



REVIEW ARTICLE

Incorporating mHealth Interventions into Kenya's Health Infrastructure to Augment Universal Health Coverage, Service Delivery Improvement Approach

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Abstract

mHealth is the use of mobile and wireless devices to improve health outcomes, healthcare services, and health research. An estimated 68% of the world's population own mobile phones, with Kenya having approximately 80% of mobile phone penetration. This makes it feasible to accelerate the uptake of mHealth interventions to improve health services delivery. While some evidence has shown how various forms of mHealth interventions have been used to transform health services, health outcomes, and health research in Kenya and globally, many remain largely anecdotal or undocumented. This paper examines the various forms of mHealth interventions that have been incorporated into Kenya's health infrastructure, and their effectiveness in improving health services delivery in Kenya. A systematic review of peer-reviewed articles, policy briefs, and credible materials published on mHealth have shown that mHealth has succeeded in the health infrastructure such as in collecting and transferring health and patient data, remote diagnosis, treatment, and patient follow-up. The paper also examines the barriers around the uptake of mHealth interventions and recommends how these interventions can be integrated into Kenya's health infrastructure. Even though there is every reason to believe that mHealth can allow limited resource settings to "leapfrog" over more advanced settings in using mobile technologies to improve health services delivery, mHealth is not a panacea. There are limited will and resources to scale up and integrate mHealth into the health infrastructure with attempted integration met with a negative attitude from the strained health workforce who still view mHealth as additional work, among other challenges. Despite the challenges, there may be an opportunity for Kenya's Government to leverage mobile and wireless devices to improve the delivery of health services to areas that were previously unreachable, thereby fast-tracking its commitment to achieving Universal Health Coverage.

Keywords: *eHealth, health systems, mHealth, mobile phones, telemedicine, Universal Health Coverage.*

Conflict of interest: None declared.

Introduction

Background of the study

The World Health Organization states that universal health coverage (UHC) means that all people and communities can use the promotive, preventive, curative, rehabilitative and palliative health services they need, of sufficient quality to be effective, while also ensuring that the use of these services does not expose the user to financial hardship (1). UHC has continued to gain momentum even as nations around the world move towards protecting their citizens against financial hardships in accessing health care. Kenya has shown great commitment towards achieving UHC with President Uhuru Kenyatta including it in his big four agenda (2). UHC has been piloted in Kisumu, Isiolo, Nyeri and Makueni counties of Kenya to inform the uptake and the metrics for upscaling (3). But even as UHC is being implemented, one of the questions that linger is how Kenya can leverage the huge mobile phones penetration which stands at an estimated 80 % (4) to accelerate the achievement of UHC. Reliable studies on mHealth around the world strongly suggest that mobile phones can be used for instantaneous access, for direct communication and for prompt transfer of health information (5). Mobile technologies are currently being used to monitor patient's adherence to treatments such as TB using apps (6), for patient's communication, to improved access to health services and diagnosis and for management of chronic diseases (7). With evidence of mHealth success around the world, Kenya too is at a vantage position to reap the benefits that come with its huge mobile phone subscriptions.

But even as research in this field is growing day by day, information is still limited as to the impact of mHealth interventions at scale (8). As such, a thorough systematic review of the available evidence was greatly war-

ranted to inform the parameters of integrating mHealth, especially during this period when the call to achieve universal health coverage is beckoning. To this end, the objective of this study was to conduct a systematic review that established how mHealth intervention could be incorporated into Kenya's health infrastructure to augment universal health coverage.

Statement of the Problem

Experts are in agreement that mobile health technologies hold great opportunity to revamp the health care industry (9) while addressing the inequalities that have remained so prevalent in Kenya. However, even with the huge mobile penetration for Kenya to leverage on in accelerating UHC, implementing the mobile health technologies requires more than purchasing a gadget and using them for health. Available studies are only providing evidence of the potential benefits that mHealth offers and not necessarily the implementation matrix (8). Though the field of mHealth is rapidly emerging, there is little evidence as to the impact of mHealth when rolled on a large scale and especially in achieving the much-desired universal health coverage. Furthermore, UHC in Kenya continues to grapple with inadequate service delivery 2 years after the Kenyan government ambitious plan to improve access to health care (10). As such, this systematic review is greatly warranted to inform on how mHealth can be integrated into Kenya's health infrastructure to augment universal health coverage and subsequently improve service delivery.

Justification of the Study

This review is particularly important at this time when the call to hasten the achievement of universal health coverage is emphasized. The aim of this review is to provide evidenced based recommendations on how mHealth technologies can improve service delivery and fast-track the achieve-

ment of UHC. Moreover, findings from this study will help in augmenting universal health coverage to reduce the burden of delivering health in the long term. And since the field of mHealth is rapidly evolving (11), research in this area is needed to inform the impact it has at scale and the strategies for integration. It will also inform the policy around mHealth by bringing together lessons learned while incorporating mHealth in Kenya.

Objectives of the Study

The purpose of this study is to systematically review the mHealth interventions in Kenya and establish how they can be incorporated into Kenya's health infrastructure to augment universal health coverage.

Specific Objectives

1. Examine the various forms of mHealth interventions incorporated into Kenya's health infrastructure.
2. Assess the effectiveness of mHealth interventions in improving health services delivery in Kenya.
3. Establish the challenges facing the uptake of mHealth interventions in Kenya.
4. Determine ways in which mHealth interventions can be integrated into Kenya's health infrastructure.

Research Questions

1. In what forms have mHealth interventions been incorporated into Kenya's health infrastructure?
2. Have mHealth interventions been effective in improving health services delivery in Kenya?
3. What have been the challenges facing the uptake of mHealth interventions in Kenya?
4. In what ways can mHealth interventions be integrated into Kenya's health infrastructure?

Methodology

This review followed the Preferred Reporting Items for Systematic Reviews checklist. The search criterion was derived from the review's objectives and the search done on CINAHL and PubMed. To ensure the search was contextual, exhaustive terms including mHealth, text messaging, Kenya, and low-middle income countries were used. Similarly, the search was limited to studies conducted around health between 2010-2020 that meet the expected threshold of validity and reliability. These studies were in English language. Four authors thoroughly reviewed the articles and their abstracts to establish if they were aligned to the objectives. The articles were cross verified for rigor, authority, and relevance before being subjected to review.

Inclusion & Exclusion Criteria

The review was conducted using a common search methodology. The reviewed studies and citations were assigned to reviewers before they could be confirmed for review. The review articles and citation conformed with the inclusion and exclusion criteria below:

- Recent i.e., 2010-2020.
- Relevant i.e., ehealth and mHealth.
- Quality of evidence (from reputable journals i.e., PubMed EANSO frontiers and Hindawi)
- Geographical context i.e., low-middle income settings.

Data Extraction and Quality Assessment

Two authors conducted data extraction following an agreed format and criteria. The findings of were then reviewed by two other senior authors. In the data extraction process, journal, study design, country of implementation, main findings, forms of mHealth intervention, challenges facing mHealth interventions, impact and effectiveness of mHealth interventions and

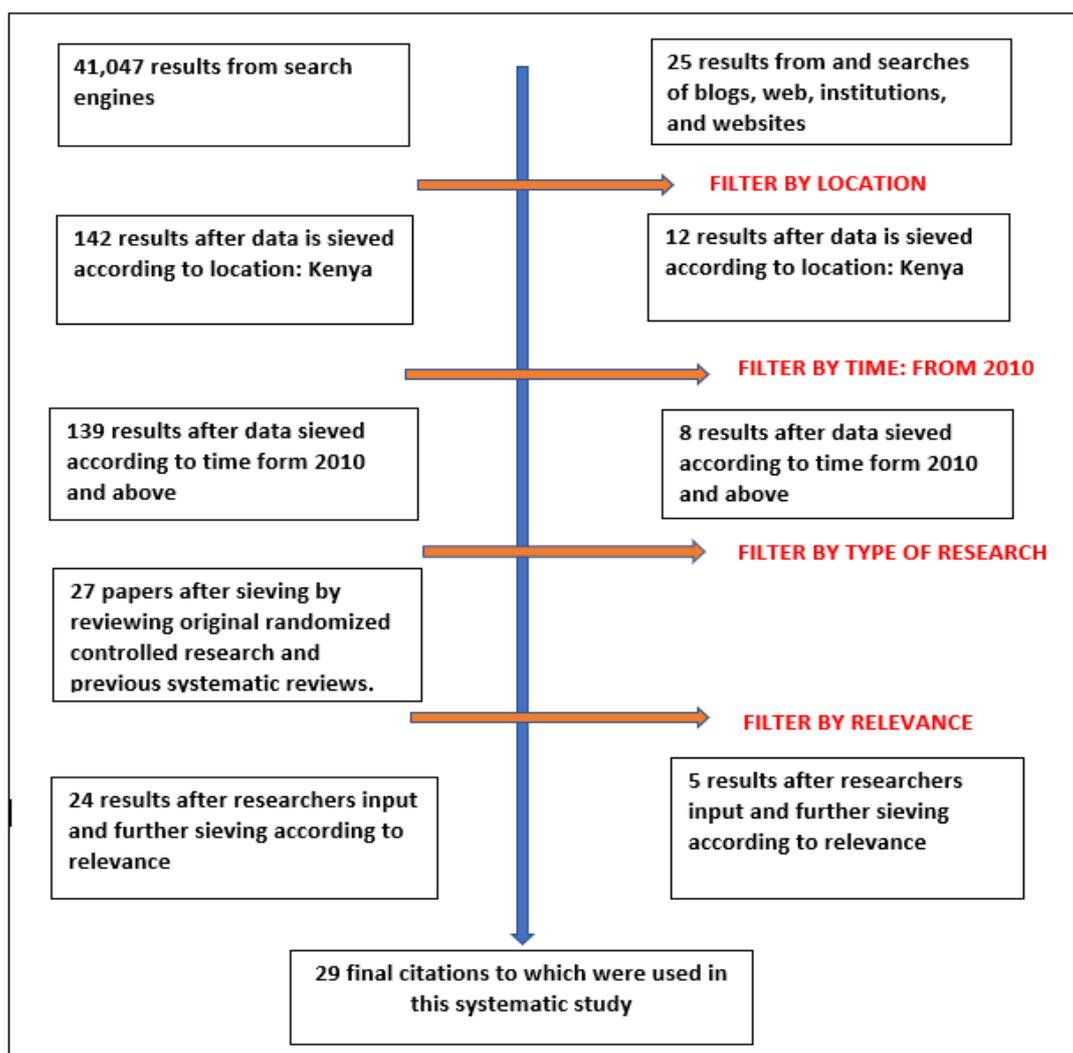
mHealth interventions scale up. To assess the methodological correctness, the reviews were evaluated using the Measurement Tool to Assess Systematic Review (AMSTAR).

Results

The search strategy identified 41,047 citations which were both peer-reviewed and non-peer-reviewed (see figure 1). An additional 25 publications were retrieved through hand searches of blogs from web searches, institutions websites, and from appropriate documents. When we applied

the filter to focus on Kenya, we got 142 citations on mhealth and 12 publications from the hand search. The researchers then applied the filter of time to look at research from 10 years ago and 139 citations from research and 8 the hand searchers emerged. The final filtering criteria involved reviewing original randomized controlled research and previous systematic reviews which led to a total of 27 papers of interest for review in addition to the 8 other citations from searches. Finally, researchers met to review the remaining documents and settled on reviewing 24 total research citations and 5 hand searched citations bringing the total of reviewed articles to 29.

Figure 1: Review Strategy, authors synthesis



Forms of mHealth interventions in the health care system

mHealth interventions have taken many forms addressing various needs in the health care delivery system. According to World Health Organization (12), mHealth interventions have taken the following forms i.e., health call centers, emergency toll-free telephone services, mobile telemedicine, health surveys, surveillance, awareness-raising, and decision support systems. Call centers, SMS and mobile Apps are the most common forms of implementing mhealth interventions in the country with SMS being used most predominantly (13-16). Most mhealth interventions are implemented in Nairobi county with about 37 counties in Kenya having at least one mHealth intervention working in the health system (13). mHealth interventions in the form of mobile Apps are also mostly found in cities where there is access to good internet connectivity and higher phone penetration while SMS and call centers generally are found in both cities and rural areas (13). Of the 29 mHealth citations reviewed, findings indicate that only 3 projects have been scaled nationally and with one project relying on the use of mobile money systems to achieve its objectives (17,18). Most mHealth interventions in Kenya focus majorly on HIV AIDS, maternal and child health and malaria (7). These interventions are provided from both private and government service providers including non-governmental organizations like Pham Access, Safaricom and Ampath bringing mHealth solution ranging from SMS daily reminders, HIV drugs compliance programmes and even medical insurance and telemedicine (9). A review of the study conducted by Vedanthan *et al.* reveals that community health workers used smartphones to improve linkages to hypertension care (14). However, this study concluded that the

strategy has to combine a tailored behavioral communication and mHealth (14).

Effectiveness of mHealth interventions in service delivery

mHealth interventions have shown success in achieving their intended outcomes. From the reviewed citations, mHealth showed success in achieving retention in care (16), behavior change (19) cultural change and adaptation of new health-friendly behavior (15), maternal and child health improvements (20). Indeed, mHealth interventions have managed to achieve effectiveness at a small scale. Most mHealth interventions have not been able to successfully scale up nationally to augment health delivery at a national level (13). In terms of cost effectiveness, of all the citations that were reviewed in this study, only two research did a cost-benefit analysis indicating that SMS use for mHealth was a cheap and cost-effective way of achieving certain health outcomes. Text messaging was found to be 35% less expensive compare to the control group through reduction in the workforce involved such as research assistants, wages, salaries required, and communication costs (5,21). In assessing the effectiveness of text messaging in clinical outcomes, the citations reviewed revealed that there is positive outcome demonstrated with moderate-quality evidence of greater improvement in the symptoms score compared to the control group (mean difference 0.36, 95% CI -0.56 to -0.17) (5). Similarly, a review of this citation further revealed that there are increased hospital visits for those in the SMS group compared to the control group. There is also reduction in number of days in hospitalization and reported better symptom control using spirometry transmission to health caregiver via SMS and cell/telephone counseling (5). Further, out of all the citations reviewed, two reviews yielded that

mobile technology led to fewer symptoms being reported for congestive heart failure (5,22). A randomized control study on cell-phone counseling in Kisumu, Kenya, showed that there was higher retention in the intervention arm than the control arm during delivery (16). The retention rate in the intervention arm was reported to be at 95.2% while that of the control arm was recorded as 77.7%. The 6 weeks postpartum was at 93.9% for the interventional arm and 72.9% for the control arm (16). Overall, despite the many mhealth interventions currently happening in the country, very few interventions have been evaluated and very few have been research based making it difficult to track overall effectiveness of mhealth interventions (13).

Challenges Facing mHealth Interventions

Together with the potential impact that comes with mHealth intervention, there are myriad of challenges hovering around their implementation. Gurupur & Wan in their systematic review indicates that usability is a challenge to mHealth implementation (23). In considering the use of mobile health technologies in providing feedback for researchers, the review submits that issues of efficacy, effectiveness and satisfaction with which users can achieve specific goals are concerns of usability. In reviewing the study by Gurupur & Wan, we found out that usability has several components which includes learnability, efficiency, memorability, and satisfaction (23). A study by Kariuki & Okanda (24) on the adoption of mHealth and usability challenges in Kenya also seem to have the same argument as that of Gurupur & Wan. The issue of usability is highlighted in the KimMNCHip m-Health application. The application was in English language hence the users who did not understand the language found it difficult to use it. Further, the study submits that the interoperability was also a challenge as the web interface did not suit every device. The display was

rather disfigured and difficult to use (24). The WelTel intervention in Kenya and Canada also revealed some of the challenges facing mHealth interventions. In reviewing their study, Bardosh *et al* reveals that juggling different interest, establishing the most appropriate financing pathways, maintaining network growth and “packaging” the intervention for impact and relevance is a challenge both in Canada and Kenya where the intervention is implemented (15).

Implementing mHealth technologies require more than just procuring the gadgets and using them. There are legal formalities that must be followed to approve their application (25). In reviewing the article by Ryan (25), it is quite evident that incorporating mobile health solutions into the larger health infrastructure calls for its implementation to be harmonized in order to remove potential inequalities that may come with it. In the view of the aforementioned, the long and bureaucratic process that involves the approval of its application is poised to cause considerable timeline challenges (25). Apart from the regulation challenges, security concerns also present another challenge that policymakers are grappling with. From the report submitted by Elliot (26), it is evident that over 400 million people are using different forms of mobile health technologies. With this huge number, a single flaw in the system can render the data available to hackers or malware. The flaw also leads to the breach of the healthcare data (27). Furthermore, mHealth has received a major blow even as critics suggest that without proper guidelines, mHealth intervention can infringe on patient's data safety. This is a widespread concern especially in the context of electronic health records (27). Still on the issue of data safety, review of the systematic review by Gurupur & Wan reveals that there is inherent problem with cloud computing-storage of data in unknown locations (23). This poses a significant threat to data and can be accessed by unauthorized persons.

Atun *et al.*, indicate that apart from problems with cloud computing, data can also suffer risk of storage in non-secure locations (28).

mHealth Integration into Kenya's Health Infrastructure

Our focus in this systematic review was to determine how mHealth can be integrated into Kenya's health infrastructure to augment universal health coverage. We were concerned about how such integration can improve service delivery and in turn, fast track the achievement of universal health coverage. In our reviewed citations, we found out that mHealth integration is possible due to the increased smartphone penetration in Kenya (24). In this study, the authors accessed the cost of accessing Uzazi Poa Web application in terms of internet bundles. The accumulative percentage of 100% of the respondents submitted that access to mHealth application was not expensive and they would adopt it at will (24). The authors are in agreement that this was attributed to the prototype being developed using light graphics which ensure prompt transmission of data from the server to the mobile phone of the user (24). In light of the above, one thing that becomes clear is the issue of usability. For mHealth intervention to be fully optimized in Kenya, the different forms of mHealth interventions must ensure efficiency which is a component of usability (23). Universal Health Coverage as defined by WHO seeks to alleviate financial hardships in accessing health care services (1) meaning that mHealth intervention must be as efficient as possible. With the huge mobile penetration in Kenya, addressing the usability concerns opens a pathway for mHealth integration into the larger health care infrastructure.

Four of the studies reviewed pointed out to the issue of an effective regulatory framework to be developed to inform the implementation of mHealth solutions (13-16,29).

The ministry of health in Kenya has the obligation of implementing mHealth committee or governing body because the field of technology and mHealth is ever-changing (29). It is paramount that the Ministry of Health set specific groups to keep up to date with new development in regard to how mobile technologies can be used to fast-track achievement of universal health coverage. A proper regulatory framework will help in data security and the protection of individual information. Similarly, integrating mHealth intervention into Kenya's health infrastructure will require more than just having a governing body. A study on the integration of mHealth in low-middle income settings suggests that governments should produce mHealth strategy and forge partnerships with NGOs implementing mHealth solutions. This partnership enhances reporting and effectiveness more so because the government is involved and has systems to accept mHealth technologies (29,30). The issue of small mHealth project reaching to scale in Kenya can also be made possible if the Ministry of Health consider endorsement of mHealth technologies as providing an acceptable standard of care (30). Changamka's Linda Jamii health insurance programme financed through a partnership between the Kenyan government and Safaricom is an example of how endorsement is critical for adoption and integration (29).

Again, for mHealth to be fully integrated into Kenya's Health Infrastructure to augment UHC, there is a growing body of need for investment in technology and infrastructure (13). The increased mobile penetration in Kenya is not a coverup for internet connectivity. It is important that the government focus on increasing cellular and data coverage and increase data speed and transmission even in most remote parts of the country (13). While at it, App developers also have the responsibility of developing applications that are efficient and can fit

well into Kenya's technological infrastructure (28). If mHealth solutions are going to fast-track the achievement of UHC, then it is only making sense if they are feasible and can be integrated into health infrastructure without major bottlenecks. Coming back on the issue of usability, mHealth interventions must be continually evaluated and reassessed to sidestep the potential problems when the intervention reaches scale (28,29).

Discussion

This systematic review was set out to identify mhealth interventions in Kenya and how mHealth could be integrated into the health system to facilitate and enhance health service delivery with the aim of augmenting universal health coverage in the country. The authors used various approaches to ensure they extensively review existing projects which fit the research criterion. The analysis of the various works in the mHealth sector revealed strong points to which mHealth interventions have indeed improved health service delivery. mHealth interventions have proven effective in achieving various health objectives necessary for the achievement of universal health coverage including improving health literacy (13), improving compliance to medication (7), enhancing positive behavior change (14,15,19), improving access to health (14,20) and improving health financing and mobile health insurance (29). In the analysis, it was also noted that mHealth interventions are a feasible way of improving service delivery (24) due to the supportive environment that the country has, which includes being one of the highest internet connection subscription rates (31), and the demographic advantage as the country mostly consists of mostly the younger population with median age being 20 years (32). Finally, one of the biggest factors in the mHealth interventions that have the potential to support and highly improve service delivery and universal health coverage is

the availability of the various forms of mHealth interventions that have been adopted and implemented in various parts of the country with success (13-16). The various forms of mHealth interventions make it very possible to fast track the achievement of Universal Health Coverage. Some of the identified challenges and limitations in the mHealth interventions included the scalability factor (13). Most mHealth interventions are implemented regionally and have not been able to scale up to various parts of the country. Another challenge identified was lack of a national governing body for mhealth interventions (29). Most mHealth interventions have been developed by private entities and until very recently, there was nobody in the government charged with streamlining mHealth interventions in the country. Finally, the biggest limitation of this research was the fact that there is a huge gap in mHealth research. Despite the numerous interventions, very few have actually been documented and even fewer have been evaluated through research (13).

Conclusion

In conclusion, this review confirms that there has been indeed a lot of mhealth interventions in Kenya, and mHealth is rapidly catching up and improving with the improved mobile internet penetration. There has been a lot of successful mHealth interventions in the country both locally and nationally. The adaptation of mHealth has been shown through research to greatly improve health service delivery and achieve various health objectives. Despite the increased developments in the mHealth space, there has been significant challenges including around perceptions, usability, interoperability, funding, and scalability. But since we are just in the beginning stages of mHealth interventions in the country and the region, these challenges are definitely expected. Owing to the findings of in this

review, and the existing evidence and future trends, it is the researcher's opinion that mHealth indeed has the potential to improve health service delivery and as a result, augment universal health coverage not only in Kenya but also around the world.

Recommendations

This review recommends the following:

1. In Kenya and even globally, more research needs to be undertaken to meas-

ure effectiveness and impact of already existing mhealth interventions.

2. mHealth interventions need to be monitored and amplified through government support and through creating a governing body for mhealth at a national level.
3. Nationwide education and sensitization should be undertaken by the governments and its partners to debunk the myths, misconceptions and ideologies surrounding mhealth to improve its acceptability by the potential users.

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