Application of an Electronic System to the Management of Medical Records

Ngoako Solomon Marutha
https://orcid.org/0000-0002-5679-4394
University of South Africa
emarutns@unisa.ac.za

Abstract

The management of functions in any sector including the healthcare sector is highly dependent on the application of electronic technology to achieve effective results and to give peace of mind to the organisation. The manual modus operandi for the management of medical records in healthcare institutions brings about many discrepancies that regularly result in chaos in healthcare services, which always affects patients negatively. This study sought to investigate the application of an electronic system for the management of medical records in the Limpopo province of South Africa to support healthcare services. The study used a survey questionnaire to collect quantitative data from a sample of 306 (49%) out of a total of 622 records management officials. The response rate was 70.9 per cent (217), and system analysis and observation were applied to augment the quantitative data. The study discovered that the electronic system has not yet been applied for the management of medical records in healthcare institutions but is only used for capturing the personal information and financial status of patients or for billing purposes, although records management modules were available in the same system, and that negatively affects healthcare services and patients directly. The study recommends the application or enhancement of the current business administration system for healthcare patients or the development of a new electronic system to cater for the electronic management of medical records to support healthcare service delivery. The study further proposes a framework for the application of an electronic system for the management of medical records to support healthcare service delivery.

Keywords: electronic system; healthcare service; Limpopo province; medical records; South Africa

Introduction

Currently, as in many other administrative activities in different organisational functions such as financial management and human resources management, technology is more advanced at the higher level in the field of records and document management. Although an electronic management system for medical records is required for different benefits, the current state of medical records management in South Africa is in the form of handwritten papers from different healthcare institutions that are filed in isolation (Weeks 2013, 140–141). Some of the benefits of an electronic management system for medical records include interoperability and time-saving processes (Shaw et al. 2011, 357–358; Weeks 2013, 140–141), quality of care, data extraction, and information retrieval (Shaw et al. 2011, 357–358).

Nowadays "the culture of keeping and management of physical records is being taken over by records in electronic formats" (Asogwa 2012, 200). This trend in technology, which grows at an immense pace, might stem from the introduction and domination of microcomputers in both the government and the private enterprise market (Asogwa 2012, 200; Katuu 2015, 139). The management of records in an electronic format requires development of local area networks (LANs), large area networks, and wide area networks (WANs). Additionally, there is a need for the installation of appropriate electronic information or records management systems and Internet connectivity (Asogwa 2012, 200; Katuu 2015, 135–136). This may also change the way businesses are run, and the way records are created and managed for the better (Asogwa 2012, 200). In other words, technology brings about changes in actions in business transactions, and the production, administering, management, preservation and access of records. Healthcare organisations need to strategise and propose a technology that will ensure that medical records are available, reliable and authentic at all times, especially electronic records in different electronic formats and media such as text, videos, audio, graphics, emails and digital images. Record-keeping technology entails the management of electronic records systems and electronic system security (Ismail and Jamaludin 2009, 139).

Furthermore, Lott (1997, vi), and Boonstra and Broekhuis (2010, 2) attest that some of the healthcare professionals see computer technology as a solution for the proper creation, sharing and retention of important healthcare records, while others disregard its existence and some are not sure whether to like it or not. In healthcare facilities, regarding medical records management, computer technology is used for the admission, discharge and transfer of patients. Computer technology can also be used for automated pharmacy records and services, accounting, investigations, procedures, financial management and nursing activities. However, Lott (1997, vi), Boonstra and Broekhuis (2010, 2), Asogwa (2012, 201), and Katuu (2015, 135) underscore that, in most instances, even if the healthcare facilities introduced computer-technology solutions, healthcare providers or professionals continue to generate paper-based records that demand more efforts to be properly managed throughout their life cycle. This was also

discovered by Ndenje-Sichalwe, Ngulube, and Stilwell (2011, 269–270) in their study about records management in Tanzania whose findings showed that "the majority of records in the government ministries in Tanzania have been created and maintained in paper format". Similarly, Asogwa (2012, 201) attest that "most offices use computers to assist in some portions of the organisation's recordkeeping and are still producing more and more paper documents that are stored as record copy".

Literature Review

In healthcare institutions, electronic records systems are normally referred to by their various names, such as electronic medical records (EMR), computerised patient records (CPR), computerised medical records (CMR), electronic health records (EHR), and automated medical records (AMR) (Boonstra and Broekhuis 2010, 1–2; Weeks 2013, 139). The EHR system was introduced as an improvement on the traditional management of paper-based records. This is owing to the fact that with the EHR system, information about the patients such as demographics, medical histories and treatments is kept electronically and shared through a computer network system and the Internet (Boonstra and Broekhuis 2010, 4; Shaw et al. 2011, 354–355; Weeks 2013, 138). Ismail and Jamaludin (2009, 139), Boonstra and Broekhuis (2010, 1), the European Commission (n.d., 10), and Ndenje-Sichalwe, Ngulube, and Stilwell (2011, 272–273) attest that an electronic records system is used to capture and manage records, including the electronic records and electronic documents. The European Commission (n.d., 10), and Katuu (2015, 135-136) emphasise that the EMR system can also be used to manage the physical records, which includes paper-based records, cassettes, tapes and many more.

Although the management of electronic records has existed for such a long time, it is still challenging to adopt it, but it is still every healthcare organisation's desire to move completely from the management of paper-based records to the management of electronic medical records. The key issues in adopting the management of electronic medical records are to ensure that information is generated, stored, shared and operated centrally. This also requires standardisation in records management operation (Boonstra and Broekhuis 2010, 2; Weeks 2013, 138). The records system must be comprehensive, since a comprehensive records system will completely cover the entire scope of the organisational business activities or section of operation. That will depend on the scope it was planned and designed to cover (ISO 15489-1 2016). In other words, the system must cover a complete scope of business records. The records system should also be systematic in its operation. This means it should systematically create, maintain and manage records (ISO 15489-1 2016; Ndenje-Sichalwe, Ngulube, and Stilwell 2011, 272–273).

The records systems and business systems should be designed and operate in such a manner that the practice of creating and maintaining records is systematic; hence it is called a system. The organisation must make sure the systems cater for proper

management, accurately documented policies, assigned responsibilities and formal methodologies (ISO 15489-1 2016). These systems should comply with organisational or industrial legal requirements to ensure that records are always trustworthy, complete, accessible, legally admissible and durable. The systems should also ensure appropriate security of the records, whether paper-based or electronic. In terms of electronic records, messages distributed by electronic means (emails) about administrative communications, and websites used to disseminate or provide access to the administrative records or transactions should also be properly managed for permanent authenticity (Ismail and Jamaludin 2009, 139–140).

However, it is a complex task to manage records electronically. This is because the electronic management system for medical records needs to satisfy all the business needs in terms of functionalities. The organisations needs to propose an electronic management system for medical records with "specialised software" in line with their functional requirements specification from specialised business requirements (European Commission n.d., 10; Ndenje-Sichalwe, Ngulube, and Stilwell 2011, 272–273). The records system must be capable of keeping complete and accurate records of all transactions that clearly relate to specific records of the business activity. That might be individual records of a particular process, which are stored as part of the metadata associated with each specific record. In other words, the system must be capable of keeping records of all transactions relating to each specific user of the system as to who did what, when and why on the business system (ISO 15489-1 2016). For example, in the public health sector, the records will cover the patient name or all personal details, treatments, prescriptions received and details of the clinician.

Furthermore, records need very strict security to ensure their permanent reliability. A reliable records management system must be able to continuously and regularly operate in relation to the relevant organisational procedure. Records about system operations must be created and maintained to document system reliability (ISO 15489-1 2016). ISO 15489-1 (2016) also states that a reliable records system must comply with the following requirements:

- routinely capture all records within the scope of the business activities it covers;

- organise the records in a way that reflects the business processes of the records' creators;

- protect the records from unauthorised alteration or disposal;

- routinely function as the primary source of information about actions that are documented in the records; and

- provide ready access to the records and related metadata.

However, the system must be set up in such a way that characteristics of records stored in it are not affected when there is a need for system changes to be made. For instance, when records are transferred from one system to another (records migration), the transfer action must not have an impact on the records characteristics (ISO 15489-1 2016). Chachage and Ngulube (2006, 10) also feel that the system is mainly about the "information integrity, privacy and records retention". The health institutions need to identify and propose a system with information integrity, privacy and retention schedules.

The EMR system assists in managing medical record information in a structured and unstructured way that ensures minimisation of incomplete charts, reduce patient waiting times and ensure compliance with clinical, legal and administrative requirements (Shaw et al. 2011, 357–358; Weeks 2013, 139). The main concern with such a system is patients' personal information, privacy, confidentiality and security. Another concern is that the systems may also be viewed to be "cumbersome, unwieldy, unfriendly and opaque to the users and the patients" (Boonstra and Broekhuis 2010, 11; Weeks 2013, 139). Electronic system security has to do with the safety and security of records and information as managed by a particular system. The system and its infrastructure need to be safeguarded against any physical hazards that may damage or destroy the records or classified information. The records system needs to be controlled and protected to avoid records "alterations and misinterpretations or loss" (Ismail and Jamaludin 2009, 140; Ndenje-Sichalwe, Ngulube, and Stilwell 2011, 272). Therefore, the integrity of records needs to be maintained through appropriate security measures.

The system must also have control measures to monitor access, verify users, authorise disposal, and ensure security. This will prevent unauthorised records access, destruction, alteration and removal. It is very important that the organisation should make sure that the records' integrity is not affected by malfunctioning, upgrading and regular maintenance of the system (ISO 15489-1 2016; Ndenje-Sichalwe, Ngulube, and Stilwell 2011, 272). Thurston (2005) emphasises that the organisation should focus on information integrity during the process of moving to an electronic records system.

It is worth noting that "electronic records and information are constantly threatened and vulnerable to cyber-attack" (Ismail and Jamaludin 2009, 140). This is why organisations must also ensure safety and easy control of their records with the introduction and usage of a system that will track records movement. The tracking system may be in a form of "movement book, cards, electronic file tracking, spreadsheet, or database application software" (Chachage and Ngulube 2006, 15). The researcher shares the same sentiment with Lott (1997, vi), and Boonstra and Broekhuis (2010, 11) stressing that effective medical records system security has to ensure that unauthorised access to healthcare records is restricted to maintain records' integrity, and to secure that records are securely maintained for as long as they are still required, and that records are always reliable and trustworthy even if they are accessed electronically by means of "keystroke or the touch of a pen or finger". Information stored in an electronic system medium needs to allow

migration to the new technology as the situation requires, otherwise access will be difficult for the new generation in future (Lott 1997, vi).

Furthermore, since some of the main functions of records management are indexing, retrieval and access, the records system must be set up in such a way that records are accessible and retrievable in time to support the ongoing business process and to meet accountability requirements for the organisation and employees (ISO 15489-1 2016; Klischewski 2006, 36). For security purposes, access to records in the system also needs to be controlled through security policies by specifying employees or users to access certain records, based on their business function in a group or individually. Access may be managed per group of users or per individual. Individuals or groups of employees may be granted access to records in the electronic records management system based on the classification scheme of the records for the proper management of access. Restrictions must also be based on the ability to conduct certain actions on the records, such as inspecting their metadata or their content, and modifying or deleting them. The permission must be removable when no longer necessary (European Commission n.d., 41). The system must be capable of preventing unauthorised access to records and must maintain and provide an audit trail (Cowan and Haslam 2006, 268; ISO 15489-1 2016; Klischewski 2006, 36).

An audit trail is one of the key security measures in the management of records, especially in the management of electronic records. An audit trail can be applied in the management of traditional (paper-based) records or the management of electronic records, including the management of electronic documents. An audit trail consists of viewable lists or databases that are either generated by transitions on a computer system or by activities on a manual system (European Commission n.d., 163). The European Commission (n.d., 163) defines an audit trail as the "information about transactions or other activities which have affected or changed entities (example: metadata elements), held in sufficient detail to allow the reconstruction of a previous activity". The researcher shares this view with the European Commission (n.d., 45) that an audit trail keeps record about actions or transactions effected on every record by a user or an administrator or by the system if records are managed by the electronic records management system. It also assists the organisation in establishing whether certain actions were conducted in accordance with the business rules and whether these actions were performed by an authorised person. For instance, Asogwa (2012, 207) accentuates that:

> Databases containing personal financial and medical records, for instance, may be extremely useful to the individuals themselves, but without proper security protections, that information may also be accessed by others, thereby threatening the privacy of the owners. Today, people have an inherent right to privacy that can be violated, intentionally or by accident, in an electronic environment. For instance, the risk of identity theft is now very real in the electronic world. Some unscrupulous individuals and companies compile and sell personal information about people; this information has

been gathered, usually illegally, from electronic sources such as credit databases, land title files, motor vehicle records or medical files. This information may be used to gain access to credit cards, bank accounts and even property title documents.

Furthermore, Cowan and Haslam (2006, 268), ISO 15489-1 (2016), and Klischewski (2006, 36) state that the audit trail will indicate any use, misuse and abuse of the records system. It can identify the person that created, changed or viewed the data, what data is entered or viewed, when it was entered or viewed, and the place at which it was entered or viewed. This will help the system manager and records manager to establish whether records were altered, destroyed or accessed by an unauthorised person. The European Commission (n.d., 45) states that, in the management of electronic records, the electronic records management system logs, keeps and maintains transactional information in an audit trail report. The online copies of the electronic records' audit trail need to be backed up periodically by moving them to offline storage. During disposal, both online and offline copies need to be disposed of. This has to be included in relevant policies and legislative prescripts to make it mandatory. The researcher can conclude that an audit trail facilitates accountability and assists in investigations.

The backup of records is also one of the fundamental records security measures. The researcher agrees with the European Commission (n.d., 47) and Asogwa (2012, 207) that the organisation has to develop a regular backup strategy for its records and metadata in case the system fails, an accident or security breach occurs, the computer becomes infected by a virus, or in case of a crash of storage devices and accidental deletion of data or records by employees. In the case of electronic records, the electronic records management system should provide full and regular control for records and metadata backup. The electronic records management system may be backed up by integrating it into the electronic document management system, its database or other software (European Commission n.d., 47).

Nevertheless, all the records need effective security, but, more importantly, priority should be given to vital records to ensure business continuity even after a records disaster. In his study about records management models in South Africa, Ngoepe (2014, 10) discovered that in most government bodies there are no vital records that were identified and secured against possible disaster. This implies that there was no disaster preparedness plan, vital records schedule and/or records inventory. The European Commission (n.d., 48) attests that vital records are "considered absolutely essential to the organisation's ability to carry out its business functions, in the long term, in the short term or both". Vital records need to be identified in order to give them first priority during emergency or disaster and they need to be highly protected for "its long-term financial and legal interest". Records may be vital to the entire organisation or sections of the organisation and should be defended or recovered first in case of disaster.

Problem Statement

In healthcare institutions, the effectiveness of healthcare services depends on the nature of the system applied in the management of medical records and healthcare services delivery; meaning the weaker the medical records and healthcare service delivery management system, the weaker the healthcare service to patients. The state of the system applied in healthcare institutions in the Limpopo province of South Africa makes it difficult or impossible for the healthcare providers to render timely service to patients. This negatively affects patients' health since they always have to wait too long before receiving healthcare service and, at times, they do not receive any service when the doctor cannot access their medical records containing their medical history (Luthuli 2017, 88; Marutha 2011, 3; Marutha 2018, 6; Marutha and Ngulube 2012, 39). It also negatively affects healthcare providers' service delivery directly, as they usually wait too long for the same records and/or cannot render certain healthcare service without medical records to check for the medical history of patients currently in need of service. For example, a doctor at a Polokwane hospital could not render healthcare service to one of his chronic patient suffering from cervical cancer owing to her missing medical record (Maponya 2013, 6), and at Nkhesani hospital, a patient who was involved in a motor vehicle accident could not be operated owing to the missing medical records about previous treatments and injuries (Chauke 2008, 7). It is hoped that the investigation and recommendations in this study will provide an appropriate solution for the improved management of medical records to support healthcare service delivery in the Limpopo province of South Africa.

Purpose of the Study

The purpose of this study is to investigate the application of electronic systems for the management of medical records to support healthcare service delivery in the Limpopo province of South Africa.

Objectives of the Study

The objectives of this study are as follows:

- to establish the current system used in the management of medical records;

- to determine the extent to which the electronic system is used for the management of medical records in the Limpopo province of South Africa;

- to assess how the electronic medical records management system would enhance healthcare provision; and

- to propose a framework for the application of an electronic system for the management of medical records to support healthcare service delivery.

Research Methodology

This quantitative study used a survey questionnaire to collect quantitative data. The questionnaire data were augmented with minimal data collected using observation, interviews and system analysis to support the statistical data from the questionnaire. The questionnaire was distributed to a sample of 306 (49%) people selected using stratified random sampling from a total population of 622 records management officials in 40 hospitals in the Limpopo province of South Africa. The response rate out of the 306 sample was 70.9 per cent (217). The interviews were only used to clarify issues during observation and analysis of the system. During the observation, records management officers, nurses and doctors in charge who also informed the researcher of their processes of records management were interviewed to clarify situation or conditions observed. The interview questions were not structured or pre-planned but instead were normally triggered by observed situations.

Presentation and Discussion of the Findings

This section provides the presentation and discussion of the findings of the study based on the objectives and literature reviewed.

Technology to Manage Medical Records

The literature shows that, although the healthcare facilities introduce a computer technology solution, healthcare providers or professionals continue to generate paper-based records that also demand more efforts to be properly managed throughout their life cycle (Asogwa 2012, 201; Boonstra and Broekhuis 2010, 2; Katuu 2015, 135; Lott 1997, vi; Ndenje-Sichalwe, Ngulube, and Stilwell 2011, 269–270). This is not exclusive to Limpopo healthcare institutions, because the institutions have not used computer technology in managing their medical records, as also confirmed by 66.4 per cent (144) of the respondents. (See item number one in Table 1.) The available system was used to capture patients' personal details and billing information rather than to use it for patient file movement tracking and other records management related functional activities as reported by the system analysis, observation and interviews.

However, the full-scope technology applied was manual since the e-system was only used for billing and for capturing patients' personal information. The system was also used for verifying the patient numbers, which were used as unique file numbers for filing of individual patient files. The institutional electronic technology never contributed towards the effective management of medical records in relation to the operational and functional requirements of the management of records throughout the life span. The electronic system did not help the institutions with the records management activities, because records management functionalities or modules were never utilised and the system did not back up the medical history of the patients, instead only the paper-based records contained the complete medical history of patients.

Furthermore, it is a complex task to manage records electronically since the electronic management system for medical records must meet all the business needs in terms of functionalities. The organisation needs to propose an electronic records management system with "specialised software" in accordance with their functional requirements specification from specialised business requirements (European Commission n.d., 10; Ndenje-Sichalwe, Ngulube, and Stilwell 2011, 272–273), whether free and open-source software (FOSS) or proprietary software (closed-source software). The literature reviewed further emphasises that the record-keeping system needs to cover functionalities relating to records management operations, record-keeping functional requirements and metadata requirements (Ismail and Jamaludin 2009, 137–138). In the Limpopo healthcare institutions, the medical records management system had no active functionalities to meet all records management operational and functional requirements throughout the life span, as confirmed by 75.1 per cent (163) of the respondents. (See item number two in Table 1.) The researcher also confirmed through system analysis that the system had almost all the records management functionalities, except for the scanning of the records created in paper-based format, but that many of these functionalities were not activated for use.

Table 1: Availability of any technology, active system functionalities and effective utilisation for management of medical records (N = 217)

Responses	Availability of any technology for management of medical records		Records management system active functionalities		Effective utilisation of records management system functionalities	
	Number	Percentage	Number	Percentage	Number	Percentage
Yes	61	28.1	39	18	48	22.1
No	144	66.4	163	75.1	160	73.7
No response	12	5.5	15	6.9	9	4.1

Furthermore, this is why not all the records management system functionalities were being utilised effectively, as confirmed by system analysis, observation and 73.7 per cent (160) of the respondents. (See item number three in Table 1.) The system was not used effectively since there were other important e-system modules or functionalities for records management that were not active or not implemented as observed and analysed. The healthcare institutions managed their medical records manually, except for billing and patients' personal information capturing and verifying the file or patients' number even when the system had all the necessary functionalities to activate, as confirmed by 24.4 per cent (53) of the respondents (see Figure 1).
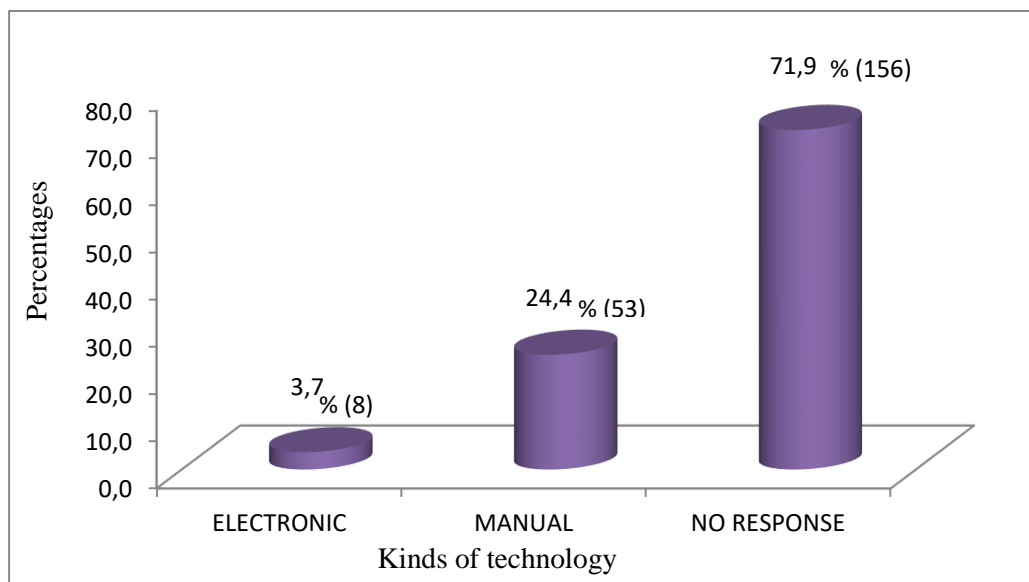
Figure 1: Use of electronic or manual technology for management of medical records (N = 217)

The System Used for the Management of Medical Records

The reviewed literature attests that the functional requirements for the management of electronic records include the capturing, identifying, arrangement, description, classifying, storage, preservation, metadata, access, appraisal, retention, disposal, access management, and security management of records, and the rendering of search and retrieval services for clients (Horsman 2001, 14–16; International Council on Archives 2008, 16; Katuu 2012, 6; Ndenje-Sichalwe, Ngulube, and Stilwell 2011, 269). The rating of the medical records management system revealed several challenges in the healthcare institutions of Limpopo relating to these requirements. One of these challenges was that the system records storage capacity was not adequate, as alluded to by 44.2 per cent (96) of the respondents. The storage was congested and the capacity was too small in most of the institutions. The system had no complete metadata required for records management, identification and retrieval, as confirmed by 42.4 per cent (92) of the respondents. The system was not able to identify the records creators, requestors and many other elements of metadata. The system metadata for records retrieval was also not adequate and not user-friendly as confirmed by 49.8 per cent (108) of the respondents. (See Table 2.)

Table 2: The state of the electronic records management system in the institution (N = 217)

State of electronic records management system		Responses				
		Strongly agree	Agree	Unsure	Disagree	Strongly disagree
The system records storage capacity is adequate	Number	4	19	13	96	85
	%	1.8	8.8	6.0	44.2	39.2
The system has complete metadata required for records management, identification and retrieval	Number	12	28	6	92	79
	%	5.5	12.9	2.8	42.4	36.4
The system metadata for records retrieval is adequate and user-friendly	Number	7	28	2	108	72
	%	3.2	12.9	0.9	49.8	33.2
The system has functionalities for records capturing	Number	52	73	16	49	27
	%	24.0	33.6	7.4	22.6	12.4
The system has functionalities for records issuing and returning (circulation)	Number	22	28	44	72	51
	%	10.1	12.9	20.3	33.2	23.5
The system has functionalities for records disposal	Number	5	2	41	134	35
	%	2.3	0.9	18.9	61.8	16.1
The system has functionalities for scanning and capturing electronic documents that were created in a paper-based format	Number	2	1	7	97	110
	%	0.9	0.5	3.2	44.7	50.7
The system has a functionality to create electronic records directly into the system	Number	18	25	36	89	49
	%	8.3	11.5	16.6	41.0	22.6
The system has the ability to produce an audit trail for each record	Number	15	22	24	91	65
	%	6.9	10.1	11.1	41.9	30.0
The system functionalities are effectively utilised	Number	11	14	37	93	62
	%	5.1	6.5	17.1	42.9	28.6
Records in the electronic system can be used as a backup for paper-based records	Number	18	39	17	121	22
	%	8.3	18.0	7.8	55.8	10.1

State of electronic records management system		Responses				
		Strongly agree	Agree	Unsure	Disagree	Strongly disagree
Electronic system is used to capture all information about administration and treatment of the patients	Number	8	22	39	109	39
	%	3.7	10.1	18.0	50.2	18.0
Access to records in the system is effectively controlled	Number	34	82	31	57	13
	%	15.7	37.8	14.3	26.3	6.0
The system is protected against any disaster	Number	13	19	51	87	47
	%	6.0	8.8	23.5	40.1	21.7
The records in the system are protected against any perils such as viruses and spyware	Number	50	71	18	53	25
	%	23.0	32.7	8.3	24.4	11.5

Furthermore, several functionalities were lacking in the medical records management system of Limpopo hospitals, although only a few were covered here, as confirmed by the majority of the respondents for each of the functionalities. The system had functionalities for records capturing and that was confirmed by 33.6 per cent (73) of the respondents, but they were not used or were inactive. The system had no functionalities for records issuing and returning (circulation) (33.2% (72)), records disposal (61.8% (134)), scanning and capturing of electronic documents that were created in a paper-based format (50.7% (110)), and creating electronic records directly on the system (41% (89)). In support of this, the researcher never detected the functionality for records disposal during the system analysis, except the functionality for deleting the records on the system. The system analysis also revealed that there were no functionalities for scanning and imaging of the paper-based records in the system used. The system records circulation functionality was also available but non-functional as indicated by the system analysis results. The system functionalities were not used effectively as alluded to by 42.9 per cent (93) of the respondents. All these are not in compliance, as suggested by the literature from Horsman (2001, 14–16), Katuu (2012, 6), the International Council on Archives (2008, 16), and Ndenje-Sichalwe, Ngulube, and Stilwell (2011, 269).

In addition, the other weaknesses entailed system inability to produce an audit trail for each record; 41.9 per cent (91) of the respondents confirmed this. The records in the electronic system could not be used as a backup for paper-based records as also confirmed by 55.8 per cent (121) of the respondents. If all the modules and functionalities can be activated and functional, the system will effectively back up the paper-based records, but now they could not be backed up because most of the functionalities were inactive. This is because the electronic system was not used to capture every piece of information about administration and treatment of the patients,

as confirmed by 50.2 per cent (109) of the respondents. The system as analysed was only used for billing purposes and the capturing of patients' personal information.

Looking at the security issues in the Limpopo hospitals, access to records in the system was effectively controlled, as confirmed by 37.8 per cent (82) of the respondents. Access to information in the system was protected through user passwords and usernames, and every system user was assigned a username and password which they used to log into the system before use or accessing the information. The records in the system were protected against any perils such as viruses and spyware, as supported by 32.7 per cent (71) of the respondents. The computers used and the server was installed with the System Center 2012 Endpoint Protection, Symantec Endpoint Protection and Symantec Network Access Control. However, 40.1 per cent (87) of the respondents said that the system was not protected against any disaster. This is because there were no disaster-prevention and disaster-fighting measures for records. Moreover, the electronic records management system never effectively met the functional requirements for the management of records, as confirmed by 62.7 per cent (136) of the respondents. This is because most of the key functionalities for records management were not covered.

Conclusion

The healthcare institutions in the Limpopo province of South Africa do not have an electronic system for the effective management of patient records electronically since the available system is not capable of discharging functionalities for the management of records except the capturing of patients personal and demographic information. The system has some of the functionalities for the management of patient records but the problem is that such functionalities are not activated for use and that renders them unavailable. This makes it impossible for the hospitals to capture full patient records into the system for electronic management. The only patient records that are complete with all patient information are produced, kept and managed manually in a paper-based format. Although the system had other functionalities which were inactive, other functionalities such as scanning or imaging and disposal were not covered in the system. As a result the system could not be suitable to be used as a backup for the paper-based records. The system server had inadequate storage capacity for the patient records and that means it was not properly planned based on the records generation frequency and load. Although the system was not used to capture all the records created about patients, access security was appropriate for the electronic system with the application of user passwords and username, and other perils like virus and spyware were prevented with the use of software for internet security and antiviruses.

Recommendations

The institutions need to either improve the current system and activate all suitable functionalities for the management of records or propose technology to be used in managing all their medical records, rather than only capturing patients' personal details and billing information. There is a need for the institutions to improve the current system

or propose a system that will be utilised for the capturing and management of a complete medical record for each patient (see Figure 2). It is also advisable that in improving the current system or introducing a new system, the institutions may need to couple the paper-based and electronic records format or phase out the manual (paper-based) way of managing records and introducing an electronic system that will assist effectively with proper records management and records sharing. They must improve the system or introduce a system that will cover all records management functionalities, including scanning or imaging of records in relation to the records management module. In order to successfully implement the electronic records management system, all records management functionalities covered need to be utilised and the system must be backed up.

The system must have functionalities such as records issuing and returning (circulation), records disposal, scanning and capturing of electronic documents that were created in a paper-based format, and creating electronic records directly on the system. The system also needs to have a functionality for records disposal. A functionality for scanning and imaging of the paper-based records into the system is also important to be covered. The institutions must make sure that the system is improved or developed in such a way that it is able to produce an audit trail for each record in the system. The records in the electronic system must also be usable as a backup for paper-based records. The electronic system needs to be used for capturing all information about the administration and treatment of the patients.

The institutions need to research or conduct a feasibility study on the amount of records or information generated every day and how long each record must be kept until the last stage of record disposal so that, eventually, they can determine the adequate storage capacity for the electronic records storage of such records. This is because institutions need to make available adequate storage capacity for records in their servers to avoid congestion, slow system response and crashing. The system needs to be populated with a complete and adequate set of metadata as required for records management, identification and retrieval. In doing this, the system will be able to identify the records creators, requestors, users and many other elements of the metadata.

It is also recommended that healthcare institutions maintain and improve safety and security measures to patients' records from time to time as technology improves to adapt with the new ways of operating in the industry. This is because access to records in the system must be controlled effectively to secure information and to ensure confidentiality of patients' personal information. Access to information on the system must normally be protected through a user password and username, under which every system user is assigned a username and password which they use to log into the system before using or accessing the information. Records in the system also need to be protected against any perils such as a virus and spyware using internet security and antiviruses. The system also needs to be protected physically against any disasters like fire, water, pests

and rodents. This can be done by making available the disaster-prevention and fighting measures for records as well as a disaster management plan.

The study further proposes a framework for the application of an electronic system for the management of medical records to support healthcare service delivery as indicated in Figure 2. According to the framework, records management practitioners (A) and healthcare practitioners (B) need to share the same electronic system in discharging their duties. This means both the management of medical records and the delivery of healthcare services to patients will have to be done or accomplished using the same electronic system. The healthcare practitioners will have to feed the electronic system with full records about patients as they render the healthcare service. At the same time, the healthcare practitioners will be able to retrieve and use the records about patients' medical history created in past consultations or treatments for further treatments and responding to complaints as stipulated by the Promotion of Administrative Justice Act, 2000 (Act No. 3 of 2000) (PAJA).

On the other hand, the medical records management practitioners will have to manage records using the same electronic system, making sure that the records are maintained, accessed and disposed of as required by the applicable policies, procedures, regulations and standards. Medical records management practitioners will also ensure that appropriate security measures, disaster management plans and backups in both electronic (cloud computing) and paper-based records are in place. This will assist in the recovery of records in case the main records or backup records are lost or damaged. The medical records management practitioners will also assist in providing access to records requesters as stipulated by the PAJA. Finally, healthcare institutions, including district offices, provincial offices, health centres, clinics, vertical programmes and hospitals must be able to share the patients' records through the cloud computing technology to avoid duplication of patients' records and files in all the institutions as the patients consult from institution to institution every day or every time.
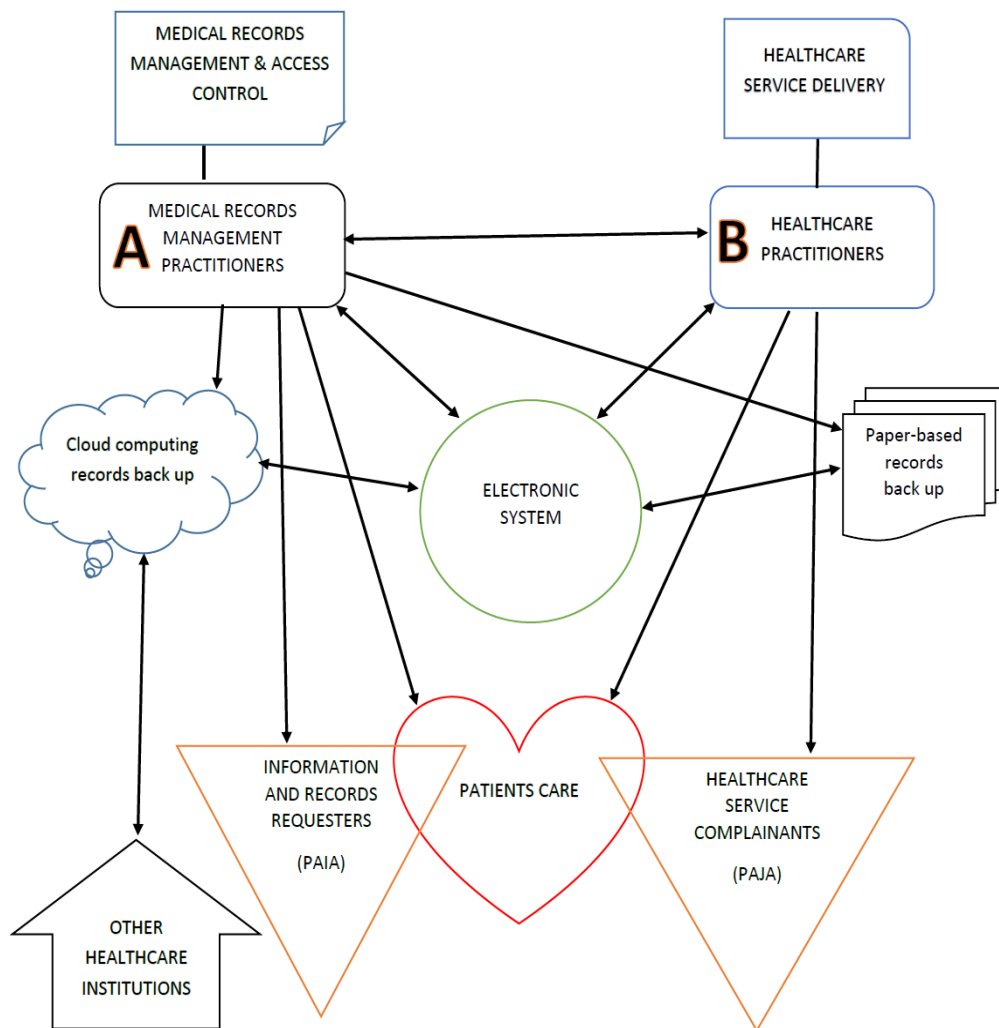
Figure 2: A framework for the application of an electronic system for the management of medical records to support healthcare service delivery

Moreover, it is hoped that the application of the proposed framework outlined in Figure 2 will assist the healthcare institutions, especially in the Limpopo province of South Africa, to recognise the effective management of medical records that also supports healthcare service beyond reasonable doubt.

References

Asogwa, B. E. 2012. "The Challenge of Managing Electronic Records in Developing Countries: Implications for Records Managers in Sub-Saharan Africa." *Records Management Journal* 22 (3): 198–211. https://doi.org/10.1108/09565691211283156.

Boonstra, A., and M. Broekhuis. 2010. "Barriers to the Acceptance of Electronic Medical Records by Physicians from Systematic Review to Taxonomy and Interventions." *BMC Health Service Research* 1–17. https://doi.org/10.1186/1472-6963-10-231.

Chachage, B., and P. Ngulube. 2006. "Management of Business Records in Tanzania: An Exploratory Case Study of Selected Companies." *South African Journal of Information Management* 8 (3): 1–18. https://doi.org/10.4102/sajim.v8i3.227.

Chauke, O. 2008. "No Operation as Patient File is Lost." *Capricorn Voice,* 10–12 September 2008, 7.

Cowan, J., and J. Haslam. 2006. "Clinical Risk Management Managing NHS Records: Complying with the New Code of Practice." *Clinical Governance: An International Journal* 11 (3): 262–269. https://doi.org/10.1108/14777270610683173.

European Commission. n.d.. "Information and Document Management." Accessed 26 April 2014. http://ec.europa.eu/archival-policy/moreq/doc/moreq2_spec.pdf.

Horsman, P. 2001. "Electronic Recordkeeping: The Recordkeeping System as Framework for the Management of Electronic Records." *Amsterdam* 1–18.

International Council on Archives. 2008. *Principles and Functional Requirements for Records in Electronic Office Environments: Module 2 – Guidelines and Functional Requirements for Electronic Records Management Systems*. Accessed 2 October 2019. http://www.naa.gov.au/Images/Module%202%20-%20%20ICA-Guidelines-principles%20and%20Functional%20Requirements_tcm16-95419.pdf.

Ismail, A., and A. Jamaludin. 2009. "Towards Establishing a Framework for Managing Trusted Records in the Electronic Environment." *Records Management Journal* 19 (2): 134–45. https://doi.org/10.1108/09565690910972084.

ISO 15489-1. 2016. *Information and Documentation – Records Management – Part 1: Concepts and Principles*. Geneva: International Organization for Standardization.

Katuu, S. 2012. *Enterprise Content Management and Digital Curation Applications: Maturity Model Connections*. Accessed 23 July 2014. http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/CI/CI/pdf/mow/VC_Katuu_28_D_1130.pdf.

Katuu, S. A. 2015. "Managing Records in South African Public Health Care Institutions – A Critical Analysis." PhD thesis, University of South Africa.

Klischewski, R. 2006. "Ontologies for E-Document Management in Public Administration." *Business Process Management* 12 (1): 34–47. https://doi.org/10.1108/14637150610643742.

Lott, L. A. 1997. "The Conundrum of Patient Records." *International Journal of Health Care Quality Assurance Incorporating Leadership in Health Services* 10 (2): iv–vi. https://doi.org/10.1108/13660759710171682.

Luthuli, L. P. 2017. "Medical Records Management Practices in Public and Private Hospitals Inumhlathuze Area, South Africa." MInf dissertation, University of Zululand.

Maponya, F. 2013. "No Medical Records, No Treatment." *Sowetan*, 10 April 2013, 6.

Marutha, N. S. 2011. "Records Management in Support of Service Delivery in the Public Health Sector of the Limpopo province in South Africa." MINF thesis, University of South Africa. http://hdl.handle.net/10500/5737.

Marutha, N. 2018. "The Application of Legislative Frameworks for the Management of Medical Records in Limpopo Province, South Africa." *Information Development* 1–13. https://doi.org/10.1177/0266666918772006.

Marutha, N. S., and P. Ngulube. 2012. "Electronic Records Management in the Public Health Sector of the Limpopo Province in South Africa." *Journal of the South African Society of Archivists* 45:39–67.

Ndenje-Sichalwe, E., P. Ngulube, and C. Stilwell. 2011. "Managing Records as a Strategic Resource in the Government Ministries of Tanzania." *Information Development* 27 (4): 264–79. https://doi.org/10.1177/0266666911417026.

Ngoepe, M. S. 2014. "Records Management Models in the Public Sector in South Africa: Is there a Flicker of Light at the End of the Dark Tunnel?" *Information Development* September:1–16. https://doi.org/10.1177/0266666914550492.

Shaw, N., V. Aceti, D. Campbell-Scherer, M. Leyland, V. Mozgala, L. Patterson, S. Sunley, D. Manca, and E. Grunfeld. 2011. "Current Use of Electronic Medical Records in Primary Care of Chronic Disease." *Clinical Governance: An International Journal* 16 (4): 353–63. https://doi.org/10.1108/14777271111175387.

Thurston, A. 2005. "Fostering Trust and Transparency through Information System." *PREM Notes Public Sector* 97: The World Bank. https://econpapers.repec.org/RePEc:wbk:wboper:11232.

Weeks, R. V. 2013. "Electronic Health Records: Managing the Transformation from a Paper-Based to an Electronic System." *Journal of Contemporary Management* 10:135–155.