Original Article

Potential for mobile health (mHealth) prevention of cardiovascular diseases in Kerala: A population-based survey

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ABSTRACT

Background: India’s southern state of Kerala stands at the forefront of India’s epidemic of cardiovascular disease (CVD), among other non-communicable diseases (NCDs). Mobile phone use in healthcare (mHealth) has shown promise in India, including NCDs. However, suitability and acceptability of m-Health interventions is poorly researched, particularly in rural settings.

Objectives:
(1) To explore mobile phone usage patterns in rural Kerala (Ernakulam).
(2) To explore acceptability of mHealth delivery of health promotion and CVD prevention.

Methods: A questionnaire regarding mobile phone usage and possible use in healthcare was verbally administered in five primary health centres and by home visits in five village councils (“panchayats”) of Ernakulam, Kerala. Adults who spoke Malayalam or English, with access to a mobile phone were recruited by convenience sampling in partnership with accredited social health activists (ASHAs). Quantitative data analysis was conducted using SPSS software.

Results: 262 participants were recruited. 87% routinely used and 88% owned a mobile phone. 92% were willing to receive mHealth advice, and 94% favoured mobile medication reminders. 70.3% and 73% preferred voice calls over short messaging service (SMS) for delivering health information and medication reminders, respectively. 85.9% would send home recorded information on their blood pressure, weight, medication use and lifestyle to a doctor or ASHA. 75.2% trusted the confidentiality of mHealth data, while 77.1% had no concerns about the privacy of their information.

Conclusions: The majority of this population approve mHealth interventions. While further investigation of mHealth as a health education tool is warranted, SMS interventions may fail to maximise equity and penetration across all patient groups.

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1. Introduction

Cardiovascular disease (CVD) remains the most common global cause of mortality and morbidity, with 80% of deaths in low and middle income countries (LMICs).^1^-^4^ India carries the largest global burden of all non-communicable diseases (NCDs) and CVD alone accounts for 29% of deaths.5,5 The epidemiological transition6 and severe shortage of healthcare professionals,5,6 particularly in rural areas which comprise 70% of India’s population, pose further challenges.

The southern Indian state of Kerala faces unique challenges in its future management of CVD,7 with the highest prevalence of NCDs and modifiable NCD risk factors.8,9 India’s epidemiological transition is most advanced in Kerala.10,11 Poor awareness of risk factors is compounded by inadequacies in treatment and prevention,12 as well as poor utilisation by patients13 and lack of research.14 m-Health, the use of mobile devices in medical and public health

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practices.\textsuperscript{15} is well placed to provide important, community-focused and cost-effective strategies to mitigate India’s burgeoning CVD epidemic.\textsuperscript{16–19} India has the second largest mobile subscriber base globally, with 877 million mobile phone users across all age, income and ethnic groups, combined with one of the world’s lowest tariff rates.\textsuperscript{20} The mHealth industry’s global net worth is projected at US$23 billion by 2017, with India holding an 8% stake of the Asia-Pacific market. mHealth interventions could improve access to healthcare in rural remote populations through flexible communication with healthcare professionals under significant resource constraints, and promote active patient engagement in health education, disease management and control.\textsuperscript{17} Given the concurrent ubiquity of CVD and mobile phones, Kerala is well placed for the implementation of mHealth strategies. mHealth’s evidence base in Indian healthcare continues to grow across different disease areas, including NCDs.\textsuperscript{21,22} However, systematic reviews of mHealth in NCD prevention highlight paucity of high quality evidence in India and other LMICs, stressing need for robust assessment of their safety, equity and scalability.\textsuperscript{23–26} Assessment of end-user acceptability and suitability is essential before implementation of interventions, particularly in rural Indian settings.\textsuperscript{25} We therefore conducted the first quantitative study to-date of current mobile phone usage in rural Kerala, investigating acceptability of mHealth for delivery of health promotion and CVD prevention.

2. Methods

2.1. Study setting and population

Kerala has a population of 33,406,061\textsuperscript{26} and 52.3% live in a rural setting.\textsuperscript{27} Malayalam and English are the most commonly spoken languages.\textsuperscript{26} A questionnaire (Appendix A) was administered in five villages (“panchayats”) and five Primary Health Centres (PHCs) in Ernakulam, Kerala. This same population of 100,000 has previously been the subject of the Epidemiology of Non-communicable Diseases in Rural Areas (ENDIRA) study,\textsuperscript{1} involving Accredited Social Health Activists (ASHAs). ASHAs are local female residents aged 25–45, employed by the National Rural Health Mission (NRHM), and designated per 1000 population with primary focus on communicable diseases, maternal and child health. The ENDIRA study highlighted ASHA potential both as a means of conducting research, and also providing a link between the community and primary healthcare for NCDs.

2.2. Inclusion and exclusion criteria

Inclusion criteria were Keralan residents aged above 18 years, Malayalam or English-speakers, and regular access to a mobile phone. Participants of the same household were included to maximise household mobile usage data. Participants were excluded if they were unwilling to provide valid consent, or lived in an area without access to mobile phone network. Participants lacking time to complete the questionnaire during the initial visit were offered a follow-up visit. Those unable to offer a suitable follow-up time were also excluded.

2.3. Study design

Recruitment was by convenience sampling, in partnership with ASHAs both at home and PHCs in February/March 2015. Recruitment at PHCs was limited to mornings due to early afternoon closures, while home visits varied from early morning to early evening to avoid recruiting from a uniform segment of the population.

This population-based, face-to-face, interviewer-led questionnaire was adapted from two previous studies of mobile phone usage in rural South India.\textsuperscript{16,22} The questionnaire was piloted in 20 individuals. The questionnaire required 20–25 min to complete, assessing:

1. Current usage of mobile phone(s).
2. The acceptability and preferences of delivering mobile health information.
3. Use in chronic disease management.
4. Use in acute disease and medical emergency management.
5. Participant demographic profile and socioeconomic status.

2.4. Analysis

IBM-SPSS version 20 was used for data analysis. Kolmogorov–Smirnov tests were used to identify variable normality. Relevant variables with statistical significance of $p < 0.10$ were identified using Chi-square tests for categorical covariates, Kruskal Wallis for non-continuously distributed covariates and independent sample t-tests for continuously distributed covariates. Logistic regression was used to investigate the relationship between these variables and mobile phone usage characteristics. A $p$-value $\leq 0.05$ was considered statistically significant.

2.5. Ethical approval

Ethical approval was obtained from the Independent Ethics Review Board at Amrita Institute of Medical Sciences (AIMS), the District Medical Officer of Ernakulam and the University of Birmingham Population Sciences and Humanities Internal Ethics Review Committee. Informed, written consent was obtained from all study participants.

3. Results

Of 297 individuals approached, 276 were willing to participate, 14 were ineligible due to lack of access to a mobile phone. 262 successfully completed the questionnaire. Sociodemographic characteristics of eligible participants are detailed in Table 1.

3.1. Basic functionality of mobile phones

3.1.1. Ownership

231 (88.2%) individuals owned a mobile phone. Male sex (OR = 7.64; 95% CI = 1.89–30.98; $p = 0.004$), completion of high school education (OR = 11.49; 95% CI = 2.49–53.15; $p = 0.002$) and a higher education qualification (OR = 7.14; 95% CI = 1.16–43.94; $p = 0.03$) were associated with mobile ownership. Among mobile phone users, 204 (83%) were in sole possession, the remainder sharing with a family member. 23 (54.8%) shared with a spouse, 12 (28.6%) shared with their entire family, 4 (9.5%) shared with a son or daughter, 3 (7.1%) with a sibling. Unskilled or semi-skilled employment (OR = 6.35; 95% CI = 1.85–21.87; $p = 0.003$), and a higher education qualification (OR = 7.68; 95% CI = 2.32–25.44; $p = 0.001$) were associated with sole ownership.

3.1.2. Mobile phone use

228 (87%) participants reported routine use of mobile phones. Of those not routinely using, 10 (34%) stated preferential use of landline connection, 6 (21%) cited financial constraints, 6 (21%) cited inability to use a mobile phone, 6 (21%) stated they had no use for mobiles, while 1 (3%) stated that a family member used a mobile phone on their behalf. Male sex (OR = 6.84; 95% CI = 1.92–24.41; $p = 0.003$), completion of high school (OR = 9.55; 95%
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