A Review of Factors that Increases or Reduces the Adoption of mHealth

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Abstract

Introduction: In the last decade, the world has witnessed the proliferation of mobile telephony across various countries be it developed or developing. This increase is in part due to expansion and the availability of connectivity. Further, there has been a significant increase in the number of mobile phone manufacturers. This has reduced the cost of mobile devices. We can take advantage of technology so as to be able to improve access to healthcare and health information, and to also improve the management of medical and health information as well as access to the latest medical knowledge for healthcare workers.

Methods: Three (3) electronic databases and journals (BMC Medical Informatics and Decision Making, Elsevier and Google Scholar) were searched with search items including mHealth, Telemedicine, Mobile Health, e-Health, Sub-Saharan Africa, developing countries, low resource countries, behaviour change, adoption of health messages and mobile health solutions. The design focused specifically on empirical research evaluating the effectiveness and the factors influencing the acceptance of mHealth interventions in low income countries not older than 5 years and published in English.

Results: From the search, it was noticed that the qualitative design method was mostly used by the researchers. They found that the extended Unified Theory of Acceptance and Use of Technology (UTAUT) is a good predictive model of general people's intention to use mHealth. Trust, perceived usefulness as well as perceived ease of use have been identified to positively correlated with adoption intention while privacy and performance risks negatively correlated with trust and adoption intention toward mHealth services. The researchers also found that personal innovativeness in Information technology has less significant effect on mHealth adoption. cost is also identified as an important determining factor for mHealth app adoption. The also found that perceived reliability has a significant impact on the adoption of mHealth.

Conclusion: This synthesis paper gives an indication that there still exists some gaps in knowledge in the area of mHealth adoption. None of the papers have specifically focused on the factors that increases or reduces adoption. The papers however provide a set of key guiding elements that paves way for further research on factors that increases or reduces the adoption of mHealth in specific contexts.

Keywords: **mHealth, e-health, developing countries**

I. INTRODUCTION

In the last decade, the world has seen a significant proliferation of mobile telephony across various countries both in the developed and developing countries. This increase is in part due to the expansion and the availability of internet connectivity. Further, an insurgence has been recorded in the number of mobile phone manufacturers. This has resulted in a reduction in the cost of mobile devices.

Records from the International Telecommunications Union's (ITU) Facts and Figures for the year 2017 indicates that there are more cell phone subscriptions across the world than the total number of people. The International Telecoms Union have declared that the mobile subscription penetration rates have gone as high as 98.7 per cent in developing nations as from the 96.3 per cent recorded in 2016. The telecoms union further reports that even in least developed nations, penetration rate has reached 70.4 per cent and still continues to rise. Voice, data and text are also getting cheaper.

Internet penetration has continued to be a challenge in Africa. However, there are a number of success stories across the continent, with the number of internet users growing consistently.

Some service providers in countries such as Ghana, Kenya and India have made available to consumers, data packages that are either low or free to access on selected websites like Facebook or apps such as WhatsApp. Internet.org (2014), Myjoyonline.com (2015).

Mobile health, from the early stages of its development have showed a lot of potentials. These potentials for mHealth has never been ignored. Right from its initial stages, there has been the acknowledgement that mHealth has the great potential of empowering public health systems in low and middle income countries (LMICs). Evidence supports the fact that a majority of mHealth programs or projects are implemented in sub-Saharan Africa. (Makuta I et al, 2015). Despite this, little has been done to scale these projects or programmes. There are several studies that have been conducted in this field that have raised issues of the lack of scale-up effort. As a result, there is limited evidence on the cost effectiveness, efficacy and feasibility of these projects (Aranda-Jan CB et al, 2014). According to available data, there are a total of 487 unique numbers of mHealth programs implemented in sub-Saharan Africa between 2006 and 2016 (Lee et al, 2017).

It is clear that technology can be relied on to improve access to healthcare as well as health information, and to also improve the management of medical and health information as well as access to the latest medical knowledge for healthcare workers. This synthesis focuses on factors that

increases or reduces the adoption of mHealth in low resource countries. This section of the paper gives a background by contextualising the discussions on developing countries, healthcare systems in developing countries, mobile penetration in developing countries, electronic health (e-health) and mobile health (mHealth).

1.1 Developing Countries

Development means different things to different people. Development is multidimensional. It is a process that involves major changes in the social structures, attitudes and institutions. It also involves the acceleration of economic growth, the reduction of inequality, and the eradication of poverty. (Todaro & Smith, 2012, p. 16). The concept of development has greatly informed public policy across the world. Development connotes "growth", "progress", "increase". It is most commonly described as the creation of jobs and wealth, and the improvement of quality of life. It is a process that influences growth and restructuring of an economy to enhance the economic well being of a community. It is a set of changes that are interrelated to the structure of an economy.(Moshe Syrquin & Chenery, 1989).

Developing countries also sometimes called Low and Middle Income Countries is generally less developed compared to other countries that are classified as "developed countries". These nations are also ranked higher than less economically developed countries. The less economically developed countries are confronted with several structural impediments to sustainable development. Developing countries have certain characteristics. These include low industrialisation as well as low human development index. Other characteristics includes poor health conditions of the people as well as limited or no health facilities as well as trained medical personnel. There are also the challenges of poverty and low literacy levels.

1.2 Health care systems in developing countries

The 2019 Sustainable Development Goals Report is made up of the latest available data to track global progress on the SDGs and aimed at taking stock of how far the world has come in realizing the commitments made. This report has shown that while tremendous advances have been made in some areas, a lot of challenges still remain the same. The report indicates that extreme poverty has drastically reduced. Also, under-5 mortality rate has fallen by 49 per cent between the period of 2000 and 2017. Notwithstanding these progress, the 2019 Sustainable Development Goals Report identifies many areas that needs urgent collective attention. One if these areas is the area of the provision of essential health services. The report indicates that at least half of the world's population lacks essential health services. (*SDG REPORT.pdf*, 2019.)

Low-income and middle-income countries account for over 80% of the world's infectious disease burden. (McBain et al., 2016). Healthcare systems face major challenges in developing countries. These challenges includes the provision of affordable and improved quality of care. In developing countries, hundreds of people die on a daily basis and eventually die from preventable and treatable diseases. Children and women die of treatable diseases such as diarrhoea, pneumonia, and malaria. These are curable. Lack of knowledge, awareness, limited access to healthcare services, remoteness, and poverty are some of the key factors contributing to these unfortunate deaths.

According to the World Health Organization (WHO), communicable diseases are the key contributors to people's death in developing countries and in most cases the reason is the lack of health knowledge P. N. Michael (2009). Research has shown that a strong training and education program can help the raise of healthcare awareness in general public M. Mackert, et al. (2011). Health education through mobile devices is a cost effective and efficient approach. This can raise awareness about medical testing, management of diseases, interventions, drug interactions, and treatments.

mHealth offers solutions to most of the above challenges faced in the developing countries. The advancement in the communication technology, such as the development of the 3G and 4G mobile telephony standards and cloud-based mHealth systems allow physicians to easily access the health related medical information anytime anywhere and to take major decisions remotely on the clinical care of patients in distant areas.

1.3 Mobile penetration in developing countries

According to Deloitte, mobile devices have now become a part of modern livelihood so much so that, people without access to mobile devices become limited in their ability to participate in present day to day activities. (Us-global-mobile-consumer-survey-second-edition.pdf, n.d.).

Qiang, Yamamichi, Hausman, Miller, and Altman have in their research stated that mobile devices have reached more people in many developing countries than power grids, road systems, water works, or fiber optic networks have reached. Per the International Telecommunications Union's Facts and Figures for 2017, there are more mobile phone subscriptions in the world than people. ITU puts the penetration rates for mobile subscriptions to hit 98.7 per cent in developing nations, from 2016's 96.3 per cent. Even in the least-developed nations, penetration is at 70.4 per cent and rising.

1.4 e-Health

Electronic Health best known as eHealth has to do with the use of information and communication technologies (ICT) for health. eHealth can be used in treating patients, conducting research, educating the health workers, diseases surveillance as well as monitoring public health. According to the regional office for Africa of the World Health Organisation (WHO), technological tools and platforms are creating opportunities for the effective use of eHealth solutions, applications and services to improve health system in low resource countries.

The WHO have indicated that eHealth can be practically applied to different health scenarios such as using it as a reminder system for compliance and overall health outcomes,

SMS reminders to parents, providing educational messages and using it during emergencies to dispatch mass announcements about satellite clinic locations. E-health has great potentials in improving the overall wellbeing of the low resourced countries.

1.5   mHealth

Over the last decades, rapid growth in mobile and wireless technologies have created pathways for the transformation of health service delivery over the world. The unmatched growth of mobile technologies and their innovative applications aimed at developing our health priorities has led to new fields of e-Health, known as mHealth. (Hoque, 2016, p. 1).

Mobile health (or mHealth) is generally defined as the use of mobile devices as well as technologies to provide healthcare services. mHealth is a term that has generally been used to describe the use of mobile phones and other technologies that are of wireless in nature for medical care. It is made up of electronic appointments with physicians, e-health consultations as well as e-health information seeking and medical examination through smart devices or smartphone-based apps. The potential of mHealth in addressing healthcare issues, cannot be over emphasised. Though mHealth has yielded positive outcomes in various contexts, there is the need to design mHealth interventions that are tailored to the context of specific countries so as to increase the prospects of adoption. (Ndayizigamiye & Maharaj, 2017).

mHealth has become a trending topic both within governments and civil society organisations that focus on health. It is also a trending theme within technologists. There are numerous projects that have recently been implemented, or are in a trial phase. Despite the implementation of the mobile health systems in various low middle income countries and contexts, there exist various challenges and barriers that affect its success since it is a new health technical innovation. There are a number of challenges that hinders the effective use of mHealth. It is therefore important for researchers to explore into what works and what does not work so as to provide accurate measurement standards for their impacts. By making an analysis of what assessments are available, this effort is aimed at identifying existing gaps that can be filled in so as to inform future project design and implementation of mHealth.

II. METHODOLOGY

To address the knowledge gap of the factors that increases or reduces the adoption of mHealth educational messages in low and middle income countries, an initial search of research and review articles was conducted using "mHealth". A literature search was conducted in three (3) electronic databases and journals (BMC Medical Informatics and Decision Making, Elsevier and Google Scholar). The references of included publications were also searched to identify additional relevant literature. The search was limited to this term (mHealth) to narrow the focus of the review. The review work was also restricted to studies that have been published in English. In an

effort to further focus the search, the researcher moved on to initially conduct a Boolean search across the broad mobile health literature. Then these were sorted out into a next level of analysis where there was a classification exercise, where the papers were identified as either empirical research or systematic reviews. The initial search resulted in 208 articles. The articles were hand searched for reference to Sub-Saharan Africa, developing countries, behaviour change, adoption of health messages, utilisation, acceptability, determinants of , usage of and Mobile health solutions. These keywords should appear alongside the headword in the title or abstract of the article. To refer to m-health for instance, the articles either had to include the terminology "m-health" (and its alternative formulations), or include both the term "health" and one of the following search terms or their variants: mobile phone, mobile application, mobile technology.

The selection process yielded 50 articles. Articles not directly pertaining to health were removed, as were articles greater than 5 years old. This screening yielded 30 articles. Additional web searches provided background information relevant to the review. The next level of analysis was a classification exercise, where the papers were identified as either empirical or systematic reviews. Twenty (20) empirical research work and ten (10) systematic reviews were identified to be critical to this review. This analysis is based on ten (10) of the twenty (20) empirical research work that were sorted and the findings summarized below.

III. FINDINGS AND DISCUSSION

This section is composed of an analysis of the research problems that have been the focus of the researchers of the ten reviewed papers as well as the research methodologies. It also focuses on the target population of the reviewed papers, the contextualisation or framing of the research and the research findings of the researchers. Time is also spent on analysing what strikes in all ten reviewed papers and how these give clues to further research in the area of mHealth.

3.1 Research Problems

The review of the ten (10) papers have revealed a majority of the papers focusing on varying research problems in the domain of mHealth. Researching on factors that influence the adoption of mHealth services among younger people in Bangladesh, Md Rakibul Hoque (2016), focused their research on the problem that although there have been a lot of benefits of mHealth services, there have been a number of challenges encountered and many of the mHealth services are still in their infancy stages. These thus requires extensive research on user adoption processes.

Woodward et al. (2014) in a qualitative study that has to do with the personal experiences of health workers in using e-health innovations in different post-conflict situations, researched the problem of limited analysis on the adoption of technology for health and whether and how e-health can be used to strengthen the health workforce. They also focused on

the problem of the lack of evidence on and how e-health could strengthen a health workforce recovering from conflict.

In their study about the key factors affecting the adoption of mHealth services in developing countries and in particular among general populations in Bangladesh, Alam et al. (2014) situated their research within the problems of low mHealth adoption in the context of Bangladesh. They were also confronted with the unfettered proliferation of mHealth solutions that has failed to meet expectations and that have not been successfully implemented in the existing health system and adopted by users. Another problem that led to the research is the low adoption rate of mHealth among the general people in Bangladesh that the researchers describe as almost insignificant. The problem of unfettered proliferation of mHealth solutions failing to meet expectations as well as a large number of mHealth projects not being successfully implemented.

The research problem of Nanyombi and Ejiri (2016) on the factors influencing adoption of the mTrac system in the Kayunga district health facilities had to do with the issue that despite the implementation of the mobile health systems in Uganda, there are various challenges and barriers that affect its success since it is a new health technical innovation. There are a number of challenges in Uganda to allow effective use of mHealth such as network challenges which reduce its effectiveness, internet is unreliable or expensive, inaccessibility of electricity in rural areas remains a challenge.

Smith et al (2014) focused their research on the opinions of overweight and obese adolescents and their parents (who have participated in a multi-disciplinary healthy lifestyle program), on the use of text messages as a form of support during the maintenance period. They focused on the problem of a gap in the evidence regarding the effectiveness of text messaging interventions in supporting behaviour change in overweight and obese adolescents. The research problem was also on limited evidence regarding the best way to construct and send text messages for use with adolescents.

Focusing on the design and content elements of health apps that facilitate or impede usage from the users' perceptive, Peng et al. (2016) identified that a majority of the available health apps are mainly for health and wellness promotion and disease prevention for the general public. They thus researched the problem that has to do with the assertion that a large number of studies on health apps adopt only a content analysis approach and that despite the fact that these content analysis provide important insight into what apps are available and whether theories and evidence-based practice are used to inform app design. Also qualitative studies examining these health apps from the users' perspectives are limited.

Ndayizigamiye and Maharaj (2017) focused their research on the factors that may influence the adoption of mHealth by healthcare practitioners in Burundi and researched the problem that although mHealth has yielded positive outcomes in various contexts, there is a need for designing mHealth

interventions that are specifically tailored to the context of individual countries to increase the prospects of adoption. This goes to suggest the need for contextualising mHealth interventions.

Munyua et al. (2015) focused on the factors that are affecting the adoption of mHealth in maternal health care in Nakuru provincial hospital and researched the problem of more women dying of pregnancy and childbirth related causes than was the case the in 2003 with the country continuing to bear the burden of a high maternal mortality ratio that is not decreasing rapidly enough to reach the Development Goals. The researchers indicate that despite the national ICT master plan, and the draft National ICT policy, 2006 and 2011 propositions to utilize the developments in ICT in improving service delivery and health care, there is no national statistics on the level of adoption and the factors underlying its adoption and Nakuru Provincial General Hospital is not exceptional. Their study therefore sought to investigate the factors affecting the adoption of mHealth in maternal health care in Nakuru Provincial General Hospital.

Deng et al. (2018) did research what predicts patient's adoption intention towards mHealth services in China. The researchers focused on the problem that despite numerous implementation of m-Health implementation in Africa, most interventions have failed to justify their value proposition to inspire utilization in low-resource settings and that although mHealth services can reduce health care costs, improve health care quality, and promote health education, some problems may arouse individual risk perception.

Researching on how Interactive Voice Response (IVR)) technology could be used to survey healthcare utilization patterns in rural Ghana, Vogel et al. (2016), focused on the research problem that despite numerous interventions to improve health care in Ghana, the health behavior of Ghana's rural population remains a relative unknown.

The research problems of the papers that have been reviewed, have centrally focused on the lack of evidence and or extensive research work in low income countries on user adoption processes. Another set of the research problems have centered on various challenges and barriers that affect the success of mHealth projects. There is also limited evidence regarding the best way to construct and send mHealth content targeting specifically young people. Other problems of focus have been on the general gap in knowledge on the value proposition to inspire utilization in low-resource settings and that although mHealth services can reduce health care costs, improve health care quality, and promote health education, there is limited knowledge on effectiveness of mHealth projects from low resource settings.

3.2 Research Methodologies

This sub section of this paper focuses on the methodologies that have been used by each of the researchers and the targeted population that was researched or that they focused on.

The reviewed papers had varied methodologies. Some however used similar approaches. In their study, Vogel et al.(2016) used a survey software using Interactive Voice Response (IVR) technology to survey healthcare behaviour by mobile phone users in rural Ghana.

The Interactive Voice Response (IVR), is a system of automated call flows that allows a recipient to select what they need from a set of options. It is a technology that can be used with any type of phone that delivers information via audio recordings and allows users to provide feedback by pressing a number key. IVR allows for the delivery of more robust information than SMS text but does not require smartphones, Internet connectivity, or even full literacy (Kate Gilroy & Abdoulaye, 2015) . An IVR system (IVRS) accepts a combination of voice telephone input and touch-tone keypad selection and provides the appropriate responses in the form of voice. The researchers used automated voice messages made up of 18-questions recorded in five (5) local languages of Ghana. The approach reached 827 rural respondents who completed 18 multiple-choice questions. Out of the number reached, 615 of them were men while 212 were women.

Deng et al. (2018) and Md Rakibul Hoque (2016) both used questionnaire-based survey for their research. Deng et al. (2018) in researching on the topic what predicts patient's adoption intention towards mHealth services in China, used a questionnaire-based survey that was administered in 3 large hospitals in China focusing on Patients and their caregivers and analysed the data using structural equation modelling. Md Rakibul Hoque (2016) on the other hand used convenience sampling method as the survey instrument to research into the Factors that influence the adoption of mHealth services among younger people in Bangladesh. Data were collected from over 250 respondents in Dhaka, Bangladesh. Key focus was on the younger citizens in Bangladesh. The data were analyzed using the Partial Least Squares (PLS) method, a statistical analysis technique based on the Structural Equation Modelling (SEM).

Both Peng et al (2016) and Smith et al. (2014) both used a qualitative approach to their research work. The former, Peng et al (2016) in researching into user perceptions of mobile health apps, conducted six focus groups and five individual interviews in the Midwest region of the U.S. with a mixture of forty four (44) smartphone owners of various social economic status. The focus groups and interviews were audio recorded and then transcribed verbatim and subsequently coded using the NVivo software. The latter, Smith et al. (2014), also organized focus groups. These were held during the maintenance phase of a multi-disciplinary healthy lifestyle program for overweight and obese adolescents aged 12-16 years and their parents.

Researching on the factors that are affecting the adoption of mHealth in maternal health care in Nakuru provincial hospital, Munyua et al.(2015) used a descriptive survey research design. All the medical staff and patients of Nakuru Provincial General Hospital was surveyed. The study population was made up of 24 medical staff and 3460 mothers visiting the antenatal clinic. They were selected using clustered random sampling technique. The main instrument for primary data collection was the questionnaire. Data analysis was done using both descriptive and inferential statistics. Descriptive statistics used frequency counts, percentages, and measures of central tendency while inferential statistics used t-test analysis and spearman correlation.

Woodward et al. (2014) and Alam et al.(2014) both used cross-sectional designs. Woodward et al. (2014) had a cross-sectional qualitative design targeted at health workers. This study focused on four countries: Sierra Leone, West Bank and Gaza, Somaliland and Liberia covering different 'post-conflict' situations. Semi-structured telephone interviews with health workers from a variety of backgrounds (that is, mixture of health cadres; those at different stages in their career; representing a variety of countries) were conducted to capture a wide variety of experiences. Sampling was purposive. Qualitative thematic analysis with coding via NVivo 10 was used to analyse the data, using a deductive approach based on Roger's innovation-decision model and the topic guide.

Alam et al.(2014) conducted a survey of patients at different private and public hospitals in Dhaka, Bangladesh with interviews conducted over a period of three weeks by a team of three interviewers. The study distributed 323 questionnaires. Data management and analysis was performed using smart PLS 2.0. Statistical significance was analysed using analysis of variance and t-test as appropriate.

In their study on determinants of mobile health adoption in Burundi, Ndayizigamiye and Maharaj (2017) collected data through questionnaire that was administered to 212 primary healthcare workers. The sample was taken from 48 primary healthcare institutions. Persuasion variables from the diffusion of innovation theory (DOI) were designed and included in the questionnaire. These were then tested as possible determinants of mHealth adoption within the specific context of Burundi. Principal Components Analysis (PCA) was then performed so as to generate a score that represent mHealth adoption (mHealth adoption index), and also scores that represent each one of the DOI factors. Correlation analysis was performed to assess the relationship between mHealth adoption and DOI factors based on the Principal Components Analysis (PCA) scores. Cronbach's Alpha statistic was used to validate the internal consistency of items within the grouped factors (mHealth adoption factors and DOI factors).

Using healthcare providers as the study population, Nanyombi & Ejiri (2016) focused their work primarily on healthcare providers who had been trained. They targeted a total of 73 participants from 23 health facilities from the Kayunga district and used a quantitative research approach with questionnaires constructed to measure the four constructs of UTAUT mode. They used a likert scale as a measurement tool.

From the ten reviewed papers, it was noticed that the qualitative design method was mostly used. Four out of the

ten researchers used the (cross sectional) qualitative design for their research work. This was followed by the use of questionnaire. Two of the researchers; Deng et al. (2018) and Md Rakibul Hoque (2016) both used questionnaire-based survey for their research work. Only one, out of the ten researchers used a quantitative research method. One researcher also used institutional based survey while another one used the descriptive survey method. Only one out of the ten researchers also used the Interactive Voice Response system to conduct the research work.

3.3   Framing of the research

In framing their research work, the researchers of the ten reviewed papers used and defined the following in an attempt to frame the context of their research work within the broader theme of mobile health (mHealth).

Rakibul Hoque (2016), framed their research around mHealth, mobile phone coverage in Bangladesh, chronic diseases among Bangladeshi youth, technology acceptance model (TAM), perceived ease of use (PEU), personal innovativeness in IT, perceived usefulness (PU) and subjective norm. Woodward et al. (2014) on the other hand positioned their research work by framing it around technological innovation, diffusion, post conflict, diffusion of innovation and e-Health.

While Alam et al. (2014) framed their research work on mHealth, the UTAUT, the extended UTAUT model, perceived reliability (PR) and price value (PV) as well as the country Bangladesh, Nanyombi and Ejiri (2016) on the other hand framed their research work around the mobile tracking system (mTrac), mHealth, factors influencing the adoption of mHealth, technology adoption models and mHealth systems.

Smith et al (2014) framed their research around obesity, adolescence and text messaging while Peng et al. (2016) framed their research within the context of the mobile Apps, health Apps, content analysis approach and user perception.

In framing their research work, Ndayizigamiye & Maharaj (2017) framed around diffusion of innovations, mobile health (mHealth), Burundi's healthcare hierarchy, Burundi's Mobile telecommunication Landscape, and Primary health care while Munyua et al. (2015) framed their work around mobile technology, mHealth, the global mHealth market, the health belief model (HBM) and the diffusion of innovations theory.

Deng et al. (2018) framed theirs on mHealth, the Technology Acceptance Model (TAM). Vogel et al. (2016), framed their research work around Universal Health Coverage, Interactive-Voice-Response (IVR) and mHealth.

3.4 Findings and what is striking

In the works of Md Rakibul Hoque (2016), what is striking is the finding that Personal innovativeness in the IT area has less significant effect on mHealth adoption. This finding is surprising because many previous studies confirm the relationship between Personal innovativeness in IT and technology adoption. Though the researchers indicated that

this finding could be a possible reflection of the fact that more innovative people do not necessarily have more intention to use technology, There is doubt about this finding especially when other research works clearly confirm the relationship between Personal innovativeness in IT and technology adoption. Further research may be needed to explore whether innovative people do or do not have appetite for more technology use.

The sampling method used by Woodward et al (2014) in their study titled "Diffusion of e-health innovations in 'post-conflict' settings: a qualitative study on the personal experiences of health workers" is striking. They give the concession that their study used a purposive sampling method. This as a result indicated a bias towards those known to be e-health users. Future studies might benefit from a comparative design (e-health users versus non-users) so as to explore further, the differences as well as the similarities that exist between these two. Further, what is striking is the finding that information need was particularly severe in the area of mental health and amongst rural health workers. The researchers assigned this to the traumatic exposure to armed conflict as well as the daily stress factors which then leads to post-conflict populations often experiencing poor mental health outcomes. This made this an area of particular need for health workers in the study. More research will have to be conducted in the domain of the use of e-health for education and clinical support of mental health professionals and rural health workers.

The results of the work of Alam et al. (2014), that the extended Unified Theory of Acceptance and Use of Technology (UTAUT) is a good predictive model of general people's intention to use mHealth services is striking. Out of the seven constructs, Effort expectancy (the ease of use of technology) and Facilitating condition have the highest positive impact on the intention to use mHealth services in comparison to other constructs. However, the researchers failed to point out how specifically these facilitating conditions affected or impacted the users decisions. Future research may need to explore how the facilitating conditions affect or impact the users. It is also striking that the researchers found that while perceived reliability had a significant impact on the adoption of mHealth due to life time threat and fear for wrong treatment (In Bangladesh, healthcare system is losing reliability day by day due to wrong treatment which in turn ultimately cause the death of patients), Price Value surprisingly, had no significant influence on adoption of mHealth services. Ironically, what this researchers define as price value is captured as a facilitating factor. This was specifically in the case of the researchers in a study titled "Factors Influencing the Adoption of Mobile Health in Uganda Health Facilities: A Case Study of Mobile Tracking System in Kayunga". Little wonder that this new addition to the original model did not have any significant influence. Future research (systematic review) may be needed to clarify what other researchers see as facilitating factors within the UTAUT Model

It is striking in the works of Nanyombi and Ejiri (2016) that though the mTrac system was implemented in all health facilities of Kayunga, it is mainly used by the Records Assistants who use it to send weekly HMIS report to the district. While the direct health care providers are not using the system, the community indicated that they were not aware that this system existed and that they needed to use it as well. Future research work may have to explore why only one out of three key stakeholders within the health facility is using the system. The researchers also report poor network connectivity in Kayunga district as a challenge for many mTrac users and that they have to look for the network in order to send messages and even after sending the messages sometimes, the messages do not get delivered to the target recipients. This is striking. The question that arises is what due diligence was done to ensure that base infrastructure was available before the system got deployed? If this initial investigation was done, it would have revealed the need for the availability of basic infrastructure before deployment. Future research may be needed to answer questions that emerge about the basic available infrastructure that is needed to support the effective deployment of the Mobile Tracking System in Kayunga.

In the findings of Smith et al. (2014), it is striking that they found that regular health-related text messages may have the potential to heighten a sense of shame in adolescents. This is certainly a new issue for consideration by researchers using text messaging with overweight and obese adolescents. According to the researchers, based on the theoretical underpinnings of CAFAP, text messages were specifically worded to promote autonomy and support adolescent choices, yet many adolescents perceived the text messages as reminders of what they should be doing but were not doing. It is worth looking into the reasons that account for the feeling of this shame. Further research work could explore the factors that accounts for the heightening of the sense of shame among adolescents when they receive regular health-related text messages. It is striking to also notice that the motivation of adolescents enrolled on the obesity programme declined over time leading to failure to maintain behaviour changes. This in the long run does not make the programme sustainable and should this be a point of worry to persons who design similar projects. It will be worth it to have researchers probe into why there is the lack of sustainability in following through the complete cycle of behaviour change.

Peng et al. (2016) in their research found that cost was identified as an important determining factor for app adoption. This is quite striking. Among all their participants, 77% used only free apps. What the research work did not reveal is the % of people who might be willing to pay for apps and how much they will be willing to pay. Further research might need to look into % of people who are willing to pay for health apps and how much they are willing to spend on health apps. Also striking, is the finding that lack of motivation and keeping discipline is one of the determining factors of adoption. The participants felt that unless an individual was already motivated or had the discipline or dedication, it would be hard

for them to continue using health apps. The critical question which might interest future researchers is what can sustain motivation for sustained use? When user begins to use a health app, what can be done to sustain the initial motivation to use the health app?

Ndayizigamiye and Maharaj (2017) reported that mobile penetration in Burundi is very low and pegs the mobile penetration rate at 34 percent while the internet penetration rate is 4.9 percent. This is striking within the context of mobile health discussions because, for mobile technology to be useful, most of the targeted population that is usually poor should have mobile phones. Therefore, where the mobile penetration rate is low, it also affects the success rate of mobile health project roll out. Looking into the future, it will be interesting for future research to try to find an answer to the questions that emerge about the relevance of mHealth in poor societies that have minimum mobile phone penetrations. It is also striking that the research focuses on the perceptions of health care personnel, leaving out the patients. This is because the adoption of mobile health services is also determined by the patient's perceptions. Future research may need to explore patients perceptions towards mHealth adoption to provide answers to research questions such as determinants of mobile health by patients in Burundi.

The works of Munyua et al. (2015) showed that healthcare facilities did not have policies in place for mHealth project implementation. This is striking because technology cannot be implemented in healthcare facilities without clear guidelines to help its adoption. While the researchers found this anomaly in the researched facilities, it may not be unique to just the researched facility and may be so for many other health facilities that have one mHealth project or the other being implemented. Future research may need to explore how policies are developed in health facilities in the country to provide answers to research questions such as the role of hospital policies in the implementation of new technologies. The findings reported by the researchers to the extent that mHealth was adopted by the hospital but it was clear that the hospital was not prepared sufficiently to take the technology because few staff were trained. This is very revealing. This is striking because one will expect that a health facility that takes on board any new project will put systems in place for the smooth running of the project. This is a basic principle for the implementation of any project. Systems have to be put in place in readiness of the take off of the project. Future research may be needed to answer questions that emerge about how prepared healthcare staff should be in implementation of new technology at their facilities.

What strikes in the works of Deng et al. (2018) is the results that trust, perceived usefulness, and perceived ease of use positively correlated with adoption intention while privacy and performance risks negatively correlated with trust and adoption intention toward mHealth services. It will be interesting to look at how other variables (apart from trust and perceived usefulness) such as the level of education, the

marital status if incorporated will influence mHealth service adoption.

Vogel et al. (2016), in their study on mobile-based healthcare utilization assessment in rural Ghana using IVR system noticed that when they used the IVR for their survey, the full survey completion rate was 1.3% (827/64,103) overall, though it rises to 18.3% (827/4,517) if a respondent continued beyond the paragraph of informed consent. This is very striking. Considering the huge drop rate, it is important to probe the failure rate and compare this to other traditional methods of assessment. It will be useful for future research to explore strategies of improving completion rate of questionnaires using IVR.

IV. CONCLUSION

To conclude, one can state that the works of Munyua et al, suggest that an important factor is whether mHealth as a technology that has come to support health care and health systems have been fully developed and ready to be fully utilised. Further, critical questions that have to be answered includes questions around the preparedness of enablers such as health workers. If these stakeholders are not fully prepared for this, it will most likely lead to higher performance and privacy risks (which are mentioned by Deng et al. in their paper). These kind of interrelations between articles can be further explored.

Peng et al. (2016) raise an important point that mHealth needs to be personalized to the user. They argue that the devices used should be able to include personalized features. In their case, it was timing and the correlation this has with the feeling of shame, but experience with technology might also be concluded. It might just be that experience or the lack of it is an underlying factor. What is not clear from this study however, is whether mHealth is not able to create behaviour change or whether the timing of the messages and or the content included was not adaptive to promote behaviour change. An important point this article raises is that mHealth might have to be adjusted depending on whether the health condition or behaviour is something that is commonly accepted or celebrated or whether it is a stigmatized condition/behaviour.

The effort that is expected for the use of mHealth is mentioned several times as a factor that influences health workers motivation to make use of mHealth. It may be deduced that health workers see the effort to be too much work and thus are not motivated to use it. Cost is also mentioned often. Alam et al. (2014) mention that for them the most salient features were social influence, perceived financial cost, performance expectancy, and perceived reliability. Considering the fact that cost is mentioned repeatedly, it is an important factor to place a key focus on. Woorward et al (2014) in their paper shows that the knowledge and awareness among health workers is not always there enough, and since previous research has shown that these are important factors in determining use of mHealth, it is important that this is stressed as in practice not everybody possesses the necessary knowledge and awareness.

V. FUTURE RESEARCH DIRECTION

Mobile health (mHealth) is attracting a great deal of attention worldwide because it presents a unique way to provide information and resources to healthcare professionals and patients alike, and may be a promising tool to support healthcare particularly in the Low and Middle Income countries. This potential of mHealth is widely recognised as it has become a trending topic both within governments and civil society organisations that focus on health. The findings from this review provides us with new knowledge on how to make it possible to better understand the challenges and opportunities related to m-health adoption.

In doing this analysis, it was realised that there are various gaps holding back the full absorption of the mHealth projects in low resource countries such as Ghana and Kenya. These gaps are the main obstacles towards achieving a full utilisation of the potentials that mHealth presents. To further advance the knowledge in this field and to fill in some of the gaps that have been identified to still exist, it is important to conduct future research.

From the findings, it is clear that healthcare facilities that implemented mHealth projects did not have policies or guidelines that could help with adoption in place. It will be important for future research to explore how policies are developed in health facilities in so as to provide answers to research questions such as the role of hospital policies in the successful implementation or adoption of mHealth projects.

It was evidently clear that the use of IVR for survey work was not successful and that it yielded very low completion rates. Considering the hue drop that has been recorded, it will be a good idea for future research to probe the failure rate and compare this to other traditional methods of assessments or conducting survey. Future research may explore strategies of improving completion rate of questionnaires using IVR.

Though other researchers found that personal innovativeness in IT has a significant effect on mHealth adoption, Md Rakibul Hoque (2016) in their work did not see how personal innovation impacted on mHealth adoption. As a result of this lack of conclusion on the relationship between personal innovativeness in IT and technology adoption, further research may be needed to explore whether innovative people do or do not have appetite for more technology.

Overall, there is a gap in or the lack of clarity in what factors increase or reduces mHealth adoption. It is therefore important for future research to answer the questions of the factors that influence (increases or reduces) the adoption of mHealth services. This research may be conducted in one country or in multiple countries that are implementing carried mHealth programmes.

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