Digitalization of health care to accelerate universal health coverage in Uganda

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Laurea University of Applied Sciences **Abstract**
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This thesis investigates how digital health services can accelerate Uganda's move closer to achieving Universal health coverage (UHC). The purpose of the study is to investigate how digitalization can accelerate Uganda's progress towards achieving Universal Health Coverage (UHC). The objectives of the study were; 1. To assess the status of digitalization of healthcare systems in Uganda. 2. To identify the key gaps in digitalization that hinder Uganda's progress towards UHC. 3. To understand how Uganda's digital health transformation aligns with global frameworks/guidelines.

The study is based on both global and regional frameworks including the WHO's global digital health strategy and Uganda's health information and digital health strategic plan. A qualitative research method was applied to this study which included semi-structured interviews with six participants from government, healthcare institutions and digital health implementors. Thematic analysis using method was applied to identify valuable patterns and perceptions from the data.

The finding indicated both positive developments and continuous challenges. Systems such as District health Information Software 2 (DHIS2), and mTrac, (a mobile software used to send data), have enhanced data management and disease surveillance, while private companies have expanded telemedicine services. However, infrastructure gaps, system fragmentation, restricted internet connection and shortage of workers continue to hinder digital health growth especially in rural areas and public health facilities.

The study concluded that digital health has enormous potential, but it requires more coordinated implementation, improved infrastructure, sustainable funding, and enhanced support for frontline health professionals. Uganda's health future is dependent not only on technology but also on inclusiveness and well supported systems that meets the needs of all beneficiaries.

Key words: Digital health, universal health coverage, Uganda, health systems, digitalization

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1 Introduction

Digitalization in healthcare is a transformative strategy that uses digital technologies to improve health service delivery, data management, and patient care across populations. Digitalization is broadly defined as the incorporation of digital instruments into healthcare system, including as electronic health records (EHRs), telemedicine, and mobile health applications, to streamline operations, cut costs and improve service accessibility (WHO 2023). In Uganda, where healthcare access and resources are limited, digitalization provides promising avenues to universal health Coverage (UHC) by making health care more efficient, accessible, and equitable (PATH 2023; Transform Health Coalition 2022).

The role of digital health in achieving UHC is well recognized, with the world Health organization arguing that it can be a vital tool for expanding equitable access to health services and improving health outcomes, particularly in poor regions. Digital health applications allow health care providers to access patient data in real time, improving diagnosis accuracy and patient monitoring (WHO 2023). In Uganda, however, the shift to digital health has been hindered by what has been dubbed “e-chaos,” which refers to the fragmented and uncoordinated deployment of digital tools in healthcare (Ashaba 2023). A systematic and unified digital health strategy, as said in current frameworks, is vital to streamline and improve these tools, ensuring that digital health solutions contribute successfully to achieving UHC (Transform health coalition 2022).

In Uganda, the government and stakeholders have created a strategy framework to coordinate digital health activities, emphasizing the value of collaborative efforts. This strategy is consistent with the worldwide call to help countries build resilient health systems via digital technologies (Ashaba 2023). By focusing on structured digital health strategy, Uganda may use the power of digital technologies to address its most critical healthcare concerns, such as inadequate healthcare access, poor health data systems and financial limits. Digital health solutions have the potential to change healthcare delivery, making it more responsive and accessible, and eventually moving the country closer to meeting UHC goals (PATH 2023).

Digitalization in healthcare has diverse benefits, including the ability to bridge healthcare gaps in Uganda. As digital health becomes a key part of health-care changes, it presents a unique chance to end geographical and resource-based obstacles, ensuring that every citizen receives prompt, high-quality healthcare services (Transform health Coalition 2022). The success of digital health in expediting UHC in Uganda will be dependent on long-term investments, good policy execution, and a commitment to overcome the underlying barriers of digital transformation in health care.

2 Background

In today's fast-changing digital landscape, the healthcare industry has undergone an unprecedented transition, with digital technology playing a critical role in transforming how healthcare services could be delivered, accessed, and monitored. The key drivers of this digital revolution are the growing demand for chronic diseases management, technological improvements, and patient's empowerment to take charge of their own health (Gopal, Suter-Crazzolara, Toldo & Eberhardt 2018) (De Mooij, Foss & Brost 2022).

Healthcare digitalization includes a wide range of technologies, including telemedicine and telehealth, as well as the integration of the internet of Things, advanced analytics, machine learning and artificial intelligence. These developments have the potential to improve diagnoses, prevention, and patient therapy, allowing healthcare providers to make better informed and evidence –based clinical decisions (Gopal et al. 2018).

Digital health techniques have appeared to be a valuable tool for improving the efficiency and effectiveness of healthcare delivery. Clinical decision support technologies and digital referral systems have shown the ability to reduce human resource restrictions and enhance access to care, particularly in underserved areas. The introduction of these digital technologies has resulted in improved healthcare use, efficiency, and overall health outcomes (Orton, Agarwal, Muhoza, Vasudevan & Vu 2018).

Uganda has seen an increase in digital health adoption, particularly during the COVID-19 pandemic, with telehealth modalities like as tele-consultation and mobile health information distribution becoming increasingly prevalent (Kamulegeya, Bwanika, Musinguzi & Bakibinga, 2020). However, fragmentation and a lack of integrated solutions pose obstacles to the digital health landscape's compatibility and sustainability (Basajja, Nambobi, & Wolstencroft 2022). While eHealth programs have been launched, there has been a shortage of systematic assessment that focuses on outcomes and impact (Nabukenya & Ashaba 2020).

The Digital Health Atlas Uganda and Uganda Digital health Dashboard are examples of existing solutions; however, their FAIRness (Findability, Accessibility, Interoperability, and Reusability) could be improved (Basajja et al. 2022). Overall, a formal assessment mechanism based on WHO recommendations is needed to analyze the impact of eHealth deployments on Uganda's healthcare system (Nabukenya & Ashaba 2020).

2.1 Global digitalization frameworks and guidelines

The digitization of healthcare is guided by several international guidelines and frameworks that seek to improve the quality, efficiency, and accessibility of healthcare services. Key

international frameworks and guidelines are presented in figure 1. and further discussed in the upcoming chapters.

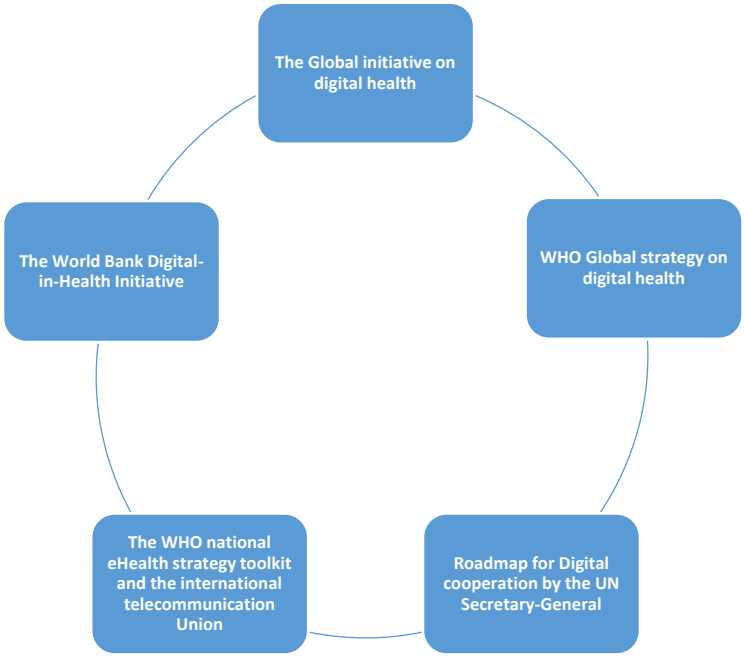

Figure 1: International frameworks and guidelines for digital health

2.1.1 The Global initiative on digital health

The global initiative on digital health (GIDH) is a World Health Organization (WHO) managed network that brings together a diverse group of stakeholders, including government agencies, institutions and technical bodies dedicated to furthering digital health transformation at the country level. GIDH was launched in February 2024 as a collaborative platform aimed at supporting the implementation of the WHO global digital health strategy of 2020-2025. Its aim is to organize and scale up country-led activities by aligning international support with national digital health priorities. The core of GIDH is to seek and identify the priorities of the evolving needs of countries pursuing sustainable digital health ecosystems. By identifying funding gaps and connecting resources with unfunded national priorities, the effort promotes more efficient use of technical and financial support (WHO 2024).

2.1.2 WHO Global strategy on digital health

The World Health Organization (WHO) created this strategy to encourage the use of digital health technology in the pursuit of universal health coverage (UHC). It provides a road map for nations looking to incorporate digital technologies into their health systems, with a focus on capacity building, governance, interoperability, and data protection. Enhancing digital health infrastructure and investment; ensuring interoperability of digital health systems; protecting

patient data and privacy; and fortifying governance and regulatory frameworks are the key areas of focus (WHO 2021).

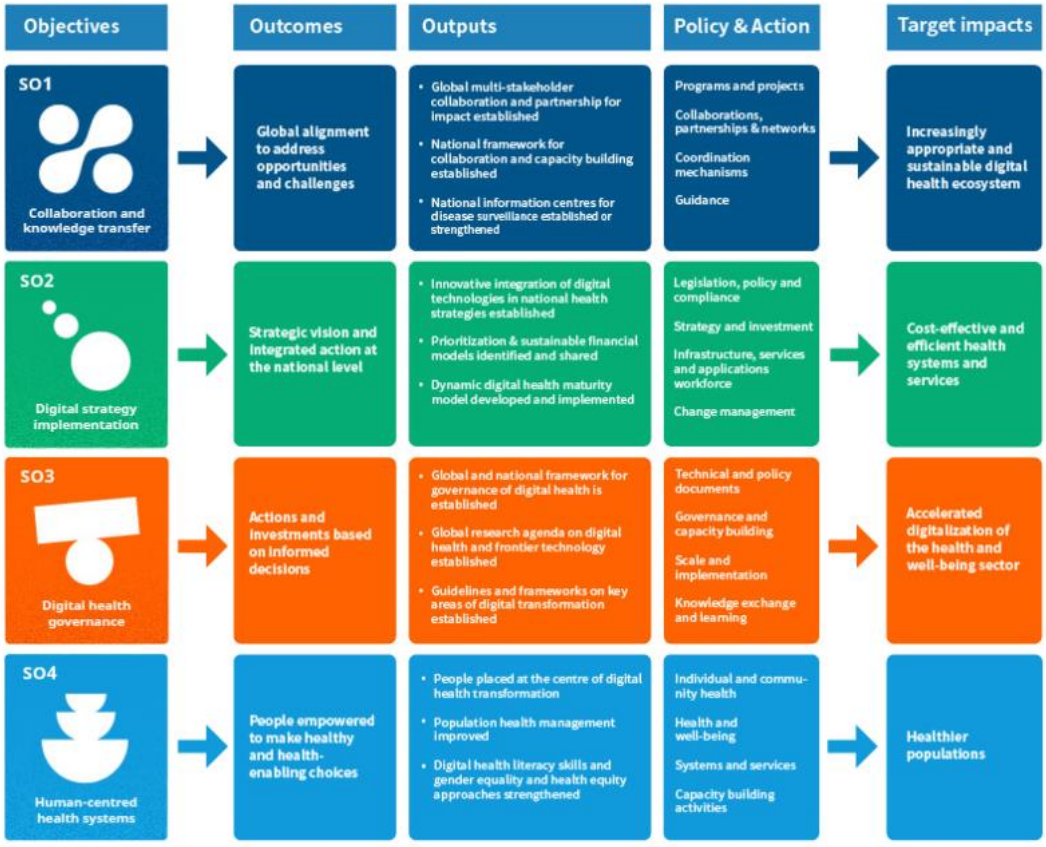

Figure 2: WHO 2021 Global strategy on digital health chart. Published with permission (CC BY-NC-SA 3.0)

2.1.3 Roadmap for Digital cooperation by the UN Secretary-General 2020

To accomplish the Sustainable Development Goals (SDGs), this roadmap provides a thorough framework for utilizing digital technologies, including the digitalization of health. This roadmap identifies five key areas for using digital health technology to promote sustainable development while addressing risks and inequality.

a. Inclusive digital economy and society
   This pillar focuses on universal connectivity, digital public goods, and inclusive digital funding. The goal is to ensure that everyone, regardless of geographical or socio-economic status, has access to and benefits from digital technologies. It promotes affordable internet access, digital literacy, and infrastructure development especially in developing countries.
b. Human and institutional capacity

Building the capacity and individual and institutional level is crucial to closing the digital gaps in society. This includes providing digital skills training and education, cultivating innovative ecosystems, and improving governments and organizations abilities to effectively regulate and manage digital technology.

c. Human rights and human agency
   The roadmap emphasizes the need to uphold human rights online, such as freedom of expression, privacy, and protection against discrimination and surveillance. It advocates for inclusive design, ethical use of AI, and protection of vulnerable communities from digital dangers.
d. Trust, security, and stability
   To ensure a secure digital environment, global effort must be made to prevent cybercrime, misinformation, and data breaches. This pillar promotes international standards for responsible cyber behavior as well as cyber security cooperation.
e. Global digital cooperation
   The roadmaps advocate for more multilateralism and inclusive governance of digital spaces. It proposes structures such as Global Digital Compact and Tech Envoy to promote coherent and inclusive dialogue among governments, civil society, the private sector, and academia.

Implementation and research insights of the roadmap.

Several studies of the roadmap explore how it is being put into action.

a. Bridging the digital divide Bon, Saa-Dittoh & Akkermans (2023, 283-298)
   This chapter of bridging the digital divide explores into the execution of the UN secretary general's roadmap for digital cooperation emphasizing ethical, human centered design methods in digital development. A case study from rural Ghana demonstrates how inclusive digital economies developed by including local communities in the co-design of digital solutions, ensuring that interventions are contextually relevant and ethically sound. This chapter connects with major roadmap pillars of such as inclusion, human rights, capacity building and global collaboration by highlighting participatory techniques, respect for human agency and multistakeholder involvement as critical for bridging the digital divide in low resource contexts.
b. Global communications governance research: colliding epistemologies and methodologies.
   This chapter investigates the execution of the UN roadmap for digital cooperation through in-depth, multi stakeholder case studies of national and local digital policies. Drawing on field interviews, policy document analysis, and lessons from city and community level pilots, the chapter highlights both progress such as the formation of digital inclusion coalitions and capacity benchmarks, and ongoing challenges related to

funding, equitable stakeholder engagement, and aligning diverse governance architectures with the roadmap's vision (Mansell 2023).

2.1.4 The WHO national eHealth strategy toolkit and the international telecommunication Union 2012

This toolkit, developed by the international telecommunication union (ITU) and the WHO, offers nations a systematic approach to design and implement their own national e-Health plans. It facilitates the integration of current health systems with digital health technologies. Key components include creating nation eHealth policies and plans; bolstering governance frameworks; addressing digital health finance and sustainability; and enhancing adoption capacity. According to (Hamilton 2013), this toolkit helps policy makers defining the vision, developing the action plan, establishing monitoring and evaluation systems, and emphasizing stakeholder participation, risk management, and iterative roadmap improvement.

Additional studies that highlight the impact of the toolkit in real world practice.

According to Riazi, Jafarpour, & Bitaraf (2024, 246-250), states that applying the toolkit in Iran led to stronger institutional commitment and clearer governance framework.

Saunders & Scott (2014, 62-69) state that they evaluated the toolkit using organizational change metaphors and concluded that it provides meaningful flexibility. However, they suggested outlining the sequential steps needed to effectively integrate eHealth into national systems.

2.1.5 The World Bank Digital-in-Health Initiative

The World bank's Digital-in-Health Initiative provides guidance on financing and scaling digital health technologies in low-and middle-income countries (LMICs). It emphasizes integrating digital tools into health financing and service delivery mechanisms. Key principles include 1) Building sustainable financing models for digital health, 2) leveraging digital tools to improve healthcare in LMICs, 3) strengthening health information systems for better decision making (World Bank 2023). The World Bank initiative has been implemented in several LMICs thus far. Examples of these include Tajikistan, where the rollout of a new health insurance scheme involved strengthening health information systems and introducing electronic processing for insurance claims. In India, World Bank support between 2016 and 2019 enabled over 40% of public health workers to adopt digital tools, reducing administrative burdens and enhancing the delivery of nutrition services to pregnant and lactating women (World Bank 2023).

2.2 Frameworks for Africa and East Africa

Digital health framework in East Africa gives standards for using technology to improve healthcare access, quality, and efficiency, hence promoting universal Health coverage (UHC).

A key policy framework for harnessing the potential of digital health to enhance service and efficiency in Uganda's Health sector is the Uganda Health Information and Digital Health Strategic Plan (UHIDSP), which is in effect from 2020/2021 to 2024/2025. The country's overarching aim of enhancing health outcomes via improved data collection, management, and distribution is in line with strategic plan. The UHIDSP strives to transform Uganda's healthcare system by using digital technology to improve health data collection, analysis, and use. Establishing a strong data health infrastructure that will ease decision-making, enhance health outcomes, and boost the effectiveness of health service delivery is the main goal of the strategic plan. Strengthening national health information systems, expanding the use of data is decision-making, improving digital health infrastructure, and promoting equity in healthcare service access using digital tools are one of its primary goals (Ministry of Health in Uganda 2023).

The Digital Regional East African Community Health (Digital REACH) Initiative, outlined by the ministry of Health in Uganda, is a collaborative effort to use digital health innovations to improve healthcare delivery across the East African Community (EAC) region, including Uganda. The initiative's goal is to integrate digital technology to strengthen health systems, improve data-sharing capabilities, and increase access to healthcare services. Telemedicine, interoperable heath information systems, and tools for making data-driven decisions are all important components. The Digital REACH Initiative aims to efficiently solve shared health concerns and advance universal health coverage through regional collaboration and digitalization. To improve healthcare for marginalized communities, Uganda's national Digital Health strategy focuses on interoperability, workforce development, equitable access, and data security which is in line with regional frameworks such as Digital REACH (Ministry of Health Uganda 2023).

The East African Community leads the Digital REACH Initiative, which focuses on interoperability, data-driven decision-making, cross-border medical services, and workforce training in Burundi, Kenya, Rwanda, South Sudan, Tanzania, and Uganda (East African Health Research Commission 2022). The Digital Reach framework aligns with the sustainable Development Goals (SDG 3) and the African Union's Agenda 2063, which emphasize health as human right. The initiative envisions a technologically connected East Africa where health care services are widely available and affordable. Its goals include strength thing health information systems, enhancing date-driven decision-making, and easing cross-border healthcare access via interoperable digital health systems. It also aims to promote innovation by incorporating emerging technologies like artificial intelligence, big data analytics, and mobile health (mHealth) solutions into the health care sector.

The African Union (AU) Digital Health strategy aims to use digital innovations to improve healthcare delivery, health outcomes, and accelerate universal health coverage (UHC) across

the continent. This strategy is consistent with the AU's Agenda 2063 for and the sustainable Development goals (SDGs), particularly SDG 3, which promotes universal health and well-being. In East Africa, digital health solutions are increasingly being acknowledged as essential enablers of UHC, addressing healthcare, quality, and affordability concerns.

The Health data Collaborative (HDC) which was set up in 2016 is an international collaboration of governments, development partners, and international agencies with the goal of enhancing health data systems to accelerate the achievement of the sustainable development goals (SDGs) and Universal health Coverage (UHC).The HDC promotes capacity-building, data system integration, and coordinated investments in health information systems. (HIS) by giving priority to country-led initiatives. The initiative has attracted interest in Africa, where attaining UHC is significantly affected by weak health data systems. HDC enhances data quality and usage by aiding health management information systems (HMIS) and encouraging common data standards in Africa (HDC 2022).

2.3 Infrastructure

To improve Universal health Coverage (UHC) in Uganda, considerable infrastructure modifications are needed. These include building and upgrading primary healthcare facilities, increasing access to medicines, and improving health funding methods (Jaca, Malinga, & Iwu-jaja 2022). Uganda faces difficulties with road maintenance, rural connectivity, and electrification, all of which have an indirect impact on healthcare access (Ranganathan & Foster 2012). To bridge these infrastructure gaps, the country will need to spend $1.4billion per year for the next decade (Ranganathan et al. 2012). Strategic purchasing arrangements, such as direct facility funding and performance-based financing, can boost service quality and resource allocation (Ekirapa, SSennyonjo, & Cashin 2022).

However, limited domestic financing and duplication of donor-funded services prevent the delivery of a comprehensive minimum health care package (Ekirapa et al. 2022). To achieve universal health coverage, Uganda must prioritize health system strengthening through enhanced health financing, infrastructure development, and alignment of government and donor goals (Jaca et al. 2022) (Ekirapa et al. 2022).

2.4 Universal Health Coverage

The pursuit of Universal health coverage has been a global priority, with countries around the world striving to ensure equitable access to quality healthcare services for all. The digitalization of healthcare presents a promising avenue to accelerate progress toward this goal (Bloom, Khoury, & Subbaraman 2018).

The World Health Organization (WHO) defines Universal Health Coverage (UHC) as ensuring that all individuals and communities have access to basic health care without financial hardship. UHC's key components are access to essential health care services, safe and effective medication and vaccinations, and financial support to prevent poverty caused by healthcare expenses (WHO 2023). Achieving UHC is a key part of sustainable Development Goal 3 (SDG 3), which seeks to ensure healthy lifestyles and promote well-being for everyone by 2030.

Uganda, like other low- and middle-income countries (LMICs), faces various obstacles in achieving universal health coverage (UHC), including poor healthcare infrastructure, limited financial resources, healthcare professional shortages, and high patient out-of-pocket payments (Mclntyre, Obse, & Barasa 2018), thus digital health technology could close these gaps and accelerate progress towards UHC.

Uganda has implemented various health financing reforms to achieve universal health coverage (UHC). These include piloting results-based finance, implementing sector-wide strategies, and dropping user fees in 2001 (Odoch, Senkubuge, Masese, & Hongoro 2023). Nevertheless, there has not been much of a change, and significant out-of-pocket expenses continue to exist (Odoch et al. 2023; Nannini, Biggeri, & Putoto 2022). Health workforce, governance, financing, service delivery, and community health are among the major research goals for UHC that have been decided by stakeholder engagements (Ssengooba, Ssennyonjo, Rutebemberwa, Musila & Namusoke 2021). Various e-health initiatives lack sustainability because of donor dependence and inadequate planning, even though they have proved potential in enhancing healthcare delivery, especially in disease surveillance (Kiberu, Mars & Scott 2017).

According to political economic study, dominating interests and ideologies do not provide adequate incentives for enacting comprehensive financial protection plans, to attain UHC, Uganda must address these difficulties and align its health financing policies with WHO recommendations for UHC reforms (Nannini et al. 2022), (Odoch et al. 2023).

2.4.1 Financial risk protection

The current state of financial risk protection in Uganda's healthcare system is still a significant concern as the country strives towards universal Health coverage (UHC). Financial risk protection guarantees that individuals have access to essential health care without incurring financial hardship. However, Uganda continues to rely on out of pocket (OOP) expenditures, accounting for around 37% of total health expenditure. This excessive reliance on OOP payments contributes to catastrophic health expenses, particularly for low-income households, comprising financial protection and equal access to healthcare (Otieno & Namyalo 2023).

To address these difficulties, Uganda has moved forward with its National Health insurance Scheme (NHIS), which tries to pool resources and decrease household financial burdens. During

its initial phase, the NHIS is projected to cover at least 25% of the population, in addition to community-based health insurance (CHI) and private health insurance (PHI). Currently, CHI and PHI programs cover approximately 7.5% of Uganda's population, showing a large gap in financial risk protection (Otieno & Namyalo 2023).

Uganda has made progress about financial risk protection in healthcare, but there are still difficulties. The percentage of Ugandans driven below the poverty line by health payments fell from 5.2% in 2005/06 to 2.7% in 2016/17 (Kwesiga, Aliti, Nabukhonzo, & Najuko 2020). Out-of-pocket payments are still common, with 77% of households reporting direct payments for healthcare (Ruhweza, Baine, Onama, Basaza, & Pariyo 2009). Despite the removal of user fees from public facilities in 2001, the prevalence of catastrophic health expenditures remained high (Nannini et al. 2022).

Poverty, having small children or elderly family members, and a history of hospitalization are all risk factors for a lack of financial protection. The present political climate in Uganda is unfavorable to implementing a comprehensive universal health coverage system with widespread financial protection, as dominant interests and ideologies do not provide sufficient incentives for such reforms (Nannini et al. 2022).

2.4.2 Access to healthcare

Access to health care in Uganda has been a major challenge due to a variety of institutional infrastructure, and socioeconomic concerns. Despite significant reforms and attempts, the health system still faces challenges with equitable access, particularly in rural areas. Geographic discrepancies are obvious, with metropolitan areas having greater access to health care than people living in rural areas. This disparity leaves majority the population, particularly in rural and underdeveloped areas, without proper care. Only 28% of Ugandans have access to basic health services, proving the level of inequality in healthcare availability (UNICEF 2024).

Maternal and child health indicators are still alarming. As of 2019, the maternal mortality rate was 336 deaths per 100,000 live births, while the infant mortality rate was forty-three per 1,000 live births. Recent data suggests that just 51.4% of pregnant women completed the necessary four prenatal appointments in 2021-22, showing difficulties to getting consistent care during pregnancy (UNICEF 2024).

Financing and health insurance are significant barriers to accessing health services. Uganda's public health budget is insufficient, relying primarily on foreign funding and government expenditure that has not kept up with rising demand for services (Ministry of Health 2020). This has generated substantial out-of-pocket costs for patients, posing a significant barrier for low-income groups.

Uganda's healthcare accessibility faces considerable obstacles, particularly among marginalized groups. The poor and rural communities face a higher disease burden but less access to health services than wealthy groups. Distance to institutions, perceived quality of care, medicine availability, and pricing are all potential barriers (Kiwanuka, Ekirapa, Peterson, Okui & Rahman 2008). Refugees and host communities confront similar challenges, with cost, organization, and acceptance of services limiting access (Emina 2024). To address these difficulties, Uganda has started healthcare reforms aiming at increasing service accessibility, including integrating refugees into the local healthcare system (Emina 2024).

Despite these challenges, there has been progress in many areas, such as an 11.2% rise in health facilities deliveries between 2020/21 and 2021/22, primary driven by results-based financing initiatives. (UNICEF 2024)

2.4.3 Accessibility of digital tools

The accessibility of digital health in Uganda is a major problem with far-reaching consequences for the country's efforts to improve health outcomes. Telemedicine, mobile health applications, and electronic health records are examples of digital health technologies that have the potential to improve the access and quality of healthcare services, especially in remote and underserved areas (Sieck, Sheon, Ancker, Castek & Callahan 2021) (Werner, Puta, Chilalika, Walker & Cooper 2023). However, the introduction of these technologies in Uganda has been hampered by several factors, including poor pilot project coordination, weak health systems, a lack of awareness and ability about digital health, inadequate infrastructure, and interoperability concerns (Olu, Muneene, Bataringaya, Nahimana & Ba 2019).

One of the key obstacles to digital health access in Uganda is the lack of robust and well-coordinated digital health ecosystem. The excessive cost of technical equipment, a lack of awareness and competency, negative feelings towards technology, and the absence of a systematic approach to teaching and learning are all ongoing issues in developing nations such as Uganda (Ndibalema 2022).

Furthermore, the COVID-19 pandemic has revealed Uganda's education system's inadequacies in embracing online and distance learning. Despite the country's investment in technology infrastructure, educational institutions have struggled to completely adopt a digitalized curriculum, posing a significant challenge for sector leaders.

2.4.4 Quality of services

According to recent reports, Uganda's healthcare system has significant difficulties. Key difficulties include insufficiently trained health personnel, a lack of vital drugs, negative staff attitudes, and extensive distances to health facilities (Kiguli, Ekirapa, Okui, Mutebi &

MacGregor 2009). These difficulties contribute to low user satisfaction and perceived accessibility, especially among the poor. However, initiatives to increase quality have proven potential.in various regions, a national quality assurance program introduced in 1994 resulted in lower maternal mortality, shorter wait times, and higher patient satisfaction (Omaswa, Burnham, Baingana, Mwebesa & Morrow 1997). More recent research emphasizes the necessity of addressing issues such as the national health system, working environment, budgetary allocation, and coordination between centers and hospitals to improve health care quality (Mwesigwa et al. 2021).

Uganda's National Health policy and the health sector development plan, both of which aim to develop the health workforce, increase access to care, and improve service delivery, are among efforts to improve healthcare quality in the country. Furthermore, the Ministry of Heath has collaborated with international partners on emergency care training programs including the emergency medical services ECHO initiative. This program has improved the abilities of over 11,000 healthcare personnel in emergency response and set up interdisciplinary resuscitation action teams (reacts) to simplify emergency care in hospitals (Seed Global health 2023).

To increase service accessibility, the government has invested in digital health technologies. The eHealth strategy intends to improve healthcare delivery by enhancing data gathering and management, as well as providing telemedicine services to underserved communities. However, these projects face challenges, such as limited internet connectivity and inadequate digital literacy among health care workers (Ainembabazi 2024).

2.5 Current studies on digitalization of healthcare in Uganda

Research on the digitalization of healthcare in Uganda proves its potential to address healthcare delivery challenges while improving access, quality, and efficiency. The growing use of digital health technologies such as electronic health records (EHRs), mobile health apps, and telemedicine marks a fundamental shift in Uganda's healthcare sector. However, studies highlight limitations such as infrastructure gaps, insufficient computer literacy, and policy challenges.

Digital health technologies are becoming more essential in Uganda's healthcare system, notably for enhancing access to care in remote areas. Enterprise architectural standards have been designed to harmonies digital health activities with the goal of maximizing efficiency and quality (Wamema, Alunyu, Amiyo & Nabukenya 2023). To address fragmentation, efforts are being made to improve interoperability using FAIR data standards (Basajja et al. 2022). The COVID-19 pandemic has increased the use of telehealth modalities such as tele-consultations and mobile phone health information dissemination (Kamulegeya et al. 2020). A mobile phone-based heart failure program designed for remote Ugandan communities shows potential for improving patient outcomes, lowering such initiatives, and providing culturally proper care

closer to home, these developments prove the potential of digital health technologies to bridge healthcare access gaps and improve service delivery in Uganda. (Wali, Ssinabulya, Muhangi, Kamarembo & Atala 2023).

3 Aim, objectives and research questions

The overarching aim of thesis study is to investigate how digitalization can accelerate Uganda's progress towards achieving Universal Health Coverage (UHC).

The thesis objectives are:

1. To assess the status of digitalization of healthcare systems in Uganda.
2. To identify the key gaps in digitalization that hinder Uganda's progress towards UHC.
3. To understand how Uganda's digital health transformation aligns with global frameworks/guidelines.

The research questions of this thesis are:

1. What is the status of digital health in Uganda?
2. What are the current gaps in digitalization of the healthcare systems that hinders progress towards achieving Universal health Coverage (UHC) in Uganda?
3. What has been done in Uganda to accelerate UHC through digitalization of healthcare?
4. To what extent does Uganda's digital health transformation align with global framework/guidelines?

In this thesis a PICo model was used to help formulate research questions and to guide in the data search for background.

Table 1. PICo model

PICo	Description
P= Population	Health service providers, policy makers and administrators, and Civil society organizations in Uganda
I= Interest	Digital health technologies available in Uganda
Co= Context	Improved access, service coverage, progress towards universal health coverage

4 Methods

This study used a qualitative research method to investigate how digitalization influences Uganda's progress toward Universal Health Coverage (UHC). A qualitative method is excellent for gaining thorough knowledge of complex social issues in their real-world situations (Jordan, Clarke & Coates 2021). Qualitative research is widely recognized as a thorough and valuable approach in health systems research, especially in low- and middle-income countries (LMICs), where health interventions interact with a wide range of socio-political and infrastructure realities (Busetto, Wick & Gumbinger 2020). Qualitative research further seeks to investigate and comprehend the nature, context and meaning of social or health related occurrences rather than merely numerical patterns. In contrast to quantitative methods that focus on how many or how much, qualitative methods tackle the questions of why or how something occurs by diving deeply into participants' experiences, perspectives, and circumstances in which they occur (Busetto et al. 2020). Qualitative research relies on a variety of data sources and methods to acquire a thorough understanding of participants' experiences and related factors. Data collection consists of gathering contextual data from interviews, focus groups, document analysis as well as conducting observations from both participant and non-participant while capturing details with audio visual materials and filed notes. The obtained data is often transcribed into text and coded, either manually or via software. Analytical techniques such as thematic analysis and content analysis are used to identify patterns, establish meaning, and develop theoretical insights based on the participants' views and observed actions (Busetto et al. 2020).

The digitalization of healthcare in Uganda is complicated, comprising a wide range of actors, technology, and institutional process. By choosing a qualitative study design, the researcher was able to gather rich, contextual insights from those directly involved in the creation and implementation of digital health solutions. Furthermore, the qualitative study design allowed for a focused assessment of Uganda as a unique setting allowing for a comprehensive investigation of systemic, infrastructural, and policy related aspects of digital health.

4.1 Study setting

This study was conducted in Uganda, a low-income country in East Africa which has a decentralized health system and ongoing initiatives to achieve universal health coverage. Uganda's healthcare system is structured at the national, regional, district and community levels with significant differences in infrastructure, resource distribution, and services accessibility between urban and rural locations. Uganda's digital health ecosystem consists of a combination of public and private sector activities aiming to health information systems, patient monitoring and remote service delivery.

The study took place within this complex environment by engaging key informants involved in digital health policy, implementation, and service delivery to capture a thorough understanding of the impact of digital health in achieving universal health coverage. The participants included six individuals from three different stakeholder levels, public health officials, civil society organizations and health facility workers operating in both urban and rural settings. The interviews were conducted between March and April 2025 via a virtual platform at the participants convenience and no one other than the researcher and participant was present, ensuring anonymity and reducing external influence. The sample was diverse in terms of gender, age, and institutional affiliation but all had more than five years of experience in providing healthcare services and coordinating digital health programs. Busetto et al. (2020) state that employing rigorous qualitative methodologies such as reflexivity, purposeful sampling and coding transparency ensures the credibility and reliability of findings.

4.3 Data collection

In this study, the data collection was guided by a set of semi structured interview questions and prompts intended to elicit participants experiences and thoughts on digitalization of healthcare in Uganda. The questions were piloted to guarantee their clarity and relevance prior to the main data collection phase. Each participant was interviewed once, and no additional interviews were undertaken. The interviews which lasted between 30 – 60 minutes were audio recorded with the consent of the participants to ensure data correctness and completeness. While field notes were not taken during the interviews to preserve the natural flow of the conversation, reflective notes were recorded shortly afterward to capture crucial insights and contextual details. Although transcripts were not returned to participants for verification, the study method recognized and explored the concept of data saturation ensuring that interviews were conducted until no new topics emerged.

This method was chosen because it allowed for the investigation of specified themes while also allowing participants to build on their own experiences, ideas, and perspective. Semi-structured interviews are popular in qualitative research due to their adaptability and capacity to collect both factual and experiential data (Gill, Stewart, Treasure, & Chadwick 2008).

Interviews were supported by an interview guide (appendix 1) that was consistent with the study questions and included open-ended prompts to encourage reflection and thorough responses.

4.4 Sampling and participants

Purposive sampling was used to identify participants for this study, allowing the researcher to deliberately seek persons with relevant experience and understanding of digital health in Uganda. This approach is often employed in qualitative research to ensure that the participants

can provide relevant and detailed information about the topic of study. Participants came from multiple stakeholder groups, including health care professionals, policymakers, and digital health implementers (Naderifar, Goli & Ghaljaie 2017).

Potential participants were initially approached by email and followed by a phone call to provide additional information and confirm their willingness to participate in the interview.

The study had six participants who were interviewed, although eight participants were selected but two were unable to participate due to difficulties associated with working in rural areas with unstable internet connectivity which hindered their ability to join virtual interviews. This sample strategy was supported by the need to acquire ideas from knowledgeable individuals to provide various perspectives on both the possibilities and barriers to digital health in pursuit of UHC.

Data collection proceeded through purposeful sampling until saturation was reached, indicated at the point at which no added information provided further insights into the objective of the study. This approach has a depth of understanding that met the unique criteria of the selected participants (Nederifar et al. 2017).

4.5 Data analysis

Thematic analysis was used to analyze the interview data. This method was chosen for its ability to identify, arrange, and evaluate patterns of relevance across qualitative datasets. The analysis followed Braun and Clarke's six-phase approach presented in graph 1. (Braun & Clarke 2006).

Initial coding was manually done, with codes derived inductively from the data. These codes were categorized as prospective themes based on recuing topics and ideas. The topics were improved through repeated reading and cross comparison to achieve consistency and distinction. This analytical technique was designed to reveal not only what participants stated but also the meanings, assumptions, and structures that support their statements (Busetto et al. 2020).

The data was coded with 250 separate coders ensuring a broad and diverse interpretation of qualitative data. The themes were not pre-identified but rather derived inductively from the raw data, allowing insights to emerge naturally based on participants' responses. The data was managed using Microsoft word and handwritten notes, with no usage of specialized qualitative analysis software. The participants did not provide feedback on the findings hence no checks were performed to validate the interpretations.

The participants' quotes were used in the findings to illustrate and support the selected themes, offering in depth contextual insight into the data. However, individual quotations were

not attached to specific participants such as using numbers. The given data consistently supported the findings with a clear narrative aligned with the major themes. The themes were clearly discussed, alongside description of minor themes that brought depth to the overall analysis.

Figure 3: Braun and Clarke's six-phase approach in thematic analysis (2006).

While the qualitative study approach yielded valuable insights on digital health and UHC in Uganda, it is not without limits. The small sample size of six participants restricted the findings' generalization, which was not the study's goal. Furthermore, the study used self-reported data, which could be compromised by social desirability bias or selective remembering. Finally, logistical obstacles, such as call schedule problems and limited internet connection, hindered the capacity to conduct interviews consistently.

Despite these constraints, the selected technique enabled a thorough, contextualized understanding of a complicated and developing topic of digital health care reform. This strategy produced useful insights for future research, policy creation, and digital health implementation techniques in Uganda and similar settings.

4.6 Data management plan

All data collected was managed securely in accordance with ethical data protection requirements (appendix 4). Audio recordings were transcribed in full, and transcripts were anonymized before the analysis. Flies were stored on encrypted drives, with only the researcher having access to them. Data management practices also included frequent backups and secure

deletion of identifiable information at the end of study. These precautions protected the integrity and security of the data throughout the research procedure.

5 Results

A total of six interviews were conducted for this study, with participants selected based on their experience and knowledge of the research topic, although they did not represent their respective organizations. The interviews were conducted online and lasted between 30 to 60 minutes, hence allowing for in-depth conversations despite the network limitations.

This chapter covers the results of in-depth interviews with healthcare professionals, policymakers, and digital health implementers in Uganda. Thematic analysis of these interviews revealed four main themes that shed light on the difficulties of digital health's role in accelerating universal health coverage (UHC) in Uganda: (1) The current state of digital health in Uganda, (2) Barriers and gaps in achieving digital health for UHC, (3) Stakeholder efforts and strategic Interventions, and (4) Global alignment and lessons from regional best practices. Each theme provides key insights into Uganda's digital health journey, including progress, problems, and future potential.

Figure 4: Summary of the main findings in this thesis

5.1 The current state of digital health in Uganda

The interviews revealed that there is an emerging digital health ecosystem in Uganda, with considerable advances in the deployment of health information systems and telemedicine services over the last decade, driven by the COVID-19 epidemic. Participants emphasised a growing awareness of digital health's potential, with one respondent remarking that digital health in Uganda has seen significant advancements in recent years particularly in electronic health records and telehealth. Another participant remarked,

> A successful digital health implementation in Uganda requires not only technological solutions but also critical attention to human aspects, such as healthcare worker skills and motivation, patient trust and involvement, and strong leadership commitment.

Uganda's digital health environment is defined by a variety of systems that serve various tasks in the healthcare sector. A participant stated that there were already existing digital solutions in place in Uganda in certain fields.

> Yes, there are examples of digital solutions in us. So, for maternal and child health, there have been many different programmes in the country.

The participants (3) raised the importance of The District Health Information Software 2 (DHIS2), which was described to have become a key component of the health information system, allowing data reporting and decision-making inside public health facilities while also improving the efficiency of delivery, reporting, and disease outbreak monitoring. A participant remarked that;

> Complementing DHIS2 is mTrac, an SMS-based reporting system that allows healthcare workers to report disease outbreaks and drug stockouts in real time, which has proven invaluable for increased health surveillance during epidemics such as Ebola, COVID-19, and malaria.

Another issue that was raised was that alongside these public sector operations, the private sector is becoming increasingly significant. Private sector-led digital health projects, such as Rocket Health, were seen as increasing access to healthcare services via telemedicine, primarily benefiting urban populations who have smartphone access and internet connectivity. As one participant stated, these telehealth providers have the potential for improved convenience and access to care. A participant noted that;

> Telehealth providers have helped expand the reach of services to busy people who could not manage to go to a clinic.

However, there is a huge discrepancy in digital health adoption between public and private healthcare facilities. Private facilities are more advanced in implementing electronic medical record systems and other digital health solutions, whereas public facilities continue to rely heavily on paper-based systems, resulting in what one participant referred to as a public-private digital divide in healthcare service delivery. This discrepancy is worsened by an urban-rural divide, emphasizing geographical disparities in access to digital health benefits, as a participant stated that;

> Those are only scenarios in urban centers, while in rural areas there is nothing digital. The participant further remarked that at least there is good mobile network coverage and internet connection.

Despite these differences, there have been encouraging advancements in specialized fields; for example, in radiology, the government has invested in CT scans at regional referral hospitals and set up a teleradiology unit at the national reference hospital. This programme allows for the electronic transmission of images from remote places to specialists in the city, which helps to alleviate the country's serious shortage of radiologists.

5.2 Barriers and Gaps in Achieving Digital Health for UHC

The participants described that while Uganda has made progress in developing digital health systems, their successful implementation and contribution to UHC are hindered by considerable challenges and gaps. These issues include infrastructure constraints, policy implementation gaps, and human resource capacity issues.

Infrastructure difficulties are a key impediment as participants repeatedly recognized internet connectivity as a serious barrier, especially in rural areas. The unpredictability of internet access severely interferes with the effectiveness of digital health systems that rely on constant connectivity, a challenge worsened in remote and isolated areas, as demonstrated by a participant;

> My experience with poor internet reception while on a working outreach on an island was horrible, only 27% of rural health facilities have reliable internet access.

The challenge of irregular electrical supply adds to the connectivity issue. This involves the use of alternate power sources, such as solar energy, and appropriate medical technology, as demonstrated by one respondent's experience of obtaining solar-compatible ultrasound equipment. The participant noted that;

> Only 47% of health centers still lack stable electricity supply.

Access to devices is a further crucial challenge. Economic constraints limit access to appropriate equipment for both healthcare personnel and patients, effectively eliminating certain groups from digital health platforms. Furthermore, the reliance on outdated or donated computer technology in healthcare facilities could hinder the effective adoption of modern digital health applications. A participant remarked that;

> Not everyone can afford a smartphone which makes access to digital platforms difficult.

In addition to infrastructure, system fragmentation and a lack of interoperability present significant problems. The fragmented operation of multiple digital health systems hinders comprehensive patient care and health system management. According to one respondent who noted that;

> The biggest one challenge is the lack of the system's integration.

That is the result of uncoordinated implementation efforts and the engagement of various international partners that introduce separate systems that are not intended to function together. This fragmentation leads to redundant data collecting, which reduces efficiency and data quality.

Furthermore, the findings revealed a financial burden for individual healthcare staff due to internet connectivity. Several respondents stated that they personally cover the cost of internet connectivity for work purposes, resulting in a reliance on individual financial capacity for system access that is unsustainable. As one participant noted;

> Even when I speak this way, I am using my own personal data. It is not offered by the institution," while another stated, "It depends on how my pocket is for me to load my data and be able to use digital systems." Other Participants stressed the importance of institutional support to address these expenditures.

Despite these limitations, participants highlighted various success stories and the benefits of digital health initiatives. Mobile health applications for mother and child health tracking have allegedly led to improved maternal health outcomes, with one respondent attributing a partial role to these solutions in the maternal mortality rate having dropped by one-half. Telemedicine and teleradiology services have increased healthcare access, especially in places with specialist shortages. The country's high mobile phone coverage (about 80%) has eased the implementation of SMS-based health interventions, allowing communication even in places with inadequate internet availability. Furthermore, the use of smart paper technology has increased data accuracy and reduced reporting backlogs.

5.3 Stakeholder efforts and strategic interventions

The findings highlight the need for stakeholder engagement and strategic interventions in overcoming identified challenges and effectively using digital health for UHC. This theme covers the roles and initiatives of the government, private sector, and international partners, as well as the crucial importance of public-private partnerships and learning from regional and international best practices.

Participants highlighted the government's critical role in promoting digital health. The government, particularly through the Ministry of Health, has made major expenditures in digital health infrastructure, most notably in the development of the DHIS2 and mTrac systems, demonstrating its strategic priorities and commitment to health system strengthening. Government measures also include supplying equipment to health facilities as one respondent stated that;

> The Minister of Health has given our facility close to around 20 to 30 computers and laptops.

Despite the government's shown readiness to develop digital health, participants identified continuing implementation obstacles, reflecting a larger trend of differences between policy aims and practical implementation.

The private sector is a key driver of digital health innovation in Uganda, particularly in telemedicine. Companies such as Rocket Health are pioneering telemedicine providers, offering online consultations, laboratory sample collection, and prescription delivery services, which proved helpful during the COVID-19 pandemic. Private facilities have been quicker to implement electronic medical records, motivated by efficiency concerns and competitive initiatives. However, it was observed that private sector innovations tend to focus on urban populations with adequate internet connectivity and smartphone access, thereby worsening existing healthcare disparities.

International organizations play a vital part in Uganda's digital health environment by offering technical expertise and financial support. The World Health Organization (WHO), UNICEF, USAID, and the Bill & Melinda Gates Foundation are among the key international partners that fund and provide technical help to digital health programmes. WHO has promoted health information systems and digital health integration, whereas UNICEF has established platforms such as mTrac and Family Connect. While appreciating the important function of these relationships, all participants highlighted worries regarding donor dependency and sustainability, stating that;

> "Most of these digital health projects are donor funded, and when donors leave, they usually leave a gap. Another participant noted that the uncoordinated deployment of diverse systems by various international partners contributes to system fragmentation and interoperability issues, resulting in multiple players with non-integrated systems.

Emerging public-private partnerships (PPPs) offer opportunities for long-term digital health deployment. To address infrastructure concerns, these partnerships can leverage the public sector's reach with the private sector's creativity and efficiency. Collaborations with telecommunications firms such as MTN and Airtel, for example, to provide community health workers with toll-free SMS services.

Participants stressed the necessity of learning from successful digital health initiatives in other countries, particularly those in the area. Rwanda was widely given as an example, with one participant stating that;

> Uganda can borrow a leaf from Rwanda, which has created one national digital health system where different health services, like hospitals, clinics, and pharmacies, are all linked and share personal data securely. Kenya was also recognized for its approach to integrating digital health into primary healthcare through community health workers and mobile platforms. Beyond Africa, India was cited as a model for utilizing public-private partnerships and platforms to implement digital health.

5.4 Global alignments and lessons from regional best practices

Uganda's digital health policies follow international standards and guidelines, particularly those of the World Health Organization (WHO). As a participant noted;

> Most of our policies are aligned with international standards in one form or another" or "aligned to WHO because we subscribe to it and other international policies by UNICEF, USAID, etc.

However, participants expressed serious concerns about the contextual relevance of these globally linked rules, emphasizing a conflict between international standardization and local implementation. One participant stated that;

> The weakness is that the policies are not tailored to the Ugandan context, which leads to implementation challenges because these policies may require certain technological advancements that we cannot find in our country, or if we find them, we can't afford them, or if we can afford them, we cannot sustain them.

This shows that policy adaptability, not just adoption, is critical for effectiveness of digital health acceleration in Uganda.

In addition to global alignment, learning from regional best practices is regarded as essential. Participants repeatedly mentioned Rwanda's accomplishment in developing a national digital health system that integrates multiple health services while ensuring secure data sharing. Kenya's strategy to integrate digital health into primary care via community health workers and mobile platforms was also cited as a useful example. These geographical examples provide useful insights into implementation tactics that can be tailored to the Ugandan environment.

6 Discussion and recommendations

This chapter presents an in-depth review of the findings reported in Chapter 5 (findings), interpreting them within the wider literature on digital health and Universal Health Coverage (UHC) and considering their implications for Uganda's health system. The discussion is organized around the four thematic areas found in the findings, which correspond to the research questions and main aim of this thesis: to investigate how digitalization can accelerate Uganda's progress toward achieving UHC.

6.1 The current state of digital health in Uganda

The findings show that Uganda's digital health landscape is changing, with considerable progress in the implementation of systems like EHMIS, DHIS2, and mTrac, as well as private initiatives like Rocket Health. These findings support previous studies that identified increasing investment in health information systems and telemedicine as essential accelerators of modern healthcare delivery in low- and middle-income countries (LMICs).

The use of digital health solutions in Uganda is consistent with global trends identified by Gopal et al. (2018) and Mooij et al. (2022), who remark that telemedicine, mHealth, and AI are increasingly transforming health systems. However, the urban concentration of such innovations in Uganda reflects long-standing geographic gaps in healthcare access. As participants noted, digital services are still mostly available in urban areas and private facilities, maintaining the "public-private digital divide". This disparity is consistent with UNICEF's (2024) finding that only 28% of Ugandans have access to basic health services, with rural people being the most neglected.

Significantly, the emergence of teleradiology services in Uganda, which enable remote diagnosis via digital imaging, implies that digital health can help to overcome critical human resource problems, particularly a lack of radiologists. This is consistent with the literature that

emphasizes digital health's ability to alleviate workforce limits through remote diagnostics and support technologies (Orton et al. 2018).

6.2 Barriers and gaps in achieving digital health for UHC

Despite Improvements Uganda's digital health implementation encounters various structural challenges. Infrastructure remains a major restriction, with unstable electricity, poor internet connection in remote regions, and high-cost digital gadgets noted as continuing challenges. These findings are consistent with those of Ranganathan and Foster (2012), who emphasize the crucial importance of infrastructure in promoting equitable health access.

Furthermore, the concern of fragmented systems and a lack of interoperability echoes previous criticisms by Basajja et al. (2022), who claimed that Uganda's digital health environment suffers from insufficient coordination and redundancy. The growth of donor-driven digital platforms without centralized integration has resulted in inefficiencies and duplication of efforts, a concern also expressed in WHO's Digital Health Strategy, which calls for unified systems and governance frameworks.

Even more challenging is the financial strain placed on healthcare personnel, who frequently pay their own internet bills to access digital systems. This concern shows the mismatch between digital health policy and operational realities, emphasizing the importance of institutional support to maintain sustainability. It also supports broader results about the unsustainable nature of donor-dependent digital health programmes in Uganda (Kiberu et al. 2017).

It is encouraging that the success of mobile health solutions in maternal care, as reported by participants, gives support to global literature demonstrating that mHealth can improve maternal and child health outcomes in low and middle-income countries (Bloom et al. 2018). These applications demonstrate how targeted digital interventions, when scaled and supported, can have real health benefits despite larger systemic challenges.

6.3 Stakeholder efforts and strategic interventions

The findings confirm that collaboration among government, the private sector, and international partners is critical to the growth of digital health in Uganda. The Ministry of Health has led significant efforts such as EHMIS, DHIS2, and mTrac, which are critical to health information management. These activities align with the Uganda Health Information and Digital Health Strategic Plan (UHIDSP) and the WHO eHealth Strategy Toolkit's focus on governance and health data infrastructure.

However, there are still gaps between policy goals and reality. While the government has provided equipment and demonstrated commitment, implementation issues remain, particularly in human resources and system usability. This adds to earlier studies emphasizing

the need for institutional preparation and workforce development in advancing digital health (Ndibalema 2022).

Private sector innovations, such as Rocket Health's, demonstrate flexibility and customer-focused service delivery. However, these services frequently target higher-income, urban groups, raising concerns about digital equity. These supports (Werner et al's 2023) assertion that if not adequately managed, digital health can potentially worsen inequality.

International partners have been vital in providing financing and technical assistance, but their fragmented approaches have resulted in interoperability challenges and sustainability concerns. Participants' worries regarding donor dependency reflect (Nabukenya & Ashaba 2020), who emphasize the importance of formal evaluation and coordination of eHealth initiatives in Uganda.

Public-private partnerships (PPPs) represent a potential path forward. Collaborations with telecoms to provide toll-free SMS services are scalable strategies for reducing access barriers. Furthermore, learning from regional peers like Rwanda and Kenya, which have achieved substantial progress in digital health integration, provides practical lessons for Uganda. The development of Rwanda's centralized digital health system is consistent with the Digital REACH Initiative's vision of a connected East African healthcare infrastructure.

6.4 Alignment with global frameworks and regional lessons

Uganda's digital health guidelines are broadly consistent with international standards such as the World Health Organization's Global Digital Health policy and the World Bank's Digital in Health Initiative. Participants acknowledged the alignment but also highlighted the problems of contextualizing these frameworks to Uganda's specific technological, financial, and human capacity constraints.

This highlights the critiques of (Basajja et al. 2022) and others, who argue that digital health policies must be both globally informed and locally adapted. The risk of implementing "best practices" that are not realistic or sustainable in local settings is substantial, especially when technological demands exceed available infrastructure and training capacity.

Learning from regional examples like Kenya and Rwanda enables Uganda to implement locally relevant models. For example, Kenya's usage of mobile-equipped community health workers demonstrates how digital health may be integrated into existing organizations rather than imposed from above.

Such regional lessons are consistent with the African Union's Digital Health Strategy and the Digital REACH Initiative's emphasis on interoperability, cross-border collaboration, and locally relevant innovation.

6.5 Implications for policy, practice, and research

The study's findings hold significant implications for digital health policy, implementation, practice, and future research paths in Uganda. First, there is an urgent need for improved coordination between national policy frameworks and the actual implementation of digital interventions. While Uganda has produced various strategic plans and harmonized with international digital health standards, participants have repeatedly noted the gap between policy goals and operational realities. Bridging this gap will necessitate not only improved leadership and governance but also the implementation of effective accountability mechanisms to ensure that strategic priorities are converted into measurable action on the ground.

In practice, infrastructure investment emerges as a fundamental need because digital health cannot thrive in areas with poor internet connectivity, unpredictable electricity, and a lack of basic digital equipment. The findings highlight the reality that these infrastructure problems are particularly severe in rural regions, contributing to a growing digital divide. A comprehensive digital health strategy must therefore include targeted investments in electricity, network expansion, and the deployment of relevant devices to both health institutions and individual healthcare personnel. Without these criteria, many people would miss the full potential of digital health innovations.

Human resource capacity is another key issue that requires attention. The skills, motivation, and support of healthcare staff, as well as technology infrastructure, are critical to the success of digital health systems. According to the study, many healthcare professionals cover the cost of their own digital access, which is both unsustainable and demotivating. Addressing this challenge entails establishing training programmes, providing ongoing professional development in digital literacy, and providing operational support such as internet data packages and devices. These steps would increase user adoption and ensure that digital solutions are not only accessible but also usable and efficiently incorporated into the workflow of hospitals.

Sustainable financing mechanisms are critical to the long-term success of digital health initiatives. A major reliance on donor-funded programmes, as identified in this study, creates an unstable environment that is liable to collapse if external financing is discontinued. The formation of public-private partnerships (PPPs) is a viable answer to this problem. This type of collaboration can combine the public sector's reach and infrastructure with the private sector's creativity and efficiency, harnessing their respective strengths. To avoid duplication of effort and ensure equitable access, these collaborations must be effectively managed and aligned with national interests.

Furthermore, the fragmentation of digital health systems requires the adoption of national standards for interoperability, data governance, and system integration. The findings show that

digital health initiatives operate in isolation, resulting in inefficiencies and lower data quality. Coordinated oversight under a centralized national digital health authority or task force is required to integrate current and future digital health programmes and link them with the health system's overall goals.

Finally, the study emphasizes the need for further thorough, context-specific research on digital health in Uganda. While there is a growing body of research supporting digital technologies' ability to improve healthcare delivery, there are still not enough systematic evaluation procedures for examining their actual impact on health outcomes, access to care, and financial protection. Future research should focus on outcome-based assessments and investigate the lived experiences of both healthcare practitioners and patients, particularly in communities that are marginalized. Such a study would provide valuable feedback to policymakers and implementers, as well as contribute to developing more effective, equitable, and long-term digital health programmes.

6.6 Ethical considerations

The researcher followed good research practices and used the (TENK 2023) Ethical guidelines which were observed throughout the study to maintain the participants' safety and dignity. All participants provided informed consent before data collection began and they were told about the study's goal, the voluntary nature of their involvement, their right to withdraw at any time, and precautions to ensure their confidentiality. During transcription and data presentation, participants' names and other identifiable information were removed.

In addition, data securely stored in password – protected folders that were only accessible by the researcher. These guidelines verified that research involving human beings met international ethical standards.

6.7 Trustworthiness

To establish trustworthiness, the study used the qualitative research criteria of credibility, dependability, transferability, and conformability proposed by Lincoln and Guba. As it was not possible to find the original book of Lincoln and Guba, the author has referred to the criteria presented in the article by (Nowell et al.2017).

In this thesis, credibility was gained by carefully selecting informed participants and allowing them to speak freely during semi-structured interviews. The research method was made more dependable by keeping an extensive inspection track, which included interviews guides, transcripts, coding decisions, and reflective comments (Nowell et al. 2017).

Confirmability was ensured by reflexivity, which involved the researcher actively considering and documenting their own potential biases and influences on the research process.

Transferability was enhanced by providing detailed explanations of the study context, participant's experience, and thematic findings, allowing readers to assess the results' utilization in similar contexts (Nowell et al. 2017)

6.8 Limitations of the study

This study's limitations include its dependence on qualitative data from a selected sample, which may not fully represent all stakeholder opinions, particularly those of patients. Furthermore, given the rapidly growing nature of digital health, certain developments may have occurred since data collection. However, the findings provide an extensive understanding of the fundamental factors influencing digital health in Uganda.

6.9 Recommendations

This study provides many major suggestions based on its interpretation of data with the existing literature. Uganda should prioritize infrastructure development as a key driver of digital health. This involves investments in dependable energy and high-speed internet, particularly in rural and underserved areas.

Digital health policy must be translated into building strategies that specify roles, timelines, and monitoring frameworks. Strengthening institutional capacity at the national and subnational levels will be important for successful implementation.

The government ought to establish a centralized digital health governance structure to assure the integration, interoperability, and oversight of all digital health initiatives. This entity should also be in the position of coordinating donor support to avoid duplication and guarantee alignment with national objectives.

There is a need to establish ongoing digital training programmes for health personnel, supported by incentives and the provision of digital technologies. These programmes should be incorporated into both pre-service and in-service training curricula.

To ensure sustainable funding for digital health, Uganda should look at new finance models such as results-based financing and public-private partnerships. Finally, future initiatives must be influenced by ongoing research and evaluation to determine the impact of digital health interventions on health outcomes, cost-effectiveness, and equity. Developing national guidelines for digital health monitoring and evaluation would encourage evidence-based policies and accountability.

7 Conclusions

This study intended to investigate how the digitization of healthcare could accelerate Uganda's journey towards achieving Universal Health Coverage (UHC). Using in-depth interviews with key stakeholders and extensive engagement with relevant literature, the study examined the state of digital health in Uganda, identified key gaps hindering its implementation, assessed stakeholder interventions, and evaluated the extent to which Uganda's digital health strategies align with global frameworks.

The findings indicated that, while Uganda has made considerable progress in implementing digital health solutions including EHMIS, DHIS2, mTrac, and private telemedicine services, these efforts are unevenly spread among regions and health sectors. Urban-rural and public-private gaps continue to influence those who benefit from digital health technology, emphasizing the importance of inclusive and equitable digital health planning.

Critical challenges remain, including limited infrastructure, fragmented systems, a lack of interoperability, financial constraints, and insufficient human resource capacity. These limitations, if not addressed, will continue to hinder digital health's potential for universal access to quality healthcare services. Nonetheless, the study identified strong political will, private sector innovation, and international support, all of which create the groundwork for growing digital health solutions.

Importantly, Uganda's alignment with global frameworks such as the WHO Global Digital Health Strategy and regional initiatives such as the Digital REACH framework demonstrates the country's commitment to implementing international best practices. However, the difficulties in adapting these frameworks to Uganda's unique social, technological, and economic environment were constantly highlighted.

From a policy and practice perspective, this study emphasizes the importance of bridging the implementation gap between digital health plans and on-the-ground reality. Sustainable finance mechanisms, improved public-private collaborations, infrastructure investment, and capacity building are all required to transition from pilot projects to scalable, meaningful digital health systems. Furthermore, integrating digital health into broader initiatives to reform the health system will be critical for sustaining progress toward UHC.

Regarding contribution, this study provides practical depth to the discussion of digital health in low and middle-income countries, including Uganda. It provides an extensive understanding of the complex nature of digital health implementation while also identifying actionable topics for policy and future research.

Future research should concentrate on continuous impact assessments of digital health interventions, user experiences with vulnerable populations, and the scalability of public-private partnerships. Furthermore, as digital transformation progresses, the governance of digital health ecosystems, including data security, privacy, and ethical use, will become increasingly important.

In conclusion, while digitalization is not the ultimate solution, it has significant potential for improving UHC in Uganda if used purposefully, inclusively, and sustainably. The task today is to translate digital health potential into systemic change, ensuring that no one falls behind in the pursuit of health for all.

References

African Union. 2020. The Digital Transformation Strategy for Africa 2020-2030. Accessed 16 October 2024. https://au.int/en/documents/20200518/digital-transformation-strategy-africa-2020-2030

Ainembabazi, M. 2024. Healthcare Excellence Unveiled: A Review of FY 2023/2024 Performance. Ministry of Health blog. Accessed 24 October 2024. https://www.health.go.ug/2024/02/24/healthcare-excellence-unveiled-a-review-of-fy-2023-2024-performance/.

Ashaba, C. 2023. Moving From E-Chaos to Uganda's New Digital Health Strategy. Accessed 2 October 2023. https://www.ictworks.org/moving-from-e-chaos-to-ugandas-new-digital-health-strategy/.

Basajja, M., Nambobi, M., & Wolstencroft, K. 2022. Possibility of Enhancing Digital Health Interoperability in Uganda through FAIR Data. Data Intelligence 4, (4). 4 https://doi.org/10.1162/dint_a_00178.

Bon, A., Saa-Dittoh, F., & Akkermans, H. 2024. Bridging the Digital Divide. Introduction to Digital Humanism. Springer, Cham. https://doi.org/10.1007/978-3-031-45304-5_19

Braun, V. & Clarke, V. 2006. Using thematic analysis in psychology, Qualitative Research in Psychology, 3:2, 77-101. Qualitative Research in Psychology, 3(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Bloom, D., Khoury, A. & Subbaraman, R. 2018. The Promise and Peril of Universal Health Care. Science 361, no. 6404. https://doi.org/10.1126/science.aat9644.

Busetto, L., Wick, W. & Gumbinger, C. 2020. How to use and assess qualitative research methods. https://doi.org/10.1186/s42466-020-00059-z

East African Health Research Commission. 2022. Digital REACH Initiative. Accessed 19 October 2024. https://www.eahealth.org/digital-reach-initiative.

Ekirapa-Kiracho, E., Ssennyonjo, A., & Cashin, C., Gatome-Munyua, A., Olalere, N., Ssempala, R & SSengooba, F. 2022. Strategic Purchasing Arrangements in Uganda and Their Implications for Universal Health Coverage. Health Systems & Reform 8. https://doi.org/10.1080/23288604.2022.2084215.

Emina, G. 2024. Healthcare Access, Quality, and Challenges among Refugees and Host Communities in Uganda. International Journal of Scientific and Research Publications 14, no. 5. 74–76. https://doi.org/10.29322/IJSRP.14.05.2024.p14913.

Gill, P., Stewart, K., Treasure, E., & Chadwick B. 2008. Methods of data collection in qualitative research: interviews and focus groups. Br Dent J. 2008 Mar 22;204(6):291-5. https://doi.org/10.1038/bdj.2008.192

Gopal, G., Suter-Crazzolara, C., & Toldo, L. et al. 2019. Digital Transformation in Healthcare – Architectures of Present and Future Information Technologies. Clinical Chemistry and Laboratory Medicine 57, no. 3. https://doi.org/10.1515/cclm-2018-0658.

Hamiliton, C. 2013. The WHO-ITU National eHealth Strategy Toolkit as an Effective Approach to National Strategy Development and Implementation. https://doi.org/10.3233/978-1-61499-289-9-913

Health Data Collaborative. 2022. Data for Health and Sustainable Development. Accessed 19 October 2024. https://www.healthdatacollaborative.org/.

Jaca, A., Malinga, T., Iwu-Jaja, C.J., Nnaji, C.A., Okeibunor, J.C., Kamuya, D & Wiysonge, C.S. 2022. Strengthening the Health System as a Strategy to Achieving a Universal Health Coverage in Underprivileged Communities in Africa: A Scoping Review. International Journal of Environmental Research and Public Health 19, no.1. https://doi.org/10.3390/ijerph19010587.

Jordan, J., Clarke, S. O., & Coates, W. C. 2021. A practical guide for conducting qualitative research in medical education: Part 1-How to interview. AEM education and training, 5(3), e10646. https://doi.org/10.1002/aet2.10646

Kamulegeya, L., Bwanika, J., Musinguzi, D & Bakibinga, P.. 2020. Continuity of Health Service Delivery during the COVID-19 Pandemic: The Role of Digital Health Technologies in Uganda. Pan African Medical Journal 35, no. Supp 2. https://doi.org/10.11604/pamj.supp.2020.35.2.23115.

Kiberu, V., Mars, M. & Scott, R. 2017. Barriers and Opportunities to Implementation of Sustainable E-Health Programmes in Uganda: A Literature Review. African Journal of Primary Health Care & Family Medicine 9, no. 1. https://doi.org/10.4102/phcfm.v9i1.1277.

Kiguli, J., Ekirapa – Kiracho, E., Okui, O., Mutebi, A., MacGregor, H & Pariyo, G.W. 2009. Increasing Access to Quality Health Care for the Poor: Community Perceptions on Quality Care in Uganda. Patient Preference and Adherence. https://doi.org/10.2147/PPA.S4091.

Kiwanuka, S., Ekirapa-Kiracho, E., Peterson, S., Okui, O., Rahman, M.H,. Peters, D & Pariyo, G.W. 2008. Access to and Utilisation of Health Services for the Poor in Uganda: A Systematic

Review of Available Evidence. Transactions of the Royal Society of Tropical Medicine and Hygiene 102, no. 11. https://doi.org/10.1016/j.trstmh.2008.04.023.

Kwesiga, B., Aliti, T., Nabukhonzo, P., Najuko, S., Byawaka, P., Hsu, J., Atuguba, J.E & Kabaniha, G. 2020. What Has Been the Progress in Addressing Financial Risk in Uganda? Analysis of Catastrophe and Impoverishment Due to Health Payments. BMC Health Services Research 20, no. 1. https://doi.org/10.1186/s12913-020-05500-2.

Mansell, R. 2023. Global Communications Governance Research: Colliding Epistemologies and Methodologies. Global Transformations in Media and Communication Research - A Palgrave and IAMCR Series. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-031-29616-1_20

McIntyre, D., Obse, A., Barasa, E & Atuguba, J.E. 2018. Challenges in Financing Universal Health Coverage in Sub-Saharan Africa. Oxford Research Encyclopaedia of Economics and Finance. https://doi.org/10.1093/acrefore/9780190625979.013.28.

Ministry of Health. 2020. Ministry of Health Strategic Plan 2020/21 - 2024/25. Accessed 9 October 2024. https://library.health.go.ug/monitoring-and-evaluation/strategic-plan/ministry-health-strategic-plan-202021-202425.

Mooij, M., Foss, O. & Brost, B. 2022. Integrating the Experience: Principles for Digital Transformation across the Patient Journey. DIGITAL HEALTH 8. https://doi.org/10.1177/20552076221089100.

Mwesigwa, D., Wahid, K., & Sohheng, N. 2021. A Case Study on the Quality of Healthcare in Uganda: Examining the Effectiveness, Safety, Patient-Centred and Timeliness of District Healthcare Facilities. Journal of Governance and Accountability Studies 1, no. 2. https://doi.org/10.35912/jgas.v1i2.741.

Nabukenya, J., Ashaba. J. 2020. An Exploratory Study on the Evaluation of eHealth Interventions in Uganda: Practices, Challenges, and Insights. https://doi.org/10.21203/rs.2.12339/v2.

Naderifar, M., Goli, H., & Ghaljaie, F. 2017. Snowball sampling: A purposeful method of sampling in qualitative research. Strides in development of medical education. 14(3). https://doi.org/10.5812/sdme.67670

Nannini, M., Biggeri, M., & Putoto, G. 2022. Health Coverage and Financial Protection in Uganda: A Political Economy Perspective. International Journal of Health Policy and Management. No.1. https://doi.org/10.34172/ijhpm.2021.116.

Ndibalema, P. 2022. Constraints of Transition to Online Distance Learning in Higher Education Institutions during COVID-19 in Developing Countries: A Systematic Review. E-Learning and Digital Media 19, no. 6. https://doi.org/10.1177/20427530221107510.

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. 2017. Thematic Analysis: Striving to Meet the Trustworthiness Criteria. International Journal of Qualitative Methods, 16(1). https://doi.org/10.1177/1609406917733847

Odoch, W., Senkubuge, F., & Masese, A.B & Hongoro, C. 2023. A Critical Review of Literature on Health Financing Reforms in Uganda – Progress, Challenges and Opportunities for Achieving UHC. African Health Sciences 23, no. 1. https://doi.org/10.4314/ahs.v23i1.78

Olu, O., Muneene, D., Bataringaya, J.E., Nahimana, M.R., Ba, H., Turgeon., Karamagi, H.C & Dovlo, D. 2019. How Can Digital Health Technologies Contribute to Sustainable Attainment of Universal Health Coverage in Africa? A Perspective. Frontiers in Public Health 7. https://doi.org/10.3389/fpubh.2019.00341

Omaswa, F., Burnham, G., Baingana, G., Mwebesa, H & Morrow, R. 1997. Introducing Quality Management into Primary Health Care Services in Uganda. Bulletin of the World Health Organization 75, no. 2. Accessed 12 November 2024. https://pubmed.ncbi.nlm.nih.gov/9185368/

Orton, M., Agarwal, S., Muhoza, P., Vasudevan, L & Vu, A. 2018. Strengthening Delivery of Health Services Using Digital Devices. Global Health: Science and Practice 6, no. Supplement 1. https://doi.org/10.9745/GHSP-D-18-00229.

Otieno, E., Namyalo, J. 2023. The Paradox of the Ugandan Health Insurance System: Challenges and Opportunities for Health Reform. Journal of Preventive Medicine and Public Health. https://doi.org/10.3961/jpmph.23.110.

Ranganathan, R., Foster, V. 2012. Uganda's Infrastructure: A Continental Perspective. Policy Research Working Papers. The World Bank. https://doi.org/10.1596/1813-9450-5963.

Riazi, H., Jafarpour, M & Bitaraf, E. 2014. Towards National eHealth Implementation – A Comparative Study on WHO/ITU National eHealth Strategy Toolkit in Iran. https://doi.org/10.3233/978-1-61499-432-9-246

Ruhweza, M., Baine, S., Onama, V., Basaza, V & Pariyo, G.W. 2009. Financial Risks Associated with Healthcare Consumption in Jinja, Uganda. African Health Sciences 9 Suppl 2, no. Suppl 2. Accessed 14 November 2024. https://pubmed.ncbi.nlm.nih.gov/20589112/

Saunders, C & Scott, R.E. 2014. Applying change management metaphors to a national e-Health strategy. https://doi.org/10.3233/978-1-61499-456-5-62

Seed Global Health. Uganda Annual progress report. 2022. Accessed 17 September 2024. https://seedglobalhealth.org/wp-content/uploads/2024/01/Seed_UgandaAnnualReport_2023_digital.pdf

Sharma, S. World Health Organization. 2023. Harness Digital Health for Universal Health Coverage. Accessed 6 October 2024. https://www.who.int/southeastasia/news/detail/20-03-2023-harness-digital-health-for-universal-health-coverage.

Sieck, C., Sheon, A., Ancker, J., Castek, J., Callahan, B & Siefar, A. 2021. Digital Inclusion as a Social Determinant of Health. Npj Digital Medicine 4, no. 1. https://doi.org/10.1038/s41746-021-00413-8.

Ssengooba, F., Ssennyonjo, A., Rutebemberwa, E., Musila, T., Kiwanuka, S.N., Kemari, E & Nattimba, M. 2021. Research for Universal Health Coverage: Setting Priorities for Policy and Systems Research in Uganda. Global Health Action 14. https://doi.org/10.1080/16549716.2021.1956752.

Finnish National Board on Research Integrity TENK. 2023. Guideline of the Finnish National Board on Research Integrity. Accessed 23 March 2025. https://tenk.fi/sites/default/files/2023-11/RI_Guidelines_2023.pdf

Transform Health. 2022. The Case for Digital Health: Accelerating progress to achieve UHC. Accessed 10 November 2024. https://transformhealthcoalition.org/wp-content/uploads/2022/07/The-Case-for-Digital-Health-TH-Report.pdf.

United Nations International Children's Emergency Fund. 2024. Sustaining public investments in health sector. Accessed 18 November 2024. https://www.unicef.org/esa/media/13261/file/UNICEF-Uganda-Health-Budget-Brief-2023-2024.pdf

United Nations. 2020. Secretary-General's Roadmap for Digital Cooperation. Accessed 18 March 2025. https://www.un.org/en/content/digital-cooperation-roadmap/

Wali, S., Ssinabulya, I., Muhangi, C.N., Kamarembo, J., Atala, J., Nabadda, M., Odongo, F., Akiteng, A.R., Ross, H., Pringle, A.M., Cafazzo, J.A & Schwartz, J.I. 2023. Bridging Community and Clinic through Digital Health: Community-Based Adaptation of a Mobile Phone-Based Heart Failure Program for Remote Communities in Uganda. BMC Digital Health 1, no. 1. https://doi.org/10.1186/s44247-023-00020-5.

Wamema, J., Alunyu, A., Amiyo, M., & Nabukenya, J. 2023. Enterprise Architecture Requirements for Standardising Digital Health in Uganda's Health System. Health Policy and Technology 12, no. 4. https://doi.org/10.1016/j.hlpt.2023.100805.

Werner, L., Puta, C., Chilalika, T., Hyde, S.W., Cooper, H., Goertz, H., Hildebrand, M.R., Bernadotte, C & Kapnick, V. 2023. How Digital Transformation Can Accelerate Data Use in Health Systems.' Frontiers in Public Health 11. https://doi.org/10.3389/fpubh.2023.1106548.

World Health Organization. 2024. Global Initiative on digital health. Accessed 10 May 2025. https://www.who.int/initiatives/gidh

World Health Organization. 2023. Universal Health Coverage. Accessed 11 November 2024. https://www.who.int/news-room/fact-sheets/detail/universal-health-coverage-(uhc).

World Health Organization. 2021. Global Strategy on Digital Health 2020-2025 (1st ed). Accessed 10 March 2025. https://iris.who.int/bitstream/handle/10665/344249/9789240020924-eng.pdf?sequence=1&isAllowed=y

World Health Organization, International Telecommunications Union. 2012. National eHealth strategy toolkit. World Health Organization. Accessed 12 March 2025. https://iris.who.int/bitstream/handle/10665/75211/9789241548465_eng.pdf?sequence=1

World Bank. 2023. DIGITAL-IN-HEALTH: Unlocking the Value for Everyone. World Bank. Accessed 13 March 2025. https://www.worldbank.org/en/topic/health/publication/digital-in-health-unlocking-the-value-for-everyone

Figures

Tables

Appendices

Appendix 1. Interview questions

Paul Jaaza 20.03.2025

Interview questions designed to address the research questions.

The pursuit of Universal health coverage has been a global priority, with countries around the world striving to ensure equitable access to quality healthcare services for all. The digitalization of healthcare presents a promising avenue to accelerate progress toward this goal (Bloom et al., 2018).

1. The status of digital health in Uganda.

a. How would you describe the status of digital health in Uganda? (can you provide examples of digital health solutions currently in Use)?

b. What are the main achievements so far in digitalizing healthcare services in Uganda? (Which digital health initiatives have been most successful and why)?

2. The gaps in digitalizing healthcare which are hindering universal health coverage

a. What are the key barriers to digitalizing Uganda's healthcare system?

b. In your opinion, what specific digital health gaps need to be addressed to accelerate towards universal health coverage?

3. Efforts to accelerate UHC through digitalization of healthcare services

a. What policies, programmes or strategies have been implemented to enhance digital health in Uganda?

b. How is the Ugandan government, private sector or international partners contributing to digital healthcare development in Uganda?

4. Alignment with global frameworks/guidelines.

a. To what extent does Uganda's digital health strategies align with global frameworks? (Any strength or weakness in the alignment)?

b. What lessons can Uganda learn from other countries that have successfully implemented digital health to achieve UHC?

Appendix 2. Participant information sheet

PARTICIPANT INFORMATION SHEET

Study title: Digitalization of healthcare to accelerate universal health coverage in Uganda.

Invitation to participate in research study.

We would like to invite You to take part in our research study which aims to explore how digital technology can improve healthcare services in Uganda making them more accessible, affordable, and efficient for everyone. By understanding the benefits and challenges of digital health, we hope to find ways to strengthen Uganda's healthcare system and ensure that all people can receive the medical care they need.

You have been invited to take part in this study because of your valuable knowledge and experience in the healthcare system in Uganda. Your insights will help us to understand how digital health solutions work, the challenges that exist and how they can be improved.

We intend to involve eight participants from diverse backgrounds to ensure an extensive understanding of digital health in Uganda.

This information sheet describes the study and Your role in it. Before you decide, it is important that You understand why the research is being done and what it would involve for You. Please take time to read this information and discuss it with others if You wish. If there is anything that is not clear, or if You would like more information, please ask us. After that we will ask You to sign a consent form to participate in the study.

Voluntary nature of participation

Participation in this study is voluntary. You can withdraw from the study at any time without giving any reason and without there being any negative consequences. If You withdraw from the study or withdraw Your consent, any data collected from You before the withdrawal can be included as part of the research data.

Purpose of the study

This study explores how digital technologies will improve healthcare delivery in Uganda, hence helping to achieve universal health coverage where everyone can access quality healthcare without financial hardships.

The overarching aim of this study is to investigate how digitalization can accelerate Uganda's progress towards achieving Universal Health Coverage (UHC).

Who is organizing and funding the research?

This study is part of a requirement for the master's degree by Laurea University of Applied Sciences in Finland. The study is not funded by the institution or the researcher.

What will the participation involve?

The participant will be involved for one hour during a virtual interview on Teams.

The study will last for approximately three weeks.

The participant will meet the researcher once for the virtual interview.

Data will be collected by answering questions during the virtual call and it will be recorded in audio format.

The study is about Uganda and will be conducted online.

Benefits of taking part.

There are no financial or personal benefits for participating in this study. However, there are several indirect benefits that may result from participation in this study i.e.

- Contribution to healthcare improvement in Uganda
- Influencing policy and practice
- Benefits to future patients and wider community

This study poses minimal risks but there are foreseeable discomforts that participants should be aware of.

- Time commitment
- Potential sensitivity discussions
- No direct financial benefits
- Financial information

Participation in this study will involve no cost to You. You will receive no payment for Your participation.

Informing about the research results

When the study is completed, a summary of the results will be shared with all participants through appropriate channels.

Participants' identities will remain strictly confidential. Any reports or publications related to this study will not include names, job titles, or personal identifiable information.

This study is a master's Thesis of Paul Jaaza.

Termination of the study

The researcher conducting the study can also terminate the study due to any foreseeable reasons for termination e.g., illness.

Potential reuse/preserving/opening of research data [if necessary]

After the completion of this study, the research data will be handled in a secure and responsible manner in accordance with data protection guidelines.

Destruction of research data

To ensure compliance with research ethical guidelines and data protection regulations, the research data will be securely destroyed after the necessary storage period.

The principal researcher and data management team will oversee the secure destruction of the data.

Further information related to the study can be requested from the researcher / person in charge of the study.

Contact details of the researcher.

Researcher/student

Name: Paul Jaaza

Email: Paul.Jaaza@student.laurea.fi

Appendix 3. Consent form

PARTICIPANT CONSENT FORM

Title of the study: Master's Degree of Global Health and Crisis Management

Location of the study: Laurea University of Applied Sciences, Finland.

Researcher: Paul Jaaza

I …… has been invited to participate in the above research study. The purpose of the research is [provide a brief and simple to understand explanation of what you are hoping to achieve by the research]

I have read and understood the written participant information sheet. The information sheet has provided me with sufficient information about the above study, the purpose and execution of the study, about my rights as well as about the benefits and risks involved in it. I have had the opportunity to ask questions about the study and have had these answered satisfactorily.

I have had sufficient information about the collection, processing, and transfer/disclosure of my personal data during the study and Privacy Notice has been available.

I voluntarily consent to participate in this study. I have not been pressurized or persuaded into participation.

I have had enough time to consider my participation in the study.

I understand that my participation is entirely voluntary and that I am free to withdraw my consent at any time, without giving any reason. I am aware that if I withdraw from the study (I can continue it later), any data collected from me before my withdrawal can be included as part of the research data.

By signing this form, I confirm that I voluntarily consent to participate in this study.

If the research data is reused or opened, by giving my signature, I consent to this.

If the legal basis of processing personal data within this study is a consent granted by the data subject, by signing I grant the consent for processing my personal data. I have the right to withdraw the consent regarding processing of personal data as described in the Privacy Notice.

Date_____

Signature of Participant

The original consent signed by the participant and a copy of the participant information sheet will be kept in the records of the researcher. Participant information sheet, and a copy of the signed consent will be given to the participant.

Appendix 4. Data management plan

DATA MANAGEMENT PLAN

Planner(s): Paul Jaaza

Thesis title: digitalization of healthcare to accelerate universal health coverage in Uganda.

Thesis commissioner: (organization/project/person, if any)

Plan preparation date: Spring 2025

1. General description of the data

1.1. Description of the data: Data and materials to be collected or that already exist and their properties.

Data/material	Type	File format	size	Access rights	Collection method
Interview recordings	Primary data	Audio	350 MB	Restricted to researcher only	Virtual interviews via Teams
Interview transcripts	Text	Word (.docx)	180kb	Restricted to researcher only	Automatic transcription from Teams
Interview notes	Text (summary notes)	Word(.docx), handwritten	5mb	Restricted to researcher only	Taken during and after the interviews
Thematic coding format	Analytical material	Word(.docx), handwritten	130kb	Restricted to researcher only	Created during data analysis

1.2. Ensuring the quality of the data

To ensure the data and materials remain unchanged, all files are saved on a secure password protected device with restricted access to the researcher only and audio recordings and transcripts are kept on a secure cloud platform.

2. Ethical principles, legislation, and the processing of personal data

2.1. Personal data and data protection considerations

Describe how you intend to process personal data by answering the following questions:

Does your data contain direct personal data: yes

Does your data contain sensitive personal data: no

If your data contains sensitive personal data, you may be required to prepare a Data Protection Impact Assessment (DPIA). Is this necessary? Describe how you will conduct your impact assessment.

2.2. Main responsibility for the processing of personal data, i.e., controllership

If the thesis material contains personal data, you must specify a controller. Describe here who is the controller of the thesis material and on what grounds.

Are you creating your thesis alone? If yes, you are the controller, i.e., the principal person, or you may be subject to joint controllership together with your higher education institution. Consult your higher education institution to determine the controller of the data.

Are you creating your thesis with a pair or in a group? If yes, you are the so-called joint controllers of the data, i.e., you are all jointly responsible for the processing of personal data.

Are you working on a thesis related to a higher education institution project, or are you in an employment relationship with a higher education institution? If yes, the controller is the higher education institution.

Are you creating your thesis for a company that has employed you or commissioned you for the work? If yes, the controller is the company.

2.3. Privacy policies and statements

Describe here what data protection-related documents and operating methods are needed in your thesis and how you will implement them. Check your institution’s instructions and describe here how you will act. If your research requires a privacy policy/statement, consent form and/or research bulletin, append them to the data management plan.

If the thesis does not involve the collection of data or materials containing personal data, this section does not apply to your work. Please note, however, that you will often be required to separately ask your participants for their consent to participate in the research.

2.4. Research designs in theses require ethical review.

Is an ethical review needed? (yes/no, justification and implementation).

No

2.5. May How will you manage the rights to the data and materials you use, produce and share?

The researcher shall maintain ownership of the research data and materials collected, produced, and reused in this thesis and will solely be responsible for their ethical use, preservation, and protection. Participants were informed about the study objective and

provided signed consent to the use of their anonymized data for this thesis. No personal identifiers were collected, and the data is used solely for study purposes. There are no external data rights issues because the participants did not represent any organization, and no third-party data were used without proper reference.

3. Data documentation

3.1. Data documentation

To maintain transparency, all phases of data processing were documented thoroughly. A personal data management folder is kept to document important actions such as interview dates, transcribing process, coding, and theme development stages. Each data file such as transcripts and coded documents is clearly labelled with a version number. This documentation provides a clear audit trail of the full data cycle which helps to ensure the research process's reliability.

3.2. Data order and integrity

If the data is to be preserved for further use, describe the locations and storage formats of its metadata.

4. Recording and information security during the thesis process

Describe here where the data will be stored and how it will be backed up during the thesis process.

All the study data will be stored in a secure password protected folder on the researcher's computer with audios stored on a secure cloud storage device. The researcher has access to both storage sites, and the cloud access is protected with a unique authenticator. To avoid unauthorized access by third parties, no data will be shared via unsecure platforms or public devices.

5. After completion of your thesis: destroying, preserving, or finding further use for and opening data

Describe how you will process your data and materials after you have completed your thesis. Explain whether you intend to destroy, preserve or share the data for possible further use and how you will implement it. Please note that sections 5.1, 5.2 and 5.3 of the instructions are primarily optional.

After completing the thesis, all data and materials will be securely preserved for a brief period to allow for possible follow up about the research. The data will be saved in password protected folders that can only be accessed by the researcher. I do not intend to publish the data publicly or share with third parties because participants did not consent to broader data sharing. The

data will be fully removed using safe data destruction process to protect the participants confidentiality making sure this strategy ensures ethical data handling.

6. Duties and responsibilities

Briefly describe how the duties and responsibilities described in the previous answers have been divided: e.g., storage, backup, sharing data, storage/destruction after the work has been completed. Remember that sufficient time must be reserved for processing the data.

The researcher is exclusively responsible for duties associated with data management. This involves safe data storage, regular backups, cloud storage, and restricting access to avoid unauthorized usage. The researcher is also in charge of documenting all data processing procedures and ensuring data integrity throughout the thesis process. After the completion of the thesis, the researcher will manage secure preservation of the data and ensuing proper deletion at end of time the required for data processing.

If you are creating the thesis for a commissioner, remember to also describe their role.