International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Impact of Telemedicine on Enhancing Healthcare Services in Kenya: A Comprehensive Review

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Abstract: ***The purpose of this article is to review the literature on telemedicine technology and how it can improve healthcare services in Kenya. This review is informed by the Technology Acceptance Model (TAM) and the Unified Theory of Technology Acceptance and Use Theories (UTAUT). These two theories anchor the assumptions on users' acceptance and use of technology. Telemedicine being one the fastest growing technologies in the delivery of healthcare services has received attention from scholars and practitioners. The uptake of this technology in Kenya is relatively low compared to other nations. This paper therefore aims to assess the importance of telemedicine and the role it can play in improved delivery of healthcare services in Kenya. A literature review of extant evidence on the effectiveness or otherwise of telemedicine has been conducted. The paper has reviewed current papers on telemedicine between 2020 and 2023 from various locations around the globe. The findings indicate that telemedicine is both feasible and practical for the effective and efficient delivery of healthcare services. Even though there are challenges, strategic management healthcare services can overcome these challenges and eventually maximize the benefits of telemedicine in Kenya.***

Keywords: telemedicine, healthcare, service, delivery, technology

1. Introduction

The global perspective for the delivery of quality healthcare services is embedded in the sustainable global goal of universal health. Among the many efforts to deliver healthcare services, telemedicine has been on the rise in recent times. According to the World Health Organization (WHO), telemedicine is defined as the delivery of healthcare services where distance is a critical factor, by healthcare professionals using information and communication technology, to exchange valid information for diagnosis, treatment, and prevention of disease, research, and evaluation WHO, 2009.

The delivery of healthcare services for the attainment of universal healthcare in Kenya remains a challenge. The main problem is the inadequacy of both infrastructure and human resources to meet the healthcare needs of the people (East *et al*., 2014). This problem is further exacerbated by inefficient and ineffective use of existing healthcare systems and infrastructure (Nzinga *et al.*, 2013). The effect of this issue on the population is evident in high mortality rates in children, women, and other members of the public, heavy disease burden, and increased household poverty due to expensive expenditure on healthcare (Waqas *et al*., 2020; Ciapponi *et al*., 2017). Tapping into the capabilities of technology, can mediate the situation, and increase access to healthcare services by the general public (Haleem *et al*., 2021)

Telemedicine therefore depends on information, and communication technology to improve the delivery of healthcare services. Zanaboni*et al*. (2014) assert that one can use the established communication channels and networks to deliver healthcare services from one geographical point to another. The adoption and use of telemedicine have been proven to increase the effectiveness in the delivery of healthcare services especially in unreachable areas (Whitten *et al*., 2010; Kangethe, 2018). Wootton (2012) conducted a literature review on telemedicine and its impact on healthcare services over twenty years. The results indicated that there was a high level of value in the management of chronic diseases including diabetes, asthma, hypertension, heart failure, and COPD.

Consequently, telemedicine seems to be gaining acceptance, and use in the delivery of healthcare services in several countries in the world (Doarn& Merrell, 2008). For instance, telemedicine has been used in the US by healthcare professionals in 60% of healthcare institutions, and 40-50% in all hospitals (Tuckson *et al*., 2017). In Colombia, telemedicine has been used to deliver medical abortion, including consultation, home delivery medication, and post-abortion procedures (Piay-Fernandez et al., 2023). In Sweden telemedicine has been used to deliver primary care by physicians (Pikkemaat *et al*., 2021). Salsabilla*et al.* (2021) found that telemedicine was cost-effective as compared to conventional approaches in Asia. Diaka *et al*. (2021) found that telemedicine improved the delivery of primary healthcare services and referrals in the Democratic Republic of Congo.

Telemedicine in Kenya

Telemedicine in Kenya is not properly established. Some of the unconventional forms of telemedicine currently in use include online pharmaceutical care, mobile clinics, air medical services, and home-visiting doctor services (Zalo, 2020). However, the Health Act 2017, identifies e-health, as an element of healthcare service. The application of telemedicine in Kenya by healthcare professionals is marred with challenges ranging from a lack of innovations in e-health systems, inadequate ICT skills among healthcare professionals, poor connectivity to the internet, and inexistent and ineffective legal and regulatory framework to operationalize telemedicine (Onsongo, 2023).

Even though there are some conventional legal frameworks to regulate healthcare services, none explicitly

operationalizes telemedicine. For instance, the Pharmacy and Poisons Act, the Health Act, the Data Protection Act, and the Consumer Protection Act among others fragmentedly, and loosely regulate telemedicine. Thus, there is a wanting gap between the tapping of the benefits of telemedicine, and regulatory frameworks to operationalize it (Anderson, 2020). Currently, it is not clear how telemedicine is to be provided in Kenya save for the e-Health guideline offered by the Kenya Medical Practitioners and Dentist Union (KMPDU) in 2019 (Mumangi, 2023).

The lack of proper legal frameworks to regulate telemedicine technology presents a grimmer picture for Kenya. Patients are at risk of being exposed to illegal practices, and unregulated fields where quacks thrive, leading to poor healthcare services provision. Associating the benefits of telemedicine is critical to both policy and practice. This paper aims to widen the understanding, and correlate telemedicine and improved healthcare services. The outcome can influence decision-making, policy formulation, and full operationalization of telemedicine in Kenya.

Healthcare Services Delivery

World Health Organization defines health as "the state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity (WHO, 1978). The importance of health is fundamental to the achievement of peace, security, and prosperity. It mainly depends on the knit integration, and two-way support from the government and the public (WHO, 1978). A well-established healthcare delivery service system, food security, better nutritional state, and lack of epidemic illnesses as essential measures of good health. These are required for the growth of a country and support to its citizens (Jessup, 2020)

Effective delivery of healthcare services requires collaboration between soft and hard infrastructure, human resources capabilities, and technological advancements (Wangari, 2014). Governments have a mandate to ensure that the systems required to promote effective delivery of health services are found within the communities of its citizens, through policy and practice (Chuma&Okungu, 2011). However, with the increasing population growth and the constraint on resources, several governments find themselves unable to deliver quality healthcare services, especially among developing nations (WEF, 2013).

In Kenya, the devolution of functions of healthcare between the national government and the county government was established by the Constitution of Kenya 2010. The national government is charged with developing healthcare policies and managing referral hospitals. The county government is charged with all functions required to deliver healthcare services to citizens (Yarow*et al*., 2019). The goal of devolved healthcare services was to improve the efficiency and effectiveness of healthcare service delivery (Lowe, 2012). However, the goal has not been fully achieved at the county level. Key challenges include understaffing, lack of requisite knowledge and skills to effectively cascade the healthcare functions, underfinancing, and insufficient technology innovation and use by the county health administrators (Yarow *et al*., 2019).

Healthcare service delivery in Kenya

The delivery of healthcare services through various policies has a long history in Kenya. In the 90's, District Health Management Boards were established to collaborate and coordinate with stakeholders at the district level (Nzinga *et al*., 2013). Key functions included planning and regulation of health systems, and resource mobilization. These boards were then succeeded by National Health Sector Strategic Plans covering 1999 to 2004, and 20005-2010. By extension of the previous roles of the district boards, and the devolution of healthcare services due to the New Constitution 2010, several realignments were undertaken (Kangethe, 2018).

The Kenya Health Policy Framework covering 2014-2030 provides guidance geared toward achieving important improvement in the provision of healthcare services in Kenya (KIPPRA, 2017). The goal of the policy is to ensure an equitable, people-centered, participatory, efficient, socially accountable, and multi-sectoral and muti-stakeholder approach to healthcare services delivery. To achieve these policy requirements there are several actors. These include the workforce, medical supplies, drugs, and finances. The factors working together can improve access to healthcare services that meet the minimum standards set for quality healthcare (Barasa *et al*., 2016).

The Constitution of Kenya 2010 devolved healthcare services delivery to 47 units (county governments) spread across the country. The county governments are responsible for planning, human resources management, budgeting, financial resources management, and the provision of emergency medicine and medical supplies (GoK, 2010). Tsofa*et al.* (2017a) investigated the effect of decentralization of health sector planning and financial management. the outcome of the study showed that decentralization of health systems increased access, prioritization, and resource allocation equity.

Other scholars echoed that even though there are benefits of devolved healthcare services delivery, challenges including inadequate health professionals, underfunding of healthcare service delivery, lack of proper infrastructure, and inadequate supply of drugs, and other medical supplies are still rampant at the national and county levels (Tsofa, *et al*., 2017b; McCollum *et al.*, 2018; McCollum *et al*., 2019). Telemedicine has been adopted in other countries to overcome challenges that are similar to Kenya (Njoroge *et al*., 2017; Ciapponi*et al*., 2017; Gao *et al*., 2020). Thus, both policy and practice can benefit from the consideration of telemedicine for the effective delivery of healthcare services in Kenya.

Telemedicine technology

Telemedicine is the use of electronic ICT to offer healthcare services through a geographical distance (Martínez-Alcalá*et al*., 2013). The aim of using telemedicine is to support medical services delivery, data exchange, and education services through an online format or offline–stored formats. These formats may include phone calls, emails, video chats, image transmission, and short text messages between patients and healthcare providers/professionals, and between the healthcare professionals (Zalo, 2020). Common services

possible through telemedicine among others are teleconsultation, telepathology, teleradiology, telepsychiatry, tele-dermatology, and telemonitoring (Tuckson *et al*., 2017).

With the rapid advancement of technological innovations, several systems can facilitate telemedicine services. These include robotics, artificial intelligence, the Internet of Things (IoT), smart devices and worn technologies, high-speed broadband, and wireless connectivity (Martínez-Alcalá *et al*., 2013). Telemedicine thus can rapidly impact healthcare provisions due to stronger architecture, established topology, and various platforms (Whitten *et al*., 2012). The utilization of telemedicine in low and middle-income countries (LMICs) can eliminate some of the social, economic, and segregationally fundamental barriers that have been in existing healthcare services provision (Doarn& Merrell, 2008).

Governments struggling with the provision of universal health care can tap into the potential of telemedicine to narrow the gap (Anderson, 2020). Telemedicine can lower the pressure on the healthcare labor force, reduce wage bills, and decrease the brain drain. Telemedicine can also improve the interaction between the patient and the healthcare professional leading to correct diagnosis, and reduced disease burden (Whitten *et al*., 2010). The need to fully employ telemedicine in Kenya was exacerbated by COVID-19, where physical contact and movement were limited (Kim *et al*., 2023). As the growth in mobile smartphone ownership continues, the need, access, and acceptance of telemedicine will continue to increase (Martínez-Alcalá *et al*., 2013).

Contribution of telemedicine technology on healthcare service delivery in Kenya

Telemedicine has been proven to be effective in bridging the existing gaps in the effective delivery of healthcare services (Ciapponi, 2017; Anderson, 2020; Gao *et al*., 2020). In Kenya, for instance, Njoroge et al. (2017) assessed the feasibility of e-health and m-health by systematically reviewing the telemedicine initiative in Kenya. Even though there were challenges, telemedicine was found to impact healthcare service delivery by improving access to healthcare, especially in remote areas. The increased accesses also translated to reduced inequity, while strengthening the overall health system.

Bakibinga *et al.* (2020) also assessed the challenges and prospects for the implementation of community health volunteers' digital health solutions. The study revealed social and political environments, behavior and attitudes, poor infrastructure, and other systems barred the effective uptake of digital health (telemedicine) solutions. However, the overall observation corroborated other findings that telemedicine is critical to improving healthcare service delivery and strengthening healthcare systems.

Kiptinness *et al.* (2023) assessed the online HIV prophylaxis delivery through a pilot inquiry. The outcome of the inquiry generally pointed out that telemedicine is important in expanding access to existing healthcare services across various needs. The findings also indicated that telemedicine is critical in relieving public healthcare facilities from the currently experienced overcrowding. Some of the models already adopted for telemedicine include courier delivery, only purchase of drugs, at-home visits, and delivery of some drugs among others.

2. Empirical Review

Siddiquee *et al.*(2020), conducted a scientific inquiry into telemedicine in a resource-limited setting, through a narrative synthesis of evidence in a Nepalese context. The study employed a systematic literature review. Data was sourced from seven data sources including CINAHL, PubMed, POPLINE, Web of Science, Scopus, DOAJ, and Summon. The keywords used for data consultation included telemedicine, telehealth, eHealth, mHealth, and Nepal through Boolean operator AND to ensure materials specificity. A narrative synthesis was executed to review 27 papers out of the initial 1161. The findings of the study among other realities showed that telemedicine improved the quality of healthcare service delivery, enhanced partner collaboration, improved health professional accessibility, and reduced disparity among patients when compared to conventional healthcare service models. Telemedicine was also found to play an important role in hard-to-reach areas as well as rural settings. The study was contextually designed and assessed in a different location, thus making it possible to analyze a similar phenomenon in a different context.

Salsabilla *et al*. (2021) investigated the cost-effectiveness of telemedicine in Asia. The study adopted a scoping review by independently screening two literary summaries in the PubMed and EBSCO databases. The keywords included in the search were patient, intervention, comparison, and outcome in the Asian context. The study consulted a total of 870 articles where upon filtration 32 articles were used for analysis. The study applied themes such as societal, healthcare, and program aspects. The duration depicted in the articles selected for analysis ranged between 3 months to 40 years period. The findings of the study revealed that telemedicine is a promising and effective approach to the provision of healthcare services. Telemedicine was found to save time and travel costs for patients and healthcare professionals. The outcome also revealed that appropriate implementation of telemedicine reduces the cost of treatment for the government while improving the quality of life for patients. The context and the scope of the methodology were narrowed to Asia. While the African context may present some similarities, these assumptions can only be differentiated through an inquiry.

Smith and Badowski (2021) conducted a study on telemedicine for HIV care assessing current status and future prospects. The study used a literature review where journal articles were sourced from PubMed, Google Scholar, and bibliography review. The keywords used were 'HIV', 'telemedicine', and 'telehealth'. Out of the initial 179 articles identified, 12 met the threshold for inclusion in the analysis. The results of the study showed that during the COVID-19 outbreak telemedicine improved the access and delivery of HIV care. The study also indicated that there were reported lower rates of missed appointments due to the application of telemedicine. The benefits of telemedicine notably were increased retention of patients who were living

far from the physical clinics, due to increased privacy of patients who did not want to be seen physically visiting clinics, and flexibility in booking and scheduling appointments for patients to fit their schedules. It was also found that the adoption of telemedicine technology was not affected by any control variables such as age, sex, and race. The greatest limitations identified included the right devices for telemedicine and digital literacy on the use of telemedicine devices. The study was conducted in the pandemic area, where other existential threats could have played a role in influencing the outcome. Assessing the uptake of telemedicine in normal times can point to a different outcome.

Pikkemaat*et al*. (2021) investigated the Swedish Primary Care Physicians' Intentions to Use Telemedicine. The study used an anonymous web survey where questions focused on theory-based predictors of behavioral intentions, for example, attitudes, subjective norms, and perceived behavior control. A total of 160 primary care physician centers in Southern Sweden were targeted with a study questionnaire in 2019. The findings of the investigation indicated that before COVID-19, primary care physicians were reluctant to use telemedicine. However, the situation improved during COVID-19 and beyond but more empowerment to use digital tools is necessary for self-efficacy to utilize telemedicine. The study was influenced by an environmental condition which might point to a different result when subjected to normal conditions. Methodologically, an in-depth interview could have given a different experience from the physicians.

Diaka*et al.* (2021) examined leveraging smart glasses for telemedicine to improve primary healthcare services and referrals in a remote rural district of Kingandu, DRC between 2019 to 2020. The study observed the usage of telemedicine technological innovation of smart glasses, communication equipment, new diagnostic tests, and moto-ambulances. The study interviewed key stakeholders and also analyzed the project cost implications. The findings of the study showed that smart glasses were used for 10% of the period during curative consultation. There was a general increase in the frequency of consultation in the application of telemedicine in the intervention health centers. The study concluded that telemedicine improved the provision of healthcare services in the remote areas of DRC. This alluded to comprehensive intervention and all-inclusive participation of all stakeholders. The study focused on preordered telemedicine tools for which users had no otherwise. This presents a scenario where alternative studies using conventional devices can show varied outcomes.

Noutsios*et al.* (2021) studied the telemedicine-based pediatric examination of the back and lower limbs, through a narrative review. The focus of the study was to narrate the evidence from the current literature on telemedicine with specificity to musculoskeletal examination in children with the age ranges of 3-18 years. The study consulted the databases of PubMed and Science Direct using a combination of keywords and nested searches between the years 2015 and 2021. The findings of the study showed that telemedicine can be used for specific purposes. For instance, caregivers can use telemedicine for consultation with young children. However, physical exam maneuvers can be self-done by older children, and adolescents without the caregiver's assistance. The study also found that smartphone tools' reliability and validity are important in establishing the foundation for telemedicine musculoskeletal examination. The study was highly specific to a more complex health condition that telemedicine would suffice better. These findings might have revealed a different result were it done in an environment where several options existed.

Shinoda *et al.* (2022) sought to determine a telemedicine approach for monitoring COPD through a prospective feasibility and acceptability cohort study. The method used by the study "was a 52-week multicenter, prospective, single-arm, feasibility and acceptability cohort study of Japanese patients "above 40 years with COPD or asthma-COPD overlap. Participants were taken through YaDoc, a telemedicine smart app. The app included 7 daily symptoms questions and weekly COPD assessment tests (CAT) questions. The goal was to assess the participants' compliance by completing questions as required. The other goal was to assess the acceptance of staff to use the YaDoc app as evidenced at the end of the 52-week questions answered. After a series of analyses based on the participants' and staff's ability to complete questions in time. The results of the study showed that telemedicine monitoring is likely feasible and can be accepted by patients and physicians when managing COPD.

Kim *et al.* (2022) studied the use of provider-to-provider telemedicine in Kenya during the COVID-19 pandemic. The study adopted a comparative analysis of data for 12 calendar months between the years 2020 and 2021 with a baseline being February 2019 to January 2020. The findings of the study indicated that provider-to-provider telemedicine usage during the pandemic increased in 2020 from 2,604 cases to 3,525 uses in 2021. However, there were some indications of a drop in some telemedicine uses during the pandemic, it ultimately gained momentum among some telemedicine healthcare service providers. The study also noted that in as much LMICs are challenged infrastructurally, telemedicine is a viable strategic option for consultations with healthcare professionals located in remote areas. The contextual duration of the study was minimized to reflect the pandemic period. This gap can be filled by widening the duration of the study under normal circumstances, and then corroborating the outcomes.

Onsongo *et al.* (2023) investigated the experiences of the utility and barriers of telemedicine in healthcare delivery in Kenya. The study conducted a semiquantitative, cross-sectional online survey between February and March 2021. A total of 1200 doctors were tarted through emails and WhatsApp questions. However, 157 doctors participated in the interview. Of those interviewed, 50% reported having used some form of telemedicine, and 73% used a mix of telemedicine and in-person care. The use of pure telemedicine was noted in physician-to-physician consultations. The study found insufficient ICT infrastructure as a major barrier to telemedicine technology adoption and delivery of healthcare services in Kenya. Other barriers mentioned included the high initial cost of

establishment, inadequate skills to use telemedicine among patients, unskilled doctors on ICT tools, weak legislation frameworks, insufficient funding for telemedicine operationalization, and undedicated space for telemedicine healthcare service delivery. The study however showed that during the COVID-19 pandemic, there was an upward uptake of telemedicine use for delivery of healthcare in Kenya. The study was influenced by an emergency condition. Mirroring such a study with the same concepts, and methodologies could present variances in within the normal conditions.

Piay-Fernández *et al.*(2023) examined the implementation of medical abortion through telemedicine in Colombia, through qualitative analysis. The study conducted an in-depth interview among healthcare professionals, coordinators, and support staff executing telemedicine for medical abortion. Data was analyzed using the framework method while applying the normalization process theory to interpret the findings. The examination revealed that for successful implementation of telemedicine for quality healthcare service delivery; training, collaboration between diverse skilled service providers, and monitoring and evaluation are critical. The study also found that the majority of the implementation staff were positive about the use of telemedicine abortion. However, they were concerned about safety, effectiveness, and safeguards in place to guard against misuse from those providers with less clinical expertise. The conceptualization was influenced by a funding organization. The outcome of the study could be tested in an environment where such influences are minimal or non-existent.

3. Findings and Conclusion

Drawing from the evidence presented through various articles reviewed, telemedicine has been used in various healthcare services delivery. The review has revealed that telemedicine is used between a healthcare provider and the patients, and between the healthcare providers. Some of the challenges to the effective use of telemedicine include the high cost of initial setup, lack of adequate skills from both the patients and the healthcare professionals on the use of telemedicine technology/ devices, lack of adequate training and government funding to operationalize telemedicine within the reach of the majority of communities, and weaker legal and regulatory frameworks to formulate policies for the adoption and use of telemedicine.

However, telemedicine has demonstrated strong feasibility and acceptability among healthcare professionals and patients.Telemedicine can be used across the majority of consultation and observation healthcare services. It is therefore important that telemedicine should be accorded the required policy and regulatory frameworks, infrastructure, and skills for both healthcare professionals and patients. The public and the private sector healthcare players should join efforts to capture and utilize the power of telemedicine technology to improve healthcare services provision in Kenya.

References

[1] Anderson, S. (2020, September 25). *Telemedicine In Kenya: Big Idea Creating Access to Healthcare*. MATTER. https://www.matter.ngo/telemedicine-kenya/

[2] Bakibinga, P., Kamande, E., Kisia, L., Omuya, M., Matanda, D. J., &Kyobutungi, C. (2020). Challenges and prospects for implementation of community health volunteers' digital health solutions in Kenya: a qualitative study. *BMC health services research*, *20*(1), 888. https://doi.org/10.1186/s12913-020-05711-7

[3] Barasa, E. W., Cleary, S., English, M., & Molyneux, S. (2016). The influence of power and actor relations on priority setting and resource allocation practices at the hospital level in Kenya: a case study. *BMC health services research*, *16*(1), 536. https://doi.org/10.1186/s12913-016-1796-5

[4] Chuma, J., &Okungu, V. (2011). Viewing the Kenyan health system through an equity lens: implications for universal coverage. *International Journal for Equity in Health*, *10*(1), 22. https://doi.org/10.1186/1475-9276-10-22

[5] Diaka, J., Van Damme, W., Sere, F., Beňová, L., Van De Put, W., &Serneels, S. (2021). Leveraging smart glasses for telemedicine to improve primary healthcare services and referrals in a remote rural district, Kingandu, DRC, 2019–2020. *Global Health Action*, *14*(1). https://doi.org/10.1080/16549716.2021.2004729

[6] Doarn, C. R., & Merrell, R. C. (2008). A roadmap for telemedicine: barriers yet to overcome. *Telemedicine journal and e-health: the official journal of the American Telemedicine Association*, *14*(9), 861–862. https://doi.org/10.1089/tmj.2008.8479

[7] East, L., Arudo, J., Loefler, M., & Evans, C. (2014). Exploring the potential for advanced nursing practice role development in Kenya: a qualitative study. *BMC Nursing*, *13*(1). https://doi.org/10.1186/s12912-014-0033-y

[8] Gao, J., Fan, C., Chen, B., Fan, Z., Li, L., Wang, L., Ma, Q., He, X., Zhai, Y., & Zhao, J. (2022). Telemedicine Is Becoming an Increasingly Popular Way to Resolve the Unequal Distribution of Healthcare Resources: Evidence From China. *Frontiers in public health*, *10*, 916303. https://doi.org/10.3389/fpubh.2022.916303

[9] Haleem, A., Javaid, M., Singh, R. P., & Suman, R. (2021). Telemedicine for healthcare: Capabilities, features, barriers, and applications. *Sensors International*, *2*, 100117. https://doi.org/10.1016/j.sintl.2021.100117

[10] Jessup, R., Putrik, P., Buchbinder, R., Nezon, J., Rischin, K., Cyril, S., Shepperd, S., & O'Connor, D. (2020). Identifying alternative models of healthcare service delivery to inform health system improvement: scoping review of systematic reviews. *BMJ Open*, *10*(3), e036112. https://doi.org/10.1136/bmjopen-2019-036112

[11] Kangethe, M. W. (2018). *Telemedicine as a disrupter in healthcare management in Kenya*. https://erepo.usiu.ac.ke/handle/11732/4152

[12] Kiptinness, C., Naik, P., Thuo, N., Malen, R. C., Dettinger, J. C., Pintye, J., Rafferty, M., Jomo, E.,

Nyamasyo, N., Wood, T., Isabelle, P., Morris, S., Hattery, D., Stergachis, A., Were, D., Sharma, M., Ngure, K., Mugambi, M. L., &Ortblad, K. F. (2023). Online HIV prophylaxis delivery: Protocol for the ePrEP Kenya pilot study. *Frontiers in public health*, *11*, 1054559. https://doi.org/10.3389/fpubh.2023.1054559

[13] Martínez-Alcalá, C. I., Muñoz, M., & Monguet-Fierro, J. (2013). Design and customization of telemedicine systems. *Computational and mathematical methods in medicine*, *2013*, 618025. https://doi.org/10.1155/2013/618025

[14] McCollum, R., Taegtmeyer, M., Otiso, L., Mireku, M., Muturi, N., Martineau, T., & Theobald, S. (2019). Healthcare equity analysis: applying the Tanahashi model of health service coverage to community health systems following devolution in Kenya. *International journal for equity in health*, *18*(1), 65. https://doi.org/10.1186/s12939-019-0967-5

[15] McCollum, R., Theobald, S., Otiso, L., Martineau, T., Karuga, R., Barasa, E., Molyneux, S., &Taegtmeyer, M. (2018). Priority setting for health in the context of devolution in Kenya: implications for health equity and community-based primary care. *Health policy and planning*, *33*(6), 729–742. https://doi.org/10.1093/heapol/czy043

[16] Mumangi, A. I. (2023, June 16). *New frontier in healthcare in Kenya – Telemedicine – Kenyatta University Teaching, Referral & Research Hospital | KUTRRH*. https://www.kutrrh.go.ke/new-frontier-in-healthcare-in-kenya-telemedicine/

[17] Njoroge, M., Zurovac, D., Ogara, E. A., Chuma, J., & Kirigia, D. (2017). Assessing the feasibility of eHealth and mHealth: a systematic review and analysis of initiatives implemented in Kenya. *BMC research notes*, *10*(1), 90. https://doi.org/10.1186/s13104-017-2416-0

[18] Njoroge, M., Zurovac, D., Ogara, E. A., Chuma, J., & Kirigia, D. (2017). Assessing the feasibility of eHealth and mHealth: a systematic review and analysis of initiatives implemented in Kenya. *BMC research notes*, *10*(1), 90. https://doi.org/10.1186/s13104-017-2416-0

[19] Noutsios, C. D., Boisvert-Plante, V., Laberge, E., Pérez, J., & Ingelmo, P. (2021). The Telemedicine-Based Pediatric Examination of the Back and Lower Limbs: A Narrative Review. *Journal of Pain Research*, *Volume 14*, 2959–2979. https://doi.org/10.2147/jpr.s329173

[20] Onsongo, S., Kamotho, C., Rinke de Wit, T. F., &Lowrie, K. (2023). Experiences on the Utility and Barriers of Telemedicine in Healthcare Delivery in Kenya. *International journal of telemedicine and applications*, *2023*, 1487245. https://doi.org/10.1155/2023/1487245

[21] Piay-Fernández, N., Stenbacka, E., Calderón-Jaramillo, M., Guerrero, G., Rodríguez, A., Montenegro, P., Moreno, D. C., & Cleeve, A. (2023). Implementing medical abortion through telemedicine in Colombia: a qualitative study. *Sexual and Reproductive Health Matters*, *31*(4). https://doi.org/10.1080/26410397.2023.2236780

[22] Pikkemaat, M., Thulesius, H., &Nymberg, V. M. (2021). Swedish Primary Care Physicians' Intentions to use Telemedicine: A survey using a new questionnaire – Physician Attitudes and Intentions to Use Telemedicine (PAIT). *International Journal of General Medicine*, *Volume 14*, 3445–3455. https://doi.org/10.2147/ijgm.s319497

[23] Salsabilla, A., Azzahra, A. B., Syafitri, R. I., Supadmi, W., & Suwantika, A. A. (2021). Cost-Effectiveness of telemedicine in Asia: A scoping review. *Journal of Multidisciplinary Healthcare*, *Volume 14*, 3587–3596. https://doi.org/10.2147/jmdh.s332579

[24] Siddiquee, N. K. A., Poudyal, A., Pandey, A., Shrestha, N., Karki, S., Subedi, R., Sah, A. K., & Kc, D. (2020). Telemedicine in Resource-Limited Setting: Narrative Synthesis of Evidence in Nepalese Context *Smart Homecare Technology and Telehealth*, *Volume 6*, 1–14. https://doi.org/10.2147/shtt.s227854

[25] Smith, E. E., &Badowski, M. E. (2021). Telemedicine for HIV care: current status and future prospects. *HIV/AIDS: Research and Palliative Care*, *Volume 13*, 651–656. https://doi.org/10.2147/hiv.s277893

[26] Tsofa, B., Goodman, C., Gilson, L., & Molyneux, S. (2017b). Devolution and its effects on health workforce and commodities management – early implementation experiences in Kilifi County, Kenya. *International Journal for Equity in Health*, *16*(1). https://doi.org/10.1186/s12939-017-0663-2

[27] Tsofa, B., Molyneux, S., Gilson, L., & Goodman, C. (2017a). How does decentralisation affect health sector planning and financial management? a case study of early effects of devolution in Kilifi County, Kenya. *International journal for equity in health*, *16*(1), 151. https://doi.org/10.1186/s12939-017-0649-0

[28] Tuckson, R. V., Edmunds, M., &Hodgkins, M. L. (2017). Telehealth. *The New England journal of medicine*, *377*(16), 1585–1592. https://doi.org/10.1056/NEJMsr1503323

[29] Wangari, T. M. (2014). Factors Influencing Citizens' Satisfaction with Service Delivery: A Case of Murang'a County, Kenya. Unpublished MSc Project, Nairobi: The University of Nairobi.

[30] Waqas, A., Teoh, S. H., Lapão, L. V., Messina, L. A., & Correia, J. C. (2020). Harnessing telemedicine for the provision of health care: Bibliometric and scientometric analysis. *Journal of Medical Internet Research*, *22*(10), e18835. https://doi.org/10.2196/18835

[31] Whitten, P., Holtz, B., & Nguyen, L. (2010). Keys to a successful and sustainable telemedicine program. *International journal of technology assessment in health care*, *26*(2), 211–216. https://doi.org/10.1017/S026646231000005X

[32] Wootton R. (2012). Twenty years of telemedicine in chronic disease management--an evidence synthesis. *Journal of telemedicine and telecare*, *18*(4), 211–220. https://doi.org/10.1258/jtt.2012.120219

[33] World Economic Forum. (2013). Sustainable health systems: vision, strategies, critical uncertainties, and scenarios. World Health Organization, Geneva Switzerland.

[34] World Health Organization (2019). Telemedicine: opportunities and developments in member states: report on the second global survey on eHealth. Available from: http://www.who.int/goe/publications/goe_telemedicine_2010.pdf.

[35] Yarow, A. A., Jirma, S., &Siringi, E. M. (2019). Management of devolved health services and healthcare service delivery in Arid and Semi-Arid lands in Kenya. *International Journal of Business and Management*, *14*(10), 21. https://doi.org/10.5539/ijbm.v14n10p21

[36] Zalo, M. (2020, September 9). The Emerging Practice of Telemedicine and the Law: Kenya's Stance - Centre for Intellectual Property and Information Technology law. *Centre for Intellectual Property and Information Technology law.* https://cipit.strathmore.edu/the-emerging-practice-of-telemedicine-and-the-law-kenyas-stance/

[37] Zanaboni, P., Knarvik, U., & Wootton, R. (2014). Adoption of routine telemedicine in Norway: the current picture. *Global Health Action*, *7*(1), 22801. https://doi.org/10.3402/gha.v7.22801