ORIGINAL ARTICLE

Barriers and facilitators to Electronic Medical Records usage in the Emergency Centre at Komfo Anokye Teaching Hospital, Kumasi-Ghana

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ABSTRACT

Introduction: The use of paper for record keeping (or a manual system) has been the order of the day in almost all health care facilities in resource poor countries. This system has presented numerous challenges, which the use of Electronic Medical Records (EMR) seeks to address. The objectives of the study were to identify the facilitators and barriers to EMR implementation in Komfo Anokye Teaching Hospital's (KATH) Emergency Centre (EC) and to identify lessons learned. These will help in implementation of EMR in ECs in similar settings.

Methods: This was a non-interventional, descriptive cross-sectional and purely qualitative study using a semi-structured interview guide for a study population of 24. The interviews were manually recorded and analysed thematically. EMR implementation was piloted in the EC. Some of the EC staff doubled as EMR personnel. An open source EMR was freely downloaded and customised to meet the needs of the EC. The EMR database created was a hybrid one comprising of digital bio-data of patients and scanned copies of their paper EC records.

Results: The facilitators for utilising the system included providing training to staff, the availability of some logistics, and the commitment of staff. The project barriers were funding, full-time information technology expertise, and automatic data and power backups. It was observed that with the provision of adequate human and financial resources, the challenges were overcome and the adoption of the EMR improved.

Discussion: The EMR has been a partial success. The facilitators identified in this study, namely training, provision of logistics, and staff commitment represent foundations to work from. The barriers identified could be addressed with additional funding, provision of information technology expertise, and data and power back up. It is acknowledged that lack of funding could substantially limit EMR implementation.

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African relevance

- Electronic Medical Records have the potential to improve emergency care in low- and middle-income countries.
- An upfront initial investment is required, but this may be balanced by an increase in quality, efficiency and indirect cost savings downstream.

- Hybrid Electronic Medical Records systems, although not ideal, could provide a bridge to full Electronic Medical Records where resources are limited.

Introduction

Conditions requiring emergency care are increasingly recognised as major health problems globally [1]. Record keeping is an integral part of medical care, but are often beleaguered with implementation challenges in low- and middle-income country (LMIC) hospitals, especially in the Emergency Centre (EC) setting. The National Alliance for Health Information Technology (NAHIT) defines Electronic Medical Record (EMR) 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 organisation who are involved in the individual's health and care [2]. EMR represents a potential method to improve record keeping in the EC.

The benefits of using EMR have been documented mostly in high-income countries and include improved quality of care and high levels of client satisfaction [3], faster retrieval of client records and avoidance of missing folders [4], improved documentation [5], enhancement of within-facility healthcare coordination [6], improved efficiency and convenience in care provision [7], reduction in staff time spent on specific paper-based administrative tasks, reduction in number of duplicate diagnostic tests ordered [8,9], and improvement in patient safety and health outcomes [8]. There is limited documented experience on the use of EMR in ECs in LMICs. The EMR usage in sub-Saharan Africa has been sparse, rudimentary, and limited to anti-retroviral therapy clinic documentation, or more generalised documentation in some health facilities [10–23]. For example, EMR use in anti-retroviral therapy has enhanced health care provision in Malawi by increasing the accuracy and completeness of data collection [9]. Moreover, EMR usage was documented to improve healthcare delivery and administration of public health policy in Cameroon [24]. Both Malawi and Cameroon are low-income countries by the World Bank definition. Furthermore, it is has been observed that the adoption of EMR in Ghana would likely make public health policies more efficient [10].

The EC at Komfo Anokye Teaching Hospital (KATH) started to implement EMR in 2014 with mixed results. This study sought to evaluate the facilitators and barriers to implementing EMR in our EC. It is expected that the lessons learned would help in the implementation of EMR not only in other ECs in Ghana, but elsewhere in other LMICs.

Methods

Ghana is a LMIC in the western part of sub-Saharan Africa with a population of 27.41 million in 2015 [25] and a gross domestic product of 37.54 billion USD in 2015 [26]. There are 210 districts within the 10 administrative regions of Ghana providing health care services at diverse levels, notably primary health care. Comprehensive emergency care services are provided at tertiary hospitals. KATH is the second largest tertiary hospital in Ghana and is located in Kumasi, the Ashanti regional capital with a total population of 2,035,064 [27]. KATH receives referrals from the following Regions: Ashanti, Brong Ahafo, Central, Western, Eastern, and parts of Volta Region of Ghana. It has a 1000 bed capacity with clinical and non-clinical directorates.

The study was conducted in the EC of KATH, Kumasi where a hybrid EMR (a system using both paper and computer data processing) was piloted. The EC has a 106 bed capacity – the largest in the West African sub-region – with modern state-of-the-art facilities. It was commissioned in April 2008 but only became operational in May 2008. The EC has several units, including triage, clinical decision, radiology, pharmacy, and laboratory.

The components of an ideal EMR system should include: clinical data repository, controlled medical vocabulary, clinical workflow, decision support and clinical knowledge management, document and data capture, physician order entry and management, and display dash. The system should be compatible with the institution's health care delivery system where data are secured [11,27,28]. The EC's preliminary steps towards creating an EMR system included scanning paper medical records and electronic data capture of patients' bio-data. At the time of this evaluation, the EMR was a hybrid system in which patients' digital bio-data (e.g. demographics and encounters) were recorded, supplemented with scans of

their paper EC medical record. The EC implemented the customisable OpenEMR 4.1.0, freeware (Boston, USA). With regards to hardware the EC had access to ten computers, two scanners and one printer (with a RAM of 512 MB–4 GB, hard disc capacities of 40 GB–3 TB, and processor speed of 1 GHz–16 GHz). The operating system was either Linux Ubuntu, or Windows connected through a LAN/WLAN network. Each end-user had a user name and password with appropriate privileges to access the system.

The study employed a descriptive, cross-sectional design using a semi-structured interview guide. The data were collected in English, which was well understood by all interviewees. Each interview was manually recorded and did not exceed 45 min. The types of data collected included description of the EMR programme, perceived facilitators and barriers to EMR use, and suggestions to overcome those barriers for successful implementation of the programme. A total of four core implementers and twenty end-users of the EMR were interviewed. The core implementers were the key people who initiated the EMR project at the EC, whereas the end users were the staff who utilised the system on a daily basis. Thus, the head of department, two emergency physicians and one computer software programmer or developer formed the core implementers. Four national service personnel, five medical records staff, and 11 triage nurses constituted the end-users. All four core implementers were purposely chosen and interviewed. The twenty end-users were interviewed until thematic saturation was reached [29,30]. Saturation was reached based on the cumulative interviews. The interviewees were contacted through phone calls and scheduled interviews at their convenience for a face-to-face interaction at the EC.

Pre-testing of the study was conducted at the Dental Unit of Korle-Bu Teaching Hospital, Accra, Ghana where two core implementers and five end users of EMR were interviewed. The raw data was transcribed and then forwarded to participants for their feedback. The data were analysed using thematic analysis [31] facilitated manually without using any software. Initial codes (codes that were first given to the various data obtained from the fair notes at the onset of the manual data analysis) were applied to the transcripts, refined and subsequently sorted into potential themes (initial themes that were obtained from the grouped fair notes). These were then grouped into broad categorical headings (major themes obtained from the potential themes), which both map onto the questions asked. These include: logistics capacity building and trainings, human resource, motivation, financial resource, data entry errors, and security. The term "facilitator" refers to activities or initiatives undertaken by institutions or the government to promote implementation and usage of EMR [32]. The term "barrier" refers to perceived personal or organisational constraints mitigating the effective and efficient use of EMR [32]. These are discussed as existing and perceived. The corresponding quotes are found in Tables 1–4.

The Committee on Human Research Publication and Ethics, Kwame Nkrumah University of Science and Technology and KATH, gave approval for the study. The interviews were conducted on individual basis to uphold confidentiality and anonymity of interviewees. All participants voluntarily participated in the study and gave their verbal consent.

Results

The results are discussed under the headings below.

Existing facilitators

The themes identified were logistics, capacity building and training, human resource, and motivation (Table 1). There were

Table 1
Facilitators of EMR use at Komfo Anokye Teaching Hospital Emergency Centre.

Themes	Quotes
Existing facilitators	
Logistics	"There are readily available items to use, like palm top, laptop, printer and storage devices. Moreover, there is a scanner, which also helps in keeping records. Currently, the department has new version of Computers" (interviewee 15)
Capacity building and trainings	"We were given an orientation on how to carry out everything. The basic IT knowledge I had from school coupled with what I had gained from colleagues improved my utility of the system. With the skills acquired in IT it made it quite easy to use the system. The system was good" (interviewee 6)
Human resource	"Management ensured that the system was working and there is involvement of department management. The supervision from the leaders has really helped us to get along successfully" (interviewee 1)
Motivation	"It is self-motivating because it is so disheartening to see the patient that you care for lose all his medical records. Therefore the EC's EMR will promote emergency medicine care. Staff present realise that there were some benefits. Example, an elderly man who is a known diabetic and hypertensive came in and his fat folder was lost but we were able to print out for him the entire folder from the scanned files. This got the records office much involved" (interviewee 21)
	"Computers will keep information about patients and make it easier for relatives to locate their patients" (interviewee 7)
Perceived future facilitators	
Logistics	"We will require a system that works very fast. In the future we will need a waiting area for incoming patients. The triage area is a busy place, we only take few patients at a time. A bigger office space could be provided in the future to help run the EMR system. This place is small. Sometimes some of us can't even get places to sit to work" (interviewee 3)
	"Back up could be provided to help support the EMR system. If there is automatic data backup, it is good. In the future they should have a standard uninterrupted power supply that can last long that will facilitate saving of data during power fluctuation" (interviewee 14)
Training	"Remedial or continuous training sessions so people are reminded of all data fields we want to capture, repeat training episodes" (interviewee 24)
Human resource	"Assign people to do entry because if you are attending to patient and at the same time you are doing entry some of the information will slip off. Those who do the entries if they backup the system it will help" (interviewee 1)
Motivation	"I think some form of motivation, whatever the form will help. Be it word of mouth, any other thing" (interviewee 10)
	"We want we should be able to see what you were seen in Wa [500 km from Kumasi] for. The motivation is to finish developing Komfo Anokye Teaching Hospital's one and then spread it out to all hospitals. Data is secured and you can access in other hospitals. That is 'one folder per Ghanaian'. This will all prevent adverse reaction to Medication" (interviewee 23)

Table 2
Barriers to EMR usage at Komfo Anokye Teaching Hospital Emergency Centre.

Themes	Quotes
Existing barriers	
Financial resources	"Our main challenge is funds and technicians. We have to hire programmers to customise various aspects of the open EMR. This is expensive. In the past, some programmers presented themselves as capable but after 3–4 months they are unable to deliver. It has been constraining finding a programmer to customise the open EMR. Initially logistics to really do EMR, resources were not enough – lack of adequate computers and scanners and external drive, lack of external drive to do backup" (interviewee 24)
Data entry errors	"Sometimes one person having different registration numbers. Data entries challenges - data entered incorrectly or incompletely. For instance, entry of date of birth and unknown details as brought in by some 'good Samaritans'" (interviewee 22)
Constraints of logistics	"The existing software application is not reliable in terms of data keeping, because we sometimes lose some important information. System has no backup" (interviewee 18)
Human resource constraints	"It's a tedious job, pulling out and putting back folder together before and after scanning data. It gives extra work" (interviewee 3)
	"Staff attitude, since it's a change process, naturally that people get stuck to old ways, especially records staff and clinical staff" (interviewee 21)
	"Before open EMR we used to use a book. It is easy to fill so they easily fill. So some of the data fields are not fields on the EMR. Some of the data of public health importance and policy health are not filled depending on those on duty" (interviewee 24)
Perceived barriers	
Data security	"Privacy and confidentiality issues need to be considered because if you are going to do entries you can see everything online" (interviewee 1)
	"Legislature, now we are small so nobody cares. So if we start to network all of Kumasi that is when the law will require that we go to Parliament to seek for approval" (interviewee 23)
Logistical constraints	"If everything is connected to the electronic and at the mercy of electricity, huge data loss if the system crashes: it becomes a life and death issue for patients" (interviewee 12)

Table 3
Suggestions to implement facilitators.

Themes	Quotes
Human resources	"Employ and pay information communication technology personnel well for their services, we need a lot of skills and highly trained staff. These will contribute greatly" ((interviewee 20)
	"They have leaders in this hospital so they have to meet and decide on how to solve this problem" (interviewee 9)
	"Attitudinal change of all staff is required in order to get the system to work" (interviewee 23)
	"Monitoring from management, this is good because it helps you to know that what you're doing is important" (interviewee 10)
Financial resources	"Funds should be generated internally to purchase the additional scanner needed. In terms of training, in terms of and development programmes the superiors can solicit for funds from external sources such as private business institutions, donor countries to support the EMR system" (interviewee 18)
	"Funds could be set aside by the hospital especially to buy computer and scanners to run the EMR system" (interviewee 17)

readily available logistics including computers, scanners, a server and printer for commencing the EMR implementation. The involvement and moral support from the EC management and core implementers was pivotal in getting end users to willingly utilise the system. Moreover, there was capacity building and training on EMR for all users before implementation, although some participants had previous technologic knowledge. This enhanced the ease of using the system. All end users were intrinsically motivated to see to the full implementation of the EMR system, where there will be data persistency and quick access to patients' data. Furthermore, the EMR system supported family members to easily locate the whereabouts of their relatives on admission.

Table 4
Suggestions to overcome barriers.

Themes	Quotes
Provision of adequate logistics	"Printers should be in the screening room so that as soon as you print you get it, management should purchase additional scanner to make work faster. More options should be considered in terms of software application development to catch up with the fast changing world. A bigger office space should be provided by the hospital. So we need to get power back up. The data should be backup all the time as often as possibly, preferably, automatic. There should be constant backup to save the system from crashing" (interviewee 22)
	"They should put in re-encounter feature to avoid duplication, possible duplication of entries" (interviewee 2)
	"Instead of typing, they can try a speech-to-text engine so that instead of them typing, they will talk into microphone or mobile device to do typing. Also instead of typing into text boxes; we can check boxes, radio boxes and combo boxes-selection boxes" (interviewee 20)
Motivation	"Motivate or provide adequate motivation when and where need be" (interviewee 19)
	"There should be training, sensitisation and creating awareness among health workers-new workers and existing workers to avoid future redundancy. This should be continued for staff to be abreast with new development in IT field" (interviewee 11)
	"Very open door policies so opinion leaders, say hospital administration, chief executive officer, Ghana Health Service, Ministry of Health, office of the president; so everybody to understand" (interviewee 23)

Perceived future facilitators

The themes identified were human resource, training, motivation, and logistics (Table 1). There was a need to employ skilled Information Technology (IT) personnel to work around the clock, do data entry, and handle all emerging IT problems or emergencies promptly. Also, regular in-service training was recommended for old and new staff. Additionally, the EMR end users required motivation in various forms, including individualised rewards and full benefits of the EMR. Moreover, the provision of a faster network, waiting area, and spacious office for the research team will facilitate the EMR usage. Furthermore, the acquisition of automatic data back up and standard uninterrupted power supply were paramount to the success of the programme.

Existing barriers

The themes identified were financial resources, data entry errors, constraints of logistics, and human resources (Table 2). The programme was constrained fundamentally in funding for hiring IT personnel and acquiring adequate logistics. There were data entry errors such as incorrect date of birth and multiple registrations. The system's lack of automatic data and power backups resulted in occasional data loss, which was costly to the EMR system. Finally, the staff complained of increasing workload and responded gradually to the change process.

Perceived future barriers

Data security and logistical constraints were the themes observed (Table 2). The system's data security was threatened by its inadequate security features and the absence of a legal backing. Also, the occasional power fluctuations in the EC could cause data loss.

Suggestions to implement facilitators

The themes considered were human and financial resources (Table 3). There was a reported need to permanently employ IT personnel to manage the system, and EC staff were admonished to exhibit continuous positive attitude towards usage of the EMR. The regular monitoring from the core implementers was commended, but support from KATH leadership was required to upgrade the system. Again, alternative means of funding were cited for the project. Lastly, adequate logistics should be provided to run the EMR.

Suggestions to overcome barriers

The themes identified were provision of adequate logistics and motivation (Table 4). The EMR project required the provision of adequate logistics, such as computers and accessories, spacious offices, reliable internet, power and data backups, and facilities for dealing with multiple registrations. Alternative provisions for data capture were suggested. Furthermore, avenues for reward to staff were to be considered. These could include regular staff trainings on EMR. Finally, a national policy on EMR should be established to aid EMR implementation.

Discussion

Our goal was to evaluate the facilitators and barriers of EMR implementation in a LMIC EC and derive lessons relevant to ECs in similar settings hoping to implement EMR. The facilitators for utilising the system included training provided to the staff, availability of some logistics, and the staff's desire to improve emergency medicine practice through data persistency. The EMR project had barriers of funding, full time IT expertise, and automatic data and power backups. It was observed that with the provision of adequate human and financial resources, the challenges would likely be overcome and the adoption of the EMR will improve.

As has been reported elsewhere in the literature, the staff's initial exposure to the EMR during the orientation, coupled with their previous IT knowledge facilitated the use of EMR [33–35]. Although an EMR is fairly low in cost, some investment in funds is usually needed to get it established and to keep it running. For example, Zandiel [36] showed that healthcare institutions with successful EMR implementation had made adequate financial investment prior to EMR adoption as well as maintenance funds [5,37,38]. In some countries, such as the USA and Australia, funds have even been allotted for national level EMR adoption [3,39].

The small office at this EC limited the number of staff and material resources utilised for the EMR implementation. This agrees with a recent report [36] that the space needed for computers can impede EMR use. In addition to financial and material support, the active involvement and encouragement by facility heads and management have been found to facilitate EMR adoption, as shown by Kamadjeu et al. [24].

The respondents called for support from various agencies, such as the core management of KATH, businesses, and donor countries to assist the EC in implementing the EMR. This supports the suggestion that developed countries should provide assistance to developing countries in adopting EMR [40].

Before drawing conclusions from these data, the limitations of the study should be addressed. First, there was no EMR evaluation tool in place at the EC. The evaluation tool is a formal document prepared by the project implementers with details for assessing the EMR project and possible recommendations for improvement. Second, there were no baseline data on the EMR for assessment

and referencing. Hence, the study needed to rely on the opinions of staff members rather than objective quantitative data. Third, the use of audio recordings might have increased the level of detail of information recorded. However, it was felt that audio recordings would not be well received in the local context. Moreover, as the topic of the interviews was technical (rather than more nuanced health behaviour issues and attitudes) and as the interviewees were all educated and able to communicate in depth on this topic, it was felt that written recording of the data was more than sufficient to meet the goals of the project.

Despite the above limitations, the data from the current study allowed us to conclude that the EMR has been a partial success, as the EC was able to implement the EMR, including recording a specified minimum amount of data on all patients. The facilitators identified in this study represent the foundations to build on in ours and other similar, resource constrained institutions. A major facilitator was that staff saw the benefits of the EMR for patient care and were highly motivated to implement it, similar to reports in Australia [35]. In this study, sustained training on EMR was a facilitator at KATH, though this was contrary to findings in California where feedback on EMR training and excessive alerts and reminder were mentioned as barriers [44]. A major barrier identified in this study was a lack of funding, which agreed with observations in Iran, [38] although it contradicts reports from Australia and United States of America [39,45]. However, this may be addressed, at least in part, by provision of access to reliable information technology expertise and data power back up. Additionally, suggestions were made for the establishment of a national EMR policy. This buttresses previous reports for the existence of defined EMR policy strategies that focus on financial support, training of technical support staff, interoperability, adaptability, and flexibility of EMR usage [41–43]. Such policies required regular reviews in order to promote inter-practice data exchange and multi-provider decision support within healthcare settings [6].

Conflicts of interest

Dissemination of results

The study findings were shared with staff members of KATH and its administration prior to submitting this manuscript for publication.

Authors' contribution

AG, PD and CNM conceived the original idea. AG, KAM, GO, PD and CNM designed the study. AG and GO collected data. AG and KAM analysed and interpreted the data. AG and CNM prepared the first manuscript draft. All authors contributed significantly and critically to the final manuscript.

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