

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

3
4
5 **Abstract**

6 **Background:** Reminder systems are effective ways to improve childhood immunization
7 coverage, but feasibility of its implementation in rural health facilities in Nigeria has not been
8 adequately evaluated. This study therefore determined the feasibility and acceptability of
9 childhood immunization 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 Ebonyi and Izzi Local Government Areas (LGA) of Ebonyi State respectively were selected
14 purposively. Mile-Four was assigned the phone reminder/recall intervention group and St.
15 Vincent as control group. Sample size was determined using the formula for comparing two
16 proportions. Caregiver-child pair was recruited in the health facilities and enrolled into the
17 two groups during the infants' BCG or Pentavalent vaccines 1 immunization visit and
18 followed till the final scheduled immunization visit for each child. Data were collected using
19 questionnaire, proforma and checklist. Statistical Package for Social Science (SPSS) version
20 22.0 was used for analysis. Ethical approval was obtained from the Research and Ethics
21 Committee (REC) of the Federal Teaching Hospital 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 immunization 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 immunizations 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:** Implementation, Phone reminders, Immunization uptake, Feasibility and
37 acceptability, Abakaliki

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40 **Introduction**

41 Immunization 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 immunization 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 immunized 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 Immunization reminders are effective methods of improving adherence to recommended
56 immunization schedules⁶⁻⁸. Immunization reminder and recall systems are cost-effective
57 methods whereby caregivers are reminded of future immunization 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 immunization clinic or physician's office for its
60 completion. Because many caregivers cannot remember the immunization schedule, public
61 health physicians/immunization providers need to take measures to ensure that their clients
62 receive immunizations 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 immunization 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 recruited in the health facilities and enrolled into the two groups
74 during the infants' BCG or Pentavalent vaccines 1 immunization visit. Only caregivers in the
75 intervention group (all had access to cell phone) received mobile phone calls 48-24 hours
76 from the researcher before the appointment date reminding them to bring their children for
77 scheduled immunizations at Mile-Four at that given date. Caregiver-child pair was followed
78 up till the final scheduled immunization visit for each child. The intervention lasted for 3
79 months. Data were collected using semi-structured interviewer administered questionnaire

80 from 145 caregiver-child pair from each group selected using systematic random sampling
 81 technique. Data was also collected using proforma and checklist. Statistical Package for
 82 Social Science (SPSS) version 22 was used for analysis. Chi-squared test was used for
 83 association with significance level set at $p < 0.05$ and confidence level at 95%. Ethical
 84 approval was obtained from the Research and Ethics Committee (REC) of the Federal
 85 Teaching Hospital Abakaliki (FETHA), Ebonyi State, Nigeria. Informed consent was
 86 obtained from the parents/caregivers after full explanation of purpose of the study to them.
 87 Only those parents/caregivers who gave their consent by signing the informed consent form
 88 participated in the study.

89
 90 **Results:** A total of 290 caregiver-child pairs (145 in each group) participated in the study.
 91 All caregivers had access to their own mobile phone or that belonging to a spouse. All the
 92 caregivers in intervention group showed willingness to record their phone numbers and
 93 receive immunization reminders and recalls while 95.2% and 96.6% of the respondents in the
 94 control group showed willingness to record their phone numbers and receive reminders and
 95 recalls respectively. Out of the 495 reminders and recalls made, 84.4% (418) went through
 96 and were answered by recipients. Appointment compliance rate (measured as the percentage
 97 of children correctly following immunization schedule) in the intervention group were
 98 91.7%, 91.7% and 91.1% for 6th, 10th and 14th week respectively when compared with 95.9%,
 99 93.1% and 77.9% for 6th, 10th and 14th week respectively in the control group, a difference
 100 that was significant in the 14th week ($p=0.04$).

101

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

103

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)				
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)		

104 FT= Fisher's exact test

105

106

107 **Table 2: Respondents' attitude towards immunization reminders and recalls**

108

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)	

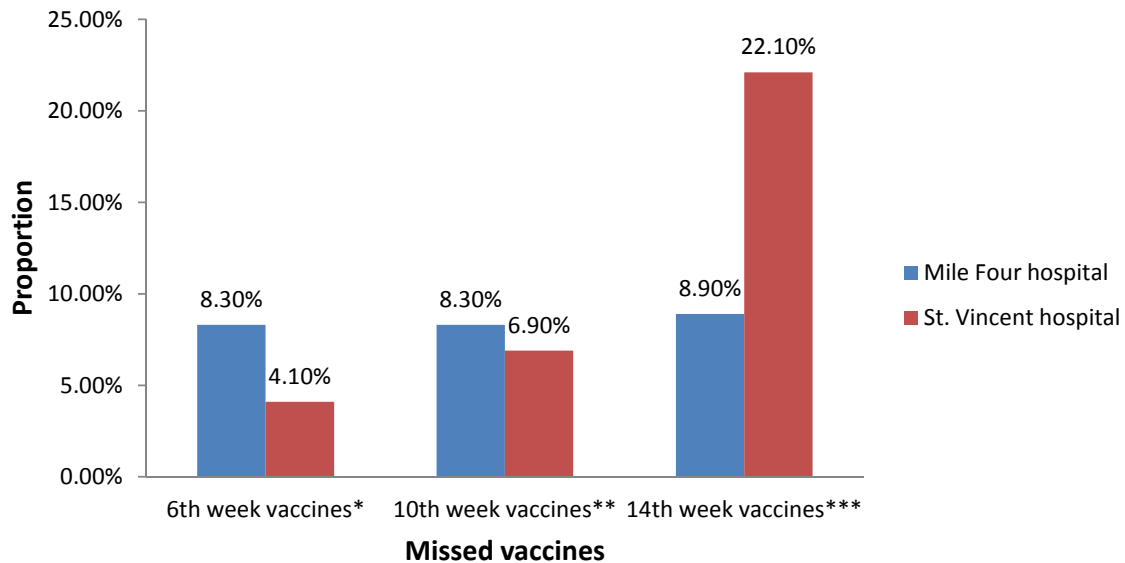
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110 **Table 3: Mobile phone reminder implementation among intervention group (n=145)**

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

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

118 *OPV1, Pentavalent1 and PCV1
119 **OPV2, Pentavalent2 and PCV2
120 ***OPV3, Pentavalent3 and PCV3

121 Figure 1 shows the proportion of respondents who missed each vaccine in both groups. A
122 greater proportion of respondents in the intervention group (8.3%) missed vaccination at the
123 6th and 10th weeks compared to the control group, a difference in proportion that was
124 statistically significant ($p=0.02$). In the control group, a greater proportion missed vaccination
125 more than the intervention group at the 14th week, a difference in proportion that was also
126 significant ($p=0.04$).

127 Discussion

128 Respondent's attitude towards immunization reminders in both groups showed that almost all
129 the caregivers were willing to record their phone numbers and receive immunization
130 reminders in the clinic. Respondents' willingness to record phone numbers and receive
131 reminders in the immunization clinic is essential to implementation and execution of
132 immunization reminders and recall system¹¹. This ultimately will lead to improved
133 immunization coverage¹¹. This finding is consistent with that in Ibadan where 97.9% showed
134 willingness to record their cellphone numbers at the immunization clinics and 95.1% willing
135 to receive reminder and recall information about their children's immunisation¹². In Kansas,
136 USA, most respondents (85%) showed willingness to implement a text message reminder

137 system given the appropriate resources¹³. More positive attitude towards immunization
138 reminders and recalls is expected of respondents in Kansas's study where literacy level and
139 awareness are both higher compared to Abakaliki, Nigeria. However, this comparably higher
140 positive attitude in the present study may be as a result of caregiver's enthusiasm to keep to
141 timeliness of immunization in order improve immunization uptake and coverage and
142 consequently avoid or reduce vaccine preventable diseases. It is also similar to studies in
143 Lagos and Benin in Nigeria that reported mothers' willingness to receive immunization
144 reminders and recalls^{11,14}. This report is comparably higher than the 77% who showed
145 willingness to receive future reminders about childhood immunizations in the quantitative
146 and qualitative studies in USA¹⁵. It also showed a wide support and acceptability for short
147 message service as a mode of immunization reminder and recall system¹⁵. It was found that
148 person to person telephone reminder has also been preferred by parents in studies in USA¹⁶
149 and elsewhere¹¹. It is possible that mothers who preferred cellphone call reminders in that
150 study may have done so because they are likely to have the opportunity to express themselves
151 if they plan to attend their children scheduled immunization clinic or request to change
152 appointment date if they cannot attend for any reason¹¹. However, it was found in a previous
153 study in USA that parents aged 30 years and above preferred e-mail for reminder¹⁶. About
154 three-quarters (77%) showed willingness to receive future reminders about childhood
155 immunizations and that was consistent with findings in the quantitative and qualitative
156 studies done in the USA¹⁵.

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

163 In this study, the lower compliance rate recorded at the 14th week of immunization schedule
164 in the control group when compared with the intervention group might be as result of reduced
165 outreach campaign in the area.

166 Nigeria is a country with a huge equity gap related to immunization. The families in the
167 richest wealth quintile are several times more likely to be immunized than those in the
168 poorest quintile. Immunization reminders if coupled with accessible and reliable services of
169 reasonable quality, could reduce this equity gap as well as improve coverage.

170 **Conclusion**

171 Implementation of mobile phone reminder to improve compliance and uptake of routine
172 childhood immunizations are feasible in rural health facilities in Nigeria. Almost all the
173 caregivers were willing to record their phone numbers and receive immunization reminders
174 and recalls in both groups. Communication about vaccination involves more than the
175 message but is also influenced by the environment and the attitudes of the deliverer and
176 receiver. It is pertinent for health policy makers and programme managers to understand
177 these factors when implementing immunization communication system.

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APPENDIX 2

238 **RESEARCH QUESTIONNAIRE FOR WEST AFRICAN COLLEGE OF PHYSICIAN**
 239 **(WACP) FELLOWSHIP ON IMMUNISATION REMINDER AND RECALL, ITS**
 240 **AWARENESS, PERCEPTION BY PARENTS/CAREGIVERS AND EFFECT ON**
 241 **IMMUNISATION DROP-OUT**

242 Dear Respondents,

243 My name is Dr. Eze Nelson Chibueze and I work at Federal Teaching Hospital Abakaliki.

244 I am carrying out a study on the above subject matter. Any information you provide will be
 245 treated with absolute confidentiality and will neither be disclosed to other persons nor be used
 246 against you in any way. Thank you for your time.

247 **SECTION A: Socio-demographic data**

248 **Caregiver**

249 1. Participant code -----

250 2. Sex: Male [] Female []

251 3. Age at last birthday ----- years

252 4. Marital status (a) Single [] (b) Married [] (c) Separated [] (d) Widowed []

253 (

Type of vaccine e	Age received (in
----------------------	------------------------

255)

256

257 D

258 i

259 vorced []

260 5. Level of formal education completed? (a) None [] (b) Primary [] (c) Secondary [

261] (d) Tertiary []

262 6. Employment status (a) Paid employment [] (b) Self-employed []

263 (c) Unemployed []

264 7. Religion (a) Christianity [] (b) Islam [] (c) Others (specify) -----

265 8. Number of children under five years old

266 9. Immunisation status of children under five years old (Please tick as appropriate)

267

Child's code	Completely immunized	Incompletely immunized
1		
2		
3		
4		

268

269 **Child**

270 10. Age in completed weeks -----

271 11. Sex (a) Male [] (b) Female []. Child's name -----

272 12. Immunisations received

273		weeks
274	SEC	or
275	TIO	months)
276	N B:	

277 **Immunisation practice and experience**

278 13. Has your child ever missed an immunisation appointment? Yes [] No [] (*If*
 279 *'No' please move to Q16*)

280 14. How many times has s/he missed an appointment?

- 281 15. What was/were the reason/s for the missed appointments?
 282 a. I did not remember the date []
 283 b. We travelled []
 284 c. I had to go to work/farm/market []
 285 d. There was no money to pay for transport/hospital fees []
 286 e. S/he was sick []
 287 f. We had other engagements []
 288 g. The hospital was not open []
 289 h. Others (pls specify)

290 16. What challenges do you face in bringing your child for immunisation

- 291 a. Distance to health facility is far []
 292 b. Transport fare is expensive []
 293 c. Time of immunisation is not convenient []
 294 d. Very busy work schedule []
 295 e. Other (pls specify)

296 ***For questions 17 to 30, please enter '1' if response is 'Yes' and '0' if response is 'No'***

297 17. Has your child ever missed an immunisation because you did not have money for
 298 transport? []

299 18. Has your child ever missed an immunisation because you forgot the date? []

300 19. Has your child ever missed an immunisation because you travelled? []

301 20. Has your child ever missed an immunisation because you were busy with work?[]

- 302 21. Has your child ever missed an immunisation because you were afraid s/he would
303 react to the antigen/vaccine? []
- 304 22. Has your child ever missed an immunisation because you didn't feel like coming
305 to the health facility on that day? []
- 306 23. Has your child ever missed an immunisation because you heard or were told the
307 vaccine does not work? []
- 308 24. Has your child ever missed an immunisation because you did not know where to
309 take him/her? []
- 310 25. Has your child ever missed an immunisation because you were not told when s/he
311 should come for the next dose? []
- 312 26. Has your child ever missed an immunisation because the vaccine was not
313 available? []
- 314 27. Has your child ever missed an immunisation because the health worker was not
315 around to give the vaccine? []
- 316 28. How long do you have to wait before your child gets vaccinated?
- 317 29. How long did you wait today?
- 318 30. What other challenges do you face when you bring your child for immunisation
319

320 **SECTION C: Awareness, Perception and Attitude towards immunisation**
321 **reminders/recall**

- 322 31. Have you heard of immunisation reminder/recall before? (a) Yes [] (b) No []
323 If yes, have you ever received any? (a) Yes [] (b) No []
- 324 32. What do you think about parents/caregivers being reminded of their child's
325 immunisation appointments before the date? (a) Not necessary [] (b) Necessary []
- 326 33. If response to Q32 is 'Necessary' what are your reasons for saying so?

- 327 a. It will help people not miss their children's appointments []
328 b. It will help people remember their appointment dates []
329 c. People won't have to keep looking at the calendar to remember []
330 d. It will take away the anxiety of meeting up with appointments []
331 e. Others (pls specify).....

332 34. If response to Q32 is 'not necessary' what are your reasons for saying so?

- 333 a. It is expected that everybody should remember their appointment dates []
334 b. It is distracting to receive such calls []
335 c. It is worrisome []
336 d. Others (specify) -----
337

338 35. What do you think about parents/caregivers being recalled for their child's
339 immunisation after they have missed an appointment?(a) Not necessary [] (b)
340 Necessary []

341 36. If response to Q35 is 'Necessary' what are your reasons for saying so?

- 342 a. It will help parents/caregivers comply better with the schedule []
343 b. It will help parents/caregiver to be on alert []
344 c. Others (specify) -----
345

346 37. If response to Q35 is 'not necessary' what are your reasons for saying so?

- 347 a. It is expected that everybody should remember their appointment dates []
348 b. It is distracting to receive such calls []
349 c. It is worrisome []
350 d. Others (specify) -----
351

352 38. What is your opinion about adherence to immunisation schedule?(a) Not
353 important [] (b) Important []

354 39. Are you willing to record your phone number with the immunisation clinic for
355 reminders/recalls? (a) Yes [] (b) No []

356 40. Are you willing to receive immunisation reminders/recalls about your child's
357 immunisation? (a) Yes [] (b) No []

358
359 Caregiver's phone numbers (mother) ----- (father) -----
360

361
362

