The assessment of acceptance and identification of barriers to use of electronic medical records by doctors in emergency centres in Cape Town, South Africa.

by

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Declaration

By submitting this dissertation electronically, I, DR. MOHAMEDSUHEL CHAGANI declare that the entirety of the work contained therein is my own, original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

This dissertation includes ONE (1) unpublished work. The development and writing of the papers (published and unpublished) were the principal responsibility of myself and for each of the cases where this is not the case a declaration is included in the dissertation indication the nature and extent of the contributions of co-authors.

Signature: …… **Date:…**December 2017**…**

Table of Contents **Page**

List of tables and figures

Abbreviations

CI	confidence interval
CPOE	computerised provider order-entry
EC	emergency centre
ECM	enterprise content management
eHealth	electronic health
EHR	electronic health record
EMR	electronic medical record
FCEM	fellowship of college of emergency medicine
HIS	health information systems
HIT	health information technology
ICT	information and communication technologies
MBChB	bachelor of medicine, bachelor of surgery
MD	doctor of medicine
MMed	master of medicine
NHC/MIS	national healthcare management information system
OpenMRS	open medical record system
SD	standard deviation
WHO	world health organization
UTAUT	unified theory of acceptance and use of technology

Part A: Literature review

Background

Millions of people in developing countries face serious health risks due to high burdens of disease together with inadequate resources and poor health infrastructures.(1) It is believed that incorporating technology into healthcare is one way of overcoming some of the challenges faced by developing countries. Electronic health (eHealth), as defined by the World Health Organization (WHO), refers to "the use of information and communication technologies (ICTs) for health to, for example, treat patients, pursue research, educate students, track diseases and monitor public health."(2) Examples of such technologies include applications (apps) on smartphones for quick reference and apps for diagnosis/consultation on specific diseases such as burns or dermatology, as well as accessing electronic health records (EHRs). Over the past 20 years, different forms of EHRs have been developed and implemented worldwide.(3) However, a key challenge has been defining electronic health records. What some people refer to as an electronic health record may not be the same as an electronic health record developed in another country.(3) The terms electronic medical records (EMRs) and EHRs have been used synonymously, however, there are some differences between them.(4) According to the WHO, an EHR is "a longitudinal record that contains all personal health information belonging to an individual; is entered and accessed electronically by healthcare providers over the person's lifetime; and extends beyond acute inpatient situations including all ambulatory care settings at which the patient receives care".(3) The term EMR refers to automated systems that store data under a central system. They are usually created and managed by healthcare providers in an organisation. The data usually contains patients' clinical summaries but may have additional features such as order entry and decision support.(5) EHRs offer access to entire medical records of patients, even in the absence of the patient, as they include data aggregated from various providers, such as general practitioners, specialists, radiologists and pharmacists. EHRs rely on the interconnectivity of EMRs to enable information exchange.(3,5,6)

There is general agreement that electronic, computer-based medical records have the potential to improve the quality of care, improve patient safety, enhance access to a patient's medical history and improve communications between health professionals, and improve efficiency via appropriate use of resources.(4,6,7) They are aimed at replacing the old paper-based systems with

a more efficient, electronic system for healthcare records.(4) Despite the potential benefits to the healthcare system, EMR implementation in the United States has been a challenge with failure rates close to fifty percent. Some of the challenges include cost, resistance from physicians, and inadequate computer skills.(8,9) EHR technologies must be adopted broadly and assimilated deeply across healthcare settings to realise the potential benefits from these investments.(10,11) Therefore, factors influencing acceptance and barriers to use of technology need to be investigated prior to implementing them.(12)

Search Strategy

Relevant articles were searched for in four databases (MEDLINE, Scopus, SA ePublications Journal Collection and WorldCat.org) as well as Google Scholar. The search dates for relevant articles was from January 2000 to December 2015. Articles printed in English language, published in peer-reviewed journals and papers published in conferences were included in the search. Due to a lack of a standardised definition of electronic medical records, the initial search strategy was broadened to increase the likelihood of finding relevant articles.

The key search terms included: electronic medical records; electronic health records; acceptance; barriers; physicians; developed countries; developing countries; South Africa; emergency department; emergency centre; technology acceptance; health information technology; and health information systems, in various combinations.

The titles and abstracts of publications identified in the search were reviewed and relevant articles were selected for possible inclusion. Full-texts of these articles were retrieved for further review. The inclusion criteria were as follows: studies involving physicians or residents/registrars, particularly in the emergency centre; assessing acceptance of EMRs, especially using the Unified Theory of Acceptance and Use of Technology (UTAUT) and barriers to use of EMRs; and studies in developed and developing countries, particularly in South Africa. In addition, reference lists of selected articles were reviewed to identify additional studies that may have been missed during the initial search.

Summary of Literature

Multiple eHealth programs are being developed in various African countries.(13) Each country

has an aim to improve healthcare using technology. Examples of this include EHRs in East Africa to fight the HIV/AIDS epidemic;(14) and Rwanda, a leader in eHealth, has prioritised the development of a national EMR as part of its national eHealth plan. Some of these projects are inter-linked. For example, the Open Medical Record System (OpenMRS) is a multi-institution, nonprofit collaborative led by the Regenstrief Institute and Partners in Health. They use open-source software to create EMRs that can be developed and self-sustained in resource-limited countries within Africa. Thus far, it has been implemented in South Africa, Kenya, Rwanda, Ghana, Lesotho, Zimbabwe, Mozambique, Uganda, and Tanzania.(13)

The majority of the healthcare sector in South Africa is still using paper-based records.(15) There is inequitable distribution of resources between urban and rural populations with the rural areas already experiencing difficulty with poor infrastructure and access to electricity and water.(16,17) The use of technology is hoped to improve the quality of healthcare services, and to reduce the inequality between rural and urban health service delivery.(16) Nationally, there has been a push from the government for change to an electronic based healthcare records system. The project kicked off in May 2002 to develop a national EHR.(18) The government has formed an eHealth strategy with the mission to establish eHealth as an integral part of the transformation and improvement of healthcare services in South Africa, especially enabling delivery on the health sector's Negotiated Service Delivery Agreement 2010-2014.(2) The overall aim of this strategy is to provide a single, harmonised and comprehensive eHealth strategy that:

a) "Supports the medium-term priorities of the public health sector;

b) Paves the way for future public sector eHealth requirements; and

c) Lays the requisite foundations for the future integration and coordination of all eHealth initiatives in the country (both public sector and private sector)."(2)

According to the eHealth strategy, South Africa is at stage 3 of eHealth maturity (i.e. migration of traditional district health information systems to electronic storage and reporting). However, depending on resource availability, individual provinces range from stages 1-4.(2) According to the landscape analysis of Health Information Systems (HIS) in developing countries funded by the Bill and Melinda Gates Foundation, "despite all the support and active implementations of various HIS, not all provinces have all components of the NHC/MIS".(2) In approximately one-third of provincial hospitals, EMRs are only "somewhat functional" with numerous different

systems in use with limited integration. In addition to this, ICT access is limited in state hospitals. The Western Cape province has progressed the furthest, with a central hospital information system based off a single patient identifier (patient ID) and includes a pharmacy system, radiology and primary health care clinics that all utilise this single identifier.(2) Kleynhans evaluated whether South Africa was ready to implement a national EHR after analysing key success factors from other EHR implementation projects.(18) She concluded that the current environment did not allow the country to be ready for a national EHR but has the potential for success.(18) In the Western Cape, an important lesson learnt from successful implementation of a "semi-EMR" system that scans and stores paper based records to an online database like enterprise content management (ECM) is that it represented a more African-based solution.(19) It addressed the issue of cultural transformation, revealed the need for training and support, and the need for a well-formulated change management process.(19–21) However, other technologies, such as digital pens can provide similar transitions to full EMR but have additional benefits of modern EMRs, such as immediate digitalisation and data mining. In addition, the increased staff required to scan documents and maintain the ECM solution may make transition to full EMR more difficult in the future. Cline and Luiz interviewed doctors, nurses and administrators at two hospitals in South Africa; respondents indicated EMRs had benefit in terms of cost, patient experience, hospital staff workflow enhancements, and overall morale in the workplace.(17) In addition, they indicated there is room for improvement through a change management process to improve perceptions of HIS.(17)

EMRs have been implemented in various health systems across the world and have improved healthcare in general as discussed below. One concern has been that the advantages stated have only been seen on paper rather than translated into practice.(22) One of the major effects of health information technology was its role in increasing adherence to guideline- or protocol-based care.(23) Decision support, usually in the form of computerised reminders, was a component in all adherence studies.(23,24) In addition, documentation of past encounters that is accessible and legible, could assist on-site decision-making and reduce exposure to litigation.(24) A review of informatics systems designed to improve care for chronic disease showed both cost effectiveness and guideline adherence were significantly improved.(22) EMRs have the capacity to improve quality of care through improvement in clinical monitoring and improvement in communication and transfer of information between healthcare providers that enables good continuity of care to patients.(15,23) These studies demonstrated how health information technology could support

new ways of delivering care that are not feasible with paper-based information management.(23) A United States based study estimates electronic medical records improve overall efficiency by 6% per year, and the monthly cost of an EMR may be offset by the reduction in cost of only a few "unnecessary tests or admissions".(25) Reduction in medication errors was another major gain.(23,26–28) This included decreases in adverse drug events and improving medication dosing. EMRs have been shown to produce more efficiency by decreasing healthcare services' utilisation via computerised provider order-entry (CPOE) systems at point of care; decrease provider time by enabling quicker access to old patient data; provide faster compilation of clinical documents through technology like voice recognition and auto-filling of fields; and decrease redundancy. Where studies have shown that time may increase, they suggest that this may be mitigated by long-term use and familiarity.(23,24,26–28) Other advantages included reduced storage costs, graphical display of results, and patient education that facilitates better understanding and satisfaction.(18,24,26,27)

Like any other technology, EMRs also have their unique set of challenges. Implementing EMRs is a mammoth task and complex in nature as it involves organisational, social and technical factors.(3,16,29) Although these skills can be learnt, they do pose some technical challenges to those unfamiliar with computers.(30) Lack of standardisation between EMRs makes it difficult for physicians to share information regarding patients.(30–32) Standardisation of vendor applications that permit clinical data exchange will be required to achieve greater interoperability.(28) Another major concern regarding EMRs is privacy and confidentiality. Patient records can be accessed and transmitted by individuals who have access to the system yet may be used for personal gains.(30) Whilst using EMRs in the hospital setting has been shown to provide improved quality of care, this did not apply to all environments. Linder et al concluded that EMRs were not associated with better quality ambulatory care.(33) Financial gains after implementing EHRs were offset by reduced physician productivity and the additional resources required to maintain the EHR system.(18) A 2010 assessment of the cost and quality of care concluded hospital computing might modestly improve measures of quality but did not reduce overall costs.(22)

Despite the high expectations and interest in EMRs in the United States, their overall adoption rate has been relatively low and they face several problems.(10,34,35) Data from the United States estimated that in 2011, 55% of physicians were using an EHR with an additional 50% of

those that were not using an EHR intending to use one within the next year.(36) This is likely due to the meaningful use incentive program that was implemented in 2009.(37) However, only 2% of US hospitals using EHRs met the criteria for meaningful use as defined by the US government.(38) In Canada, EMR adoption rates have increased from about 20% of practitioners in 2006 to an estimated 62% of practitioners in 2013; this was attributed to good leadership and support from EMR organisations.(39) Jha et al examined the use of EHRs in the ambulatory and hospital settings of seven nations. They concluded that four nations (the United Kingdom, Netherlands, Australia, and New Zealand) had nearly universal use of EHRs among general practitioners (each >90%) and Germany was far along too (40–80%).(40) They found little data on the hospital sector but the best evidence suggests that there is little inpatient EHR use in any of these countries (<10%).(40)

Emergency centres (ECs) have particular characteristics that make them different from other departments, e.g. large patient volumes, providing urgent care for life-threatening conditions, and this is likely to affect the way that medical personnel use EMRs.(41) Between 2001 and 2003, approximately 30% of emergency centres in the United States used EMRs.(42) However, EMR implementation rates were low with approximately one in five using it for medication ordering and clinical documentation and around 10% using it for medication error checking.(43,44) In the United Kingdom, staff showed concerns about computer knowledge and skills, the technical aspects of a system, and the organisational and environmental factors which might influence the use of computer-based records in the EC.(41)

Based on a systematic literature review of 22 studies conducted in the United States, Canada, Israel, Ireland and Norway, barriers to physicians accepting EMRs were identified and grouped into eight categories.(45) The identified barriers were applicable to all cadres of hospital staff, and not specifically to the emergency centre. The “Organisational” and “Change Process” categories mediate the other six categories that contain “Financial”, “Technical”, “Time”, “Psychological”, “Social” and “Legal” barriers.(45) *Financial* concerns revolved around a potentially costly investment in the setting of limited financial resources; high maintenance costs; slow and uncertain return on investment; and questionable financial incentives for physicians’ using EMRs.(6,27,46,47) Regarding *technical* barriers, EMRs were viewed as challenging to the physician’s traditional working style. EMR providers appear to underestimate the level of computer skills required from physicians and/or staff.(6,27,47) Lack of adequate training and

easy access to technical support was a key concern for EMR users.(45) The inability to adapt systems to users' needs; inability to interconnect with existing systems or other EMRs and lack of computers/hardware were other *technical* barriers identified.(45) In addition, fostering dependency on a system that can crash was not perceived as an improvement to healthcare delivery.(46) *Time* is key in healthcare delivery and can be a significant challenge when implementing a new EMR system. Physicians' concerns included time needed to install a new system, time required to enter data thus leading to more time needed per patient, and converting old patient records to the new system.(45) Getting physicians to set aside time from clinical work in order to attend training and assist in adapting the system according to their department's needs was a challenge to the *change process*.(27,47) For successful implementation of EMRs, an EMR-friendly culture needs to be adopted and project leaders need to motivate their team, as well as offer incentives for adoption to reach expected levels.(45) *Psychological* factors included physicians' attitudes toward using EMRs. Whether EMRs were easy to use or if they helped improve patient care; looking for satisfaction from the patient or missing the feeling of physical paper records formed part of the *psychological* acceptance of EMRs.(46–48) Few studies have considered the need for control as an important psychological factor to adopting EMRs.(45) Maintaining confidentiality of patients' records in a system with excessive information access was a worry for *legal* issues. Despite security measures, the potential for breach in the system that stored all patients' data was not accepted.(45–47) The relationships between a physician and other stakeholders in healthcare such as EMR vendors, patients, and administrative staff can create what can be categorised as a *social* barrier.(45) They include lack of support from management level, lack of support from other colleagues, interference between the doctor-patient relationship, and lack of support from external parties such as insurance companies.(45,47) Group practice size was a significant factor for adoption of EMRs as an *organisational* barrier. Studies indicated physicians in larger medical practices have a higher EMR adoption rate than those in smaller practices.(7,49) Physicians who are employed by or contracted to a medical practice are more likely to use EMRs than those who own their own practices.(45)

Transformation to an electronic system is a complex process, it is not only about implementation and adoption of new systems but it requires the need to understand the human aspect of technology adoption.(21) Moving completely to an electronic system takes five or more years even if issues such as interoperability do not influence the use of the EMR.(49) The lack of participation of physicians in the use of EHR systems has serious quality-of-care and cost

consequences.(34) When even a few of the clinicians are reluctant to shift to the electronic systems, the practices are forced to maintain duplicate electronic and paper-based systems.(49) This limits the effectiveness of health information technology (HIT) systems and, in fact, may increase patient care hand-off errors. In addition, the financial gain from EMR implementation is missed with minimal return on investment.(34)

To improve EMR acceptance, appropriate measures are required. These measures occur at different levels and include administrative, group and the individual. After identifying barriers to use of EMRs, these measures need to be implemented as part of a change management process to improve acceptance as discussed above.(15) Previous studies, including one conducted in South Africa, have identified factors that can be addressed in order to improve acceptance of EMRs.(15) They can be classified into organisational, leadership, cultural and individual factors.(27) As part of organisational change, performance incentives such as financial payback and mandates for information technology use would increase the acceptance and use of EMRs.(47,50) In addition, it is important to ensure that the decision-making process for developing or selecting a system involves those who will use the system.(51) There is a need to establish a professional body which will monitor implementation of HIS and adherence to policies and regulations.(15) A 'champion user' or a motivated leader who takes ownership of the project is needed to direct and drive the use of EMRs once the system is implemented.(15,39,51) The cultural profile of the practice, especially in the areas of practice cohesiveness and the value placed on efficiency, and the degree of agreement on the culture by the physicians will help gauge the amount of passive or active resistance that can be expected.(34) Raising awareness on HIT and the benefits associated with use of HITs also improves adoption.(15) Individual factors including a user-friendly EMR that requires little training to use, which assists clinical work, improves patient care, is easily accessible, is easily modified and developed, which saves time and increases productivity has been shown to improve the acceptance of EMRs.(27,48,50–53) Castillo et al conducted a systematic review to identify a knowledge-based classification of critical factors for adopting electronic health records by physicians.(12) They identified six critical factors for adopting EHRs: user attitude towards information systems, workflow impact, interoperability, technical support, communication among users, and expert support (arranged in descending order of relevance).(12) User attitude is a strong determinant of adoption of EHRs; it is important to understand the motive when users demonstrate low interaction with the EHR. If a physician feels that using EMRs negatively impacts patient interaction, he/she will not use it. Being able to share

data between different electronic health records, getting technical support in case of system failure, being able to communicate to other physicians using EHRs or getting their expert opinion in case of difficulty are all factors which increase adoption of EHRs.(12)

Conclusion

It is clear from the available literature that EMR implementation is a complex process, requiring attention to technical and human needs for successful use. There is no single clear answer into what drives users to successfully adopt technology that, in all likelihood, will improve the working environment as well as patient care.

South Africa, and in particular South African emergency centres, have had very little research into perceptions of use and value of EMRs. Whilst it is probable that many of the challenges, barriers and benefits will be the same as those found in international studies, emergency centers are very unique environments that experience different challenges to other areas of primary and hospital care. Both limited time and patient information will arguably validate the benefits of a well designed EMR system to staff and patients alike, however, uptake is largely dependent on the practitioners' attitudes and hence, prior to any potential implementation, such analysis and research must be undertaken to increase the potential for adoption.

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Part B: Article

The assessment of acceptance and identification of barriers to use of electronic medical records by doctors in emergency centres in Cape Town, South Africa.

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Abbreviations

CI – confidence interval

EC – emergency centre

eHealth – electronic health

EHR – electronic health record

EMR – electronic medical record

FCEM – fellowship of college of emergency medicine

ICT – information and communication technologies

IT – information technology

MBChB – bachelor of medicine, bachelor of surgery

MD – doctor of medicine

MMed – master of medicine

SD – standard deviation

WHO – world health organization

UTAUT - unified theory of acceptance and use of technology

Abstract

Introduction: Millions of people in developing countries face serious health risks. It is believed that incorporating technology into healthcare is one way to overcome some of these challenges faced by developing countries. However, acceptance of electronic medical records (EMRs) into daily practice has been poor despite these potential advantages. In order to realise the potential benefits from EMR technologies, they must be adopted broadly and assimilated deeply across healthcare settings. The study aimed to assess acceptance and barriers to use prior to implementation of EMRs.

Methods: The Unified Theory of Acceptance and Use of Technology model was used to assess technology acceptance. A self-administered questionnaire-based survey was sent to emergency centre (EC) doctors working in district hospitals in the Cape Town metropolis.

Results: With a 73% (n=105) response rate, participants believed that EMRs would be both useful in their practice and improve their productivity. Almost 50% (n=51) of participants felt that they would find EMRs easy to use and approximately 60% (n=61) felt they would receive management support. However, the participants felt that the necessary resources would not be available for success, specifically a lack of financial investment, training and support as well as poor infrastructure and project management skills.

Conclusion: The study overall indicates that the majority of doctors are willing to use EMRs in their daily practice. Barriers to successful implementation were similar to those found in similar studies conducted in other environments, and include financial, technical and change process barriers. There is a need to conduct further studies involving other cadres of staff including ECs where EMRs are already in use.

Keywords: Unified Theory of Acceptance and Use of Technology, electronic medical records, emergency centre.

Introduction

Millions of people in developing countries face serious health risks due to high burdens of disease together with inadequate resources and poor health infrastructures.(1) It is believed that incorporating technology into healthcare is one way to overcome some of these challenges faced by developing countries. Electronic health (eHealth), as defined by the World Health Organization (WHO), refers to "the use of information and communication technologies (ICTs) for health."(2) The terms electronic medical records (EMRs) and electronic health records (EHRs) have been used synonymously, however, EHRs are more comprehensive as they include data aggregated from various providers, such as general practitioners, specialists, radiologists and pharmacists. EHRs rely on the interconnectivity of EMRs to enable information exchange.(3–6)

EMRs have the following advantages: improved care quality through increased adherence to guidelines and improved clinical monitoring, improved patient safety via reduction in medication errors, faster access to a patient's medical history, improved communications between health professionals, improved efficiency via appropriate use of resources, and increased cost effectiveness.(5–7) Disadvantages include high financial start-up costs, lack of standardisation between EMR vendors, and maintaining patient privacy and confidentiality.(8–11)

Due to high expectations of and interest in EMRs, data from the United States estimated that in 2011, 55% of physicians were using an EHR with an additional 50% intending to use one within the next year.(12) Another study concluded that four nations (the United Kingdom, Netherlands, Australia, and New Zealand) had nearly universal use of EHRs among general practitioners (each >90%) and Germany was also advanced (40–80%), however, there is little inpatient EHR use in any of these countries (<10%).(13) Emergency Centres (ECs) have particular characteristics that make them different from other departments, e.g. large patient volumes and providing urgent care for life-threatening conditions, and this is likely to affect the way that medical personnel use EMRs.(14) Between 2001 and 2003, approximately 30% of ECs in the United States used EMRs.(15)

Based on a systematic literature review of 22 studies conducted worldwide, barriers to physicians accepting EMRs were identified.(16) The barriers were applicable to all cadres of hospital staff, and not specifically to the EC. Financial concerns revolved around a potentially costly investment in the setting of limited financial resources.(17,18) The level of computer skills required, the inability to adapt systems to users' needs, and the inability to interconnect with existing systems represented the technical barriers.(5,18,19) Time, a key element in healthcare delivery, was identified as a barrier.(18,19) An EMR-friendly culture, motivated team leaders, and incentives to use EMRs were identified as potential change process barriers.(18,20) EMRs were better accepted if they helped improve patient care.(21) Maintaining confidentiality of patients' records in a system with excessive information access was a worry for legal issues.(19,20) Lack of support from management and other

colleagues was a social barrier.(17,18,20) And finally, physicians in smaller practices adopted EMRs at a lower rate than physicians in larger medical practices.(5,17,18)

The majority of the healthcare sector in South Africa uses paper-based records.(22) However, the government formed an eHealth strategy with the mission to establish eHealth as an integral part of the transformation and improvement of healthcare services in South Africa, especially enabling delivery on the health sector's Negotiated Service Delivery Agreement 2010-2014.(2) The project kicked off in May 2002 to develop a national EHR.(23) In approximately one-third of provincial hospitals, EMRs are only "somewhat functional" with numerous different systems in use with limited integration. In addition to this, ICT access is limited in state hospitals.(2) The Western Cape province has progressed the furthest, with a central hospital information system based off a single patient identifier (patient ID) and includes a pharmacy system, radiology and primary health care clinics that all utilise this single identifier.(2)

In order to realize the potential benefits from EMR technologies, they must be adopted broadly and assimilated deeply across healthcare settings.(18,24) It is clear from the available literature that EMR implementation is a complex process, requiring attention to technical and human needs for successful use. Both limited time and patient information will arguably validate the benefits of a well-designed EMR system to staff and patients alike, however, uptake is largely dependent on the practitioners' attitudes. Hence, prior to any potential EMR implementation, analysis and research must be undertaken as part of a change management process to increase the potential for EMR adoption.(22,25,26)

The Unified Theory of Acceptance and Use of Technology (UTAUT), a widely used model to assess user acceptance of information technology (IT) was used in this study. UTAUT has four core constructs of which performance expectancy, effort expectancy, and social influence are theorised to influence behavioural intention (i.e. "the degree to which a person has formulated conscious plans to perform or not perform some specified future behaviour") to use a technology while two constructs (facilitating conditions and behavioural intention) determine technology use.(27)

1. "Performance expectancy – the degree to which an individual believes that using the system will help him or her attain gains in job performance;
2. Effort expectancy – the degree of ease associated with the use of the system;
3. Social influence – the degree to which an individual perceives that important others believe he/she should use the new system;
4. Facilitating conditions – the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system."

The research question was "How likely are emergency centre doctors to use Electronic Medical Records in their clinical practice in Cape Town, South Africa?". The aim of this study was to determine whether emergency center doctors will accept EMRs into their practice and to identify potential barriers to use of electronic medical records in the emergency centre.

Methodology

The study was conducted in the Cape Town metropole. It included five provincial public district hospitals with 24-hour Emergency Centres.

Target population included doctors (e.g. interns, community service medical officers, medical officers, registrars and consultants) working in the ECs. Sessional/locum doctors were excluded from the study, as they are not typically involved in the decision-making process. The minimal sample size required was 90 (based on item response theory).(28) A response rate of greater than 70% was considered representative of the population.

A cross-sectional questionnaire-based survey was used for the study design. Data was collected using a paper-based or web based (i.e. SUrvey) self-administered questionnaire, at the convenience of the study participant.

The UTAUT model was used for the development of our questionnaire assessing technology acceptance. Questions on barriers to use of EMRs were based on a systematic review of 22 studies conducted worldwide.(16) It was a comprehensive review that identified and grouped barriers to use of EMRs into eight categories. The questionnaire is attached as Appendix B below.

The five-point Likert scale was used to measure participants' responses where strongly disagree=1, disagree=2, neither agree nor disagree=3, agree=4 and strongly agree=5. Descriptive statistics were used to summarise demographic data. For each of the constructs assessing technology acceptance, the reliability coefficient was calculated using Cronbach's alpha. The accepted cut off value was 0.70.

Data was captured in Microsoft Excel and Stata was used for statistical analyses. The Shapiro-Wilk test indicated that the scores in the 5-point Likert scale were not normally distributed, hence the non-parametric Wilcoxon sum of rank test was used to compare previous use of EMRs. Descriptive statistics included mean, median and range. The results were presented graphically using box-and-whisker plots. A Chi-squared test was applied when comparing proportions for categorical data. For all analyses, a p-value <0.05 was considered the threshold of statistical significance.

Results

The survey was sent out to 143 doctors across five district hospitals. In total, 105 respondents completed the survey yielding a 73% response rate (ranging from 59 - 81% across the hospitals).

The ratio of male to female doctors (1.1:1) was almost equal. Approximately 65% (n=69) of the doctors reported seeing between 3001-5000 patients per month in their respective units. About 53% (n=56) of respondents had not previously used an EMR. However, for those who had used an EMR, the specific type of EMR they had used was not known. A summary of the demographic details of the respondents is shown in Table 1.

Table 1. Demographics and electronic medical records usage by Emergency Centre doctors

		n	%
Age	21 – 30	68	64.8
	31 – 40	27	25.7
	41 – 50	10	9.5
Gender	Male	55	52.4
	Female	50	47.6
Qualification	MBChB/MD	93	88.6
	MMed/FCEM	12	11.4
Place of work (Hospital)	Khayelitsha	19	18.1
	Mitchells Plain	39	37.1
	New Somerset	21	20.0
	Karl Bremer	9	8.6
	Victoria	17	16.2
EC patient volume per month	<1000	1	0.9
	1000 – 3000	28	26.7
	3001 – 5000	69	65.7
	>5000	7	6.7
Position held	Intern	8	7.6
	Community service	28	26.7
	Medical Officer	40	38.1
	Registrar	17	16.2
	Consultant	12	11.4
Previous EMR use?	Yes	49	46.7
	No	56	53.3

MBChB/MD, medical doctor; MMed/FCEM, emergency medicine specialist; EC, emergency centre; EMR, electronic medical record

The mean and median for each of the constructs assessing acceptance of technology is shown in Table 2. All the constructs in our survey had a reliability coefficient greater than 0.70 indicating the items for all five constructs were reliable.

Table 2. Descriptive statistics for each acceptance construct:

Construct name	Mean	SD	Median	Reliability coefficient
Performance expectancy	4.0	0.97	4.0	0.94
Effort expectancy	4.1	0.77	4.0	0.93
Social influence	3.6	0.88	3.5	0.89
Facilitating conditions	3.6	0.91	3.8	0.79
Behaviour intention	3.9	0.89	4.0	0.82

SD, standard deviation

Performance expectancy had a mean of 4.0 indicating most participants *agree* to the individual questions. Specifically, approximately 63% (n=66) of the participants responded *agree* or *strongly agree* that they believed EMRs would help attain gains in job performance in the EC.

Almost 50% (n=51) of participants believed they would find EMRs easy to use and would become proficient in using them.

The respondents had a neutral response to social influence on use of EMRs. Just over half (n=54; 51%) of participants responded with *neither agree nor disagree* indicating they believed that the people who influence them or whose opinions they value will not influence their decision to use EMRs. However, the question "the management will support the use of EMRs" had an overwhelmingly positive response from the participants compared to the other three items, with 58.1% (n=61) of the participants responding with *agree* or *strongly agree*.

Regarding facilitating conditions, "I have the knowledge necessary to use EMRs" and "I can get help from others when I have difficulties using EMRs" stood out with 52% (n=55) and 50% (n=52), respectively, having responded *agree* to each item. On the other hand, 18% (n=19) of participants *strongly disagreed* that they have the resources necessary to use EMRs. However, approximately 30% (n=33) believe EMRs are compatible with other technologies they use thus increasing acceptance of EMRs in their daily practice.

Respectively, approximately 41% (n=43) and 48% (n=50) of participants responded *strongly agree* to "I intend to use EMRs in the coming future" and "I would use EMRs to improve my work". This indicates an intention to use EMRs in their daily practice (n=93; 89%).

Age had no impact on overall acceptance of EMRs.

When comparing previous use of EMRs to individual responses on the Likert scale, there was a statistically significant difference in the proportion that responded *agreed* or *strongly agreed*

compared to those who did not use EMRs (p=0.043)(Table 3). However, there was no statistically significant difference when comparing previous use of EMRs to the overall acceptance (p=0.0792).

Table 3. Responses frequencies for overall acceptance versus previous EMR use

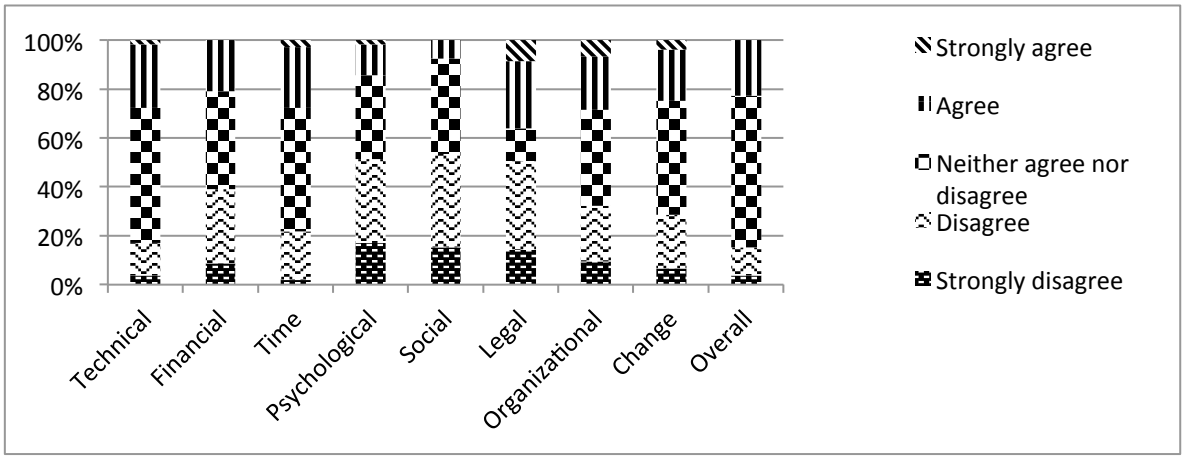
Overall acceptance	**Previous EMR use?**		**Total**
	Yes	**No**	
	n (%)	**n (%)**	**n (%)**
Strongly disagree	2 (66.7)	1 (33.3)	3 (100)
Disagree	2 (33.3)	4 (66.7)	6 (100)
Neither agree nor disagree	17 (34.0)	33 (66.0)	50 (100)
Agree	25 (58.1)	18 (41.9)	43 (100)
Strongly agree	3 (100)	0 (0.0)	3 (100)
Total	49 (46.7)	56 (53.3)	105 (100)
Mean	4.0	3.7	3.8
SD	0.76	0.65	0.71
95% CI	3.74 – 4.18	3.54 – 3.89	3.69 – 3.97

EMR, electronic medical record; SD, standard deviation; CI, confidence interval

Regarding technical barriers, nearly half of all participants responded *agree* to lack of technical training and support (n=52; 50%), lack of reliability (n=49; 47%) and interconnectivity, for example, integrating existing laboratory and imaging software with EMR systems (n=47; 45%). These indicate major issues that need to be addressed prior to implementation. In addition, 73 (70%) and 80 (76%) participants responded *agree* or *strongly agree* to lack of computers and lack of portable devices, respectively. Some participants expressed concerns regarding the inability of the existing infrastructure to support EMRs, for example, slow Internet access.

A summary of response frequencies for each question assessing barriers to use of EMRs is shown in Figure 1.

Figure 1. Response frequencies, by construct, for barriers to using electronic medical records



The majority (n=64; 61%) of the participants responded *agree* or *strongly agree* to all three financial barriers (i.e. high start-up and maintenance costs, and lack of financial resources). However, 7.6% (n=8) responded *disagree* to lack of financial resources as a barrier.

Forty-two (40%) participants *agreed* that time to implement the system is an obstacle, however, 33% (n=35) *disagree* that time to learn the system is a barrier. This points to the fact that doctors believe they will learn to use the system quickly once implemented. Approximately 25% (n=26) *disagreed* that more time per patient was a hurdle when using EMRs.

The majority of participants did not doubt that EMRs could improve patient care and would not affect physicians' autonomy in terms of control of patients' information and working processes.

Around 20% (n=20) responded *agree* or *strongly agree* to interference with doctor-patient relationship, however, 59% (n=62) of the participants disagreed with the above statement. Approximately 15% (n=15) of participants felt they would lack support from patients when using EMRs while 35% (n=37) had a neutral response. A lack of support from the management level was seen as a significant barrier by approximately 10% (n=10) of respondents.

Privacy of patients' information was not a concern for most participants. However, one participant mentioned concerns about who takes ownership of liability if the EMR software is hacked. The majority (n=41; 39%) of the participants had a neutral response regarding the organizational barriers. Less than 10% (n=7) felt strongly that the size or type of practice affected implementation of EMRs.

Lack of participation from other members (e.g. nurses, admin staff, information technology (IT) staff) was identified as a major change process barrier by 56% (n=59) of the participants. Approximately 33% (n=35) of the participants responded *agree* to lack of incentives and lack of leadership from project management as a barrier indicating specific areas that need to be addressed with regards to the change management process.

Discussion

According to UTAUT, performance expectancy, effort expectancy, and social influence are thought to influence behavioral intention to use a technology, while behavioral intention and facilitating conditions determine technology use.(27)

Our results show that participants believed using EMRs in the EC would be useful and would improve their productivity (i.e. performance expectancy). Having a positive impact on performance translates to increased acceptance of EMRs when implemented. This is in keeping with other studies that showed interventions that improve productivity are better accepted among healthcare personnel.(29,30). The study participants responded that they would find EMRs easy to use and would become proficient in using them. We expected that the participants would find EMRs difficult to use thus making acceptance difficult. It is known from previous studies that a user-friendly EMR increases acceptance of technology.(29–32) Participants believe the management will support the use of EMRs. This finding increases the likelihood of acceptance of EMRs, which is in keeping with existing literature.(16,21) There is also a push from the national level to encourage use of EMRs in South Africa.(2) Lack of resources remains a major challenge. Our results indicate that EC doctors feel that they have the knowledge and help that they require using EMRs but lack the necessary resources. Current infrastructure does not support use of EMRs.(23,33) For successful implementation, matters such as speed of IT and quantity of computers need to be upgraded to meet the demands of EMR use. The study results reveal that EC doctors have the intention and determination to use EMRs in their daily practice.

Lack of training and support for using EMRs is a concern for EC doctors. This is in agreement with other studies done worldwide.(21,34) The financial investment needed in developing and maintaining EMRs is considerable. This was echoed in the study results. In order to increase acceptance, disclosing the potential for returns on investment once it is implemented would be helpful. Considering the current IT infrastructure in the ECs, implementing EMRs would be difficult.(22,25) Therefore, buying new hardware such as personal computers and handhelds as well as improving Internet speed is a requirement before deploying EMRs. Approximately 20% of EC doctors felt EMRs would interfere with the doctor-patient relationship. This represents a significant number thus emphasizing the need to increase awareness of benefits of EMRs. It would be good to survey patients or prospective patients in the future on how EMRs affect the doctor-patient relationship. Previous studies indicate increased acceptance of EMRs by auxiliary staff once doctors have accepted them.(16) Thus, doctors need to be informed of the added benefits once they use EMRs in daily practice. As part of the implementation process, each EC needs to identify a project leader who will encourage and drive the use of EMRs. In addition, incentives such as showing improved patient care as a result of EMR use or monetary gains are needed for sustained use of EMRs.

A study assessing acceptance and barriers to use of EMRs in the EC has never been conducted in the Western Cape. Due to distance between hospitals, the study was limited to the metropole only; however, these hospitals represent a wide range of health care practitioners ranging from interns to consultants. The UTAUT model was constructed to assess mandatory use of technology.(35) However, use of EMRs in the EC in this setting is at present, voluntary. Therefore, voluntariness of use was not assessed for acceptance.

Conclusion

This study indicates EC doctors are willing to use EMRs in their daily practice. They believe they have the knowledge and support from the management level. The barriers identified were similar to those found in other studies with emphasis on particular items such as infrastructure, training and technical support which need to be addressed in the change management process. There is a need to conduct similar studies in ECs where EMRs are currently present for comparison to our study findings and expanding to include different cadres of staff such as nurses who are involved in decision-making.

Acknowledgements

We would like to thank the EC staff that participated in the study as well as the CEOs of all five district hospitals where the study was conducted.

Conflicts of Interest

The authors declare no conflicts of interest.

Dissemination of Results

Results will be shared within the Division of Emergency Medicine (Stellenbosch University and University of Cape Town). A report will also be given to the Provincial Government of the Western Cape Department of Health for internal dissemination.

Authors' contributions

M.C. and J.F. developed the original idea. All authors contributed to designing the research protocol. M.C. collected the data and carried out the analysis with the SU biostatistician. All authors approved the final version.

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Part C: Appendices

Appendix A: Instructions to Authors

Journal: African Journal of Emergency Medicine

Maximum length: 3,000 words, 5 tables and/or figures, plus the abstract (300 words) and references (max 50).

Essential Title Page Information: title, author names and affiliations, corresponding author present/permanent address, word count, table/figure count and keywords.

All authors should have made substantial contributions to all of the following: (1) the conception and design of the study, or acquisition of data, or analysis and interpretation of data, (2) drafting the article or revising it critically for important intellectual content, (3) final approval of the version to be submitted.

Please write your text in UK English by setting your word processor to English (U.K.).

Collate acknowledgements in a separate section at the end of the article before the references. Collate conflicts of interest in a separate section at the end of the article before the acknowledgements.

Appendix B: Questionnaire/ data capture instrument

Demographic details:

1. What is your age? _____
2. Gender:
   - ☐ Male
   - ☐ Female
3. Qualification:
   - ☐ MBChB/MD (Medical Doctor)
   - ☐ MMed/FCEM
   - ☐ Others (please specify) – _____
4. In which hospital are you working?

   _____
5. How many patients does your EC attend to on a monthly basis on average?
   - ☐ <1000
   - ☐ 1000-3000
   - ☐ 3001-5000
   - ☐ >5000

6. Position held:
   - ☐ Intern
   - ☐ Community Service Officer
   - ☐ Medical Officer
   - ☐ Registrar
   - ☐ Consultant
7. Have you ever used an Electronic Medical Record?

   NB: ECM (Open Text Content Server) is not a form of Electronic Medical Record as defined by this study.
   - ☐ Yes
   - ☐ No

Acceptance of Electronic Medical Records (EMRs): (answer all questions)

8	Performance expectancy	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
A	I would find using EMRs in the EC useful	☐	☐	☐	☐	☐
B	Using EMRs would enable me to accomplish tasks more quickly	☐	☐	☐	☐	☐
C	Using EMRs would increase my productivity	☐	☐	☐	☐	☐
D	If I use EMRs, I will increase my chances of achieving better performance	☐	☐	☐	☐	☐

9	Effort expectancy	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
A	I would find EMRs easy for me to use	☐	☐	☐	☐	☐
B	I would find it easy for me to become skillful at using EMRs	☐	☐	☐	☐	☐
C	I would become proficient at using EMRs	☐	☐	☐	☐	☐
D	Learning to use EMRs would be easy for me	☐	☐	☐	☐	☐

10	Social influence	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
A	People who are important to me think that I should use EMRs	☐	☐	☐	☐	☐
B	People who affect my learning behaviour think that I should use EMRs	☐	☐	☐	☐	☐
C	People whose opinions I value prefer that I use EMRs	☐	☐	☐	☐	☐
D	The management will support the use of EMRs	☐	☐	☐	☐	☐

11	Facilitating conditions	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
A	I have the resources necessary to use EMRs	☐	☐	☐	☐	☐
B	I have the knowledge necessary to use EMRs	☐	☐	☐	☐	☐
C	EMRs are compatible with other technologies I use.	☐	☐	☐	☐	☐
D	I can get help from others when I have difficulties using EMRs	☐	☐	☐	☐	☐

12	Behaviour intention	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
A	I intend to use EMRs in the coming future	☐	☐	☐	☐	☐
B	I would use EMRs to improve my work	☐	☐	☐	☐	☐
C	I plan to use EMRs in the next 24 months	☐	☐	☐	☐	☐

Barriers to use of Electronic Medical Records (EMRs):

The following questions assess barriers to use of electronic medical records. They have been classified under specific sub-headings. Please answer all questions

13	Technical	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
A	Lack of computer skills of the physician and/or staff	☐	☐	☐	☐	☐
B	Lack of technical training and support	☐	☐	☐	☐	☐
C	Complexity of the system (multiple screens, options and navigational aids)	☐	☐	☐	☐	☐
D	Limitation of the system (machine-based, developed/programed by IT companies)	☐	☐	☐	☐	☐
E	Lack of customizability (adapt software based on individual needs)	☐	☐	☐	☐	☐
F	Lack of reliability (dependability of the technology systems e.g. load shedding)	☐	☐	☐	☐	☐
G	Interconnectivity (lack of compatibility with existing practice systems)	☐	☐	☐	☐	☐
H	Lack of computers	☐	☐	☐	☐	☐
I	Lack of portable devices e.g. tablets	☐	☐	☐	☐	☐

14	Financial	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
A	High start-up costs	☐	☐	☐	☐	☐
B	High maintenance costs e.g. monitoring, modifying, upgrading	☐	☐	☐	☐	☐
C	Lack of financial resources	☐	☐	☐	☐	☐

15	Time	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
A	Time to implement the system	☐	☐	☐	☐	☐
B	Time to learn the system	☐	☐	☐	☐	☐
C	Time to enter data	☐	☐	☐	☐	☐
D	More time per patient	☐	☐	☐	☐	☐
E	Time to convert the records	☐	☐	☐	☐	☐

16	Psychological	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
A	Lack of belief in EMRs (doubt that EMRs can improve patient care)	☐	☐	☐	☐	☐
B	Need for control of patient information and working processes (physicians' autonomy)	☐	☐	☐	☐	☐

17	Social	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
A	Interference with doctor-patient relationship	☐	☐	☐	☐	☐
B	Lack of support from other colleagues e.g. nurses, administrative staff	☐	☐	☐	☐	☐
C	Lack of support from the management level	☐	☐	☐	☐	☐
D	Lack of support from patients	☐	☐	☐	☐	☐

18	Legal	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
A	Privacy or security concerns for patients' information	☐	☐	☐	☐	☐

19	Organizational	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
A	Organizational size (large vs. small medical practices)	☐	☐	☐	☐	☐
B	Organizational type (stand-alone practice vs. hospital affiliated)	☐	☐	☐	☐	☐

20	Change process	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
A	Lack of support from organizational culture (EMR-friendly culture)	☐	☐	☐	☐	☐
B	Lack of incentives	☐	☐	☐	☐	☐
C	Lack of participation from other members e.g. nurses, admin staff, IT staff	☐	☐	☐	☐	☐
D	Lack of leadership from project management	☐	☐	☐	☐	☐

If there are any other barriers not included above, please specify: _____

Appendix C: Consent forms and any related participant information sheets

PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM

TITLE OF THE RESEARCH PROJECT:

The assessment of acceptance and identification of barriers to use of electronic medical records by doctors in emergency centres in Cape Town.

ETHICS REFERENCE NUMBER: S15/09/202

PRINCIPAL INVESTIGATOR: Dr. Mohamedsuhel Chagani

ADDRESS: 32 Avonduur Road, Pinelands, 7405

CONTACT NUMBER: 0789454617

You are being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the investigator any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied, that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the Health Research Ethics Committee at Stellenbosch University and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research. The Stellenbosch University HREC approval number is S15/09/202.

The study is going to include provincial district hospitals within the Cape Town metropole. Doctors working in the emergency centre will be included in the study.

We aim to evaluate acceptance and barriers to use of electronic medical records (EMRs) by doctors working in the emergency centre.

Electronic Medical Records (EMRs) have been used to describe automated systems based on

health centre. *For the purposes of this study,* an Electronic Medical Record is defined as a digital medical record that originates from electronic format. Digital records that originate from paper-based format e.g. ECM (Open Text Content Server) *is not* considered as an EMR.

There is general agreement that electronic medical records have the potential to improve the quality of medical care. However, electronic health record technologies must be adopted broadly and assimilated deeply across healthcare settings to realize the potential benefits from these investments. A primary step toward successful technology implementation is to proactively identify the factors affecting end user adoption and implementing strategies to improve acceptance. The South African government has formed an eHealth strategy with the mission to establish eHealth as an integral part of the transformation and improvement of healthcare services in South Africa, especially enabling delivery on the health sector's Negotiated Service Delivery Agreement 2010-2014.

The study will be conducted via a paper-based and web-based (online) questionnaire. SUrvey will be used for the web-based survey. It is a research tool available to Stellenbosch University students. You are free to choose either platforms depending on your convenience. It will take you less than 10 minutes to complete the questionnaire.

The target population for the study is doctors working in the emergency centre. Only permanent staff working in the emergency centre will be surveyed. Sessional doctors will not be included in the study.

You are participating in this study voluntarily as explained above. You will be required to complete the survey and submit it either online or to your head of department if the paper-based survey is used.

You will not receive any benefit from this study personally. The aim of the study is to evaluate acceptance and identify barriers prior to implementation of EMRs in order to improve uptake and have successful implementation of EMRs.

There is no risk to you in this study.

The data collected via web-based survey will be stored in a central, secure institutional database. Data collected via paper-based survey will be manually entered in a Microsoft Excel spreadsheet that will be password protected.

The principal investigator, supervisor and biostatistician will have access to the data.

You will not be paid to take part in the study. There will be no costs involved for you, if you do take part.

You can contact Dr. Mohamedsuhel Chagani at 0789454617 or suhel_c@msn.com if you have any further queries or encounter any problems.

You can contact the Health Research Ethics Committee at 021-938 9207 if you have any concerns or complaints that have not been adequately addressed by your study doctor.

You will receive a copy of this information and consent form for your own records.

If you choose the **web-based survey**, your completion of this questionnaire implies you have agreed to take part in this study.

Thank you for participating.

Kind regards.

Declaration by participant

By signing below, I ……..……. agree to take part in a research study entitled *The assessment of acceptance and identification of barriers to use of electronic medical records by doctors in emergency centres in Cape Town*.

I declare that:

- I have read the information and consent form and it is written in a language with which I am fluent and comfortable.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.

Signed at (*place*) .....…..…….. on (*date*) ……...…….. 2015.

.....

Signature of participant

Appendix D: Acknowledgements

I would like to thank my supervisors for all their support with my MMed.

We would like to thank the EC staff that participated in the study as well as the CEOs of all five district hospitals where the study was conducted.

Appendix E: Research Protocol

1. Abstract

Electronic Medical Records (EMRs) have been used to describe automated medical record systems based on document imaging or systems that have been developed within a medical practice or community health centre. EMRs are aimed at replacing the old paper based system with a more efficient electronic system for health care records. There is general agreement that electronic medical records have the potential to improve the quality of medical care. The South African government has formed an eHealth strategy with the mission to establish eHealth as an integral part of the transformation and improvement of healthcare services in South Africa. Electronic health record technologies must be adopted broadly and assimilated deeply across healthcare settings to realize the potential benefits from these investments. In the United States, overall adoption has been low despite the high expectations associated with EMRs.

It is important to assess user acceptance and identify barriers to EMR use prior to implementation of EMRs and thereafter implement appropriate measures as part of a change management process for successful implementation as shown by previous research.

This study aims to evaluate acceptance of EMRs by doctors working in Emergency Centres in the Cape Town metropole and to identify potential barriers to use of EMRs. No studies assessing acceptance and identifying barriers to use of EMRs have been undertaken in Cape Town.

Data will be collected using a paper-based or web based (SUrvey) self-administered questionnaire**.** User acceptance will be assessed using the Unified Theory of Acceptance and Use of Technology (UTAUT) model. (1) Analysis of the data will entail descriptive summary statistics that will be presented via bar charts and frequency tables. On conclusion of the study, participating emergency centres will receive feedback regarding the study outcomes and recommendations to implement strategies prior to implementation of EMRs.

2. Introduction

2.1 Literature review

With the advancement in Information Technology (IT) systems, specifically in health care, their

where such applications are being used such as applications (apps) on smartphones for quick references and apps for diagnosis/consulting on specific diseases such as burns or dermatology. Electronic medical records (EMRs) are part of the evolution of IT in health care systems. The term EMR has been used to describe automated systems based on document imaging or systems that have been developed within a medical practice or community health centre. However, the type and extent of electronic medical records vary and what one country defines as an EMR may not be the same as that defined in another country. (2) For the purposes of this study, an EMR is defined as a digital medical record that originates from an electronic format. Digital records that originate from paper-based format (such as electronic content management systems) are not considered an EMR. EMRs have been used extensively by general practitioners in many developed countries and include patient identification details, medications and prescription generation, laboratory results and in some cases all healthcare information recorded by the doctor during each visit by the patient. (2) They allow patient information to be captured under a central system that can be accessed when necessary, even without presence of the patient. It enables physicians to access previous records of patients and enter new data that is accurate and legible. (3)

There is general agreement that electronic, computer-based medical records have the potential to improve the quality of medical care. (3,4) They are aimed at replacing the old paper based system with a more efficient electronic system for health care records. A United Stated based study estimates electronic medical records improve overall efficiency by 6% per year, and the monthly cost of an EMR may (depending on the cost of the EMR) be offset by the cost of only a few "unnecessary" tests or admissions. (5) In South Africa, there has been a push from the government level for change to an electronic based health care records system. The government has formed an eHealth strategy with the mission to establish eHealth as an integral part of the transformation and improvement of healthcare services in South Africa, especially enabling delivery on the health sector's Negotiated Service Delivery Agreement 2010-2014. (6) The overall aim of this strategy is to provide a single, harmonised and comprehensive eHealth strategy that:

a) "Supports the medium-term priorities of the public health sector;

b) Paves the way for future public sector eHealth requirements; and

c) Lays the requisite foundations for the future integration and coordination of all eHealth initiatives in the country (both public sector and private sector)." (6)

EMRs have been implemented in various health systems across the world and have many advantages as discussed below. One of the major effects of health information technology was its role in increasing adherence to guideline- or protocol-based care. (7) Decision support, usually in the form of

improve quality of care through improvement in clinical monitoring based on large-scale screening and aggregation of data. (7) These studies demonstrated how health information technology could support new ways of delivering care that are not feasible with paper-based information management. (7) Reduction in medication errors was another major gain. (7–9) This included decreases in adverse drug events and improving medication dosing. EMRs improved efficiency in terms of health care provider to patient time. (7–9) Absolute decreases in utilisation rates ranged from 8.5 to 24 percentage points. One study examined overall time to delivery of care and found an 11% decrease in time to deliver treatment through the use of computerized order entry with alerts to physician pagers. (7) Other advantages included reduced redundancy, graphical display of results, medication/allergy/problem documentation, patient education, and more complete and better information on the system. (8,9)

Like any other technology, EMRs also have their unique set of challenges. They may be complex systems requiring knowledge and computer skills to be able to operate. Although these skills can be learnt, they do pose some technical challenges to those unfamiliar with computers. (10) Lack of standardization between EMRs makes it difficult for physicians to share information regarding patients. (10) Another major concern regarding EMRs is privacy and confidentiality. Patient records can be accessed and transmitted by individuals who have access to the system yet may be used for personal gains. (10) One study concluded that EMRs were not associated with better quality ambulatory care. (11)

Despite the high expectations and interest in EMRs in the United States, their overall adoption rate is relatively low and they face several problems. (12–14) Data on hospitals' adoption of electronic health records suggest levels of adoption that range between 5% and 59%. (4) Another study showed the overall EMR adoption rate is between 20 and 30 percent for hospitals and up to 12 percent for physician practices. (15) A survey conducted in the United States between 2001 and 2003 revealed 31% of emergency departments used EMRs. (16) A study of United States residency-affiliated emergency departments in 2000 found low rates of EMR implementation, with only 7% reporting fully implemented technology for medication error checking, 18% for computerized medication order entry, and 21% for clinical documentation. (17) In Massachusetts, USA, a 2006 survey of emergency departments found full implementation of the following technologies: 15% medication ordering, 11% medication error checking, and 41% current visit information. (18) Electronic health record technologies must be adopted broadly and assimilated deeply across healthcare settings to realize the potential benefits from these investments. (13,19)

Based on a systematic literature review of 22 studies conducted in the United States, Canada, Israel, Ireland and Norway, barriers to physicians accepting EMRs were identified and grouped into eight categories. (20) Of these, the "Organizational" and "Change Process" categories mediate the other six categories that contain "Financial", "Technical", "Time", "Psychological", "Social" and "Legal" barriers. (20) *Financial* costs involved in setting up and getting EMRs operational, as well as maintenance costs, were a major concern for many clinicians; many identified it as a significant barrier. Other financial difficulties included slow and uncertain financial payoff for a potential costly investment and questionable financial incentives for physicians' using EMRs. (3,9,21,22) Regarding *technical* barriers, EMRs were seen as contrary to a physician's traditional working style and required a greater capability in dealing with computers. (3,9,22) In addition, fostering dependency on a system that can crash was not perceived as an improvement to health delivery. (21) *Time* was a key factor and was seen as a challenge in various aspects. For example, the speed of implementation was a challenge in that it prevented developing new procedures. Regarding *change process* barriers, personnel time was diverted from clinical work for implementation; there were difficulties getting physicians and personnel to attend training and help adapt the system to their department's needs. (9,22) *Psychological* factors included physicians' attitudes towards using EMRs, ease of use, and if EMRs helped improve patient care, continued reliance on humans and user satisfaction; the absence of physical paper records. (21–23) Maintaining confidentiality of patient's records in a system with excessive information access was a worry for *legal* issues. Despite security measures, the potential for breach in the system that stored all patient's data was not accepted. (21,22) Group practice size was a significant factor for adoption of EMRs as a *social* barrier. Studies indicated smaller practices have lower EMR adoption rates. (4,24) *Organizational* challenges included complementary changes that accompanied implementing a new system and support from management level. (22)

Practice administrators report that it often takes five years or more to shift completely to the electronic systems even when interoperability issues do not influence their use. (24) When even a few of the clinicians are reluctant to shift to the electronic systems, the practices must maintain duplicate electronic and paper-based systems. (24) This seriously limits the effectiveness of these information systems in improving quality of care and, in fact, may increase patient care hand-off errors. Of equal importance, these dual systems distort financial performance data and return on investment experiences.(12) The lack of full participation of physicians in the use of EHR systems after those systems are adopted by medical group practices potentially has serious quality-of-care and cost consequences. (12)

After identifying barriers to use of EMRs, appropriate measures can be implemented as part of a change management process to improve its acceptance. These can be at different levels including administrative, group or individual. A user-friendly EMR, which assists clinical work, is easily accessible, is easily modified and which saves time and increases productivity has been shown to improve acceptance of EMRs. (9,25,26) Performance incentives such as financial payback and mandates for Information Technology use would also increase the acceptance and use of EMRs for quality improvement. (22) In addition, organizational, leadership and cultural factors are important in addressing acceptance of EMRs. (9) Similarly, earlier research suggested doctors would become enthusiastic users if the electronic medical records were helpful in the care of their patients. (23) Culture of the practice has a significant impact on adoption of EMRs. Hence the institution can predict physician cooperation by assessing the culture of the practice before they start the implementation process. The cultural profile of the practice and the degree of agreement on the culture by the physicians will help gauge the amount of passive or active resistance that can be expected. (12) Education is key to acceptance and successful implementation. Castillo et al identified critical factors for adopting electronic health records that can be classified from a knowledge-oriented perspective to support the development of approaches for assisting the adoption of EHRs. (27) There are six critical factors for adopting electronic health records: user attitude towards information systems, workflow impact, interoperability, technical support, communication among users, and expert support (arranged in descending order of relevance). (27,28) In 2005, a systematic review of the costs and benefits of clinical health information technology (HIT) systems in the United States concluded that successful implementation of HIT systems likely requires the following actions: choose a system that is intuitive to use and that requires little training for users; choose a system that can be modified and developed easily; ensure that the decision-making process for developing or selecting a system is participatory, but once this decision has been taken ensure that implementation is directed and driven. (29)

2.2 Motivation

Electronic medical records have the potential to improve quality of medical care. However, successful implementation requires prior identification of barriers and implementing appropriate intervention strategies to improve acceptance. This study intends to evaluate acceptance of EMRs by doctors working in Emergency Centres in the Cape Town metropole and to identify barriers to use of EMRs that are specific to this setting. It is anticipated that after barriers have been identified, they can then be modified in a change management process to smoothen the transition to EMRs. Implementation of appropriate interventions prior to transition has led to improved acceptance of EMRs. (9,25)

2.3 Research Question

1. How likely are emergency centre doctors to use Electronic Medical Records in their clinical practice in Cape Town, South Africa?

2.4 Specific Aims

1. To determine if Emergency Center doctors will accept EMRs into their practice
2. To identify potential barriers to use of electronic medical records in the emergency centre

3. Methodology

3.1 Study design

Cross-sectional questionnaire-based survey.

3.2 Study setting

The study will be conducted in Cape Town, South Africa. It will include hospitals in the metropole area, which is situated in the southern peninsula of the Western Cape province. It has a coastline of 294 kilometres with a population of approximately 3.7 million. It stretches from Gordon's Bay to Atlantis and includes the suburbs of Khayelitsha and Mitchells Plain. (30)

The study will include provincial district hospitals with 24 hour Emergency Centres. District hospitals will include Victoria Hospital, New Somerset Hospital, Karl Bremer Hospital, Mitchells Plain District Hospital, and Khayelitsha District Hospital.

3.3 Study population and sampling

The target population will include doctors (interns, medical officers, registrars and consultants) working in the emergency centres. The minimal sample size required is 80 (based on item response theory). A response rate of greater than 70% will be considered representative of the population.

Inclusion criteria: Doctors in substantive positions or trainees only will be included in the study. Once implemented, they will be using electronic medical records regularly and their opinion/acceptance will have a major impact on whether the system is implemented successfully or not. ECM (Open Text Content Server) is not a form of Electronic Medical Record as defined by this study. Doctors with prior exposure to EMRs (as defined by this study) will be included in the study

Exclusion criteria: Sessional/locum doctors will not be included in the survey. They are not usually involved in the decision-making process as they will not be using EMRs on a daily basis hence they will not be included in the survey.

3.4 Data collection and management

Information regarding the study will be given to all participants (appendix A). Data will be collected using a paper-based or web based (SUrvey) self-administered questionnaire (appendix B), depending on convenience of the study participant. For the *paper-based* questionnaire, written informed consent will be taken from all participants. For the *web-based* survey, the bottom of the information page will include the statement 'your completion of this questionnaire implies you have agreed to take part in this study' implying inferred consent. SUrvey is a web-based service available free of cost to Stellenbosch University students who need to conduct online surveys as part of their academic research activities.

The questions have been pre-tested outside the sampling population to check the readability and understandability of the questionnaire. Appropriate changes were made based on the pre-test responses. For content validity, three experts including two emergency physicians and one medical doctor involved with the Open Medicine Project (Mobile Technology Designers and Developers to tackle specific health system problems) will review the questionnaire and changes will be made as per their comments prior to the study.

User acceptance will be assessed using the Unified Theory of Acceptance and Use of Technology (UTAUT). (1) This is a validated model assessing acceptance of technology and has the following core constructs:

1. "Performance expectancy – the degree to which an individual believes that using the system will help him or her attain gains in job performance.
2. Effort expectancy – the degree of ease associated with the use of the system.
3. Social influence – the degree to which an individual perceives that important others believe he/she should use the new system.
4. Facilitating conditions – the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system.
5. Behavioural intention – the degree to which a person has formulated conscious plans to perform or not perform some specified future behaviour."

The effect of core constructs is moderated by gender, age, experience, and voluntariness of use.

The Likert scale with five-levels including Strongly Disagree, Disagree, Neither agree nor disagree, Agree, Strongly Agree will be used to measure participants responses.

All information obtained will be kept stored in a central, institutional database, which is backed up and password secured. The participants in the study will be assigned a number that will be used to identify the participants. No personal identification particulars of the participating clinicians will be required thus maintaining anonymity and confidentiality.

Data will be collected over an 8-week period. Contact details for all doctors working in the emergency centres included in the survey will be obtained from the respective head of departments. A link to the questionnaire will be emailed to the individual participants. A reminder to all participants to complete the questionnaire will be sent again twice spaced one week apart. We will also visit each of the study sites and deliver the paper questionnaires. Upon completion, the participant will return the questionnaire in a sealed envelope to the principal author or the emergency centre consultant. We will visit the hospitals twice. The first visit will be to deliver the questionnaires and the second visit after two weeks to pick up completed questionnaires. We understand doctor's work on a shift system in the emergency centre hence those wishing to use the paper questionnaire can pick up and return the completed questionnaire to the principal author or the emergency centre consultant.

In order to improve response rates, the principal investigator and/or a delegated person will follow-up doctors to complete the questionnaire in addition to the email reminder. Furthermore, the questionnaire has been designed to be user friendly and can be completed in less than 10 minutes.

Data from the online questionnaire will be exported and data from the paper-based questionnaires will be manually transferred to a Microsoft Excel spreadsheet that will be password protected. Following this, the paper questionnaires will be shredded and discarded.

3.5 Data analysis

Descriptive statistics (mean, standard deviation, median, range and inter-quartile range) will be used to summarise demographic data. Data will be presented in form of frequency tables and bar charts. For the Likert-scale questions, we will present the findings as medians or modes. If variables such as age, gender, or experience, etc. appear to be independent during data analysis, we will use the Mann-Whitney U Test to determine such a difference. The questionnaire and study methodology was reviewed with a statistician from the Biostatistics Unit at Stellenbosch University. Data from the MS-Excel document will be exported to Stata for analysis.

4. Ethical and legal considerations

Autonomy:

The participation in the study by the doctors is voluntary, and the doctors may choose not to participate. They may decide to withdraw from the study at any time. Informed consent will be taken from all participants (written consent for paper-based survey and inferred consent for the web-based survey) and information regarding the study will be given to all participants (appendix A).

Justice:

No personal identification from the participants is required and confidentiality of participants will be guarded. Participating doctors will not be penalised if they decide not to participate or withdraw from the study. Data collected will be entered into a password protected electronic spreadsheet or stored in a secure institutional database which will only be accessible by the research team.

Beneficence:

The result of the study will be used to give feedback and recommendations to the study hospitals and participating doctors via respective heads of departments.

Non-maleficience:

There is no risk to the participants or hospitals included in the study.

5. Strengths and limitations

This study has not been conducted in Cape Town before.

The UTAUT model used as the basis for the questionnaire does not integrate barriers as factors to acceptance of technology. However, it is the best model available that is widely used and validated.

Cape Town encompasses a large number of hospitals and the distance between hospitals has limited the study to the metropole only; therefore the results of the study might not be generalisable to all hospitals in Cape Town. However, these hospitals represent a wide range of health care practitioners

Data collection will be done via self-administered questionnaire that may create errors in interpretation. Errors during transferral of paper-based data to electronic datasheets are possible. This may in turn influence the study conclusions and consequently affect the validity of the study.

6. Data dissemination plan

The principal investigator is conducting this study to prepare for his thesis, which is a requirement for the MMed Emergency Medicine.

We aim to publish the study in the African Journal of Emergency Medicine.

Participating emergency centres will be given feedback regarding the study outcomes and recommendations to improve uptake of EMRs.

We also aim to present the study as a poster/talk at the International Conference on Emergency Medicine (ICEM) 2016 in Cape Town.

7. Project timeline

2015/2016	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
EM-DRC	X 2015											
Sx-DRC	X 2015	X 2015										
Ethics			X 2015	X 2015	X 2015	X 2015	X 2016	X 2016				
Interviews (Data Collection									X 2016	X 2016		
Transcribing of Data										X 2016		
Data Analysis										X 2016	X 2016	
Compilation of Final Report											X 2016	X 2016
Submission												X 2016

8. Resources and budget

Budget				
July 2015 – January 2016				
Item	**Description**	**Unit cost**	**N° of Units**	**Total cost**
Consumables				
1. Specialized services	None	0	0	0
2. Office supplies, printing & reproduction for data collection	Printing paper	40	1	40
	Envelopes	12	20	240
	File	34	5	170
	Stapler and pins	13	1	13
	Pens	15	10	150
	Photocopying	1/pg	200	200
3. Office supplies, printing & reproduction for reports	Printing paper	40	1	40
	Binding	30	2	60
Research travel				
1. Travel to sites	Travelling to and fro government and private hospitals	R12.46/l t		2000
2. Other, specify	None	0	0	0
Communication				
1. Cell phone/landline	For contacting hospitals, statistician			500
Personnel				
1. Statistician	For data analysis	0	10	0
2. Research Assistant(s)	None	0	0	0
Sub-Total				**3413**
Inflation (10%)				**341.3**
Total				**3754.3**

The principal investigator will be funding the study. No scholarship or bursary is provided.

9. References

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Appendix F: Approval letters

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Approval Notice
Response to Modifications- (New Application)

22-Feb-2016
Chagani, Mohamedsuhel MMA

Ethics Reference #: S15/09/202

Title: The assessment of acceptance and identification of barriers to use of Electronic Medical Records by doctors in Emergency Centres in Cape Town, South Africa.

Dear Dr Mohamedsuhel Chagani,

The **Response to Modifications -** ***(New Application)*** received on **17-Dec-2015**, was reviewed by members of **Health Research Ethics Committee 1** via Expedited review procedures on **22-Feb-2016** and was approved.
Please note the following information about your approved research protocol:

Protocol Approval Period: **22-Feb-2016 -21-Feb-2017**

Please remember to use your **protocol number** (**S15/09/202**) on any documents or correspondence with the HREC concerning your research protocol.

Please note that the HREC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

After Ethical Review:
Please note a template of the progress report is obtainable on www.sun.ac.za/rds and should be submitted to the Committee before the year has expired. The Committee will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly for an external audit.
Translation of the consent document to the language applicable to the study participants should be submitted.

Federal Wide Assurance Number: 00001372
Institutional Review Board (IRB) Number: IRB0005239

The Health Research Ethics Committee complies with the SA National Health Act No.61 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 Part 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health).

Provincial and City of Cape Town Approval

Please note that for research at a primary or secondary healthcare facility permission must still be obtained from the relevant authorities (Western Cape Department of Health and/or City Health) to conduct the research as stated in the protocol. Contact persons are Ms Claudette Abrahams at Western

Cape Department of Health (healthres@pgwc.gov.za Tel: +27 21 483 9907) and Dr Helene Visser at City Health (Helene.Visser@capetown.gov.za Tel: +27 21 400 3981). Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

We wish you the best as you conduct your research.
For standard HREC forms and documents please visit: www.sun.ac.za/rds

If you have any questions or need further assistance, please contact the HREC office at 0219389657.

Included Documents:
Declaration R Allgaier
Protocol
CV R Allgaier
20160121 MOD Protocol
20160121 MOD Cover letter
Application form
Declaration M Chagani
CV M Chagani
Protocol Synopsis
Declaration J Fleming
CV J Fleming
Checklist

Sincerely,

Franklin Weber
HREC Coordinator

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Ethics Letter

10-Mar-2016

Ethics Reference #: S15/09/202
Title: The assessment of acceptance and identification of barriers to use of Electronic Medical Records by doctors in Emergency Centres in Cape Town, South Africa.

Dear Dr Mohamedsuhel Chagani,

Your letter dated 26 February refers.

Proposed changes to the protocol are in order and may be implemented.

If you have any queries or need further help, please contact the REC Office 0219389657.

Sincerely,

REC Coordinator
Franklin Weber
Health Research Ethics Committee 1

Western Cape Government
Health

STRATEGY & HEALTH SUPPORT
Health.Research@westerncape.gov.za
tel: +27 21 483 6857 : fax: +27 21 483 9895
5th Floor, Norton Rose House, 8 Riebeek Street, Cape Town, 8001
www.capegatheway.gov.za

REFERENCE: WC_2016RP43_940
ENQUIRIES: Ms Charlene Roderick

University of Stellenbosch
Private Bag X1
Matieland
7602

For attention: **Dr Mohamedsuhel Chagani, Dr Julian Fleming and Ms Rachel Allgaier**

Re: **THE ASSESSMENT OF ACCEPTANCE AND IDENTIFICATION OF BARRIERS TO USE OF ELECTRONIC MEDICAL RECORDS BY DOCTORS IN EMERGENCY CENTRES IN CAPE TOWN, SOUTH AFRICA.**

Thank you for submitting your proposal to undertake the above-mentioned study. We are pleased to inform you that the department has granted you approval for your research.
Please contact the following people to assist you with any further enquiries in accessing the following sites:

Contact No:
Contact No:

Kindly ensure that the following are adhered to:

1. Arrangements can be made with managers, providing that normal activities at requested facilities are not interrupted.
2. Researchers, in accessing provincial health facilities, are expressing consent to provide the department with an electronic copy of the final feedback (**annexure 9**) within six months of completion of research. This can be submitted to the provincial Research Co-ordinator (Health.Research@westerncape.gov.za).
3. In the event where the research project goes beyond the estimated completion date which was submitted, researchers are expected to complete and submit a progress report (**Annexure 8**) to the provincial Research Co-ordinator (Health.Research@westerncape.gov.za).
4. The reference number above should be quoted in all future correspondence.

Yours sincerely

DR A HAWKRIDGE
DIRECTOR: HEALTH IMPACT ASSESSMENT
DATE: 11/3/2016.
CC:

STRATEGY & HEALTH SUPPORT
Health.Research@westerncape.gov.za
tel: +27 21 483 6857; fax: +27 21 483 9895
5th Floor, Norton Rose House, 8 Riebeek Street, Cape Town, 8001
www.capegateway.gov.za

REFERENCE: WC_2016RP43_940
ENQUIRIES: Ms Charlene Roderick

Stellenbosch University
Private Bag x1
Matieland
7602

For attention: Dr Mohamedsuhel Chagani, Dr Julian Fleming, Ms Rachel Allgaier

Re: The assessment of acceptance and identification of barriers to use of Electronic Medical Records by doctors in Emergency Centres in Cape Town, South Africa.

Thank you for submitting your proposal to undertake the above-mentioned study. We are pleased to inform you that the department has granted you approval for your research.

Please contact the following people to assist you with any further enquiries in accessing the following sites:

Karl Bremmer Hospital	**Dr Linda Naude**	**021 444 7421**

Kindly ensure that the following are adhered to:

1. Arrangements can be made with managers, providing that normal activities at requested facilities are not interrupted.

2. Researchers, in accessing provincial health facilities, are expressing consent to provide the department with an electronic copy of the final feedback (**annexure 9**) within six months of completion of research. This can be submitted to the provincial Research Co-ordinator (Health.Research@westerncape.gov.za).

3. Please Note that access is granted until the end of 30th December 2016 due to facility renovations.

4. In the event where the research project goes beyond the *estimated* completion date which was submitted, researchers are expected to complete and submit a progress report (**Annexure 8**) to the provincial Research Co-ordinator (Health.Research@westerncape.gov.za).

5. The reference number above should be quoted in all future correspondence.

Yours sincerely

DR A HAWKRIDGE

DIRECTOR: HEALTH IMPACT ASSESSMENT

DATE: 17/5/2016

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www.capegateway.gov.za

REFERENCE: WC_2016RP43_940
ENQUIRIES: Ms Charlene Roderick

Stellenbosch University

Private Bag x1

Matieland

7602

For attention: Dr Mohamedsuhel Chagani, Dr Julian Fleming, Ms Rachel Allgaier

Re: **The assessment of acceptance and identification of barriers to use of Electronic Medical Records by doctors in Emergency Centres in Cape Town, South Africa.**

Thank you for submitting your proposal to undertake the above-mentioned study. We are pleased to inform you that the department has granted you approval for your research.

Please contact following people to assist you with any further enquiries in accessing the following sites:

Kindly ensure that the following are adhered to:

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4. The reference number above should be quoted in all future correspondence.

Yours sincerely

DIRECTOR: HEALTH IMPACT ASSESSMENT

DATE: 8/6/2016

CC: **M.PHILLIPS** **DIRECTOR:KESS**

Western Cape Government
Health

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Health.Research@westerncape.gov.za
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5th Floor, Norton Rose House, 8 Riebeek Street, Cape Town, 8001
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REFERENCE: WC_2016RP43_940
ENQUIRIES: Ms Charlene Roderick

Stellenbosch University
Private Bag x1
Matieland
7602

For attention: Dr Mohamedsuhel Chagani, Dr Julian Fleming, Ms Rachel Algaier

Re: The assessment of acceptance and identification of barriers to use of Electronic Medical Records by doctors in Emergency Centres in Cape Town, South Africa.

Thank you for submitting your proposal to undertake the above-mentioned study. We are pleased to inform you that the department has granted you approval for your research.

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4. The reference number above should be quoted in all future correspondence.

Yours sincerely

DIRECTOR: HEALTH IMPACT ASSESSMENT

DATE: 9/6/2016

CC **P OLCKERS** **DIRECTOR: MITCHELLS PLAIN / KLIPFONTEIN**