

1 **Implementation of Mobile phone Reminder System to Improve Immunisation Uptake in**
2 **Abakaliki, Southeast, Nigeria: Its feasibility and acceptability**

3
4
5 **Abstract**

6 **Background:** Reminder systems are effective ways to improve childhood immunisation
7 coverage, but feasibility of its implementation in rural health facilities in Nigeria has not been
8 adequately evaluated. This study therefore described the feasibility and acceptability of
9 childhood immunisation reminder implementation in rural health facilities in Southeast
10 Nigeria.

11 **Materials and Methods:** This is a descriptive analytical report of a non-randomized control
12 study in rural health facilities in Abakaliki, Nigeria. Mile-Four and St. Vincent hospitals in
13 Izzi and Ebonyi Local Government Areas (LGA) of Ebonyi State were selected purposively.
14 Mile-Four was assigned the phone reminder/recall intervention group and St. Vincent as
15 control group. Sample size was determined using the formula for comparing two proportions.
16 Caregiver-child pair was enrolled into the two groups during the infants' BCG or Pentavalent
17 vaccines 1 immunisation visit and followed till the final scheduled immunisation visit for
18 each child. Data were collected using questionnaire, proforma and checklist. Statistical
19 Package for Social Science (SPSS) version 22 was used for analysis. Ethical approval was
20 obtained from the Research and Ethics Committee (REC) of the Federal Teaching Hospital
21 Abakaliki (FETHA), Nigeria.

22 **Results:** A total of 290 caregiver-child pairs (145 in each group) participated in the study. All
23 caregivers had access to their own mobile phone or that belonging to a spouse. All the
24 caregivers in intervention group showed willingness to record their phone numbers and
25 receive immunisation reminders and recalls while 95.2% and 96.6% of the respondents in the
26 control group showed willingness to record their phone numbers and receive reminders and
27 recalls respectively. Out of the 495 reminders and recalls made, 84.4% (418) went through
28 and were answered by recipients. Appointment compliance rate in the intervention group
29 were 91.7%, 91.7% and 91.1% for 6th, 10th and 14th week respectively when compared with
30 95.9%, 93.1% and 77.9% for 6th, 10th and 14th week respectively in the control group, a
31 difference that was significant in the 14th week (p=0.04)

32 **Conclusion:** Mobile phone reminder (interventions) to improve compliance and uptake of
33 routine childhood immunisations are feasible in rural health facilities in Nigeria. Further
34 research to test the potential for scale up in urban setting is recommended.

35
36 **Keywords:** Childhood, Immunisation uptake, Phone reminders, Feasibility and acceptability,
37 Abakaliki

38
39
40 **Introduction**

41 Immunisation is one of the most effective public health interventions that prevents
42 debilitating childhood illnesses and disabilities and saves millions of lives yearly¹. Despite
43 this, vaccine-preventable diseases (VPDs) constitute about a quarter of the eight million
44 annual deaths among children under five children especially in low-income countries² and
45 poor compliance to immunisation schedules and completion of recommended vaccinations

46 have been found to limit the effectiveness of vaccination³. Globally, about 22 million infants
47 are not fully immunised with routine vaccines and more than 1.5 million children less than
48 five years of age die from vaccine preventable diseases⁴

49 Fourteen percent of all incompletely vaccinated children globally live in Nigeria⁵.
50 Compliance to and completion of recommended routine vaccines among children in Nigeria
51 is sub-optimal with more than 3.2 million children aged 12 months old unimmunized, leading
52 to outbreaks of VPDs across the country. Effective and novel strategies are therefore required
53 to meet the WHO recommended 95% level for the sustained control of VPDs and reduce
54 under-five mortality.

55 Immunisation reminders are effective methods of improving adherence to recommended
56 immunisation schedules⁶⁻⁸. Immunisation reminder and recall systems are cost-effective
57 methods whereby infants are reminded of future immunisation appointments or those who
58 had come for vaccination but fail to continue or come for subsequent vaccinations are
59 identified and contacted to come to the immunisation clinic or physician's office for its
60 completion. Because many caregivers cannot remember the immunisation schedule, public
61 health physicians/immunisation providers need to take measures to ensure that their clients
62 receive immunisations on a timely basis. However, the feasibility of mobile phone
63 reminder/recall implementation in rural areas in low-resource settings, such as Nigeria, has
64 not been adequately evaluated. Therefore this study determined its feasibility and
65 acceptability.

66

67 **Materials and Methods:** This is a descriptive analytical report of a non-randomized control
68 study among Caregivers of infants accessing immunisation services in rural health facilities
69 in Abakaliki, Nigeria. Mile-Four and St. Vincent hospitals in Izzi and Ebonyi Local
70 Government Areas (LGA) of Ebonyi State were selected purposively. Mile-Four was
71 assigned the mobile phone reminder/recall intervention group and St. Vincent as control
72 group. Sample size was determined using the formula for comparing two proportions^{9,10}.
73 Caregiver-child pair was enrolled into the two groups during the infants' BCG or Pentavalent
74 vaccines 1 immunisation visit. Caregivers in the intervention group received mobile phone
75 calls 48-24 hours before the appointment date reminding them to bring their children for
76 scheduled immunisations in Mile-Four at that given date. Caregiver-child pair was followed
77 up till the final scheduled immunisation visit for each child. The intervention lasted for 3
78 months. Data were collected using semi-structured interviewer administered questionnaire
79 from 145 caregiver-child pair from each group selected using systematic random sampling

80 technique. Statistical Package for Social Science (SPSS) version 22 was used for analysis.
 81 Chi-squared test was used for association with significance level set at $p < 0.05$ and
 82 confidence level at 95%. Ethical approval was obtained from the Research and Ethics
 83 Committee (REC) of the Federal Teaching Hospital Abakaliki (FETHA), Ebonyi State,
 84 Nigeria. Informed consent was obtained from the parents/caregivers after full explanation of
 85 purpose of the study to them. Only those parents/caregivers who gave their consent by
 86 signing the informed consent form participated in the study.

87

88 **Results:** A total of 290 caregiver-child pairs (145 in each group) participated in the study.
 89 All caregivers had access to their own mobile phone or that belonging to a spouse. All the
 90 caregivers in intervention group showed willingness to record their phone numbers and
 91 receive immunisation reminders and recalls while 95.2% and 96.6% of the respondents in the
 92 control group showed willingness to record their phone numbers and receive reminders and
 93 recalls respectively. Out of the 495 reminders and recalls made, 84.4% (418) went through
 94 and were answered by recipients. Appointment compliance rate (measured as the percentage
 95 of children correctly following immunization schedule) in the intervention group were
 96 91.7%, 91.7% and 91.1% for 6th, 10th and 14th week respectively when compared with 95.9%,
 97 93.1% and 77.9% for 6th, 10th and 14th week respectively in the control group, a difference
 98 that was significant in the 14th week ($p=0.04$)

99

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

101

Variables	Mile-Four (n=145) Freq. (%)	St.Vincent (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)			6.38	0.16
15-19	11 (7.6)	9 (6.2)		
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			2.44	0.69
Married	137 (94.5)	134 (92.4)		
Single	8 (5.5)	11 (7.5)		
Education			3.67	0.15
Primary	10 (6.8)	17 (11.7)		
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)		

102 FT= Fisher's exact test

103

104

105 **Table 2: Respondents' attitude towards immunisation reminders and recalls**

106

Variables	Intervention group (n=145) Freq. (%)	Control group (n=145) Freq. (%)	χ^2
Number willing to record phone numbers for reminders and recalls			
Yes	145 (100.0)	138 (95.2)	FT
No	0 (0.0)	7 (4.8)	
Number willing to receive reminders and recalls			
Yes	145 (100.0)	140 (96.6)	FT
No	0 (0.0)	5 (3.4)	

107

108 **Table 3: Mobile phone reminder implementation among intervention group (n=145)**

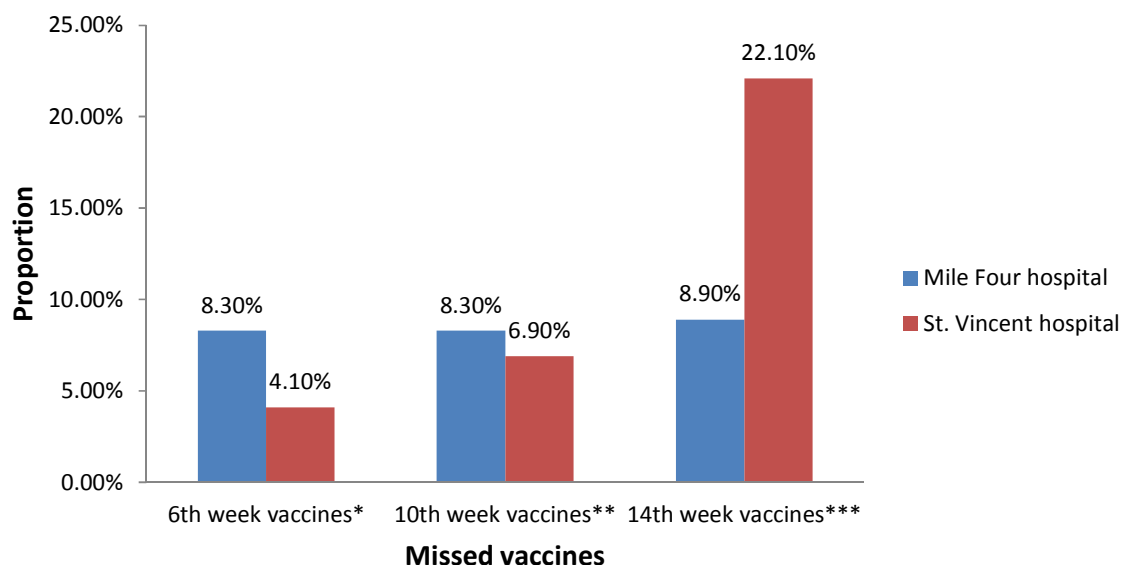
Phone activity	Yes		No	
	No (Freq.)	%	No (Freq.)	%
Call went through for Pentavalent vaccines 1	142	97.9	3	2.1
Call answered for pentavalent vaccines 1	139	95.9	6	4.1
Call went through for Pentavalent vaccines 2	144	99.3	1	0.7
Call answered for pentavalent vaccines2	141	97.2	4	2.8
Call went through for Pentavalent vaccines 3	140	96.6	5	3.4
Call answered for pentavalent vaccines 3	138	95.2	7	4.8

109

110

111

112



113
114

115 Figure 1: Proportion of infants who missed each vaccine on each schedule

116 *OPV1, Pentavalent1 and PCV1

117 **OPV2, Pentavalent2 and PCV2

118 ***OPV3, Pentavalent3 and PCV3

119 Figure 1 shows the proportion of respondents who missed each vaccine in both groups. A

120 greater proportion of respondents in the intervention group (8.3%) missed vaccination at the
121 6th and 10th weeks compared to the control group, a difference in proportion that was

122 statistically significant ($p=0.02$). In the control group, a greater proportion missed vaccination

123 more than the intervention group at the 14th week, a difference in proportion that was also

124 significant ($p=0.04$).

125 Discussion

126 Respondent's attitude towards immunisation reminders in both groups showed that almost all

127 the caregivers were willing to record their phone numbers and receive immunisation

128 reminders in the clinic. Respondents' willingness to record phone numbers and receive

129 reminders in the immunisation clinic is essential to implementation and execution of

130 immunisation reminders and recall system¹¹. These ultimately will lead to improved

131 immunisation coverage¹¹. This finding is consistent with that in Ibadan where 97.9% showed

132 willingness to record their cellphone numbers at the immunisation clinics and 95.1% willing

133 to receive reminder and recall information about their children's immunisation¹². In Kansas,

134 USA, most respondents (85%) showed willingness to implement a text message reminder

135 system given the appropriate resources¹³. More positive attitude towards immunisation

136 reminders and recalls is expected of respondents in Kansas's study where literacy level and
137 awareness are both higher compared to Abakaliki, Nigeria. However, this comparably higher
138 positive attitude in the present study may be as a result of caregiver's enthusiasm to keep to
139 timeliness of immunisation in order improve immunisation uptake and coverage and
140 consequently avoid or reduce vaccine preventable diseases. It is also similar to studies in
141 Lagos and Benin in Nigeria that reported mothers' willingness to receive immunisation
142 reminders and recalls^{11,14}. This report is comparably higher than the 77% who showed
143 willingness to receive future reminders about childhood immunisations in the quantitative
144 and qualitative studies in USA¹⁵. It also showed a wide support and acceptability for short
145 message service as a mode of immunisation reminder and recall system¹⁵. It was found that
146 person to person telephone reminder has also been preferred by parents in studies in USA¹⁶
147 and elsewhere¹¹. It is possible that mothers who preferred cellphone call reminders in that
148 study may have done so because they are likely to have the opportunity to express themselves
149 if they plan to attend their children scheduled immunisation clinic or request to change
150 appointment date if they cannot attend for any reason¹¹. However, it was found in a previous
151 study in USA that parents aged 30 years and above preferred e-mail for reminder¹⁶. About
152 three-quarters (77%) showed willingness to receive future reminders about childhood
153 immunisations and that was consistent with findings in the quantitative and qualitative studies
154 done in the USA¹⁵.

155 In Ibadan, Nigeria, significantly high proportion of respondents (97.9%) showed willingness
156 to record their cellphone numbers at the immunisation clinics for reminder and receive
157 reminder and recall information about their children's immunisation (95.1%). Significantly
158 high proportion (95.6%) believed that adherence to immunisation schedule is important. In
159 this study, mothers' willingness to receive immunisation reminder and recall is similar to the
160 findings in Lagos and Benin in Nigeria^{11,14}.

161 **Conclusion**

162 Implementation of mobile phone reminder to improve compliance and uptake of routine
163 childhood immunisations are feasible in rural health facilities in Nigeria. Almost all the
164 caregivers were willing to record their phone numbers and receive immunisation reminders
165 and recalls in both groups. Communication about vaccination involves more than the
166 message but is also influenced by the environment and the attitudes of the deliverer and
167 receiver. It is pertinent for health policy makers and programme managers to understand
168 these factors when implementing immunisation communication system.

169

170 **References**

- 171 1. Andre FE, Booy R, Bock HL, Clemens J, Datta SK, John TJ, Lee BW, Lolekha S,
172 Peltola H, Ruff TA, Santosham M, Schmitt HJ. Vaccination greatly reduces disease,
173 disability, death and inequity worldwide. *Bull World Health Organ.* 2008;86 (2):140–
174 6.
175
- 176 2. United Nations Children’s Fund (UNICEF). Levels and trends in child mortality
177 report 2011: estimates developed by the United Nations interagency group for child
178 mortality estimation. New York, USA: UNICEF; 2011:3–
179 5. http://www.unicef.org/media/files/Child_Mortality_Report_2011_Final.pdf.
180 Accessed 17th May 2017
- 181 3. National Center for Immunization and Respiratory Diseases. General
182 recommendations on immunization: recommendations of the advisory committee on
183 immunization practices (ACIP). *MMWR Recomm Rep.* 2011;60 (2):1–64.
184
- 185 4. World Health Organization. World immunization week 2013: protect your world - get
186 vaccinated: origins the campaign, public health context. Switzerland: WHO; 2013.
187 [http://www.who.int/campaigns/immunizationweek/](http://www.who.int/campaigns/immunizationweek/2013/en/index.html) 2013/en/index.html. Accessed 13
188 July 2017
- 189 5. Centers for Disease Control and Prevention. Global routine vaccination coverage,
190 2011. *MMWR Morb Mortal Wkly Rep.* 2012;61(43):883–5.
- 191 6. Jeffrey DS. From Millennium Development Goals to Sustainable Development Goals
192 *Lancet* 2012; 379: 2206–11
- 193 7. World Health Organisation (WHO). Nigeria launches penta vaccine.
194 [http://www.afro.who.int/en/nigeria/press-materials/item/4735-nigeria-launches-penta-](http://www.afro.who.int/en/nigeria/press-materials/item/4735-nigeria-launches-penta-vaccine.html)
195 [vaccine.html](http://www.afro.who.int/en/nigeria/press-materials/item/4735-nigeria-launches-penta-vaccine.html). Accessed August 27, 2015
- 196 8. Nnonyelu AN, Nwankwo IU. Social determinants of differential access to health
197 services across five states South-East Nigeria. *Europ. Scientific J.* 2014
198 Sept;/SPECIAL/edition vol 3: 1857-7881
- 199 9. Araoye MO. Research methodology with statistics for health and social sciences. Ist
200 Edition. Ilorin: Natadex. 2003:69,107,118-122
- 201 10. Onwasigwe CN. Principles and methods of epidemiology. 2nd Edition. Enugu: EL
202 Demark publishers. 2010:147-148.
- 203 11. Balogun MR, Sekoni AO, Okafor IP, Odukoya OO, Ezeiru SS, Ogunnowo BE,
204 Campbell PC. Access to information technology and willingness to receive text
205 message reminders for childhood immunisation among mothers attending a tertiary
206 facility in Lagos, Nigeria. *Afr JCH.* 2012; 6(3):76-80. DOI:10.7196/SAJCH.439
- 207 12. Brown VB, Oluwatosin A, Ogundeji MO. Experiences, perceptions and preferences
208 of mothers towards childhood immunisation reminder/recall in Ibadan, Nigeria: a
209 cross-sectional study. *The Pan Afr. Medical J.* 2015;20:243
- 210 13. Luman ET, Barkar LE, Shaw KM et al. Timeliness of Childhood vaccinations in the
211 United States: days under vaccinated and number of vaccines delayed. *JAMA.* 2005;
212 293: 1204-11
- 213 14. Sadoh AE, Okungbowa E. Nigerian mothers opinion of reminder/recall for
214 immunisation. *Nig J Pediatr.* 2014; 41 (1):38-42.
- 215 15. Kharbanda EO, Stockwell MS, Fox HW, Rickert VI. Text4Health: A qualitative
216 evaluation of parental readiness for text message immunisation reminders. *Am J*
217 *Public Health.* 2009; 99(12):2176-8

- 218 16. Clark SJ1, Butchart A, Kennedy A, Dombkowski KJ. Parents' experiences with and
219 preferences for immunisation reminder/recall technologies. *Pediatrics*. 2011;
220 128(5):100-5.