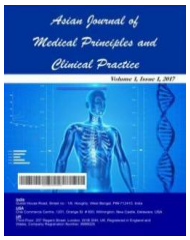

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# Implementation of Mobile Phone Reminder System to Improve Immunisation Uptake in Abakaliki, Southeast, Nigeria: Its Feasibility and Acceptability

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***Authors' contributions***

*This work was carried out in collaboration between all authors. Author NCE designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors NCE, CNO and AFU managed the analyses of the study. Authors NCE and CNO managed the literature searches. All authors read and approved the final manuscript.*

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## ABSTRACT

**Background:** Reminder systems are effective ways to improve childhood immunisation coverage, but the feasibility of its implementation in rural health facilities in Nigeria has not been adequately evaluated. This study, therefore, determined the feasibility and acceptability of childhood immunisation reminder implementation in rural health facilities in Southeast Nigeria.
**Materials and Methods:** This is a descriptive-analytical report of a non-randomized control study in rural health facilities in Abakaliki, Nigeria. Mile-Four and St. Vincent hospitals in Ebonyi and Izzi Local Government Areas (LGA) of Ebonyi State respectively were selected purposively. Mile-Four was assigned the phone reminder/recall intervention group and St. Vincent as a control group. The sample size was determined using the formula for comparing two proportions. Caregiver-child pair was recruited in the health facilities and 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, proforma and checklist. Statistical Package for

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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:** A total of 290 caregiver-child pairs (145 in each group) participated in the study. All caregivers had access to their own mobile phone or that belonging to a spouse. All the caregivers (100%) in intervention group showed willingness to record their phone numbers and receive immunisation reminders and recalls while 95.2% and 96.6% of the respondents in the control group showed willingness to record their phone numbers and receive reminders and recalls respectively. Out of the 495 reminders and recalls made, 84.4% (418) went through and were answered by recipients. Appointment compliance rate in the intervention group was 91.7%, 91.7% and 91.1% for $6^{th}$, $10^{th}$ and $14^{th}$ week respectively when compared with 95.9%, 93.1% and 77.9% for $6^{th}$, $10^{th}$ and $14^{th}$ week respectively in the control group, a difference that was significant in the $14^{th}$ week ($p=0.04$)

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

*Keywords: Implementation; phone reminders; immunisation uptake; feasibility and acceptability; Abakaliki.*

## 1. INTRODUCTION

Immunisation is one of the most effective public health interventions that prevents debilitating childhood illnesses and disabilities and saves millions of lives yearly [1]. Despite this, vaccine-preventable diseases (VPDs) constitute about a quarter of the eight million annual deaths among children under five children especially in low-income countries [2] and poor compliance to immunisation schedules and completion of recommended vaccinations have been found to limit the effectiveness of vaccination [3]. Globally, about 22 million infants are not fully immunised with routine vaccines and more than 1.5 million children less than five years of age die from vaccine preventable diseases [4].

Fourteen percent of all incompletely vaccinated children globally live in Nigeria [5]. Compliance to and completion of recommended routine vaccines among children in Nigeria is sub-optimal with more than 3.2 million children aged 12 months old unimmunized, leading to outbreaks of VPDs across the country. Effective and novel strategies are therefore required to meet the WHO recommended 95% level for the sustained control of VPDs and reduce under-five mortality.

Immunisation reminders are effective methods of improving adherence to recommended immunisation schedules [6-8]. Immunisation reminder and recall systems are cost-effective methods whereby caregivers are reminded of future immunisation appointments or those 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. Because many caregivers cannot remember the immunisation schedule, public health physicians/ immunisation providers need to take measures to ensure that their clients receive immunisations on a timely basis. However, the feasibility of mobile phone reminder/recall implementation in rural areas in low-resource settings, such as Nigeria, has not been adequately evaluated. Therefore this study determined its feasibility and acceptability.

## 2. MATERIALS AND METHODS

This is a descriptive analytical report of a non-randomized control study among Caregivers of infants accessing immunisation services 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 mobile phone reminder/recall intervention group and St. Vincent as control group. Sample size was determined using the formula for comparing two proportions [9,10]. Caregiver-child pair was recruited in the health facilities and enrolled into the two groups during the infants' BCG or Pentavalent vaccines 1 immunisation visit. Only caregivers in the intervention group (all had access to cell phone) received mobile phone calls 48-24 hours from the researcher before the appointment date reminding them to bring their children for scheduled immunisations at Mile-Four at that given date. Caregiver-child pair was followed up till the final scheduled immunisation

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

## 3. RESULTS

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

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

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

| Variables | Mile-Four (n=145) Freq. (%) | St.Vincent (n=145) Freq. (%) | $\chi^2$ | 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. Respondents' attitude towards immunisation reminders and recalls**

| Variables | Intervention group (n=145) Freq. (%) | Control group (n=145) Freq. (%) | $\chi^2$ |
|---|---|---|---|
| **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) | |

**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 |

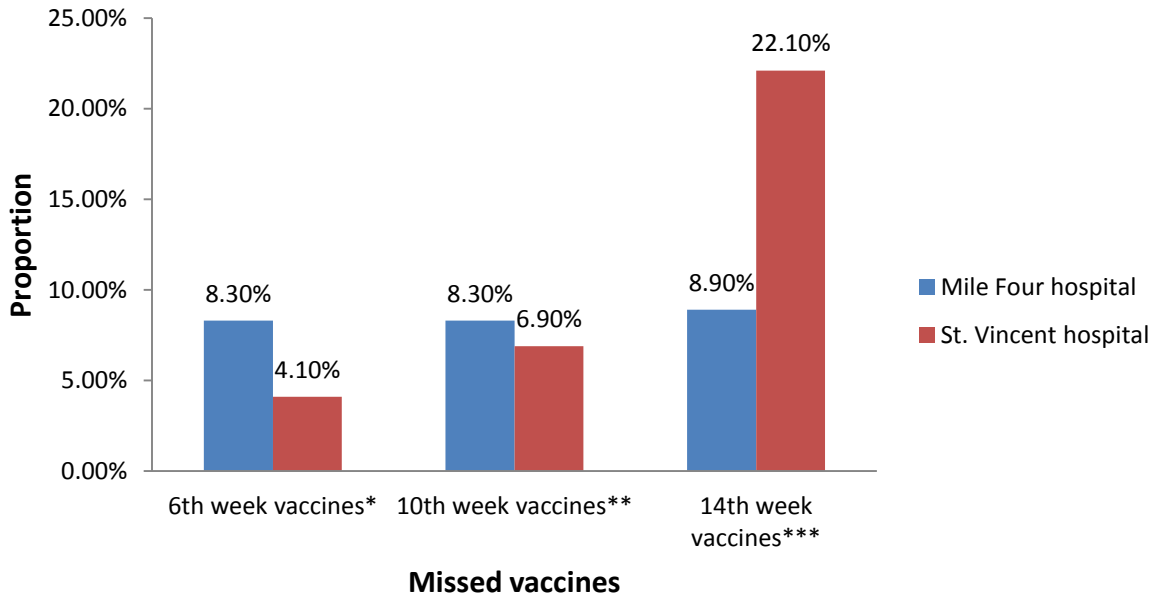


**Fig. 1. Proportion of infants who missed each vaccine on each schedule**

**OPV1, Pentavalent1 and PCV1; **OPV2, Pentavalent2 and PCV2; ***OPV3, Pentavalent3 and PCV3*

## 4. DISCUSSION

Respondent's attitude towards immunisation reminders in both groups showed that almost all the caregivers were willing to record their phone numbers and receive immunisation reminders in the clinic. Respondents' willingness to record phone numbers and receive reminders in the immunisation clinic is essential to the implementation and execution of immunisation reminders and recall system [11]. This ultimately will lead to improved immunisation coverage [11]. This finding is consistent with that in Ibadan where 97.9% showed willingness to record their cellphone numbers at the immunisation clinics and 95.1% willing to receive reminder and recall

information about their children's immunization [12]. In Kansas, USA, most respondents (85%) showed willingness to implement a text message reminder system given the appropriate resources [13]. More positive attitude towards immunisation reminders and recalls is expected of respondents in Kansas's study where literacy level and awareness are both higher compared to Abakaliki, Nigeria. However, this comparably higher positive attitude in the present study may be as a result of caregiver's enthusiasm to keep to timeliness of immunisation in order improve immunisation uptake and coverage and consequently avoid or reduce vaccine preventable diseases. It is also similar to studies in Lagos and Benin in Nigeria that reported mothers' willingness to receive immunisation reminders and recalls [11,14]. This report is comparably higher than the 77% who showed willingness to receive future reminders about childhood immunisations in the quantitative and qualitative studies in USA [15]. It also showed a wide support and acceptability for short message service as a mode of immunisation reminder and recall system [15]. It was found that person to person telephone reminder has also been preferred by parents in studies in USA [16] and Lagos, Nigeria [11]. It is possible that mothers who preferred cellphone call reminders in that study may have done so because they are likely to have the opportunity to express themselves if they plan to attend their children scheduled immunisation clinic or request to change appointment date if they cannot attend for any reason [11]. However, it was found in a previous study in USA that parents aged 30 years and above preferred e-mail for reminder [16]. About three-quarters (77%) showed willingness to receive future reminders about childhood immunisations and that was consistent with findings in the quantitative and qualitative studies done in the USA [15].

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

In this study, the lower compliance rate recorded at the 14$^{th}$ week of immunisation schedule in the control group when compared with the intervention group might be as result of reduced outreach campaign in the area.

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

## 5. CONCLUSION

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

## 6. LIMITATIONS

1.Participants' recruitment been done in the health facilities means that all participants were already users of health services and thus more likely to be well-disposed towards immunisation. Thus, the findings do not apply to mothers who do not bring their children to government health services (other than possibly for medical emergencies)…, those who have poor access, fear or don't understand the need for vaccination, etc. 2.Calls haven been made by the researcher is a real limitation on the feasibility of a reminder system, because the study did not show if the health facility staff were willing and able to make reminder calls or if they would make such calls effectively.

## CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the author(s).

## ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee

has been collected and preserved by the author(s).

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES


1. Andre FE, Booy R, Bock HL, Clemens J, Datta SK, John TJ, et al. Vaccination greatly reduces disease, disability, death and inequity worldwide. Bull World Health Organ. 2008;86(2):140-6.
2. United Nations Children's Fund (UNICEF). Levels and trends in child mortality report 2011: estimates developed by the United Nations interagency group for child mortality estimation. New York, USA: UNICEF; 2011:3-5. Accessed 17th May 2017
3. National Center for Immunisation and Respiratory Diseases. General recommendations on immunisation: recommendations of the advisory committee on immunisation practices (ACIP). MMWR Recomm Rep. 2011;60(2):1–64.
4. World Health Organization. World immunisation week 2013: protect your world - get vaccinated: origins the campaign, public health context. Switzerland: WHO; 2013. Accessed 13 July 2017.
5. Centers for Disease Control and Prevention. Global routine vaccination coverage, 2011. MMWR Morb Mortal Wkly Rep. 2012;61(43):883–5.
6. Jeffrey DS. From Millennium Development Goals to Sustainable Development Goals Lancet. 2012;379:2206–11.
7. World Health Organization (WHO). Nigeria launches penta vaccine. Accessed August 27, 2015
8. Nnonyelu AN, Nwankwo IU. Social determinants of differential access to health services across five states South-East Nigeria. Europ. Scientific J. 2014;3:1857-7881
9. Araoye MO. Research methodology with statistics for health and social sciences. Ist Edition. Ilorin: Natadex. 2003:69,107,118-122.
10. Onwasigwe CN. Principles and methods of epidemiology. 2nd Edition. Enugu: EL Demark Publishers. 2010;147-148.
11. Balogun MR, Sekoni AO, Okafor IP, Odukoya OO, Ezeiru SS, Ogunnowo BE et al. Access to information technology and willingness to receive text message reminders for childhood immunisation among mothers attending a tertiary facility in Lagos, Nigeria. Afr JCH. 2012;6(3):76-80.
12. Brown VB, Oluwatosin A, Ogundeji MO. Experiences, perceptions and preferences of mothers towards childhood immunisation reminder/recall in Ibadan, Nigeria: A cross-sectional study. The Pan Afr. Medical J. 2015;20:243
13. Luman ET, Barkar LE, Shaw KM et al. Timeliness of Childhood vaccinations in the United States: days under vaccinated and number of vaccines delayed. JAMA. 2005;293:1204-11.
14. Sadoh AE, Okungbowa E. Nigerian mothers opinion of reminder/recall for immunisation. Nig J Pediatr. 2014;41(1): 38-42.
15. Kharbanda EO, Stockwell MS, Fox HW, Rickert VI. Text4 Health: A qualitative evaluation of parental readiness for text message immunisation reminders. Am J Public Health. 2009;99(12):2176-8.
16. Clark SJ, Butchart A, Kennedy A, Dombkowski KJ. Parents' experiences with and preferences for immunisation reminder/recall technologies. Pediatrics. 2011;128(5):100-5.

## APPENDIX 1

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

Dear Respondents,

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

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

**SECTION A: Socio-demographic data**

**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 | | |

**Child**

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

| Type of vaccine | Age received (in weeks or months) |
|---|---|
| | |
| | |
| | |
| | |

**SECTION B: Immunisation practice and experience**

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

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

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

    a. I did not remember the date [ ]
    b. We travelled [ ]
    c. I had to go to work/farm/market [ ]
    d. There was no money to pay for transport/hospital fees [ ]
    e. S/he was sick [ ]
    f. We had other engagements [ ]
    g. The hospital was not open [ ]
    h. Others (pls specify) .....

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

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

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

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

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

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

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

21. Has your child ever missed an immunisation because you were afraid s/he would react to the antigen/vaccine? [ ]

22. Has your child ever missed an immunisation because you didn't feel like coming to the health facility on that day? [ ]

23. Has your child ever missed an immunisation because you heard or were told the vaccine does not work? [ ]

24. Has your child ever missed an immunisation because you did not know where to take him/her? [ ]

25. Has your child ever missed an immunisation because you were not told when s/he should come for the next dose? [ ]

26. Has your child ever missed an immunisation because the vaccine was not available? [ ]

27. Has your child ever missed an immunisation because the health worker was not around to give the vaccine? [ ]

28. How long do you have to wait before your child gets vaccinated? .....

29. How long did you wait today? .....

30. What other challenges do you face when you bring your child for immunisation
    .....

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

31. Have you heard of immunisation reminder/recall before? (a) Yes [ ] (b) No [ ]

    If yes, have you ever received any? (a) Yes [ ] (b) No [ ]

32. What do you think about parents/caregivers being reminded of their child's immunisation appointments before the date? (a) Not necessary [ ] (b) Necessary[ ]

33. If response to Q32 is 'Necessary' what are your reasons for saying so?

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

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

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

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

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

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

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

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

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

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

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

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



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