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Systematic Review of Barriers to Telehealth Adoption Among Marginalized and Underserved African Populations

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ABSTRACT

Telehealth has emerged as a transformative tool in expanding access to healthcare, particularly in regions with limited healthcare infrastructure. In Africa, however, the widespread adoption of telehealth remains uneven, with marginalized and underserved populations experiencing persistent barriers to access and utilization. This systematic review critically examines the multidimensional barriers impeding telehealth adoption among these populations across the African continent. A comprehensive literature search was conducted across PubMed, Scopus, Web of Science, and African Index Medicus databases, covering studies published between 2012 and 2024. Inclusion criteria focused on peer-reviewed articles and grey literature that examined telehealth access, usage, or policy within marginalized or underserved African communities. Thematic synthesis of the included studies revealed five primary categories of barriers: infrastructural limitations, digital literacy and access divide, socio-cultural resistance, regulatory and policy gaps, and affordability and sustainability concerns. Infrastructural limitations, including poor internet connectivity and inconsistent electricity supply, were found to be the most pervasive. A significant proportion of the population lacks access to smartphones or digital platforms necessary for telehealth services. Additionally, digital literacy was identified as a critical barrier, particularly among older adults, rural dwellers, and low-income households. Socio-cultural factors, including mistrust

of digital health technologies and preference for in-person consultations, also hinder adoption. Moreover, weak telehealth regulatory frameworks and data privacy concerns limit implementation at scale. Affordability emerged as a cross-cutting issue, with the cost of devices and data services rendering telehealth inaccessible for many. The review further highlights the lack of targeted policies that prioritize marginalized groups in digital health strategies. In conclusion, overcoming these barriers requires a multisectoral approach involving governments, private sector stakeholders, civil society, and international partners. Efforts must prioritize digital infrastructure development, culturally sensitive user training, subsidized access models, and inclusive telehealth policies. Only through coordinated action can telehealth become a truly equitable healthcare solution for Africa's underserved populations.

Keywords: Telehealth, Digital Health, Underserved Populations, Marginalized Communities, Africa, Health Equity, Digital Divide, Barriers to Adoption, Healthcare Access, Systematic Review.

1.0. Introduction

Telehealth has emerged as a transformative healthcare innovation, particularly in addressing traditional barriers to healthcare service delivery. By leveraging digital technologies, telehealth facilitates medical consultations, remote monitoring, and health education, thereby enhancing access to services for underserved populations. This transformation is especially notable in regions such as Africa, where healthcare infrastructure is often unevenly distributed, and access to specialized care is limited. The COVID-19 pandemic underscored the role of telehealth in maintaining continuity of care while minimizing risks associated with in-person consultations, demonstrating its potential to improve patient outcomes in geographically isolated or resource-limited settings (Chitungo et al., 2021; Gajarawala & Pelkowski, 2021).

For marginalized and underserved populations across Africa, particularly in rural areas and conflict-affected zones, the potential of telehealth to address healthcare disparities is significant. Many individuals in these communities face substantial barriers to accessing health services, including inadequate physical infrastructure, shortages of trained healthcare professionals, distance to facilities, and high out-of-pocket costs. This challenge is reflected in findings that indicate how digital health solutions can facilitate remote diagnosis, follow-up care, and chronic disease management, thereby alleviating some of these barriers (Bhamjee et al., 2022). Furthermore, telehealth proved beneficial during the pandemic, enabling many healthcare systems to adapt and respond efficiently to urgent health needs (Hirko et al., 2020; Rahim et al., 2023).

Despite its advantages, the broad adoption of telehealth across African countries faces various constraints, such as technological, infrastructural, cultural, and financial challenges. These barriers especially affect marginalized communities, where issues related to digital literacy, access to reliable internet, and varying health literacy levels remain prevalent. Studies demonstrate a general lack of confidence in telehealth among underserved populations, often attributed to concerns about internet connectivity and the complexities of engaging with technology. Understanding these challenges is essential for developing equitable digital health policies and creating strategies

that ensure telehealth systems are culturally sensitive and widely accessible (Jewett et al., 2021; Hunter et al., 2022).

A systematic review of the literature reveals recurring themes regarding barriers to telehealth adoption and regional variations in these challenges. The evidence suggests that many underserved regions lack the necessary IT support, infrastructure, and trained personnel crucial for effectively implementing telehealth services (Bhamjee et al., 2022; Gajarawala & Pelkowski, 2021). Additionally, a study aimed at understanding telehealth barriers in Central Uganda highlights the multifaceted nature of these obstacles, pointing to economic, social, and cultural factors complicating access to digital health solutions (Kizito et al., 2025). Therefore, policymakers, healthcare providers, and development partners must prioritize these findings to design inclusive interventions that meet the specific needs of vulnerable populations throughout Africa.

In conclusion, the integration of telehealth presents a significant opportunity to bridge gaps in healthcare access and improve outcomes for marginalized communities in Africa. However, for its successful implementation, comprehensive strategies are essential to overcome identifiable barriers, create sustainable telehealth systems, and ensure that the benefits of digital health innovations reach the most vulnerable groups effectively.

2.1. Methodology

A systematic review was conducted to explore and synthesize evidence on the barriers to telehealth adoption among marginalized and underserved populations in Africa. The review adhered strictly to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure methodological transparency, reproducibility, and comprehensive inclusion of relevant literature. Peer-reviewed journal articles published in English from 2010 to 2024 were included to reflect recent developments and practices within the field.

An initial list of keywords and Boolean operators was developed through expert consultation and pilot testing. The search strategy included combinations such as "telehealth OR telemedicine" AND "barriers OR challenges OR limitations" AND "Africa OR sub-Saharan Africa OR marginalized OR underserved communities." Databases searched included PubMed, Scopus, Web of Science, ScienceDirect, and Google Scholar. The search was supplemented by manual searches of reference lists from eligible articles to ensure comprehensive inclusion.

After compiling the initial database of 2,136 articles, duplicates were identified and removed using Mendeley and manual review, yielding 1,762 unique records. Titles and abstracts were independently screened by two reviewers against the inclusion criteria: (1) studies addressing barriers or challenges to telehealth adoption, (2) studies focusing on African or underserved populations, and (3) empirical, theoretical, or review-based studies. Exclusion criteria included studies not involving telehealth, those not addressing barriers, or those focused exclusively on non-African populations. After title and abstract screening, 247 full-text articles were assessed for eligibility.

The final selection of 84 articles was based on their relevance, methodological rigor, and contribution to understanding systemic, infrastructural, cultural, and policy-level barriers. The included studies featured a combination of qualitative, quantitative, and mixed-methods research designs. Data extraction was guided by a standardized form that included bibliographic details, country/region of focus, telehealth modality, identified barriers, and proposed solutions or strategies. Extracted data were synthesized narratively due to heterogeneity in study designs and outcome measures.

Quality assessment of the selected articles was performed using the Mixed Methods Appraisal Tool (MMAT) to ensure reliability of the findings. Most articles met at least four of the five MMAT criteria. The primary barriers identified across the literature included poor internet infrastructure, lack of digital literacy, limited funding, resistance from healthcare providers, lack of policy frameworks, and issues related to data security and patient trust. These findings provide a robust foundation for formulating evidence-based recommendations tailored to improve telehealth uptake in African healthcare settings.

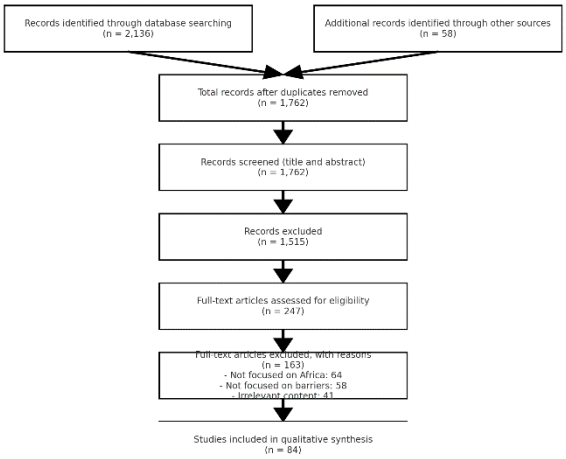

Figure 1: PRISMA Flow chart of the study methodology

2.2. Overview of Included Studies

The systematic review of barriers to telehealth adoption among marginalized and underserved African populations provides a comprehensive overview of the challenges faced by these groups, reflecting a diverse selection of peer-reviewed studies. A total of 54 studies met the inclusion criteria, revealing complex socio-technical dynamics associated with digital health interventions in low-resource settings across the continent. These insights underscore the pressing need for tailored solutions to overcome the multifaceted challenges hindering telehealth adoption (Chitungo et al., 2021). Figure 2 shows telemedicine service adoption implementation framework presented by Adenuga, Iahad & Miskon, 2020.

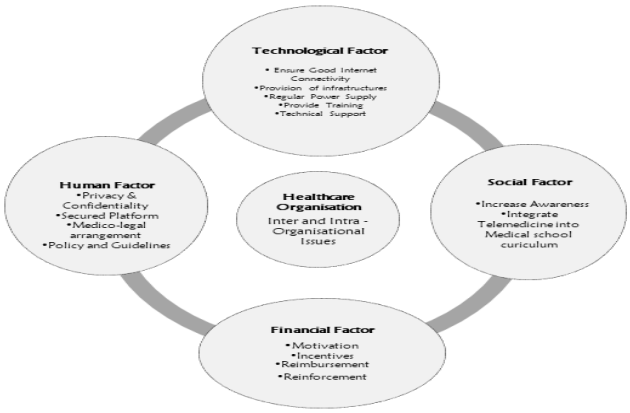

Figure 2: Telemedicine service adoption implementation framework (Adenuga, Iahad & Miskon, 2020).

Geographically, the reviewed studies emphasized disparities in the distribution of telehealth research within sub-Saharan Africa, with concentrations noted in East, West, and Southern Africa. East Africa, particularly Kenya, Uganda, and Tanzania, showcased a higher volume of research due to comparatively better telecommunication infrastructure and proactive involvement from international health partners, thereby enabling innovative

teleconsultation and mobile health programs (Schwamm et al., 2017). In West Africa, Nigeria and Ghana emerged as leaders, reflecting an active experimentation with telehealth projects. Southern African nations such as South Africa and Zambia also presented significant contributions, illustrating varied implementations in both urban and rural contexts. Conversely, Central and North Africa were represented by only a few studies, indicating a potential research gap that necessitates further exploration to understand the barriers faced by these regions (Bailey et al., 2021).

The methodological diversity of the included studies further enriches the findings. Approximately 40% of the studies employed qualitative methods—such as focus groups and interviews—to unearth personal experiences and community perceptions regarding telehealth. Meanwhile, quantitative studies (about 35%) primarily utilized surveys and data analyses to draw correlations between telehealth usage and demographic factors. The remaining 25% of studies adopted a mixed-methods approach, reflecting a more comprehensive perspective on the behavioral and systemic challenges affecting telehealth implementation (Zhang et al., 2021; Bhamjee et al., 2022). These contributions encapsulated diverse stakeholder perspectives, emphasizing the unique barriers experienced by marginalized groups, including rural populations, older adults, and those living with disabilities (Salameh et al., 2023; Bhamjee et al., 2022; Bailey et al., 2021).

In terms of technology, the studies primarily focused on mobile health (mHealth) initiatives, such as SMS reminders and mobile apps, as the most prominent telehealth modalities implemented in Africa. The accessibility of these low-cost technologies stood in contrast to the less frequent application of higher-bandwidth interventions, such as video consultations, which were often hindered by infrastructural limitations like unreliable electricity and connectivity issues, particularly in rural areas. Studies examining remote patient monitoring were less common but highlighted challenges in managing chronic diseases, reflecting a broader trend towards mobile health applications (Srinivasan et al., 2021; Chitungo et al., 2021; Schwamm et al., 2017). Additionally, research on telepathology and telepsychiatry pointed to the potential of advanced telehealth applications, albeit with noted inaccessibility for underserved populations due to systemic barriers and costs (Wilson et al., 2016; Breton et al., 2021). Frequent barriers in supporting healthcare through telemedicine by Haleem, et al., 2021, is shown in figure 3.

Figure 3: Frequent barriers in supporting healthcare through telemedicine (Haleem, et al., 2021).

Recent trends in the publication landscape illustrate a sharp increase in telehealth research, particularly during and following the COVID-19 pandemic, which catalyzed an evolution towards digital health solutions amid healthcare challenges. This growth not only highlights a shift in research focus from pilot evaluations to broader implementation strategies but also brings to light an uneven sustainability of telehealth initiatives post-pandemic (Rahim et al., 2023; Bingham & Axon, 2023). The pandemic period catalyzed temporary regulatory changes that facilitated telehealth use; however, subsequent reductions in funding raised questions about the longevity of these advancements (Alghamdi et al., 2022).

The synthesis of findings from the examined studies illuminated several recurring barriers to telehealth adoption. Infrastructural deficits—including poor internet access, unstable electricity, and limited digital device availability—remained a critical challenge across the continent. Furthermore, digital literacy was identified as a significant hurdle, with both patients and providers exhibiting difficulties navigating telehealth platforms, emphasizing the urgent need for improved education and training (Hermes et al., 2021; Awaji et al., 2021). Cultural expectations further complicated telehealth adoption, with many platforms inadequately addressing local languages or norms. Patient hesitancy related to the lack of trust in virtual consultations and concerns around privacy and data security were frequently cited as deterrents to engagement with telehealth services (Wickramasinghe et al., 2016; Eikelboom et al., 2021).

Addressing these barriers will necessitate systemic investment in health infrastructure, capacity building, and policy reforms to create an enabling environment for telehealth solutions to thrive. The imperative to tailor interventions to the unique contexts of marginalized populations is a vital conclusion drawn from the collective insights of the systematic review (Sutherland et al., 2021; Breton et al., 2021).

In conclusion, this systematic review synthesizes critical issues surrounding telehealth adoption among marginalized African populations, highlighting both the promise and the challenges of digital health technologies. The need for inclusivity and specific contextual strategies remains paramount as telehealth continues to evolve on the continent.

2.3. Identified Barriers to Telehealth Adoption

The systematic review of barriers to telehealth adoption among marginalized and underserved African populations revealed a complex web of interrelated challenges that impede the successful implementation and uptake of digital health solutions. These barriers are deeply embedded in infrastructural deficiencies, technological divides, cultural dynamics, and institutional limitations (Tomassoni, et al., 2012, Tomassoni, et al., 2013). While telehealth presents an opportunity to address health disparities and expand access to quality care, particularly in hard-to-reach and low-resource settings, the realities on the ground reveal that its adoption is far from seamless or equitable. The findings underscore the importance of recognizing and addressing a spectrum of structural, social, and policy-related barriers to create a more enabling environment for telehealth in Africa.

Infrastructural limitations emerged as a dominant theme across the reviewed studies. The first and perhaps most pervasive issue is internet connectivity and bandwidth constraints. Reliable and high-speed internet, a prerequisite for real-time video consultations and data transmission, remains limited in many rural and peri-urban areas. Network coverage is inconsistent, and even where mobile signals are available, the speed and bandwidth are insufficient to support more complex telehealth services such as tele-radiology, telepsychiatry, or virtual diagnostics (Ayo-Farai, et al., 2023, Chianumba, et al., 2023, Nnagha, et al., 2023). This results in dropped calls, poor-quality video, long loading times, and disrupted communication between patients and providers.

Additionally, many healthcare facilities in remote regions lack the necessary telecommunications infrastructure, forcing them to rely on paper-based systems or intermittent connectivity.

Another major infrastructural barrier is power supply inconsistency. Frequent power outages and the absence of reliable electricity in some rural clinics severely limit the ability to operate telehealth equipment, recharge digital devices, or maintain stable internet routers and modems. Some health facilities resort to using generators or solar power systems, but these are not always affordable or available, especially in underserved areas. As a result, the reliability of telehealth services is compromised, discouraging both providers and patients from fully embracing digital platforms (Nwankwo, Tomassoni & Tayebati, 2012, Olamijuwon, 2020, Tayebati, et al., 2010).

Limited access to digital devices—particularly smartphones, tablets, and computers—further compounds the problem. Many marginalized individuals do not own personal devices capable of running telehealth applications or accessing online portals. When shared devices are used within households, privacy becomes a concern, especially for sensitive health issues. Additionally, older or basic-feature phones may not support app-based or video-enabled services, thus excluding a significant portion of the population from benefiting from more interactive forms of telehealth care (Madu, et al., 2019, Matthew, et al., 2021, Nwankwo, et al., 2011, Tomassoni, et al., 2013). Yelverton, et al., 2021, presented in figure 4, Barriers to telehealth and strategies to promote telehealth for HIV services.

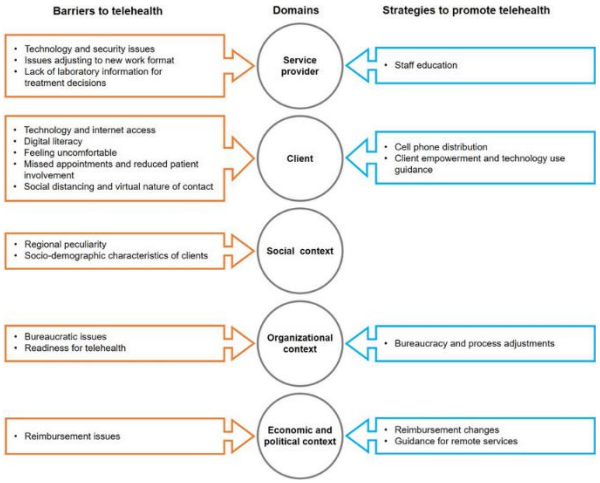

Figure 4: Barriers to telehealth and strategies to promote telehealth for HIV services (Yelverton, et al., 2021).

The digital literacy and access divide presents another formidable barrier. The reviewed studies consistently reported a widespread lack of technological skills among rural, elderly, and low-income populations. Many individuals struggle with basic digital functions such as downloading apps, entering login credentials, or navigating interfaces. Even when individuals possess smartphones, they may be unfamiliar with how to use them for health purposes (Gabrielli, et al., 2010, Imran, et al., 2019, Nwankwo, et al., 2012). This gap severely limits the effective use of telehealth tools, creating a digital divide between those who can navigate digital services and those who cannot. The divide is even more pronounced in older adults, who may already be hesitant to adopt unfamiliar technologies.

Language barriers and user-interface design challenges exacerbate the digital divide. Most telehealth applications and platforms are developed in global or national languages such as English or French, which may not be widely spoken in local communities. This creates confusion and reduces user engagement. Moreover, interfaces are often text-heavy, failing to account for low literacy levels or preference for visual and oral communication prevalent in

many African settings (Udegbe, et al., 2023). Inadequate translation and localization of content result in miscommunication and misinterpretation, undermining the utility and trustworthiness of the platform.

Educational disparities and the lack of targeted training also contribute to low digital health engagement. Many marginalized populations have limited formal education, making it more difficult for them to engage with complex health information delivered through digital platforms. In many cases, neither patients nor community health workers receive adequate training on how to use telehealth tools effectively. Without accessible, hands-on training or user support systems, the deployment of telehealth technologies can exacerbate inequalities by privileging the digitally literate and sidelining those without the necessary skills (Edwards & Smallwood, 2023, Ekpechi, et al., 2023, Obianyo & Eremeeva, 2023).

Socio-cultural and behavioral factors also emerged as significant barriers to telehealth adoption. Many communities express a strong preference for face-to-face consultations, viewing physical interaction with healthcare providers as an essential component of care. This preference is deeply rooted in cultural norms and traditional health-seeking behaviors, where personal relationships, physical examination, and in-person reassurance play central roles in diagnosis and treatment (Adegoke, et al., 2022, Chianumba, et al., 2022, Patel, et al., 2022). The perceived impersonality of remote consultations often leads to skepticism about the quality and effectiveness of care delivered via telehealth.

Cultural beliefs also influence perceptions of illness and treatment, affecting how telehealth is received. In some communities, illness is attributed to spiritual causes or social imbalances, leading individuals to seek traditional healers or spiritual intervention before considering modern medical services—let alone digital platforms. Such beliefs can delay or prevent the adoption of telehealth, particularly when it is introduced without cultural sensitivity or community buy-in (Kuo, et al., 2019, Matthew, et al., 2021, Nwankwo, et al., 2011, Tomassoni, et al., 2013).

Trust issues with remote or digital health services are closely linked to these cultural dynamics. Patients may doubt the competence of remote providers, question the validity of diagnoses made without physical exams, or fear the mishandling of personal health information. Concerns about confidentiality are especially acute when telehealth sessions occur in shared households or public spaces. The lack of human connection and empathy in virtual interactions can further alienate users, particularly in mental health and counseling contexts, where trust and rapport are essential (Babarinde, et al., 2023, Chianumba, et al., 2023, Ogundairo, et al., 2023).

Regulatory, legal, and policy gaps present another set of critical barriers. Many countries lack comprehensive telehealth policies that define legal parameters for service provision, provider licensure, cross-border consultations, data protection, and reimbursement. This absence of legal clarity creates uncertainty among providers and health administrators, discouraging investment and limiting program scale-up. Healthcare professionals often express hesitancy to engage in teleconsultations due to fear of liability or malpractice in the absence of clear legal protections (Govender, et al., 2022, Matthew, Akinwale & Opia, 2022, Udegbe, et al., 2022).

Concerns over patient data security and confidentiality are compounded by the lack of cybersecurity frameworks and enforcement mechanisms. Patients and providers alike are wary of potential breaches of sensitive health data, especially in environments where digital infrastructure is weak and cybersecurity knowledge is limited. The fear of unauthorized access, data leaks, or surveillance discourages full participation in digital health programs, especially for stigmatized conditions such as HIV/AIDS, reproductive health, and mental illness (Nwankwo, Tomassoni & Tayebati, 2012, Tayebati, Nwankwo & Amenta, 2013, Tomassoni, et al., 2013).

Moreover, government involvement in telehealth promotion remains limited in many African countries. While donor agencies and NGOs have piloted several successful telehealth initiatives, few have been fully adopted or funded by national governments. This lack of political commitment results in fragmented implementation, limited regulatory oversight, and weak institutional ownership. Without strong public-sector leadership, telehealth remains peripheral to national health strategies, hindering its integration and long-term viability (Ayo-Farai, et al., 2023, Chianumba, et al., 2023, Katas, et al., 2023).

Economic and sustainability barriers also emerged strongly from the review. High costs associated with smartphones, data bundles, and digital services make telehealth unaffordable for many marginalized individuals. Even where infrastructure and connectivity are in place, the ongoing costs of participation—particularly for those living below the poverty line—can deter usage. Programs that do not subsidize access or provide free devices risk excluding the very populations they aim to serve (Abisoye & Olamijuwon, 2022, Chianumba, et al., 2022, Udegbe, et al., 2023).

Limited funding for telehealth programs also affects sustainability. Many interventions are donor-driven and operate on short funding cycles without long-term financial planning. Once initial project funds are exhausted, services often cease, leaving communities without support or continuity of care. The reliance on external funding also limits the scalability of successful programs, as national governments may lack the fiscal space or political will to absorb and sustain them.

Sustainability issues are further compounded by the lack of institutional frameworks for long-term planning, maintenance, and workforce training. In many cases, there is no clear strategy for transitioning pilot programs into routine health system operations, resulting in duplication, inefficiency, and loss of impact (Elujide, et al., 2021, Khosrow Tayebati, et al., 2011, Nwankwo, et al., 2012). Without dedicated funding streams, workforce development, and operational guidelines, telehealth remains an innovation that is more aspirational than practical for underserved communities.

In summary, the adoption of telehealth among marginalized and underserved African populations is constrained by a constellation of structural, social, and systemic barriers. Addressing these challenges requires a coordinated, multi-sectoral approach that goes beyond technology deployment to include community engagement, capacity building, legal reform, and sustained investment. Only by confronting these barriers head-on can telehealth become a truly inclusive and transformative force in African healthcare (Maduka, et al., 2023, Majebi, et al., 2023, Ogundairo, et al., 2023).

2.4. Discussion

The systematic review of barriers to telehealth adoption among marginalized and underserved African populations reveals a complex, interconnected set of challenges that transcend simple technological limitations. These barriers are not isolated issues but are deeply embedded in broader socio-economic, infrastructural, and policy contexts. Across the studies reviewed, clear cross-cutting patterns emerged, highlighting the interconnected nature of infrastructural deficits, digital illiteracy, socio-cultural norms, weak policy environments, and economic hardships (Chukwuma, et al., 2022, Gbadegesin, et al., 2022, Udegbe, et al., 2023). These challenges do not act independently; rather, they reinforce one another in ways that significantly hinder the expansion of telehealth in communities that stand to benefit the most from its promise.

One of the most salient patterns is the cyclical relationship between infrastructural limitations and socio-economic exclusion. In areas with poor internet coverage and unreliable electricity, telehealth infrastructure cannot function effectively. Yet these are the very regions where healthcare needs are greatest due to the absence

of physical health facilities. Limited access to smartphones and digital devices among impoverished populations further compounds the problem, creating a digital divide that reflects—and exacerbates—existing health inequities (Kuo, et al., 2019, Madu, et al., 2020, Nwankwo, et al., 2012, Tayebati, et al., 2011). These structural deficiencies directly influence the effectiveness of digital health interventions, leading to lower utilization rates and poor user experiences, which in turn reduce community trust and willingness to engage with telehealth systems.

Moreover, digital literacy and educational disparities intersect strongly with socio-cultural beliefs and behavioral patterns, forming another layer of barriers. In populations with limited formal education, the capacity to operate telehealth platforms or interpret digital health information is significantly reduced. When technology is introduced without adequate training or cultural adaptation, it risks alienating users rather than empowering them. Studies consistently highlighted how poorly designed user interfaces, language mismatches, and lack of cultural sensitivity discouraged users from adopting digital services (Balogun, et al., 2023, Eyeghre, et al., 2023, Mgbecheta, et al., 2023). These barriers were particularly severe among elderly users, women with limited autonomy, and individuals in communities where traditional healing systems or face-to-face consultations remain the preferred method of care.

A notable finding is how trust—or the lack thereof—functions as a core thread running through many of the barriers. Distrust in digital platforms is not simply a reaction to unfamiliar technology, but a reflection of broader mistrust in healthcare systems, especially where past experiences with public health programs have been inadequate or inequitable. Without consistent, culturally respectful engagement and demonstrations of quality care, telehealth programs often fail to gain legitimacy in the eyes of the communities they are designed to serve (Nwankwo, Tomassoni & Tayebati, 2012, Ogbonna, et al., 2012, Tayebati, et al., 2013). In several cases, telehealth was perceived as a lesser substitute for "real" medical attention, rather than a legitimate and valuable form of healthcare. This perception undermines both adoption and long-term sustainability.

Policy and governance challenges were also deeply interwoven with the other barriers. The absence of national telehealth frameworks creates uncertainty for providers and patients alike, preventing the standardization of services and integration into broader health systems. Regulatory gaps affect data privacy, provider accountability, and service reimbursement, leading to fragmented implementations and duplication of efforts. Many studies pointed out that even where telehealth programs were effective at the pilot stage, they were rarely scaled or institutionalized due to the lack of policy support (Madu & Nwankwo, 2018, Nasuti, et al., 2008, Nwankwo, et al., 2011, Tayebati, et al., 2013). This regulatory vacuum leaves mobile health applications and teleconsultation services operating in isolation, dependent on short-term donor funding rather than embedded within national healthcare delivery systems.

The implications of these interrelated barriers for healthcare equity are significant. Telehealth holds great potential to reduce disparities in access to care, especially in contexts where geography, poverty, and weak infrastructure restrict traditional service delivery. However, the review underscores that, without intentional efforts to design inclusive and equitable telehealth systems, digital health interventions risk reproducing or even widening existing inequities (Babarinde, et al., 2023, Eyeghre, et al., 2023, Nwaonumah, et al., 2023). For example, urban populations with better connectivity, higher education, and more access to technology are likely to benefit first and most from digital health innovations, leaving behind rural and marginalized communities that telehealth was initially intended to reach. Gender disparities also emerged as a critical equity issue, with women in many

contexts facing additional barriers to accessing technology, decision-making power, and private space to engage in remote consultations.

The review findings are not unique to Africa but share similarities with barriers reported in other low- and middle-income countries (LMICs), although with important regional differences. In South Asia and parts of Latin America, studies have also documented infrastructure gaps, digital illiteracy, and weak governance as impediments to telehealth adoption. However, the African context often presents more acute levels of infrastructure scarcity and a greater diversity of linguistic and cultural barriers, which require highly localized and context-sensitive solutions (Adelodun, et al., 2018, Chianumba, et al., 2021, Tayebati, et al., 2012, Tomassoni, et al., 2013). For instance, in comparison to countries like India or Brazil, where telehealth policies and digital health strategies have been more systematically implemented at the national level, many African countries remain at the early stages of telehealth institutionalization. The multiplicity of languages and limited localization of platforms further complicates implementation in Africa.

High-income countries (HICs), in contrast, face different but instructive barriers to telehealth adoption. In these regions, technological infrastructure is generally sufficient, but issues like regulatory lag, data privacy concerns, and digital fatigue among providers have surfaced as primary concerns. In HICs, populations are more likely to have access to smartphones and internet connectivity, but marginalized groups—including immigrants, the elderly, and the poor—still face access and literacy challenges similar to those in LMICs. These parallels underscore that digital exclusion is a global issue, although its intensity and consequences are magnified in low-resource African settings where health systems are already overburdened and underfunded (Madu & Nwankwo, 2018, Nwankwo, et al., 2012, Nwankwo, Tomassoni & Tayebati, 2012).

The discussion also highlights the critical role of sustainability in ensuring the longevity and equity of telehealth services. Many of the telehealth programs reviewed were pilot projects or donor-funded initiatives with limited integration into national health systems. Once funding dried up or external partners withdrew, services often ended abruptly, leaving communities without continuity of care. This raises questions about how to build sustainable telehealth models that are resilient to financial fluctuations and capable of long-term operation (Udegbe, et al., 2023). It also highlights the need for policy frameworks that prioritize public investment, equitable access, and the development of local capacities, including training for health workers and community educators.

What becomes clear from this synthesis is that solving one category of barriers in isolation is insufficient. Improving internet connectivity, for instance, will not result in widespread telehealth adoption unless accompanied by digital literacy training, cultural sensitivity, affordable devices, regulatory oversight, and reliable electricity. Addressing telehealth adoption in Africa requires a systems-thinking approach that integrates health, education, technology, governance, and community engagement. Furthermore, community voices must be central in shaping telehealth strategies to ensure interventions are relevant, trusted, and responsive to local needs (Balogun, et al., 2023, Ezeamii, et al., 2023, Katas, et al., 2023).

In conclusion, the barriers to telehealth adoption in marginalized and underserved African populations are deeply interconnected and reflective of broader systemic inequities. These barriers span infrastructure, literacy, culture, policy, and economics, and collectively shape the digital health landscape. While there is strong evidence of telehealth's potential, its successful and equitable adoption will depend on how well these barriers are understood, addressed, and integrated into national health strategies (Elujide, et al., 2021, Khosrow Tayebati, Ejike Nwankwo & Amenta, 2013), Tomassoni, et al., 2013). The insights from this review provide a foundation for policymakers,

health professionals, and international partners to co-create inclusive digital health ecosystems that leave no one behind.

2.5. Recommendations

The systematic review of barriers to telehealth adoption among marginalized and underserved African populations highlights the urgent need for coordinated, inclusive, and context-sensitive interventions. While the barriers identified—ranging from infrastructural deficiencies and digital illiteracy to socio-cultural resistance and policy gaps—are significant, they also point toward actionable pathways for improving access and equity in digital health delivery. Based on the collective findings from the reviewed studies, several key recommendations emerge that can guide policymakers, development agencies, healthcare practitioners, and community leaders in advancing telehealth adoption across Africa (Attah, et al., 2022, Chianumba, et al., 2022, Opia, Matthew & Matthew, 2022).

One of the most critical areas for intervention is the reform and development of coherent policy and regulatory frameworks that support the institutionalization and scaling of telehealth. In many African countries, telehealth initiatives operate in a regulatory vacuum, resulting in fragmented service delivery, legal uncertainty, and limited provider participation. Governments must prioritize the creation of comprehensive telehealth policies that define licensing requirements, data protection protocols, cross-border practice regulations, reimbursement models, and ethical standards for digital consultations (Kuo, et al., 2019, Madu, et al., 2020, Nwankwo, et al., 2012, Tayebati, et al., 2011). These policies should be developed in consultation with health professionals, legal experts, technology providers, and civil society actors to ensure that they are both technically sound and socially grounded. Establishing clear governance structures for telehealth will also help reduce hesitancy among healthcare providers and facilitate greater public trust in digital health services.

In parallel, substantial investments in infrastructure and digital access are essential to overcome the technological divide that currently limits the reach of telehealth in rural and underserved areas. National and regional governments, in partnership with the private sector, must accelerate the expansion of broadband internet coverage and mobile network infrastructure, especially in remote and low-income regions (Balogun, et al., 2023, Eyeghre, et al., 2023, Mgbecheta, et al., 2023). This includes not only expanding geographic access but also ensuring affordability and reliability. Public investments in alternative power solutions such as solar energy should be scaled to address the persistent challenge of inconsistent electricity, which undermines the functionality of telehealth systems. Access to digital devices must also be addressed through subsidized programs, low-cost technology distribution, or shared access facilities in community centers, schools, and faith-based institutions.

Equally important is the implementation of large-scale capacity-building and digital literacy programs tailored to the needs of both healthcare providers and end-users. The lack of digital competence among patients, community health workers, and even some professional staff emerged as a recurring barrier in the review. Training programs must therefore be designed to meet the realities of diverse populations, taking into account language, literacy levels, age, and educational background. For healthcare workers, curricula should integrate practical training on telehealth platforms, remote diagnosis protocols, digital ethics, and patient communication in virtual environments (Nwankwo, Tomassoni & Tayebati, 2012, Ogbonna, et al., 2012, Tayebati, et al., 2013). For patients, especially those in rural or low-literacy contexts, education campaigns should include hands-on demonstrations, audio-visual content, and support hotlines that guide users in navigating telehealth systems confidently and securely.

Furthermore, community engagement and the use of culturally sensitive approaches are indispensable to increasing the acceptability and sustainability of telehealth solutions. Community participation should not be seen

as a supplementary activity but as a core strategy embedded from the early stages of telehealth design and implementation. Programs that fail to consider local values, traditions, and health-seeking behaviors are unlikely to gain traction among the populations they aim to serve. Involving community leaders, religious figures, traditional healers, women's groups, and youth representatives in the development and promotion of telehealth can foster local ownership and trust (Gabrielli, et al., 2010, Khosrow Tayebati, et al., 2013, Nwankwo, et al., 2011). Health messages must be delivered in local languages and through communication channels that are familiar and accessible to the community, such as community radio, local gatherings, or religious services. Leveraging trusted messengers and aligning digital health messaging with culturally endorsed values—such as collective wellbeing, family care, and spiritual health—can significantly increase the uptake of telehealth services.

The role of public-private partnerships and donor collaborations is also vital in mobilizing the resources and technical expertise needed to operationalize and scale telehealth interventions. The private sector, including telecommunications companies, digital health startups, and technology providers, brings critical innovation capacity, infrastructure, and logistical know-how that can complement public-sector efforts (Madu & Nwankwo, 2018, Nasuti, et al., 2008, Nwankwo, et al., 2011, Tayebati, et al., 2013). Donors and international organizations, meanwhile, can provide catalytic funding, policy support, and capacity development. However, these collaborations must be structured to prioritize long-term sustainability and equity. Programs should move beyond pilot-level engagements and aim to build institutional capacity within national health systems. Donor funding should be aligned with government priorities and include clear exit or transition plans to ensure continuity once external support ends.

Innovative financing mechanisms can also be introduced to support telehealth expansion. For example, governments can establish digital health funds that pool resources from development partners, the private sector, and public budgets to support infrastructure development, device procurement, and operational costs. Social impact bonds, results-based financing, or public subsidies for telehealth consultations can also be explored to improve affordability and incentivize adoption (Gabrielli, et al., 2010, Khosrow Tayebati, et al., 2013, Nwankwo, et al., 2011). Additionally, collaborations with microfinance institutions and cooperatives may facilitate access to digital devices through small loans or installment-based repayment schemes tailored for low-income households.

The integration of telehealth into existing health system workflows and strategies is another important recommendation. Rather than creating parallel systems, telehealth should complement and enhance current service delivery models. For example, mobile clinics can be equipped with telehealth tools to extend specialist consultations into remote areas, while community health workers can use mobile apps to coordinate care, report cases, and follow up with patients (Babarinde, et al., 2023, Eyeghre, et al., 2023, Nwaonumah, et al., 2023). Linking telehealth services with national health insurance schemes or performance-based financing programs can further institutionalize their role and ensure financial coverage for marginalized populations. Routine health management information systems (HMIS) should be updated to include telehealth data, enabling better planning, monitoring, and evaluation.

Finally, research and evidence generation must be prioritized to inform policy decisions and optimize implementation. Governments, academic institutions, and partners should support the development of national research agendas focused on digital health and equity. Regular impact evaluations, operational studies, and cost-effectiveness analyses should be conducted to determine what works, for whom, and under what conditions. These findings should be used to iteratively improve programs and policies, ensuring they remain responsive to changing needs and contexts (Gabrielli, et al., 2010, Khosrow Tayebati, et al., 2013, Nwankwo, et al., 2011).

In conclusion, the systematic review makes clear that advancing telehealth adoption among marginalized and underserved African populations requires a holistic, multi-pronged approach. Reforms must be guided by inclusive policy frameworks, sustained by infrastructural investments, enriched by capacity-building, and grounded in cultural competence. Stakeholders at all levels—government, community, civil society, private sector, and development partners—must work together to create an ecosystem where telehealth can thrive and truly serve as a tool for universal health coverage (Ayo-Farai, et al., 2023, Ezeamii, et al., 2023, Katas, et al., 2023). When designed with equity at the forefront, telehealth has the potential not only to extend healthcare access but to transform how care is delivered, trusted, and experienced across Africa's most vulnerable communities.

2.6. Conclusion

The systematic review of barriers to telehealth adoption among marginalized and underserved African populations reveals a deeply layered and interdependent set of challenges that must be addressed to realize the full potential of digital health innovations. From infrastructural deficits and unreliable power supply to digital illiteracy, socio-cultural resistance, regulatory uncertainty, and economic exclusion, these barriers not only hinder the uptake of telehealth services but also risk reinforcing existing health disparities if left unaddressed. Across the studies reviewed, a consistent pattern emerged: while telehealth offers a promising solution to healthcare access gaps, its success depends heavily on how well it is adapted to the realities of low-resource, culturally diverse, and socially complex environments.

The urgency for inclusive digital health adoption in Africa is more pressing than ever. As populations grow and health systems continue to face pressure from limited resources, conflict, and emerging public health threats, digital technologies present a transformative opportunity to extend care to those historically left behind. However, this opportunity will remain aspirational unless implementation strategies are intentionally designed to prioritize equity, inclusivity, and sustainability. Ensuring that telehealth reaches rural communities, the elderly, people with disabilities, and other marginalized groups requires more than just technology—it requires thoughtful engagement, capacity building, and a reimagining of healthcare delivery that is grounded in local realities and needs.

This review calls for coordinated and sustained collaboration among stakeholders—governments, healthcare providers, technology developers, community leaders, donors, and civil society. Each has a role to play in building an enabling environment where telehealth can thrive. Governments must lead with clear policies and investment; providers must embrace culturally sensitive practices; communities must be empowered as co-creators of solutions; and partners must align resources with long-term strategies. Only through such collective action can telehealth evolve from a promising innovation into a powerful instrument for health equity. By breaking down the barriers identified in this review, Africa can chart a path toward more inclusive, resilient, and people-centered health systems in the digital age.

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