Factors Influencing the Utilization of Electronic Medical Records in the Eastern Region of Ghana

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Original Article/Research

Factors associated with the utilization of electronic medical records in the Eastern Region of Ghana

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ABSTRACT

Objectives: This study examined the factors associated with the use of Electronic Medical Records (EMR) in public hospitals in the Eastern Region of Ghana.

Methods: Three hundred and ninety-six (396) healthcare professionals were surveyed from the various public hospitals in the Eastern Region of Ghana. The participants included physicians, physician assistants, nurses, laboratory technicians, radiologists, pharmacists, record managers, and ICT staff. Frequency and Chi-Square analyses were performed on the data.

Results: The results showed that approximately 59% (n=212) of health professionals indicated low use of EMR services in their hospitals. Lack of computer competence ($p<0.001$), poor communication between users ($p=0.050$), cost of EMR resources and facilities ($p<0.001$), lack of technical personnel to install and operate EMR technology resources ($p<0.001$), and lack of EMR software packages ($p<0.001$) had significant negative relationships with EMR utilization.

Conclusion: Utilization of EMR services is low among the healthcare professionals in the Eastern Region. Therefore, the Ghana Health Service needs to provide training to their employees and supply the needed resources to encourage and support the hospitals and healthcare workers to increase the utilization of the EMR services that improve healthcare delivery in the Region. To enhance EMR utilization, it will be essential that government supports health facilities who have challenges using EMR. To better understand the issues, a mixed method approach is recommended to be used to study healthcare workers from both private and public healthcare facilities in the Eastern Region of Ghana.

Introduction

Technological advancement is increasing exponentially, affecting every facet of human existence, with public health and healthcare delivery a great beneficiary. Thus, health information becomes one critical factor helping to strengthen and improve healthcare delivery in every country [1]. Traditionally, patients' health information is saved and managed on papers and files. However, due to the advancement in Information Communication Technology (ICT), there has been a seismic shift from the traditional paper and file system to the adoption of the computer and other electronic devices to managing patients' health information known as e-health [2]. This move has improved the general reliability and effectiveness of health information and further strengthened healthcare delivery systems through its various tailor-made innovative applications and programmes such as Electronic Medical Records (EMR) [3].

Tang and McDonald [4] considered EMR generically to mean a repository of electronically maintained information about an individual's health status and healthcare. Meanwhile, McMullen et al. [5] explained that EMR is a single practice digital version of a patient's chart. Thus, EMR contains patients' medical history, diagnoses, charts and treatments which are designed to be shared with other healthcare providers like physicians and pharmacists, either within the same health facility or across other health facilities for the management of patients' health and wellbeing. The advent of the EMR has therefore speedily facilitated healthcare services to patients, reduced waiting time, and addressed structural problems within the health service systems [6]. However, owing to uncertainty about what exactly constitutes a computer-based medical

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records, many scholars [4,7], firms [8] and institutions [5] have several definitions for EMR.

The relevance of EMR in health delivery globally has not been new, but its uptake and promotion especially in developing nations including Ghana has been problematic because the capacities of developing nation's health system fall short of demand [9–11]. Studies further provide challenges such as poor technological and funding support [12–14], poor management capacity at all levels, insufficient training of personnel, insufficient leadership, and organizational issues [10,11,15] as complex milieus affecting the adoption and implementation of the programme.

The formal adoption of EMR system in Ghana by the Ministry of Health in 2014 placed Ghana as one of the few African countries to have adopted the technology in the public health sector [16]. "Notwithstanding the tremendous growth in the adoption and implementation of the EMR system, most of these projects have been recorded to have survived partially or fully at the pilot phase but have been repealed at the full implementation phase" [17, p. iii]. Some studies have been conducted on the benefits of EMR in the Western Region [18] and the adoption and use of EMR in the Ashanti Region [19]. Findings from the Western Region indicated that the hospital had sufficient preparations such as an establishment of Information Technology (IT) department, provision of infrastructure and network connections, and the training of staff. However, these authors highlighted some inadequacies, including inadequate computers, inadequate training and the non-involvement of users in the design and configuration of the system, with poor network connections, illegible handwriting of some doctors, unstable power supply and increased work task as other challenges [17]. Similarly, a pilot study from Ashanti Region revealed insufficient funding, inadequate computers and accessories, lack of full time IT experts, automatic data and power backups, data entry and limited office space [18]. However, the authors from Western and Ashanti Regions predominantly studied institutional factors rather than personal factors. The studies were also qualitative, and hospital-based rather than regional-based, which limit their scopes and the ability to generalize their results and findings. Besides, Komfo-Anokye Teaching Hospital in Kumasi, Ashanti Region, and Effia-Nkwanta Regional Hospital in the Western Region are all teaching hospitals with specialized professionals, unlike other hospitals in the country. Again, while Gyamfi and Mock [19] concentrated on barriers and facilitators of EMR usage at the emergency centers, Acquah-Swanzy [18] studied only physicians and nurses, narrowing the scope of variables, categories of professionals, and healthcare facilities.

The adoption and utilization of EMR services for healthcare delivery in Ghana was supposed to be implemented across the country after the few pilots, which indicated its viability and usefulness to service outputs and patients' satisfaction and health outcomes [17,20]. However, available literature shows that no study has been conducted on the factors influencing utilization of EMR in the Eastern Region of Ghana. Moreover, the Eastern Region has one regional and many district hospitals, where the adoption and use of the ICT services including EMR will yield higher quality service delivery and utilization, and better patients' health outcomes [18,21]. In addition, the region is considered poor, has several rural areas, and provides healthcare services to a high number of patients [18], and that adoption and utilization of modern technological services like EMR would have yielded to better provisions of healthcare services to the vast majority of their clients. Also, all categories of healthcare professionals (i.e. physicians, physician assistants, nurses, midwives, pharmacists, dispensers, laboratory, x-ray technicians, accountants and record clerks) are collectively important to the successful healthcare delivery chain. For that matter, the adoption and utilization of EMR by this array of professionals becomes topical in contemporary healthcare delivery. Therefore, the purpose of the current study is to investigate the factors associated with the utilization of EMR in public hospitals in the Eastern Region of Ghana. Based on this purpose, the study was backed by three objectives that sought to assess the level of utilization of EMR in public hospitals in the Eastern Region, examine the relationship between personal factors and EMR utilization by health professionals in the Eastern Region, and determine the relationship between institutional factors and EMR utilization by health professionals in the Eastern Region.

Materials and methods

Participants' selection criteria

Eastern Region has one regional hospital and 18 district hospitals. There are several other clinics and health centres situated in the various rural and urban communities to serve the health needs of the people. In this study, eleven health facilities made up of a regional hospital, five district hospitals, two polyclinics, and three clinics were considered. Using a cross-sectional design, we employed stratified and simple random sampling procedures to obtain 360 study participants using a formula $s = X^2\ NP\ (1\text{-}P) \div d^2\ (N\text{-}1) + X^2\ P(1\text{-}P)$, where s is the required sample size, X^2 is the table value of chi-square for 1 degree of freedom at the desired confidence level (0.05 = 3.841), N the population size [22], P the population proportion (assumed to be 0.50) and d is the degree of accuracy expressed as proportion (0.05). Ten percent was added to cater for non-responses, making the sample size 396. First, the health professionals were put into eight strata (i.e., physicians, physician assistants, nurses, laboratory technicians, radiologists, pharmacists, record managers and ICT staff). Each strata was made up of equal proportions of health professionals based on the population. This was done to ensure that each category of critical healthcare workers was representative [23]. Although each of these categories of health professionals had different numbers, the strata was done in such a way that each group was selected appropriately. Second, the lottery approach simple random sampling was used to select participants from each of the groups, giving an equal chance to each member of a specific group to be selected for the study [23].

A questionnaire was administered by the researchers after permission was granted by the hospital authorities from 22nd September 2017 to 16th March 2018. Hospital administrators and unit heads were contacted and dates and times were arranged for the data collection. To eschew contextual influence, an introductory session was arranged to brief participants on the purpose of the study and the standard instructions needed for a completion of the questionnaire. Participants provided written informed consent, by signing the form, after the participants were assured of anonymity and confidentiality at all stages of the data collection process. The copies of questionnaire were delivered to the participants by hand and they were given three days to complete and return them for collection by the researchers. Three hundred and ninty-six (396) copies were administered and 91% return rate was achieved. This represented 360 questionnaires and that formed the sample size used for the analysis.

Instrumentation

We developed a questionnaire based on literature, and further segmented the questionnaire into sections A, B, C and D, which measured demographic characteristics, utilization of EMR, personal factors and institutional factors that influence EMR respectively. Section 'A' solicited demographic characteristics (i.e., gender, level of formal education, age, position in the facility and number of

years at the facility). Section 'B' comprised 15 items, which obtained data on the utilization of EMR at the health facility, inquired on the extent to which electronic system was used to do the following (e.g., record vital signs, record diagnosis, record and maintain medication allergy lists). Section 'C' subscale measured personal factors influencing the utilization of EMR. Some of the items in this section were "lack of general computer competence", "poor communication between users" and "the fear of using technology". Section 'D' items were on institutional factors influencing EMR utilization and few of such factors were "Lack of adequate infrastructure," "Maintenance costs of EMR technology facilities" and "Lack of software packages of EMR." Participants responded to the items in sections C and D on a four-point scale ranging between strongly disagree (4) and strongly agree (1).

To ensure reliability of the instrument, the questionnaire was pre-tested using health professionals at Cape Coast. This is because Cape Coast has a regional hospital, a district hospital, polyclinic, and clinics, and that the category of healthcare professionals available at these facilities are likely to be the same throughout the country. The internal consistency measure for the binary variable subscales of the instrument was calculated using Kuder–Richardson Formula 20 (*KR-20*) and Cronbach's Alpha was used to assess the reliability of the continuous (four-point Likert scale) items. The questionnaire yielded reliability coefficients of 0.68 and 0.71 for the binary and continuous variables respectively. Moreover, the initial questionnaire was given to three Master of Health Education candidates at the Department of Health, Physical Education and Recreation (HPER), University of Cape Coast (UCC), two nurses from the Central Regional Hospital in Cape Coast, and later a health information manager at the UCC Hospital for their evaluation and inputs, which we incorporated into the final instrument for data collection. In addition, ethics approval was obtained from the Institutional Review Board (IRB) at University of Cape Coast, Ghana (UCCIRB/CES/2017/05).

Data analysis

Data were analyzed in different stages using SPSS version 21. Regarding EMR utilization, responses were categorized into 'high' for respondents who chose 'yes' for at least 8 items out of the 15 items and 'low' for respondents who chose 'yes' for 7 items or less out of the 15 items. These scores were transformed into frequency and percentages. On the relationship between personal factors and EMR utilization as well as institutional factors and EMR utilization, significant differences were assessed with a univariate analysis using Chi-square test with continuity correction at an alpha level of 0.05.

Results

We examined factors associated with the use of EMR in public hospitals in the Eastern Region of Ghana. The results are presented by looking at first, the level of utilization of EMR among the healthcare workers; second, relationship between personal factors of the workers and EMR utilization, and third, relationship between institutional factors and EMR utilization among the healthcare workers.

Characteristics of the research participants

The participants included 26.6% (n=95) nurses/midwives, 19.7% (n=71) physician assistants, 14.8% (n=53) pharmacists/dispensing technicians, 9.9% (n=35) physicians, 9.3% (n=33) laboratory technicians, 8.6% (n=31) record managers, 6.8% (n=24) radiologists, and 5.2% (n=18) ICT staff. With the age range of 21-59, and working experience between one and 38 years, 62.8% (n=226) of the participants were married, 29.2% (n=105) single, 5.3% (n=19) divorced, while 2.7% (n=10) were identified as either widows or widowers. Majority of the participants, 46.8% (n=168), completed the bachelor's degree, 22.7% (n=82) diploma, 20.5% (n=74) certificate, 9.4% (34) master degree, and only 0.6 (n=2) were doctorate degree holders.

Table 1
Utilization of EMR by health professionals in the public hospitals.

Level of utilization	Frequency	Percentage
High	148	41.1
Low	212	58.9

Utilization of EMR by health professionals in the public hospitals

Frequency count and percentage analysis were used to find out the level of EMR utilization among health professionals in the Easter Region of Ghana. The findings revealed low utilization of EMR among the health professionals, as results in Table 1 show that about 59% (n=212) of health professionals indicated low use of EMR services in their hospitals.

Relationship between personal factors and EMR utilization

Table 2 contains Chi-Square analysis on the relationship between personal factors and EMR utilization among healthcare professionals. The results showed that lack of computer competence (χ^2=45.643, p<0.001), lack of knowledge about EMR (χ^2=70.765, p<0.001), lack of use of EMR technology (χ^2=255.993, p<0.001), workload (χ^2=26.747, p<0.001), and poor communication between users (χ^2=3.855, p=0.050) had statistically significant negative relationships with EMR utilization, and that as these factors exist, the rate of EMR utilization among these healthcare workers will continue to be low.

Relationship between institutional factors and EMR utilization

Table 3 contains results on the relationship between institutional factors and EMR utilization among the healthcare professionals. The results showed that lack of general infrastructure (χ^2=151.167, p<0.001), cost of EMR resources and facilities (χ^2=33.906, p<0.001), lack of technical personnel to install and operate EMR technology resources (χ^2=65.806, p<0.001), maintenance cost of EMR technology facilities (χ^2=52.093, p<0.001), inadequate internet bandwidth (χ^2=85.528, p<0.001), legal concepts (security and privacy) (χ^2=97.014, p<0.001) and lack of EMR software packages (χ^2=171.218, p<0.001) had statistically significant negative relationship with EMR utilization among the healthcare professionals.

Discussion

The main focus of this study was to examine the factors associated with the utilization of EMR in the public hospitals in the Eastern Region of Ghana. Our findings showed that utilization of EMR services was particularly low compared with the United Kingdom (96%) and the Netherlands (99%) [24,25]. The reason for the low level of EMR utilization in this study and many developing nations is linked to implementation costs, administrative and technical problems, privacy problems and problems regarding empathy and inflexibility [26,27]. The findings of the current study confirm the findings of other studies [28,29] who also found low level of utilization of EMRs. Contrary to the current study, two studies [30,31] found high EMR utilization among health professionals. The

Table 2
Relationship between personal factors and EMR Utilization.

Factors	Level of Utilization		χ^2	*P*-value
	High	Low		
Lack of general computer competence			45.64	<0.001
Disagree	51.3% (138)	48.7% (131)		
Agree	11.0% (10)	89.0% (81)		
Lack of knowledge of EMR			70.765	<0.001
Disagree	57% (134)	43% (101)		
Agree	11.2% (14)	88.8% (111)		
Lack of use of EMR technology			255.993	<0.001
Disagree	87.5% (140)	12.5% (20)		
Agree	4% (8)	96% (192)		
Fear of using technology			2.582	.108
Disagree	42.8% (133)	57.2% (178)		
Agree	30.6% (15)	69.4% (34)		
Too much workload			26.747	<0.001
Disagree	51.3% (117)	48.7% (111)		
Agree	23.5% (31)	76.5% (101)		
Poor communication between users			3.855	.050
Disagree	45.5% (96)	54.5% (115)		
Agree	35.1% (52)	64.9% (96)		

Table 3
Relationship between institutional factors and EMR utilization.

Factors	Level of Utilization		χ^2	*P*-value
	High	Low		
Lack of general infrastructure			151.167	<0.001
Disagree	89.8% (97)	10.2% (11)		
Agree	20.2% (51)	79.8% (201)		
Cost of EMR resources and facilities			33.906	<0.001
Disagree	69.1% (56)	30.9% (25)		
Agree	33% (92)	67% (187)		
Lack of technical personnel to install and operate EMR technology resources			65.806	<0.001
Disagree	58% (127)	42% (92)		
Agree	149% (21)	85.1% (120)		
Maintenance cost of EMR technology			52.093	<0.001
Disagree	78.9% (56)	21.1% (15)		
Agree	31.8% (92)	68.2% (197)		
Inadequate internet bandwidth			85.528	<0.001
Disagree	73.2% (93)	26.8% (34)		
Agree	23.8% (55)	76.2% (176)		
Legal concepts (security and privacy)			97.014	<0.001
Disagree	71.7% (107)	28.7% (43)		
Agree	19.5% (41)	80% (169)		
Lack of EMR software packages			171.218	<0.001
Disagree	76% (133)	24% (42)		
Agree	8.1% (15)	91.9% (170)		

dissimilarities in the findings can be ascribed to the different sampling, setting and population characteristics. By inference, quality healthcare service delivery in the health facilities may be poor as waiting time, ineffective data on patients, and other purposes that EMR seeks to cater for will not be in place. The non-use of EMR to record diagnosis automatically tracks prescription of medications with an electronic medication administration record (eMAR) which may compromise effective healthcare delivery to patients [17,25].

We also found personal factors (i.e., lack of general computer competence, lack of knowledge about EMR, lack of use of EMR technology, the fear of using technology, too much workload and poor communication between users) to be significantly associated with EMR utilization by the health professionals. This finding reaffirms the results from other developing nations [32,33] and Saudi Arabia [27] where personal factors are associated with EMR uptake. The reason may be that most of these factors were likely to be predominant individual capacity factors which are also sometimes associated with the use of new technologies. The decision of an individual to move from one way of doing something to another is sometimes problematic, probably because of lack of general competence, knowledge about that technology, inadequacy in the technology usage, the fear of using technology, too much workload and communication between users [18,20]. This is further alluded to by other studies that found personal factors as barriers to the use of technology in healthcare delivery [14,34]. For instance, evidence suggests that, among hospitals without electronic records systems, the most commonly cited personal barriers were resistance on the part of physicians, unclear return on investment, and lack of availability of staff with adequate expertise in information technology [35]. By inference, we contend that other methodological disparities accounted for the difference in the study findings.

We further found that institutional factors including lack of general IT infrastructure, cost of EMR resources and facilities, and maintenance, lack of technical personnel, lack of reliable EMR software and inadequate internet bandwidth, and security challenges with privacy of patients' data were significantly associated with EMR utilization. The current study confirms the findings obtained by Sood et al. and Odekunle et al. [14,36] on institutional factors and EMR utilization. Respondents' own institutional memory and experience show that most of the health facilities in the East-

ern Region have inadequate infrastructure that support the use of EMR. This is a manifestation of inadequate infrastructure, cost of EMR resources and facilities, lack of technical personnel to install and operate EMR, maintenance costs of EMR technological facilities, inadequate internet bandwidth, legal concept such as security and privacy concerns, and lack of EMR software packages. This is not too surprising because recent reviews [37] revealed that many sub-Saharan Africa nations and their healthcare systems lag behind due to high costs of procurement and maintenance of the health technology infrastructures, lack of financial incentives and priorities, poor electricity supply and internet connectivity, and primary user's limited computer skills. However, with appropriate implementation plan, financial supports, good system selection of health technology, training of the end users, and the adoption of the phased implementation process will facilitate the use of EMR.

Practical implications

EMR is currently available in many countries; nonetheless, there are still many barriers to its successful implementation over the years, especially, in healthcare systems within low resource nations. There is a further disproportionate adoption and utilization of EMR infrastructures against the poorest regions or areas even within the low-income nations. The findings from this study suggest that health professionals in the Eastern Region will most likely not use EMR even in future when these personal factors continue to exist among them. When this occurs, the ease of access to healthcare services by patients becomes problematic. For example, it results in delay in healthcare access, misdiagnosis and misclassification, loss of patients' vital information, reduced system coordination that can lead to poor service delivery. Furthermore, it limits patients' access to their health information which affords and empowers them to make informed health decisions. Thus, the health problems that can be managed appropriately will still persist in public hospitals in the Eastern Region of Ghana when the personal and institutional factors continue to hinder the use of EMR.

Limitations

Though the study provides useful information about EMR utilization in a resource limited area, it also has a few limitations. The participants for the study were stakeholders of the healthcare delivery systems; thus, it became very difficult getting them to respond to the questionnaire due to the busy nature of their work schedule. This may have resulted in the provision of inaccurate responses to some of the questions. With regard to measurement, the use of questionnaire as a data collection instrument was not enough to provide detailed information for the study. Therefore, questionnaire lacks the power to detect all misunderstandings despite the presence of a team of officials. Finally, this study could not employ parametric tests like binary logistic regression in analyzing the data since the data was not normally distributed. Hence, chi-square test which is a non-parametric test and is considered appropriate when data is not normally distributed was employed. The use of the chi-square test made it impossible to examine the degree/magnitude of the relationship/association between the variables. However, the authors were able to assess the direction of the relationship/association (negative or positive) and could ascertain practical relevance from the findings, upon which conclusions and recommendations were made.

Conclusion

Despite the positive effects of using EMR, there are still personal and institutional barriers hampering the smooth implementation of its services to improve healthcare delivery in the Eastern Region of Ghana. Addressing the barriers to EMR utilization calls for concerted efforts from multidisciplinary health professionals and government. Widespread utilization of EMRs may essentially impact and improve the quality of healthcare delivery in the Eastern Region of Ghana, while yielding significant income. However, the cost of EMR may also hinder its utilization in the region. To enhance EMR utilization, it will be essential that government supports health facilities who have challenges using EMR due to financial challenges, while limiting political influence in their activities. A range of policy options can be used to facilitate the development and improvement of EMRs services in the Region of Ghana. Healthcare administrators in the Eastern Region need to begin preparing their staff for the inevitable technology upgrades that will take place in their practices. The training of health professionals across all divide needs to include health technology. In addition, the systemic challenges need to be addressed to pave ways for the healthcare system in the Region to take advantage of the current technological revolution. To better understand the issues, a mixed method approach is recommended to be used to study healthcare workers from both private and public healthcare facilities in the Eastern Region of Ghana.

Author Statements

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Competing interests

None declared.

Ethical approval

Ethics approval for the study was obtained from the Institutional Review Board (IRB) at University of Cape Coast, Ghana (UCCIRB/CES/2017/05).

Supplementary materials

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CRediT authorship contribution statement

Lawrence R. Essuman: Conceptualization, Data curation, Formal analysis, Methodology, Writing - original draft, Writing - review & editing. **Daniel Apaak:** Formal analysis, Methodology, Supervision, Writing - original draft, Writing - review & editing. **Edward W. Ansah:** Data curation, Formal analysis, Methodology, Supervision, Writing - original draft, Writing - review & editing. **Francis Sambah:** Data curation, Formal analysis, Methodology, Writing - original draft, Writing - review & editing. **Joyce E. Ansah:** Writing - original draft, Writing - review & editing. **Mercy Opare:** Writing - original draft, Writing - review & editing. **Bright Opoku Ahinkorah:** Data curation, Formal analysis, Methodology, Writing - original draft, Writing - review & editing.

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