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Telemedicine as a Catalyst for Change in Sub-Saharan Africa: Evaluating Organizational, Technological, and Social Factors- A Systematic Literature Review

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Abstract

Modern healthcare has increasingly relied on telemedicine and virtual software platforms, especially during the onset of COVID-19. This systematic review explores the perspectives and experiences of using voice and video-based telemedicine consultation services for outpatient care in Sub-Saharan Africa. Several key factors influence telemedicine adoption by patients and medical practitioners. This review compiles findings from numerous studies to explain the organisational, technological, and social elements that play a role in this process. The study utilised a comprehensive search strategy across multiple online databases, including Google Scholar, PubMed, and ScienceDirect. Keywords such as "telemedicine," "telehealth," "virtual software platforms," "digital health," and "e-health" were employed to retrieve relevant literature. After thorough screening and evaluation, 148 articles were initially identified, with 18 meeting the inclusion criteria. Healthcare accessibility is significantly enhanced through telemedicine, especially benefiting remote and underserved regions. Findings demonstrate that telemedicine is critical in bridging the healthcare gap for these communities. Adopting telemedicine facilitates timely diagnosis, treatment initiation, and continuous patient monitoring while reducing the strain on healthcare facilities. However, barriers such as inadequate funding, insufficient training, integration challenges, and data privacy concerns hinder widespread adoption. To address existing challenges, this review emphasizes the transformative potential of telemedicine in advancing healthcare delivery. It underlines the necessity for robust I.T. infrastructure, regulatory support, and comprehensive training programs. Future research should focus on examining long-term impacts, demographic influences, and strategies for integrating telemedicine into standard healthcare practices. Improving outpatient care and overall healthcare performance, especially in developing regions, can be achieved through telemedicine's scalable, effective, and sustainable solutions.

Keywords: COVID-19, Healthcare Delivery, Outpatient Care, Sub-Saharan Africa, Telemedicine, Virtual Software Platforms.

Introduction

Sub-Saharan Africa (SSA) is experiencing rapid population growth, which, according to the International Monetary Fund [1], is increasing exponentially. However, this region still has impoverished health systems and limited resources to expand healthcare services [2]. This challenge is exacerbated by a chronic shortage of health professionals, with the WHO Global Health Observatory reporting an average of one doctor per 5,000 people in Africa, far below the recommended ratio of one doctor per 1,000 people. Telemedicine has the power to revolutionize healthcare in SSA, making it more accessible and efficient for everyone. This will enable enhanced healthcare delivery and bridge the gap in access to skilled health professionals. Therefore, leveraging technology to provide healthcare services

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presents a promising opportunity to address these challenges.

Most healthcare expenditures in developing countries are directed toward outpatient care [4]. Therefore, success in outpatient healthcare delivery would significantly improve overall healthcare performance. Despite Africa's chronic shortage of healthcare workers, telemedicine offers a viable solution for improving access to healthcare services [5]. Several pilot projects across Africa have demonstrated the potential of telemedicine to enhance and accelerate health service delivery [6]. However, the major challenge remains the inability of Africa and other similar developing economies to scale these telemedicine initiatives [7].

Infrastructure, legal, policy, and system challenges are significant barriers to implementing telemedicine in Africa [8]. Additionally, resistance from healthcare professionals and patients and a pervasive lack of understanding about telemedicine are critical limitations [9, 10]. While over 90 per cent of countries report employing telemedicine, few have evaluated its effectiveness in healthcare delivery [3]. This lack of evaluation represents a significant gap in our current understanding of telemedicine applications.

Problem to be Solved

This study addresses the primary problem of the limited understanding and evaluation of voice and video-based telemedicine consultation services for outpatient care in developing countries, particularly in Sub-Saharan Africa. Despite the recognised potential of telemedicine to improve healthcare delivery, systematic evaluations of its effectiveness are scarce, which hampers its scalability and broader adoption.

Existing Solutions for the Problem

Various telemedicine initiatives have been piloted across Africa with varying degrees of success. As a result, healthcare service delivery has been significantly enhanced through telemedicine initiatives, which improve access to medical consultations and alleviate the strain on the limited healthcare workforce [4]. However, these solutions often face significant challenges, including inadequate infrastructure, legal and policy hurdles, resistance from healthcare professionals and patients, and a lack of comprehensive understanding and evaluation [5, 7]. The success of these pilot projects inspires hope and encourages further exploration of telemedicine's potential in Sub-Saharan Africa.

Best Solution

The best solution, as evidenced by the success of pilot projects, is the implementation of telemedicine initiatives that incorporate voice and video-based consultation services. These services can bridge the gap between patients and healthcare providers, offering a more interactive and effective way to deliver healthcare than text-based consultations alone. However, for these initiatives to be successful and scalable, they must be supported by robust infrastructure, favourable policies, and comprehensive training for healthcare providers and patients. Policymakers play a crucial role in creating and implementing these supportive policies.

Limitations

Despite the potential benefits, implementing telemedicine faces several limitations. The primary challenges are inadequate infrastructure, especially in rural areas, and legal and regulatory issues. Telemedicine technology also faces resistance from healthcare professionals unfamiliar with it and scepticism from patients who opt for traditional face-to-face consultations [6, 10]. Furthermore, there is a pervasive lack of comprehensive evaluation studies on the effectiveness and impact of telemedicine initiatives, which hinders evidence-based scaling and adoption [3]. It is essential to be aware of these

challenges and work towards overcoming them to ensure the successful implementation of telemedicine in Sub-Saharan Africa.

Achievements

Notable achievements in telemedicine include several successful pilot projects that have demonstrated significant improvements in access to healthcare services and a reduced burden on the healthcare workforce. For example, the African Tele-dermatology Project, launched in several countries that included a review of 1229 consultations from sub-Saharan Africa, has enabled remote diagnosis and treatment of skin diseases, significantly reducing the need for patients to travel long distances for specialised care [11]. Another successful project is the MOMCONNECT initiative in South Africa, which uses mobile technology to provide pregnant women with vital health information and direct access to healthcare providers, improving maternal and child health outcomes [12]. Similarly, the Uganda Health Information Network (UHIN) has utilised mobile technology to improve communication and data sharing among healthcare workers in rural areas, enhancing overall healthcare delivery. These projects have shown that telemedicine can effectively deliver outpatient care, particularly in remote and underserved areas, improving healthcare delivery [4]. In Kenya, several telemedicine initiatives have been successfully implemented, demonstrating significant improvements in healthcare access and delivery. One notable project is *mHealth Kenya, after the mHealth* and *Penda Health* initiative, which uses mobile technology to enhance the delivery of healthcare services, particularly for HIV/AIDS management [13-15]. This project has improved patient monitoring, data collection, and communication between healthcare providers and patients, leading to better treatment outcomes and reduced strain on healthcare facilities. The potential of telemedicine to enhance outpatient care delivery and improve overall health outcomes has been demonstrated by these projects.

This study aims to explore the perspectives and experiences of using voice—and video-based telemedicine consultation services for outpatient care through a systematic review of the literature. It seeks to fill the gap in existing knowledge by providing a comprehensive evaluation of telemedicine's effectiveness and identifying the key factors influencing its success and scalability in Sub-Saharan countries.

This study is novel in systematically reviewing and synthesising healthcare providers' and patients' perspectives and experiences regarding voice and video-based telemedicine consultation services. Focusing on outpatient care in developing countries, particularly in Sub-Saharan Africa, addresses a critical gap in the literature and provides valuable insights that can inform future telemedicine initiatives and policies.

Schematic Diagram

The diagram below illustrates the process flow for telemedicine consultation services, starting with patient access through a digital platform, followed by voice or video consultation with healthcare providers, real-time diagnosis, and follow-up care.

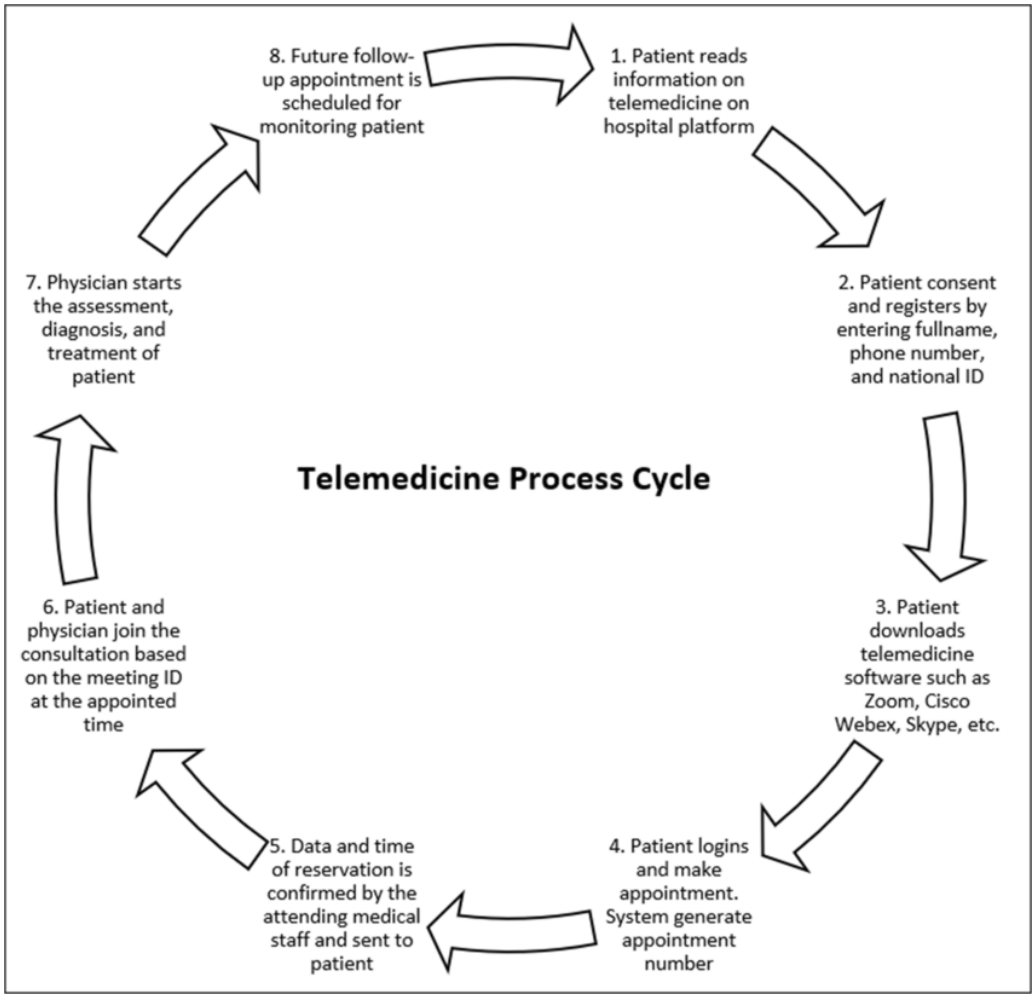

Figure 1. Telemedicine Process Cycle

Source: *Adopted from Iliyasu et al. (2023) [16]*

Materials and Methods

Description of the Site

This systematic review focuses on telemedicine consultation services for outpatient care in Sub-Saharan Africa, a region chosen for its diverse demographic composition and varying levels of healthcare infrastructure across different countries and settings. The onset of the COVID-19 contagion has accelerated telehealth services adoption worldwide, including in Sub-Saharan Africa, where remote healthcare solutions have become critical [8, 16]. The accessibility to healthcare, particularly in remote and underserved areas, was significantly highlighted by the potential of telemedicine during the pandemic.

Description of the Experiments Done (Comprehensive Search Strategy)

Various online databases and libraries were extensively searched for studies that have empirically examined telemedicine and virtual software platforms in Africa. Due to their relevance mainly to medical/health science and their advanced search filtering options, databases like “Google Scholar, ScienceDirect, PubMed, Springer, Wiley, Emerald, Web of Science, Sage, and Scopus” were chosen. Keywords, publication year, type, and research area were specified during the search process to refine the results. Boolean operators were employed to enhance search relevance. Various terms were considered, including "telemedicine," "telehealth," "virtual software

platforms," "digital health," "virtual medicine," "e-health," and "African context." Other relevant papers were identified using additional search strings, such as "digital care" and "e-medicine."

Description of the Laboratory Methods

Although this study is primarily a systematic review and does not involve direct laboratory experiments, the review process was systematic and methodical. A total of 148 articles were retrieved after conducting the search process using the specified keywords. After removing 42 duplicate papers, 106 articles remained. These articles were then subjected to a title and abstract check, which assessed their alignment with the research objective. This process led to removing 44 studies, resulting in 62 remaining papers.

The inclusion and exclusion criteria were also considered in this study to evaluate the remaining papers. This step identified 14 articles that met the criteria. A total of 18 papers were counted in the qualitative analysis, with four additional papers added based on cross-referencing.

Description of Statistical Methods Used

Since this study employs qualitative analysis, the selected papers were analysed using thematic analysis. Data were extracted from each study using a standardised data extraction form, capturing information on study design, telemedicine interventions, outcomes, challenges, and recommendations.

The thematic analysis involved identifying key themes and patterns related to the implementation and outcomes of telemedicine services. This process provided a comprehensive understanding of the factors influencing the success and scalability of telemedicine interventions in Sub-Saharan Africa.

Overall, this systematic review followed a rigorous methodological approach, guided by the PRISMA framework, to comprehensively evaluate voice and video-based telemedicine consultation services for outpatient care in Sub-Saharan Africa.

Findings

The following key themes were extracted from the systematic review:

Opportunities for Embracing Telemedicine and Virtual Software Platforms

Telemedicine has proven especially beneficial in conserving personal protective equipment while at the same time maintaining connections for isolated patients with their close family members and friends. Telemedicine care during the pandemic has seen many medical centres turn to virtual software platforms like Microsoft Teams, Zoom, Google Meetings, Skype, Facebook Messenger, and WhatsApp Messenger. There are several advantages associated with the adoption of telemedicine and virtual software platforms, as noted by Holst et al., Allsop et al. and Onsongo and Kagotho [9, 14, 17]:

1. **Close Patient Monitoring:** Telemedicine helps avoid the overcrowding of healthcare facilities by allowing for close patient follow-up and monitoring from home.
2. **Minimised Movement and Infection Risk**: Telemedicine minimises the risk of intra-hospital infections by reducing the need for physical movement.
3. **Reduced Time for Diagnosis and Treatment:** Telemedicine shortens the time needed for diagnosing, starting treatment, stabilizing, or quarantining patients**.**
4. **Coordination of Medical Resources**: It supports coordinating medical resources across distant locations.
5. **Protection for Medical Practitioners**: Telemedicine prevents the risk of contagion for medical practitioners, who are crucial to the healthcare system.
6. **Cost Savings:** Telemedicine reduces expenses on disposable materials such as

gowns, antiseptic supplies, gloves, and disinfecting hospital areas.

7. **Public Information:** It assists in educating the public about health concerns and essential preventative measures.
8. **Training During the Pandemic**: It facilitates the training of medical practitioners during the COVID-19 pandemic, ensuring they are well-equipped to handle the crisis.

Telemedicine And Virtual Software Platforms Adoption to Treat Outpatients

Public health emergencies have previously seen the utilization of telemedicine and virtual software platforms to deliver medical care [18]. Medical practitioners benefit from these technologies as they provide a dependable platform for real-time access to accurate information, allowing attending physicians to obtain authenticated data quickly [17]. After-hours health services from 6 pm to 8 am rely heavily on telemedicine and virtual platforms, mainly due to COVID-19 [5, 16]. Telemedicine facilitates the storage and transfer of relevant data, such as physical findings or patient complaints, through video or static images [17, 19, 20]. The receiving physician can review this data at a later time. Outpatients can use asynchronous methods (not in real-time, such as email, patient portal messages, health apps, and e-consults) or synchronous methods (in real-time, such as telephone and videoconferencing) for telemedicine consultations. According to Holst et al. and Okereke et al., on-site commercial telemedicine carts are being deployed by medical centres, alongside the provision of hospital laptops for remote use by healthcare staff [9, 19]. Video conferencing software such as Zoom and Google Meet, as well as commercially available digital stethoscopes and web cameras, are also utilised to enhance telemedicine capabilities and ensure comprehensive patient care even from a distance.

Iliyasu et al. Bunge et al. and Chitungo et al. prove that patients were generally satisfied with the virtual consultations and treatment [5, 16, 21]. Medical care continues seamlessly without the risk of leaving home during the COVID-19 pandemic, which is greatly appreciated. Audiovisual appointments are one of the critical methods currently employed for real-time patient consultations, encompassing initial consultations and follow-up visits, as noted by Onsongo et al. [22]. Consequently, appropriate P.P.E. is still essential for physicians when examining patients who require immediate medical attention in person [15, 16]. Patients and physicians benefit from telemedicine by reducing the risk of potential infections while allowing for necessary physical examinations when urgent care is needed. This approach does not aim to replace in-person healthcare but is crucial in protecting patients and medical staff and effectively supports quarantine and social distancing measures. Telemedicine ensures that essential medical services continue uninterrupted while minimising the risk of COVID-19 transmission [23, 24].

Determining Factors to Use Telemedicine and Virtual Software Platforms

Various digital approaches, such as smartphone applications, telephone calls, videoconferencing, and email, offer practical and feasible solutions to support medical practitioners and patients. Telemedicine and digital platforms use these methods to facilitate effective healthcare delivery [17]. These technologies enable real-time and delayed interactions, ensuring that medical consultations, follow-ups, and essential communications can be carried out efficiently, regardless of physical distance. By leveraging these diverse communication tools, healthcare providers can offer comprehensive care, enhance patient engagement, and maintain continuity of services [23, 24]. Although adopting these technologies shows excellent

potential for managing responses to pandemics, several limitations must be addressed [19, 20, 22]. These include the need for solid I.T. infrastructure, licensing and regulatory requirements, equipment costs, physician and nurse training, and modifications to existing hospital workflows. In addition, the implementation process must carefully address ethical considerations.

This study examines the key factors that influence the adoption of extensive telemedicine and virtual software platforms among patients and medical practitioners in Sub-Saharan Africa. Telemedicine and virtual software platforms are gaining traction in this region, driven by the need to overcome healthcare access challenges and improve service delivery. The research aims to identify the key elements that facilitate or hinder the integration of these technologies, providing insights into how they can be effectively utilized to enhance healthcare outcomes in SSA.

Organisational Factors

Workflow Integration: Integrating telemedicine into existing healthcare practices can present challenges in managing virtual software platforms for patient treatment. These issues can result in low patient and physician uptake [25]. Healthcare providers should have workflows to trigger virtual software platforms to minimize their burden and enhance efficiency [5]. Effective medical care requires that telemedicine and virtual software platforms be adopted to empower medical practitioners with the flexibility needed to deliver high-quality services [12]. By streamlining these processes, healthcare professionals can focus more on patient care and less on administrative tasks, thus improving overall healthcare delivery.

Availability of Funding: Implementing telemedicine and virtual software platforms is a gradual process that requires significant funding to purchase necessary resources [26]. Healthcare providers must consider various expenses, including the costs associated with developing virtual software platforms, purchasing equipment, paying medical practitioners' salaries, and providing I.T. support and training. Adopting telemedicine, as highlighted by Dodoo et al., necessitates a comprehensive strategy to address the technical fees required for establishing the necessary infrastructures [20]. However, telemedicine adoption faces a significant barrier due to inadequate funding, making it challenging to implement these technologies effectively. This financial constraint stresses the need for robust funding mechanisms to support the widespread use of telemedicine solutions.

Inadequate Training: Thorough training is essential for medical practitioners who deliver virtual care, ensuring they are well-prepared to use these technologies effectively. Virtual or physical presence should be provided for these training sessions, making them accessible as needed [27, 28]. A notable challenge in adopting telemedicine and virtual software platforms is that some citizens may struggle with digital technologies, necessitating training to enhance their proficiency and comfort with these tools. Previous studies suggest that unfamiliarity with virtual software platforms is a significant barrier to the adoption of telemedicine services [17, 19].

Technological Factors

Broadband Access and Wi-Fi Quality: The quality of network communication plays a vital role in the adoption of telemedicine [17]. Poor video quality can negatively impact Patient and physician relationships, diminishing patient engagement and satisfaction. Effective transmission of sound, images, and video data relies on adequate bandwidth, making reliable broadband access a critical telemedicine component. Implementing telemedicine, especially in rural areas where Internet access is often limited, hinges on improving broadband speed. Enhancing broadband speed

is vital for telemedicine's successful and efficient use [20].

Data Privacy and Access: Telemedicine can be successfully implemented only with a strong focus on data privacy and security. Owing to the breaching of data in the past, ensuring the protection and confidentiality of patient information is paramount. During the COVID-19 pandemic, patient data might have been accessed without explicit consent for safety reasons. Therefore, maximum data privacy and access protection are necessary to maintain trust and ensure compliance [20, 26].

Availability of I.T. Infrastructure: Telemedicine adoption faces a significant barrier in many developing countries due to the lack of coordinated and advanced I.T. infrastructure [26]. High costs associated with Internet access and inadequate I.T. infrastructure create substantial challenges. The availability of high-speed Internet and robust audiovisual hardware is essential for real-time teleconsultations, which demand continuous, high-quality communication between patients and physicians [17, 22, 26]. These requirements ensure that medical consultations can be conducted effectively, with reliable streaming capabilities to maintain the integrity of the telemedicine experience. Addressing these infrastructural issues is critical to enhancing the adoption of telemedicine in these regions.

Data Security and Risk: The potential security risks associated with telemedicine and virtual software platforms arise from the digital collection and management of sensitive medical data. These platforms handle a wealth of confidential information, making them vulnerable to breaches and cyber threats, including collecting, using, and disclosing personal data. Ensuring robust security measures and protocols is vital to protecting patient privacy and maintaining trust in the digital healthcare system [28]. Data protection regulations significantly hinder the adoption of virtual software platforms in healthcare, as evidenced by recent studies. According to Keesara et al. and Cho et al., 94 per cent of participants pinpointed these regulations as a significant obstacle.[29, 30] Obile health applications may inadvertently share sensitive metadata with third-party advertisers, raising concerns about privacy and data security [26]. The stringent data privacy and security requirements create barriers that healthcare providers must navigate to implement these technologies effectively.

Social Factors

Patients and Medical Practitioners' Willingness: Telemedicine and virtual software platforms are often attributed to the reluctance of physicians to embrace these technologies [31, 32]. Telemedicine can be complex and disruptive, requiring physicians to adapt to new consulting methods [26]. New consulting methods introduced by telemedicine can be complex and disruptive, necessitating physicians adapt to unfamiliar ways of interacting with patients [26]. The perception of telemedicine among physicians is crucial, as their acceptance hinges on viewing it as a standard, safe, and effective practice. Furthermore, many physicians may lack familiarity and awareness due to inadequate training in telemedicine, which can impede its adoption [20]. Resistance to technological changes also plays a role, with many patients feeling uncomfortable using virtual software platforms and initially resisting the shift. Also, the use of audio and video technologies in telemedicine requires patient consent for implementation [33].

Lack of Regulation and Advocacy: While telemedicine and virtual software platforms have the potential to be practical tools in managing health crises, existing regulations pose significant barriers to their widespread adoption [8]. Policies often restrict how, where, and when telemedicine can be utilised. Furthermore, the sluggish adoption of these technologies can be attributed to the limited presence of advocacy organizations, including

physician advocacy groups and telemedicine associations, which play a vital role in promoting and supporting telemedicine practices. The lack of strong advocacy efforts has significantly slowed down the widespread acceptance and implementation of telemedicine solutions [34]. Enhanced regulation and increased advocacy could facilitate broader implementation and acceptance of telemedicine and virtual software platforms [33].

Demographic Factors

Patient demographics such as age, gender, and education level significantly influence healthcare experiences, including satisfaction with telemedicine consultations [21, 31, 35]. Despite this, many studies neglect to examine how demographic factors affect satisfaction levels in telemedicine. The connection between video consultation (V.C.) satisfaction and patient-related factors can be understood through the lens of technological acceptance models (T.A.M.) [17, 22]. According to these models, demographics are crucial in shaping individuals' attitudes toward technology. In other words, specific demographic characteristics may make individuals more or less inclined to have a positive attitude towards technologies like V.C.s.

Discussion

The research findings of this study highlight the transformative impact of telemedicine and virtual software platforms on the healthcare system. These results closely align with the objectives outlined in the Introduction, demonstrating how these technologies can revolutionize healthcare delivery and accessibility. Specifically, the results demonstrate how telemedicine has emerged as a crucial tool for enhancing healthcare delivery, particularly in response to the COVID-19 pandemic. Telemedicine addresses critical challenges such as limited access to care and the need for social distancing by facilitating asynchronous sharing of biometric data and enabling remote consultations.

The results are consistent with other research that recognises the rapid adoption of telemedicine in developing regions, especially in Sub-Saharan Africa. As noted by Mann et al., telemedicine's role in monitoring patients remotely—such as pregnant women using home devices linked to electronic health records—demonstrates its effectiveness in managing care and improving patient outcomes; this aligns with previous studies showing that telemedicine can enhance care access and support patients during emergencies.

However, while telemedicine has proven beneficial, gaps and challenges must be addressed. The study suggests that critical organisational, technological, and social factors are crucial for improving the adoption of telemedicine. Further research is required to explore these factors and identify strategies for overcoming barriers such as insufficient training, lack of regulatory support, and technological limitations. For instance, investigating how different demographic groups respond to telemedicine could provide insights into improving user acceptance and satisfaction.

Future research should also focus on the long-term impacts of telemedicine adoption, particularly in post-pandemic settings. Ongoing regulatory changes and technological advancements will increasingly influence the role of telemedicine in healthcare. Gaining a comprehensive understanding of these dynamics is crucial, as they will play a pivotal part in shaping the future of telemedicine and its integration into standard healthcare practices. Additionally, studies could examine the effectiveness of telemedicine in managing chronic conditions and its potential for integration into standard care practices.

Conclusion

Healthcare delivery can be significantly enhanced by adopting telemedicine and virtual software platforms for treating outpatients. This approach offers substantial benefits and advancements, streamlining processes and improving patient outcomes. The risk of exposure to infectious diseases is minimised through telemedicine, as it reduces the need for in-person visits and interactions. This also alleviates the burden on healthcare facilities. Moreover, virtual platforms facilitate real-time monitoring and follow-up, improving patient outcomes and more personalised care.

The implications of this adoption extend beyond immediate patient care. As healthcare systems increasingly integrate these technologies, they have the potential to address broader issues, such as healthcare disparities, especially in underserved or remote areas. Telemedicine and virtual platforms can significantly enhance ongoing medical education and professional development by offering remote training and collaborative opportunities. These technologies facilitate continuous learning and skill-building for medical practitioners, allowing them to stay updated with the latest advancements and best practices without needing to be physically present in order to foster a more interconnected and informed healthcare community. Future research and development in this field could focus on enhancing the security and privacy of telemedicine platforms, improving user interfaces, and expanding the range of services available through virtual consultations. By innovating and refining these technologies, the healthcare industry can further leverage its benefits to deliver high-quality, accessible, and efficient care to a diverse patient population.

Conflict of Interest Statement

I hereby declare that I have no conflict of interest regarding the publication of the article "Telemedicine as a Catalyst for Change in Sub-Saharan Africa: Evaluating Organizational, Technological, and Social Factors- A Systematic Literature Review."

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