



RESEARCH ARTICLE

Adoption of health information systems in emerging economies: Evidence from Ghana

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Abstract

This research aims to assess the implementation of health information systems (HIS) in state-owned hospitals in Ghana, particularly focusing on teaching, regional, district, and quasi-government hospitals. The purpose is to evaluate the HIS application, training, data protection measures, internal system communication within hospitals, and the impact of internet connectivity and electricity supply on HIS adoption. The study employed a quantitative research design. Data were collected through questionnaires from 80 healthcare workers across 10 hospitals in Northern, Middle, and Southern regions. Quantitative data was analyzed using frequencies and percentages. The research revealed that although some hospitals had implemented HIS, there was inadequate training for healthcare workers. While data protection measures were in place, challenges included limited internal system communication, hindering effective HIS operation within hospitals. Additionally, poor internet connectivity and electricity supply hindered HIS usage and adoption. This study contributes by uncovering specific challenges in HIS implementation within Ghanaian hospitals, emphasizing the need for enhanced training, internal system communication, and addressing infrastructure limitations.

Keywords: Health information systems, Interoperability, Healthcare workers, Emerging economies, State-owned hospitals.

Introduction

The global healthcare landscape is undergoing a profound transformation propelled by the escalating integration of digital and networked technologies (Haleem *et al.*, 2023). This transformation has not only facilitated unprecedented connectivity but has also led to a paradigm shift in the way health organizations operate (Amjad *et al.*, 2023). In response to this digital revolution, health systems worldwide are making substantial investments in information systems to enhance efficiency, decision-making processes, and overall service delivery (Bell *et al.*, 2018). At the forefront of this technological wave is the health information system (HIS), an intricate web of interconnected technologies that

has evolved to become a cornerstone in the functioning of health systems globally (Alotaibi & Federico, 2017).

HIS is not merely a repository of health data but an integrated technology designed to generate reliable and timely patient health reports (Dash *et al.*, 2019). Its capacity to analyze information within individual health organizations and seamlessly interact with broader national health systems underscores its pivotal role in shaping the future of healthcare delivery (Abernethy *et al.*, 2022). The acceptance of HIS in health organizations is underscored by its track record of operational reliability and the delivery of precise, timely information, factors deemed essential for effective decision-making in the dynamic landscape of healthcare (Sanjuluca *et al.*, 2022).

To facilitate informed decision-making and efficient service delivery, HIS has been designed to provide health organizations with easy access to reliable, accurate, and secure patient records (Adane *et al.*, 2019; Alotaibi & Federico, 2017; Mutale *et al.*, 2013; Paul *et al.*, 2023). Despite the proven benefits of HIS in many developed countries, its implementation in developing nations, including Ghana, has been haphazard and fragmented, often driven by external pressures (Azevedo, 2017). The challenges are compounded by the division of health data among different ministries focused on specific diseases, leading to inefficiencies and overburdening health workers (Rumisha *et al.*, 2020). The existing manual filing system in some Ghanaian hospitals

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poses obstacles to timely and convenient record retrieval, while the computerized systems, if not well-designed, may require reassessment and re-implementation.

The central issue addressed by this research is the suboptimal performance of HIS at the national and regional levels in developing countries, with evidence suggesting below-average success rates (Stansfield *et al.*, 2006). The fragmented nature of HIS and the challenges associated with data quality, timely reporting and feedback, efficient information use, and system relevance further exacerbate the issues faced by Ghanaian health workers (Bagyendera *et al.*, 2023). This research seeks to address these problems by conducting a comprehensive assessment of the HIS in the Ghanaian health services. The assessment will focus on the fragmented sub-health systems, data quality, timely reporting and feedback, efficient information use, and the relevance of HIS. The ultimate goal is to provide healthcare professionals with recommendations and a proposed framework to enhance the efficient utilization of HIS, thereby contributing to the overall improvement of the healthcare system in Ghana.

Research Questions

The primary focus of this research is encapsulated in the main research question:

RQ1: How can the assessment of the HIS be leveraged to enhance the delivery of healthcare services in resource-constrained environments in Ghana?

RQ2: What are the current strengths and weaknesses of Ghana's HIS?

RQ3: What are the ideas, concerns, and expectations of health workers in Ghana regarding regional HIS for both administrative and clinical support?

RQ4: How can the outcomes derived from the HIS assessment be effectively utilized to formulate a strategic HIS framework supporting both administrative and clinical processes in hospitals?

Objectives

RO1. To evaluate the effectiveness of the HIS employed by various types of hospitals in Ghana, including teaching, regional, district, and quasi-government hospitals, to improve healthcare service delivery in resource-constrained environments.

RO2. To evaluate the existing strengths and weaknesses of the HIS currently implemented in hospitals across Ghana.

RO3. To investigate the perceptions and ideas of healthcare professionals regarding the utilization of HIS for both administrative and clinical work processes.

RO4. To utilize the recommendations provided by health workers to formulate a strategic HIS framework. This framework will be designed to enhance administrative and clinical work processes, ultimately supporting hospitals in their delivery of healthcare services.

Significance of the Study

The significance of this study lies in its potential to catalyze transformative improvements in healthcare delivery within Ghana. By systematically assessing the challenges and shortcomings in the implementation of HIS in state-owned hospitals, the research sheds light on critical areas of concern, ranging from limited training for healthcare workers to obstacles in internal system communication. Addressing these issues is paramount as it directly impacts the efficiency, accuracy, and confidentiality of patient data management.

Literature Review

Health Information Systems

The HIS plays a pivotal role in modern healthcare delivery, contributing to the efficient management of health data, patient records, and overall healthcare processes (Adane *et al.*, 2019). HIS encompasses a broad range of technologies, processes, and tools designed to collect, store, manage, and transmit health-related information (Annamalai *et al.*, 2023). These systems can include electronic health records (EHRs), facility-based registry systems, and community recording systems (Aliabadi *et al.*, 2020). The implementation of HIS has been recognized globally as a transformative approach to enhance healthcare delivery, streamline administrative processes, and improve patient outcomes (Annamalai *et al.*, 2023).

The evolution of HIS can be traced back to the manual recording of patient data and healthcare processes (Bouayad *et al.*, 2017). Over time, technological advancements led to the development of electronic systems, such as EHRs, to digitize and centralize health information (Paul *et al.*, 2023). The integration of these systems into healthcare practices has been associated with improved efficiency, accuracy, and accessibility of health data.

Globally, the adoption of HIS has demonstrated significant benefits in healthcare delivery (Popescu *et al.*, 2022). Improved patient outcomes, streamlined administrative processes, and enhanced data management are among the advantages witnessed in other countries (Annamalai *et al.*, 2023). The exploration of these benefits sets the stage for understanding the potential impact of HIS on healthcare in Ghana (Yusif *et al.*, 2020). In the context of Ghana, the GHS serves as the primary organization overseeing healthcare delivery (McCarthy *et al.*, 2023). Understanding the organizational structure and service delivery mechanisms within the GHS is essential for evaluating the adoption and effectiveness of HIS at both national and local levels (Kushitor *et al.*, 2023).

HIS Adoption in Developing Countries

Developing countries face unique challenges in implementing and maintaining effective HIS (Koumamba

et al., 2021). Limited financial and infrastructural resources, ambiguity in policy development, and the absence of skilled personnel are common hurdles (Bogaert *et al.*, 2021). Regional and district integration pose additional challenges, making it imperative to explore these issues in the specific context of Ghana (Ampomah *et al.*, 2023).

Extant literature suggests various factors that influence the adoption of HIS (Yusif *et al.*, 2020). Financial considerations, lack of training, security and confidentiality concerns, anxiety among healthcare workers, and the absence of standardized practices are critical determinants (Talwar *et al.*, 2023). These factors are particularly relevant in developing countries, where resource constraints and diverse healthcare settings contribute to the complexity of HIS adoption. Understanding the perspectives of health workers is crucial in assessing the adoption of HIS (Addotey-Delove *et al.*, 2023). Health workers' ideas, concerns, and expectations regarding HIS provide valuable insights into the challenges and opportunities associated with system implementation (Mumtaz *et al.*, 2023). Factors such as the advantages and disadvantages of HIS contribute to shaping health workers' attitudes toward these systems (Edo *et al.*, 2023).

The advantages of HIS include financial motivations for medical providers, faster documentation, easy access to information, time-saving features, accurate billing, and its potential as a preventive health tool (Dash *et al.*, 2019). However, challenges such as security risks, unauthorized data access, issues arising from outsourcing, irregular updates, the unavailability of devices, expensive implementation, staffing concerns, and the type of HIS implementation sourced can impede the seamless adoption of these systems (Alenoghena *et al.*, 2022). The need for further investigation in the Ghanaian context is evident to tailor HIS implementation strategies to the specific challenges and opportunities within the country's healthcare landscape (Kesse-Tachi *et al.*, 2019).

The adoption of HIS in developing countries is a complex process influenced by various factors. This study draws on several theoretical frameworks to provide a comprehensive understanding of HIS adoption in this context. The technology acceptance model (TAM) suggests that users' perceptions of technology's ease of use and usefulness significantly impact its adoption. In the context of HIS adoption in developing countries, TAM helps formulate hypotheses related to healthcare professionals' attitudes and beliefs about the technology (Nguyen *et al.*, 2020). Institutional theory emphasizes the role of institutions and societal norms in shaping organizational behavior. It helps to understand how external pressures and institutional forces influence the adoption of HIS in developing country settings where healthcare infrastructure and policies play a crucial role (Sherer *et al.*, 2016). Diffusion

of innovations (DOI) focuses on the process through which innovations spread within a social system. HIS adoption can be analyzed using DOI to explore how innovations diffuse among healthcare professionals and organizations in developing countries (Zhang *et al.*, 2015).

Hypotheses Development

Technology adoption theories

In the context of developing countries, the adoption of HIS is influenced by a complex interplay of technological, organizational, and contextual factors. Several theoretical perspectives contribute to understanding HIS adoption in these settings. Institutional theory posits that societal norms, regulations, and practices influence organizations. In the adoption of HIS in developing countries, institutions such as government policies, healthcare regulations, and cultural norms play a crucial role. Hospitals and healthcare organizations may embrace HIS to conform to institutional expectations and norms (Burnett *et al.*, 2016). Innovation diffusion theory (IDT) suggests that innovations spread through a social system over time. In the healthcare context of developing countries, this theory helps to understand how HIS innovations diffuse among healthcare professionals and organizations. Factors such as communication channels, leadership influence, and the perceived benefits of HIS contribute to its diffusion (Zhang *et al.*, 2015). Unified theory of acceptance and use of technology (UTAUT) integrates several technology adoption models and identifies key determinants of technology acceptance, including performance expectancy, effort expectancy, social influence, and facilitating conditions. Applying UTAUT to HIS adoption in developing countries helps formulate hypotheses related to healthcare professionals' perceptions and organizational support (Schretzlmaier *et al.*, 2022).

The HIS forms the backbone of modern healthcare, integrating technology, information management, and healthcare services. The theoretical foundation of this study draws on three key theoretical frameworks: Actor-network theory (ANT), innovation diffusion theory (IDT), and the technology acceptance model (TAM) as shown in Figure 1. The ANT emphasizes the interconnectedness and relationships between various actors or elements within a system. In the context of HIS, it underscores the symbiotic relationship between human actors (healthcare staff) and the technological elements of the system. This theory guides the understanding that successful HIS implementation requires a harmonious interaction between the healthcare workforce and the technology (Cresswell *et al.*, 2010). The IDT explores the process through which innovations, such as HIS, are adopted and diffused within a social system. In the healthcare setting, it helps to comprehend how different healthcare professionals embrace and incorporate HIS into their daily practices.

Factors like training, skills, and organizational support play a crucial role in the diffusion process (Anwar, 2020). On the other hand, the technology acceptance model (TAM) focuses on individuals' acceptance and use of technology. In the context of HIS, it helps formulate hypotheses related to healthcare workers' attitudes and perceptions towards the system. Perceived usefulness, ease of use, and other TAM constructs guide the development of hypotheses regarding the adoption and utilization of HIS (Nguyen *et al.*, 2020).

The study hypothesizes that a positive and symbiotic interaction between healthcare staff and HIS technology, as emphasized by ANT, will positively influence the acceptance and utilization of the system. Following the principles of IDT, it is hypothesized that healthcare professionals at different stages of innovation adoption will exhibit varying levels of readiness and enthusiasm for HIS adoption. Drawing from TAM, the study proposes that perceived usefulness and ease of use will significantly impact healthcare workers' attitudes and intentions toward adopting and using HIS.

Conceptual model for the present study

The conceptual model for the present study is designed to illustrate the multifaceted factors influencing the adoption of HIS in the healthcare context of developing countries. The model integrates key theoretical perspectives, emphasizing the interplay between institutional, communication, and technology acceptance factors.

Institutional Factors

Government policies and regulations

The model incorporates the influence of governmental policies and regulations, representing the institutional environment shaping healthcare organizations' decisions to adopt HIS. Compliance with these policies is a critical determinant.

Cultural norms and expectations

Cultural factors within the society and healthcare community are considered, acknowledging that the alignment of HIS with cultural norms enhances its acceptance and integration into routine practices.

Communication Factors

Leadership influence

Effective leadership communication is highlighted as a key factor influencing the diffusion of HIS. Strong leadership support and advocacy contribute to the successful adoption of health technologies.

Peer networks

Communication channels among healthcare professionals, including peer networks, are integrated. The model recognizes the role of peer influence and knowledge-sharing in fostering a positive environment for HIS adoption.

Technology Acceptance Factors

Performance expectancy

Building on the UTAUT, the model includes performance expectancy as a central factor. Healthcare professionals' perceptions of HIS enhancing their performance positively contribute to adoption.

Organizational support

UTAUT emphasizes the significance of organizational support. The model incorporates the provision of resources, training, and support from healthcare organizations as essential elements influencing the acceptance and use of HIS.

HIS Adoption Outcome

Adoption levels

The outcome in the model is the varying levels of HIS adoption within healthcare organizations. The interplay of institutional, communication, and technology acceptance factors influences this outcome.

Hypothesis

Extent of HIS training and effectiveness of applications

H0: There is no significant association between the extent of HIS training provided to healthcare workers and the effectiveness of HIS applications in state-owned hospitals in Ghana.

H1: There is a significant association between the extent of HIS training provided to healthcare workers and the effectiveness of HIS applications in state-owned hospitals in Ghana.

Protection and confidentiality of patients' data

H0: There is no significant relationship between the level of protection and confidentiality of patients' data and the perception of healthcare workers regarding the safety of HIS in state-owned hospitals in Ghana.

H1: There is a significant relationship between the level of protection and confidentiality of patients' data and the perception of healthcare workers regarding the safety of HIS in state-owned hospitals in Ghana.

Internal communication among HIS systems

H0: There is no significant impact of the lack of internal communication among different HIS systems within hospitals on the effectiveness of HIS operations in state-owned hospitals in Ghana.

H1: There is a significant impact of the lack of internal communication among different HIS systems within hospitals on the effectiveness of HIS operations in state-owned hospitals in Ghana.

Data sharing and access across healthcare facilities

H0: There is no significant association between the inability of hospitals to share data and the limited access to patient information across different healthcare facilities in Ghana.

H1: There is a significant association between the inability of hospitals to share data and the limited access to patient information across different healthcare facilities in Ghana.

Impact of infrastructure limitations on HIS usage

H0: There is no significant correlation between poor internet connectivity and electricity supply and the limitations in the usage and adoption of HIS in state-owned hospitals in Ghana.

H1: There is a significant correlation between poor internet connectivity and electricity supply and the limitations in the usage and adoption of HIS in state-owned hospitals in Ghana.

Research Methodology

In conducting this research, the quantitative approach was employed to comprehensively assess Ghana's HIS. The quantitative facet involved utilizing a meticulously validated survey questionnaire to gauge the perceptions of stakeholders actively engaged in HIS management and planning. This structured approach sought to provide a quantitative understanding of the system's dynamics and was distributed among health planners and managers. Given resource constraints, a purposeful sampling technique was employed to identify participants within the sampling frame who could offer valuable insights into HIS adoption in Ghanaian hospitals. Convenience sampling facilitated the recruitment of 80 study participants, ensuring representation from key roles such as administrative officers, doctors, nurses, and health information officers.

Recommendations derived from the study findings were crafted to inform potential reforms, not only within the HIS but also to contribute to improvements in the broader health system. In essence, this comprehensive research methodology facilitated a balanced exploration, leveraging both quantitative precisions and ultimately providing valuable insights for enhancing Ghana's HIS and associated healthcare services.

Statistical Analysis

The research analysis comprised of survey analysis. The survey data were analyzed to explore health workers' ideas,

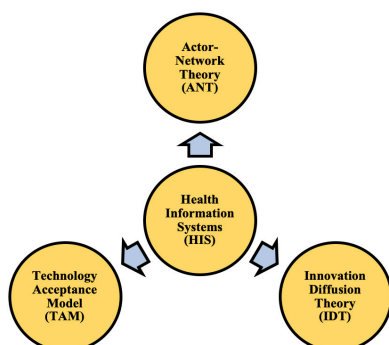


Figure 1: Theoretical framework of health information systems

concerns, and expectations regarding HIS. Descriptive statistics, including frequency tables, means, and standard deviations, were used to analyze the survey data. The research prioritized quantitative findings related to respondent characteristics, computer skills, and perceptions of the HIS.

Study Site

This study involved the selection of 10 hospitals across four regions of Ghana. These hospitals included:

- Korle-Bu Teaching Hospital, Greater Accra Regional Hospital
- Police Teaching Hospital, Mamprobi Poly Clinic
- The Trust Hospital Limited (from Greater Accra)
- Tamale Teaching Hospital (from Northern Region), Cape Coast Teaching Hospital
- Dunkwa Municipal Hospital (from Central Region)
- Komfo Anokye Teaching Hospital and Agogo Presbyterian Hospital (from Ashanti Region)

The data collection for this study was conducted among parents affiliated with these selected hospitals.

Results

Assessment of Staff Characteristics

In the medical doctor category, 75% were male ($n = 15$), and 25% were female ($n = 5$). The age distribution showed 35% in the 30 to 39 years bracket, with equal representation (25%) in the 40 to 49 and 50 years and above brackets; 15% fell within 21 to 29 years. Junior Medical doctors constituted 65%, while physicians were 35%. The Medical Department employed 50% of doctors, and one each worked in anesthesia, outpatients, and accident & emergency departments. Among nurses, 85% were female ($n = 17$), and 40% worked in the Medical Department. The majority (60%) fell within the 30 to 39 years age bracket. These findings mirror certain trends in the Ghanaian medical sector. Traditionally, the medical doctor profession is characterized by a male majority, while nursing is predominantly female. Notably, there is a gradual rise in the number of males entering the nursing profession and conversely, an increasing presence of females in the medical doctor field. Additionally, a substantial proportion of both medical doctors and nurses fall within the 30 to 39 years age range and are primarily stationed in the medical departments of the healthcare facilities surveyed (Table 1).

Assessment of Staff HIS Exposure

Most administrative workers represented for the study were identified as female ($n = 11, 55%$) whilst the health information professionals were heavily represented by the male gender ($n = 17, 85%$). The majority of these professionals fell within the 30 to 39 years of age bracket (*Administration = 65%; Health Information = 55%*). Administrative Managers

Table 1: Descriptive statistics for doctors and nurses of the 10 hospitals

Characteristics		Categories	
		Doctors	Nurses
		Frequency (%)	Frequency (%)
Gender	Male	15 (75.0)	3 (15.0)
	Female	5 (25.0)	17 (85.0)
Age (yrs.)	21–29	3 (15.0)	6 (30.0)
	30–39	7 (35.0)	12 (60.0)
	40–49	5 (25.0)	2 (10.0)
	≥50	5 (25.0)	-
Status doctor	Physician	7 (35.0)	-
	Junior medical	13 (65.0)	-
Department	Medicine	10 (50.0)	8 (40.0)
	Obstetrics/ Gynaecology	2 (10.0)	-
	Anesthesia	1 (5.0)	-
	Surgery	3 (15.0)	3 (15.0)
	Dental	2 (10.0)	-
	Public health unit	-	1 (5.0)
	Outpatient	1 (5.0)	6 (30.0)
Accident and emergency		1 (5.0)	(10.0)

Source: Field Data

Table 2: Descriptive statistics for administrative and health information professionals

Characteristics		Categories	
		Administration	Health information
		Frequency (%)	Frequency (%)
Gender	Male	9 (45.0)	17 (85.0)
	Female	11 (55.0)	3 (15.0)
Age (yrs.)	21–29	3 (15.0)	3 (15.0)
	30–39	13 (65.0)	11 (55.0)
	40–49	3 (15.0)	6 (30.0)
	≥50	1 (5.0)	-
Status	Manager	9 (45.0)	6 (30.0)
	Staff/Officer	11 (55.0)	14 (70.0)

Source: Field Data

were 45% represented whilst HIS managers were 30%. This meant that more of the representation of these two categories were represented by staff and officers (Table 2).

Perceptions of Staff on HIS

The majority of respondents (73.8%) expressed satisfaction with the current HIS, citing contentment with storage, processing, security, time-saving, and confidentiality aspects, while 26.2% held differing views. Regarding the accuracy and completeness of patient health information recording, 66.3% of respondents endorsed its efficacy, with 32.5% expressing reservations. Participants' confidence in the security of their stored information on the HIS was notable, as 88.8% perceived it to be secure. A minority (11.2%) harbored doubts. The quality and format for sharing information among healthcare professionals were deemed effective and user-friendly by the majority (82.5%) of respondents, with 17.5% expressing contrary opinions. Finally, all participants unanimously recognized the benefits and utility of the HIS system for recording, sharing, storing, and transferring patient health information within their respective hospitals (Table 3).

Assessment of HIS Features

Respondents were tasked with providing ratings for each feature on a comprehensive 5-point scale, allowing them to express their perspectives, ranging from 1 (very good) and 2 (good) to 3 (satisfactory), 4 (unsatisfactory), and 5 (poor). This multifaceted evaluation aimed to capture nuanced insights into the effectiveness and user experience of the HIS, acknowledging the pivotal role of health workers in shaping the assessment (Table 4).

The analysis of responses unveiled diverse perceptions among health workers regarding the key attributes of the HIS. A notable 42.5% of respondents, constituting the majority, deemed the relevance of their HIS to be good, with an additional 35% expressing a very good perception. However, a singular respondent found it unsatisfactory. Evaluating timeliness, 41.5% perceived it as good, while 3%

Table 3: Summary of descriptive statistics of HIS exposure

HIS exposure	Response (%)		
	Yes	No	Both
Use ICT system to collect/record patient health information	80 (100.0)	-	-
Basic ICT infrastructure for rapid compilation at hospital	80 (100.0)	-	-
Satisfied with confidentiality of HIS system at hospital	59 (73.8)	21 (26.2)	-
HIS system provides accurate and complete information	53 (66.3)	26 (32.5)	1 (1.2)
Perceived secure nature of HIS system	71 (88.8)	9 (11.2)	-
Quality and effective ease of use of HIS system	66 (82.5)	14 (17.5)	-
HIS system is beneficial to the hospital	80 (100.0)	-	-

Source: Field Data

Table 4: Summary of descriptive analysis of health professionals' perception on the features of their HIS

Features	Very good	Good	Satisfactory	Unsatisfactory	Poor
Relevance	28 (35.0)	34 (42.5)	17 (21.3)	1 (1.2)	-
Timeliness	17 (21.3)	33 (41.5)	24 (30.0)	3 (3.6)	3 (3.6)
Accuracy	17 (21.3)	36 (45.0)	19 (23.7)	4 (5.0)	4 (5.0)
Availability	20 (25.0)	31 (38.8)	24 (30.0)	5 (6.2)	-
Accessibility	22 (27.4)	33 (41.5)	18 (22.4)	6 (7.5)	1 (1.2)
Confidentiality	25 (31.3)	29 (36.3)	14 (17.5)	9 (11.3)	3 (3.6)
Observability	46 (57.5)	24 (30.0)	9 (11.3)	1 (1.2)	-
Compatibility	40 (50.0)	30 (37.7)	5 (6.2)	2 (2.5)	3 (3.6)
Interoperability	-	-	-	-	80(100)

Source: Field data.

Table 5: Summary of descriptive analysis on perception of health professionals on the functioning of their HIS

Functions	Very good	Good	Satisfactory	Unsatisfactory	Poor
Data collection	24 (30.0)	44 (55.0)	8 (10.0)	3 (3.8)	1 (1.2)
Data transmission	15 (18.8)	39 (48.8)	19 (23.7)	5 (6.2)	2 (2.5)
Data processing	11(13.7)	39 (48.8)	24 (30.0)	4 (5.0)	2 (2.5)
Data storage	27 (33.7)	28 (35.0)	16 (20.0)	7 (8.8)	2 (2.5)
Information retrieval	20 (25.0)	27 (33.8)	17 (21.2)	12 (15.0)	4 (5.0)

Source: Field data

considered it unsatisfactory and poor. The accuracy of the HIS garnered positive reviews, with 45% indicating a good perception, although 3% each deemed it unsatisfactory and poor. Regarding availability, 38.8% perceived the HIS as satisfactory. Assessing accessibility, 41.5% considered it good, and an appreciable 36.3% affirmed the system's sound confidentiality. Furthermore, the analysis revealed that a substantial 57.5% of health workers endorsed the HIS for its excellent ability to make data readily available for monitoring. Half of the respondents (50%) found the HIS to be very compatible, while a unanimous 100% stated dissatisfaction with its interoperability. This nuanced examination provides a comprehensive understanding of health workers' varied perspectives on the HIS attributes, shedding light on areas of strength and potential improvement.

Assessment of HIS Functions

This assessment encompassed an exploration of HIS roles across five pivotal themes: data acquisition, data transfer, data processing, data storage, and retrieval. To gauge the effectiveness of these characteristics, respondents were tasked with rating each aspect on a nuanced 5-point scale, where 1 denoted "very good," 2 represented "good," 3 reflected "satisfactory," 4 indicated "unsatisfactory," and 5 signified "poor." This systematic evaluation allowed for a comprehensive understanding of the HIS functionalities, enabling a nuanced analysis of its strengths and areas requiring potential enhancement within the diverse

healthcare contexts of the surveyed health facilities (Table 5).

A predominant proportion of the respondents (55%) expressed that the data collection function of their HIS is deemed good, while a minimal 5% considered it unsatisfactory and poor. The data transmission function garnered positive perceptions from 48.8% of the respondents, with an additional 18.8% perceiving it to be very good, while 8.8% viewed it as unsatisfactory and poor. The majority of respondents held a favorable view of the data processing function, categorizing it as very good and good, while a modest 7.5% found it unsatisfactory and poor. Moreover, 68.8% emphasized the efficacy of data storage in their HIS, rating it as very good and good, although 11.3% perceived it as unsatisfactory and poor. The information retrieval aspect of the HIS received positive evaluations from the majority, marked as very good and good, yet 20% of respondents indicated dissatisfaction, labeling it as unsatisfactory and poor. Despite the prevalent positive perceptions, noteworthy pockets of respondents identified aspects where improvements could enhance the overall effectiveness of their HIS.

Discussion

The study aimed to assess the perception of HIS influence, effectiveness, and acceptance among Ghanaian health workers, identifying strengths and vulnerabilities. Data was collected from different regions through a quantitative approach, using surveys.

Quantitative findings showed varying demographics and exposure levels to electronic health systems. While participants expressed satisfaction with HIS confidentiality, they noted challenges like power supply issues and inadequate logistics. Interoperability issues were highlighted, hindering effective HIS operation in hospitals.

Strengths of HIS were identified as accessibility, user-friendliness, data storage, and information retrieval. Weaknesses included time consumption, confidentiality concerns, and interoperability issues. Recommendations included increased sensitization, training, reliable power supply, and robust policies to enhance HIS.

The findings supported existing literature, highlighting issues such as limited resources, lack of training, and security concerns as barriers to successful HIS implementation. The study emphasized the importance of a balanced HIS, considering user characteristics, system features, and functions for effective integration.

Conclusion

This study on HIS adoption in Ghana utilized a quantitative design, involving health staff from ten hospitals. The design proved suitable, considering the pragmatic grounding and the necessity of both quantitative and qualitative data. The unit of analysis, focusing on geographical location and health workers, provided a comprehensive view, ensuring representation from various zones and professionals.

The collected data using questionnaires captured the contextual complexity within diverse hospital settings. The analysis revealed challenges in HIS adoption, including limited utilization of electronic systems, the absence of a doctor-patient interface, and interoperability issues. Also, concerns were raised about implementation challenges, necessitating a comprehensive implementation guideline.

The study contributes theoretically by integrating the actor-network theory, innovation diffusion theory, and technology acceptance model, forming an integrated model for the revised health information system framework assessment. This underscores the symbiotic relationship between staff and technology, emphasizing variables such as staff characteristics, HIS features, functions, and the symbiotic bond between users and technology.

Practically, the research addresses challenges in Ghana's healthcare environment, offering a step-by-step implementation method. Overall, the study provides valuable insights for improving health information systems in developing countries, particularly in the Ghanaian context.

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APPENDIX

A1 -Letter of permission from The Trust Hospital



HOSPITALS & CLINICS
CONTACTS & LOCATIONS

HOSPITALS

Trust Hospital - Osu
Oxford Street
Osu.
Tel: 0302761974-9

Trust Specialist Hospital
Angola Road
Osu Kuku Hill
Osu.
Tel:

Trust Mother and Child Hospital
Troas Crescent
Osu.
Tel:

CLINICS

Trust Clinic - Tema
SSNIT Building
Community 2
Tema.
Tel: 0303212292

Trust Clinic - Sakumono
Opposite Tennis Court
Sakumono.
Tel: 0303403861-2

Trust Clinic - Adenta
Adenta Shopping Mall
Adenta.
Tel: 0302949600

Trust Clinic - Dome
Dome SSNIT Flats
Dome.
Tel: 03022433133
0302433111

Trust Clinic - Dansoman
Housing Estates
Dansoman.
Tel:

Trust Clinic Pension House
Pension House
Car Park.
Tel:

THE TRUST HOSPITAL COMPANY LIMITED

PMB 16
MINISTRIES, ACCRA
TEL: 0302761974-9

Fax: 0302777790
Loc. Oxford Street: Osu, Accra, Ghana

TO : Amanda Quist
Cc : Prof. Alfred Coleman
FROM : Kenneth K. Azumah
DATE : September 7, 2020
SUBJECT : **Expert Review**

The proposed Revised Health Information System Framework(R-HIS-F) for creating and managing a national EHR appears to be well-reasoned and supported by initial analyses of surveyed environment. The work laying out a framework for a national database hosted in the cloud is a significant contribution to efforts of Ghana Health Service to make health records conveniently available to clinicians and specialists. Adding a financing model will make the framework generally stronger, acceptable and more useful to similar developing economies.



Kenneth K. Azumah
Hospital Information Systems Manager

A1 -Letter of permission from the Ghana Health Service**GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE**

*In case of reply the
number and date of this
Letter should be quoted.*



MyRef. GHS/RDD/ERC/Admin/App
Your Ref. No. 19/1593

Research & Development Division
Ghana Health Service
P. O. Box MB 190
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Tel: +233-302-681109
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Email: ethics.research@ghsmai.com

24th October, 2019

Amanda Quist Okronipa
Ghana Technology University College
Private Mail Bag 100
Accra-North

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

GHS-ERC Number	GHS-ERC 003/09/19
Project Title	Assessment of Health Information System Adoption: A Case study of Ghana Health Service
Approval Date	24 th October, 2019
Expiry Date	23 rd October, 2020
GHS-ERC Decision	Approved

This approval requires the following from the Principal Investigator

- Submission of yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report after completion of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.
- Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....

Dr. Cynthia Bannerman
(GHS-ERC Chairperson)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra