Mapping The Benefits And Limitations Of The Global Advancements In Ehealth: A Scoping Review

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Abstract: Electronic Health (eHealth) is a rapidly growing phenomenon worldwide. There are many benefits and limitations that have come with the use of information and communication technology for health. In this paper we conclude that eHealth could be more impactful if countries or responsible institutions could develop policies and increase funding to ensure tailor-made effective solutions are developed and implemented. Findings in this review also indicate that there is need for rigorous research to go hand-in-glove with the developments in technology for health as this could potentially drive both policy and future programmatic efforts.

Keywords: electronic health; eHealth; mHealth; telemedicine

I. INTRODUCTION

Internet explosion in the 1990s brought with it the need to explore the use of information and communication technologies in health (World Health Organization (WHO), 2004)(Oh Hans, Rizo Carlos, Enkin Murray, & Jada Alejandro, 2005). The Internet Society in its highlights on the history of internet evolution in Africa reported that there has been rapid evolution in internet technology from reliance upon Unix to Unix Copy Protocol (UUCP) and Fido net to full Internet Protocol connections using satellites and fibre connections(Internet Society, 2003). The communication authority of Kenya (CAK) reported that as of December 2016 internet users in Kenya stood at 39.6 million with internet penetration in Kenya standing at 89.7%. During the same period, mobile phone penetration was at 88.2%. Most people who access internet use data bundles accounting for 99% of internet subscribers. This is because smartphones in Kenya have become affordable and data bundles are offered at relatively affordable rates by different competing providers (Communications Authority of Kenya, 2017).

The deep penetration of mobile telephony technology in the last decade has immensely contributed to the uptake and use of technology for health in Sub-Saharan Africa (SSA)(Communications Authority of Kenya, 2014, 2017; Gillwald Alison, Futtter Ariel, Koranteng Kweku, Odufuwa Fola, & Walubengo John, 2007; Twinpine, 2014). Mobile telephony shows potential to continue influencing healthcare in various ways including at patient level and system strengthening at service provision level (Hamine Saee, Gerth-Guyette Emily, Dunia Faulx, Beverly Green, & Amy Sarah Ginsburg, 2015).

Across the world, the conceptualization, definition, understanding and scope in using technology for health continues to change over time. A compendium of definitions in a systematic review found out that in the definitions of the term eHealth, technology is viewed both as a tool to enable a process/function/service and as the embodiment of eHealth itself (e.g. a health website on the Internet)(Oh Hans et al., 2005). Most often, the words telemedicine and telehealth are used interchangeably. Historically "telemedicine" was used to refer to the link between two clinicians with the remote clinician presenting the patient or the problem/condition to the specialist for diagnosis, advice or treatment via technology. Various medical devices including smartphone applications for tracking activities, automating reminders, other health

condition monitors, and those used for transmitting health information can be categorized as telehealth (United States Department of Health and Human Services, 2016). Borrowing from the World Health Organization (WHO), the Kenya National e-Health Strategy defines eHealth as 'the combination in use of electronic communication and information technology in the health sector'(Ministry of Medical Services & Ministry of Public Health and Sanitation, 2017). Some of the key aspects of eHealth as detailed in various global eHealth strategies are the need for right information to the right individuals, at the correct timing and location(Ministry of Medical Services & Ministry of Public Health and Sanitation, 2017). From the many definitions and points of view of what eHealth is, it is clear that eHealth has ability of responding and adapting to the emerging health needs in varied societal and economic contexts(World Health Organization Global Observatory for eHealth, 2010).

The developed world has seen a lot of investment put into electronic health as complimentary efforts in prevention, assessment, diagnosis, counselling and treatment programs addressing chronic diseases and conditions including diabetes, mental illnesses, heart diseases, overweight and obesity among others(Boydell Katherine et al., 2014; Chou Wen-ying Sylvia, Hunt Yvonne, Beckjord Ellen Burke, Moser Richard, & Hesse Bradford, 2009; Robin Cohen & Patricia Adams, 2011; Siliquini Roberta et al., 2011; Tierney William, Kanter Andrew, Fraser Hamish, & Bailey Christopher, 2008; Wagner Todd, Baker Laurence, Bundorf Kate, & Singer Sara, 2004).

In Africa, eHealth is showing potential to revolutionize healthcare service delivery. Literature search by Yusif and Soar in 2014 revealed that the two highest priority objectives of e-Health in Africa were: providing health education for health professionals (identified in 7 of the 16 projects reported on in the literature) and improvement of primary health care services (identified in 9 of the 16 projects)(Yusif Salifu & Soar Jeffrey, 2014). The advancements in eHealth in SSA call for the need to have rigorous research going hand in glove in an effort to monitor or track the advancements as well as evaluate and provide better recommendations for policy and programmatic efforts.

This paper seeks to report the findings of a review on the benefits and limitations of the recent advancements in eHealth across the world.

II. OBJECTIVE OF THE REVIEW

The review aimed at mapping out the evidence in global eHealth advancement focussing on the benefits and limitations.

III. METHODS

This review followed the acceptable steps in doing a scoping review (Dijikers Marcel, 2011)(Arksey Hilary & O'Malley Lisa, 2005) as follows:
✓ Identifying and defining of the "benefits and limitations of global advancements in eHealth'' as the research question or domain to explore.

✓ Use of online search engines including Google-scholar, PubMed, Mendeley and Popline.
✓ Selecting the relevant studies based on the selection criteria which included studies/documents on eHealth advancements, speaking to the benefits and advantages. Steps 2 and 3 were as shown in the diagram below:
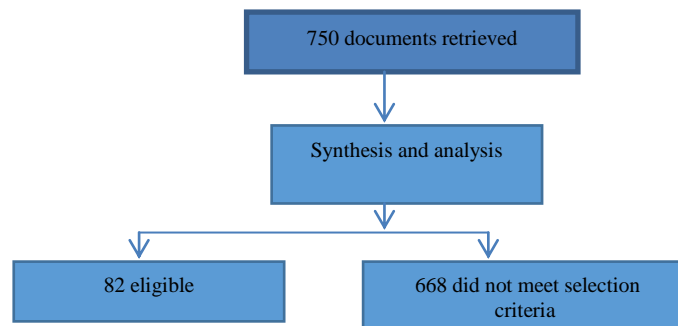

Figure 1: Documents' retrieval and culling process

✓ Establishing of a Mendeley library specifically for drafting of this paper
✓ Charting and analysing of the information from the relevant studies
✓ Collating and summarizing the findings into a draft manuscript
✓ Reviewing of the manuscript by an expert in electronic health

IV. RESULTS

A. ELIGIBILITY

Based on our selection criteria only 10.9% (n=82/750) of the documents retrieved including peer reviewed papers, reports, working papers, website documents and other grey literature materials met the inclusion criteria for this review. It is worth noting that only 23% (19/82) of the documents reviewed were touching on Sub-Saharan Africa. Documents reviewed and referenced in this paper are not mutually exclusive. Most of them have information on advancements in eHealth and cite both benefits and limitations.

B. WORKING DEFINITION FOR EHEALTH

Borrowing from the various resources in this review (World Health Organization (WHO), 2004)(World Health Organization, 2016) eHealth can be defined as the use of electronic means (mobile phone, tablets, desktops computers, laptops, electronic mass media) to provide health solutions to targeted populations.

C. ADVANCEMENTS AND USE OF EHEALTH

The use of information communication technology for health is a global phenomenon. The use of eHealth both in terms of the number of functions and geographical scope continues to grow at a rapid rate. eHealth provides solutions relevant to health challenges in both developed and developing countries. Through eHealth, the rich, the poor, the

literate and illiterate can receive simple tailored, key health information messages and services (World Health Organization Global Observatory for eHealth, 2010).

Currently eHealth is used in four modalities which including (United States Department of Health and Human Services, 2016):

LIVE VIDEOS (SYNCHRONOUS): This implies the use of audio-visual communication between a care giver, patient at a lower point of contact and another provider at a higher levels for example a consultant(United States Department of Health and Human Services, 2016).

STORE-AND-FORWARD (SFT): SFT is used to refer to circumstances where videos and other digital materials including photos and x-rays can be transmitted (United States Department of Health and Human Services, 2016).

REMOTE AND PATIENT MONITORING (RPM): Refers to the collection and transmission of individual information from one location to another location(United States Department of Health and Human Services, 2016).

MOBILE HEALTH (MHEALTH): These are mobile phone systems and applications that provide solutions ranging from diagnostics, treatment, referral and behaviour change(United States Department of Health and Human Services, 2016). They could be accessed as simple short messages, interactive voice response downloadable apps through which information can be accessed.

Social media is an interesting, quickly evolving platform on internet. Social media allows the coming together of individuals and communities to ease communication and sharing of information in a much comfortable and faster way. Through the interaction of people on social media, there is potential to influence health information and outcomes. Examples of internet sites that influence access to health information include the following:

✓ *Social networking sites:* Some social networking sites are usually exclusive and meant for specific groups and specific functions. For example physicians can have their social network site from where they discuss professional topics and consult from each other ("Social Media and Health Care Professionals : Benefits , Risks , and Best Practices," 2014). Social networking in health has also begun to attract a lot of attention in the recent past. Various social network platforms are being used to share key health information. Online health professional communities are able to share and communicate through professional networks, health organizations also create platforms from where they create visibility and reach their clients, through patient care, individuals can reach their doctors for inquiries and information via patient care online platforms. The inventions of social platforms such as Twitter and Facebook have provided opportunities through which public health programs for example in response to disasters and emergencies are conducted.

✓ *Blogs:* The term "blog," has been used for a long term now to refer to websites or web pages where information on health can be found without restriction. Sometimes information on blogs goes viral reaching wide and broad audience based on interest ("Social Media and Health Care Professionals : Benefits , Risks , and Best Practices,"

2014). Some blogs provide opportunity for users to comment thus making it quite interactive.

✓ *Microblogs:* Use of brief messages that touch on health via Microblog platforms such as Twitter continue to provide the most flexible, succinct and quick form of information exchange via social media. This format allows users to post a large number of brief messages or updates over a short period. Some microblogs provide hyperlinks to other websites and online resources where people can review("Social Media and Health Care Professionals : Benefits , Risks , and Best Practices," 2014).

✓ *Media-Sharing Sites:* Several Media-sharing sites exist through which key health information is provided. Platforms such as YouTube have become useful in terms providing real time reference materials from where health providers and patients can access information("Social Media and Health Care Professionals : Benefits , Risks , and Best Practices," 2014).

✓ *Wikis:* These are speedy platforms through which both lay people and health professionals can access information on specific topics of interest. Wikipedia is the most commonly used wiki ("Social Media and Health Care Professionals : Benefits , Risks , and Best Practices," 2014) (Muhlen MV & Ohno-Machado L, 2012).

✓ *Virtual Reality and Gaming Environments:* More social and gaming multi-user sites that provide environments where patients or interested populations get key health information. These could be more relevant to young people. However some may view these as more social games than clinical information (Grajales FJ, Sheps S, Ho K, Novak-Lauscher H, & Eysenbach G, 2014).

D. GLOBAL OVERVIEW ON EHEALTH

The 2015 WHO report(World Health Organization, 2016) on eHealth showed that 58% of member states had an eHealth strategy, 55% of countries had legislation to protect patient data, and 87% of the countries had a mHealth initiative. The key tenet in over 90% of those countries with eHealth strategies was towards universal health coverage. Most of the countries with eHealth strategies had some funding in place specifically to support eHealth, had government online sites for referencing and information resources and had available training institutions that were offering trainings(World Health Organization, 2016).

E. BENEFITS OF EHEALTH

Findings in this review unearthed a myriad of overreaching benefits of the use of eHealth to the population, health professionals and healthcare systems in general. Some of the overriding benefits from this review include ability for eHealth solutions to provide real time health communication, tracking of health risks and disease outbreaks, capability to identify health misinformation, usability in mapping of priority areas of intervention both geographically and in scope of delivery, provision of platforms to monitor public reaction to health issues, communication of risk in a timely manner, ability to increase coverage towards universal health care,

enhancement of privacy and confidentiality [1–3], [8–12], [14], [16–18], [20], [21], [26–53].

F. LIMITATIONS OF EHEALTH

eHealth solutions come with several limitations [23], [54–58]**.** We summarize the limitations identified from this review as follows**:**

UNAFFORDABILITY: Although eHealth has been found to be potentially cost-effective, a lot of literatures show that many countries have not fully embraced eHealth innovations with most of them citing affordability as a barrier. According to the internet world stats, by March 31, 2017, internet penetration in Africa was at 27.7% while the world average was at 49.6% [23]. A 2017 report on affordability of internet across fifty-eight middle- to low- income countries shows evidence of inaction by governments to provide universal coverage [23].

INACCESSIBILITY: Different groups of some vulnerable populations such as the poor and uneducated do not find Internet as a being very attractive. There are many people within the low income communities that cannot afford a personal computer at home and may not have access to the public access points or smart phones. Sometimes the complexity of the technology and lack of basic skills could be a hindrance to the access of the internet. There is also a category of people especially the elderly who have little or no basic computer skills due to lack of training and therefore their use of the internet and blogging is significantly lower than the rest of the population.

LOW QUALITY INFORMATION: eHealth solutions create a danger in that there are chances of providing low quality level information because some of the sites are unguided and sometimes most of the information is authored by non-professionals. Such information might be too complex, too shallow or totally wrong for the intended users (Schmidte-Kaehler Sebastian, 2003).

NEGATIVE EFFECT ON PROVIDER-PATIENT RELATIONSHIP: Findings from this review show that the use of eHealth and mostly unguided internet use has potential to lead to poor relationships between patient and the service provider(de Oliveira Jayr Figueiredo, 2014). A study on the use of Internet by patients as a source of information on health and disease concluded that 56.9% of the physicians thought that the Internet helped the doctor–patient relationship, 27.6% thought it interfered with the relationship, and 15.5% believed that the Internet had a negative impact on the relationship(de Oliveira Jayr Figueiredo, 2014). Using the internet to access health information can lead to ignorance of service provider direction by the patient.

BREACH OF PATIENT PRIVACY AND CONFIDENTIALITY(de Oliveira Jayr Figueiredo, 2014): Social media for health and generally eHealth solutions expose patients to a risk of lack of privacy and confidentiality to their information. It is possible that lack of safe guards on system security can lead to leakage of patients' information or patients talking about other patients' conditions with whom they share social health platforms(de Oliveira Jayr Figueiredo, 2014).

INABILITY IN APPLYING THE INFORMATION(de Oliveira Jayr Figueiredo, 2014): Sometimes eHealth solutions provide information to the populations but then application of the information becomes a challenge in cases where there is no clear guidance on how to put it to use. Situations where information is provided on diagnosis of conditions and symptoms might lead to individuals misdiagnosing themselves and going for over the counter treatment that could be disastrous(de Oliveira Jayr Figueiredo, 2014).

Ventola Lee(Ventola Lee, 2014) suggests basic guiding principles that could be referred to in the process of developing eHealth interventions. These principles could be useful in settings where policies and guidelines are non-existent. The principles include the need to ensure content credibility, observation of legal concerns, knowing the professional licencing provisions, being clear and responsible with networking practices, observing patient care, privacy and confidentiality and putting in place high levels of professionalism(Ventola Lee, 2014).

V. DISCUSSIONS

Findings from this review are in agreement with findings in other reviews showing that there is still lack of globally agreeable definition of eHealth [8], [35], [38–40], [43], [44], [48], [60]. In addition, it is evident that whereas eHealth is still in its nascent steps, particularly in developing countries(McClung Alex et al., 2014), Many countries do not have clear policies that would guide the process in developing and implementing eHealth solutions (World Health Organization, 2016). The implication of lack of agreement on what eHealth is and proper policies or guidelines or legal framework poses the danger of missing the proper strategies and goals in developing and implementing eHealth innovations that would be beneficial.

Findings in this review reveal the unprecedented quick expansion in eHealth across the world with a mixed bag of both benefits and limitations. eHealth could for example be the present quick fix solution to the three delays in accessing healthcare(Save the Children, 2013; "Section 1: The three delays Section 1: The causes of maternal mortality in the Philippines," n.d.). For example with regard to the first delay (Save the Children, 2013; "Section 1: The three delays Section 1: The causes of maternal mortality in the Philippines," n.d.) which is usually the decision to seek care, eHealth has potential to create awareness on danger signs and importance of seeking care thus ensuring that a quick decision to access services is taken by a patient. On the second delay which refers to reaching the point of care(Save the Children, 2013; "Section 1: The three delays Section 1: The causes of maternal mortality in the Philippines," n.d.), eHealth provides real time information that would help a patient to avoid the pain of using transport cost and time to reach a service provider for advice. As regards the third delay related to receiving adequate and timely care at the point of service(Save the Children, 2013; "Section 1: The three delays Section 1: The causes of maternal mortality in the Philippines," n.d.), eHealth bridges the gap by providing a quick platform through which plans for referrals can be made and preparations at the health

facility can be done early enough through interactive communication between patient and service providers and service providers at lower levels and those at higher levels of healthcare in consultations and referral plans of a patient.

On the other hand the many limitations identified in this review which are in concurrence with findings in other studies(Aranda-Jan Clara et al., 2014; Flynn Kathryn, Smith Maureen, & Freese Jeremy, 1982; Moorhead Anne et al., 2013; Wangberg Silje et al., 2008) suggest that some eHealth solutions indeed show signs of being ineffective because for example they lock out certain disadvantaged populations such as the poor or illiterate from maximizing on the use of the available solutions. It is evidently clear that sub-Saharan Africa lags behind in both programmatic and policy efforts compared to the developed world. This situation is both an opportunity and a challenge for concerted efforts in developing effective solutions by borrowing from lessons learnt in the developed world. Investment is therefore needed in the developing countries toward eHealth solutions.

VI. CONCLUSIONS AND RECOMMENDATIONS

eHealth has potential to disrupt healthcare systems for the better across the world. Nonetheless, this review has identified a reasonable number of limitations that come with eHealth. Of priority in terms of recommendations derived from this review is the need for countries to come up with strong policies and guidelines that could then set clear goals, scope and strategies in developing and implementing eHealth solutions. However as it is currently, it is important that those involved in developing eHealth solutions consider and adhere to global standards but tailor their solutions to different categories of populations and context. This could have the advantage of increasing acceptability and effectiveness in using the eHealth solutions. User participation and awareness in designing and implementing eHealth solutions is critical in ensuring sustainability of the solutions.

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