

Improving Access to Healthcare through Digital Health Platforms in Uganda

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Abstract

Despite significant reforms, Uganda's health system still faces challenges. Digital health technologies, particularly mobile health (mhealth), have the potential to overcome barriers in service delivery and improve health outcomes in low-income countries. This paper examines Uganda's digital health policy environment, reviews a sample of consumer mhealth interventions and examines barriers to digital health uptake. The findings highlight the need for more studies that assess the integration of mhealth interventions in national systems. The challenges identified on the supply side included weak governance structures, poor funding, lack of infrastructure, shortage of skilled staff and limited digital health literacy skills. On the consumer side, barriers included affordability of internet and digital tools, poor internet, socio-cultural issues and low digital literacy skills. In conclusion, overcoming these challenges will require bigger investments to improve policy development and implementation, infrastructure, increased funding, digital health literacy skills of health workers and consumers and awareness campaigns

Keywords: digital health technologies, mobile health, healthcare, barriers, Uganda

INTRODUCTION

The World Health Organization defines Digital Health as the field of knowledge and practice associated with developing and using digital technologies to improve health (World Health Organization, 2021). It also encompasses technologies such as the Internet of Things, Advanced Computing, Big Data Analytics and Artificial Intelligence, including machine learning, and robotics. Digital health interventions is the application of mobile health (mHealth) and electronic health to improve health systems and services (Wilson et al., 2014). Mhealth refers to the use of mobile devices to access health-related information and services. The use of mobile health technologies to improve access to health is gaining momentum in Africa, including Uganda. The introduction of digital technologies in healthcare, particularly mobile devices, can transform health service delivery, making it more accessible, affordable and available in low-income countries (Free et al., 2013). For example, digital technologies can promote adherence, enhance the uptake of health services and improve the quality of diagnosis and treatment (Drake et al., 2017).

Despite significant progress in reducing maternal and child mortality rates, Uganda's disease burden remains high. Malaria, HIV/AIDS, tuberculosis, and non-communicable diseases such as cardiovascular, diabetes and mental health are the leading causes of illness and death. The COVID-19 pandemic further disrupted essential health services, reversing the gains made in the last decade (Ministry of Health, 2020). Problems across the health system limit the utilisation of services. These include the cost of services, distance to health facilities, level of education, cultural beliefs and health facility challenges such as stock out of medicines (Musoke et al., 2014).

The rapid growth of mobile phone owners and internet users in developing countries offers opportunities to improve health services through mobile health programmes (Gupta, 2014; Ojo, 2018). Data from the International Telecommunications Union (ITU) show there were approximately 4.9 billion internet users globally at the end of 2021, of which 27% were users in developing countries (International Telecommunication Union, 2021). Mobile technology has emerged as the preferred platform to create, distribute and consume digital content in Uganda. Over 74% of the population has access to mobile phones, and nearly half of all mobile subscribers also access mobile internet services. (NITA-U, 2022).

Mobile technologies are an ideal channel for reaching healthcare consumers with targeted health information and providing them with individual support because of their portability and popularity (Roberts S et al., 2015). The most commonly used m-health platforms in Uganda include SMS, which accounts for most health programmes, web-based applications, and voice calls such as interactive voice recognition (IVR) or call-in services (Kamulegeya et al., 2019). Artificial intelligence-powered chatbots is an emerging field in Uganda's mhealth landscape (Nakatumba, 2019).

To harness the potential of mobile health technologies, three essential skills are required by both healthcare providers and consumers. These skills are digital literacy, health literacy and digital health literacy. According to Bawden (2008) digital literacy is the ability to use the internet and other digital technologies and to discover, understand and evaluate the information presented. This definition is constantly developing as emerging technologies grow more complex. Another literacy concept required in health settings is health literacy, defined as the ability to obtain, read, understand, and use healthcare information to make appropriate/informed health decisions (Sørensen et al., 2015). With the accelerated digital transformation, digital health literacy is increasingly becoming a core skill to access health information on digital platforms. Dunn & Hazzard (2019) define digital health literacy as the ability to

seek, find, understand, and appraise health information from electronic sources, apply the knowledge gained to appropriately address a health problem and post information on the web.

There has been limited evidence on how consumer m-health technologies can enhance health service delivery in Uganda. This paper adds new knowledge to what is currently available. This paper examines the extent to which Uganda's policy environment promotes making digital health technologies accessible, reviews a sample of mhealth interventions delivered to healthcare consumers and lessons learned in their implementation, and examines barriers to adopting digital health technologies.

Methods

This study is based on an exploratory desk-based non-systematic review of academic literature from PubMed, Scopus, and Google Scholar. Keywords used to search these databases included Uganda; sub-Saharan Africa; knowledge management; digital literacy; health literacy; digital health literacy; digital divide; mobile health programmes; consumer digital health programmes; Artificial intelligence programmes; health worker digital skills, and digital policies. An extensive review of grey literature was conducted based on initial indications that Google retrieved several reports on digital health in Uganda published by the Ugandan government, nongovernmental organisations, and development partners. The main grey sources included the Ministry of Health and Ministry of ICT, and National Guidance. The relevance of each paper was assessed and considered for inclusion. Articles met the inclusion criteria of this search if they were written in English and published between 2013 and 2023, reporting substantive qualitative or quantitative information on service delivery and digital health behavioural health outcomes. Articles that passed preliminary screening were further examined in full text and considered for ultimate selection in the literature search. The findings were categorised into subthemes: governance framework, interventions, funding and infrastructure, digital health infrastructure, human resources, digital health capacity and digital gender divide.

Main text

Governance framework

Governance is a critical component of a well-functioning health system (Yuan et al., 2017). Both international and national policy instruments demand the ethical, safe, secure, reliable, equitable, and sustainable use of digital health technologies. At the global level, Uganda is committed to implementing and achieving the United Nations 2030 Agenda for Sustainable Development (United Nations, 2015). Uganda has also shown commitment to several regional development goals. These include the African Union Agenda 2063 (African Union Commission, 2015) and East Africa Community (EAC) Vision 2050 (East African Community, 2015). The policies and regulations that demonstrate Uganda's commitment to digital transformation at the national level include National Development Plan III 2020/21 - 2024/25, the National eHealth Policy 2016 and Ministry of Health Strategic Plan 2020/21 – 2024/25 (Ministry of Health, 2016).

Whereas, the Government of Uganda has developed and disseminated several policies and guidelines to accelerate digital health, implementation at lower levels remains weak. There is evidence that digital health governance structures are not well streamlined, and there are no committees or personnel to oversee the development and implementation of digital health at all levels of the health sector (Ministry of Health, 2021). In addition, the eHealth policy lacks coordination and cohesion (Nabukenya & Ashaba,

2019). Furthermore, a national governance framework is lacking to monitor compliance with standards and guidelines for digital health (Ministry of Health, 2021). There are no governance structures to support planning and monitoring compliance of digital health guidelines at the health facility level. Also, a significant digital gender divide exists in Uganda; therefore, the government should ensure that the digital policy framework integrates women's unique perspectives to produce gender-sensitive laws and policies.

Mhealth Interventions

FamilyConnect is a mobile based tool used by the Ministry of Health in Uganda to improve the uptake of reproductive and child health services in public health facilities (UNICEF Uganda, 2018). FamilyConnect sends messages via SMS or shortcodes (USSD) to enable women, their partners and caregivers to register and access information on actions they should take to ensure the good health of both themselves and their babies in the critical first 1,000 days of life. It also sends SMS messages to health workers on key follow-up actions they should offer to new mothers. By the end of 2022, more than 60,000 women had signed up. Developed in collaboration with UNICEF and the Johnson & Johnson Center for Health Worker Innovation, FamilyConnect was rolled out countrywide in 2020.

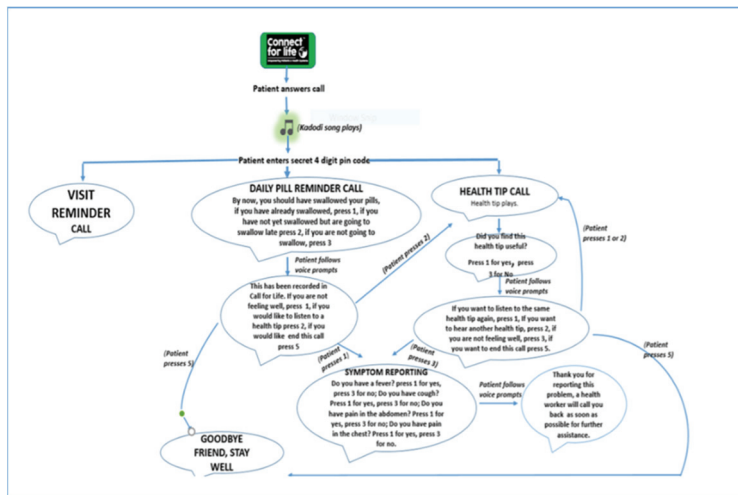
MatHealth App is an offline mobile application that provides maternal and child health information, Antenatal Care (ANC) appointment reminders, and remote connection to an obstetrician for questions by multimedia video and audio (Musiimenta et al., 2022). The app runs on android smartphones and was developed using Java programming language and SQLite. The app has been piloted on rural women with limited education and effectively provides tailored information that is easy to understand and recall. Eighty women were enrolled in a randomised control pilot to measure the impact of MatHealth App. Results show that the app positively influenced some maternal health-related practices. All women who used the MatHealth App exclusively breastfed their babies and took them to the health facility at 6 weeks for HIV testing, compared to the routine care arm. Although the Mat Health App improved women's knowledge of maternal and child health, knowledge alone was insufficient to enhance adherence to the recommendation to attend at least 4 ANC visits. The reason for non-adherence to the ANC was the lack of transport to the clinic, tied to the financial challenges among women of low socioeconomic status. Lessons learned from the intervention include; spousal involvement through the development of messages targeted at male spouses and messages the couple can watch together and incorporating financial solutions such as travel subsidies sent through mobile money applications.

Call for Life (C4LU) is a mobile health platform that aims to promote healthy behaviours and adherence to treatment by sending patients pill reminders, visit reminders, health tips and symptom management support through Interactive Voice Response (IVR) and SMS (Naggirinya et al., 2022; Twimukye et al., 2021). The platform was tested on HIV/AIDS patients that attend the Infectious Disease Institute Mulago clinic. The platform facilitates knowledge exchange and connects patients and healthcare providers. A randomised controlled trial involved the enrolment of 600 patients who were followed up for 12 months. The results show that people living with HIV found a high uptake and acceptability of the IVR tool. People with higher usage of the tool showed greater improvements in quality of life, viral suppression, and appointment keeping at 12 months of the study. A follow-up study at 18 and 24 months on the sustainability and scalability of C4LU showed that 95% of participants were willing to continue using C4LU, with 77.8% willing to pay for the service. Overall, this shows that mhealth tools can support HIV patient management and improve ART adherence and promote viral load suppression in people living with HIV. Figure 1 shows the C4LU call flow from the system to the end user, with

functionalities for daily pill reminder calls, clinic visit reminders, health tips, and the interactive guide and options until a call ends

Figure 1

Connect for Life Call Flow



Source (Twimukye et al., 2021). Copyright © Originally published in JMIR mHealth and uHealth (<https://mhealth.jmir.org>), 14.06.2021.

Artificial Intelligence powered chatbots

Uganda is increasingly exploring the use of Artificial Intelligence Chatbot technology to improve its patient-centered care. Artificial Intelligence (AI) is the ability of algorithms encoded in technology to learn from data so that they can perform automated tasks without every step in the process having to be programmed explicitly by a human (World Health Organization, 2021). While AI in healthcare promises great patient benefits, it equally presents risks to patient safety, health equity and data security (Alami et al., 2020). Most AI interventions in Uganda are still at the proof of concept or pilot stage.

Ask RHU is an Artificial Intelligence powered chatbot counsellor for young people seeking advice and services to protect their health (SafeHands, n.d.). Developed by Reproductive Health Uganda, SafeHands and Say It Now, ASK RHU provides accurate instant responses to questions on Sexual Reproductive Health Rights (SRHR). Young people type a question to Ask RHU and instantly receive medically-verified answers on over 750 SRHR topics. Content includes contraception, unwanted pregnancy, HIV and STIs, and COVID-19. Should they need to see a health worker, Ask RHU connects youth to a nearby Reproductive Health Uganda clinic using GPS location. ASK RHU works through Facebook messenger and was piloted on 230 young people. Uganda has one of the highest rates of teenage pregnancies in sub-Saharan Africa, estimated at 25% (Uganda Bureau of Statistics- UBOS and ICF, 2018). Youth rely on the internet and social media to connect with friends and family and keep abreast of new developments. Therefore, one of the ways to reach the youth with sexual health information is through chatbots on messenger platforms.

Health Adviser Another prominent example of a healthcare chatbot is Mirembe Chat Bot (Kamulegeya et al., 2019). Developed by The Medical Concierge Group (TMCG) in 2017, Mirembe is a female

personal health adviser that offers free triage and care advice to health symptoms in Facebook Messenger. Mirembe's AI processes the health symptoms provided against a user's age, gender, symptom severity, and any known medical problems

U-Report COVID-19 chatbot In February 2020, UNICEF developed a U-Report Information chatbot to support COVID-19 Risk Communication and Community Engagement in 52 countries, including Uganda. U-Report is a messaging tool that allows users to report on issues affecting them and their communities and get real-time information and feedback on new initiatives (United Nations Children's Fund (UNICEF), 2022). A COVID-19 chatbot was added to the platform to help address misinformation and share reliable information on where communities can seek assistance (United Nations Children's Fund (UNICEF), 2020). Through social media platforms such as SMS, Facebook Messenger, and WhatsApp, users can ask about COVID-19 and receive preprogrammed answers from health experts. Monthly polls and awareness messages were sent to U-Reporters nationally to understand the community's perceptions about the COVID-19 vaccine and vaccine hesitancy. A rapid assessment on vaccine compliance and acceptance conducted amongst U-Reporters of 18 years and over provided feedback that UNICEF and the Ministry of Health used to address concerns and misinformation about the COVID-19 vaccine. Over 135,885 U-Reporters benefited from the COVID-19 vaccine chatbot information, polls, alerts and awareness messages sent out in response to COVID-19 vaccine hesitancy. The lessons learned from this intervention include the following; A one-on-one anonymous conversation with U-Reporters adds more value to participation. Overall, AI powered chatbots can potentially improve healthcare access and outcomes in Uganda. Chatbots are fast and cost-effective, can reach many people at once, including those in rural areas, and provide opportunities for direct communication with users. (Zhang et al., 2020).

Barriers to the adoption of digital technologies

Poor funding and infrastructure

The health sector accounts for 5.1% of the national budget Financial Year 2020/2021, down from 7.9% in Financial Year 2019/2020. This is critically low if the country is to ensure Universal Health Coverage. International development assistance institutions finance a significant proportion of the health sector resources (Ministry of Finance Planning and Economic Development, 2019). Inadequate funding is related to weak political support and the unreliable nature of international donor commitments. All the interventions studied involved an implementing agency with abundant financial resources. Most interventions were at the pilot stage. While many health providers and consumers often adopt digital health technologies, it was observed that many technologies were not integrated into the national health system to promote large-scale application and sustainability (Huang et al., 2017). While the Ministry of Health has the will to scale digital interventions, it is often faced with little to no public funding for large-scale public health interventions.

Digital health infrastructure

Most health facilities cannot afford to establish and maintain the required digital health infrastructure (Ministry of Health, 2021). Electricity is still a very big challenge in Uganda. Health facilities experience unreliable electricity supply from the main grid. Even when backup alternatives are available, these

cannot sustain the digital health systems for extended periods (Ministry of Health, 2021; Namatovu et al., 2021). Access to reliable internet is also a big challenge (Kaboré et al., 2022). Slow, intermittent and unreliable internet connections especially during peak hours limit the use of digital technologies. To address this challenge, the government of Uganda has connected all major towns and government departments onto an Optical Fibre Cable based Network to ensure high bandwidth data connectivity (Ministry of ICT and National Guidance, 2022). Least developed countries such as Uganda also face issues related to legacy infrastructure, technology ownership, privacy, security, and adapting and implementing global standards and technology flows (World Health Organization, 2021).

Human Resources

Health workers have been recognised as a key factor in the digital transformation of the healthcare sector (World Health Organization, 2016). However, Uganda's health system faces many human resources related challenges that affect the adoption of digital health. Health workers possess inadequate digital literacy skills, receive inadequate training and have limited awareness of the digital health solutions available (Brown et al., 2020; Owoyemi et al., 2022). Therefore, the Ministry of Health and its partners should equip health workers with digital health competencies, from basic to more complex skills, such as teaching patients about the safe and appropriate use of digital health information sources. This capacitating can be done through mentorship, support supervision and provision of equipment and infrastructure.

Digital health capacity

On the consumer side, barriers to adopting digital resources include a lack of knowledge and skills before using digital health technologies, poor internet, and no access to computers and mobile devices. Although internet connectivity in Uganda has greatly increased, a big urban-rural digital divide still exists, with 13% of the households in urban areas having a working internet connection compared to 3.2% in rural areas (NITA-U, 2022). The main reasons for not having internet access at home are the high equipment cost and internet services. Internet intermittency and the limited systems that bridge the gap between consumers and healthcare providers further hinder technology uptake (Chen et al., 2018; Kaboré et al., 2022). A study by Namatovu et al. (2021) with mothers in Uganda found that limited or no user involvement during the development of digital health systems hindered the uptake of digital technologies. Other challenges included a lack of systems that bridge the gap between consumers and health providers, limited knowledge of the potential benefit of digital health technologies and low trust in digital technologies.

Digital Gender Divide

Socio-cultural characteristics such as gender, poverty, lack of education and living in rural areas limit the adoption of digital tools. Ugandan women use the internet and digital technologies less than men leading to a digital gender divide that puts them at risk of missing the benefits offered by digital transformation. According to a 2022 report from the International Telecommunication Unit (ITU), lower-income countries have the widest digital gender gap in the world, with only 21% of women using the Internet, compared with 32% of men, a figure that has not improved since 2019 (International Telecommunication Union, 2022). Women struggle to afford technology and internet access because they often have lower income levels and are less financially independent. The gender pay gap (women often earn 30–50% less than men) and unpaid labour create a financial barrier for women to adopt digital

tools (Brandusescu & Nwakanma, 2018). Women who live in rural areas are affected more due to gaps in infrastructure and internet network coverage in rural areas.

In addition, social norms such as stereotypes around technology being for men and fear of being discriminated against stop women from using digital tools and further impede women from using technology (Sterling, Grubbs, & Koutsky, 2020). This is fueled by a lack of digital literacy skills and discomfort in using technology associated with not having a formal education, income and employment status. For example, in India, women report not using the Internet because of the negative social perception associated with its use due to the lack of acceptance by family members (Intel & Dalberg, 2012). However, studies show that the removal of social norm barriers enables women and girls to be more frequent and active users (Girl Effect & Vodafone Foundation, 2018)

Furthermore, with the growth of the internet, women are increasingly suffering from cyberbullying and online harassment, as well as data security and privacy risk. In many countries, women have experienced online abuse, including stalking, sexual intimidation and exposure to sexual trafficking (Kuroda et al., 2019). Most online abuse occurs on social media platforms; therefore, women perceive social media as unsafe (World Wide Web Foundation, 2020). Although the government of Uganda enacted the 2011 Computer Misuse Act⁴² (Uganda Computer Misuse Act 2011, 2011) to criminalise cyber harassment (section 24), offensive communication (section 25) and cyberstalking (section 26), this policy has not been used to prevent digital harm and protect women. Online privacy is also a concern. Women have less trust in technology companies using their data responsibly. For example, 54% of female respondents in a study said they would not allow companies to use any of their data, compared with 47% of men (World Wide Web Foundation, 2020).

Conclusion

Overall, mhealth technologies have the potential to enhance public health programs. While the government of Uganda has policies that aim to provide an enabling environment for mhealth, there were still gaps in implementing these policies. Overcoming these challenges will require bigger investments to improve policy development and implementation, infrastructure, increased funding, digital health literacy skills of health workers and consumers and awareness campaigns.

At the national level, there is a need for the Ministry of Health to develop and implement the digital health governance framework to oversee the development and management of digital health at all levels of the health ecosystem. The government should develop a funding model for digital health communication infrastructure to ensure all facilities are equipped with adequate digital tools. The government should reduce the tax on digital devices and internet data services to accelerate adoption and information access. There should be a deliberate effort to scale up and integrate successful mhealth interventions into national health systems. Digital literacy and digital health literacy skills are critical for healthcare providers and consumers. This can be achieved by massive education and awareness campaigns, training health workers and consumers, and advocating support at the national and hospital levels. More research and data is needed in order to effectively design initiatives that work to close the digital gender divide for women.

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