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**Evaluating the Relationship Between Information Technology
Adoption and Healthcare Outcomes in Sub-Saharan Africa**

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Abstract

Purpose: The aim of the study was to investigate evaluating the relationship between information technology adoption and healthcare outcomes in Sub-Saharan Africa

Methodology: This study adopted a desk methodology. A desk study research design is commonly known as secondary data collection. This is basically collecting data from existing resources preferably because of its low cost advantage as compared to a field research. Our current study looked into already published studies and reports as the data was easily accessed through online journals and libraries.

Findings: The study found that IT adoption in Sub-Saharan Africa's healthcare varied by country and played a positive role in improving healthcare outcomes when effectively implemented. However, challenges like infrastructure limitations and financial constraints hindered adoption. Tailored strategies and policy interventions are needed to overcome these barriers and harness the potential benefits of IT adoption in the region's healthcare systems.

Unique Contribution to Theory, Practice and Policy: Technology Acceptance Model, Diffusion of Innovations Theory & Health Information Technology Adoption Model may be used to anchor future studies on evaluating the relationship between information technology adoption and healthcare outcomes in Sub-Saharan Africa. Advocate for capacity building initiatives to enhance digital literacy and IT skills among healthcare providers, administrators, and policymakers. Engage with policymakers at the national and regional levels to influence the formulation of healthcare IT adoption policies.

Keywords: *Evaluating Relationship, Information Technology, Adoption Healthcare Outcomes*

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INTRODUCTION

Healthcare outcomes are the health consequences that result from the planned treatment, intervention, or series of interventions within the healthcare system. They can include events or results in patient health status, quality of life, attitudes, behavior, and new evidence. Health outcomes research is a methodology used to identify and measure the link between treatments or interventions delivered and the actual outcomes achieved. Healthcare outcomes in developed economies such as the USA and UK are crucial indicators of the effectiveness and quality of healthcare systems. For example, in the United States, a study by Jha (2018) found that mortality rates have been steadily declining over the past few decades, primarily due to advancements in medical technology, improved access to healthcare, and better disease management. The study reported a decline in the age-adjusted death rate from 745.2 per 100,000 populations in 1980 to 578.0 per 100,000 population in 2014, reflecting an overall positive trend in healthcare outcomes.

In the United Kingdom, another study by Walker (2019) examined the impact of National Health Service (NHS) policies on healthcare outcomes, particularly in reducing waiting times for elective surgeries. The research demonstrated that targeted interventions and policy changes led to a substantial reduction in waiting times, with a notable decline in the number of patients waiting for more than 18 weeks for elective treatment. These statistics illustrate the positive effects of healthcare policy reforms on access and waiting times, ultimately improving patient outcomes in the UK.

In contrast, developing economies like India and Nigeria face unique challenges in healthcare outcomes. For instance, a study by GBD 2017 Disease and Injury Incidence and Prevalence Collaborators (2018) reported that India has made significant progress in reducing child mortality rates, with the under-5 mortality rate declining from 126.3 per 1,000 live births in 1990 to 42.2 per 1,000 live births in 2017. This decline is attributed to improved access to basic healthcare services, immunization programs, and public health initiatives.

Brazil is a developing country in Latin America with a diverse healthcare landscape. A study by França (2017) examined trends in maternal mortality in Brazil. The study found a significant reduction in maternal mortality rates, with a decline from 141.5 maternal deaths per 100,000 live births in 1990 to 58.2 maternal deaths per 100,000 live births in 2015. This decline is attributed to improved access to maternal healthcare services and policies aimed at reducing maternal mortality. However, disparities in healthcare access and outcomes still exist between urban and rural areas, and among different socioeconomic groups, highlighting the need for targeted interventions.

In South Asia, Bangladesh has made remarkable progress in improving healthcare outcomes, particularly in reducing child mortality. A study by Rahman (2016) showed a significant decline in under-5 mortality rates in Bangladesh, with the rate dropping from 151 deaths per 1,000 live births in 1990 to 38 deaths per 1,000 live births in 2014. Key factors contributing to this improvement include expanded immunization programs, community-based healthcare initiatives,

and improvements in maternal and child healthcare services. These efforts have played a crucial role in enhancing the overall health status of the population. These examples highlight the diverse healthcare experiences within developing economies, where progress has been made in addressing specific health challenges. However, persistent disparities and challenges, such as unequal access to healthcare services and regional variations, underscore the ongoing need for comprehensive healthcare interventions and policy reforms to further enhance healthcare outcomes in these regions.

In Nigeria, healthcare outcomes have shown some improvements, but challenges persist. According to a study by Oleribe (2018), there has been progress in reducing the prevalence of diseases such as malaria and HIV/AIDS. However, maternal mortality rates remain high, with Nigeria having one of the highest maternal mortality ratios globally. This underscores the need for continued efforts to enhance maternal healthcare services and improve healthcare infrastructure in developing economies to achieve better healthcare outcomes.

Turning to sub-Saharan African economies, healthcare outcomes vary across countries in the region. For instance, a study by Kenya National Bureau of Statistics (KNBS) and ICF International (2015) revealed that Kenya has made substantial progress in child healthcare, with a decline in under-5 mortality rates from 115 deaths per 1,000 live births in 2003 to 52 deaths per 1,000 live births in 2014. This improvement can be attributed to investments in healthcare infrastructure and the expansion of healthcare services.

In Tanzania, healthcare outcomes have also shown positive trends in some areas. A study by Ministry of Health, Community Development, Gender, Elderly and Children (2019) indicated a reduction in the prevalence of malaria, with a notable decrease in malaria-related deaths due to improved access to insecticide-treated bed nets and antimalarial treatments. However, challenges related to maternal and child healthcare persist, emphasizing the need for continued efforts to enhance healthcare systems and services in sub-Saharan African economies.

India has made significant strides in improving healthcare outcomes in recent years. A study published in *The Lancet* by Dandona et al. (2017) reported that life expectancy in India has increased from 63.7 years in 1990 to 67.9 years in 2016. This upward trend in life expectancy can be attributed to improvements in healthcare infrastructure, increased access to healthcare services, and advancements in medical treatments. Additionally, there has been a decline in the age-standardized death rate, indicating a reduction in premature mortality due to communicable diseases.

Nigeria, while facing healthcare challenges, has also witnessed some improvements. A study by Adeloye (2019) revealed that there has been a reduction in the age-standardized death rate in Nigeria from 895.3 per 100,000 population in 2007 to 695.6 per 100,000 population in 2017. However, the study highlighted the burden of non-communicable diseases, which are on the rise and contributing to the country's overall disease burden. Addressing the increasing prevalence of

non-communicable diseases remains a priority for healthcare policymakers in Nigeria to further enhance healthcare outcomes. These examples illustrate the complex healthcare landscape in developing economies, where improvements are being made, but challenges persist. It is important for these nations to continue investing in healthcare infrastructure, disease prevention, and health promotion programs to further enhance healthcare outcomes for their populations.

In Kenya, healthcare outcomes have experienced notable changes over the years. A study by Maina et al. (2017) highlighted improvements in child survival rates. The under-5 mortality rate in Kenya decreased from 95 deaths per 1,000 live births in 2008 to 52 deaths per 1,000 live births in 2014. This progress can be attributed to various factors, including expanded immunization programs, increased access to antenatal care, and improved healthcare facilities. However, challenges persist, particularly in maternal healthcare, where maternal mortality rates remain high. This underscores the need for continued investments in maternal health services and infrastructure.

Tanzania has also shown positive trends in healthcare outcomes, particularly in the fight against malaria. A study by Mmbando (2020) demonstrated the effectiveness of malaria control interventions in Tanzania. The study reported a significant reduction in malaria prevalence and related morbidity and mortality. This achievement is attributed to widespread distribution of insecticide-treated bed nets, indoor residual spraying, and improved access to antimalarial treatments. These efforts have contributed to improving the overall health status of the population, especially in malaria-endemic regions. These examples from Sub-Saharan African countries highlight the progress made in certain healthcare areas but also emphasize the ongoing challenges, particularly in maternal healthcare and the need for sustained efforts to address them. Strengthening healthcare systems and ensuring equitable access to quality healthcare services remain crucial for further improving healthcare outcomes in the region.

Ethiopia has made significant efforts to improve healthcare outcomes, particularly in maternal and child health. According to a study by Tesema (2020), Ethiopia has seen a substantial reduction in maternal mortality rates over the past few decades. The study reported a decline in the maternal mortality ratio from 871 deaths per 100,000 live births in 2000 to 412 deaths per 100,000 live births in 2016. This improvement is attributed to increased access to skilled birth attendants and maternal healthcare services, as well as community-based interventions. However, challenges related to healthcare infrastructure and access to services persist in certain regions, highlighting the need for continued investments.

South Africa, as one of the more developed countries in Sub-Saharan Africa, faces unique healthcare challenges. A study by Mayosi (2012) examined the burden of non-communicable diseases in South Africa, such as cardiovascular diseases. The research revealed a growing prevalence of these diseases, contributing to increased mortality rates. South Africa's healthcare system is addressing this challenge by implementing strategies for the prevention and management of non-communicable diseases. Additionally, the country has faced significant healthcare disparities, with access to quality healthcare services being unequal across different population

groups. These examples underscore the diverse healthcare landscapes within Sub-Saharan Africa, where progress has been made in certain areas, but persistent challenges remain. Continued efforts to strengthen healthcare systems, improve infrastructure, and ensure equitable access to healthcare services are essential to further enhance healthcare outcomes in these regions.

Information technology adoption, in the context of healthcare, refers to the process by which healthcare organizations and providers integrate and utilize various information technologies to enhance the quality, efficiency, and accessibility of healthcare services. Four key information technology adoption areas are Electronic Health Records (EHRs), Telemedicine, Health Information Exchange (HIE), and Clinical Decision Support Systems (CDSS). EHRs involve the digitization of patient records, enabling healthcare professionals to access comprehensive patient data, leading to improved decision-making and coordination of care. Telemedicine facilitates remote patient consultations, which can enhance access to healthcare services, particularly in underserved or remote areas. HIE platforms enable the secure exchange of patient information among different healthcare providers, enhancing care continuity and reducing duplication of tests and procedures. CDSS employs algorithms and medical knowledge to assist clinicians in making more accurate diagnoses and treatment recommendations. These technology adoptions have been shown to positively impact healthcare outcomes by reducing medical errors, enhancing patient engagement, and improving overall healthcare quality (Lau, 2019; Adler-Milstein, 2014; Rojas 2012).

Moreover, research has demonstrated the association between information technology adoption in healthcare and positive healthcare outcomes. For instance, a study by Lau (2019) found that the implementation of EHRs was associated with significant reductions in medication errors, adverse drug events, and hospital readmissions. Telemedicine adoption has shown promise in improving patient access to care, especially in rural areas, leading to better management of chronic conditions and preventive care (Adler-Milstein, 2014). HIE has been linked to improved care coordination, leading to decreased hospital admissions and emergency room visits, thus reducing healthcare costs (Rojas, 2012). CDSS has proven beneficial in providing healthcare professionals with evidence-based guidelines and recommendations, resulting in more accurate and timely diagnoses and treatment decisions. Overall, the adoption of information technology in healthcare holds great potential for enhancing patient outcomes and the overall healthcare delivery system.

Problem Statement

Information technology (IT) has been widely adopted in various sectors of society, including healthcare. However, the impact of IT adoption on healthcare outcomes, especially in low- and middle-income countries (LMICs), remains unclear. This study aims to evaluate the relationship between IT adoption and healthcare outcomes in sub-Saharan Africa (SSA), a region that faces many health challenges and resource constraints. The study will use secondary data from the World Health Organization (WHO), the World Bank, and other sources to measure IT adoption and healthcare outcomes in SSA countries. The study will also identify the factors that influence IT

adoption and the barriers that hinder its effective use in healthcare delivery. The study will contribute to the literature on IT and health by providing empirical evidence on the benefits and challenges of IT adoption in LMICs, particularly in SSA. The study will also provide policy recommendations for improving IT adoption and healthcare outcomes in SSA. (Smith, 2023)

Theoretical Framework

Technology Acceptance Model (TAM)

Originated by Fred Davis in 1986, posits that the adoption of technology is influenced by users' perceived usefulness and ease of use. It emphasizes that individuals are more likely to accept and use technology if they believe it is both useful and user-friendly. In the context of "Evaluating the Relationship Between Information Technology Adoption and Healthcare Outcomes in Sub-Saharan Africa," TAM can help researchers understand the factors influencing healthcare professionals' and patients' acceptance of health information technology (HIT). By examining perceived usefulness and ease of use, the study can assess the likelihood of successful IT adoption and its impact on healthcare outcomes (Davis, 1986).

Diffusion of Innovations Theory

Developed by Everett M. Rogers in 1962, explored how innovations, such as new technologies, spread through social systems over time. It identifies key factors that influence the rate and extent of adoption, including the characteristics of the innovation, communication channels, social systems, and time. In the context of healthcare IT adoption in Sub-Saharan Africa, the Diffusion of Innovations Theory can provide insights into the factors that facilitate or hinder the spread of health IT solutions. It considers the roles of opinion leaders, communication channels, and the socio-cultural context in determining the success of IT adoption in healthcare settings (Rogers, 1962).

Health Information Technology Adoption Model (HITAM)

Developed by Menachemi and Collum in 2011, focuses on the adoption of health information technology within healthcare organizations. It identifies factors such as leadership support, financial resources, technical infrastructure, and organizational culture as determinants of successful health IT adoption. In the research on healthcare outcomes in Sub-Saharan Africa, HITAM can provide a tailored framework for assessing the adoption of health information technology within healthcare facilities. It considers the organizational context and resources, which are critical for understanding how IT adoption impacts healthcare delivery and outcomes (Menachemi & Collum, 2011).

Empirical Studies

Adu (2019) assessed the influence of electronic health record (EHR) adoption on patient outcomes in the healthcare system of Ghana. Employing a cross-sectional survey method involving data

collection from healthcare providers, the research unveiled compelling findings. EHR adoption significantly enhanced data accuracy, reducing errors and optimizing patient care. The introduction of EHR systems streamlined the management of patient information, granting healthcare professionals prompt access to critical health data. This improved decision-making, leading to more effective and informed healthcare interventions. As a result, the study's recommendations underscored the need for a broader implementation of EHR systems in Ghana's healthcare infrastructure to further enhance patient care, increase data accuracy, and ultimately improve healthcare outcomes across the nation.

Mekonnen (2018) evaluated the far-reaching impacts of telemedicine adoption on maternal and child health outcomes in Ethiopia. Utilizing a longitudinal analysis approach that incorporated extensive health data and telemedicine usage statistics, their research uncovered profound results. The study identified a remarkable reduction in maternal and child mortality rates, presenting strong evidence of the transformative potential of telemedicine in enhancing healthcare outcomes. Telemedicine facilitated remote consultations, enabling timely interventions and improving accessibility to healthcare services, particularly in remote and underserved regions of Ethiopia. The study's recommendations resonated with the urgent need to continue nurturing and scaling telemedicine initiatives in Ethiopia and similar regions, aiming to further strengthen maternal and child health outcomes and promote healthcare equity.

Nkengasong (2017) delved into the realm of mobile health (mHealth) to gauge its impact on HIV patient adherence and broader health outcomes in Cameroon. Employing a rigorous randomized controlled trial design, their research uncovered compelling insights. The mHealth application introduced during the study exhibited a profound capacity to enhance medication adherence and achieve viral load suppression among HIV-positive patients. Regular reminders, medication tracking features, and access to pertinent health information through mobile phones contributed significantly to improved adherence rates. This study's recommendations resonated with the idea that integrating and expanding mHealth interventions into HIV care programs could substantially advance patient outcomes, suggesting a promising path forward in the fight against HIV/AIDS in Cameroon and beyond.

Osifo-Dawodu (2020) embarked on a critical exploration of the impact of electronic prescribing systems on medication errors within Nigerian healthcare settings. Employing a comprehensive before-and-after study design, their research uncovered significant findings. The introduction of electronic prescribing systems led to a remarkable reduction in medication errors, enhancing patient safety within healthcare facilities. These systems streamlined medication ordering processes, mitigating the risks associated with handwritten prescriptions. The study's recommendations emphasized the critical importance of continued adoption and utilization of electronic prescribing systems in Nigerian healthcare facilities as a pivotal strategy for reducing medication errors, ultimately contributing to safer and more effective patient care.

Agyepong (2019) evaluated the efficacy of e-learning programs designed for healthcare professionals in Ghana. Employing a mixed-methods approach, including surveys and in-depth interviews, their research yielded multifaceted insights. E-learning programs were found to significantly enhance the knowledge and skills of healthcare professionals, offering tangible benefits in terms of job satisfaction and job performance. The flexibility of e-learning, coupled with access to up-to-date medical information, contributed to the professional development of healthcare providers. The study's recommendations underscored the value of expanding digital education initiatives to bolster healthcare outcomes and foster ongoing professional growth within Ghana's healthcare sector.

Afolabi (2017) assessed the impact of mobile phone-based health interventions on maternal and child health outcomes in Nigeria. Employing a randomized controlled trial, their research uncovered compelling results. Mobile phone-based health messages effectively enhanced maternal and child health practices and outcomes. These interventions resulted in increased antenatal care attendance, improved vaccination rates, and a more informed approach to healthcare decisions among caregivers. The timely delivery of health information via mobile phones played a pivotal role in strengthening healthcare practices. The study's recommendations underscored the immense potential of mobile health interventions in enhancing maternal and child healthcare, advocating for their continued use and expansion in Nigeria's healthcare landscape.

Chib (2018) delved into the arena of tuberculosis (TB) treatment within South Africa, assessing the impact of a mobile health program on treatment adherence and overall outcomes. Employing a pre- and post-intervention analysis, their research revealed transformative results. The mobile health program significantly improved TB treatment adherence rates and contributed to a notable reduction in treatment failure rates. Mobile-based interventions facilitated treatment monitoring, support, and adherence, underscoring their potential in strengthening disease management efforts. The study's recommendations emphasized the imperative of sustaining and expanding mobile health programs to further enhance TB treatment outcomes, not only in South Africa but also in analogous settings, thereby advancing the fight against tuberculosis on a global scale.

METHODOLOGY

This study adopted a desk methodology. A desk study research design is commonly known as secondary data collection. This is basically collecting data from existing resources preferably because of its low-cost advantage as compared to field research. Our current study looked into already published studies and reports as the data was easily accessed through online journals and libraries.

FINDINGS

The results were analyzed into various research gap categories that is conceptual, contextual and methodological gaps

Conceptual Research Gaps: While the studies by (Osifo-Dawodu, 2020) discussed the positive impacts of various technological interventions (e.g., EHR adoption, telemedicine, mobile health) on healthcare outcomes, there is a need for more in-depth exploration of the underlying mechanisms and theories that drive these improvements. A comprehensive understanding of the theoretical foundations of these interventions can guide future research and implementation strategies.

Contextual Research Gaps: The studies mentioned by (Nkengasong, 2017) focus on specific African countries (Ghana, Ethiopia, Cameroon, Nigeria, South Africa), each with its unique healthcare system and challenges. Future research should consider a comparative analysis across multiple African nations to determine the contextual factors that influence the success or failure of healthcare technology adoption. This would provide a broader perspective on the generalizability of findings.

Geographical Research Gaps: The studies by (Chib, 2018) primarily cover Sub-Saharan African countries. Expanding research to include North African countries and other regions of the continent would provide a more comprehensive understanding of healthcare technology adoption and its impact on healthcare outcomes across diverse African settings. Many of the studies focus on immediate or short-term outcomes of technology adoption. Research gaps exist in understanding the long-term sustainability of these interventions and their continued impact on healthcare outcomes over extended periods. There is a research gap in exploring the qualitative experiences and perspectives of healthcare providers, patients, and caregivers regarding the use of healthcare technologies. Understanding user acceptance and satisfaction can inform implementation strategies.

CONCLUSION AND RECOMMENDATIONS

Conclusion

Evaluating the relationship between Information Technology (IT) adoption and healthcare outcomes in Sub-Saharan Africa reveals a complex and evolving landscape. While Sub-Saharan Africa faces numerous healthcare challenges, including limited access to quality healthcare services, inadequate infrastructure, and a high burden of diseases, the adoption of IT solutions holds promise in addressing these issues. The studies and initiatives in this region have shown that IT adoption can bring about notable improvements in healthcare outcomes.

Key findings indicate that the implementation of IT systems, such as electronic health records (EHRs), telemedicine, and mobile health (mHealth) applications, can enhance data management, healthcare delivery, and patient engagement. These technologies have the potential to improve access to healthcare services, streamline clinical processes, and empower both healthcare providers and patients with valuable information.

However, challenges persist, including disparities in IT infrastructure, digital literacy, and resource allocation across different Sub-Saharan African countries. Additionally, issues related to data

privacy, security, and interoperability need careful consideration to ensure the successful integration of IT into healthcare systems. In the midst of these challenges, it is essential for policymakers, healthcare providers, and stakeholders in Sub-Saharan Africa to continue investing in IT adoption and infrastructure development. Collaboration with international organizations, public-private partnerships, and innovative approaches to funding can play pivotal roles in advancing healthcare outcomes in the region. Additionally, fostering digital literacy and promoting the use of IT among healthcare professionals and the general population is crucial for maximizing the benefits of technology adoption.

In conclusion, while there is a growing body of evidence suggesting a positive relationship between IT adoption and healthcare outcomes in Sub-Saharan Africa, sustained efforts, strategic planning, and targeted investments are required to fully harness the potential of information technology in transforming healthcare delivery and ultimately improving the well-being of the region's populations.

Recommendation

Theory

Establish a robust theoretical framework that comprehensively elucidates the relationship between information technology (IT) adoption and healthcare outcomes in the specific context of Sub-Saharan Africa. This framework should consider the unique socio-cultural, economic, and healthcare system factors that characterize the region. Apply and adapt existing IT adoption theories (e.g., Technology Acceptance Model, Diffusion of Innovations) to the Sub-Saharan African healthcare context. Identify the factors that may influence IT adoption and healthcare outcomes differently in this setting, such as infrastructure limitations, cultural factors, and resource constraints. Identify gaps in existing healthcare IT adoption literature in Sub-Saharan Africa and address them through empirical research. Generate new theoretical insights by investigating underexplored aspects of IT adoption and its impact on healthcare outcomes, such as the role of mobile health (mHealth) technologies or the influence of policy frameworks.

Practice

Utilized rigorous research methodologies, including longitudinal studies, case studies, and mixed-methods approaches, to capture the multifaceted nature of IT adoption in healthcare. Ensure data collection instruments are culturally sensitive and contextually relevant. Identify and disseminate best practices for IT adoption in Sub-Saharan African healthcare settings. This includes examining successful IT implementations in similar contexts and documenting key factors contributing to their success. Advocate for capacity building initiatives to enhance digital literacy and IT skills among healthcare providers, administrators, and policymakers. Offer training programs and resources tailored to the Sub-Saharan African context.

Policy

Engage with policymakers at the national and regional levels to influence the formulation of healthcare IT adoption policies. Provide evidence-based recommendations for policy changes or the creation of frameworks that promote IT adoption and healthcare outcomes. Highlight regulatory challenges that hinder IT adoption and suggest policy revisions that streamline approval processes for healthcare IT solutions. Advocate for policies that ensure data privacy and security in healthcare IT systems. Collaborate with governments and international organizations to allocate resources effectively, including funding and infrastructure development, to support IT adoption in healthcare. Advocate for sustainable funding models that prioritize healthcare IT investments. Establish mechanisms for continuous monitoring and evaluation of healthcare IT initiatives. Promote the use of key performance indicators (KPIs) to assess the impact of IT adoption on healthcare outcomes and use these findings to inform policy adjustments.

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