

Information Security Management Systems (ISMS) on patient information protection within the healthcare industry in Oyo, Nigeria

Adebola Folorunso

Capella University Minneapolis USA

folorunsoadebola25@gmail.com

Abstract: This empirical study explores the impact of Information Security Management Systems (ISMS) on patient information protection within the healthcare industry in Oyo, Nigeria. The research specifically examines three key components of ISMS: regular staff training, access controls, and encryption of patient data, to assess their effectiveness in safeguarding sensitive patient information. A descriptive survey research design was employed, involving a sample of 250 healthcare professionals from various public and private healthcare facilities across Oyo State. Data were collected using structured questionnaires, and the analysis was conducted using Pearson Product-Moment Correlation and multiple regression techniques to determine the relationship between the ISMS components and patient information protection. The findings reveal a significant positive correlation between regular staff training and patient information protection ($r = 0.65$, $p < 0.01$), emphasizing the importance of ongoing training in enhancing security protocols. Access controls exhibited a strong correlation ($r = 0.78$, $p < 0.01$), underscoring the necessity of restricting data access to authorized personnel. Encryption practices also emerged as a significant predictor of information protection ($r = 0.55$, $p < 0.001$). Collectively, these ISMS components accounted for 78.0% of the variance in patient information protection ($R^2 = 0.780$). In conclusion, the study underscores the critical role of a comprehensive Information Security Management System in protecting patient information within the healthcare sector. It recommends the continuous implementation of regular staff training, stringent access controls, and advanced encryption techniques to enhance the overall security of patient data in healthcare facilities in Oyo, Nigeria.

Keywords—information; security management; patient information; healthcare industry; Nigeria

1. INTRODUCTION

Health is generally believed to be wealth statutorily provided to citizens to support them. Hospitals are those institutions that deal with life and health of their patients generally and in specific terms offered by doctors. Good medical care relies on well-trained doctors and nurses and on high-quality facilities and equipment. Good medical care also relies on good record keeping. Without accurate, comprehensive up-to-date and accessible patient case notes, medical personnel may not offer the best treatment or may in fact misdiagnose a condition, which can have serious consequences. Good records care also ensures the hospital administration runs smoothly unneeded records are transferred or destroyed regularly; keeping storage areas clear and accessible; and key records can be found quickly, saving time and resources. Records also provide evidence of the hospital accountability for its actions and they form a key source of data for medical research, statistical reports and health information systems [1].

Records management according to [2] is the systematic and consistent control of all records in which they are held throughout their lifecycle. Where: Systematic Records need to be managed in a planned and methodical way; Consistent approach Records of the same kind should be managed in the same way. Whether electronic or paper, the management of the record must be consistent; Consistency over time Managing records is always vital whether resources are adequate or scarce; Control Organisations need to control how

records are produced, received, organised, registered, stored and retrieved, retained, destroyed or permanently preserved and All Records that includes all documents, active and inactive, formal ones and informal regardless of the medium in which they are held. is the systematic and consistent control of all records throughout their lifecycle [1].

The art of preservation and management of health records is an issue that has generated series on concern overtime. This is so because of its role in supporting medical care as well as a platform for monitoring the health history of patients. Many writers have argued that such effort is a basis for referral service and improved medical care delivery. It is therefore necessary to probe into some constraints that forestall the availability of health records in hospitals and suggest some necessary steps to the hospital managers on how to enhance its improvement. Unfortunately, many low-income countries, however, have struggled to initiate large-scale electronic medical record systems. While some low-income countries have been able to attract technical and financial resources to install patient information systems at some sites, these require significant investments for their successful implementation. In fact, these systems require abundant resources including skilled labour, technological, and financial means, all of which can be difficult to procure in low-income settings [3]. The high income countries and few of the low income countries have adopted the technology herein called information and technology into the field of health information management.

The introduction of information and technology into the field of health information management has attracted different names which have been used synonymously, although with slight differences, over the years; Electronic Health Record (E.H.R.), Electronic Medical Record (E.M.R.), Computer-based Patient Record (C.B.P.R.), Hospital Information System (HIS), Electronic Health Management Information System (E.H.M.I.S.) and Information Security Management Systems (ISMS) among others (Nicholas, et al, 2023). Information Security Management Systems (ISMS) is a special System for managing electronic health information of patients and is essential for improving access to and administration of medical data [4]. Healthcare organisations worldwide acknowledge the value of investing in information technology as a cost-effective way to deliver high-quality care through quick information retrieval and effective data management. Studies have demonstrated that the traditional paper-based health information system may be replaced with flexible electronic methods thanks to the development of information technology, which will result in lower costs and more efficient and timely delivery of healthcare services [4], [5].

The effectiveness of a reliable system of health information management such as Information Security Management Systems (ISMS) cannot be overemphasized in achieving quality health care in Nigeria; this is because when memory forgets or fails the owner, he or she turns to the recorded facts and figures. After all, accurate and relevant records remind when memory forgets or fails. Hence, the centrality of the framework for managing patient information in every health facility cannot be overemphasized [6]. Therefore, measuring the health information management system is significant to the overall performance of a healthy population care system in any nation. Managing the health information system connects health care practitioners with information technology, and it represents a bridge between health information provided to patients and to the health care insurers. The patient records administrators are responsible for handling vital health information as a health care team member in the hospital. They prepare and build information systems for health which comply with accreditation and regulatory standards. These professionals often model health information systems necessary for the various sizes and types of health care facilities [7].

Despite the places of Information Security Management Systems (ISMS), the patient information protection within the healthcare industry in Oyo, Nigeria still suffers. Observably, certain information security management system seem to influence patient information protection, such as regular staff training [8], access controls [8], and encryption of patient data [8].

Regular staff training is a crucial predictor of patient information protection. [8] investigated the relationship

between training, work environment and service delivery of health information management (HIM) professionals in special hospital Akure, Ondo State. The study used both descriptive survey and correlational survey. The inferential statistical tool used is Pearson Product Moment Correlation Coefficient. The findings of the study revealed that HIM professionals in the State Specialist Hospital do often go for training on an average level but on and off-the-job training programme provided by the State Specialist Hospital for their HIM professionals is poor. The study also revealed that the work environment of the hospital is moderately conducive. It is revealed by the study revealed that the State Specialist Hospital service delivery is highly satisfactory. The study also demonstrated a very favorable correlation between HIM service delivery at the State Specialist Hospital, work environment, and training. In summary, there is no significance to this link. The study suggested that the government create infrastructures that would continue to improve the service delivery of HIMs, and that hospital administration should give HIM professionals with high-quality training and skilled trainers on a timely basis.

Also, [9] reported that the goal of training in any organization is to develop the capacity required to raise employee performance and help the organization accomplish its goals. This demonstrates how crucial training is to an organization's ability to maximize employee potential and enable them to perform their duties effectively and efficiently.

[10] evaluated the Routine Health Information System (RHIS) in Oyo state. The study used a questionnaire-based assessment and key informant interviews of staff of the HMIS unit in Oyo SMOH and the health department of five selected LGAs. A total of six management assessment questionnaires were administered to the HMIS/Monitoring and Evaluation (M&E) officers at the state (one individual) and LGA (five individuals) level. Key informant interviews were also held with representatives from state and LGA HMIS offices. The findings showed that the HMIS is partly functional in three of the five LGAs visited; the exceptions are Egbeda and Atiba. The three LGAs submit data on paper. Among the LGAs assessed, Ibadan North-East, Atiba, and Ogbomosho North each have one functional computer. Internet service is not available in any of the LGAs. The state-level HMIS unit meets monthly and produces several reports from RHIS data collated monthly from data submitted by LGAs. (In contrast, regular meetings do not take place at the LGA level; respondents repeatedly commented on how limited resources prevented them from holding regular meetings). The study further reported lack of support (financial and political will) from some LGA leaders, limited capacity-building opportunities, and lack of equipment such as computers are major challenges raised during the interview with the respondents. Problems noted by state-level HMIS officers include poor computer memory capacity, limited training on use of DHIS 1.4 software, and lack of funds to produce the revised HMIS forms. Officers at the LGAs also complained

of lack of HMIS registers at health facilities, lack of computers to work with, lack of political support, and interference in administration of the health department by political office holders. Poor financing of the department and mobility problems were among other challenges identified. As such, a clear request for improved financial resource allocation and collaborative support by SMOH and the LGA leadership will go a long way in ensuring that the goals of the HMIS are achieved.

Access controls is another predictor of patient information protection. Implementing role-based access control mechanisms can maintain the confidentiality and protection of the patient's health information according to the patient's consent. Each healthcare provider might have multiple roles and there may be a different range of services for different purposes for each role. Each role can include a location limit and access and time limitations [11]. Role-based access control is in place in most healthcare organisations. Audit trails become an important tool for data security as some of the security breaches have resulted from misuse of access privileges by authorised persons [11].

Encryption of patient data is presumed to potential predictor of patient information protection. In information privacy and security research, this can be a daunting task since being well-informed about a particular situation may include the need for an understanding of the technology, policies, regulations, and/or common practices used to obtain private data. Encryption involve knowledge of good security practices and knowing the importance of protecting personal information while using information security management system [12]; [13]; [14]. It is the knowledge of the users about private information provided, and how it is can store private information for a long period that increases the ability to collect, store, analyze and share private information without authorization from users. Previous research has shown that increased security awareness encourages users to perform good security behavior [15]; [14].

[16], showed how to provide privacy in e-health systems with attribute-based encryption. However, their approach is based on a specific structure for health records and in their model patients administers their own health records as PHRs. The authors do not discuss transferrable authorization secrets, but let patients define encryption policies. They assume that patients know whom to authorize when they create (or re-encrypt) EHRs. [17] used Quick Response (QR) codes and smart phones to access emergency information while preserving patient privacy of sensitive information. The method used was to embed emergency information on smart phone's lock screen in the form of a two-dimensional barcode. The code is then scanned and decoded using the same smart phone app or any QR code scanner. This is dependent on the assumption that a patient will be carrying the smart phone during emergency, thus it is considered to be impractical for the basis of health care.

From the foregone, no single study has combined regular staff training, access control and encryption of information security management system and tie them to patient information protection as it was done in this study therefore this study explored the impact of Information Security Management Systems (ISMS) on patient information protection within the healthcare industry in Oyo, Nigeria. The research specifically examined three key components of ISMS viz regular staff training, access controls, and encryption of patient data, to assess their effectiveness in safeguarding sensitive patient information.

2. THEORETICAL BACKGROUND

2.1 Objectives of the Study

The main purpose of this study is to examine the impact of Information Security Management Systems (ISMS) on patient information protection within the healthcare industry in Oyo, Nigeria. The specific objectives of the study are to:

1. assess the relationship between regular staff training and patient information protection.
2. assess the relationship between access controls and patient information protection.
3. assess the relationship between encryption practices and patient information protection.
4. investigate the joint contribution of ISMS components (staff training, access controls and encryption practices) to patient information protection.

2.2 Research Questions

The following research questions were answered and guided the study:

1. What is the relationship between regular staff training and patient information protection?
2. What is the relationship between access controls and patient information protection?
3. What is the relationship between encryption practices and patient information protection?
4. What is the joint contribution of ISMS components (staff training, access controls and encryption practices) to patient information protection?

3. METHODOLOGY

The study adopted a descriptive survey research design. The variables of the study are already in existence, so they only need to be observed in their natural occurrences, thereby the independent variables were not manipulated. The targeted population of this study was the entire employees of the

surveyed hospitals. These include Doctors, Nurses, Health Record keepers, Specialists, Administrative Officers, Clerks, and Personal Assistants. The total sample of 250 healthcare professionals from various public and private healthcare facilities across Oyo State participated in the study. Data were collected using structured questionnaires designed by the researcher. The designed questionnaire instrument for this research work is divided into the following sections: A - Demographic Information; B – staff training; C – access control D- encryption practices and E- patient information protection. The psychometric properties of the instrument were investigated and the reliability for the questionnaire was 0.861. Data collected were analysed by Pearson Product-Moment Correlation and multiple regression techniques to determine the relationship between the ISMS components and patient information protection.

4. RESULTS AND DISCUSSION

4.1 Results

Research Question One: What is the relationship between regular staff training and patient information protection?

Table 1: Relationship between Regular Training and Patient Information Protection

Variable	N	X	SD	R	p-value	Remark
Regular Staff Training	250	26.32	4.48	0.650*	0.000	Sig
Patient Information Protection	250	28.90	3.51			

Table 1 shows the relationship between regular staff training and patient information protection. The table revealed a significant positive relationship between regular staff training and patient information protection ($r = 0.65$, $p < 0.001$). This implies that patient information protection within the healthcare industry in Oyo, Nigeria is strongly related to regular staff training emphasizing the importance of ongoing training in enhancing security protocols.

Research Question Two: What is the relationship between access controls and patient information protection?

Table 2: Relationship between Access Controls and Patient Information Protection

Variable	N	X	SD	R	p-value	Remark
Access Controls	250	25.04	2.46	0.781*	0.000	Sig
Patient Information Protection	250	28.90	3.51			

Table 2 shows the relationship between access controls and patient information protection. The table revealed a significant positive relationship between access controls and patient information protection ($r = 0.781$, $p < 0.001$). This implies that information protection within the healthcare industry in Oyo, Nigeria is strongly related to access controls underscoring the necessity of restricting data access to authorized personnel.

Research Question Three: What is the relationship between encryption practices and patient information protection?

Table 3: Relationship between Encryption Practices and Patient Information Protection

Variable	N	X	SD	R	p-value	Remark
Encryption Practices	250	20.02	1.18	0.550*	0.000	Sig
Patient Information Protection	250	28.90	3.51			

Table 3 shows the relationship between encryption practices and patient information protection. The table revealed a significant positive relationship between encryption practices and patient information protection ($r = 0.55$, $p < 0.001$). This implies that information protection within the healthcare industry in Oyo, Nigeria is positively related to encryption practices.

Research Question Four: What is the joint contribution of ISMS components (staff training, access controls and encryption practices) to patient information protection?

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
	.883	.780	.704	2.739

5.

Table 5: ANOVA

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	697.382	3	232.46	15.492	.000*
Residual	5574.35	24	0		
Total	7	6	22.659		
	6271.73	24	9		
	9	9			

**Significant at $P < 0.001$ level

The multiple regression correlation coefficient (R) show the linear relationship between Predictor variables Information Security Management Systems ISMS components (staff training, access controls and encryption practices) and the information protection within the healthcare industry in Oyo, Nigeria as shown in Table 4 is 0.883, the multiple R^2 is 0.780

which is 78% and the Adjusted R square value is 0.704 which is 70.4%. This means that the variation in information protection within the healthcare industry in Oyo, Nigeria accounted for by the predictor variables Information Security Management Systems ISMS components (staff training, access controls and encryption practices) is approximately 78% and it is statistically significant at $P < 0.001$ level. Furthermore, the Table 5 indicates the Analysis of variance of the multiple regression data. The model produced an F- ratio of $F(3,246) = 15.492$ and found to be significant at 0.001 Alpha level.

4.2 Discussion of Findings

The result on the relationship between regular staff training and patient information protection revealed a significant positive relationship between regular staff training and patient information protection which implies that patient information protection within the healthcare industry in Oyo, Nigeria is strongly related to regular staff training emphasizing the importance of ongoing training in enhancing security protocols. The result of this study supports that of [8] who investigated the relationship between training, work environment and service delivery of health information management (HIM) professionals in special hospital Akure, Ondo State. The study revealed that HIM professionals in the State Specialist Hospital do often go for training on an average level but on and off-the-job training programme provided by the State Specialist Hospital for their HIM professionals is poor. The study also revealed that the work environment of the hospital is moderately conducive. It is revealed by the study revealed that the State Specialist Hospital service delivery is highly satisfactory. The study also demonstrated a very favorable correlation between HIM service delivery at the State Specialist Hospital, work environment, and training.

The finding on the relationship between access controls and patient information protection showed a significant positive relationship between access controls and patient information protection which implies that information protection within the healthcare industry in Oyo, Nigeria is strongly related to access controls underscoring the necessity of restricting data access to authorized personnel. The finding of this study agrees with that of [11] who reported that role-based access control is in place in most healthcare organisations and the audit trails become an important tool for data security for most patients. Some of the security breaches however, have resulted from misuse of access privileges by authorised persons.

The result on the relationship between encryption practices and patient information protection revealed a significant positive relationship between encryption practices and patient information protection which implies that information protection within the healthcare industry in Oyo, Nigeria is positively related to encryption practices. The result of this study tallies with that of [16] who found out provide privacy

in e-health systems with attribute-based encryption should be based on a specific structure for health records and in their model patients administers their own health records as PHRs for maximum patient information protection.

The finding on the joint contribution of ISMS components (staff training, access controls and encryption practices to patient information protection show the linear relationship between Predictor variables Information Security Management Systems ISMS components (staff training, access controls and encryption practices) and the information protection within the healthcare industry in Oyo, Nigeria The variation in information protection within the healthcare industry in Oyo, Nigeria accounted for by the predictor variables Information Security Management Systems ISMS components (staff training, access controls and encryption practices) is high and it is statistically significant.

The finding on the joint contribution of ISMS components (staff training, access controls and encryption practices to patient information protection show the linear relationship between Predictor variables Information Security Management Systems ISMS components (staff training, access controls and encryption practices) and the information protection within the healthcare industry in Oyo, Nigeria The variation in information protection within the healthcare industry in Oyo, Nigeria accounted for by the predictor variables Information Security Management Systems ISMS components (staff training, access controls and encryption practices) is high and it is statistically significant.

5. CONCLUSION

Collectively the Information Security Management Systems ISMS components have joint contribution and predictive ability to patient information protection. Meanwhile, the critical role of a comprehensive Information Security Management System in protecting patient information within the healthcare sector cannot be over sighted. There it is recommended that the continuous implementation of regular staff training be undertaken by health information staffers. Also, stringent access controls, and advanced encryption techniques be kept and enabled to enhance the overall security of patient data in healthcare facilities in Oyo, Nigeria.

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