



# Digital Technologies as a Driver in the Provision of Universal Health Coverage

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**Abstract:** The digital revolution is affecting various sectors in the world ranging from banking, healthcare, telecommunications, retail, insurance, and Government. Technological innovations like digital health and electronic healthcare are core in the attainment of Universal Health Coverage (UHC) in developing countries. However, their successful deployment is faced by several barriers and challenges in Kenya. This paper applied exploratory research methodology in reviewing existing literature in the health sector with an objective to analyse the benefits and challenges associated with the application of digital technologies for UHC. The results of this study show that some of the benefits of digital technologies to UHC are efficiency, controls, and quality to areas of health finance, e-referrals, electronic health records, and health information systems. This results in reduced healthcare costs, predicting epidemics, avoiding preventable deaths, improving quality of life, reducing healthcare waste, developing new drugs and treatments, improving efficiency, and quality of healthcare. While these technological developments offer countless benefits, some of the concern revolves around the distributed storage of medical data across various facilities leading to lack of data interoperability among medical agencies and the security of health information systems and patients' medical records. Lack of digital health causes delayed decision-making processes, poor medical service delivery, inaccuracy, untimeliness, and inefficiency in access to medical data. The results were used to guide the development of a conceptual framework that would be used to address the challenges for the adoption of digital technologies for UHC.

**Keywords:** Digital Technologies, Universal Health Coverage, Digital Health, Healthcare Technological Innovation, Information Communication Technology

## 1. Introduction

Digital technologies (DT) refer to the use of information communication technologies (ICT) and tools that generate, process, transmit and store data. Digital health (DH) hence is the use of digital technologies for health (Meessen, 2018). Innovations that apply Digital Technologies in low-and middle-income countries (LMICs) are viewed as a catalyst for health systems. These innovations range from delivery of medicine and blood in remote places using drones (BBC, 2018; The East African, 2020), management of maternal and child health information in urban and rural areas (G. L. Mehl, Tamrat, Bhardwaj, Blaschke,



& Labrique, 2018) , improvement of in service healthcare worker efficiency, delivery of financial information to hospitals and health workers, monitoring of patients, secure sharing of health records (Blockchain), connection of medical devices (Internet of Things), predicting and prevention of diseases like cancer (Artificial Intelligence), Improved planning, organization and management of health services and improvement of personal health through use of wearable devices which monitor analyze and transmit patient information (Okech & Lelegwe, 2015; Tham et al., 2018). However, the role and potential for digital technologies as a driver in provision of UHC is poorly understood. To better understand the possibility of digital technologies as a driver for provision of UHC in low and middle income countries, one must first describe the existent health systems and identify the UHC challenges they face. In most LMICs, their ministries of health are responsible for provision of key health systems functions, including budgeting for priority areas, and provision of health services. Irrespective of their level of development, LMICs require reforms in their health systems, by embracing digital technologies, in readiness for future emerging health needs and attain Universal Health Coverage (UHC) and related commitments to strengthen their health systems, Sustainable Development Goals (SDGs) and Health Systems Strengthening (HSS) (Lygidakis, McLoughlin, & Patel, 2016).

According to World Health Organization (WHO) (World Health Organization, 2019), Universal Health Coverage (UHC) means that all people and communities can use the promotive, curative, rehabilitative and palliative health services they need, of sufficient quality to be effective, while also ensuring that the use of these services does not expose them to financial hardship. This definition of UHC embodies three related objectives which include; equity in access to health services, where everyone who needs services should get them, not only those who can pay for them; the quality of health services should be good enough to improve the health of those receiving services; and people should be protected against financial-risk, ensuring that the cost of using services does not put people at risk of financial harm, which aligns to SDG Target 3.8.1 (equitable access to health) and Target 3.8.2 (financial risk protection) (Lozano et al., 2018). Digital Technologies if applied in UHC can enhance the attainment of other health-related SDGs such as gender equality (SDG 5), poverty reduction (SDG 1), and nutritional improvement (SDG 2). Different countries have applied different strategies and approaches to address UHC, through strengthening primary healthcare. Recent evidence (Lozano et al., 2018; Tham et al., 2018) shows that achieving UHC and health-related SDG targets requires concerted shift from disease-centered curative interventions towards more multisector, prevention-oriented policy action that addresses the social determinants of health, while honoring the promise of leaving no-one behind. However, barriers to integration of digital technologies, lack of infrastructure, affordability, political support, and human capital in LMICs (Nomura et al., 2020), need to be addressed to maximize the potential of digital technologies as a driver in the provision of UHC.

## 2. The Problem

Advancement in the use of digital technologies to enhance digital health has attracted substantial interest in the health sector in low and middle income countries including



Kenya. Lack of digital health causes delayed decision-making processes, poor medical service delivery, inaccuracy, untimeliness, insecurity and inefficiency in access to medical data. The adoption of digital technologies for digital health innovations aims at addressing the challenges that hinder the full implementation of universal health coverage. These innovations will lead to solutions that improve healthcare quality, support health professionals to access good quality evidence and digital data needed for decision making and open new channels to help overcome the geographical inaccessibility barriers of healthcare for all. This paper aims at reviewing existing literature to identify the barriers that hinder full adoption and implementation of digital technologies in digital health for universal health coverage. The results are used to propose a conceptual framework that can be used in the adoption of digital technologies in digital health for universal health coverage.

### 3. Objectives

- To explore the digital technologies in use for adoption of digital health for universal health coverage
- To assess the potential benefits of digital technologies in support digital health for universal health coverage,
- To analyze the challenges that hinder full potential of the adoption of digital technologies in digital health for universal health coverage
- To propose a conceptual framework that can be used in the adoption of digital technologies in digital health for universal health coverage

### 4. Methodology

This paper employed the exploratory research methodology in reviewing existing literature in the health sector with an objective to analyze the benefits and challenges associated with the application of digital technologies for UHC.

The systematic review only includes research that introduces UHC, shows a new solution in using digital technologies in achieving UHC, benefits and challenges associated with the application of digital technologies in digital health for UHC and key policy initiatives aimed at achieving universal health coverage and how they have impacted on access, equity and financial protection. Secondary information was obtained from Ministry of Health official documents such as strategic plans, the draft Kenya National Health Sector Strategic Plan (KHSSP) III, draft Health Policy Framework, 2012–2030, draft Health Care Financing Strategy, and National government documents such as Vision 2030, Medium expenditure Framework (MTEF) paper, National Hospital Insurance fund documents (Manuals and operational plans), the Constitution and the Draft Health Bill, 2015 and relevant commissioned studies by Health Policy Initiatives. An in-depth review of 32 research papers and policy documents from the years 2010-2020 that were most relevant from the advanced search in the online digital libraries was conducted in September 2020, using the query string(s) defined below:

(universal health coverage OR “UHC”) AND (digital technologies OR digital health OR ICT OR electronic health\* OR e-health\* OR ehealth OR \*mhealth\*)



Steps followed in the review; first, a comprehensive review was carried out to find out what is meant by digital technologies, digital health, UHC and the influence of digital technologies in achieving UHC. Second, an in-depth review of the existing literature was performed to explore the current state of digital health and how digital technologies has been employed in the health sector globally. Further, the potential benefits and challenges associated with the application of digital technologies in Digital Health for UHC and existing UHC frameworks were reviewed. The results are used to guide the development of the proposed Conceptual Framework for Digital Technologies adoption in Universal Health Coverage.

## 5. Results

This section discusses the digital technologies used in digital health for Universal Health Coverage, applications, benefits and challenges, existing UHC frameworks, and proposes a framework in adoption of digital technologies for UHC.

### 5.1. *Digital Technologies Used in Digital Health*

The application of digital health in the achievement of UHC is enabled by key digital technologies which include: Health Information Systems to automate the process of generating, accessing, sharing and storage medical records; Blockchain technology (Dubovitskaya, Xu, Ryu, Schumacher, & Wang, 2017) used for secure distribution of medical records; Internet of Things (El-Hajj, Fadlallah, Chamoun, & Serhrouchni, 2019) used for connection of medical devices; Artificial Intelligence (Gómez-González et al., 2020) used for prediction and prevention of diseases; Cloud Computing (Maksimović, 2017) used for online storage and sharing of medical records; Telemedicine (Al-Majeed, Al-Mejibli, & Karam, 2015) used for provision of remote health care services; M-Health, mobile health (G. Mehl, Labrique, & District, 2014) for personalized delivery of health information and services; E-Learning and M-Learning for provision of health knowledge management and distance learning for health workers and Big Data tools and techniques for data capturing and analysis of large health datasets to optimize health processes. The stated main digital technologies are key pillars and represent areas where digital health intervention measures can be adopted as drivers in the attainment of UHC. This reveals that health information systems and blockchain are the most applied to achieve UHC, while the other technologies are gaining popularity. The digital technologies applied in UHC is as shown in figure 1.

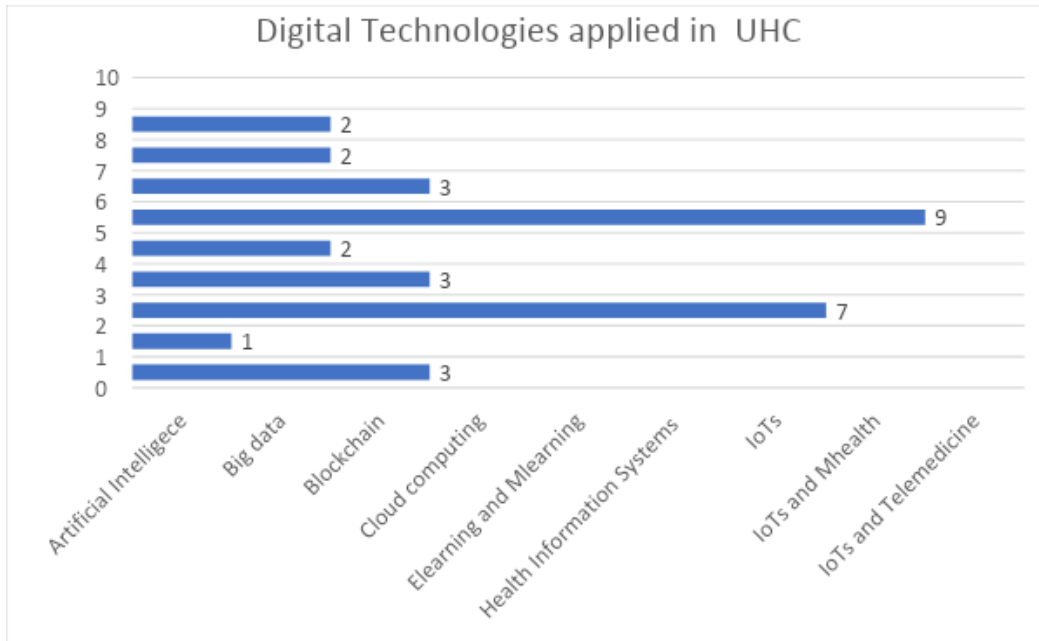


Figure 1: Digital Technologies applied in UHC

The study revealed that digital technologies have been mostly applied in managing electronic medical records and remote patient monitoring. The other use cases are shown in figure 2.

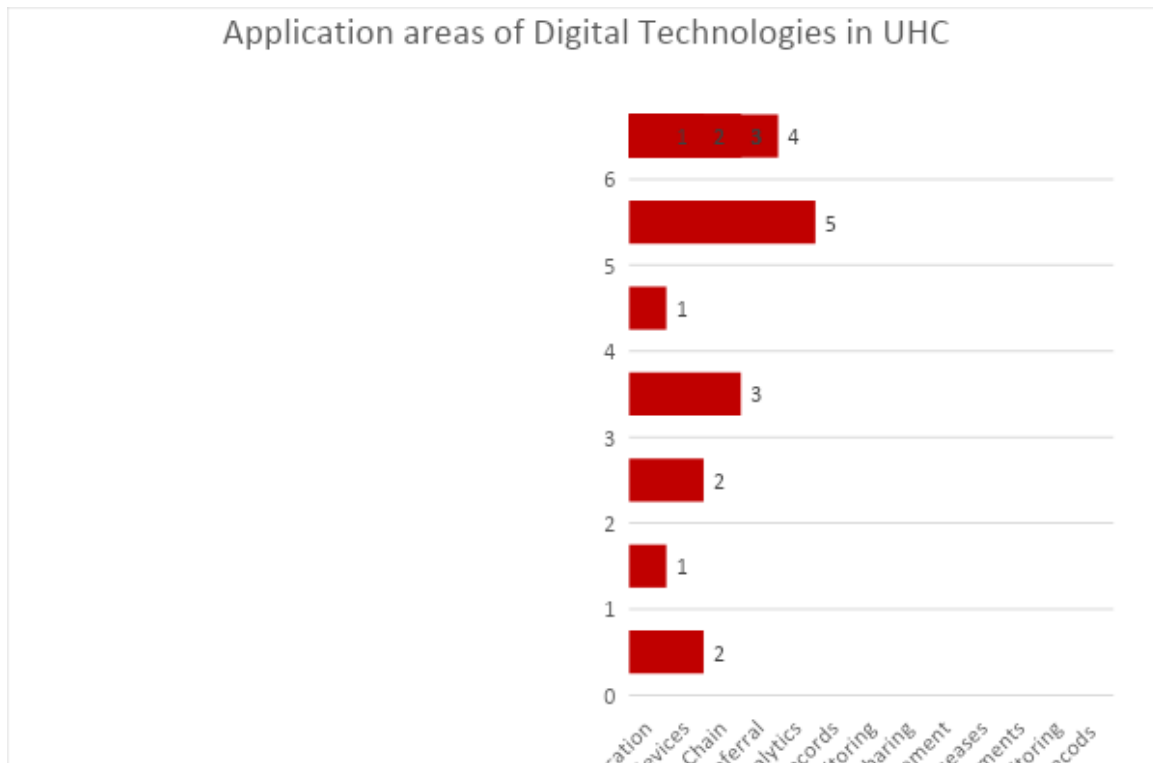


Figure 2: Application Areas of Digital Technologies in UHC

### 5.2. Benefits and Challenges associated with the application of digital technologies in Digital Health for UHC

Digital Technology (Lozano et al., 2018) is a key pillar to enhancing fulfilment of a solid healthcare delivery plan and other pillars are; Leadership & Governance, Finance and Human Resources which play a critical role in strengthening healthcare delivery. Digital Technology brings efficiencies, controls and quality to areas of: Health finance (mobile-money gateways), Referrals (e-referrals), Continuity of care (electronics health records), Knowledge Management (e-learning and m-learning), Access-to-care (telemedicine), Quality-of-care (Health Information Systems), Health care cost reduction, Artificial Intelligence and robotics, Research & Development and Legal framework for healthcare technology (Alonso, Arambarri, López-Coronado, & de la Torre Díez, 2019) . Digital Technologies are beneficial in the achievement of UHC, by improving healthcare quality since they support health professionals to access good quality evidences and digital data needed for decision making to deliver comprehensive health services for all (Sachs, 2012). Additionally, collaboration between primary, secondary and tertiary health facilities and professionals can be achieved via use of digital health applications and technologies to improve the quality of healthcare in promoting the agenda of UHC. Digital health applications and solutions may have high initial development and implementation cost, however, this reduces over time with more usage and hence balances the economies of



scale (Bloom et al., 2019). The use of digital technologies lowers the direct and indirect cost of access to UHC hence ensure affordability of health services (Alpert et al., 2020).

Digital technologies overcome the issue of access and isolation to UHC by enabling access, storage and sharing of medical records among health practitioners and patients resulting to undisrupted healthcare services (Chan, 2016). Digital Technologies also enhances capacity building and exchange programs by health professionals through e-Learning & m-learning and trainings to improve service delivery and health education in the achievement of UHC (World Health Organization, 2019). This study shows that digital technologies enhance timeliness, efficiency and effectiveness in the delivery of health services hence a strong pillar in the achievement of UHC. This will result to expansion of the main dimensions of UHC which are the size of population covered, quality of health services delivered and the cost of accessing health services for all. Despite the benefits of digital technologies in digital health for the attainment of UHC in Kenya (Okech & Lelegwe, 2015), its success is constrained by challenges such as: large proportion of the population living in extreme poverty and unable to pay for health services; large informal sector whose members are mostly uninsured ; high dropout rate from insurance schemes; inadequate digital technologies and infrastructure resulting to delayed access to health information of patients for unilateral decision making and service delivery (Meessen, 2018); fragmented health records stored in separate databases in various health facilities leading to immobility of health records among different health providers resulting to inability to share health information across health service providers (Till, Peters, Afshar, & Meara, 2017); scarcity of funds to support UHC, leading to low penetration and equipping of health facilities for primary healthcare facilities in attainment of UHC; insufficient human resource, limited medical expertise who are trained with skills sets applicable for deployment of e-Health for UHC (Olu et al., 2019); in the Kenyan Public Health Sector (Okech & Lelegwe, 2015), staff deployment is inconsistent due to government bureaucracy and underfunding, security of health information systems and medical data, unreliable power supply and uncompetitive remuneration of medical personnel are also key barriers in the attainment of UHC.

### 5.3. *Existing UHC Frameworks*

Universal Health Coverage aims to ensure that all people have access to affordable and quality health services. However, existing financial hardships hinders the access to quality and affordable health services hence affecting the full implementation of Universal Health Coverage. According to (Tanahashi, 1978) adoption of technology ensures effectiveness, contact, acceptability, accessibility and availability of health services. However, bottlenecks and service operation challenges that exist affects availability and accessibility of services due to poor allocation and employment of resources and facilities, poor appreciation of services by the people and the challenge of effectiveness of poor quality health services (Meessen, 2018).

Additionally, the world health organization report of 2019 (*WHO Guideline*, 1980) extends the Tanahashi framework showing interventions that can be adopted to address the barriers in adoption of UHC and increase the accessibility to health services. These





interventions help in overcoming the geographical accessibility challenge, improves the decision making processes and enhances the quality of health services to enable achievement of UHC. Further, in the WHO 2020 report (World Health Organization [WHO], 2020) Layers of UHC affected by digital technologies as adapted from Tanahashi framework components include accountability, supply, demand, quality and affordability. For affordable and effective coverage of health services, the framework extends: Accountability that covers a targets a given population interested in accessing health services, registered into the health system for accountable coverage; Supply which relates to ensuring availability of human resource for assured availability and accessibility of health facilities to ensure access to health facilities and availability of commodities and equipment; Demand which related to continuous coverage which relates to the extent to which clients receives required interventions and contact coverage so that patients have contact with existing relevant facilities, providers and services among the targeted population; Quality for effective coverage relating to the proportion of individuals receiving satisfactory health services among a target population and ensure Affordability with regard to financial coverage so that the proportion of patients are protected from impoverishment due to health related costs (Lygidakis et al., 2016; Ngethe, n.d.; World Health Organization [WHO], 2018, 2020; World Health Organization, 2016).

Digital health intervention measures if properly adopted can lead to use of open standards, open data, open source, and open innovations that ensure sharing of non-sensitive data after ensuring that data privacy needs are addressed, adoption and expansion of open standards (Ndungu, 2020), to enable sharing of data across digital applications and digital health platforms, automation of data sharing, connection of tools and flexible adoption to future needs, development of new software code to be open source so that anyone can view copy modify share and distribute in public repositories (Agustina et al., 2019). Digital interventions range from clients specific, healthcare provider specific, health system manager and data service related. It is under this backdrop that the proposed conceptual framework for the adoption of digital technologies in UHC, was formulated. The framework addresses the universal health coverage goals that relate to affordability, quality, demand, supply and accountability. Health systems challenges to be address include delayed decision making, inadequate technologies and infrastructure, fragmented health records, security of health systems, geographical inaccessibility, lack of adherence to guidelines, policies and standards and government bureaucracy (Bakibinga et al., 2020) . The universal health coverage enablers covered range from digital technologies, leadership and governance, finance and human resource. The digital technology interventions as per the proposed conceptual framework related to interventions for clients, healthcare providers, health systems or resource managers and data services. Universal health coverage contributions as per the proposed framework range from; improved decision making by health workforce, availability of health technologies and infrastructure, shared, interoperable health records, secure health systems and records, timeliness and efficiency in accessing health records and improved monitoring and evaluation measures. Figure 1 outlines the conceptual framework.



#### 5.4. Proposed Conceptual Framework for the Adoption of Digital Technologies in UHC

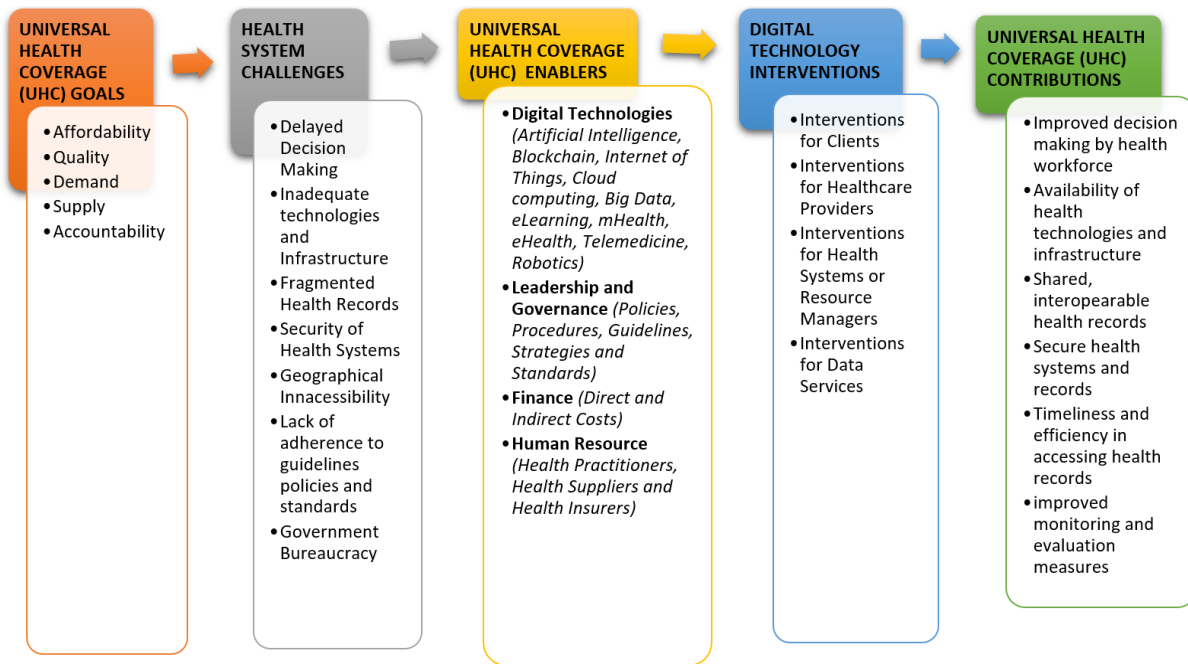


Figure 3: Proposed Conceptual Framework for the Digital Technologies adoption in Universal Health Coverage (UHC)

The proposed conceptual framework in Figure 1 can be used to address the challenges for the adoption of digital technologies in UHC.

### 6. Recommendations, Conclusion and Future Work

The results of this study show that some of the benefits of digital technologies to UHC are efficiency, controls, and quality to areas of health finance, e-referrals, electronic health records, and health information systems. This results in reduced healthcare costs, predicting epidemics, avoiding preventable deaths, improving quality of life, reducing healthcare waste, developing new drugs and treatments, improving efficiency, and quality of healthcare. While digital technological developments offer countless benefits, some of the concern revolves around the distributed storage of medical data across various facilities leading to lack of data interoperability among medical agencies and the security of health information systems and patients’ medical records. Lack of digital health causes delayed decision-making processes, poor medical service delivery, inaccuracy, untimeliness, and inefficiency in access to medical data. Further research should be done on the



implementation of the proposed framework to allow an in-depth analysis of digital technologies as an enabler in achievement of Universal Health Coverage (UHC).

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