Review Article

BARRIERS OF UTILIZING AN ELECTRONIC HEALTH SYSTEM IN SUB-SAHARAN AFRICA

ABSTRACT

BACKGROUND: Accessing of data information of patients has been a challenge for years due to use of paper recording, some essential data are either lost or mistaken thrown away and cannot be retrieved. This is a major public health concern to ensure effective provision of healthcare to patients. The purpose of the study focuses on the barriers of utilizing an electronic health system in sub-Saharan Africa.

METHOD: A systematic review was carried out with the aid of online research journal websites as well as other in-context articles. While conducting this study, the key words in the search query were directed towards the barriers in the implementation of electronic health system in Sub-Saharan Africa. Areas noted in relation to this study was use of electronic health system among health professionals. Therefore, there was linkage of papers pointing out the barriers hindering the implementation of the e-health system.

RESULTS: According to Kemper and other researchers more than half (58.1%) of the physicians without an electronic medical record doubt that electronic medical records can improve patient care or clinical outcomes (Kemper et al., 2006). In Shachak's research, where this issue was considered, 92% of physicians felt EMR use did disturb communication with their patients (Pizziferri et al., 2005).

CONCLUSION: The findings of this study can be used as an overview of barriers that physicians might possibly see in the EMR implementation process and, as such, could be valuable for EMR policymakers and implementers. The study indicates that policymakers should be more aware of the reality that removing technical, financial, and legal barriers is not sufficient to ensure the realization of the promises of EMR.

KEYWORDS: Electronic Health System, Electronic Health Records, Electronic Medical Records

INTRODUCTION

Sub-Saharan Africa is a resource-constrained region that suffers a top-heavy share of the world's burden of disease. According to the World Health Organization (WHO), about 12% of the world's population live in sub-Saharan Africa, yet the region suffers 27% of the world's total burden of disease (WHO, 2008). To make the situation worse, the same region with a high burden of disease still lags in health information technology which is vital in ensuring improved patients care (Chaplin et al., 2015; Ajiboye et al., 2014; Fraser et al., 2005). Timely as well as accurate patient information is essential to meet the health-care needs of any patient in any population.

Physicians and other care providers require high quality information to make sound clinical decisions; however, their information needs are often not met (Williams, Boren, 2008; Simba, Mwangu, 2004). This lack of high quality information often leads to lesser quality and inefficient patient care; reporting as well as clinical research is also affected adversely (Monda, Keipeer, Were, 2012). The critical need for good health information systems in sub-Saharan Africa has become the current focus of attention.

In recent years, there has been a growing interest in electronic medical records or electronic health records adoption in many countries this is due to an increasing recognition that a stronger health information technology is crucial to achieving a higher quality care at lower costs (Cline, Luiz, 2013; Pantuvo et al., 2011). The International Organization for Standardization (ISO)

defines an Electronic Health Record (EHR) as a “repository of patient data in digital form, stored and exchanged securely, and accessible by multiple authorized users. It contains retrospective, concurrent, and prospective information and its primary purpose is to support continuing, efficient, and quality integrated health care” (ISO, 2005).

In addition, the National Alliance for Health Information Technology defines Electronic Medical Record as the electronic record of health-related information on an individual that is created, gathered, managed, and consulted by licensed clinicians and staff from a single organization who are involved in the individual’s health and care (Neal, 2008). Electronic Health Records has been identified to be an important integral part of an efficient health-care information system that guarantees positive health outcomes (Williams, Boren, 2008). Many studies conducted in different health-care settings have indicated that electronic health records will assist health professionals to reduce medical errors, achieve better effective care coordination, improve safety and quality, and also, it can reduce health-care costs (Blaya et al., 2010; Castelnuovo et al., 2012).

Health-care systems, similar to other industries, are information-intensive organizations. Health-care workers need adequate data as well as information management tools to make accurate decisions, both during patient care and management of the health-care system, and to communicate and document patient care plans (Shortliffe, Cimino, 2014). Electronic health record represents a potential method to improve record keeping in the EC (Desroches et al., 2008; Asabe et al., 2013; Miller, Sim, 2004).

The benefits of using electronic health record have been documented mostly in high-income countries and include improved quality of care and high levels of client satisfaction, faster retrieval of client records and avoidance of missing folders, improved documentation,

enhancement of within-facility healthcare coordination, improved efficiency and convenience in care provision, reduction in staff time spent on specific paper-based administrative tasks, reduction in number of duplicate diagnostic tests ordered, and improvement in patient safety and health outcomes (O' Malley et al., 2010; Canada Health Infoway, 2013).

There is limited documented experience on the use of electronic health record in ECs in LMICs. The electronic health record usage in sub-Saharan Africa has been sparse, rudimentary, and limited to anti-retroviral therapy clinic documentation, or more generalized documentation in some health facilities (Healy, Lubeck, 2012; Douglas et al., 2010; Atweam, 2012; Oluoch et al., 2014). For example, electronic health records use in anti-retroviral therapy has enhanced health care provision in Malawi by increasing the accuracy and completeness of data collection (Marcus et al., 2009).

Moreover, electronic medical records usage was documented to improve healthcare delivery and administration of public health policy in Cameroon (Kamadjeu et al., 2005). Both Malawi and Cameroon are low-income countries by the World Bank definition. Furthermore, it is having been observed that the adoption of EMR in Ghana would likely make public health policies more efficient (Healy, Lubeck, 2012). The factors that limit the implementation of EHR in different health-care settings in Africa have not been widely studied. Therefore, to bridge this gap, this paper reviewed the barriers in the implementation of the electronic health system in sub-Saharan Africa.

METHOD

A systematic review was carried out with the aid of online research journal websites as well as other in-context articles. While conducting this study, the key words in the search query were

directed towards the barriers in the implementation of electronic health system in Sub-Saharan Africa. Areas noted in relation to this study was use of electronic health system among health professionals. Therefore, there was linkage of papers pointing out the barriers hindering the implementation of the e-health system.

RESULTS

Lack of belief in the Electronic Health System

According to Kemper and other researchers more than half (58.1%) of the physicians without an electronic medical record doubt that electronic medical records can improve patient care or clinical outcomes (Kemper et al., 2006). Other researchers have stated that those who are unwilling to use such a system are skeptical about claims that electronic health records can successfully improve the quality of medical practices (Jha et al., 2009; Simon et al., 2007; Vishwanath, Seamurra, 2007). This creates a personal resistance to the adoption of electronic health records.

However, this is very much a perceived barrier to electronic health records, there is a lack of valid statistical data and success stories about electronic health records available to non-users. Clearly, implementing EMRs does mean a change in working styles for physicians and, initially, people are generally afraid of change and doubt its necessity. Further, the physicians' skepticism and negative perceptions of EMRs are affected by the social influences around them.

Need for control

Professional autonomy plays a very important role in the working practices of physicians. Professional autonomy is defined as "professionals having control over the conditions, processes, procedures, or content of their work", which will not be possessed or evaluated by others (Walter, Lopez, 2008). With the implementation of EMRs, physicians are concerned about the loss of their control of patient information and working processes since these data will be shared with and assessed by others. Walter and Lopez concluded that physicians' perceptions of the threat to their professional autonomy are very important in their reaction to EMR adoption. Very few studies have really considered this problem (two articles among the twenty included studies) and offered suggestions to overcome it (Vishwanath, Seamurra, 2007; Walter, Lopez, 2008).

Interference with doctor-patient relationship

Only a few researchers have considered the possibility of interaction problems between doctors and patients when using EMRs. In Shachak's research, where this issue was considered, 92% of physicians felt EMR use did disturb communication with their patients (Pizziferri et al., 2005). Physicians have to turn to the computer to complete electronic forms during the encounter, and this can be time consuming especially when they suffer from limited computer skills. In the research by Ludwick and Douchette, some physicians reported that they sometimes stop using EMRs because hunting for menus and buttons disrupts the clinical encounter (Ludwick, Douchette, 2009).

According to Shachak and other researchers, using EMRs increases the average screen gaze time of physicians from 25% to 55% of the consultancy session, inevitably resulting in less eye-contact and less conversation with the patient (Shachack et al., 2009). Further, as some electronic health records are patient-accessible, they might even distort the clinical encounter with more interference and distractions from the patient (Earnest et al., 2004).

Thus, the traditional doctor-patient relationship will be changed by EMRs. However, whether this is really a problem for physicians and patients requires further empirical research since this issue has so far been largely neglected by most researchers.

Lack of support from other colleagues

Physicians work cooperatively with other healthcare professionals, such as nurses and administrative staff, in medical practices. The lack of technical skills, complaints about workload increases, negative perceptions and resistance to using EMRs, all barriers which have been mentioned in previous categories, also apply to these colleagues. This leads to a lack of support from these colleagues, which impedes physicians in further adopting the system (Randeree, 2007; Vishwanath, Scamurra, 2007). Again this is not widely acknowledged, and only these two publications in our survey saw this lack of support as a potential barrier to physicians adopting EMRs.

Lack of support from the management level

Whether the management level supports the use of EMRs, and believes in the benefits of EMRs, has been found to influence the rate of EMR adoption by physicians (Miller, Sim, 2004; Vishwanath, 2007; Reardon, Davidson, 2007). However, most researchers do not consider this issue, or take for granted that managers will be committed to EMR implementation.

Privacy or security concerns

Many researchers agree that the use of computerized EMRs is an issue that may have a negative effect on patient privacy (Jha et al., 2009; Menachemi et al., 2007; Loomis et al., 2002; Valdes et al., 2004; Kemper et al., 2006; Earnest et al., 2004). Physicians doubt whether EMRs are a secure store for patients' information and records, and fear that data in the system may be

accessible to those who are not authorized to obtain it. The consequent inappropriate disclosure of patient information might lead to legal problems. Furthermore, there is, in some countries, a lack of clear security regulations that could help ensure patient privacy and confidentiality.

According to Simon and other researchers, physicians are more concerned about this issue than the patients themselves (Simon et al., 2007). Even among the physicians who do use EMRs, most believe that there are more security and confidentiality risks involved with EMRs than with paper records (Loomis et al., 2002). This shows that concerns about the privacy and security of patient data are experienced as a barrier to EMR usage.

Lack of incentives

EMRs have the potential benefit of improving the quality of medical care. However, unless physicians see some personal benefit from using EMRs, they will not be motivated to switch and will instead stick to their traditional working procedures. Miller and Sim and Vishwanath, Scamurra concluded that unless physicians have some personal incentives during the implementation of EMRs, the adoption of EMRs will not reach the expected level (Miller, Sim, 2004; Vishwanath, Scamurra, 2007). Interestingly, the incentives considered in the cited studies were largely financial ones and, to us, this seems an area worthy of wider investigation.

Lack of leadership

From the project management perspective, project leaders or project champions play a critical role in the success of a project. In an EMR implementation project, project leaders/champions are the people who lead, encourage and support the change at the management level (Terry et al., 2008). Provided they strongly believe that EMRs will bring benefits and quality improvement, they will be willing to bear the risks and costs in order to generate the benefits (Miller, Sim,

2004). One important function of project leaders/champions is to motivate other members of a practice to participate in the change process. Miller and Sim argue that practices without EMR champions may struggle to improve quality or see financial benefits from EMRs (Miller, Sim, 2004). As such, more attention should be paid to the role and influence of project leaders/champions in order to increase the adoption rate of EMRs.

Uncertainty over Return on Investment (ROI)

As implementing and maintaining EMRs is very costly, physicians worry that their practices will face substantial financial risks and that it could take years before they see a return on the investment (Miller, Sim, 2004). According to Miller and Sim "financial benefits vary greatly, from none in practices that made few work practice changes to more than $20,000 per physician per year in the few practices that eliminated most paper processes" (Miller, Sim, 2004). While EMR vendors claim that the benefits outweigh the costs, physicians remain to be convinced (DesRoches et al., 2008; Randeree, 2007; Miller, Sim, 2004; Valdes et al., 2004).

Lack of financial resources

Only one paper directly pointed to a lack of financial resources/funds as a barrier to EMR adoption (Meade et al., 2009). However, the high start-up and ongoing costs of implementing an EMR system can result in problems finding sufficient financial resources in a medical practice. As these costs are very high, there can be inadequate financial resources to cover them, especially in small and medium practices with low IT budgets

lack computer skills from health professionals

Many researchers, based on their surveys, have concluded that, physicians have insufficient technical knowledge and needs of the user applications" (Randeree, 2007). Many surveys show that one reason why physicians do not adopt EMRs is that they cannot find a system that meets their special needs or that they can utilize to meet their requirements (DesRoches et al., 2008; Kemper et al., 2006). However, it does seem that more effort is required from the vendors of EMRs to increase their customizability. However, such customer services will increase the costs to practices of implementing EMRs; potentially erecting financial barriers.

Lack of computers

The use of EMR systems requires a sufficient quantity of hardware in practices, including computers, phone lines and internet connections. Some researchers state that some practices lack these 'basic' facilities/hardware needed to support EMR implementation and that this issue blocks the widespread adoption of EMRs (Laerum et al., 2001). Further, in such practices, the start-up costs associated with setting up EMRs will be higher as more resources are needed.

Time required to select, purchase, and implement the system

It has been found that physicians opt not to invest time in system selection and procurement as they think they should spend their time and effort on patients, rather than on selecting and contracting an EMR system, which is not regarded as part of their daily working practice (Jha et al., 2009; Meade et al., 2009). However, there is no clear statement that physicians should be responsible for this work. Therefore, whether physicians investing time in selecting, purchasing, and implementing is really a barrier depends on the quality of project management during the EMR implementation process.

Time to learn the system

However, “the demands and pressures of delivering officebased care may not afford them the time to learn the system” (Simon et al., 2007). Given this situation, they report that they lack the time to learn, as it would slow their workflow and increase their workload. However, other researchers argue that mastering an EMR system will help physicians to work more efficiently (Meade et al., 2009). Maybe, further benefit-effort analyses are required to demonstrate the value of learning and mastering the system.

Time required to enter data

It is perhaps surprising that many researchers conclude that data entry is a problem for physicians using EMRs (Jha et al., 2009). In 2002, Loomis and other researchers researched, more than half of the EMR users stated that data entry was both cumbersome and time-consuming (Loomis et al., 2002). As such, data-entry is a widely experienced barrier among physicians.

More time per patient

Many physicians report that using EMRs will take more time for each patient than using paper as, in some situations, it might be more convenient and efficient to use paper records during the clinical encounter (Laerum et al., 2001). If using EMRs, physicians may have to stop halfway through a consultancy in order to enter information on patients or type a prescription, and this will disrupt the flow. Additionally, the fact that physicians are slow in typing and entering data will cost more time for each patient visit than before.

Focusing on this issue, Pizziferri and other researchers carried out a time and motion study on physicians’ time utilization before and after implementing an EMR system and found that most

physicians were able to avoid “sacrificing time with patients or overall clinic time, but they do spend more time on documentation outside of clinic sessions” (Pizziferi et al., 2005). The same study also showed that using EMRs does increase a physician’s workload although, as a note of caution, we would add that there are no other studies focusing on this issue to confirm these findings.

Time to convert patient records

Implementing an EMR means switching from paper-based to electronicbased systems, and this involves transferring records between the two systems. Some physicians regard the task of record conversion as their own responsibility as “they are only comfortable with the summaries they themselves would make of handwritten notes, histories, and so on” (Davidson, Heslina, 2007). They are aware of the time and cost burden associated with record conversion, which may outweigh any acknowledged potential benefits of EMRs. As a result, the time required to convert records is considered as a barrier to the integration of EMRs in medical practices.

DISCUSSION

The review of identified articles shows the wide range of possible barriers to implementing EMRs, and provides insight into the relationships between barriers. We deduce that the most frequently identified barriers are ‘primary’ barriers, i.e. they are the first to arise when physicians are faced with EMRs. From the results reviewed, we also saw that barriers within different categories or subcategories seemed to be interrelated. For instance, high start-up costs and ongoing costs lead to a lack of financial resources; and a lack of adequate computer skills is the reason why physicians need a long time to learn the system.

Overcoming the high cost barriers, especially the purchase costs associated with EMRs, may require incentives from the government, such as low-interest loans or funding programs (Anderson, 2007). Anderson, when addressing privacy and security concerns, similarly argued that national government action was required to develop and regulate a comprehensive set of national privacy laws on data protection (Anderson, 2007).

Many countries have already addressed these concerns through new laws and regulations. In the United States, for example, the Health Insurance Portability and Accountability Act (HIPAA) Privacy Rule offers federal protection for the privacy of personal health information. Other countries have comparable legal frameworks for dealing with medical data. The 'Study on the Legal Framework for Interoperable eHealth in Europe' provides an overview of regulatory frameworks in European Union member states, but also notes that many privacy and security issues have to be resolved (European Commission, 2009).

In order to receive EHR stimulus money, the HITECH act requires doctors to show "meaningful use" of an EHR system. In Australia, Health Connect is a national strategy to establish and maintain standardized electronic health information products and services for healthcare providers and consumers. The strategy is a partnership between National, State, and Territory Governments which aims to leverage e-health systems in different parts of the health sector through a common set of standards such that health information can be securely exchanged between healthcare providers.

In many other countries, such as the United Kingdom, Denmark, the Netherlands, and France, comparable initiatives are being taken to develop a national electronic health infrastructure. These initiatives are normally directed at developing a structure for the exchange of medical information, and are often funded or sponsored by public resources. However, the barriers

developed in this paper indicates that physicians often experience other forms of barrier, and these need to be systematically addressed to realize high adoption rates.

CONCLUSION

Despite the positive effects from using EMRs in medical practices, the adoption rate of such systems is still low and they meet resistance from physicians. In this article, based on a systematic literature review of studies, barriers to physicians accepting EMRs have been identified. The paper analyzes the reasons behind the relatively low adoption rate of EMRs among physicians. Implementing an EMR system clearly changes the workflow in a medical practice. Moreover, an EMR implementation is a major change that is felt throughout the practice; it demands complementary adjustments and innovation in other aspects such as to the structure and culture of a practice.

The findings of this study can be used as an overview of barriers that physicians might possibly see in the EMR implementation process and, as such, could be valuable for EMR policymakers and implementers. The study indicates that policymakers should be more aware of the reality that removing technical, financial, and legal barriers is not sufficient to ensure the realization of the promises of EMR. However, it would be wrong to conclude that there is a “one way fits all” route. EMR implementers and change managers have to choose and decide on relevant interventions based on their actual conditions and situation. At the same time, they should consider the structures and conditions of the practices with which they are dealing - an interesting and challenging task.

REFERENCES

Ajiboye BA, Adekoya AJ, Alawiye MK, Oyedipe WJ. Knowledge and utilization of health information and communication technologies (HICTs) by health workers of the North-Eastern health zone of Ogun State, Nigeria. Inform Health Soc Care 2014; 39:104-23.

Anderson JG: Social, Ethical and Legal Barriers to E-health. International Journal of Medical Informatics 2007, 76(5-6):480-483.

Asabe SA, Oye ND, Goji M. Hospital patient database management system a case study of General Hospital North-Bank Makurdi- Nigeria. Compusoft 2013;2(3): 65–72.

Atweam DK. Ghana e-health framework, Joint ITU-WHO workshop e-health standards and interoperability. Geneva-Switzerland, 26-27 April 2012. Available from: http://www.itu.int/en/ITU-T/Workshops-and-Seminars/eHealth/201204/Pages/bios.aspx.

Blaya JA, Fraser HS, Holt B. E-health technologies show promise in developing countries. Health Aff (Millwood) 2010; 29:244-51.

Burt CW, Sisk JE: Which Physicians and Practices Are Using Electronic Medical Records? Health Affairs 2005, 24(5):1334-1343.

Canada Health Infoway. The emerging benefits of electronic medical records use in community-based care; 2013. Available from: https://www.pwc.com/ca/en/healthcare/publications/pwc-electronic-medical-record-usecommunity-based-care-report-2013-06-en.pdf.

Castelnuovo B, Kiragga A, Afayo V, Ncube M, Orama R, Magero S, et al. Implementation of provider-based electronic medical records and improvement of the quality of data in a large HIV program in SubSaharan Africa. PLoS One 2012;7: e51631.

Chaplin B, Meloni S, Eisen G, Jolayemi T, Banigbe B, Adeola J, et al. Scale-up of networked HIV treatment in Nigeria: Creation of an integrated electronic medical records system. Int J Med Inform 2015; 84:58-68.

Cline GB, Luiz JM. Information technology systems in public sector health facilities in developing countries: The case of South Africa. BMC Med Inform Decis Mak 2013; 13:13.

Davidson E, Heslinga D: Bridging the IT Adoption Gap for Small Physician Practices: An Action Research Study on Electronic Health Records. Information Systems Management 2007, 24(1):15-28.

DesRoches CM, Campbell EG, Rao SR, Donelan K, Ferris TG, Jha A, Kaushal R, Levy DE, Rosenbaum S, Shield AE, Blumenthal D: Electronic Health Records in Ambulatory Care - A National Survey of Physicians. New England Journal of Medicine 2008, 359(1):50-60.

DesRoches MC, Campbell GE, Rao RS, et al. Electronic health records in ambulatory care - a national survey of physicians. N Engl J Med 2008; 359:50–60.

Douglas GP, Gadabu JO, Joukes S, et al. Using touchscreen electronic medical record systems to support and monitor national scale-up of antiretroviral therapy in Malawi. PLoS Med 2010;7(8):1–6.

Earnest MA, Ross SE, Wittevrongel L, Moore LA, Lin CT: Use of a Patient Accessible Electronic Medical Record in a Practice for Congestive Heart Failure: Patient and Physician Experiences. Journal of the American Medical Informatics Association 2004, 11(5):410-417.

European Commission: Study on the Legal Framework for Interoperable eHealth in Europe Brussels: European Commission, Directorate General Information Society 2009.

Fraser HS, Biondich P, Moodley D, Choi S, Mamlin BW, Szolovits P. Implementing electronic medical record systems in developing countries. Inform Prim Care 2005; 13:83-95.

Healy L, Lubeck P. Patient information privacy and security in Ghana: a review of current policy and suggestions for the future [Undergraduate thesis]. University of California Santa Cruz; 2012. Available from: https://www.google.com.gh/search?q=8.%09Healy,+L.+and+Lubeck,+P.+Patient+information+privacy+and+security+in+Ghana:+a+review+of+current+policy+and+suggestions+for+the+future.+Undergraduate+thesis+2012&ie=utf-8&oe=utf-8&gws_rd=cr&ei=jlJ1V9ihIYiVaLzHi-gG.

International Organization for Standardization ISO/DTC 20514. Health Informatics-Electronic Health Record-Definition, Scope, and Context 2005. Available from: https://www.iso.org/obp/ui/#iso:std:39525:en.

Jha AK, Bates DW, Jenter C, Orav EJ, Zheng J, Cleary P, Simon R: Electronic Health Records: Use, Barriers and Satisfaction Among Physicians Who Care for Black and Hispanic Patients. Journal of Evaluation in Clinical Practice 2009, 15(1):158-163.

Kamadjeu RM, Tapang ME, Moluh RN. Designing and implementing an electronic health record system in primary care practice in Sub-Saharan Africa: a case study from Cameroon. Inform Prim Care 2005; 13:179–86.

Kemper AR, Uren RL, Clark SJ: Adoption of Electronic Health Records in Primary Care Pediatric Practices. Pediatrics 2006, 118(1):20-24.

Laerum H, Ellingsen G, Faxvaag A: Doctors' Use of Electronic Medical Records Systems in Hospitals: Cross Sectional Survey. British Medical Journal 2001, 323(7325):1344-1348.

Loomis GA, Ries S, Saywell RM, Thakker NR: If Electronic Medical Records Are So Great, Why Aren't Family Physicians Using them? Journal of Family Practice 2002, 51(7):636-641.

Ludwick DA, Doucette J: Primary Care Physicians' Experience with Electronic Medical Records: Barriers to Implementation in a Fee-forService Environment. International Journal of Telemedicine and Applications 2009, 853524.

Marcus DD, Lubrano J, Murray J. Electronic medical records – the physician's guide. 2nd ed. Texas: Medical Foundation; 2009.

Meade B, Buckley D, Boland M: What Factors Affect the Use of Electronic Patient Records by Irish GPs? International Journal of Medical Informatics 2009, 78(8):551-558.

Menachemi N, Langley A, Brooks RG: The Use of Information Technologies Among Rural and Urban Physicians in Florida. Journal of Medical Systems 2007, 31(6):483-488.

Miller RH, Sim I. Physicians' use of electronic medical records: barriers and solutions. Health Aff 2004; 23(2):116–26.

Miller RH, Sim I: Physicians' Use of Electronic Medical Records: Barriers and Solutions. Health Affairs 2004, 23(2):116-126.

Monda J, Keipeer J, Were MC. Data integrity module for data quality assurance within an e-health system in sub-Saharan Africa. Telemed J E Health 2012; 18:5-10.

Neal H. EHR vs EMR – what's the difference? 2008. Available from: http://profitable-practice.softwareadvice.com/ehr-vs-emr-whats-the-difference/.

O'Malley AS, Grossman JM, Cohen GR, et al. Is electronic medical record helpful for health coordination? Experiences of physician practices. J Gen Intern Med 2010;25(3): 177–85.

Oluoch T, Katana A, Ssempijja V, et al. Electronic medical record systems are associated with appropriate placement of HIV patients on antiretroviral therapy in rural health facilities in Kenya: a retrospective pre-post study. J Am Med Inform Assoc 2014;21(6):1009–14.

Pantuvo JS, Naguib R, Wickramasinghe N. Towards implementing a nationwide electronic health record system in Nigeria. Int J Healthc Deliv Reform Initiatives 2011; 3:39-55.

Pizziferri L, Kittler AF, Volk LA, Honour MM, Gupta S, Wang S, Wang T, Lippincott M, Li Q, Bates DW: Primary Care Physician Time Utilization Before and After Implementation of an Electronic Health Record: A timemotion Study. Journal of Biomedical Informatics 2005, 38(3):176-188.

Randeree E: Exploring Physician Adoption of EMRs: A Multi-Case Analysis. Journal of Medical System 2007, 31(6):489-496.

Reardon JL, Davidson E: An Organisational Learning Perspective on the Assimilation of Electronic Medical Records among Small Physician Practices. European Journal of Information Systems 2007, 16:681-694.

Shachak A, Hadas-Dayagi M, Ziv A, Reis S: Primary Care Physicians' Use of an Electronic Medical Record System: A Cognitive Task Analysis. Journal of General Internal Medicine 2009, 24(3):341-348.

Shortliffe EH, Cimino JJ. Biomedical Informatics: Computer Applications in Healthcare and Biomedicine. New York, NY: Springer; 2014. p. 1-43.

Simba DO, Mwangu M. Application of ICT in strengthening health information systems in developing countries in the wake of globalisation. Afr Health Sci 2004; 4:194-8.

Simon SR, Kalshal R, Cleary PD, Jenter CA, Volk LA, Oray EJ, Burdick E, Poon EG, Bates DW: Physicians and Electronic Health Records: A Statewide Survey. Archives of Internal Medicine 2007, 167(5):507-512.

Terry AL, Thorpe CF, Giles GG, Brown JB, Harris SB, Reid GJ, Thind A, Stewart M: Implementing Electronic Health Records. Canadian Family Physician 2008, 54:730-736.

Valdes I, Kibbe DC, Tolleson G, Kunik ME, Petersen LA: Barriers to Proliferation of Electronic Medical Records. Informatics in Primary Care 2004, 12(1):3-9.

Vishwanath A, Scamurra SD: Barriers to the Adoption of Electronic Health Records: Using Concept Mapping to Develop a Comprehensive Empirical Model. Health Informatics Journal 2007, 13(2):119-134.

Walter Z, Lopez MS: Physician Acceptance of Information Technologies: Role of Perceived Threat to Professional Autonomy. Decision Support Systems 2008, 46(1):206-215.

Williams F, Boren SA. The role of the electronic medical record (EMR) in care delivery development in developing countries: A systematic review. Inform Prim Care 2008; 16:139-45.

World Health Organization. Core Health Indicators; 2008. Available from: http://www.apps.who.int/whosis/database/core/core_select_process.cfm.