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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.

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.[4,5] The epidemiological transition[4] 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 patients[13] and lack of research.[4,14] m-Health, the use of mobile devices in medical and public health

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practices,[15] is well placed to provide important, community-focused and cost-effective strategies to mitigate India's burgeoning CVD epidemic.[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.[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 remote rural populations through flexible communication with healthcare professionals under significant resource constraints, and promote active patient engagement in health education, disease management and control.[15] 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.[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.[23,24] Assessment of end-user acceptability and suitability is essential before implementation of interventions, particularly in rural Indian settings.[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[26] and 52.3% live in a rural setting.[27] Malayalam and English are the most commonly spoken languages.[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,[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.[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 ≤ 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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Table 1
Sociodemographic differences between males and females in study population.

	Total (262)	Female (142) = 54.2%	Male (120) = 45.8%	*p*-value
Age (median) K–S *p*-value = 0.04	45	45	46	0.642
Age (IQR)	33–57	33–56.25	34–58	
Family members (median) K–S *p*-value < 0.001	4	4	5	0.219
Family members (IQR)	4–5	4–5	4–6	
Marital status				
Married	222 (84.7)	122 (85.9)	100 (83.3)	
Divorced	4 (1.5)	4 (2.8)	0 (0)	
Widowed	12 (4.6)	11 (7.7)	1 (0.8)	
Not married	23 (8.8)	4 (2.8)	19 (15.8)	
Living alone	1 (0.4)	1 (0.7)	0 (0)	
Literacy (Malayalam)	254 (96.9)	137 (96.5)	117 (97.5)	0.632
Literacy (English)	79 (30.3)	35 (24.8)	44 (36.7)	0.038
Landline	92 (35.1)	47 (33.1)	45 (37.5)	0.457
Landline monthly expenditure (median); K–S *p*-value < 0.01	0	0	0	0.246
Landline monthly expenditure (IQR)	0 – 190	0–163.50	0–240	
SES				0.003
Low	5 (1.9)	4 (2.8)	1 (0.8)	
Middle	31 (11.9)	25 (17.6)	6 (5.0)	
High	225 (86.2)	113 (79.6)	112 (94.1)	
Formal education	251 (95.8)	135 (95.1)	116 (96.7)	0.521
Formal employment	128 (48.9)	33 (23.2)	95 (79.2)	0.001
Education attainment level				0.809
No formal	11 (4.2)	7 (4.9)	4 (3.3)	
Primary school	39 (14.9)	18 (12.7)	21 (17.5)	
Middle school	24 (9.2)	15 (10.6)	9 (7.5)	
High school	98 (37.4)	53 (37.3)	45 (37.5)	
Pre-University	34 (13)	19 (13.4)	15 (12.5)	
Graduate	40 (15.3)	23 (16.2)	17 (14.2)	
Post-graduate	16 (6.1)	7 (4.9)	9 (7.5)	
Occupation				<0.001
None	134 (51.1)	109 (76.8)	25 (20.8)	
Unskilled	35 (13.4)	7 (4.9)	28 (23.3)	
Semiskilled	33 (12.6)	9 (6.3)	24 (20.0)	
Skilled	27 (10.3)	4 (2.8)	23 (19.2)	
Semi-professional	16 (6.1)	7 (4.9)	9 (7.5)	
Professional	17 (6.5)	6 (4.2)	11 (9.2)	
Diagnosis of NCD				
Any	134 (51.3)	76 (53.9)	58 (48.3)	0.370
HTN	68 (26.3)	37 (26.4)	31 (26.1)	0.945
High cholesterol	32 (12.2)	20 (14.3)	12 (10.1)	0.306
CVD	6 (2.3)	3 (2.1)	3 (2.5)	0.840
DMII	48 (18.3)	26 (18.6)	22 (18.3)	0.986
COPD	4 (1.5)	2 (1.4)	2 (1.7)	0.870
Cancer	1 (0.4)	0 (0)	1 (0.8)	0.277
Medications				
Any	105 (40.2)	56 (39.7)	49 (40.8)	0.854
HTN	67 (25.8)	36 (25.7)	31 (25.8)	0.983
Statins	29 (11.2)	17 (12.1)	12 (10)	0.584
DMII medications	37 (14.2)	18 (12.9)	19 (15.8)	0.493
Insulin	3 (1.2)	1 (0.7)	2 (1.7)	0.473

CI = 2.41–37.81; $p = 0.001$) and a higher education qualification (OR = 7.39; 95% CI = 1.36–40.32; $p = 0.021$) were associated with routine use.

Participants made 3 (median) outgoing calls per day, and received 4 calls (median). 220 (84.3%) used SMS (≥1 SMS per week). Participants sent 2.16 daily SMS (mean), and received 4.49 SMS (mean). Decreasing age (OR = 0.95; 95% CI = 0.92–0.99; $p = 0.009$) and un-skilled or semi-skilled occupation (OR = 3.26; 95% CI = 1.05–10.16; $p = 0.04$) were associated with SMS usage.

154 (58.8%) used the alarm function on their mobile phones: 149 (89.8%) to wake up, 16 (9.6%) as a reminder of errands, and only 1 (0.6%) as a medication reminder. 109 (41.6%) used their mobile phone for other purposes: 89 (37.9%) to listen to music/radio, 68 (28.9%) to take pictures, 51 (21.7%) to browse internet or social media, 25 (10.6%) to play games, and 2 (0.8%) to use communication applications (e.g. WhatsApp). Decreasing age (OR = 0.89; 95% CI = 0.86–0.92; $p < 0.001$), male sex (OR = 3.51;

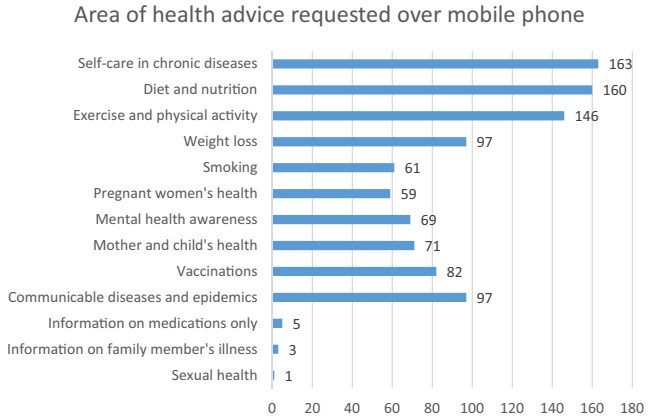

Fig. 1. Area of health advice requested over mobile phone.

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95% CI = 1.47–8.41; $p = 0.005$) and a higher education qualification (OR = 7.45; 95% CI = 1.25–44.27; $p = 0.03$) were associated with other usage, excluding SMS and alarm functions.

3.1.3. Communication with healthcare professional

250 (95.4%) were willing to provide their mobile number to healthcare professionals. 250 (95.4%) would prefer to make an appointment by mobile phone. 247 (94.3%) preferred to communicate with a doctor over a mobile in the event of an acute illness. Preference for personal interaction with a doctor, proximity to hospital and inability to use a mobile phone were the most frequent reasons for reluctance to disclose a phone number or contact a healthcare professional. 260 (99.2%) considered it beneficial to use mobile phones for medical emergencies.

3.2. Mobile phones in adherence to primary CVD prevention

242 participants (92%) were willing to receive health advice. Fig. 1 depicts health topics on which participants would receive information and advice. Requesting information on exercise and physical activity were associated with mobile ownership (OR = 4.77; 95% CI = 1.34–17.04; $p = 0.02$) and absence of diabetes diagnosis (OR = 0.29; 95% CI = 0.13–0.69; $p = 0.005$). Request for advice on weight loss was associated with mobile ownership (OR = 4.23; 95% CI = 1.18–15.17; $p = 0.03$) and absence of diabetes diagnosis (OR = 0.28; 95% CI = 0.12–0.65; $p = 0.003$).

170 (70.3%) preferred health information delivery by voice calls, 55 (22.7%) preferred SMS, while 17 (7.0%) had no preference. Age (OR = 1.09; 95% CI = 1.04–1.14; $p < 0.001$) and either primary or no formal education (OR = 3.47; 95% CI = 1.28–9.38; $p = 0.015$) were associated with voice call preference. English literacy (OR = 0.23; 95% CI = 0.10–0.54; $p = 0.001$) and perceptions that these interventions would intrude (OR = 0.15; 95% CI = 0.044–0.512; $p = 0.002$) were inversely associated with voice call preference.

Delivery of mobile health information was preferred on a daily basis by 31 (12.9%), twice a week by 36 (14.9%), weekly by 100 (41.5%), fortnightly by 4 (1.7%), and monthly by 70 (29.0%). Concerns over patient privacy were inversely associated with preference for greater frequency of mHealth information delivery (OR = 0.49; 95% CI = 0.26–0.95; $p = 0.04$).

246 (94%) participants thought medication reminders were useful. Of those who refused, 7 (64%) stated the intervention would be futile since they would remember to take their own medications; 2 (18%) had concerns over data confidentiality, while 2 (18%) preferred personal interaction with medical staff. 179 (73%) preferred reminders by voice call, 52 (21%) by SMS, 15 (6%) had no preference. English literacy (OR = 0.42; 95% CI = 0.18–0.98; $p = 0.046$), SMS usage (OR = 0.35; 95% CI = 0.14–0.88; $p = 0.025$), and either semi-professional or professional occupation (OR = 0.78; 95% CI = 0.62–0.98; $p = 0.036$) showed predilection for SMS.

For health information by SMS, only English literacy (OR = 0.06; 95% CI = 0.018–0.203; $p < 0.001$) was associated with a preference for messages in English or without language preference (Fig. 2). Preference for SMS medication reminders in English or without language preference had significant associations with English literacy (OR = 0.028; 95% CI = 0.003–0.241; $p = 0.001$), decreasing age (OR = 1.136; 95% CI = 1.029–1.255; $p = 0.012$), female sex (OR = 11.695; 95% CI = 1.657–82.540; $p = 0.014$) and increasing occupational status (OR = 0.517; 95%CI = 0.306–0.875; $p = 0.014$).

28 (11.4%) participants wanted reminders for the duration/timing of therapy, 41 (16.7%) preferred on a daily basis, 23 (9.3%) twice a week and 154 (62.6%) once a week. A diagnosis of CVD (OR = 0.04; 95% CI = 0.003–0.38; $p = 0.006$) was associated with preference for more frequent medication reminders. Middle school level of education (OR = 6.02; 95% CI = 1.02–35.49; $p = 0.05$) was associated with preference for less frequent reminders. 225 (85.9%) would be willing to send home-recorded information on their blood pressure, weight, medication use and lifestyle.

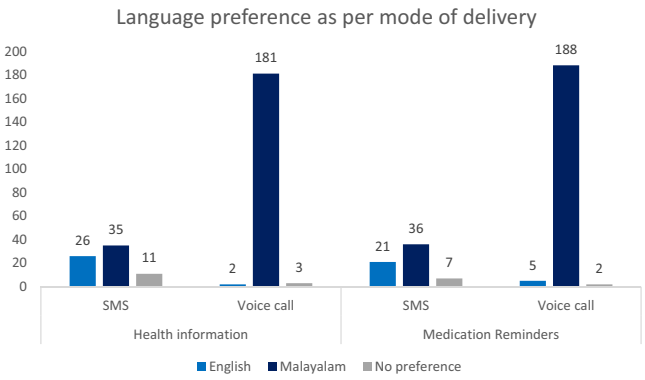

Fig. 2. Language preference as per preferred mode of delivery.

3.3. Perceived barriers to mHealth solutions

29 (11.1%) believed mHealth interventions were an intrusion, while 32 (12.2%) believed these interventions would be troublesome to a doctor or ASHA. 197 (75.2%) were sure that their mobile-transferred data would remain confidential. 202 (77.1%) had no concerns about privacy. Among suggested measures to improve confidentiality and privacy were restriction of data sharing to doctors (74.3%), to ASHAs (7.1%), type of data shared (8.6%), voice call (4.3%) or SMS (1.4%).

4. Discussion

This is the first quantitative study to assess suitability of mobile-based interventions in CVD prevention in a high-risk Keralan population, specifically assessing concerns of privacy and data confidentiality.[25] It is also the first study to provide statistical analysis of participant language preference for potential mHealth interventions. We present four findings. First, there were high rates of mobile ownership and routine use. Second, the majority would be willing to receive weekly mobile health advice and adherence reminders, with a clear demand for health advice on topics related to improving CVD and NCD risk profile. Third, there was clear preference for voice calls in Malayalam. Finally, the majority had confidence in mobile phone interventions to preserve confidentiality and privacy.

Our findings corroborate those of a recent study in rural Karnataka[22] and given the high rates of use and ownership, mHealth relevance to communicable and NCDs cannot be ignored.[28] Despite high mobile ownership, the associations that mobile routine use and ownership share with male sex and higher education status may result in marginalisation of female populations and those of lower educational status, which both carry significant burden of CVD,[11,29–31] and CVD risk factors.[32–34] Before widespread scale-up of m-health interventions for NCDs in India and globally, an evidence base linking m-health to "hard" outcomes is required, and currently lacking. Until such data are available, the success and appropriateness of m-health must be judged by context-specific information such as the information gathered in our study.

Willingness to receive advice and reminders by mHealth is encouraging, given the poor awareness of CVD risk factors such as hypertension in Kerala,[13] and reflects results elsewhere in South India.[22] Recent qualitative interviewing of CVD patients in Kerala highlighted the potential role for mHealth as a valuable health

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education tool, showing willingness to receive mHealth advice and education pertaining to modifiable CVD risk factors.[35] Mobile delivery of lifestyle advice, medication and appointment reminders has shown improved health outcomes in a systematic review of NCDs in LMICs across Europe, Asia (including India) and South America.[36] Surprisingly, we found diabetic patients were less interested in receiving mobile advice on physical exercise and weight loss, despite their importance in glycaemic control,[37] perhaps due to pre-existing awareness and knowledge of disease management.[12] However, Thankappan et al.[12] have shown glycaemic control in only 20% of Keralan diabetic patients. Despite implementation of adherence reminders in management of both communicable and NCDs,[39–41] mHealth interventions may not alleviate poor access[38] to CVD medication in India, including Kerala, and warrants further investigation before mHealth implementation.

The finding of preference for voice calls may limit potential impact of SMS interventions and highlights the importance of context-specific m-health. As in other studies in India,[16,22] SMS is not favoured by individuals of older age, lower educational status or lacking employment. Since these groups have higher prevalence of risk factors and CVD, there is potential for SMS-based interventions to widen existing health disparities in CVD.[11,34] Previous voice call interventions have used automated, interactive delivery systems,[39] which may be inappropriate in this context if voice calls were preferred due to a specific desire to speak directly to a healthcare professional/ASHA. This was beyond the scope of the current study. Interestingly, qualitative analysis of patients in the HIVIND trial in South India favoured the interactivity of an automated phone call to an SMS.[40] Establishing the most convenient timing for voice call delivery was also important to avoid disclosure of the caller's origin and subsequently the patient's HIV status feared-aspects not explored in our study.

Participants preferred Malayalam in SMS and voice calls. We found no statistically significant associations between participant demography and language preference of voice calls. Importantly, we showed that participants of increasing age, male sex, low occupational status and English illiterate were significantly more likely to prefer SMS to be sent in Malayalam. This may pose further challenges to the feasibility of SMS medication reminders, potentially isolating these high-risk groups, since many mobile phones only accommodate English language. These concerns have been highlighted in qualitative analysis of CVD patients in Kerala[35] and elsewhere in South India.[22] Use of pictorial SMS has been advocated by studies in South India,[22,39] but was not explored in our study.

While the majority of ambivalent participants suggested only sharing information with a doctor, they also supported sending home-recorded information to doctors/ASHAs. This supports the growing role of ASHAs and other non-physician health workers in this context.[41–43] Previous studies in India have shown positive CVD outcomes after integration of mHealth strategies into existing health structures,[28,36,44] including ASHAs. Complementing existing healthcare frameworks with mHealth interventions would avoid widening health disparities in high-risk groups less familiar with mobile technology, while simultaneously preserving crucial face-to-face contact with physicians and ASHAs.

4.1. Study limitations

Generalisability to other settings in India may be limited due to convenience sampling and sample size, despite our efforts to capture a representative study population and vary the recruitment time (early morning to early evening), unlike comparable studies in South India.[22] High socioeconomic status individuals were over-represented in our sample, which may affect the generalisability to all sectors of the population. The generalisability of such findings is also changing in terms of the nature and acceptability of m-health interventions both in India and globally. Surveys such as ours can be used to assess the "readiness" of the mHealth market and mobile carrier companies might be required to conduct these type of surveys periodically (incorporating health questions).

There is potential for social desirability bias, since ASHAs were responsible for data collection and healthcare provision, potentially exaggerating acceptability outcomes in this population, particularly regarding confidence in security and privacy. We attempted to minimise this bias by assuring participants that answers would not impact on future healthcare. Interviewer bias may also have occurred if ASHA perceptions had influenced participants' answers. Finally, sampling bias may have arisen if systematic differences existed in individuals residing in areas without mobile network, or those without regular access to a mobile phone, including age, gender or socioeconomic status. Views of clinicians and ASHAs regarding m-health were not investigated in this study, though qualitative interviewing in Kerala found greatest opposition to mHealth among physicians, highlighting need for mutual cooperation and commitment from end users, the healthcare professions, regulators and governmental policy.

5. Conclusions

The widespread use of mobile phones and acceptability of mHealth in this population corroborates previous findings in rural South India, suggesting feasibility and suitability of mHealth interventions in CVD management and prevention. However, future research should ensure that m-health interventions do not neglect the sectors of the population at highest risk of CVD and its risk factors.

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Conflicts of interest

The authors have none to declare.

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Appendix A. Questionnaire on the current usage of mobile phones in Kerala and potential for mHealth in non-communicable diseases: A population-based survey

Date of Interview:
Interviewer:
Participant number:
Age:
Gender:
Number of family members:
Number of male adults:
Number of female adults:
Number of male children:
Number of female children:
How many phones are owned: □ In the entire household: □ By the males: □ By the females:
Do you own a landline connection: □ Yes □ No If yes: how much is spent on the landline phone per month

Q No.	Question	Response	Instructions/notes
1.	Do you routinely use a mobile/cell phone?	□ Yes □ No	If 'Yes', proceed to Q3.
2.	Why do you not use a mobile phone?	□ Lack of money □ Lack of network □ No use for it □ Inability to use it □ Other: _____ _____ _____	No prompts. Multiple reasons possible
3.	Do you own a mobile phone?	□ Yes □ No	If no, skip to Q10
4.	Is this phone usually in your possession?	□ Yes □ No If no, shared by:	

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		_____ _____	
5.	Since when have you used a mobile phone?	_____ yrs	Eg 0.5, 2.0, 2.5
6.	How often do you - Call others - Receive calls	_____/day or week _____/day or week	Mark carefully whether day/week
7.	How often do you - Send SMS/text messages - Receive SMS	_____/day or week _____/day or week	Mark carefully whether day/week
8.	Do you use the alarm function on your mobile phone?	☐ Yes ☐ No	If no, skip to Q9
8.a)	What do you use the alarm function on your mobile phone for?	☐ As a wakeup call ☐ To remind me of errands ☐ As a reminder for medications ☐ Other: _____ _____ _____ _____ _____	Multiple answers possible
Q9.	What else do you use the mobile phone for?	☐ For listening to radio/music ☐ For playing games ☐ To use the camera ☐ To access the internet ☐ Other: _____ _____ _____ _____	Multiple answers possible

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		_____	
Q10.	Would you provide your mobile number to a doctor so that he or she may contact you?	☐ Yes ☐ No	
Q11.	If you responded 'No', what are the reasons for this?	_____ _____ _____ _____ _____ _____ _____ _____	
Q12.	Would you like to receive health advice on your mobile phone?	☐ Yes ☐ No	If no, go to Q18
Q13	If yes, what topics would you like to receive information on?	☐ Improving diet and nutrition ☐ Exercise and physical activity ☐ Weight reduction ☐ Smoking cessation ☐ Pregnant women's health ☐ Mental health awareness ☐ Mother and child health ☐ Vaccinations ☐ Self-care in chronic diseases like high blood pressure and diabetes ☐ Information on epidemics and precautions ☐ Other	Provide each option

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		_____ _____ _____ _____	
Q14.	What format would you like to receive this information?	☐ Voice call ☐ SMS ☐ No preference	
Q15.	If you would prefer SMS form, in which language would you prefer the SMS?	☐ Malayalam ☐ English ☐ Other _____ _____	
Q16.	If you would prefer voice calls, in which language would you prefer the call?	☐ Malayalam ☐ English ☐ Other _____ _____	
Q17.	How frequently would you like this information?	☐ Daily ☐ Twice a week ☐ Once a week ☐ Fortnightly ☐ Monthly	Choose only one
Q18.	Consider a patient with a chronic illness such as high blood pressure, diabetes, or high cholesterol. They are receiving long-term medications. Do you think it would be helpful to have automatic reminders sent to their mobile phone to help remind them to take their medications?	☐ Yes ☐ No	
Q19.	If you were provided with automatic reminders for taking your medications, what format would you	☐ Voice call ☐ SMS ☐ No preference	If SMS, go to Q21

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	like these to be?		
Q20.	If you would prefer voice calls, in which language would you prefer the call?	☐ Malayalam ☐ English ☐ Other _____	
Q21.	If you would prefer SMS form, in which language would you prefer the SMS?	☐ Malayalam ☐ English ☐ Other _____	
Q21.	If we were to provide patients with automatic reminders for their medications, how often would you like these reminders to be sent?	☐ As often as their medicine needs to be taken ☐ Daily ☐ Once a week ☐ Twice a week	Choose only one
Q22.	Why do you think these medication reminders would not be useful?	_____ _____ _____ _____ _____ _____ _____ _____ _____	
Q23.	If a mobile phone based application was developed using mobile phones for people in India living with	☐ Enable communication with the doctor/health worker	

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	high blood pressure, diabetes or high cholesterol – what would you like to see this application do?	☐ Provide information on medicines ☐ Provide further information about illnesses ☐ Other uses _____ _____ _____ _____ _____ _____ _____	
Q24.	Would you consider sending home-recorded information on your blood pressure, weight, medication use and lifestyle to your healthcare worker/doctor by mobile phone?	☐ Yes ☐ No	
Q25.	If you possessed a mobile phone, would you use it to communicate with your doctor or health worker?	☐ Yes, definitely ☐ Yes, sometimes ☐ Not sure ☐ Rarely ☐ Probably not	Provide options, choose only one
Q26.	Would you prefer to communicate with a doctor over a mobile phone, for care of an acute illness?	☐ Yes ☐ No	If 'No', go to Q26a
Q26a.	If no, why?	_____ _____ _____	

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		_____ _____ _____ _____	
Q27.	Would you like to be able to make an appointment with your doctor over the phone?	☐ Yes ☐ No	If 'No,' go to Q27a
Q27a.	If no, why?	_____ _____ _____ _____ _____ _____ _____ _____	
Q28.	Do you feel it would be beneficial to use mobile phones during emergencies?	☐ Yes ☐ No	If 'Yes', go to Q29
Q28a.	If no, why?	_____ _____ _____ _____ _____ _____ _____ _____	
Q29.	Do you feel that use of mobile phones during	☐ Yes ☐ No	

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	emergencies could be beneficial?		
Q30.	Do you think that usage of mobile phones to supplement health practices in the above-mentioned ways will intrude into people's lives?	☐ Yes ☐ No	
Q31.	Do you think that calling the doctor/health worker over the mobile phone will be troublesome to him/her?	☐ Yes ☐ No	
Q32.	Would you feel confident that information shared by mobile phone with your health worker/doctor would remain confidential?	☐ Yes ☐ No ☐ Not sure	Choose only on option
Q33.	Would you have any concerns about the privacy of the information you shared with your health worker/doctor?	☐ Yes ☐ No ☐ Not sure	Choose only on option Only proceed to Q34 if answered 'Yes'/'Not sure'
Q34.	Could anything be done to increase your confidence in the privacy and confidentiality of any information you shared with your health worker/doctor?	☐ Only share information with a health worker ☐ Only share the information with a doctor ☐ Only share certain information by mobile phone ☐ Only send information by SMS ☐ Only send information by voice call ☐ Other _____ _____	

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		_____ _____ _____	

Marital status:
- ☐ Married
- ☐ Divorced
- ☐ Widowed
- ☐ Not married
- ☐ Living alone

Language (mother-tongue):

Languages subject can:

(read and write)

(speak fluently)

Education level:
- ☐ No formal
- ☐ Primary school
- ☐ Middle school
- ☐ High School
- ☐ Pre-University
- ☐ Undergraduate
- ☐ Post-graduate

Occupation:
- ☐ None
- ☐ Unskilled
- ☐ Semiskilled
- ☐ Skilled
- ☐ Semi-professional
- ☐ Professional

If no current employment, does anyone in your family have regular employment?
- ☐ Yes
- ☐ No

If yes, who?

Do you have a diagnosis of any illness?
- ☐ Yes
- ☐ No

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If yes, please detail
Do you currently receive any treatment for this/these illness(es)? ☐ Yes ☐ No If Yes, please detail
What type of house do you live in? ☐ Pucca (built with a foundation, using stone/bricks with mortar and cement with a concrete/stone-laid roof) (4) ☐ Semi-pucca (some cement/mortar/flooring/roofing used) (2) ☐ Katcha (more than one room using mud walls and thatched roof) (0)
Does this household own this house or any other house? ☐ Yes (2) ☐ No (0)
How much agriculture land does this household own? ☐ 5 acres or more (4) ☐ 2-4.9 acres (3) ☐ <2 acres or unknown acreage (2) ☐ No land (0)
Out of this land, how much is irrigated? ☐ Some (2) ☐ None (0)
Does this household own any livestock? ☐ Yes (2) ☐ No (0)
Do you have a separate room which is used as a kitchen ☐ Yes (1) ☐ No (0)
What type of fuel does your household mainly use for cooking?

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☐ Wood (0) ☐ Crop residues (0) ☐ Dung cakes (0) ☐ Coal/coke/lignite (1) ☐ Charcoal (1) ☐ Kerosene (1) ☐ Electricity (2) ☐ LPG (2) ☐ Bio-gas (2)
What is the main source of lighting for your household? ☐ Electricity (2) ☐ Kerosene (1) ☐ Gas (1) ☐ Oil (1)
What is the main source of drinking water for members of your household? ☐ PIPED WATER piped into: - residence/yard/plot (2) - public tank (1) ☐ GROUND WATER - Hand pump at residence/yard/plot (2) - Public hand pump (1) ☐ WELL WATER Well in residence/yard/plot - Covered well (2) - Opened well (2) Public well ☐ SURFACE WATER - Spring (0) - River/stream (0) - Pond/lake (0) - Dam (0) ☐ RAIN WATER (0) ☐ TANKER TRUCK (0)
Does the household own any of the following A mattress ☐ Yes (1) ☐ No (0) A pressure cooker ☐ Yes (1) ☐ No (0) A chair ☐ Yes (1) ☐ No (0) A cot/bed ☐ Yes ☐ No A table ☐ Yes (1)

☐ No (0)
A clock/watch
☐ Yes (1)
☐ No (0)
An electric watch
☐ Yes (2)
☐ No (0)
A bicycle
☐ Yes (2)
☐ No (0)
A radio/transistor
☐ Yes (2)
☐ No (0)
A sewing machine
☐ Yes (2)
☐ No (0)
A telephone
☐ Yes (3)
☐ No (0)
A refrigerator
☐ Yes (3)
☐ No (0)
A black and white television
☐ Yes (2)
☐ No (0)
A colour television
☐ Yes (3)
☐ No (0)
A moped/scooter/motor
☐ Yes (3)
☐ No (0)
A car
☐ Yes (4)
☐ No (0)
A water pump
☐ Yes (2)
☐ No (0)
A bullock cart
☐ Yes (2)
☐ No (0)
A thresher
☐ Yes (2)
☐ No (0)
A tractor
☐ Yes (4)
☐ No (0)
Total score

0-14: LOW
15-24: MIDDLE
25-67: HIGH

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