

1 **Feasibility and Acceptability Implementation of a Mobile Phone Reminder System to**
2 **Improve Immunization Uptake in Abakaliki, Southeast, Nigeria: Its feasibility and**
3 **acceptability**

4
5
6 **Abstract**

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

12 **Materials and Methods:** This is a descriptive, analytical report of a non-randomized control
13 study in rural health facilities in Abakaliki, Nigeria. Mile-Four and St. Vincent hospitals in
14 Ebonyi and Izzi Local Government Areas (LGA) of Ebonyi State respectively were selected
15 purposively. Mile-Four was assigned the phone reminder/recall intervention group and St.
16 Vincent as a control group. Sample size was determined using the formula for comparing two
17 proportions. Caregiver-child pairs ~~were~~ recruited in the health facilities and enrolled into
18 the two groups during the infants' visit for BCG or first Ppentavalent vaccines ~~—~~
19 ~~immunization visit~~ and followed till the final scheduled immunization visit for each child.
20 Data were collected using questionnaire, proforma and checklist. Statistical Package for
21 Social Science (SPSS) version 22.0 was used for analysis. Ethical approval was obtained
22 from the Research and Ethics Committee (REC) of the Federal Teaching Hospital Abakaliki
23 (FETHA), Nigeria.

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

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

37
38 **Keywords:** Implementation, Phone reminders, Immunization uptake, Feasibility and
39 acceptability, Abakaliki

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42 **Introduction**

43 Immunization is one of the most effective public health interventions that prevents
44 debilitating childhood illnesses and disabilities and saves millions of lives yearly¹. Despite
45 this, vaccine-preventable diseases (VPDs) constitute about a quarter of the eight million

46 | annual deaths among children under five children, especially in low-income countries² and
47 | poor compliance to immunization schedules and completion of recommended vaccinations
48 | have been found to limit the effectiveness of vaccination³. Globally, about 22 million infants
49 | are not fully immunized with routine vaccines, and more than 1.5 million children less than
50 | five years of age die from vaccine-preventable diseases⁴
51 | Fourteen percent of all incompletely vaccinated children globally live in Nigeria⁵.
52 | Compliance to and completion of recommended routine vaccines among children in Nigeria
53 | is sub-optimal, with more than 3.2 million children aged 12 months old unimmunized,
54 | leading to outbreaks of VPDs across the country. Effective and novel strategies are therefore
55 | required to meet the WHO recommended 95% level for the sustained control of VPDs and
56 | reduce under-five mortality.
57 | Immunization reminders are effective methods of improving adherence to recommended
58 | immunization schedules⁶⁻⁸. Immunization reminder and recall systems are cost-effective
59 | methods to identify and remind whereby caregivers are reminded of future immunization
60 | appointments and reminder those who had come for vaccination but fail to continue or come
61 | for subsequent vaccination dates are identified and contacted to come to the
62 | immunization clinic or physician's office for its completion. Because many caregivers cannot
63 | remember the immunization schedule, public health physicians/immunization providers need
64 | to take measures to ensure that their clients receive immunizations on a timely basis.
65 | However, the feasibility of mobile phone reminder/recall implementation in rural areas in
66 | low-resource settings, such as Nigeria, has not been adequately evaluated. Therefore, this
67 | study determined its feasibility and acceptability.

68 |
69 | **Materials and Methods:** This is a descriptive, analytical report of a non-randomized control
70 | study among caregivers of infants accessing immunization services in rural health facilities
71 | in Abakaliki, Nigeria. Mile-Four and St. Vincent hospitals in Izzi and Ebonyi Local
72 | Government Areas (LGA) of Ebonyi State were selected purposively. Mile-Four was
73 | assigned the mobile phone reminder/recall intervention group and St. Vincent as a control
74 | group. Sample size was determined using the formula for comparing two proportions^{9,10}.
75 | Caregiver-child pairs were recruited in the health facilities and enrolled into the two groups
76 | during the infants' visit for BCG or first Ppentavalent vaccination 1 immunization visit.
77 | Only caregivers in the intervention group (all had access to cell phones) received mobile
78 | phone calls 48-24 hours from the researcher before the appointment date reminding them to
79 | bring their children for scheduled immunizations at Mile-Four at that given date. Caregiver-

80 child pair was followed up till the final scheduled immunization visit for each child. The
 81 intervention lasted ~~for three~~3 months. Data were collected using semi-structured, interviewer-
 82 administered questionnaire from 145 caregiver-child pair from each group, selected using
 83 systematic random--sampling technique. Data ~~were~~also collected using a proforma and
 84 checklist. Statistical Package for Social Science (SPSS) version 22 was used for analysis.
 85 Chi-squared test was used for association with significance level set at $p < 0.05$ and
 86 confidence level at 95%. Ethical approval was obtained from the Research and Ethics
 87 Committee (REC) of the Federal Teaching Hospital Abakaliki (FETHA), Ebonyi State,
 88 Nigeria. Informed consent was obtained from the parents/caregivers after full explanation of
 89 purpose of the study to them. Only those parents/caregivers who gave their consent by
 90 signing the informed consent form participated in the study.

91
 92 **Results:** A total of 290 caregiver-child pairs (145 in each group) participated in the study.
 93 All caregivers had access to their own mobile phone or that belonging to a spouse. All the
 94 caregivers in intervention group showed willingness to record their phone numbers and
 95 receive immunization reminders and recalls, while 95.2% and 96.6% of the respondents in
 96 the control group showed willingness to record their phone numbers and receive reminders
 97 and recalls respectively. Out of the 495 reminders and recalls made, 84.4% (418) went
 98 through and were answered by recipients. Appointment compliance rates (measured as the
 99 percentage of children correctly following immunization schedule) in the intervention group
 100 were 91.7%, 91.7% and 91.1% for 6th, 10th and 14th week respectively, ~~when~~ compared with
 101 95.9%, 93.1% and 77.9% for 6th, 10th and 14th week respectively in the control group, a
 102 difference that was significant in the 14th week ($p=0.04$).

103

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

105

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)		

106 FT= Fisher's exact test

107

108

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

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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)	

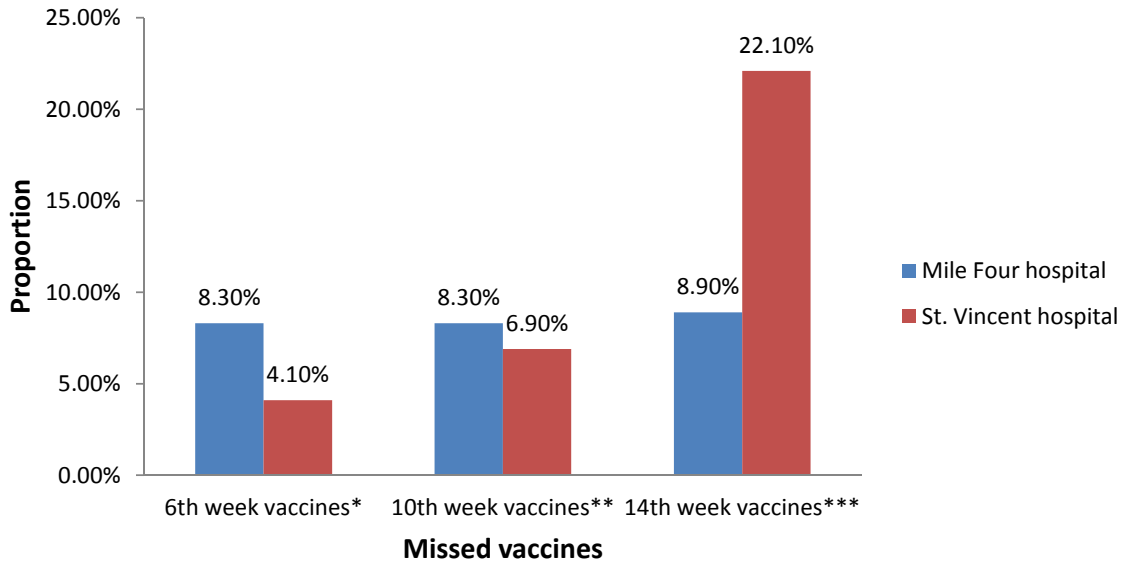
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112 **Table 3: Mobile phone reminder implementation among intervention group (n=145)**

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

Call answered for pentavalent vaccines 3	138	95.2	7	4.8
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119 Figure 1: Proportion of infants who missed each vaccine on each schedule

120 *OPV1, Pentavalent1 and PCV1
121 **OPV2, Pentavalent2 and PCV2
122 ***OPV3, Pentavalent3 and PCV3

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

129 **Discussion**

130 ~~Almost all R~~espondent's ~~attitude towards immunization reminders~~ in both groups ~~showed~~
131 ~~that almost all the caregivers~~ were willing to record their phone numbers and receive
132 immunization reminders in the clinic. Respondents' willingness to record phone numbers and
133 receive reminders in the immunization clinic is essential to implementation and execution of
134 immunization reminders and recall system¹¹. This ultimately will lead to improved
135 immunization coverage¹¹. This finding is consistent with that in Ibadan, where 97.9% showed
136 willingness to record their cellphone numbers at the immunization clinics, and 95.1% were

137 willing to receive reminder and recall information about their children's immunisation¹². In
138 Kansas, USA, most respondents (85%) showed willingness to implement a text message
139 reminder system given the appropriate resources¹³. More positive attitudes towards
140 immunization reminders and recalls ~~is expected~~ of respondents in Kansas's study are not
141 surprising, because both where literacy levels and awareness are ~~both~~ higher ~~compared to~~ than
142 in Abakaliki, Nigeria. However, this comparably higher positive attitude in the present study
143 may be as a result of caregiver's enthusiasm to keep to timeliness of immunization in order
144 improve immunization uptake and coverage and consequently avoid or reduce vaccine-
145 preventable diseases. ~~This~~ is ~~also~~ similar to study findings in Lagos and Benin in Nigeria
146 that reported mothers' willingness to receive immunization reminders and recalls^{11,14}. This
147 report is comparably higher than the 77% who showed a willingness to receive future
148 reminders about childhood immunizations in the quantitative and qualitative studies in
149 USA¹⁵. It also showed a wide support and acceptability for short message service as a mode
150 of immunization reminder and recall system¹⁵. It was found that person-to-person telephone
151 reminders ~~has are~~ also ~~been~~ preferred by parents in studies in USA¹⁶ and elsewhere¹¹. It is
152 possible that mothers who preferred cell phone call reminders in that study may have done so
153 because they are likely to have the opportunity to express themselves if they plan to attend
154 bring their children to a scheduled immunization clinic or request to change an appointment
155 date if they cannot attend for any reason¹¹. However, it was found in a previous study in USA
156 that parents aged 30 years and above preferred e-mail for reminder¹⁶. About three-quarters
157 (77%) showed a willingness to receive future reminders about childhood immunizations,
158 ~~which and that~~ was consistent with findings in the quantitative and qualitative studies done in
159 the USA¹⁵.

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

166 In this study, the lower compliance rate recorded at the 14th week of immunization schedule
167 in the control group when compared with the intervention group might be as result of reduced
168 outreach campaigns in the area.

169 Nigeria is a country with a huge equity gap related to immunization. The families in the
170 richest wealth quintile are several times more likely to be immunized than those in the

171 | poorest quintile. Given that virtually all mothers appear to have access to cell phones,
172 | immunization reminders, if coupled with accessible and reliable services of reasonable
173 | quality, could reduce this equity gap as well as improve coverage.

174 | **-Conclusion**

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

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APPENDIX 2

242 **RESEARCH QUESTIONNAIRE FOR WEST AFRICAN COLLEGE OF PHYSICIAN**
243 **(WACP) FELLOWSHIP ON IMMUNISATION REMINDER AND RECALL, ITS**
244 **AWARENESS, PERCEPTION BY PARENTS/CAREGIVERS AND EFFECT ON**
245 **IMMUNISATION DROP-OUT**

246 Dear Respondents,

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

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

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

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Caregiver

- 1. Participant code -----
- 2. Sex: Male [] Female []
- 3. Age at last birthday ----- years
- 4. Marital status (a) Single [] (b) Married [] (c) Separated [] (d) Widowed []
(e) Divorced []
- 5. Level of formal education completed? (a) None [](b) Primary [](c) Secondary []
(d) Tertiary []
- 6. Employment status (a) Paid employment [] (b) Self-employed []
(c) Unemployed []
- 7. Religion (a) Christianity [](b)Islam [] (c) Others (specify) -----
- 8. Number of children under five years old
- 9. Immunisation status of children under five years old (Please tick as appropriate)

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

266
267
268
269
270

Child

- 10. Age in completed weeks -----
- 11. Sex (a) Male [] (b)Female []. Child's name -----
- 12. Immunisations received

271

272 **SEC**

273 **TIO**

274 **N B:**

275 **Imm**

276 **unisa**

277 **tion**

Type of vaccine	Age received (in weeks or months)

278 **practice and experience**

279 13. Has your child ever missed an immunisation appointment? Yes [] No [] (*If*

280 *'No' please move to Q16)*

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

282 15. What was/were the reason/s for the missed appointments?

283 a. I did not remember the date []

284 b. We travelled []

285 c. I had to go to work/farm/market []

286 d. There was no money to pay for transport/hospital fees []

287 e. S/he was sick []

288 f. We had other engagements []

289 g. The hospital was not open []

290 h. Others (pls specify)

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

292 a. Distance to health facility is far []

293 b. Transport fare is expensive []

294 c. Time of immunisation is not convenient []

295 d. Very busy work schedule []

296 e. Other (pls specify)

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

298 17. Has your child ever missed an immunisation because you did not have money for

299 transport? []

- 300 18. Has your child ever missed an immunisation because you forgot the date? []
- 301 19. Has your child ever missed an immunisation because you travelled? []
- 302 20. Has your child ever missed an immunisation because you were busy with work?[]
- 303 21. Has your child ever missed an immunisation because you were afraid s/he would
- 304 react to the antigen/vaccine? []
- 305 22. Has your child ever missed an immunisation because you didn't feel like coming
- 306 to the health facility on that day? []
- 307 23. Has your child ever missed an immunisation because you heard or were told the
- 308 vaccine does not work? []
- 309 24. Has your child ever missed an immunisation because you did not know where to
- 310 take him/her? []
- 311 25. Has your child ever missed an immunisation because you were not told when s/he
- 312 should come for the next dose? []
- 313 26. Has your child ever missed an immunisation because the vaccine was not
- 314 available? []
- 315 27. Has your child ever missed an immunisation because the health worker was not
- 316 around to give the vaccine? []
- 317 28. How long do you have to wait before your child gets vaccinated?
- 318 29. How long did you wait today?
- 319 30. What other challenges do you face when you bring your child for immunisation
- 320

321 **SECTION C: Awareness, Perception and Attitude towards immunisation**

322 **reminders/recall**

- 323 31. Have you heard of immunisation reminder/recall before? (a) Yes [] (b) No []
- 324 If yes, have you ever received any? (a) Yes [] (b) No []

- 325 32. What do you think about parents/caregivers being reminded of their child's
326 immunisation appointments before the date? (a) Not necessary [] (b) Necessary []
- 327 33. If response to Q32 is 'Necessary' what are your reasons for saying so?
- 328 a. It will help people not miss their children's appointments []
329 b. It will help people remember their appointment dates []
330 c. People won't have to keep looking at the calendar to remember []
331 d. It will take away the anxiety of meeting up with appointments []
332 e. Others (pls specify).....
- 333 34. If response to Q32 is 'not necessary' what are your reasons for saying so?
- 334 a. It is expected that everybody should remember their appointment dates []
335 b. It is distracting to receive such calls []
336 c. It is worrisome []
337 d. Others (specify) -----
338
- 339 35. What do you think about parents/caregivers being recalled for their child's
340 immunisation after they have missed an appointment?(a) Not necessary [] (b)
341 Necessary []
- 342 36. If response to Q35 is 'Necessary' what are your reasons for saying so?
- 343 a. It will help parents/caregivers comply better with the schedule []
344 b. It will help parents/caregiver to be on alert []
345 c. Others (specify) -----
346
- 347 37. If response to Q35 is 'not necessary' what are your reasons for saying so?
- 348 a. It is expected that everybody should remember their appointment dates []
349 b. It is distracting to receive such calls []
350 c. It is worrisome []
351 d. Others (specify) -----
352
- 353 38. What is your opinion about adherence to immunisation schedule?(a) Not
354 important [] (b) Important []
- 355 39. Are you willing to record your phone number with the immunisation clinic for
356 reminders/recalls? (a) Yes [] (b) No []
- 357 40. Are you willing to receive immunisation reminders/recalls about your child's
358 immunisation? (a) Yes [] (b) No []

359

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

361

362

363

364