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Towards a design of E-Health systems to improving healthcare service delivery

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Abstract

Patients' medical records are critical to services, it helps to prevent errors in prescriptions and medications. Despite the understanding of these consequential risks to patients, medical errors remain prevalence in South Africa and many parts of the world. Empirically, this study reports medical errors and their consequences to patients. Qualitative and quantitative data relating to healthcare services delivery were used. The interpretation of the data reveals that medical errors manifest wrong medications, misrepresentations in prescriptions and mismanagement by facility. Also, patients' lack of access to medical records and the use of incomplete medical records were other factors identified. This study lays justification and motivation for patients' unique identifier, which contributes to improving the quality of healthcare service delivery.

Keywords: Healthcare, Medical errors, Healthcare service, Health in Africa, Medical records.

1. Introduction

Health passport is an electronic smart device that contains patient's (holder's) biodata and health related information. Primarily, it is used as a tool to bridge communication between patients and physicians including administrators of health facilities (such as hospital and clinics). As a tool, it enhances health service delivery from two main angles: (1) reduce patients' unnecessary visits to health facilities (Heifetz & Lunsky, 2018); and (2) increase access to patients' medical history. The health passport concept is in use in New Zealand by the Health and Disability Commission. In the United Kingdom, the concept is purposely to improve communication with health care providers. In South Africa, it is referred to, as "My health passport". It is a nationwide medical communication tool that identifies a patient and associate his/her with medical record. In South Africa, the practice is not common among the facilities (or medical personnel) that are employed by Discovery Health, which is a private health entity.

Accurate, organised and up-do-date medical records are essential for good patients' care. A medical record or a health record demonstrates the patient's health history, physical examination result, progress and the list of prescribed medications (Bali et al., 2011). By examining these records, a physician can easily continue with the treatment of a patient from where another physician has left off, thereby ensuring effectiveness in providing quality healthcare for patients. The information in the medical records also play a crucial role in determining the truth in circumstances where patients claim negligence against the physicians (Pienaar, 2016). Therefore, maintaining and preserving medical records are vital to the provision and judgement of healthcare services.

The administration of medical records in South African context presents a gloomy picture as at the time of this study. On one hand, the quality of record management in the healthcare facilities in South Africa varies depending on various factors like infrastructure, budget, and staff capacity (Katurura & Cilliers,

2018). From another perspective, some of the healthcare facilities have a proper filing system while others do not. Even if a healthcare facility maintains a proper filing system, their medical records are not accessible among the other healthcare facilities across the country. This becomes problematic because of physicians' obligation to treat a patient without knowing his medical history. The medical history provides useful and important health information of a patient that leads to timely and accurate diagnosis (Muhrer, 2014).

Access to the medical history of a patient proves to be cost effective by eliminating the process of physical examination and testing, to determine health conditions. It is also important for a physician to be aware of the medications a patient has taken in the past or is currently taking. The physician can determine the future treatment based on how the patient has responded to these medications. The physicians fail to provide timeous and quality services as they do not have access to the medical records of their patients (N. Marutha & Ngoepe, 2017). The fact is that there is no effective centralized system in South Africa, to guide the health care facilities to care for their patients. Therefore, it necessitates developing a centralized system relating to electronically preserving patient's medical history.

Currently, the practice of the health passport requires patients to have the passport on visit to health facilities. Consequently, any health practitioner or hospital administrative staff can read the information on the passport, which reduces privacy. Despite the benefits of the health passport, Bailie et al. (2020) identified and explained that there is a need to improve clinician engagement and future transference into a smartphone application. Subsequently, from the literature and practice, we identified the gaps in the current health passport concept, as problematized in the section that follows. In bridging the gaps, the main objective is to examine how medical errors come to being and their consequences. This study reveals challenges and presents implications in practice. The novelty of the e-health system is in its diverse nature and accessibility. For example, the e-health system does not necessarily need a patient to always carry his or her passport with. It requires the passport or national identity number (NIP), to uniquely identify the patient and associated him/her with physicians and visits to health facilities, which also reveal previous medications.

2. Problematisation

Patients consult with various physicians, some of whom are situated in different health facilities and locations across the country. The challenge in many countries including South Africa is that patients' medical histories are not easily accessible or shared between physicians across different health facilities and locations, owing to distinct reasons. This has high consequence to the patients in that the lack of access or limited access to patient's record slowdown response time. The challenge emanates from two main perspectives. Firstly, some patients often do not remember or know the medications in their prescriptions from previous visits to physicians. According to Rashid (2018), the health passport seeks to improve the coordination of healthcare for people with intellectual disabilities, with a particular focus on psychiatric and emergency care. Secondly, some patients, simultaneously, visit physicians without disclosing such information. These problems exist because of lack of system that secure and seamlessly provide patients' data for real-time access purposes.

3. Literature Review

Some of the public health centres still use a manual filing system in many countries (Masana & Muriithi, 2019). However, many health systems are enabled and supported by information technology (IT) or information systems (IS), to collect, use and store patient's medical history (Pearce & Bainbridge,

2014). Many studies have proposed solutions, to address challenges that are hindering healthcare advancements. This includes lack of: centralisation, consolidation (Persaud, 2019), synchronisation, and real-time access to patient's medical record (Masana & Muriithi, 2019). Azarm et al.(2017) proposed a cloud-based portal and a web-service API for accessing and exchanging information across healthcare providers. A medical aid, a health organisation maintains an online portal to store medical records, which only be used by their members (Reid et al., 2020).

One of the main challenges is the heterogeneity of patients and medical practitioners. For example, a patient being treated by several doctors have several medical records and there is no guarantee that these records are synchronised or corroborated into one single and accurate medical history (Dubovitskaya et al., 2018). This brings about the importance of having a centralized system (or database) that provides an integrated view of a patients' medical records. A database can be accessed on real-time, from anywhere and at any time, using a smart device referred as to "health Passport" (Bailie et al., 2020). The "health passport" concept have been introduced in several countries with the aim to provide quality health care services to their citizens.

Many countries such as the Australia, Canada, United Kingdom, and South Africa continue to explore ways of improving the processes and activities of health, for better quality of care and services (Andargoli, 2021). This includes the need to centralise healthcare data for real-time accessing of patients' data, which has been under consideration for many years. In 2013, the National Health Service of United Kingdom launched the 'care.data' (care dot data), a centralised system that integrates patients' records and hospital records (Presser et al., 2015). In New Zealand, shared care records (SCR) takes proper measures to ensure that the privacy of the patients is safeguarded by allowing access to only health practitioners who can access the system (Pagliari et al., 2007).

In some countries, particularly in developing countries, the majority of the population are unaware of their health status because the health records are poorly administered (Rensburg, 2021). Owing to the inconsistency and inaccuracy regarding the manual filing of patient medical data and medical error reports, the concept of e-health record (EHR) systems was introduced in Australia (Xu et al., 2013). This does not seems to have resolved the challenges in the country (Collyer et al., 2019). In Canada, the health professionals can access laboratory test results, medication details, diagnostic results and all relevant health information of the patients in their province (Graham et al., 2018). The downfall of this approach is that, in case of an emergency, a health practitioner will be unable to access the details of a patient who is registered in another province (Persaud, 2019).

Health care services integrated with IT or IS have seen significant progress over the past few years (Wu & Trigo, 2020). Currently, there are expectation of physicians to provide quality healthcare services to the people. In addition, there is obligation for physicians to access and share patients' medical records with the relevant authorities and personnel on a regular basis. At present, there is no system in South Africa that allows the health practitioners to access patient records regardless of their location. Therefore, developing a system that contains digitalised patient's medical records and link them to facilities and physicians is necessary.

4. Methodology

The mixed method is employed in this study. Substantially, the methods enrich data collection (Schoonenboom & Johnson, 2017). Mixed methods research design combines the strengths of both methodologies and reduces the weakness of both approaches (Creswell & Poth, 2017). Questions were formulated based on the objectives of the research and the gaps identified in literature. The questions and guidelines were used to collect both qualitative and quantitative data. It entails an in-depth process. It began with formulating eighteen questions, covering patients and medical personnel (nurses and doctors). Thereafter, the questions were for patients and medical personnel, respectively. Each The questions were constructed in a way that suit the participants, for ease of understanding and interaction.

At the end, nine and nine number of questions for patients and medical personnel, respectively, were finalised for data collection. The questions were improved and finalised through an iterative process of verifying whether each question in the guide was linked to the research objectives. The primary data for this study was collected using questionnaires.

The case study approach is most suitable, primarily because it helps with in-depth investigation (Yin, 2018), required for this study. The AfricanHealth hospital in Cape Town, South Africa was selected, for three reasons: (1) it is one of the oldest, thus, it has gone through test of time; (2) it one of the largest hospitals, it comprises of all spheres of medical units, from specialised to general practitioners'; and (3) among other, the management granted access, to use the hospital as case in the study. The hospital host some of the best specialists in the country. AfricanHealth is a pseudo name assigned to give anonymity to the hospital. This was to comply with the hospital's authority, to avoid identity disclosure owing to the sensitive nature of the healthcare environment. Document, nurses and patients were based on their units, availability and interest, to participate in the study. The objectives of the study were explained to interested persons, based on which each decided to participate. The first set of participants introduced their colleagues to the researchers, which was the mechanism used to garner interest of more participants. Data was collection was stopped at a point where participants began to repeat what have previously gathered others.

This study used two sets of questionnaires, for doctors and nurses, and patients. The aim of the questionnaires was to collect the views and perceptions of doctors, nurses and patients regarding the challenges faced by both medical practitioners and patients due to the lack of a system that secures and seamlessly provides patients' data for real-time accessing of patients' records from any health facilities and locations within South Africa. The questionnaires were mixed questionnaires consisting of both closed and open questions.

The pilot interview approach was used to assess the strength and suitability of the questionnaires. People of the diverse groups, medical personnel and patients participated in the pilot. It was important to conduct a trail-run to establish the validity and reliability of the data collection technique and the questions. The usefulness of piloting has long been tested, it assists the researcher to determine whether the designed research instrument is effective in fulfilling the purpose of the study (Friesen et al., 2017). The pilot provided feedback on the structure and format of the questions. From the feedback, the researchers amended the questions. The questionnaires were distributed through electronic means, using Google Forms. The means was convenient to reach participants who were geographically distant, and it was the safest and cheapest way to gather data during the pandemic. A total of 53 people participated in the study of which 7 were doctors, 20 were nurses and 26 were patients.

The data was analysed using content analysis technique from the perspective of interpretivism and statistical analysis of positivism. For the qualitative data, keywords were identified and organised them into categories. The categories were organised into themes thereby deriving a meaningful insight to the study. For the quantitative data, both numerical and graphical statistical descriptive methods were used. The numerical description of the study was represented by statistics, which focuses on frequencies and percentages. The graphical description was presented in the form of tables and charts. These statistics helped to identify meaningful patterns in the data. The findings were reach from the data analysis using the interpretivist approach, towards achieving the objectives.

5. Findings and Discussion

The analysis is conducted based on the objectives of the study, sections 5.1 and 5.2. To avoid repetitions, abbreviations are used to represent some categories. The patients and doctors (including nurses) that participated in the study are referred to as PPs and DNPs, respectively.

5.1 Detailed information about patient's previous medications and prescriptions

Two fundamental actions and practices, detailed information about patients and histories of medical records can be employed, to significantly reduce patients' risks. Although important, the challenges of omission persist in gathering and storing detailed information about patients. For several reasons, medical histories are significant in preventing errors in medications, prescriptions and other consequent risks to patients. FitzGerald (2009) states that there are many errors that can be associated to lack of medication history, such as omitting drugs erroneously, potentially, cause to harm patient. In the context of this study, medical (medication, prescription and facility) error is unintentional action, failure to complete intended or the use of inappropriate action to achieve an aim. Despite the long-standing of these challenges, long lasting solutions seemed farfetched.

The patient participants (PPs) in the study considered it important to remember their previous medication and prescriptions. The PPs considered these details are important as it helps them to track the side effects of the medication prescribed, to monitor the progress in health conditions, and to keep record of the appropriate medications for their illnesses. The challenges of not able to keep track and memoire of information about history is associated to distinct reasons. Both PPs and DNPs considered three, medication, prescriptions, and facilities, as the main types of errors and challenges they frequently and often encounter.

i. Medication error

Some of the common medication errors are incorrect drugs, strength of dosage, and failure to identify drug interactions or contraindications. Medical practitioner and patient cause these types of errors. Other factors contributing to medication errors include inaccurate medication administration record, poor or lack of communication, and lack of strict adherence to medical code of ethics. Linden-Lahti et al. (2021) empirically reveal that medication errors are one of the most prevalent among patients' care. As shown in Figure 1, 96% of patients strongly agree that they find it extremely difficult to keep track of previous medications and history of prescriptions. Jessurun et al. (2022) explained that prescription and medication processes are prone to errors because of the multistep involved.
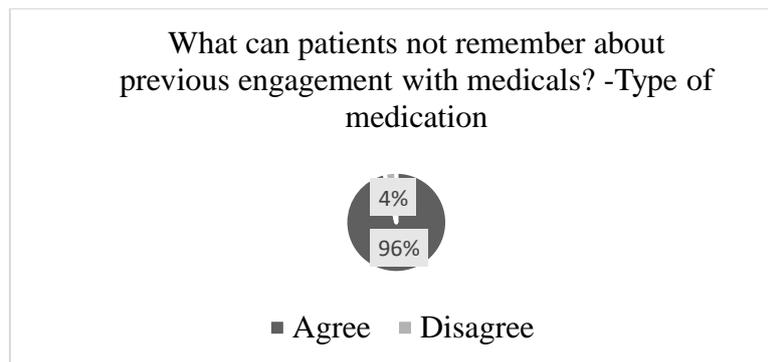

What can patients not remember about previous engagement with medicals? -Type of medication

4%
96%

■ Agree ■ Disagree

Figure 1: Patients do not remember the type of medication

ii. Prescription error

In the views of some patients, many of the prescribed drugs are difficult to administer, remember and manage, which lead to confusion and errors in the dosage. Frequently, errors occur in the administration of different prescriptions of drugs (Kuitunen et al., 2021). As shown in Figure 2, DNPs attest that 70% of their patients do not always remember their prescriptions. Some of the patients assume that the DNPs

should remember on their behalf. In such situations, patients will have to check with the hospital or previous doctors or partners or, consequently, allows the doctors to conduct the investigations and treatments from the beginning.

Prescription errors have caused death or severe harm, and therefore, should be primary target of medication risk management in healthcare facilities (Linden-Lahti et al., 2021). Thus, medical facilities should take more responsibilities and appropriate care.
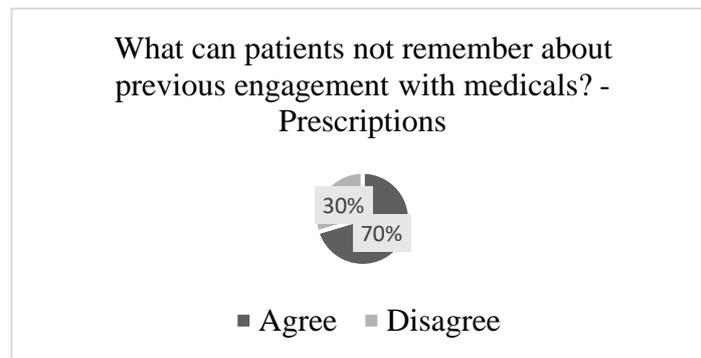

Figure 2: Patients do not remember their prescriptions

iii. Error by Facility

As depicted in Figure 3, 65% of patients often do not remember or accurately, identify either the facility they last visited or the medical personnel that assisted them, or both. Accurate medical history helps to prevent prescription errors, which could have endangered the life of a patient. On the progressive side, nurses, doctors including pharmacists identify errors (Blaine et al., 2022). On the desperate perspective, the same practitioners are associated with diverse types of errors. Thus, it is critical that patients remember the facility and practitioners that provided care to them. According to many of the DNPs, some of the factors that make patients not to remember these critical are memory issues of sick patients, ineffective medication, complicated prescriptions, numerous and rapid changes of doctors and hospitals, and incomplete information provided on visitation.
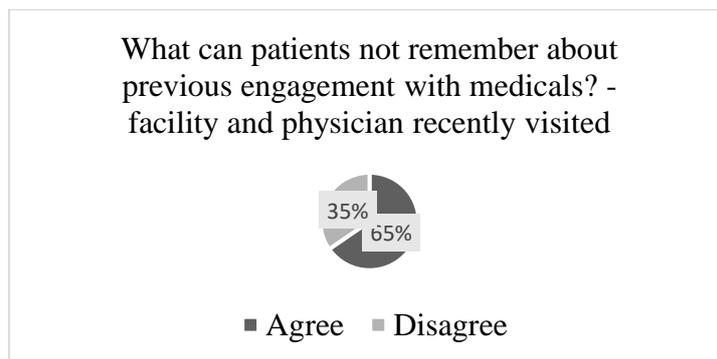

Figure 3: Patients do not remember the facility and physician they visited

Many of the patients consider openness and sharing of medical information with doctors vital, to avoid the risk of prescribing wrong medication and accuracy in diagnosis. FitzGerald (2009) explains how polypharmacy, certain drugs, and clinical specialty can be of severe risk to patients, due to lack of medication records. Incomplete patient medical information can lead to some profound consequences

like prolonged consultation time, unnecessary hospital admissions and ICU stays, wrong patient prescriptions, worse health conditions of the patients due to mistreatments and even staff dismissals due to misjudgements from the medical staff. A complete and up-to-date medical record keeping system may assist both the patients and medical staff in such situations. Facility becomes even more important because of the multiplicity of services and people involved, complexity of procedures (Jessurun et al., 2022).

5.2 Synchronization and secure seamless access to patients' medical records

A timely and continuous patient care enriches patients' information and contribute to accurate medical record system. This study elicited information from both patients and medical personnel's perspectives, to ensure balance and corroboration. The balanced views help to develop deeper understanding of how the healthcare environment stimulate from patients' records perspective. From the memoires and views gathered, it is empirically clear that synchronisation of patients' medical information is critical in improving care by South Africa health facilities. By implication, both patients and medical personnel must take responsibility in sharing and management information. Currently, most patients do not have access to their medical information, which exclude them from accountability and responsibility, from one ontological view. From another perspective, lack of access to ones' information renders a patient helpless in times of need. Two factors, (1) Patients' lack of access to medical records, and (2) Incomplete medical records negatively influence synchronisation and secure seamless.

i. Patients' lack of access to medical records

Medical records play a vital role in ensuring quality and continued health care to the patients. Poor record keeping practices may result in incorrect an inefficient delivery of services to the patients. From the experiences of some DNPs, some facilities use digital records and personal electronic medical records to manage patients' real-time medical information, while others employ the manual approach in many facilities. Consequently, the information is not always correct or complete, which contribute to errors, inefficiency and ineffectiveness. Empirically, Masana and Muriithi (2019)confirm that some health centres in South Africa rural areas still make use of manual filing system and this has led to serious consequences such as missing patient file, and incorrect patient details. Lack of complete medical information of patients can delay the patient's treatment, which can be of serious consequences (Marutha, 2016).

As depicted in Figure 4, 77% of the PPs indicated that the medical personnel do not allow them to have access to their medical records. However, a total of 23% of the participants indicated that they do have access to their medical records. The access is often on request, granted on strict conditions, and assisted by third party, such as the medical insurance firms (medical aid apps) and general practitioner (GP). Patients' inclusiveness is their health-related matters is essential. Patients' access to own medical records has several positives, such as empowerment, reduces inaccuracies in reports, improves education about health conditions (Giardina et al., 2014). There are evidences that patient access to medical records has also helped to improve patient-doctor communication (D'Costa et al., 2020).
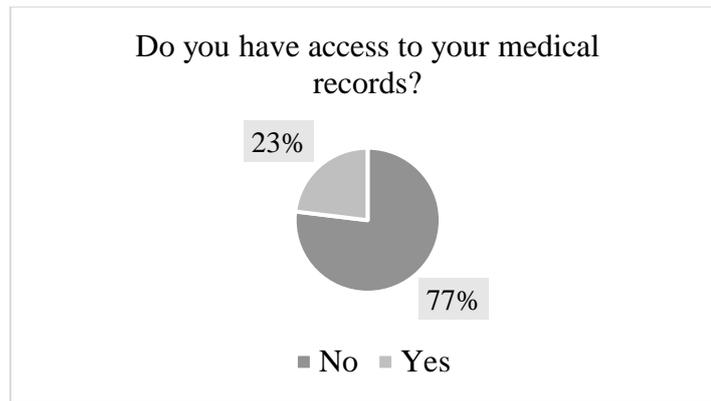
Figure 4: Lack of access to medical records

Despite the current challenges, some PPs considered it important to have access to their medical records. Primarily, it avoids delay in the care that they receive, especially during emergencies, as it can assist future doctors to have a thorough view of previous health conditions. In addition, many PPs feel it is responsible and accountable to be knowledgeable about individual's health condition. Another factor revealed by many of the DNPs is that healthcare professionals in a facility do not have access to patients' record in another facility, in South Africa. According to the 27% of the DNPs, access to patients' records is granted to practitioners from another facilities, on special request. Accuracy and completeness of medical records can be maintained if facilities share patient's medical records (Sayles & Gordon, 2013).

ii. Source of Incomplete medical records

In some cases, some doctors perform tests, investigations and assessments on patients without access to previous medical records. This leads to increased cost to the system and undertreating or overtreating the patient. Also, such circumstance delays treatment, thereby putting the patient's life at risk. From another perspective, incomplete medical records become more problematic in an emergency. In attempt to manage such desperate situation, the doctor may treat the patient based on his/her training and previous experiences or on the symptoms at the time of emergency. Studies reveal that one of the reasons why medical practitioners sometimes prolong patient's hospitalisation is due to fear of prescribing wrong treatments, which often suffice from insufficient medical information (Marutha & Ngoepe, 2017).

In complicated situations, some doctors approach other hospitals and specialists for guidance. According to Sajan, Haeusler and Parrish (2020), physicians usually request for medical information of patients from previous doctors before treating a patient, to avoid further complications. Unfortunately, medical records will be incomplete because of the manual (personal note) approach employed by some practitioners and facilities. Incomplete records can have serious negative impacts on the delivery of healthcare services (Marutha, 2016). This is discouraging because real-time access to medical record system can increase response time, assist doctors with diagnoses of patients, in more correct and accurate manner. This helps doctors to better understand patients' health conditions, assure better service to the patients, eliminate unnecessary tests, and reduce long term hospitalisation. Additionally, real-time systems can assist in monitoring patients' health and providing them with continuous care thereby reducing in-hospital death rate.

6.Implication of Practice

There are four main implications: (1) design and development of a system; (2) transfer of data; (3) training of medical practitioners; and (4) review of policy.

6.1 Design and development of a system
There is a need for a digital system, which captures and stores and update medical information of patients, for completeness and real-time purposes. There seems to be no system that stores real-time, up-to-date patients' records in many South African health facilities. In practice, a digitalised system can assist in conducting and managing more accurate diagnoses and treatments of patients. The DNPs view the contribution of a computerised system from the perspectives of real-time access of patients' medical information. This is purposely to increase response time, and improved accurate view of patients' health conditions, by both patients and medical personnel. This is not new, countries like New Zealand, Australia and United Kingdom have systems that stores real-time medical information of patients, which has assisted in improving the quality of their health care system (Andargoli, 2021).

6.2 Transfer of data
Furthermore, the DNPs stated that there is a lot of effort involved in transferring the data to an electronic system which is an additional burden for them. In practice, two factors are critical importance, technology enablement and validity of the data. Technology solutions enable and support the transfer of patients' data from manual to digital system. The implications include cost of the IT solutions, architecture redesign of the environment, and human efforts. This increases the capacity of health practitioners and improve quality of care to patients, because it increases timeous access patients' information, which increase response time. The validity ensures protection, classification, and certification of the data (Hallinan et al., 2021).

6.3 Training of medical practitioners
Many health practitioners, particularly the older general, find it difficult to learn or use digital systems. Many of the practitioners continue to employ the manual approach. This implication is critical in that the use of new (or emerging) IT solutions to enable and support healthcare services increases access to patients' information, to enhance response time and improve care. The training increases automaticity of the health practitioners. Through training, staff turnover, complete and up-to-date record management system will be improved, which in-turn, assist in providing quality health care services in the country.

6.4 Review of Policy
This implication leads to review of healthcare policy in the country. Fundamentally, policy contributes to improved governance of healthcare services. This is to promote best practices, by ensuring specifics, priorities and timeliness of responses to patients' care in the facilities. Ralston et al. (2021) emphasised on the significant of policy, on divergence and implications for health governance. In practice, the policy helps to define (or redefine) and managing sharing of patients' health information by health practitioners including patients' relations. This aspect of policy should align with the South African Protection of Personal Information Act of 2021. It sets the standard, to evaluate and quantify the efficiency and effectiveness of the services provided by health facilities in the country.

8.Conclusion

This paper highlights the challenges encounter by many health facilities in South Africa, due to lack of access and synchronisation of patients' real-time medical records. As revealed in the study, these challenges manifest into three critical types of errors: medication, prescriptions, and facilities. Some of

these errors result to deaths severe medical injury. In practice, this paper contributing by making medical personnel gain deeper understanding of the implications of patients consulting with various physicians, situated in different health facilities and locations across the country, when there is no centralised system that records and provides access to patients' data for real-time access purposes. Another contribution is that the study demonstrates theoretical usefulness of unique identification of patients.

Based on the empirical evidence from the study, a unique identification (UI) of patients can be design and developed. In addition, the findings from the study can be used to guide the development of policy, for protect errors in patients' information. The UI system and policy will be of use and benefit to different stakeholders, which includes patients, medical personnel and government. The usefulness comes when the UI system or policy prevent medical personnel from treating patients without access to real-time medical information, which provides accuracy, for improved quality of care to the patients.

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