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Review Article

Does mHealth suitable for the Indian population? analysing criticisms and possibilities

Susanna Gunamany*

Humanities and Social Sciences, Indian Institute of Technology, Gandhinagar, Gujarat, India

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***Correspondence:**
Dr. Susanna Gunamany,
E-mail: susanna.g@iitgn.ac.in

ABSTRACT

India is the second-largest country globally in terms of population, with two-thirds of the population living in rural areas. India has made a significant pace in improving the overall health scenario even with several existing hurdles like vast geographical area, lack of quality transport facilities, high population density and nutrition, illiteracy, and poverty in the past decade. India has an exponential increase in mobile phones that have covered a substantially higher number of rural households. Even though technological innovations, especially mHealth platforms, are growing in developing countries like India, it faces many criticisms. This paper aims to analyse whether mHealth is a potential tool for the Indian population or not. mHealth interventions can be used in different domains to improve the performance of health workers, such as data collection and reporting, decision support and training, emergency referrals, alerts and reminders and supervision and interaction with other members of the healthcare system. It also helps the health system manage the problem of healthcare personnel absenteeism and can be used as an alternative to telemedicine. However, mHealth apps may not be broad enough to provide a healthy environment that enables individuals and populations to adopt a healthy life. Our study highlights the importance of integrating beneficiary-specific factors in developing mHealth interventions. The pathways linking access to, and use of, mobile services with healthcare utilisation need an in-depth study to ensure effective planning, designing and implementation of mHealth interventions.

Keywords: mHealth, Mobile phone, India, Public health, Health service, Health care utilisation

INTRODUCTION

India is the second-largest country globally in terms of population, with two-thirds of the population living in rural areas.[1] The demographic and epidemiological transition of the country is supplementing the already existing high burden of communicable, non-communicable and various other infectious diseases.[2] In the past decade, India has made a significant pace in improving the overall health scenario even with several existing hurdles like vast geographical area, lack of quality transport facilities, high population density, and issues related to nutrition, illiteracy, and poverty.[3] These factors continue to be the underlying reasons to slow down the pace in achieving an efficient healthcare system.[3] Significant disease burden of communicable and non-communicable diseases, limited human resources, poor health infrastructure, high absenteeism of health care providers at government facilities, accessibility issues related to health care by rural inhabitants increases the existing catastrophes in health care delivery in the country.[4,5] Challenges still exist in the health system due to malfunctioning of the three-tier referral system accessibility and affordability of secondary/tertiary level health services.[1] It is important to develop innovative and cost-effective methods to strengthen the existing health care delivery system in the current scenario. Hence, the global agencies, including the world health organization

(WHO) and the world bank, highlight and recommend the possibilities of incorporating technological innovations to tackle the existing challenges in public health in developing countries.[6,7] They recommend applications of information communication technology (ICT) such as telemedicine, health information system, electronic health (eHealth), mobile technology in health (mHealth) etc., as possible alternatives.[6] According to the latest statistics provided by the telecom regulatory authority of India (TRAI), India has an exponential increase in mobile phones that have covered a substantially higher number of rural households.[8] In light of this, the government of India decided to incorporate various ICTs such as telemedicine, eHealth and mHealth platforms to extend health services and empower healthcare providers, especially those who are working at the grass-root level.[7]

Even though technological innovations, especially mHealth platforms, are growing in developing countries like India, it faces many criticisms. Among those criticisms, an important one would be mHealth placing an excessive burden on citizens while reducing the accountability of the public health system. Hence, there is a risk of viewing it as a panacea for ailing public health system, especially in Indian context. This paper aims to discuss arguments that support, counter these criticisms.

mHEALTH PLACES AN EXCESSIVE BURDEN ON THE CITIZEN WHILE REDUCING THE ACCOUNTABILITY OF THE PUBLIC HEALTH SYSTEM

The primary argument for supporting this view could be that mHealth technologies mostly emerge from a simplistic biomedical approach on social determinants where the mHealth interventions try and attempt to modify the agent's behaviour. Hence the primary assumption of this agent-centric approach is that the behaviour change of agents can bring improvements in health outcomes. Hence mHealth interventions are too narrow as an approach as it does not often consider major societal level determinants of health. Since individual-centric mHealth interventions are a good fit for the biomedical approach, the responsibility of the use and non-use of these technologies are also ascribed to the citizens.[9] Naturally, the subsequent change in health status (whether it is good or bad) will be seen as the responsibility of the individual intended to use the mHealth intervention. Hence there could be a natural shift in responsibility from the health system to the individual.

The following section of this paper tries to explain various factors that make mHealth interventions an extra burden on the common man and also tries to point out a few findings suggestive of the same.

Digital literacy as a prerequisite for the success of mHealth interventions

In general, literacy is considered a social determinant that impacts health outcomes.[9] Similarly, to achieve desirable health outcomes from a mHealth intervention, basic digital literacy is an important factor.[10] In a study conducted in rural Bangladesh, only 45% of the participants reported owning mobile phones.[11] Out of the total respondents, only 31% of them were aware of the use of mobile phones for healthcare. The study also concludes that males, younger age group, better educated, and those from comparatively higher socioeconomic status were more aware of the existing mHealth services.[11] This finding indicates that the social determinants of digital literacy are as important as the universality of digital innovations. The same study also concludes that among the participants who availed of health services in the preceding two weeks of the survey, only 2% used mobile phones for healthcare access. Adherence to the advice from the healthcare providers in terms of purchasing and taking the drugs was somewhat similar between the patients who used a mobile phone for consultation versus making a physical visit.[11] The above findings conclude that digital literacy and awareness play an important role in the success of various mHealth initiatives. It also suggests that mHealth interventions may not be effective if implemented alone (without linking to the existing health system) and may add extra burden on them.

Patients' motivation levels and commitment play a role in the outcome

Even though mHealth interventions are known for behavioural modifications and improving health outcomes, it is also important to note that it highly relies on the participant's motivation levels and commitment.[12] Several studies proved that treatment adherence (HIV, Tuberculosis, etc.), adopting healthy lifestyles, and even interventions to improve health awareness are associated with the participants' motivation levels.[12] Even though the mHealth tools are trying to improve the motivation levels, it does not focus much on the social support systems. For instance, if we consider the treatment adherence of HIV patients in rural India through the mHealth platform, the participant will be getting reminders and updates.[13] However, none of the existing platforms in India can provide social support and measures to reduce the social stigma associated with HIV. mHealth may be a potential tool for better health outcomes, but it almost depends on the motivation and acceptance levels of the individual. This may increase the individual level of responsibility in achieving better health outcomes.

Health promotion without enabling and mediating the target population

Health promotion is one of the important functions of the public health system. Ideally, health promotion has three core components: advocate, enable and mediate the target population to achieve better health outcomes.[14] When we consider mHealth platforms, most of them are only concerned about the aspects of individual advocacy and behavioural change. They often neglect the political, economic, social, cultural and environmental aspects.

Most of the time, mHealth apps may not be broad enough to provide a healthy environment that enables the individuals and population to adopt a healthy life. Most of the time, these innovations may not be able to focus much on mediating function of health promotion, i.e., between different groups and different sectors to ensure health.

Not addressing the structural factors of inequalities

When we tackle the inequities in health, the health system needs to focus more on the structural factors leading to those inequities.[15] Contemporary research focuses on the social and societal determinants of health and criticises the primitive frameworks such as biomedical and lifestyle as they merely focus on the individual level, thereby limiting the actions capable of changing the structural and political determinants inequities.[16] As most mHealth initiatives focus more on personal lifestyle changes, it fails to enable the communities to counteract the pressures towards harmful events, resource depletion, unhealthy living conditions and environments.[9] For example, a study conducted in rural Karnataka to evaluate the effectiveness of a mHealth intervention found it helpful in quitting smoking. The key features of this intervention include timely reminders, text messages and motivational pre-recorded voicemails.[17] Even though it was found effective, it is important to note that it addresses only the individual-level risk of smoking. The effective way of tobacco control may include policy changes and interventions addressing social determinants of smoking. The health system's responsibility is not merely the individual-level intervention but should address the inequities and the broader aspects and underlying causes for the same.

Determinants influence the effectiveness of mHealth interventions

As it is mentioned earlier, various determinants can influence the effectiveness of mHealth interventions. The determinants that can positively affect outcomes include lower age group, male gender, formal education, employment, access to mobile phones and willingness to receive mHealth services.[18] In a study conducted in rural Orissa, respondents with formal education were six times more likely to call their doctor over the mobile phone in an acute illness than those literate in English who did not prefer calling the doctor.[19] Similarly, A study conducted among HIV patients in semi-rural Karnataka in 2010 found that eighty per cent of the study participants preferred reminders as a voice call in the local language instead of an SMS text in the local language.[20] These findings shed light on various determinants that influence the effectiveness of mHealth interventions, and they can adversely affect the health outcome of the user.

Affordability of smartphones/mobile phones

Ownership of a mobile phone is one of the key determinants of the success of a mHealth intervention. According to the latest world bank report, one in five Indians is poor, and eighty per cent of them live in rural areas. The report also highlights that the poor spend more on food, fuel, and light than health and education.[21] A study conducted in rural Puducherry concludes that only 38% of participants had personal mobile phones, and less than half (43.5%) had a mobile phone with their family members.[22] The cheapest version of mobile phones even costs INR 500 and above, and for a smartphone, it can go up to INR 1500.[23] Even though around 61 per cent of the poor owns a mobile phone, most of them are using basic versions, which may not be able to facilitate health interventions that are specially targeted for illiterates.[24] The charges associated with making calls, sending SMS and access to the internet may contribute to a further financial burden to the citizens.[21] Also, if the health system entirely relies on mHealth interventions, the common man may suffer the extra economic burden associated with the use and maintenance of mobile phones.

mHEALTH IS NOT PLACING AN EXCESSIVE BURDEN ON THE CITIZEN WHILE REDUCING THE ACCOUNTABILITY OF THE PUBLIC HEALTH SYSTEM, BUT IT ENHANCES THE EFFICIENCY OF THE PUBLIC HEALTH SYSTEM

Even though the mHealth interventions lack the aspects mentioned above, it is also proved that they can potentially improve and strengthen the existing health care system. As the definition of mHealth indicates, it is not only used by the beneficiaries of the health system but also by the providers. Various mHealth interventions were found to be effective for both supply and demand sides of the health system.

Acceptability of mHealth among citizens

Even though the penetration levels of mobile phones and gadgets are high in rural India, it is important to explore the acceptability of mHealth interventions among the rural population. A study conducted in rural Karnataka concludes that out of 488 respondents, 99% were open to receiving health information on mobile phones.[24] The study also concludes that 75% of respondents were willing to call their doctor using their mobile phones to manage acute illnesses. Almost all of them (99.7%) would call their doctor with their mobile phones in a medical emergency.[24]

Similarly, a study conducted in rural Puducherry concludes that. The 60% of the participants were willing to receive health information, and 52.6% preferred voice calls. It is also found that lower age group, male gender, having a formal education, employment, and access to mobile phone was associated with willingness to receive mHealth services. Of the study participants who were willing to receive health-related information, 52.6% preferred voice calls, 42% preferred SMS, and 5% preferred either. Nevertheless, at the same time, 93.6% of

the participants preferred to receive health tips in the local language. Diet, medication usage, and lifestyle modification were the three most common bits of information that participants were willing to receive.[22] The above evidence and similar studies conducted in a different part of India conclude a greater level of acceptance for mHealth interventions among the general population.

Preference of mHealth over traditional ways of health communication

In most of the studies conducted, the participants preferred mHealth platforms over other traditional mediums of health communication. A study conducted in rural Karnataka concludes that around 78 respondents were satisfied by health communication through mobile phones than through traditional mass mediums.[24] Participants preferred information on topics on healthy living, nutrition, maternal and child health, vaccination, self-care in chronic illnesses, and information on infectious disease epidemics. Interestingly, out of the 484 participants willing to receive health information via mobile phones, 45% preferred to receive the information daily, 46% weekly, and 9% monthly. Similarly, when it comes to the perceptions regarding the vaccination reminder system, a majority (76%) preferred to receive vaccination reminders a day earlier to the date of vaccination, 15% on the vaccination day itself and 9% from a week to a month prior to the date of vaccination. Most respondents preferred voice calls (86%) and SMS (65%) in the local language.[24]

Similarly, A study conducted among HIV patients in semi-rural Karnataka in 2010 to demonstrate usage of mobile phones and perceptions of their use as an adherence aid found that 74% of the participants consider automated reminder features would help maintain good adherence. It is also found that this opinion was not associated with the participant's age, gender, literacy or mobile phone ownership. Eighty per cent of these respondents preferred this reminder as a voice call in the local language instead of an SMS text in the local language. Two-thirds (66%) preferred to receive the automated reminders once or twice a week, while the remainder desired a once- or twice-daily schedule. The study concludes that 89% of respondents did not consider such automated reminders as intrusion on their privacy.[25]

The above findings show that the beneficiaries preferred mHealth over other communication mediums and consider them as a support system rather than a burden.

mHealth in reaching out to illiterate and rural populations

India has an overall literacy rate of 74 per cent, according to 2011 census data.[1] Reaching out and improving health awareness among the illiterate rural population is an important challenge in public health.[2] Even though the government has been implementing several health promotion programmes, sometimes the traditional health education methods like posters, hand-outs and mass media campaigns through newspapers may not be effective among the population mentioned above.[2] According to the latest statistics provided by the telecom regulatory Authority of India (TRAI), India had some 1078 million total wireless subscribers by the end of October 2016.[8] The world bank report also emphasises the increased penetration level of mobile phones in rural households.[21] Even though this coverage appears to be low, mobile phones have covered a substantially higher number of rural households.[8] A population-based clinical trial in South Africa concludes that the health education sessions regarding HIV prevention and treatment using mobile gadgets were more effective than the existing methods. The study also found that the intervention was equally effective irrespective of the educational status.[26]

Similarly, a Bangalore study compared a self-monitoring weight management intervention delivered by a smartphone app and a traditional health education session and follow up in 128 overweight volunteers. Finally, the study findings conclude that the app using group adherence was significantly higher than other. Literature evidence shows that there is growing acceptability of mHealth interventions among the rural populations.[5]

A study was conducted in 2014 in rural Karnataka to explore the acceptability of delivering healthcare interventions through mobile phones among the rural population. The study found that 99% of participants were willing to receive health-related information on their mobile phones and did not consider receiving such information an intrusion into their personal life. 98% of the participants showed interest in receiving reminders for drug adherence, 89% preferred voice calls to other forms of communication.[27]

According to the latest World Bank report, around 68 per cent of India's population is living in rural areas, so it is important to spread health education interventions to the maximum number of people. Based on all of these studies, we can conclude that mHealth can potentially act as an alternative for existing forms of mediums in reaching out rural Indian population. In this way, mHealth interventions can act as a supportive measure in strengthening the existing health system.

It can be used to reach large numbers

Health education and promotion are one of the key functions of the health system.[28] Traditionally, health education programs are conducted through various mass mediums such as newspapers, television, health magazines and radio, when provided at a sufficient frequency, can promote healthy behaviours.[29] Advantages of health education campaigns through traditional mass media include a broad audience reach, an easily expandable frequency of delivery, a high degree of

control over the content, and a relatively low cost.[30] On the other hand, limitations include difficulties capturing the audience's attention in an increasingly cluttered media environment, the one-way flow of information from providers to consumers, and a limited ability to offer specific target messages.[31] In this scenario, mHealth programs offer several advantages over traditional health promotion methods and disease prevention adopted by the health system. They provide opportunities for interactive two-way communication and target specific, customised behaviour change communication.[32] Such interventions offer the opportunity to disseminate automated, timely, and target-specific messages, which can be designed to complement or mirror in-person counselling.[33,34] For example, messages can offer customised advice, behaviour tracking, goal setting, encouragement, or personal feedback in different stages of behaviour change.[34] Many theories focus on the need for health messages to offer to reinforce and enable components of effective health interventions.[33] mHealth platforms can potentially help the target population stick to the desired health behaviours with the help of reminders and follow up systems. In this manner, mHealth can be used as a potential tool for supplementing health system's efforts in reaching out to its beneficiaries in large numbers.

Enhancing the ability and quality of healthcare providers

Healthcare providers are considered one of the key players in the healthcare delivery system. The ability efficiency and quality of providers can impact health outcomes.[29] Various initiatives are happening around the globe to achieve the same. In this scenario, in a study conducted in 2008, researchers evaluated a mHealth intervention with several short mobile videos developed for community health workers (CHWs) to assist them during advice to the pregnant women in rural communities in the state of Orissa in India.[36] These videos conveyed messages that could potentially motivate pregnant women to adopt better health practices and motivate the ASHAs, a CHW engaged in providing counselling, facilitating access to health services, and improving their performance. The four-minute videos had animated actors expressing powerful messages or just delivering lectures. The spoken message was in the study area's local language, such as Oriya or Kui languages. Messages focused on various dangers that pregnant women face, such as the dangers of anaemia preventive actions. This video was prepared using multimedia software available in the market before converting the video to a format suitable to play on a readily available phone in rural India.[36] The experiment with seven health workers and their 52 clients improved the quality of counselling and client engagement as seen by the response by the client to the video, health worker and attention level.[36] The mobile video project in Orissa demonstrates the uses of mobile communication both in behavioural change communication and delivery. Hence, the mHealth interventions like this target the beneficiary group and improve the health services by the providers. Thereby it can improve functioning of the health system.

Better outcomes in resource-constrained settings

Despite being operational for over 30 years, universal immunization programme (UIP) has been able to fully immunise only 65% of children in the first year of their life, and the increase in coverage has stagnated in the past five years to an average of 1% every year.[37] Short message service (SMS) texts using the existing maternal and child tracking system (MCTS) may offer a potential low-cost solution in India. They may accelerate India's drive to vaccinate all children against vaccine-preventable disease.[38] Similarly, surveillance and data gathering are also important functions of the health system. In the Indian context, data from peripheral health facilities are collected and maintained in paper-based formats.[39] Research conducted in Malawi in 2007 shows that 14% of paper-based data had been discarded because of unreadable handwriting, missing decimal points, or some outliers in the forms.[40] On the other hand, error rates of 4% for electronic forms, 5% for SMS and less than 1% for telephonic helpline.[41] A study conducted in Gujarat to compare the effectiveness of different data collection methods found that electronic data collection methods have the lowest error rate of 4.2%. This result motivated the same investigators to migrate from paper forms to electronic forms data collection in their next project to minimise errors in critical health data.[42] In 2008, National Rural Health Mission implemented a country-wide health information system that is considered a well-established health management information system for routine reporting.[43] From the existing literature evidence, it is convincing that mobile devices can be gradually used in data collection and reporting of HMIS and other surveillance data in future. Besides improving data quality, data collection using mobile devices allows faster reporting of services delivery to facilitate supervisor verification.

Convenient and easy to use for grass-root level workers

The evidence from the literature also reported that various mHealth initiatives are found to be convenient and easy to use, especially for grass-root level workers. Grass-root level workers such as ASHAs, Anganwadi workers and ANMS play an important role in the Indian health system.[44] In 2012, the Uttar Pradesh government implemented a mobile app called mSakhi to improve the performance of ASHA workers.[45] mSakhi is a mobile-based interactive tutorial that offers 153 key health messages on women and child health which include a combination of text messages, audio, and illustrations, all contextualised with localised illustrations and dialects. The study concluded that ASHAs were more likely to use mSakhi (55%) than handbooks/ flipbooks (22%) during home visits. It is also found that knowledge of key topics improved significantly among ASHAs using mSakhi,

who also demonstrated greater recall of at least six critical newborn conditions warranting referral.[45]

Similarly, in a study conducted in rural Mexico and Guatemala, seventeen partners in health community health workers (CHWs) completed one-day training in the mHealth medicine dosing tool.[46] Following the training, a prescription dosing test was conducted, and CHWs were given a choice to use the mHealth or paper-based tool. Out of the total participants, 82% chose the mHealth tool for at least 1 of 7 questions compared to 53% who chose to use the paper-based tool. Whereas 93% CHWs rated the mHealth tool as easy or very easy to use, and 56% who used the paper-based tool rated it as easy or very easy. When comparing the accuracy levels, it was higher among questions answered using the mHealth tool than questions answered using paper-based tool. Analysis of major qualitative themes indicated that mHealth tool was perceived as quick, easy to use and complete information.

CONCLUSION

mHealth interventions can be used in different domains to improve the performance of health workers, such as data collection and reporting, decision support and training, emergency referrals, alerts and reminders and supervision and interaction with other members of the healthcare system. It also helps the health system manage the problem of healthcare personnel absenteeism and can be used as an alternative to telemedicine. However, mHealth apps may not be broad enough to provide a healthy environment that enables the individuals and population to adopt a healthy life. Sometimes, these innovations may not be able to focus much on the mediating function of health promotion, i.e., between different groups and different sectors to ensure health. From the arguments mentioned, someone can argue that the individual-centric mHealth interventions may create utilization divide among the common man. However, it may consider a potential tool, considering the broader applications of mHealth in health system strengthening. There is need to conduct a detailed study of target populations' use of mobile phone services, and their autonomy in purchasing and using mobile phone and the Internet. Our study highlights the importance of integrating beneficiary-specific factors in developing mHealth interventions. The pathways linking access to, and use of, mobile services with healthcare utilization need an in-depth study to ensure effective planning, designing and implementation of mHealth interventions.

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