

The implementation of an electronic patient healthcare record system: a South African case study

RV WEEKS (University of Pretoria)

Abstract

Establishing an e-health infrastructure forms a fundamental building block of the National Health Insurance (NHI) initiative; directed at transforming the South African healthcare infrastructure. Currently patient healthcare records constitute paper-based files that result in numerous difficulties in making patient related information available to healthcare practitioners. This research study was directed at determining the typical difficulties encountered in implementing an electronic healthcare record (EHR) system and how they could be addressed.

A literature review and a narrative enquiry formed the basis of the research study. The empirical study was conducted at a Pretoria based clinic, where an EHR system was being implemented to learn from the practitioners' first-hand experience. A multi-disciplinary literature review was undertaken and the insights gained from the empirical study were correlated with the findings emanating from the literature review.

Findings emanating from the research study indicate that the human socio-technology factors involved in the change management process need to be actively managed. The technology concerns found to play a critical role in the systems deployed; relate to network connectivity and bandwidth. The finding emanating from the research could serve as a source of information for management involved in implementing and managing similar projects.

Key phrases

change management; e-health, electronic medical records, national health insurance; narrative enquiry

1. INTRODUCTION

"Patients often move among multiple providers, payers and other stakeholders. This 'crossover' or migration of patients leads to fragmentation of their healthcare records across multiple locations that are historically not interconnected or interoperable. The fragmentation leads to gaps in information for the clinician at the bedside".

Shapiro and Kuperman 2011:147.

In his foreword to the Department of Health's (2012:5) e-health strategy document, the Minister of Health specially makes reference to the fragmentation of South African health information systems, which attest to the introductory contention of resultant gaps in information existing during a clinical patient encounter. This acts as a constraint in enabling clinicians to

provide patients with professional healthcare services. Adebisin Foster, Kotz and Van Greunen (2013:55) draw attention to the need for multidisciplinary teams of clinicians to be able to share information and coordinate treatment interventions. Clinicians increasingly require a multiplicity of information resources and an ability to interact with other healthcare service providers to ensure accurate diagnoses and treatment of a patient's specific and often complex condition.

The prevalence of manual paper-based systems (Department of Health 2012:5) will undoubtedly act as a constraint in bringing together required information resources for effective decision making and treatment of patients. Difficulties encountered in practice in moving from a paper-based information to an electronic system is reflected in the World Economic Forum's (2013:12) observation that few healthcare systems have kept up with the wider information revolution, as it is still common to see trolleys of patient files being wheeled around hospitals. It would appear from this statement that it is not only South Africa that is experiencing difficulty in implementing electronic healthcare information systems, and as a consequence critical information needs of healthcare service providers are often not being met (Gatero 2011:60). Gatero (2011:60) asserts that improved usage of ICT was viewed as the only realistic strategy for enhancing information access and information sharing among healthcare professionals.

1.1 E-Health systems

Despite the advantages associated with electronic healthcare information systems, Harrison, Koppel and Bar-Lev's (2007:542) research reveals that many unanticipated and undesirable consequences are encountered during their implementation. The researchers claim that when healthcare service providers assume that healthcare information systems will deliver the results promised by vendors, they overlook likely interplays between the new technologies and existing sociotechnical conditions (Harrison *et al.* 2007:543). The systems concerned alter prior patterns of work, communication, interaction and relationships among healthcare practitioners that need to be taken into consideration (Harrison *et al.* 2007:543-544).

Consequently the very ways "things are done" are fundamentally disrupted. Technologists involved in the healthcare information system design and implementation are often caught off-guard by the unexpected socio-cultural consequences that emanate from the implementation and utilisation of the systems concerned (Harrison *et al.* 2007:544). Harrison *et al.* (2007:543) make specific reference to "paper persistence", namely an ingrained medical culture of paper-based patient medical records. Sociotechnical studies would seem

to indicate that system designers tend to adopt a “rational/static” mechanistic approach and consequently fail to grasp the impact that the system will have on medical practitioners (Harrison *et al.* 2007:543).

Suchman (2011:11) argues that “the way we think about organizational change makes a big difference in the way we approach the work and, ultimately, how successful we are”. McCarthy and Eastman (2010:1) compare the implementation of electronic medical record systems to a tornado that whips through the healthcare facility, turning life upside down. The deployment of EHR systems is fundamentally about change management that it is multifaceted in nature, thus transcending the traditional mechanistic technology-based approach, to one adopting a more complex adaptive, people-centred orientation. The term “adaptive” is intentionally added as the system has the capacity to alter or change, portraying an ability of people able to learn from experience (Begun, Zimmerman & Dooley 2003:254).

The multidisciplinary nature of the people that interact in deploying and using the system, namely medical practitioners, dentists, pharmacists, specialists, technologists, researchers, medical aid administrators and managers, attests to the complexity of the change management process. Relationship development is seen by Suchman and Williamson (2011:319) as playing a vital role in the change management process. Sluyter (2011:2-3) claims that the problem is often that most healthcare leaders find themselves thrust into the responsibilities for leading change without the benefit of adequate preparation.

The brief introductory discussion suggests that information and communication technology (ICT) may have significant advantages in enabling healthcare information to be available when and where required, but the design, implementation and use of such systems may be fraught with difficulties not initially foreseen. The research study underpinning this paper was essentially qualitative in nature, being directed at determining from a theoretical and practical perspective the typical difficulties encountered in implementing a healthcare information system and how they can best be addressed from a management perspective. The research study could be described as being analytically descriptive, exploratory and explanatory in nature, the narrative case study in particular being directed at learning from the first-hand experience of practitioners in implementing an EHR system.

1.2 Research design

A multi-disciplinary literature review and narrative enquiry were intentionally selected to form the basis of the research design, the accent being on gaining an understanding and insight into the difficulties encountered and how they could best be managed. It is contended that EHR

system implementation and the management issues associated therewith transcends the boundaries of a particular discipline and the insights gained from adopting a multi-disciplinary approach enriches our understanding thereof. The narrative enquiry was undertaken at a Pretoria clinic, attached to the University of Pretoria, currently implementing an electronic medical record and healthcare information system. The narrative enquiry therefore constitutes the underpinning methodology of the case study, namely exploring the implementation of an EHR system within an actual environmental and management setting. As noted by Brandell and Varkas (2001:3) “fundamentally, the narrative case study provides entrée to information that might otherwise be inaccessible. It makes possible the capture of phenomena that might not be understood as readily through other means of study”.

The research study was undertaken by two lecturers and four students from the University of Pretoria’s Graduate School of Technology Management (GSTM). In view of the sensitive nature of some of the information derived from the interviews with both system vendors and staff at the clinic their names are not be divulged; the objective is only to learn from their first-hand experience in the implementation and use of the systems concerned. The ensuing section will focus on the insights gained from the literature; where-after the lessons learnt from the case study will be discussed and brought into correlation with the literature research findings.

2. E-HEALTH: AN INTERNATIONAL AND SOUTH AFRICAN PERSPECTIVE

“Evaluating the success of e-health initiatives and programs means looking beyond the numbers of users to their impact on the people” Keeton 2012:Internet

An emerging trend, that appears to be gaining ground, is a move towards “evidence-based” research in support of contemporary management practice. The approach brings into question the basis used for measuring success or failure in implementation and use of e-health support systems.

The introductory statement suggests that it is not a mere statistical analysis, but one which determines what impact it has had on improving peoples’ health and quality of life. Keeton (2012:Internet) quotes Marc Mitchell as claiming that the critical question is “Does this improve health”? It is argued by Keeton (2012:Internet) that a lot of “technology hype” still exists without the supporting evidence. Therefore, as noted by Scott and Saeed (2008:Internet), decision and policy makers are faced with having to make major decisions regarding an allocation of scarce health care resources and are being encouraged to use rigorous evidence to guide their actions.

Stroetmann, Jones, Dobrev, & Stroetmann (2006:9), however, contend that this is precisely the problem as little reliable evidence exists as to the impact of using ICT in support of quality healthcare. The researchers acknowledge that “the impact is potentially enormous”, but stress that it is “difficult to measure” (Stroetmann *et al.* 2006:9). Evaluations, it is contended by Stroetmann *et al.* (2006:9), often have only one perspective namely financial, or the view of a single stakeholder, and a holistic perspective is frequently not presented.

In a review of the literature, Black, Car, Pagliari, Anandan, Cresswell, Bokun, McKinstry, Procter, Majeed, and Sheikh (2011:12) found that “empirical evidence for the beneficial impact of most eHealth technologies is often absent or, at best, only modest”. Black *et al.* (2011:12) consequently conclude that “there is a pressing need for further evaluations before substantial sums of money are committed to large-scale national deployments under the auspices of improving health care quality and/or safety”. They further stress that while the number of eHealth technologies in health care is growing, “we still have insufficient understanding of how and why such interventions do or do not work”. This contention assumes particular relevance, in light of the South African government’s eminent implementation of the NHI strategy.

2.1 Implementation of EHI systems

The World Health Organisation (2005a:Internet), noting the impact of advances in ICT, adopted an e-Health Strategy resolution for the organisation. It defined e-Health as “the cost-effective and secure use of information and communication technologies in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education” (World Health Organization 2005a:Internet). It is a wide definition that undoubtedly encapsulates electronic healthcare records, as defined by Black *et al.* (2011:5), namely “a complex construct encompassing digitised health care records and the information systems into which these are embedded”.

For the purposes of this paper electronic healthcare records (EHR) are seen as being an integral element of an e-health system. Having adopted the strategy the World Health Organisation (2005b:Internet) urged member states to “develop the infrastructure for information and communication technologies for health as deemed appropriate to promote equitable, affordable, and universal access to their benefits, and to continue to work with information telecommunication agencies and other partners to strive to reduce costs to make eHealth successful”. It is a call that apparently has not gone unheeded by member states.

The World Health Organisation’s (2012:6) report relating to trends and challenges in implementing patient information systems reveals that many developed countries are actively

engaged in adopting electronic healthcare information (EHI) systems and that even “emerging economies, such as Brazil, China and India are beginning to introduce electronic medical records (EMRs) into their health systems”. The report, however, acknowledges that in many of the countries paper-based patient information systems are still being used (World Health Organisation 2012:6). Where paper-based systems are still being used, scanned image technology is often used for electronic transfer of the information. Of relevance in the report is the reference to standards that must be applied to allow for and facilitate the exchange of data between various sources (World Health Organisation 2012:7). It is further concluded that “the adoption of standards is progressing well across most Member States, including standards for eHealth architecture, data, interoperability, vocabulary, and messaging” (World Health Organisation 2012:7). Also claimed is that most member countries have taken steps to establish legal frameworks for the protection of patient data.

Despite political commitment and substantial investment, it is suggested by Murray, Burns, May, Finch, O'Donnell, Wallace and Mair (2011:1), that there have been significant variability in the success of different e-health implementations across the British National Health Service. Apparently “many projects have been subject to considerable delay, increasing budget deficits, and in some cases, severely negative impacts on the quality and effectiveness of care” (Murray *et al.* 2011:2). Implementation difficulties are seen, by Murray *et al.* (2011:2), as being an international phenomenon, that has raised questions about what “successful” implementation actually means. Hage, Roo, van Offenbeek and Boonstra (2013:2) similarly found that while European policymakers are investing heavily in e-Health developments, yet system implementation has not always been all that successful.

Cripps, Standing and Prijatelj (2011:129) presents a contrasting view of the adoption and implementation of electronic medical records in Australia and Slovenia. In Slovenia there is a high level of adoption of electronic record systems in hospitals, health clinics and pharmacies, while apart from general practitioners, which have an almost 100% adoption rate, the health system in Australia is well behind all other sectors of the economy in its use of computerised systems (Cripps *et al.* 2011:129).

While general practice is advanced in its adoption of e-health there is, however, no mechanism for securely sharing electronic information between practices and hospitals yet. Compared to the centralised health systems of European countries Australia has a multi-tiered system, with state and federal government involvement and a large private health sector.

Widespread uncertainty exists surrounding the adoption of e-health in Australia, from a political, policy, administrative, clinical and patient perspective. Slovenia, in contrast, has adopted a fairly centralised and incremental process for e-health implementation, driven by government departments (Cripps *et al.* 2011:129). The Australian approach is deemed far more ad hoc and erratic in nature. The uncoordinated implementation of divergent, incompatible systems within hospitals and between hospitals, compounds a dire lack of national coordination in Australia (Cripps *et al.* 2011:131). A pertinent finding emerging from the Cripps *et al.* (2011:132) study is that the more centralised health systems in European countries, such as Denmark and England, have a far higher level of adoption than those in Australia and the USA.

2.2 E-Health strategy

Blaya, Fraser and Holt's (2010:244) review of evaluations of e-health implementations in developing countries reveal that systems that improve communication between institutions, assist in ordering and managing medications, and help monitor and detect patients who might abandon care show promise. The South African Department of Health (2012:7) only recently adopted an e-health strategy that is specifically confirmed to include electronic health records, routine health management information, vital registration, consumer health informatics, health knowledge management, m-health, and virtual healthcare. It is also pertinently stated that the e-health strategy for the public sector provides the roadmap for the rolling out of a well-functioning, patient-centred national health information and EHR system (Department of Health 2012:5).

The goal of the latter is to allow patient tracking, wherever patients present themselves, and to address the issues of a lack of interoperability, fragmentation and the absence of a national Patient Master Index (Department of Health 2012:15). As noted in the World Health Organisation (2012:7) report, standards and interpretability are listed as strategic priorities needing to be addressed (Department of Health 2012:7). The South African e-health strategy similarly stresses that technical standards are essential to ensure national and international compatibility, interoperability, open architecture, modularity and the capacity for upgrade (Department of Health 2012:16). Seen in the context of the World Health Organisation's (2005b:Internet) call on member states to develop an ICT infrastructure for health, the South African strategy document is an important first step in this direction.

The e-health strategy needs to be seen within the context of the prevailing situation in South Africa. Mars and Seebregts (undated:Internet) claim that only a third of all Provincial Hospitals have some form of functioning EMR system and interoperability is an important

consideration, as the nine Provinces use five different systems. The private sector appears to be no better off as a host of diverse un-integrated systems exist (Department of Health 2012:9). A very similar situation to that previously alluded to as prevailing in Australia. A lack of technology regulations and policy frameworks for all aspects of infrastructure delivery, the Department of Health (2012:9) cites, are the result of the inability of the ICT to effectively support Healthcare services. The following additional challenges are also listed by the Department of Health (2012:9-10):

- Widely differing levels of eHealth maturity across and within provinces.
- A large number of disparate systems between which there is little or no interoperability and communication.
- Expensive broadband connectivity.
- A low degree of cooperation, collaboration and sharing across all sectors.
- Several past initiatives have not reached fruition because of poor planning or lack of consistent sponsorship, management and/or funding.
- A need for strong information governance to ensure compliance with standards and procedures.
- The absence of a national master patient index and lack of consensus on unique identification of patients.
- A lack of cooperation between various groups resulting from a lack of a clear understanding that eHealth includes all ICTs for health, such as mobile technologies.

Mars and Seebregts (undated:Internet) emphasise that there is an urgent need for capacity development in e-Health, at all levels, as many South African healthcare workers have received no computer training. Foster (2011:14) also notes that e-health does not constitute a core subject in the training of healthcare practitioners. Skilled human resources therefore remain a key challenge, according to Foster (2011:17), in efforts to improve healthcare information systems.

The golden tread weaving its ways through the literature appears to be one of complexity and challenges associated with the implementation of e-health and the associated healthcare information systems. The move towards a centralised design and implementation of an e-health information system, it would seem from the Slovenia case study, may be a more effective approach. It is an approach that would be more in line with the South African e-health strategy document, but current reality would seem to suggest a more fragmented approach in practice that is more in line with the previously discussed Australian situation.

The reality, as noted by Blaya *et al.* (2010:244), is that healthcare information systems, such as EHR and mobile systems, also referred to as m-health, can be of fundamental value in realising the vision of “enabling a long and healthy life for all South Africans” (Department of Health 2012:8). In the ensuing section the NHI initiative will be briefly analysed from an e-health perspective.

3. THE SOUTH AFRICAN NHI INITIATIVE: AN E-HEALTH PERSPECTIVE

The NHI policy paper (Department of Health 2011a:4), while essentially focused on introducing an innovative system of healthcare financing, acknowledges that major changes in service delivery structures, as well as administrative and management systems will also be required. The stated objective is that “all South Africans [must] have access to affordable, quality healthcare services regardless of their socio-economic status”.

Four key interventions are envisaged for the effective implementation of the NHI process, namely a complete transformation of healthcare provision and delivery, the total overhaul of the entire healthcare system, a radical change of administration and management, and a move towards primary health care (PHC) (Department of Health 2011a:5). The latter, from an e-health perspective, has specific relevance as it entails bringing mobile (m-health) technology information systems into consideration. It is contended that PHC services are to be re-engineered to focus mainly on community outreach services (Department of Health 2011a:23).

3.1 An integrated NHI system

Clearly articulated in the NHI policy document is the need for “an integrated and enhanced National Health Information System”, deemed essential for so termed “portability of services” (Department of Health 2011a:23). The NHI initiative is to be phased-in and during the first five (5) year period a National Health Information Repository and Data Warehousing (NHIRD) infrastructure is to be established (Department of Health 2011a:49).

The Department of Health’s (2012:8) e-health strategy is seen as constituting an integral part of the transformation and improvement of healthcare services, as alluded to in the NHI policy document, and as laying the foundation for the future integration and co-ordination of all e-health initiatives in both the South African public and private healthcare sector. Inferred therefore is a centralised co-ordinated process similar to that in Slovenia. Important deliverables in terms of laying this foundation are (Department of Health 2012:31):

- the implementation of a national patient master index for unique patient identification;

- the establishment of a basic national health record system with information exchange to support interoperability; and
- ensuring broadband connectivity.

The Department of Health (2011b:9), in terms of the National Health Act (Act 61 of 2003), is required to facilitate and co-ordinate the establishment, implementation and maintenance of information systems. The objective is to create a comprehensive national health information system. One such system is the “District Health Management Information System” (DHMIS) (Department of Health 2011b:9), but the establishment of a national integrated system remains an elusive objective. Hampering the establishment of the national systems, it is suggested, is a lack of governance and standardisation of the DHMIS, as shown by ad-hoc and uncoordinated implementation of systems, as well as a shortage of managers with the required expertise (Department of Health 2011b:12).

3.2 Client-centred healthcare

It would seem that the prevailing situation is not unique to South Africa as the New Zealand health information system is also characterised by a large number of systems dispersed across twenty (20) District Health Boards, and bringing patient information together into a single patient-centric view is equated as “assembling a jumble of jigsaw puzzles” (National Health IT Board 2010:10).

It is similarly contended by the National Health IT Board (2010:11) that the deployment of a fully optimised suite of clinical and business information systems remains an elusive goal in New Zealand. Of pertinence to the South African situation is the approach that the National Health IT Board (2010:11) intends to adopt to address the situation: “The next generation of health information solutions must be person-centred, optimising the patient’s experience as they engage with the health system through a range of clinical pathways”.

Implied is system integration and interoperability, with a primary client-centred focus of enhanced healthcare service delivery. In this regard the World Economic Forum (2013:5) stresses that by envisioning an ideal system leaders can propose strategies to attain it. South Africa’s problem now, however, is getting implementation on the road so as to get to its envisaged destination, a process fraught with constraints. This is confirmed by Loggenberg (2013:Internet) who cites the Minister of Health as claiming that the Health Ministry “is plagued with many challenges in trying to kick-start the NHI pilot programme”.

The first steps of implementation of the NHI project are through pilot projects within ten (10) districts (Department of Health 2011a:52). The based Pretoria clinic selected for the

research study underpinning this paper is situated in one of these pilot districts. In view of the Pretoria University's involvement at the clinic, a "Health Living Lab", involving academics from a number of faculties and disciplines was established, the purpose is to engender a research context that could add value to the future unfolding of the NHI initiative. One such research project was the GSTM's EHR research study. In the ensuing discussion the deployment of an EHR at the clinic will be explored, and in so doing the insights gained from the literature will serve as a basis of analysis.

4. THE DEPLOYMENT OF AN EHR SYSTEM: A CASE STUDY

Transforming envisioned EHR systems into operational systems that are accepted and actively utilised by all medical practitioners involved, as claimed by McCarthy and Eastman (2010:1) in the introduction, can result in a tornado of change. How best to manage that change is quite a different story. Suchman (2011:15) views it as a "gigantic complicated conversation" weaving itself through the healthcare facility and involving all stakeholders. In trying to gain an understanding of the deployment and change management process adopted at the Pretoria based clinic, the truth encapsulated in this metaphor soon became apparent. Within this so termed gigantic conversation, myriads of sub-conversations were taking place, each shaping not only the technology systems deployed, but also the emerging culture within which the systems would be utilised.

Unlike the predetermined functionality of the technology systems, these conversations created new shared meanings, understandings, insights, values and beliefs that were constantly emerging and changing in the process. The medical practitioners had to learn and come to accept new practices and ways of doing things. This implied letting go of well entrenched beliefs as to what constituted accepted practice, such as paper-based patient medical records. This would not be easy, as the paper-based systems had acquired a life of their own and changes in this regard engendered an emotional response. In the ensuing discussion the narrative enquiry methodology utilised for the case study is briefly described.

4.1 Research methodology

The methodology adopted for the research study, as previously alluded to in the introductory discourse, constituted a narrative enquiry that could be described as being analytical, interpretive and descriptive in nature. The objective was to learn from the respondents' first-hand experiences in the design, deployment and utilisation of the EHR system at the Pretoria based clinic.

An important motivation for using a narrative enquiry was that it enabled the researcher to capture not only the respondent's narrative but also the associated emotions expressed. Collectively the narrative and the emotions expressed engender far greater insight, as to what the respondent is attempting to convey. The objective was to identify common patterns emerging from the narratives captured and interpret these within the context of the deployment of the systems concerned. Snowden (2005:Internet) for instance quite pertinently claims that narratives reveal patterns of behaviour and understanding in a far more effective way than traditionally encountered in questionnaire based approaches. Snowden (2010:Internet) further argues that "humans are pattern processors", and consequently understanding people will involve the identification and management of those patterns.

The research study was conducted by four students under the supervision of two senior researchers at the GSTM. It constituted a review of the literature and a narrative enquiry. The latter entailed interviewing technologists and managers from the vendor institutions, who had designed and were responsible for the EHR systems implementation, and the various healthcare and associated practitioners who made use thereof in rendering services to the community. Two vendor institutions were involved, one which is responsible for the deployment of an electronic patient medical record system, and the other for implementing a mobile health (m-health) system to be used by healthcare workers in a community outreach programme. In both cases the vendors were responsible for the design, implementation, and respective change management initiatives involved.

The clinic respondents interviewed were medical practitioners, a dentist, nurses, healthcare workers, and administrative personnel. They were asked open-ended questions with the aim of allowing them to elaborate as they thought fit. The interviews were conducted on a confidential basis, thus the names of the respondents concerned are not divulged, in view of the sensitive nature of some of the material obtained. No patients at the clinic were interviewed and no sensitive patient information was accessed for obvious ethical considerations.

The intent in using narratives to conduct the research, can be best described by means of Lawlor and Mattingly's (2000:5) conceptual paper. They suggest that "rich narrative depictions are much more useful than abstract generalizations or belief statements", and that personal descriptions, can often provide the interviewer with an "inside perspective" of what had taken place. (Lawlor & Mattingly 2000:5). Riley and Hawe (2005:230) would concur with this contention, in claiming that "narrative inquiry captures how people make sense" of their

world. Citing Kerby and Kramp (Undated:5) similarly concludes that “narratives are a primary embodiment of our understanding of the world, of experience”. Within the research study this was precisely the objective, namely to learn from the hands-on experience of the respondents. Seen in the context of a case study, which Lalor, Casey, Elliot, Coyne, Corniskey, Higgins, Murphy, Devane and Bergley (2013:3) a flexible “research design” it allows for the “capture of holistic and meaningful characteristics of real life events”.

The ensuing sections deal with the research findings emanating from the narrative enquiry. The first deals with the vendors’ development and deployment of the systems, and the second with the utilisation and change management, from a user’s perspective.

4.2 Electronic systems development and deployment

Two systems are being deployed at the Pretoria clinic. The first is a primary EHR system and the second a m-health system used by community healthcare workers. A key consideration in their design was interconnectivity and consequently standards. As reflected in the literature review South Africa has a host of disparate systems, most of which inhibit interoperability (Department of Health 2012:5). The Council for Scientific and Industrial Research (CSIR) has been tasked by the Department of Health to develop the required standards, but currently these have not yet been published.

The EHR system had been deployed within private sector healthcare facilities and over eight hundred (800) physician practices, according to the Chief Executive Officer (CEO) of the vendor company, and this would consequently facilitate interoperability with the private sector. The problem, however, is that even within the private sector such interoperability tends to be within the domain of financial information transfer, essentially being used to submit claims to medical aids. The two system vendors therefore needed to customise their systems to ensure interoperability.

The director of the EHR system vendor confirmed that “third generation” source code had been used in the development of the system, mainly C# (C Sharp) as well as the Microsoft Studios environment. The systems have been designed as to facilitate user utilisation of the system itself. The respondent confirmed, however, that the user would need to be trained in the use of the system as part of the change management process, an aspect to be dealt with in the issuing section.

An important element in the system design, mentioned by the respondent, was that of patient and medical practitioner identification. This had an important implication in terms of administration and information confidentiality considerations. At the clinic paper-based

patient healthcare records are still being used in conjunction with the EHR system. Patient files are given a unique file number that is cross referenced to the patient's national identification number and name. The file number serves as a key identification element in the EHR system. A difficulty associated with the EHR system is the need to capture all the legacy information and on-going information still being generated into the system. A data capture is transferring the paper based information to the electronic system. Notably, at patient reception, time is spent finding and retrieving patients' paper files, resulting in long queues, a waste of time and increased patient frustration.

The clinic serves as a training facility for medical students from the University of Pretoria, and each new intake of students need to be trained to use the EHR system, in effect constituting a never ending training process. Approximately sixty (60) new students a month pass through the clinic and need to get a unique electronic identification to access the systems. From system architecture perspective the need to bring students onto the system has been addressed. Associated with each student is also a registered healthcare "supervisor" that has been factored into the system architecture.

The technologist responsible for implementing the m-health systems, to be used by the community healthcare workers, confirmed that touch screen cellular phones and handheld devices formed the basis for the collection and transfer of patient/community information to the EHR system. The information to be acquired by healthcare workers, in house-to-house visits within the community, was predetermined by the medical practitioners at the clinic. An electronic-based questionnaire was then developed that could be accessed and completed by means of the mobile hand-held devices, the objective being to provide members of the community with preventative healthcare services.

4.3 System utilisation and change management

The EHR system vendor's CEO confirmed that one of the significant challenges in dealing with the change management process at the Pretoria based clinic was the issue of a well-established "paper-based" culture, which constituted a so termed "barrier to entry". As stated by the CEO, the paper-based healthcare records in effect have assumed a life of their own in many respects. Moving from a predominantly paper to an electronic environment therefore constituted a major step for most of the people concerned. This contention would seem to resonate with the literature reference to what was termed to be "paper persistence" (Harrison *et al.* 2007:543). Even community healthcare workers indicted that having to complete the mobile questionnaire acted as a distraction in discussions with the community. This

notwithstanding the healthcare workers found the mobile system relatively easy to deal with once trained in its use.

Asked as to how “paper persistence” was dealt with, the respondent indicated that in the private sector the healthcare practitioner who had invested financial resources in implementing the system had a direct interest in its utilisation. In addition in the private sector healthcare information such as pathology tests, clinical results, and even radiology images and the interpretation thereof are being dealt with electronically in many instances.

At the Pretoria based clinic, however, there is no commercial interest involved in the system’s utilisation and change management consequently assumes a far greater role. It was also contended by the respondent that for a more “electronic savvy” younger generation, accustomed to electronic systems and handheld devices, the transition was less dramatic than for an older generation that had become accustomed to paper-based systems. The respondent acknowledged that in practice, the need to engender a fundamental change in the behaviour of the diverse stakeholders involved is turning out to be more difficult than first envisaged. The human behaviour change embodies an emotional element of having to let go of well entrenched beliefs and ways of doing things.

4.4 Human aspects of change management

Central to the change management approach adopted at the clinic are a series of “conversations” with users of the system. Currently bringing all the diverse healthcare practitioners on-board is proving to be quite difficult and the conversations were still on-going at the time when the interviews were being conducted. An important point in bringing all the stakeholders on-board was the need to create a “shared vision” of the role to be played by the EHR system in the overall operations of the clinic and this in itself entailed “conversations” to engender a shared understanding as to the advantages to be derived from the systems concerned. The system and its use also need to be integrated with the healthcare services business model adopted at the clinic, thereby becoming part and parcel of operational day-to-day practice.

The technologist responsible for the implementation of the m-health system similarly confirmed that the technology itself was not a major difficulty encountered, but that training the healthcare workers and engendering a culture change at the clinic was far more of a challenge. Interviews with nursing staff at the clinic also revealed that they had become used to the paper-based systems and that they found the changes in the practices necessitated by the introduction of the electronic systems “unsettling”.

It was suggested by a nurse respondent that it would require a duplication of work as legal considerations required signed documents. In addition the nurse interviewed was of the view that typing in the patient history and diagnoses was far more time consuming, than was the case with paper-based systems. They apparently had not been involved in discussions relating to the selection and deployment of the electronic systems.

It was noted that they still make use of the paper-based system and the data capture captured this information on the EHR system. It could be concluded from the nursing staff interviews that they viewed the EHR system as being a duplication of effort with little real additional benefit. The administrative staff interviewed also saw the capturing of the paper-based information into electronic format as additional work they had been landed up with. Registering new patients on the dual systems was also seen as being time consuming.

Medical practitioners interviewed similarly were concerned with the time aspect of capturing patient information electronically. They found the system to be slow and consequently they were at the time of the interviews not yet using it in the consulting rooms. A high circulation of students and training requirements added to the complexity of the implementation process. There are eight specialities represented in the clinic and incorporating them all in the use of the EHR system is proving to be challenging. Doctors need to sign off student diagnoses and treatment and the system is seen as a complication of their work load as paper-based records were also still in use.

Medical practitioner and specific speciality requirements of the system had also not been factored into the system, which are more aligned to private sector requirements. Far more than clinical information needs to be captured in a speciality context and the system needed to be adapted to deal with these requirements. Access to information and confidentiality requirements was seen as another challenge in a specialty context that needed to be addressed.

It was acknowledged by the clinicians that it was early days yet and they were still not quite sure as to the functionality of the system. It was stressed that they were open to discussions that still needed to take place regarding the functionality and their requirements of the system. A PHC dispensation and the accent on family medicine for instance necessitated special tools, such as a genogram, that was currently not available on the system, thereby necessitating the use of a paper-based system. Change management was also cited by clinicians as being critical in getting the EHR and m-health systems functional. Communication was seen as playing a vital in this regard.

5. CONCLUSION

The literature reveals an accent on the advantages to be derived from EHR systems, yet at a clinical level this is not always the centre of focus, where the impact of the implementation experienced in terms of day-to-day operational realities assumes priority. The reality of a dual paper and electronic system's effect on time utilisation is one case in point, the high turnover of student users and the resources required for their training another. The multiplicity of speciality system requirements differ from that in private practice, thereby placing additional user specific needs to be met on the system design.

An essentially private sector system design needs to be reconfigured to deal with the diversity encountered within a public sector healthcare facility. Technologists do not see this as being an insurmountable problem, but one requiring clarification of clinician requirements and availability of resourced to adapt the system.

Healthcare practioners interviewed raised the issue of the time required for patient specific data entry versus the time taken with a paper-based record system. The use of data captures would appear to offer a solution in this regard. The advantages of the electronic availability of patient information could bring about a change in healthcare practitioners willingness to directly enter patient information during a clinical encounter. At the time of the case study interviews, the EHR was not yet fully operational, nor had the issue of user specific requirements been dealt with and this could have a significant impact. A longitudinal study needs to be conducted to determine such changes. Undoubtedly, engendering a culture change in moving from a paper to an EHR system assumes particular pertinence from a change management perspective, both in the literature and in practice.

A common denominator emanating from both the literature review and the case study is the reality that the technology difficulties encountered in implementing an EHR system are far more easily dealt with than the human aspects involved. Change management thus assumes a critical dimension in implementing and managing the EHR system in theory and practice.

REFERENCES

- ADEBESIN F, FOSTER R, KOTZ P & VAN GREUNEN D.** 2013. A review of interoperability standards in e-Health and imperatives for their adoption in Africa. *South African Computer Journal* 50:55-72.
- BEGUN JW, ZIMMERMAN B & DOOLEY K.** 2003. Health care organizations as complex adaptive systems. In MICK SM & WYTTEBACH M (eds). *Advances in health care organization theory*. San Francisco, CA: Jossey-Bass. pp.253-288.

- BLAYA JA, FRASER HSF & HOLT B.** 2010. E-health technologies show promise in developing countries. *Health Affairs* 29(2):244–251.
- BLACK AD, CAR J, PAGLIARI C, ANANDAN C, CRESSWELL K, BOKUN T, MCKINSTRY B, PROCTER R, MAJEED A & SHEIKH A.** 2011. The impact of eHealth on the quality and safety of health care: a systematic overview. [<http://www.plosmedicine.org/article/fetchObject.action?uri=info%3Adoi%2F10.1371%2Fjournal.pmed.1000387&representation=PDF>; downloaded on 27 January 2014.]
- BRANDELL JR & VARKAS T.** 2001. Narrative case studies. [<http://srmo.sagepub.com/view/the-handbook-of-social-work-research-methods/n16.xml>; downloaded on 6 December 2013.]
- CRIPPS H, STANDING C & PRIJATEL JV.** 2011. The implementation of electronic health records: a two country comparison. [[https://domino.fov.uni-mb.si/proceedings.nsf/0/b5cd9bc99bfa3db5c12578f900802cbb/\\$FILE/P10_Cripps.pdf](https://domino.fov.uni-mb.si/proceedings.nsf/0/b5cd9bc99bfa3db5c12578f900802cbb/$FILE/P10_Cripps.pdf); downloaded on 29 January 2014]
- DEPARTMENT OF HEALTH.** 2011a. National health insurance in South Africa: policy paper. Pretoria: Government Printer.
- DEPARTMENT OF HEALTH.** 2012. eHealth strategy South Africa: 2012-2016. Pretoria: Government Printer.
- FOSTER R.** 2011. eHealth review: Cape Town, South Africa: Medical Research Council.
- GATERO GM.** 2011. Utilization of ICTs for accessing health information by medical professionals in Kenya: a case study of Kenyatta National Hospital. *Journal of Health Informatics in Developing Countries* 5(1):60-88.
- HAGE E, ROO JP, VAN OFFENBEEK MAG & BOONSTRA A.** 2013. Implementation factors and their effect on e-Health service adoption in rural communities: a systematic literature review. [<http://www.Biomedcentral.com/1472-6963/13/19>; downloaded on 27 January 2014]
- HARRISON MI, KOPPEL R & BAR-LEV S.** 2007. Unintended consequences of information technologies in healthcare: an interactive sociotechnical analysis. *Journal of American Medical Informatics Association* 14(5):542-549.
- KEETON C.** 2012. Measuring the impact of e-health. [<http://www.who.int/bulletin/volumes/90/5/12-020512.pdf>; downloaded on 24 January 2014]
- KRAMP K.** Undated. Exploring life and experience through narrative inquiry. [http://www4.nau.edu/cee/ci_doc/current/resources/6_kramp.pdf; downloaded on 5 February 2014]
- LALOR JG, CASEY D, ELLIOT N, COYNE I, CORNISKEY C, HIGGINS A, MURPHY K, DEVANE D & BERGLEY C.** 2013. Using case study within a sequential exploratory design to evaluate the impact of specialist and advanced practice roles on clinical outcomes: The SCAPE study. *BMC medical research methodology*. [<http://www.biomedcentral.com/1471-2288/13/55>; downloaded on 24 March 2014.]
- LAWLOR M & MATTINGLY C.** 2000. Learning from stories: narrative interviewing in cross-cultural research. *Scandinavian Journal of Occupational Therapy* 7:4–14.
- LOGGENBERG C.** 2013. NHI pilot projects to kick-off. [<http://ewn.co.za/2013/02/22/NHI-pilot-projects-to-kick-off>; downloaded 19 on January 2014]
- MARS M & SEEBREGTS C.** Undated. Country case study for e-health South Africa. [<http://ehealth-connection.org/files/resources/County%20Case%20Study%20for%20eHealth%20South%20Africa.pdf>; downloaded on 16 December 2012.]
- McCARTHY MA & EASTMAN D.** 2010. Change management strategies for an effective EMR implementation. Chicago, IL: HIMSS.
- MURRAY E, BURNS J, MAY C, FINCH T, O'DONNELL C, WALLACE P & MAIR F.** 2011. Why is it difficult to implement e-health initiatives? A qualitative study. *Implementation Science* 6(6):1-11.

- NATIONAL HEALTH IT BOARD.** 2010. National Health IT plan: enabling an integrated healthcare model. National Health IT Board, Wellington, New Zealand. [http://www.ithealthboard.health.nz/sites/all/files/National%20Health%20IT%20Plan%20v11_1.pdf; downloaded on 31 January 2014]
- RILEY T & HAWES P.** 2005. Researching practice: the methodological case for narrative inquiry. *Health Education Research* 20(2):226–236
- SCOTT RE & SAEED A.** 2008. Global eHealth – measuring outcomes: why, what, and how. a report commissioned by the World Health Organization's global observatory for eHealth. [http://www.ehealth-connection.org/files/conf-materials/Global%20eHealth%20-%20Measuring%20Outcomes_0.pdf; downloaded on 26 January 2012]
- SHAPIRO JS & KUPERMAN G.** 2011. Health information exchange. In Ong K (ed). *Medical informatics: an executive primer*. 2nd ed. Chicago, IL: HIMSS. pp.147-159.
- SLUYTER DJ.** 2011. Introduction. In Suchman AL, Sluyter DJ & Williamson R (eds). *Leading change in healthcare: transforming organizations using complex, positive psychology and relationship-centred care*. London: Radcliffe. pp.1-8.
- SNOWDEN D.** 2005. Narrative patterns: The perils and possibilities of using story in organisations. [http://cognitive-edge.com/uploads/articles/41_narrative_patterns_-_perils_and_possibilities_final.pdf; downloaded on 10 January 2014.]
- SNOWDEN D.** 2010. Appendix 2: Narrative research. [http://narrate.typepad.com/100816-narrative-research_snowden-final.pdf; downloaded on 10 January 2014]
- STROETMANN KA, JONES T, DOBREV A & STROETMANN VN.** 2006. eHealth is worth it: the economic benefits of implemented eHealth solutions at ten European sites. [<http://www.ehealth-impact.org/download/documents/ehealthimpactsept2006.pdf>; downloaded on 26 January 2014]
- SUCHMAN AL.** 2011. How we think about organizations: a complexity perspective. In Suchman AL, Sluyter DJ & Williamson R (eds). *Leading change in healthcare: transforming organizations using complex, positive psychology and relationship-centred care*. London: Radcliffe. pp11-24.
- SUCHMAN AL & WILLIAMSON PR.** 2011. Principles and practices of relationship-centered meetings. In Suchman AL, Sluyter DJ & Williamson R (eds). *Leading change in healthcare: transforming organizations using complex, positive psychology and relationship-centred care*. London: Radcliffe. pp319-324.
- WORLD HEALTH ORGANISATION.** 2005a. eHealth. [http://www.who.int/healthacademy/media/en/eHealth_EB_Res-en.pdf?ua=1; downloaded on 26 January 2014]
- WORLD HEALTH ORGANISATION.** 2005b. WHO eHealth Resolution. [<http://www.who.int/healthacademy/news/en/>; downloaded on 26 January 2014]
- WORLD HEALTH ORGANISATION.** 2011. Management of patient information: trends and challenges in member states. [http://apps.who.int/iris/bitstream/10665/76794/1/9789241504645_eng.pdf?ua=1; downloaded on 26 January 2014]
- WORLD ECONOMIC FORUM.** 2013. Sustainable health systems: visions, strategies, critical uncertainties and scenarios. [http://www3.weforum.org/docs/WEF_SustainableHealthSystems_Report_2013.pdf; downloaded on 19 January 2013]