A study to assess the feasibility of *Text Messaging Service* in delivering maternal and child healthcare messages in a rural area of Tamil Nadu, India

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RESEARCH

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ABSTRACT

Background
Mobile text messaging is a potentially powerful tool for behaviour change because it is widely available, inexpensive, and instant.

Aims
To evaluate whether mobile Text Messaging Service is a feasible mode of raising knowledge regarding maternal and child health (MCH) and to explore issues related to mobile text messages as a mode of health education.

Method
A community-based intervention study was conducted from January to June 2013 in six randomly selected villages of Vellore district, Tamil Nadu. A multi-stage sampling technique was followed: 120 individuals from 120 households (30 clusters in six villages) were contacted. Data was collected using a pretested questionnaire by house-to-house visits in three phases: 1) baseline assessment of aptitude towards text messages; 2) intervention: sending MCH-related text messages; and 3) end-line assessment to evaluate the increase in knowledge level. Qualitative data regarding mobile text messages as a mode of health education was explored. Quantitative data was analysed using SPSS version 17.0 and qualitative data by Anthropac software.

Results
Of the individuals surveyed, 69.17 per cent and 52.5 per cent were "able to read" and "type and send" text messages, respectively. Seventy per cent of individuals were willing to receive health information via text messages, and 98.33 per cent believed text messages could effectively spread health messages. A significant increase in knowledge was observed following text messages. Male gender and subjects' ability to read text messages were significantly associated. Factors related to mobile phone use include minimum economic burden, easy availability, portability, and ease of use. Factors related to mobile text messages as a mode of health message delivery include direct receipt of information, mass reach, the absence of regional language font in many handsets, and illiterate individuals being unable to read messages.

Conclusion
In rural areas, mobile text messages have the potential to deliver health messages regarding MCH.

Key Words
Health education, maternal and child health, text messages

What this study adds:

1. What is known about this subject?
Use of mobile phone technology has already been explored in clinical medicine in various countries and mobile text reminders to patients are now common practice in many developed countries.

2. What new information is offered in this study?
Rural populations in resource-poor settings have a willingness and ability to use mobile text messaging, and acknowledge its possible role in public health. A mobile text messaging service can deliver messages regarding maternal and child health care in rural settings.

3. What are the implications for research, policy, or practice?

Mobile text messaging is a feasible mode of health education in rural areas. If logically introduced, it can promote public health and empower the community at large.

Background

Mobile health (mHealth) is the use of mobile phone technology to deliver health care. Studies have found that periodic prompts and reminders are an effective method to encourage and reinforce healthy behaviours.[1] With the high penetration of mobile phones in rural India,[2] mobile text messaging-based intervention could be the logical step to spread health-related information in rural India for several reasons: availability on most types of mobile handsets, low cost, and it does not require great technological expertise.[2] Text messaging also has the advantage of being asynchronous because it can be accessed at any time that is convenient.[3]

Mobile phones also present the opportunity to leverage mHealth for maternal and child health (MCH) care, a public health priority particularly in an under-resourced country like India.[4] In view of India's high maternal and under-five mortality, and the coverage gap in maternal and child health services,[5] many states now opt for mHealth and seek text messaging support to improve MCH.[6] The global proliferation of mobile technology has generated a new instrument to address public health challenges and shift the paradigm of healthcare access and delivery. Recent years have witnessed an explosion of mHealth activities throughout the world. A 2011 global survey of 114 nations by the World Health Organization (WHO) found that mHealth initiatives are recognised in many nations, but there are differences in mode of application levels.[7]

Method

A community-based intervention study was carried out from January to June 2013 in six randomly selected villages (Erukkanthotti, Lalikuppam, Chettithangal, Bhel Malaimedu, Rettiyur and Vilvanathapuram) of Walaja Taluka in Vellore district, Tamil Nadu. The Vellore district was purposefully selected as the study area for ease of data collection by the study investigators (residents of Vellore district), who were required to visit the area frequently.

Sampling technique: Sample size was calculated by Epi_Info software. The total population for the six villages was 12,332 (Census 2011).[8] The calculated sample size was 115 households (average family size 4.5, mobile phone users 80 per cent, CI 95 per cent, design effect two and five per cent for non-response). A multi-stage sampling technique was followed. First, six villages in Walaja Taluka were randomly selected. In the second stage, 30 clusters were sampled with four households in each cluster, making the total sample size of 120. One respondent (male or female willing to participate and able to communicate, preferably the family head) in each of the four households in a cluster, thus 120 respondents in 120 households were enrolled.

Baseline assessment: After obtaining written consent (right thumb impression considered for those who were unable to read and write), information regarding socio-demographic characteristics, aptitude, and willingness to receive, read, and reply to health-related text messages was collected. This phase also consisted of an assessment of respondent knowledge regarding selected MCH practices. Further, the investigator sought permission to send MCH-related text messages in the following days (Annex 1).

Intervention: Mobile text messages with standard MCH practices were sent to each respondent. A total of 10 standard messages (onr message per day, these messages were brief and a of maximum 90 characters to fit the standard text message limit of a regular mobile handset) were sent to all 120 respondents in both Tamil (local language) and English font.

End-line assessment: The investigator revisited the same 120 respondents and asked the same questions as during first phase, and assessed the increase in knowledge level.

Qualitative data collection: The role of mobile text messages as a mode of health education in a rural community was explored using focus group discussions (FGD).[9] For this purpose two focus groups were conducted until the point of exhaustion, when no new information related to the use and role of text messages as a mode of health education was generated. The focus groups included both males and females who talked freely and were willing to participate. FGDs were conducted by a faculty member from the Dept. of Community Medicine who has adequate training in qualitative research. Information was collected in writing by a reporter and also by voice recording to cross check findings. Further, various domains and items in relation to the use of text messages as a mode of health education were also identified.

Statistical analysis: Data was analysed using SPSS 17.0. To assess the significance of study findings, a Z test for sample proportions was applied and $P < 0.05$ (with 95 per cent CI) was considered statistically significant. A content analysis of the qualitative material collected via the focus groups was conducted via a free listing (computer program generates an output file consisting of items of interest more frequently mentioned by participants) and pile

sorting exercise (computer program gives output of piles consisting of similar items as perceived by various participants) using Anthropac 4.98.1/X software.

Results

Among a total of 120 subjects, 62 (51.67 per cent) were male and 58 (48.33 per cent) were female. The majority (74.17 per cent) were 18–35 years of age and from nuclear families (84.17 per cent). More than half (59.17 per cent) were from educationally and socially disadvantaged families as per the Government of India.[8] Only 10 (8.33 per cent) were illiterate. Approximately two-thirds (65 per cent) of participants were married and the remaining participants (33.33 per cent) were unmarried.

During the baseline assessment, 45 (37.5 per cent) respondents indicated that their personal mobile was shared by other family members. Each family had two (1–6) mobile phones. Study subjects spent an average of 267.13 rupees (USD $4.25) every month on mobile phones. A total of 83 (69.17 per cent) and 63 (52.5 per cent) subjects, respectively, were "able to read" and "type and send" text messages. A total of 84 (70 per cent) individuals communicated that they are willing to receive health-related information via text messages.

Among the subjects who were willing to receive mobile text messages, 41 (48.81 per cent) wished to receive text messages in both Tamil (local language) and English. Thirty (35.71 per cent) and 13 (15.48 per cent) individuals, respectively, wished to receive text messages only in Tamil or only in English.

A total of 66 (55 per cent) individuals said that if they receive health-related information through mobile text messages, they would share such information with other family members, friends, and relatives. More than half (62, 51.67 per cent) communicated that they were willing to respond to text messages sent by health authorities. Most (98.33 per cent) of the individuals believe that text messages are an effective way to spread health messages in rural communities (Table 1).

Significant increases in knowledge related to MCH care were observed after texts were sent to study participants. After receiving text messages, more than half (67, 55.83 per cent) knew the minimum number of iron folic acid tablets to be consumed by a pregnant mother, as compared to 26 (21.67 per cent) individuals before receiving text messages ($P < 0.05$, 95 per cent CI:0.21–0.46). Similarly, 52 (43.33 per cent) individuals knew about low birth weight babies after receiving text messages, as compared to 24 (20 per cent) individuals before receiving texts ($P < 0.05$, 95 per cent CI:0.12–0.35). Knowledge of maternal health care improved considerably, relative to that about child health care (Table 2).

Table 1: Opinion about use of mobile phone in health care

Characteristics	N (%)
Mobile phone shared by other family members	45 (37.5)
Number of mobile phones in the family (Median, range)	2 (1-6)
Individual monthly expenditure on mobile phone (INR)	267.13 ± 482.95
Can read text messages	83 (69.17)
Like to receive health related information via texts	84 (70)
Like to receive messages in (N=84)	
Tamil	30 (35.71)
English	13 (15.48)
Both Tamil and English	41 (48.81)
Will share health information received via texts with family, and relatives	66 (55)
Can type and send mobile texts	63 (52.5)
Willing to respond to texts sent by health authorities	62 (51.67)
Believe that health messages can be effectively spread by texts messages	118 (98.33)

Qualitative findings

Using the qualitative data collected via the focus group discussions, the factors related to the role of mobile text messages as a mode of health education delivery in rural communities were explored. This involved free listing (technique of identifying relevant themes or domains) and pile sorting (technique of studying relations among relevant items within a theme or domain). Free list combined with pile sort exercises are usually done to explore local people's perceptions on a given research topic in a systematic manner. Both favourable and problem issues were taken into records.

Free listing

Factors related to the role of text messages as a mode of health message delivery in rural areas as perceived by participants included (with descending Smith's S value, as per Salience analysis, which accounts for frequency of mention by participants): the absence of the Tamil font (local language) in many handset models; the direct delivery of information; illiterate individuals being unable to read text messages; text messages can be delivered to masses without much complexity; limited mobile phone literacy among the general population in the study area; the opportunity to ignore messages during busy schedule; the opportunity to issue reminders; text limits that can prevent the receipt of lengthy messages as many mobile

Table 2: Respondents' knowledge before and after receiving text messages

Indicators	Before N (%)	After N (%)	*P* value (95% CI)
Maternal health: Respondent had knowledge regarding			
No. of TT injections to be received during pregnancy	46 (38.33)	82 (68.33)	**<0.05 (0.17-0.42)**
Min. No. of IFA tablets to be consumed during pregnancy	26 (21.67)	67 (55.83)	**<0.05 (0.21-0.46)**
Min. No. of ANC visits during pregnancy	12 (10)	45 (37.5)	**<0.05 (0.16-0.38)**
Can name at least two danger signs during pregnancy	22 (18.33)	45 (37.5)	**<0.05 (0.08-0.31)**
Min. gap between two successive pregnancies	39 (32.5)	67 (55.83)	**<0.05 (0.11-0.36)**
Child health: Respondent had knowledge regarding			
When to call a baby as "low birth weight"	24 (20)	52 (43.33)	**<0.05 (0.12-0.35)**
Hypothermia as a danger sign for young children	105 (87.5)	107 (89.17)	>0.05 (-0.07-0.09)
Age till exclusive breast feeding should be continued	44 (36.67)	76 (63.33)	**<0.05 (0.14-0.39)**
Age when complementary feeding should be initiated	40 (33.33)	59 (49.17)	**<0.05 (0.03-0.28)**
Name at least two vaccines given to children	60 (50)	68 (56.67)	>0.05 (-0.06-0.19)

handsets provide up to 90 alphabet limits for text messages; the possibility of dissemination of incorrect message(s) from the messenger or incorrect interpretation by the recipient(s); and casual response or recipient fatigue after too many text messages.

Pile sort analysis

Participants also identified three broad groups of factors related to the usefulness of text messages in the delivery of health messages. The first related to mobile phones and included font problems in many mobile handsets, the direct delivery of messages, the opportunity to issue reminders, and prospect to reach the masses. The second related to the audience and included limited language literacy, limited mobile phone literacy, the opportunity to ignore messages, and the possibility of recipient fatigue with too many text messages. The third related to mobile text messaging and included text limits that can prevent the receipt of lengthy messages, lengthy text messages that are difficult to read and/or understand, and risk of dissemination of incorrect message(s) from the messenger (from the healthcare delivery system), incorrect interpretation by the recipient, or both (Figure 1).

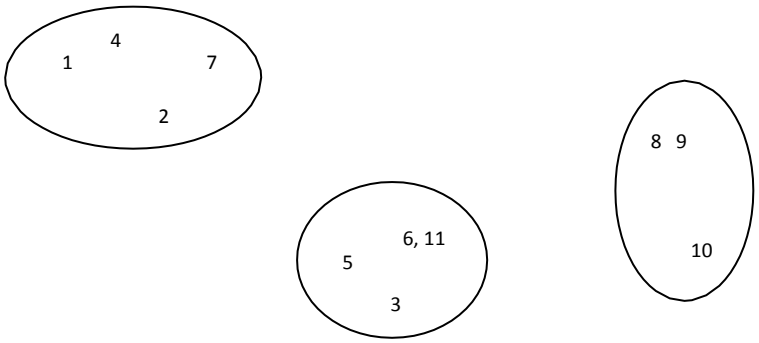
Discussion

Mobile phone text messaging is a tested method for delivery of health education.[10] Although text messaging has expanded in popularity worldwide, there is limited evidence of its role and feasibility in promotion of health, especially from Tamil Nadu. We observed that text messaging is a feasible and effective tool in delivering MCH care-related health messages as evidenced by 51.67 per cent of respondents communicating that they are willing to act on text messages sent by health authorities, while 98.33 per cent of respondents believed that text messages are an effective media to spread health information. Similar findings were observed in a study conducted in Zanzibar, East Africa, in 2012 where text messaging services appeared to be valued by both antenatal women and health workers.[11] Tamil Nadu, being a role model state in terms of healthcare delivery in India,[5,8] can use this forum of information and technology as an opportunity to further accelerate progress in the field of public health, especially for future generation diseases like non-communicable diseases, mental health, genetic disorders, etc.

This study observed a significant increase in awareness about maternal and child health after participants received mobile text messages. Jareethum et al. also showed encouraging results in Thailand, where pregnant women who received text messages were more satisfied compared to a general antenatal care group.[12] Similarly, Kaewkungwal et al. showed that the application of mHealth in Thailand improved ANC and immunisation coverage among pregnant mothers and children.[12] This suggests that mobile text messages could be adopted as a potential behaviour change communication strategy in other resource-poor countries like India. Mobile phone technologies have also shown success in improving vaccination services, asthma care, diabetes control, and in primary healthcare settings,[10,13-15] reiterating its potential role.

However, during focus group discussions and later on, participants raised various limitations of mobile text messages (Figure 1), which should be addressed while planning for any health program using mobile text messaging as an intervention.

Figure 1: Factors related to role of mobile texts in delivery of health messages: Non-metric, multi-dimensional scaling and hierarchical cluster analysis



1–font problem
2–message conveyed directly
7–reminder possible
4–reach masses
3–Illiterate can't read
5–often don't know how to respond
6, 11–chance to ignore and not interested
8–long messages
9–difficult to understand
10–wrong information

Chu and Ganz[16] discussed similar concerns while explaining the communication aspects of mHealth in tele-trauma networks. However, encouraging increases in knowledge through text messages and literature from other developing countries overshadow such concerns.

Clinical mHealth in isolation cannot succeed without the application of such cost-effective technology in public health. To effectively use text messages to disseminate health information, healthcare workers, especially grassroot level workers, need to be trained in the use of mHealth technology.[6,7] Mobile text messages present a new and potential platform to address maternal and child health, and findings indicate that a mobile text messaging service can empower both healthcare providers and the community at large. If envisaged effectively under the MCH programme, it can prove to be a decisive strategy.

The present study, however, has some limitations like small sample size, limited health education messages (only MCH care messages), and the text messages sent also had some limitations being only script in nature and no pictures. These limitations should be addressed while conducting larger studies on this issue.

Conclusion

Our study population had aptitude and a positive attitude toward the use of mobile text messages as a mode of health education. Mobile text messages are a feasible mode of health education and have the potential to increase knowledge regarding maternal and child health care in rural areas.

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PEER REVIEW

Not commissioned. Externally peer reviewed.

CONFLICTS OF INTEREST

The authors declare that they have no competing interests. We also declare that all the authors have approved the final version of the manuscript.

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ETHICS COMMITTEE APPROVAL

Ethical permission to conduct the study was obtained from the Medical College Institutional Human Ethical Committee of MGMC and RI, Pondicherry (Ref. No. MGMCRI/ IHEC/ UG/ 2013/10).

Annex 1: Maternal and child healthcare messages

Sent as text message via mobile phone

1. Pregnant mother should receive two TT injections during her pregnancy.
2. Pregnant mother should consume minimum 100 iron folic acid tablets during her pregnancy.
3. Pregnant mother should receive minimum three check-ups during her pregnancy.
4. Vaginal bleeding, lower abdominal pain, blurring of vision, moderate to severe headache, convulsion, excessive vomiting etc. are danger sings during pregnancy.
5. There should be minimum three-year gap between successive pregnancies.
6. A baby born less than 2.5kg is a low birth weight baby and needs special care.
7. Low body temperature in a newborn baby is also a danger sign and needs special care.
8. A newborn baby should receive only mother's milk immediately after birth until six months of age.
9. Semi-solid foods should be given to a child only after six months of age in addition to breastfeeding.
10. Vaccines advised for newborn babies include: BCG, and Polio drops at birth, DPT and Polio drops at 1½ months, 2½ months and 3½ months age, Measles and Vitamin A solution at nine months. Three doses of Hepatitis B vaccine can also be given as per doctor's advice.