



Core Mechanisms in Mediating eHealth Implementation and Uptake: A Case Study of Eastern Uganda

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Abstract

Researchers agree that, globally, in both developing and developed countries, healthcare management is faced with acute challenges: expanding areas of health needs, operationalizing health management, constrained budget allocations, as well as resource limitations. Hence, there is an imminent drive to find solutions to stimulate health system transformation through health system innovation. Therefore, effective national operational strategies to minimize resource wastage and contain the costs of health service delivery are critical. The study adopted a methodology that incorporated different research approaches and strategies. Deductive and inductive approaches were used; the strategies were surveys and case studies. A sample of 178 health professionals and administrators in three Health care facilities in Eastern Uganda, were determined and surveyed. Eligible respondents were stratified and selected through simple random sampling. Self-administered questionnaires and interview guides were used to gather the data. The captured data was analysed using Stata version 17. Regression analysis was used to determine the impact of eHealth Implementation core mechanisms on Quality Health Service Delivery. From the results of regression analysis, the core mechanisms variable had a p-value of 0.049 which was significant. For eHealth Implementation Core Mechanisms, the respondents have less control over them since they are dependent on several environmental factors, such as government funding or grants, Government regulations, and policies among others.

Introduction

The World Health Organization (WHO) defines health as an integrated condition of physical, mental, and social well-being, not just the absence of illness or impairment. Enjoying the best possible health is a fundamental right for everyone, regardless of ethnicity, religion, political beliefs, wealth or social standing. One of the most significant difficulties today confronting health systems is the effective management of both complicated chronic and acute disorders. This necessitates innovative methods of providing health care involving the integration of healthcare professionals or, at the very least, much closer management of their operations (Ondulo et al., 2014).

The rising number of healthcare facilities has resulted in the necessity of distinguishing one product from another, in addition to quality service and speed. This requirement is a primary motivator for eHealth adoption (Kesse-Tachi et al., 2019).



Researchers, academic institutions, professional societies, and funding organisations have proposed various eHealth definitions (Kesse-Tachi et al., 2019). The concept of "eHealth" first appeared in 2000, but it is now used globally. The meaning of this phrase was looked at from various perspectives. It is defined as "the leveraging of ICT in health" by the World Health Organization (WHO). This definition combines two central ideas (health and technology) into a single, generally distinct notion (eHealth) (Alshahrani et al., 2019). According to the World Health Organization (WHO) and the International Telecommunication Union (ITU), an electronic health system (eHealth) is a computerised medical record used to gather, store, and share information among healthcare practitioners in an organisation to enhance the delivery of healthcare services to patients.

Despite the benefits of eHealth, there have been reports of implementation difficulties independent of the eHealth technology used. Most of these failures might be attributed to a lack of consideration of multidimensional factors, which can be broadly classified as Technological, Environmental, Social, and Organisational factors (Mauco et al., 2021).

According to WHO, Low ICT budgets, unpredictable electrical supply, poor infrastructure supporting health services, and insufficient workforce capacity are all barriers to eHealth implementation in developing countries. Significant multi-level challenges mark the setting of eHealth initiatives in underdeveloped nations. As a result, initiatives to leverage and integrate eHealth processes into health systems necessitate cross-sector collaboration, strategic planning, and commitment focusing on i) constructing physical infrastructure, ii) installing applications and suitable eHealth services, and iii) ensuring a sound legal and regulatory environment; iv) developing a skilled health workforce; v) enhancements to administration, policy, standards, plus interoperability (Jasper et al., 2020).

Related Studies

Barriers to Implementing eHealth: A Multi-dimensional Perspective by Alkhalidi *et al.* (2014) explores the challenges and obstacles encountered in applying eHealth systems from a comprehensive, multi-dimensional perspective. The study looks at several aspects of eHealth implementation, including technological, organisational, human, and regulatory aspects. It digs into eHealth adoption's details and diverse nature, considering healthcare organisations' readiness, technology infrastructure, worker participation, and regulatory compliance. The authors emphasise the importance of understanding these multi-dimensional barriers. This is to effectively address the challenges associated with implementing eHealth solutions and provide valuable insights for healthcare organisations and policymakers seeking to overcome obstacles and improve the positive deployment of eHealth technologies.

The Challenge of Integrating eHealth into Health Care: A Systematic Literature Review of the Donabedian Model of Structure, Process, and Outcome by Tossaint-Schoenmakers et al. (2021) conducted a systematic review to understand how the Donabedian model influences eHealth integration into healthcare. The Donabedian model classifies healthcare quality into structure, process, and outcome. It emphasises the many challenges and opportunities involved in adopting eHealth technology, which has altered the quality and effectiveness of healthcare provision. The model was used to measure the quality of healthcare. "Structure" refers to the physical and organizational features of healthcare, "process" refers to the methods of care delivery, and "outcome" refers to the effects on patients' health and overall well-being.

According to Kruk et al. (2018), the shifting health demands, rising public expectations and ambitious new health goals are putting pressure on health systems to achieve better health outcomes and higher social value. Data from a variety of countries and settings reveal that the quality of care is consistently low.



A study conducted in Bangladesh found that perceived ease of use, gender, and subjective norm boosted patient adoption of eHealth. Similarly, other studies conducted in the Netherlands demonstrated that eHealth systems' ease of use and benefits greatly enhanced patient acceptance (Namatovu & Semwanga, 2021).

Kesse argued that eHealth can improve healthcare service efficiency while positively influencing the quality of care. It is hampered by several issues, including high acquisition prices, particularly at the start, safety, confidentiality, security concerns and lack of technical competence. Healthcare professionals' resistance to change, the failure of Healthcare Information Systems (HIS) to interoperate and communicate information, and the enormous variety of available eHealth standards, many of which compete, overlap, and occasionally contradict each other, have all slowed eHealth adoption (Kesse-Tachi et al., 2019).

Methods

The research approach was both deductive and inductive. A deductive approach, which is secondary, entailed an extensive literature review to determine some of the core mechanisms which successful eHealth implementers have applied. In contrast, an inductive, empirical approach entailed a survey and case study strategies to aid in the scoping. The study evaluated eHealth implementation core mechanisms and uptake in public healthcare facilities to deliver healthcare services.

Secondary data

Secondary data allows researchers to save time and resources by utilising existing information, and it can provide valuable context, background, or benchmarks for new empirical research. Peer-reviewed journals were used to access the secondary information.

The core mechanisms in the implementation of eHealth systems

According to research on successful IT adoption in healthcare, there are mechanisms to boost healthcare IT adoption, including direct and indirect incentives. Subsidies, bonuses, tax breaks, grants or loans, and co-funding mechanisms are all examples of adoption incentives.

Environmental factors

Environmental factors, such as government funding or grants, are crucial in the acceptance and deployment of eHealth. These factors are essential in supporting the continuing viability of eHealth deployment (Fanta & Pretorius, 2018). The environmental factors are Business regulation and licensing, Affordability, Infrastructure (energy, roads, railways), ICT infrastructure and services, Macro level stability (economic, Taxation, Legal and political), funding, Profitability, Financial incentives, Government Leadership, Government Regulations, policies, Monitoring and Evaluation of systems. The affordability of connection, like mobile cellular taxes, broadband internet charges and eHealth system procurement pricing, directly impacts economic consequences (Adong et al., 2024; Bilbao-Osorio et al., 2014; Busagala & Kawono, 2013; Kesse-Tachi et al., 2019; Shirandula et al., 2022).

Empirical data

Empirical data is information obtained from direct observation, experimentation, or other types of primary study. Researchers gather it directly to answer specific research questions or test hypotheses. This form of data can be quantitative (numerical) or qualitative (descriptive), commonly used to provide solid, real-world evidence. Empirical data is helpful because it helps researchers investigate fresh insights, validate theories, and guarantee that discoveries are based on actual, observable occurrences rather than assumptions or existing data. The empirical study validated the core mechanisms captured in the secondary research for successful implementers in developing countries, such as in the case of Eastern Uganda.



The study identified three study sites that vary in terms of geographical location and coverage, financial assets, eHealth service consumption levels, unique provision and strategy settings. The sites were site 1 (Regional Referral Hospital), site 2 (General Hospital) and site 3 (Health Centre IV).

This study sought the opinions of persons with practical knowledge of eHealth compared to hypothetical beliefs. The study was limited to only three healthcare facilities in eastern Uganda. A methodological drawback of the study could have been subjective. For instance, qualitative data collection, analysis, and interpretations could be subjective and susceptible to researcher bias (Azungah, 2018). Thus, to reduce bias, the authors combined interviews with questionnaires to cross-check and validate the evidence.

The outcome variable was Quality Health Service Delivery (QHSD) based on the implementation and uptake of eHealth. eHealth implementation core mechanisms were the mediating variable.

The data collected was first checked for completeness and cleaned before data analysis. Stata version 17 was used for statistical analysis. Regression analysis was done to predict the association between the value of the dependent variable based on the values of the predictor and mediating variables. The p-value of <0.05 was considered statistically significant.

Results

Table 1: Linear regression

| Quality Health Service Delivery (QHSD) | Coef. | St. Err. | t-value | p-value | [95% Conf Interval] | Sig | |
|--|-------|----------|---------|---------|---------------------|-------|----|
| eHealth implementation core Mechanisms | 0.081 | 0.041 | 1.99 | 0.049 | 0.001 | 0.161 | ** |

*** $p < .01$, ** $p < .05$, * $p < .1$

Source: Respondents' score 2024

eHealth Implementation Core Mechanisms - An increase of one score on the eHealth implementation core mechanisms improves the rating of the QHSD by 0.081, with a p-value of 0.049 (**), which is statistically significant. The t-value of 1.99 is marginally significant at the 95% confidence level.

Therefore, focus is needed on the variable, eHealth Implementation core mechanisms, because those variables must be addressed to change the respondents' rating or understanding of Quality Health Service Delivery and achieve successful eHealth implementation and uptake.

Discussion

This study established the core factors that influenced the successful implementation of eHealth at public healthcare facilities in sites 1, 2, and 3 of Eastern Uganda. It also determined possible associations between the dependent variable (QHSD) and the eHealth Implementation Core Mechanisms.

Extensive primary research was done to assess eHealth implementation progress at each facility. Nonetheless, it was found that its adoption and implementation lagged or could not be comparable to the success cases of the developed world due to underestimating or omitting implementation factors. Several factors interact in different ways to influence the implementation and uptake of eHealth.

The study highlighted several Core Mechanisms factors in Mediating eHealth implementation and uptake in Eastern Uganda. First, robust infrastructure (energy, roads, railways), ICT infrastructure and services are essential for establishing a solid foundation for eHealth systems. Limited digital



resources and unreliable electricity or internet access greatly hinder the effectiveness of these interventions. The policy support and governance structures are essential in promoting the regulatory and financial frameworks necessary for widespread implementation and uptake. Without sufficient policy backing, including data privacy and security guidelines, the implementation of eHealth systems remains fragmented. Economic stability ensures governments and healthcare facilities have the financial resources to invest in necessary infrastructure, such as digital health platforms. Sustainable funding models, including public-private partnerships, donor funding and implementing partners, are vital for long-term implementation and uptake. Taxation policies can either encourage or discourage investment in health technology, influencing the cost of eHealth services and the affordability of digital tools for healthcare practitioners and patients. Stakeholder engagement, including healthcare practitioners and patients, is crucial in ensuring that eHealth solutions are tailored to local needs and practices, resulting in increased uptake and sustainable use. Furthermore, capacity-building for healthcare personnel through training and technical support ensures that digital health solutions are successfully integrated into current workflows. Additionally, a stable political environment encourages the development and implementation of supportive policies that prioritise digital health innovation, ensuring that healthcare goals are aligned with technical advancements.

It is important to add that from the available anecdote information, in the African political setup, government regimes often have a lot of influence on the economic well-being of an environment. Regimes can always skew things to favour a given region and deprive another region, thus leading to skewed empowerment and growth, which will trickle down to the health facility or organisation. Pagalday-Olivares et al. (2017) add a voice to the debate by stating that poverty is a significant factor in using ICT in health service delivery in developing countries. They argue that a low economy level may be a considerable challenge in adopting fully developed European/Western-based solutions for developing African countries where information systems are not fully established. Therefore, an information system support for health in rural areas of developing countries should consider the macro and micro economy (which are components of broad environmental factors) level of the community where it is to be implemented. Factors like availability of funds, accessibility to health care, availability of energy and infrastructure, affordability and adaptability of new technology to the communities should be considered (Olukunle, 2012).

Everett et al. (2010) equally add a voice to the debate by arguing that there are complementarities between a healthy natural environment and prosperity. They state that the natural environment plays a vital role in the economy as a direct input into production and through the many services it provides. Environmental resources directly facilitate the production of goods and services. This was vividly evident from the three case study sites with varying natural environments and economic endowment. Site 3 is more of a rural facility situated within an upcoming urban Centre (which owes its growth to the presence of a national educational institution in the area; otherwise. The region largely relies on agriculture for its economic being). Thus, it has a low economic income or index compared to the other two study sites.

Further, site 3 has not been favoured by different political regimes and needs a better road network. Site 2 is located in a semi-urban environment (one of the biggest districts in Eastern Uganda) and thus is exposed to several economic opportunities and other situational advantages. Site 1, on the other hand, is situated in an urban environment (City located in Eastern Uganda) endowed with naturally good climatic conditions for agriculture, which therefore forms the environment's economic base, besides the region can also be argued to have had favours with different political regimes thus driving their economic growth.

A sound economic environment is thus necessary for the growth of an organisation. Economic situations and financial constraints, countrywide and in the health sector, are such that many health



facilities and medical training institutions cannot cater to their needs, including computerisation. Thus, dependence on external resources or donor funding to introduce eHealth in organisations has become the rule rather than the exception. Other factors besides economics play a role in the development of an organisation, hence the adoption and implementation of innovation, such as political regimes, stability, leadership, legal framework, vision, and policies. An enabling environment must be created by providing a firm foundation at the political and government levels. The government must provide legislation and policies which will need to be implemented that are conducive to promoting eHealth practices. The government should equally create a culture of transparency and accountability.

Further, leadership must ensure coherence and less disruption in the workflow by introducing innovations at the workplace and providing proper communication, change management, incentives, and motivation to the staff through training. This approach would easily enhance staff buy-in.

Conclusion

From the foregone discussions, empirical findings, literature reviews, and anecdote data, it can be concluded that the core mechanisms are key mediating factors in the implementation and uptake of eHealth. The study highlights the strides made and the success stories in other regions versus the gaps in the Uganda health system. This was achieved by generalising the findings from the three case studies.

The combination of secondary and empirical data provided a comprehensive approach to the study by leveraging the strengths of both data types. Secondary data provided a solid basis, allowing the researchers to expand on existing knowledge, identify trends, and interpret their findings. On the other hand, empirical data provided original, first-hand views that directly addressed the core mechanisms in eHealth implementation. Triangulating findings from both sources allowed the researchers to validate, contrast, or expand on existing knowledge, resulting in more informed conclusions.

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