

Impact of Electronic Health Records Implementation on Medical Education Internship at Tenwek Hospital in Bomet, Kenya.

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Abstract

Electronic Health Record (EHR) is a digital version of a patient paper chart which has become a necessary component of healthcare in developed countries. However for Africa, it is until recent years in this millennium that health facilities began using HER. Few healthcare facilities in Sub Sahara Africa have adopted the use of EHRs while in East Africa, implementation began with hospitals who were running specific programs. Use of EHRs was implemented in Kenya in 2001 and Tenwek hospital initiated it in 2013 and by 2014 there was full transition from use of paper charts to completely paperless system. Since then, there is no study that has been done to determine its impact on medical education, precisely, internship program at Tenwek Hospital. The objectives of this study was to: Find out if use of EHRs fosters or hinders medical education for interns, Determine the implications of EHRs use on the MO and CO interns' ability to apply critical thinking for clinical judgement and decision making, describe the challenges experienced by the MO and CO interns, regarding the use of EHRs and to Suggest recommendations regarding use of EHRs that can enhance the learning experience for medical and clinical officer interns at Tenwek Hospital. This was a qualitative, descriptive, cross-sectional study conducted at Tenwek hospital in Bomet County, Kenya. The study population was composed of purposively sampled: 4 Consultants from Surgery, Medicine, Paediatrics and OB/Gyn respectively, One Interns Coordinator, 5 Medical Officers and 5 clinical Officers who completed Internship at Tenwek in the last one year. Both trainers and trainees reported positive implications of EHRs use to include; easy retrieval of information, enhanced ability for clinical judgement and decision making among others, as well as well and negative implications such as temptation to copy-paste, procrastination and reduced trainee-patient interaction time. Use of EHRs impacts the internship learning both positively and negatively as implied by both the trainees and teachers, however, the factors that enhance learning outweigh those that hinder the same.

Key Terms: Electronic Health Record, Internship, Medical Education, Faith Based Hospitals.

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1.0 INTRODUCTION

Electronic Health Record (EHR) refers to a digital version of a patient paper chart and can be defined as a longitudinal electronic record of patients' information generated by one or more encounters in any care delivery (Menachemi and Collum, 2011). EHRs contain patients' health information, such as: Administrative and billing data, Patient demographics, Progress notes, Vital signs, Medical histories, Diagnoses, Medications, Immunization dates, Allergies, Radiology images, Lab and test results (HealthIT, 2019). This software allows physicians to easily share records with other health care providers such as laboratories, specialists, medical imaging facilities, pharmacies, emergency facilities, as well as school and workplace clinics; regardless of their location (Ndifon, Edwards, and Halawi, 2016).

The use of EHR dates back to 1972 in developed countries and it is posited to have evolved with advancement in technology. Use of EHRs has become a necessary component of health care in developed countries for example, United Kingdom and Sweden already have national EHRs running, while United States of America enhanced the wide use by 2014 (Tierney *et al.*, 2010). However, this is different for Africa because it is until recent years in this millennium that health facilities have been sighted to be using HER. Moreover, few health care facilities in Sub Sahara Africa have adopted the use of EHR (Waithera, Muhia and Songole, 2017). In East Africa implementation of EHRs began with hospitals who were running specific programs. It was introduced in Kenya in 2001 when AMPATH in Moi Teaching and Referral Hospital developed the AMPATH Medical Records System (AMRS) with the aim of capturing and monitoring data for HIV/AIDS clients; Tanzania followed in late 2005 and Uganda in 2007, both under the HIV/AIDS programs (Tierney *et al.*, 2010).

At Tenwek Hospital, implementation of EHRs was initiated in 2013 and by 2014 there was full transition from use of paper charts to completely paperless system. Since the implementation of EHRs use at Tenwek hospital, Health care workers have informally reported both positive and negative implications, however; there is no study that has been done to determine its impact on medical education, precisely, internship program. Medical internship is a training period of one year undertaken by graduate medical and Clinical officers, conducted on rotational basis comprising of three months each. This internship is offered in selected Ministry of Health and Faith Based Hospitals which have been assessed, approved and accredited by Medical Practitioners and Dentist Board, Clinical Officers Council and the Ministry of Health (KMPDC, 2020 and Clinical Officers Council, 2020).

2.0 LITERATURE REVIEW

General Benefits of Using Electronic Health Records

According to the study by Brotzman *et al* (2009), it has been opined that EHRs have progressed over time and are rapidly becoming a standard element of medical practices as evidenced by clinics and hospitals turning to using it. The reason to support this move is the ability of EHR to improve data access and reduce reliance on cumbersome paper records. This is reinforced by Leapaldt, (2016) who postulated that EHRs have been shown to improve patient-specific benefits such as patient care quality and safety, promoting optimal patient outcomes and reducing or even eradicating errors. He also posited that using EHRs foster cost effectiveness, enhance job satisfaction among healthcare providers through better communication, as well as improving the healthcare system as a whole.

Several benefits of using EHRs have been explained by HealthIT, (2019) and it has been inferred that EHRs are premeditated to stretch beyond the health organization that originally collects and compiles patient's information. They are designed to share information with other health care providers. EHRs allow clinicians to: Track data over time, easily identify which patients are due for certain procedures or checkups and to check how their patients are doing on certain parameters—such as blood pressure readings or vaccinations. Consequently, this improves monitoring and overall quality of care within the practice in a particular health care setting. Owing to the fact that EHRs are designed to be accessed by all people involved in patients' care, it offers opportunities for effective communication of information from one party to another and, ultimately, the ability of multiple parties to engage in interactive communication of information thus enhance the team effort which is the rule of thumb in health care. With fully functional EHRs, all members of the team have ready access to the latest information allowing for more coordinated, patient-centered care. According to Williams and Boren, (2008) other benefit of using EHRs are: improved efficiency in health owing to the system's ability to facilitate accurate medication lists, legible notes and prescriptions and immediately available charts.

According to the study done in Uganda by Castelnovo et al, (2012) which compared the rate of errors in the database before and after the introduction of the provider based EHR, it was asserted that the introduction of provider-based EHR improved the quality of data collected with a substantial reduction in missing and incorrect information. In the same study, it is also implied that majority of providers and clients expressed satisfaction with the EHR system. This resulted in the researcher recommending the use of provider-based EHR in large HIV programs in Sub-Saharan Africa.

Impact of Electronic Health Records Use on Patient Care

Research shows that using EHRs has various benefits that translates to better healthcare. EHRs has the capability to exchange health information electronically thereby helping health care workers to provide higher quality and safer care for patients while creating noticeable enrichments for the particular organization implementing EHRs use (Leapaltd, 2016). EHRs help providers better manage care for patients and provide better health care by: Providing precise, up-to-date, and comprehensive information about patients at the point of care, Enabling quick access to patient records for more coordinated, efficient care, Helping providers more effectively diagnose patients, reduce medical errors, and provide safer care; as well as helping promote complete, legible documentation and exact, streamlined coding. Furthermore, clinician's notes from the patient's hospital stay can help inform the discharge instructions and follow-up care and enable the patient to move from one care setting to another more smoothly (HealthIT, 2019). Although the same writer asserted that EHRs enhance privacy and security of patient data it has been argued differently that there are varied concerns that storing patient-specific information in computers will lead to the inappropriate release and use of such data, with consequential breach in confidentiality and privacy of information (Shortliffe 1999).

According to the study done in the University of California San Diego, on impact of EHRs implementation on Ophthalmology trainee time expenditures by Gali et al (2019), it is depicted that trainees spent proportionally more time documenting the clinical encounter in the room when using EHR compared to paper chart. This could be attributed to the fact that paper chart review was previously done outside of the clinic room prior to bringing patient to the room whereas with HER, chart review was conducted on a desk top computer in the room.

Furthermore, the perceived increase in time spent by the trainee with the patient performing data collection through EHR may influence the trainees to believe that they require less history from the patient thereby missing some important information. Tierney *et al* (2013) added that EHRs can reduce time spent in data gathering thus increasing chances of missed opportunities due to health care providers' inability to be exhaustive in obtaining information. This finding is reinforced by the study by Chiang *et al* (2013) which revealed that EHR implementation was associated with increased documentation time by the trainees while there was minute or no rise in clinical volume of patients per clinician. This is also supported by Brotzman *et al* (2009) who implied that as the use of EHR increased time spent entering data it subsequently decreased the time actually taken for taking care of patients in the clinical setting thereby affecting the care of patients.

The study by Leapaltdt, (2016) regarding Electronic Health Records in the Academic World, implied that EHRs have been shown to boost optimal patient outcomes, reduce or stamp out errors, enhancements in drug monitoring, and increased use of evidence-based guidelines for interventions. These findings may translate to improved patient care because whatever information is entered into and obtained from EHR has a corresponding impact on patient's clinical state or course (Gagliardi and Turner, 2016)

Implications of Electronic Health Records Use on Medical Education

According to the study done by Peled *et al* (2009) in New York on whether EHRs help or hinder medical education, a number of factors affecting both the teachers and the trainees were depicted. In this study it was deduced that EHRs placed barriers on trainees placing orders by themselves and yet they believed that placing orders helped them learn what tests and treatments patients needed. Moreover, the readily available information in the data base diminished the interaction period between the trainees and the attending consultants. It is further argued that use of EHR hinder learning because it detours the need for trainees to synthesize clinical information such as signs, symptoms and laboratory test results, therefore, trainees are guaranteed the option of turning over the raw data from the screen to the consultant in a completely unprocessed manner. This is supported by Hammoud *et al* (2012) who argued that even though students could obtain and record more information when using an EHR system; it affected their learning because they spent less time with the patient and the fact that that computerized order entry was a barrier to them placing orders for their patients especially with the difficulty for residents to then review those orders.

The study done by Gali *et al* (2019), revealed that trainees spent statistically significantly less time talking exclusively with the patient during an encounter that was charted using EHR compared with one using paper charting. Although this may have affected the quality time spent by interacting between trainee and the patient, it offered the trainees opportunities for access to huge amount of progress notes, operative notes and laboratory results traversing the whole health system and encompassing multiple specialties than they had with reviewing paper charts.

Another study done by Crawford *et al* (2019) regarding Electronic Health Record Documentation Times among Emergency Medicine Trainees, confirmed that the level of training and experience with an electronic system affected the learners' documentation time as evidenced by second- and third-year trainees being significantly faster than first-year trainees. This implied that for trainees to come to speed with use of EHRs, there is need training and exposure to the system prior to using the system.

A cross-sectional survey was done in 2013, on Perceptions of Faculty and Trainees regarding effect of the adoption of a comprehensive EHR on graduate medical education; and a follow up survey of the same study was done in 2015 (Rosdahl et al., 2018). Findings revealed that both faculty and trainees had a positive impression of EHRs. However, during the implementation phase, participants believed that face-to-face teaching was negatively affected. Faculty believed EHRs had a negative effect on trainees' ability to take a history, conduct physical examinations, formulate a differential diagnosis and develop a plan of care independently.

Another study by Tierney et al (2013) indicated that EHRs has the ability for permitting efficient profiling and tracking of trainee clinical experiences and milestones, notwithstanding; they may also introduce workflow inefficiencies in terms of data entry and hardware down time issues. Conversely; there are positive workflow efficiencies including: less time spent in accessing medical histories, ease of data retrieval, greater remote access, and automated creation of sign-out documents to support handoff workflow. Moreover, some medical educators have raised an alarm that the EHR could negatively affect development of critical thinking skills among the learners. Additionally, EHRs use may negatively affect the self-directed learning efforts of trainees because of automation resulting in overdependence on automated systems leading to contentment of clinicians in evaluating their own decisions. An example, of overdependence is when trainees expect that EHR system will alert them of potential serious side effects or drug interactions, they may be less likely to research these possibilities before ordering a medication. This is reinforced by Gagliardi and Turner (2016) who argued that some habitual practices, in EHR data entry such as copy and paste may undermine professionalism, accountability, communication, and medical competence, particularly among learners. Furthermore, EHRs can either augment or impede the development of effective written or oral communication skills, which medical students are expected to begin developing during undergraduate medical education.

Tenwek hospital receives ten Medical Officer (MO) and ten Clinical Officer (CO) Interns every year, who undertake internship training program by rotating through the specified departments in the hospital for the entire year. MO and CO interns who are posted to Tenwek hospital each year come from different Universities and Medical Training colleges and they bring on board varied levels of experiences with EHRs use, if any; or exhibit no acquaintance with the use of EHRs at all. When they report to Tenwek, they are taken through induction for one day, out of which EHR section takes two-hour maximum. Owing to the fact that the EHRs system at Tenwek hospital is completely paperless and web-based, and that no inquiry has been done to ascertain the experiences the Interns undergo during their internship training, the question then becomes; "how has the use of EHRs at Tenwek hospital impacted the learning among Medical and clinical Officer Interns?" This review therefore seeks to explore the effects of EHR use on internship training at Tenwek hospital by considering the following objectives: Find out whether use of EHRs foster or hinder medical education for Interns at Tenwek Hospital, Determine the implications of EHRs use at Tenwek Hospital on the MO and CO interns' ability to apply critical thinking for clinical judgement and decision making, Establish the challenges experienced by the MO and CO Interns at Tenwek Hospital, regarding the use of EHRs and to Suggest recommendations regarding use of EHRs that can enhance the learning experience for medical and clinical officer interns at Tenwek Hospital.

3.0 METHODOLOGY

This study adopted a qualitative study design whereby the investigator personally carried out 20 to 30 minutes interviews with each participant. In order to obtain relevant information from different cadres, data collection tools included separate semi-structured interviews for Medical Officers and clinical officers, consultants and Interns coordinator respectively. This was aimed at obtaining, organizing, analyzing and interpreting textual data from the participants in order to understand the implications of EHRs use on the learning experience by the interns at Tenwek hospital.

Setting and Participants

The study population was composed of: 4 Consultants from Surgery, Medicine, Paediatrics and OB/Gyn respectively, One Interns Coordinator, 5 Medical Officers and 5 clinical Officers who completed Internship at Tenwek in the last one year. The sampling technique was purposive because the researcher needed a representative sample to address specific initiatives related to the research question and therefore the selection of cases deemed to be most informative in regard to the research question were selected (Kothari, 2004). The researcher opted for MOs and COs who have graduated from internship at Tenwek because they would be in a better position to provide a range of experience through the one-year term freely as opposed to interviewing the Interns in progress, who by then were only few months old into internship, who may not have enough exposure to the system and may not be free to share their experience due to the fear that it may affect how their seniors relate with them thereafter or even being victimized. Thirdly, interview was done with the Internship Coordinator and consultants from different departments of the hospital where interns take their clinical rotations so as to obtain information from the teacher/supervisor perspective.

4.0 RESULTS AND DISCUSSION

The aim of this study was to find out if use of EHRs fosters or hinders medical education for Interns at Tenwek Hospital. In view of answering the research question, findings from this study revealed that Use of EHR impacted the teaching and learning environment as well as the learning both positively and negatively.

Feedback from Consultants and Internship Coordinator

Consultants and Interns Coordinator were asked to give their view on how use of EHRs contributed to interns' learning and their feedback revealed that: Use of EHR impacted the teaching and learning environment both positively and negatively. They reported that the Outpatient module of the EHR system provided for prompts which heightened interns' ability to learn basic history-taking and Physical exam skills because it ensured that the trainees are systematic as they take medical history and perform physical examinations. Conversely, for others it may reduce trainees' skills especially when they omit certain parameters as evidenced by some of the interns' documentation which were incomplete.

They also indicated that it offers ability to review trainees' work at the comfort of the attending consultant without having to go to where the patients' records are or having the intern present the work physically. Although it offers this flexibility, contrariwise it denies the opportunity for immediate interrogation of

the particular intern regarding his or her work. Additionally, they reported that use of EHRs augments trainees' supervision through ability of consultant to review several records by different trainees within a short period. In so doing it saves the attending consultant's time. Another advantage to the supervision is eradication of the problem of having to deal with different interns' handwriting concerns with the pursuit of making records legible. Allows for interdisciplinary consultations and exchange of information.

With regards to research, they stated that that use of EHRs makes retrieval of information for use in teaching and research easy and efficient because data needed for a study can be obtained directly from the electronic record, making research-data collection a derivative of routine clinical record keeping. Furthermore, it can help to identify patients who are eligible for a study, and can ensure compliance to an intricate protocol whose logic depends on currently available data about that patient.

Feedback from Medical and Clinical Officers: Responses from the MOs and COs showed that use of EHRs contributed to the learning both positively and negatively.

Positive Implications: Positive implications include: Easy and efficient retrieval of information from previous records compared to the case when using paper charts. This also enriched their ability to make clinical judgement and decision making as well as helped to reduced time wasted going through cumbersome paper charts in which information may not even be accessible after all.

They also reported that use of EHRs Enhances real time documentation by the trainees which facilitated prompt interventions by the multidisciplinary teams. Moreover, it provides interns the ability to document patients' information while not being physically present thus allowing them to multi-task while reducing exhaustion from movement between departments for the purpose of going to document as in the case with paper charts. This subsequently eliminated the habits of interns taking the paper charts away from the specific departments to go and do data entry elsewhere which could result in missing charts, hence interfering with the work flow and care for the patients. They also allude to the fact that use of EHRs has become a cure for illegible patient records due to bad handwriting by trainees, faculty and other healthcare providers. This goes a long way in reducing medical errors.

Negative Implications: Medical Officers and Clinical Officers also reported some of the negative implications of using EHRs which includes: Temptation to copy-paste which reduces interaction time between the patient and the trainee and also it may lead to procrastination in documentation of patients' information by the trainee due to the deceiving notion that it can be done any other time which leads to delayed interventions for the patient. They also stressed that the short period of induction at the start of internship challenges the interns' ability to adjust quickly while keeping on track with the pressing demands of internship. Additionally, EHR System down-time periods which affects interns' ability to do real time documentation of their plan of care and interventions.

Discussion of the findings

Owing to the research findings of this study that has shown that both the trainers and trainees have a common perception that use of EHR has both positive and negative implications on medical education, it is therefore

prudent to consider the learners interest during the implementation of EHR system as well as during their induction process for new comers. This will facilitate a user-friendly system as well as enhance understanding and adherence to the documentation standards in the EHR.

Although use of EHR has positive implications on the learning environment which the participants spoke of highly, as well enhancing Real-Time documentation, there is the negative impact such as omission of certain parameters and procrastination with eventual failure to document which should urge the trainers be vigilant abot. This is in congruence with the assertion by Hammoud et al (2012); Clarke et al (2016) and Rosdahl et al (2018) who argued that limitations experienced in learners' documentation in HER could possibly have consequences on their learning.

As much as the trainers claimed strongly that use of HER gave them the flexibility to review trainees' work at their comfort without having to be present physically where the records are, as well as enhancing supervision of trainees, on the contrary; It denies them and the trainees the opportunity for prompt interrogation that would enhance their learning. This is in agreement with Peled et al (2009); Gagliardi and Turner (2016) and Gali et al (2019) who debated that use of HER would deter learning for the trainees, as this would encourage them to turn in unprocessed documentation regarding patient care processes.

Findings also revealed that use of EHR has heightened efficiency as it has reduced unnecessary movements and energy expenditure among the trainers and trainees as well as eliminating practical challenges such as missing charts as posited by Tierney et al (2013); Leapaltd (2016) and Crawford et al (2019). Even though some negative implications have been reported regarding use of on medical education, Gagliardi and Turner (2016); Tierney et al (2019) and Gali et al (2019) research shows that positive implications outweighs the negatives.

Implications for Internship Program: The findings from this study has contributed to the body of knowledge regarding the experiences of the Interns at Tenwek hospital on the use of EHRs. It has also help to identify gaps that are present in the system during orientation process and the entire internship rotations hence would guide in developing strategies to mitigate them moving forth. Findings also will guide in developing suggestions geared towards improving the learning experience for the interns at Tenwek hospital.

Implications for Administration: The findings of this study will guide Tenwek Hospital Management in making decisions and consideration as they make choices for the next Electronic Health System to be adopted. The hospital is currently considering changing the Health System product and the provider.

Implications for future Research: The findings of the study identified gaps in the implementation and use of EHRs in Teaching and referral hospital and its implication on the learning experience. It would therefore be imperative to consider carrying out research that explores subject such as implication of learning experience of other trainees off different programs who go through clinical rotations at Tenwek hospital. It would also suggest study into the implications of HER use on patient care and their outcome.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Use of EHRs impacts the internship learning both positively and negatively as implied by both the trainees and teachers, however, the factors that enhance learning outweigh those that hinder the same. Use of EHRs boost Interns' ability to apply critical thinking for clinical judgement and decision making as well as promoting efficiency in their work flow. This therefore makes EHR use a favourable system to adopt in order to enhance both learning and patient care. Although the overall view regarding how use of EHR impacts learning for internship is positive, there are challenges such as, the short three hours' induction period which was perceived to be inadequate for the interns to be well equipped to work with the EHR system; and EHR System down-time periods which affects interns' operations, therefore these require strategies for mitigation. The recommendation from this study is that there is need to consider increasing the duration of interns' EHR induction from three hours to a full day and enhance the content to include practical sessions and opportunities for return demonstration by the interns. Tenwek hospital needs to define a back-up plan for use during EHRs system down-time in order to ensure that retrieval of data and documentation continues even when the EHR system is down or experiencing technological challenges. Considering EHRs' effect of improved the healthcare system as a whole, there is need for training institutions to consider integrating it into student curriculum.

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