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

Abstract

Background: Immunization drop-out rate measures the effectiveness of the immunization programme. When drop-outs exceed 10 percent it indicates a problem of utilization of services. Receipt of vaccines at the recommended ages and intervals will ensure that children are adequately protected from target diseases at all times. Immunization reminder and recall (RR) systems are cost-effective methods of improving adherence to recommended immunization schedules. This study therefore determined the effect of immunization 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 control group. Sample size was 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 immunization visit and followed till the final scheduled immunization 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 vaccinnation 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 immunization drop-out in the control group. It is 2.8 times more likely to cause immunization 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 immunization reminders and recall systems are therefore recommended in immunization clinics in developing countries especially in Nigeria for improved immunization coverage in order to achieve Sustainable Developmental Goal 3 (SDG 3).

Keywords: Phone reminders and recall, pentavalent vaccines, drop-out rate, infants, Abakaliki

Introduction

Immunization drop-out and coverage rates at primary health care (PHC) level indicate the level at which communities utilize the preventive services and thus serve as a measure of the strength of the public health system. They also measure the effectiveness of the immunization programme[1]. Immunization drop-outs refer to infants who have used or missed immunization services and do not return for subsequent vaccinations[1]. When drop-outs exceed 10 percent, it indicates a problem of utilization of services[1]. In most settings where full immunization 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].

Immunization 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 immunization clinic or physician's office for its completion. It is a cost-effective method of improving adherence to recommended immunization schedules[2,3]. Reminder system tracks future immunization appointments, whereas recall system tracks missed immunization appointments and prompts clients to return to the clinic to catch up on needed overdue immunisations[2]. A "reminder" is the postcard, letter, short message services [SMS] or telephone call reminding clients of immunizations before they are due. A "recall" is the postcard, letter, short message services or telephone call after clients miss an immunization appointment or when an individual has fallen behind on scheduled immunizations 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 immunization schedules as the number of subscribers' increase[3]. Different methods exist such as chart reminders, mail reminders, postcards, telephone calls, SMS, home visits, computerized immunization 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 utilize 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 immunization uptake with decreasing expectations about the performance of primary health care system. Consequently low immunization coverage and high childhood immunization 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 immunization reminders and recalls on pentavalent vaccines drop-outs in Abakaliki.

Materials and Methods: This is a quasi-experimental study among mothers/caregivers accessing childhood immunization 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 immunization reminders to keep future immunization dates and immunization recalls for missed immunization dates. Phone calls were made 24-48 hours prior to next appointment date reminding the parents/caregivers that immunization 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 penta-valent vaccines, data on immunization drop-out was extracted from immunization 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 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.

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. The difference in the proportion for gender in the two groups was not statistically significant (p=0.90).

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 immunization drop-outs in the intervention group. More female infants also had immunization drop-outs in the control group. The difference in their proportions was not significant (p>0.05).

Table 4 below 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 below, far distance to health facility was a predictor of immunization drop-out in the control group. It is 2.8 times more likely to cause immunization drop-out than near distance to health facility.

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

Variables	**Intervention (n=145) Freq. (%)**	**Control (n=145) Freq. (%)**	χ^2	**p-value**
Sex				
Male	5 (3.4)	4 (2.8)	**FT**	0.73
Female	140 (96.6)	141 (97.2)		
Age group (years)				
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)		
Marital status				
Married	137 (94.5)	134 (92.4)	2.44	0.69
Single	8 (5.5)	11 (7.5)		
Education				

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)		
Employment				
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)		
Religion				
Christianity	142 (97.9)	143 (98.6)	**FT**	1.00
Others	3 (2.1)	2 (1.4)		

FT= Fisher's exact test

Table 2: 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				
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 immunization drop-out post-intervention

Variables	**Intervention group (n=145) Immunization drop-out**				**Control group (n=145) Immunization drop-out**			
	Yes Freq. (%)	**No Freq. (%)**	**Total**	**χ^2 (p-value)**	**Yes Freq. (%)**	**No Freq. (%)**	**Total**	**χ^2 (p-value)**
Sex of infants								
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)
Number who dropped-out vaccines						
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)	
Number who dropped-out each vaccine						
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*
Drop-out rate	35.7%	5.5%		47.7%	22.1%	0.01*

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

Table 5: Predictors of immunization drop-out post intervention

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

AOR = adjusted odd ratio

**Predictor

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 immunization 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 immunization and these children might remain permanently at risk for vaccine preventable diseases.

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 immunization 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-emphasized. For every child recalled for immunization, 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 immunization 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 immunisation[13]. A Cochrane review found that patient reminder/recall systems

were effective in improving immunization rates in 33 of 41 studies. Increased immunization 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 immunization. This is due to high knowledge and awareness of importance of immunization by caregivers even without reminders in that setting. Although a higher proportion of patients immunized 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%) immunized 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 immunization 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 immunization drop-out in the control group. There was no predictor of immunization drop-outs in the intervention group at a cut off of 0.1 (90%).

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

Ethical approval:

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

Consent: NA

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