [12].

This study found mobile phone call reminders and recalls very effective in reducing childhood immunisation drop-out. A Pennsylvanian pilot study using phone recall showed that the health providers traced and recalled about 50% of overdue infants and brought them up-to-date for immunization [13]. A Cochrane review found that patient reminder/recall systems were effective in improving immunisation rates in 33 of 41 studies.

Increased immunisation rates due to reminders were in the range of 5 to 20% [1].

A study carried out in Northwest India reported that in overall, the telephone reminder did not show more effectiveness than provider recommendation as a trigger for immunisation. This is due to high knowledge and awareness of the importance of immunisation by caregivers even without reminders in that setting. Although a higher proportion of patients immunised during the project reported telephone reminder as the intervention triggering vaccine acceptance, there was no significant difference in the proportion of respondents between interventions (54.89% of patients reported telephone reminder, 45.11% reported provider recommendation). Again, the telephone reminder did not show more effectiveness than provider recommendation for any race, gender, age, or number of years in practice. Obviously more patients (80%) immunised during a physician visit reported the telephone reminder as the main trigger for vaccine acceptance compared to 20% that reported provider recommendation [14].

Factors that led to immunisation drop-out in the control group were marital status, far distance to health facility and educational status. Multivariable analysis with binary logistic regressions showed that far distance to health facility was a predictor of immunisation drop-out in the control group. There was no predictor of immunisation drop-outs in the intervention group at a cut off of 0.1 (90%).

## 5. CONCLUSIONS

Mobile phone reminders and recall has proven very effective in reducing pentavalent vaccines drop-outs in Abakaliki. Implementation of immunisation reminders and recall systems are therefore recommended in immunisation clinics in developing countries especially in Nigeria for improved immunisation coverage in order to achieve Sustainable Developmental Goal 3 (SDG 3).

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

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

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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