



THE ASSESSMENT OF THE USABILITY OF HEALTH INFORMATION SYSTEMS IN REFERRAL HOSPITALS IN TANZANIA: A CASE OF GEITA REGIONAL REFERRAL HOSPITAL

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Abstract

This study assesses the usability of the health information system in referral hospitals in Tanzania. The study divided the research participants into two strata, including service providers and service recipients, to ensure balanced opinions. The participants were obtained using a simple random sampling technique. The mixed-research approach was applied to collecting both quantitative and qualitative data. A questionnaire and an unstructured interview guide were used in data collection. The findings revealed that the usability of the health information system at Geita regional referral hospital is adequate, despite a few insights that should be taken into consideration to maximize its usability, quality of service delivery, and increased level of acceptance. The usability factors that were perceived positively include visibility, navigation, and easy retrieval of data. On the other hand, although factors including task-technology match, report generation capability, stock level management notifications, and the ability to manage queues were positively perceived, it was found that a significant percentage of participants were not sure or disagreed. Additionally, despite the usability challenges, the use of the health information system at Geita Regional Referral Hospital has resulted in improved quality of healthcare provision in terms of reduced waiting time, easy and quick patient data retrieval, a proper payment system, and equitable service.

Keywords: *Health Information System, Information and Communication Technology, Usability, Health Care, Awareness, Quality Health Care.*

1.0 INTRODUCTION

Healthcare is one of the fundamental rights of human beings. The government of Tanzania has a constitutional commitment to guarantee public health for all its citizens. Part III, Section 14, of the Tanzania Constitution declares the right to life, emphasizing that "every person has the right to live



and to the protection of his life by society by the law" (Tanzania Constitution, 1977). This implies that all Tanzanian citizens, regardless of their strata, have equal access to standard medical services. Healthcare systems in Africa suffer from neglect and underfunding, leading to severe challenges across the six World Health Organization (WHO) pillars of healthcare delivery (Oleribe et al., 2019). Ricardson (2006) argues that healthcare providers and governments have no choice but to meet healthcare demands for future citizens, and the application of e-health is therefore fundamental.

Over the years, African countries have suffered more from man-made issues that cut across institutional, human resources, financial, technical, and political developments (Oleribe et al., 2019). In 2007, the World Health Organization (WHO) proposed a framework that describes healthcare systems in terms of six core components or "building blocks": i) service delivery; ii) healthcare workforce; iii) healthcare information systems; iv) medicines and technologies; v) financing; and vi) leadership and governance (Oleribe et al., 2019).

Several studies have been conducted on health service delivery and revealed that the use of information and communication technology (ICT) has a significant positive contribution towards the improvement of health services. A study by Khatun (2015) found that using ICT is a key strategy to meet the demand for health services, as it helps to meet increasing demands and cut health service costs due to limited resources and workforce shortages. Khatun (2015) also found that the adoption of ICT in the supply chain enhances the quality of services in the purchase and supply of essential medicines. In addition, a study by Omondi (2016) revealed that the use of ICT improves health service delivery to patients.

According to Mimbi and Bankole (2015), ICT significantly improves life expectancy at birth and reduces infant mortality rates. The study also proposes that African countries must significantly invest in ICT to improve their health systems. However, in Tanzania, little is known about to what extent the ICT investment and application have contributed to the quality of health services in public regional referral hospitals. Regardless of the interventions and studies conducted, the problem of poor health care in RRHs persists (HSSP, 2015). Poor health care may result in increased waiting time, increased demands, increased health costs, delayed service delivery, incorrect health data, and even death (Ruxwana et al., 2010). The purpose of this study was to assess the contribution of health information system usability towards quality health care in Tanzania's public regional referral hospitals as one aspect of effective ICT application.

Luhanya, Bakkabulindi, and Muyinda (2017) view ICT as a shorthand for computers, software, networks, satellite links, and related systems that allow people to access and share information and knowledge in a variety of forms. According to Ajayi (2009), ICT is defined as a technological means of collecting (inputting or gathering), collating (processing or analyzing), and conveying (outputting or transferring) information via technology. Generally, ICT covers any product that will store, retrieve, manipulate, transmit, or receive information electronically in a digital form. For example, personal computers, digital television, email, robots, phones, Local Area Networks (LANs), application software from stand-alone to enterprise resource planning (ERP), social media, etc. For effective utilization of ICT facilities, there is a need for an adequate and reliable electricity supply, a good information system, computers and computer environments, a literate computer population, and technical expertise (Akor et al., 2016).

Moreover, when addressing the enhancement of healthcare quality through ICT, the usability of the health information system plays a crucial role in its acceptance for use (Kavuta, Msanjila, & Shidende, 2023). ISO (2018) defines usability as the degree to which a product can be utilized by specific users to accomplish specific goals effectively, efficiently, and satisfactorily within a defined context of use. Additionally, Nielsen (1993) outlines five elements of usability heuristics as perceived by novice users: learnability, efficiency, memorability, errors, and satisfaction. Efficiency pertains to the resources expended in relation to the accuracy and completeness with which users achieve their goals. Satisfaction involves freedom from discomfort and positive attitudes towards product usage.

Learnability indicates that the system should be easy to grasp so that users can promptly begin using it. Memorability implies that the system should be easy to remember so that occasional users can return to it after a period of non-use without having to relearn everything. Another aspect of usability, as explained by Nielsen (1993), is error, which emphasizes the importance of a low error rate and easy error recovery for users. Nielsen (1993) further defines the user as the individual interacting with the product, and the goal as the intended outcome.

2.0 OBJECTIVE OF THE STUDY

The objective of this study was to assess the usability of health information systems in referral hospitals towards the improvement of the quality of healthcare services. Geita Regional Referral Hospital was used as a case study.



3.0 LITERATURE REVIEW

3.1 Theoretical Framework or Research Mode

This section assessed different theories used to support the study on the contribution of ICT usage to the provision of quality health care in public regional referral hospitals: a case study of Geita Regional Referral Hospital. The study was guided by the Unified Theory of Acceptance and Use of Technology (UTAUT).

The UTAUT theory was developed by Venkatesh, Thong, and Xu (2016) based on the previous models, including the Technology Acceptance Model (TAM), Combined TAM and the Theory of Planned Behaviour (CTAMTPB), Motivational Model (MM), the model of PC Utilization (MPCU), Innovation Diffusion Theory (IDT), and Social Cognitive Theory (SCT). The UTAUT theory suggests that the acceptance and use of the information system depend on the perceptions of the individuals on the level of performance expectancy, required effort during the use of a system, external forces from other people, and the level of infrastructure available to facilitate the use of the system.

Performance expectancy is the level of the user's belief that the system will help him or her attain job performance (Venkatesh et al., 2016). Additionally, the user will increase their intention to use the system if it is easy to use. This means that the system should not require the individual to exert much effort, either cognitively or physically, to accomplish the tasks. Besides, UTAUT theory indicates that social influence is important in making the individual (user) feel good and increasing the level of acceptance and use of the system (Chauhan & Jaiswal, 2016). For example, when the user of the system perceives that other people around him or her know that he or she uses the new technology, this will increase his or her motivation to use the system. Moreover, the individual (user) of the system needs the technical infrastructure to support the use of the system (Venkatesh et al., 2016). For example, modern computers, reliable internet, and stable electricity are among the technical infrastructures that influence the use and acceptance of technology (Mswahili, 2022).

This theory is relevant to this study as it provides insights on the factors that contribute to the usability and acceptability of the system. This study aimed to assess how the usability of the health information system contributes to the quality of healthcare services in Tanzania. Using the UTAUT theory, the study succeeded in finding out how healthcare service practitioners and patients perceived the benefits obtained from the use of technology in improving the quality of healthcare provision.

3.2 Usability of information systems

The system's acceptance and usage depend on various factors, including ease of use, interactivity, and usability (Saleh, Salman, Ali, & Hashim, 2016). Usability is defined as the effectiveness, efficiency, and satisfaction with which specific users can achieve a specific set of tasks in a particular environment (ISO, 2018). To achieve effectiveness, efficiency, and user satisfaction with the use of the health information system, Broekhuis, Velsen, Peute, Halim, and Hermens (2021) suggested usability evaluation factors including basic system performance, task-technology match, accessibility, interface design, navigation and structure, guidance and support, and satisfaction. Other studies that suggest similar factors in different ways include Hyppönen et al. (2019), ISO (2018), and Halim (2019). Other usability factors used in evaluating health information systems include visibility, perceived ease of use, and perceived benefits (Hyppönen et al., 2019; ISO, 2018; and Halim, 2019).

Basic system performance is important in evaluating the usability of the system. Broekhuis et al. (2021) showed that usability issues related to technical performance, such as system errors, response time, and compatibility with other external systems, and usability issues related to general system interaction, such as the use of menus, scroll bars, and the use of the cursor and clicks of the system, contribute to the usability of the system. Additionally, task-technology match is the usability factor that determines how the system incorporates necessary tasks that are required to accomplish the healthcare service process using the system (Broekhuis et al., 2021; ISO, 2018). Correspondingly, the system's accessibility is a crucial factor in determining its usability; thus, if the system is difficult to access, for example, when retrieving patients' data, then its usability will also be difficult. The interface design increases the level of memorability and learnability, thereby increasing the attractiveness and desire to use the system. The ability of the user to navigate from one page to another on the system is also important for determining its usability. Moreover, although the system can be well designed to enable users' independence, the accessibility of the supporting personnel is important so as to provide help when necessary. Furthermore, the satisfaction of the user will increase if the system utility is measurable and the user can perceive the benefit (Hyppönen et al., 2019; Broekhuis et al., 2021).

Moreover, the usability of information systems can be evaluated using various methods, such as inspection, usability testing, inquiry methods, and standardized questionnaires (Kopanitsa, Tsvetkova, & Veseli, 2012; Price et al., 2016). Inspection involves the use of experts to evaluate the system. This method is suitable for identifying interface design issues related to usability during



the development stage. Examples of inspection methods include cognitive walk-throughs and heuristics, and they are cost-effective due to the involvement of only a few experts. Usability testing, on the other hand, involves end users as the primary participants and includes methods such as think-aloud, log file analysis, and remote testing. This approach is advantageous as it is user-based, allowing for opinions based on user perceptions and increasing acceptance once issues are addressed. Additionally, inquiry methods incorporate both experts and users, with examples including questionnaires, focus group discussions, interviews, and observations (Price et al., 2016). The questionnaire is the most commonly used tool in inquiry-based usability evaluations.

Furthermore, there are standardized questionnaires used to assess the usability of various information systems, including the System Usability Scale (SUS), the Post-Study-SUS Questionnaire (PSSUSQ), the After Scenario Questionnaire, the Questionnaire for User Interface Satisfaction (QUIS), and the TeleHealth Usability Questionnaire (TUQ) (Broekhuis et al., 2019). While these standardized questionnaires are commonly used in usability evaluation, some are more specific to a particular system and may not be suitable for assessing the usability of other types of information systems. The system usability scale is the most widely used standardized questionnaire due to its broad applicability compared to others. This study employed a customized questionnaire to ensure that it was in line with the current context of use (i.e., a referral hospital in Tanzania).

4.0 METHODOLOGY

Research approach and design

The study applied both quantitative and qualitative approaches. A quantitative approach was focused on acquiring data that helped in evaluating the usability of the current system, and a qualitative approach was used to acquire the factors that could help in improving the usability of the health information systems at Geita regional referral hospital. Additionally, the study used a case study design, whereas Geita regional referral hospital was selected.

4.1. Study area

The study took place in the Geita region of Tanzania, specifically at the Geita regional referral hospital. The area was chosen because the study aimed to evaluate the usability of health information systems in referral hospitals, with Geita Hospital being one of them. This region is among the most populated (Statista, 2021), making the use of technology in healthcare delivery inevitable. Therefore, it was crucial to assess the usability of the health information system applied there.

Population, sampling technique and sample size

The sample size of 153 participants was obtained from a population of 600 in two groups, including 250 service providers (named SP in Table 1) at Geita Regional Referral Hospital and 350 average daily attendance service recipients (named SR in Table 1). Additionally, 10 participants from experienced service providers were interviewed to acquire insights that could help in improving the usability of health information systems in the Geita regional referral hospital. The study employed probability-stratified simple random sampling selection to obtain an equal representation of both service providers and recipients.

Data analysis

The data were analyzed using both descriptive and thematic analysis methods. The quantitative data employed descriptive analysis using SPSS version 25, while the qualitative data was analyzed using thematic analysis to identify important patterns from the interviews.

5.0 RESULTS OF THE FINDINGS

This study aimed to assess the usability of health information systems in referral hospitals in Tanzania, with Geita Regional Referral Hospital as a case study. Before conducting the usability evaluation, the study sought to determine if the participants were aware of and using the health information system in order to involve them in assessing its usability. The results indicated that 91% of the respondents agreed that Geita Regional Referral Hospital uses health information systems to treat patients. This result provided legitimacy for conducting the usability evaluation study. The results are organized into two sections: findings based on a questionnaire and findings based on interviews.

5.1 Findings from questionnaire

Health information system usability factors that were tested include visibility (i.e., interface colors, menu arrangement), navigation, task-technology match (i.e., does the health information system incorporate all hospitalization functions), ability to generate reports, patients' simplified data retrieval, notification feature, and ability to control queue. The results from the service providers are indicated as SP, and those from the service receivers as SR, as presented in Table 1.



Table 1: Service Providers' Responses for health information system usability

Case #.	Case	Participants category	Service Provider's Responses										Total F(%)
			Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		
			F	(%)	F	(%)	F	(%)	F	(%)	F	(%)	
1	The pictures, icons, links are and color used are visible and information within are readable.	SP	1	1%	2	3%	11	15%	44	59%	16	22%	74 (100%)
2	It is easy to navigate from one page to another on the system and has proper arrangement of the menus.	SP	0	0%	3	5%	18	24%	34	46%	19	25%	74 (100%)
3	The system accommodates all necessary healthcare tasks to accomplish healthcare delivery, and matches with the actual healthcare tasks.	SP	4	5%	16	21%	14	19%	20	27%	20	27%	74 (100%)
4	Users can generate various reports using a system	SP	3	4%	14	19%	15	20%	28	38%	14	19%	74 (100%)
5	The system has ability to give alert/notification for minimum stock level.	SP	12	16%	12	16%	20	27%	21	28%	9	12%	74 (100%)
6	Patients' data retrieval is simplified using health information system	SP	1	1%	5	7%	10	14%	42	57%	16	22%	74 (100%)
		SR	2	3%	5	6%	14	18%	32	41%	26	33%	79 (100%)
7	The system has ability to control patients' queue in every section; hence reduced patients waiting time and complaints	SP	3	4%	12	16%	17	23%	28	38%	14	19%	74 (100%)
		SR	2	3%	11	14%	13	16%	28	35%	25	32%	79 (100%)

i.) The visibility of the interface

This factor was assessed using three items, including the visibility of icons and the attractiveness of the colors used on the system's interface. This factor was assessed using healthcare service providers (i.e., healthcare professionals who interact with the system in their daily activities). The results revealed that the system has satisfactory visibility. The results showed that 81% of participants visualized the icons easily, and the colors used on the interface were neutral. Additionally, the participants perceived that the system has a good menu arrangement, which helps the user easily predict the next steps while performing tasks.

ii.) *The easy of navigation*

The study aimed to evaluate the ease of navigating the health information system interface from one process to another. The results showed that 71% of participants found it easy to move from one page to the next on the interface, and the menus are properly arranged to allow the user to select them easily. This indicates that the system is user-friendly for navigation.

iii.) *Task-technology match*

The study evaluated whether the system fully supports all healthcare processes at Geita Regional Referral Hospital. 54% of respondents confirmed that the health information system is capable of carrying out all hospital functions. Additionally, the findings revealed that 20% of participants neither agreed nor disagreed that the system supports all healthcare processes, while 26% disagreed. These results suggest that while most respondents agreed that the system caters to all healthcare processes, there is a notable percentage of respondents who are uncertain or disagree. This should be addressed as a serious usability issue that requires attention.

iv.) *Ability to generate reports*

Moreover, this study measured whether the system had the ability to generate reports necessary for decision-making. The result showed that 57% of participants agreed that all necessary reports could be generated through the system. However, there is a significant percentage: 20% of participants were not sure whether the system was able to generate the reports, and 23% disagreed that the system could not be able to generate the reports. This indicates that the system might be able to produce reports for some functions and departments while other departments and users cannot. Thus, a thorough investigation is required to rectify the problem and make the system useful.

v.) *Notification for stock level control*

The assessment was performed to find out whether the health information system at Geita Regional Referral Hospital was able to manage the minimum stock level by giving notifications or alerts to respective users such as dispensing, laboratories, and the main store to avoid stock outs that could cause the patients to miss medications and other laboratory services. The result showed that only 40% of participants agreed that the health information system at Geita Regional Referral Hospital could give alerts on the minimum stock level. The results also showed that 60% (i.e., 27% and 33%) of all participants were not sure and disagreed, respectively, that the system is giving notifications to avoid stockouts. This indicates that the alert or notification at Geita Regional



Referral Hospital is either not familiar to a considerable number of users or that they are not aware of the feature.

vi.) Ease to retrieve data

The study also wanted to understand the perceptions of both service providers (SP) and service recipients (SR) on how the system has made it easy to retrieve data, managed queuing, reduced patient waiting time, and managed to reduce complaints. The results showed that 58 (79%) and 58 (74%) of service providers and service recipients, respectively, agreed that the patients' data retrieval process had been simplified. This indicates that HIS's usability is good and has increased efficiency and satisfaction among healthcare professionals and patients at Geita Regional Referral Hospital. This implies that the system is easy to use in terms of retrieving data that was previously stored for decision-making.

vii.) Ability to manage queue

This study also assessed to what extent the existing health information system helps in managing and controlling queues, considering the FIFO algorithm to make patients satisfied on special occasions. The result showed that 33 (45%) service providers and 45 (57%) service recipients, for a total of 78 (51%) of the participants, agreed that the queue of patients is controlled in every section of HIS at Geita Regional Referral Hospital. The findings revealed that the HIS control queue at every point increases HIS usability and effectiveness and meets users' and customers' satisfaction at Geita Regional Referral Hospital, which in turn increases users' performance. However, the study found a significant percentage of the participants who are not satisfied with the control of the queue (i.e., 55% and 43%) of healthcare providers and patients (service recipients) were either not sure or disagree that the system has helped to control the queue. This gives an alert that there is a need for hospital management to assess the cause of this dissatisfaction.

5.2 Findings from unstructured interview

This study also conducted an unstructured interview to acquire opinions from experienced healthcare professionals on the factors that could help in improving the usability of health information systems at Geita regional referral hospital. The study findings showed that regular user training, adequate ICT facilities (e.g., computers), increased availability of ICT support personnel, and ensuring network and internet stability could help in improving the usability of the system and increasing the level of system acceptance. The participants expressed that a lack of training among system users affected usability and reduced their performance. Additionally, participants

mentioned that unreliable networks and the internet negatively impacted the use of the health information system at Geita regional referral hospital. Limited computers and inaccessible ICT support personnel led to avoidable delays in service delivery.

Moreover, interviewees expressed that although the existing health information system at Geita faces some challenges in terms of usability, it has managed to reduce many patients' complaints. This is due to the fact that the system has eliminated many of the manual processes that were tedious for both patients and healthcare professionals. Among the issues that have been solved by the health information system at Geita regional referral hospital are lost or misplaced files, an improper payment system, uncontrolled queues, and long service waiting times. The reduced complaints among patients are an indication of an increased level of satisfaction (Wibowo, 2022).

5.3 Discussions

The usability of information systems is an essential factor for system acceptance and improving quality-of-service delivery (Lubua & Pretorius, 2018). Therefore, regular assessment of the usability of information systems is essential to ensuring the quality of service and increasing the level of acceptance. This study focused on assessing the usability of the health information system in referral hospitals in Tanzania, using the Geita regional referral hospital as a case study. The results of the current study revealed that the majority of the participants agreed that the health information system's usability was of an acceptable level and thus contributed to the improvement of health care service delivery at Geita Regional Referral Hospital. The factors that were used in usability evaluation include visibility, navigation, task-technology match, ability to generate reports, notification for managing stocks, ease of retrieving data, and ability to control queues.

It was revealed that although the participants showed satisfaction to some extent, system developers need to investigate the insights that were revealed in this study. The study revealed that the majority of the participants agreed that the system was visible and easy to navigate from one page to another, and the menu was properly arranged to follow the health care service delivery process. Another factor that was positively perceived was the ease of retrieving data through the system. Khatun (2015) and Mimbi and Bankole (2015) suggest that a system that is easy to navigate, visible, and allows for easy data retrieval leads to greater acceptance and improved service delivery quality.

However, the study found that factors like task-technology match, report generation capability, and stock level management notifications were poorly perceived by participants. Results indicated that



only 40% to 57% of all participants agreed that the system had the necessary functions for healthcare service delivery, report generation, and stock level notifications. The absence of functionalities or the mismatch between the functions within the system and the real-world tasks that are used to accomplish the healthcare goal indicates that users cannot rely on the system only for healthcare service delivery. These findings highlight the need for further investigation into the health information system at Geita regional referral hospital in order for healthcare providers and patients to have confidence in it. According to Topaloglu, Gumussoy, Bayraktaroglu, and Calisir (2012), usability and functionality are interconnected aspects of a system. Therefore, usability is affected if the system lacks essential functions for healthcare processes. Thus, in order to improve the quality of healthcare services at Geita regional referral hospital, all usability insights that were discovered in this study should be addressed effectively.

Moreover, this study revealed that lack of user training, insufficient infrastructure such as computers, lack of ICT support personnel, and poor network and internet stability are the major issues contributing to the poor system usability. These are the external factors that should be rectified to increase the system's usability. Akor, Joshua, and Idika-Mba (2016) suggested that for effective utilization of ICT facilities, there is a need for adequate and reliable electricity supply, a good information system, computers and computer environments, a literate computer population, and technical expertise. In addition to that, the level of awareness among both users and customers is another important factor for increasing the level of usability of health information systems (Okonoko & Eruvwe, 2020; Çallı, Coşkun, & Özşahin, 2019).

6.0 CONCLUSION

The study assessed the usability of the health information system towards the improvement of the quality of healthcare service delivery in regional referral hospitals through a case study of Geita Regional Referral Hospital. The findings of this study revealed that health information system usability has a contribution to make towards improving the quality of healthcare at regional referral hospitals. The usability factors that were positively perceived in the health information system at Geita regional referral hospital include visibility, ease of navigation, and easy retrieval of data. On the other hand, the study revealed that the health information system faces some usability challenges that should be rectified. Among these challenges are a lack of task-technology match, the inability to generate reports for some departments, and the inability to give notifications on the stock level. This study recommends further research on the health information systems at Geita referral regional hospital and other referral hospitals in Tanzania to increase the level of usability

and, hence, the level of acceptance. Trainings among staff, adequate ICT facilities (e.g., computers), increased availability of ICT support personnel, and ensuring network and internet stability could help in improving the usability of the health information system at Geita regional referral hospital, thus increasing the level of system acceptance.

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