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Perceptions of EMR usage by health sciences students in Ghana

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Background and Purpose: Electronic Medical Records improve healthcare delivery, reduce medical errors and costs among many other benefits. A knowledgeable and willing workforce is an important antecedent to actual EMR use. Students in health training institutions should be educated about these tools in order to encourage adoption in their future workplaces. This study therefore set out to identify factors that could influence perceptions of EMR use among College of Health Science students.
Methods: This was a cross-sectional study of students of the College of Health Sciences, University of Ghana. EMR perception was measured on 5 domains using a 5-point Likert scale measured from 1 (Strongly disagree) to 5 (Strongly agree). Chi-square tests examined significant differences in the levels of agreement across the respondents' background characteristics, experience and knowledge in computing. Means were used to determine ranking of applications/tools thought to be most useful for respondents' work.
Results: The study identified age, school affiliation, type of study, health sector work experience, frequency of computer use and knowledge of eHealth communication techniques as factors influencing students' perception of autonomy and physician-patient relationship. Again, type of study, frequency of computer use and knowledge of eHealth communication techniques were the factors influencing students' perception of ease of use, usefulness and attitude of physicians.
Conclusions: Findings from this study bring to the fore, the need for inclusion of health informatics curricula in training health professionals. This will ensure easier adoption of EMR technology as the country journeys towards a paperless health care delivery system.

Keywords: User acceptance, medical education, electronic health records

1 Introduction

Electronic Medical Records (EMR) surfaced in the 1960's with the hope of transforming healthcare delivery [1]. They are known to improve healthcare quality, reduce medical errors and reduce costs, among others [2]. An important component that plays a crucial role in achieving these healthcare delivery improvements is the human resource for eHealth. Workforce, is a component in the eHealth framework proposed by the WHO and development of human resource to engage eHealth should be the focus of every country [3]. Similarly, Strategy 2 in Ghana's eHealth Strategy focuses on building capacity for eHealth, while Strategy 4 entails moving towards a paperless records and reporting system [4].

While these frameworks and strategies spell out what countries should do to maximize the potential in eHealth, there are possible bottlenecks that could slow this process down. A number of factors influence the adoption and use of EMRs in various settings both positively and negatively. EMR implementations are challenged by high initial costs, workflow reengineering, inadequate training, user resistance and many more [5, 6]. Among the many challenges, user resistance was found to be a primary hindrance to adoption in a pilot situation in Ethiopia [7]. This could be as a result of poor computer literacy or lack of knowledge of eHealth. Health professionals are major stakeholders in the use of EMR and their

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willingness to adopt this new technology is critical. The Ghana Ministry of Health (MOH) has indicated the inadequacy of eHealth skill sets in the country and the need to improve this situation by incorporating computer and eHealth literacy in health professionals training curriculum [4]. Students training as healthcare professionals ought to be trained on eHealth since their exposure or lack of it can influence their adoption behaviour for future use. Currently, few health facilities have implemented EMRs in Ghana, based on anecdotal evidence and few published literature reviews on the subject [8, 9]. Paper-based records are being used in the health facilities even though they are fraught with challenges such as inadequate space for storing paper-based records, missing and duplicate patient records [10]. Thus students being trained in health institutions lack or have inadequate exposure to EMRs during their training. Out of the four medical schools training medical doctors in Ghana, only one has a medical informatics course as part of the curricula [11]. Nursing training schools also, did not have informatics as part of their curricula until recently [12]. This could potentially hamper their acceptance and adoption of EMRs when they are eventually introduced in health facilities where they may practice. Based on these issues outlined with EMR adoption, this study set out to identify factors that influence perceptions of EMR use among College of Health Science students in Ghana. Knowing health students perceptions of EMR use could help in acceptance and identifying potentially negative attitudes [13]. It could also provide more justification for its mandatory inclusion in health professional training curricula in to minimize future change management challenges.

2 Materials and methods

This paper is part of a cross-sectional study to examine the knowledge, attitudes and use of ICT tools (computers, mobile phones/devices and Internet) and eHealth in general by students of the College of Health Sciences, University of Ghana. The College of Health Sciences has six schools with each having different levels of academic progression, from entry year undergraduates to postgraduates at the PhD level.

Sample size was estimated based on simple random selection with the expected proportion of the outcome(s) set at 0.5±0.03, 95% confidence level and adjusted for potential nonresponse by up to 10%. The 773 students who responded were randomly selected from all the levels of the six schools under the College proportionately according to the relative school and class sizes. In most instances, the questionnaires were self-administered with support from data collectors where further help was sought.

The dependent variables on agreement to the various domains on EMR perception were measured on a 5-point Likert scale where 1= Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree and 5= Strongly agree. Both categories under agreement and disagreements were merged as one, resulting in a 3-point Likert scale (Disagreement, Neutrality and Agreement) for analysis.

Chi-square tests were carried out to find out if there were significant differences in the levels of agreement across the respondents' background characteristics, experience and knowledge in computing. Where assumptions underlying the use of Chi-square failed, Fisher's exact tests were used. Alpha levels of significance for these tests were indicated at 5%, 1% and 0.1% and for nonsignificant relationships, exact p-values were stated. Means and standard deviations were also used to determine ranking of applications/tools thought to be most useful for respondents' work. Microsoft Excel 2010 was used for data management and Stata 13 for analysis.

3 Results

The total number of respondents was 773 students at a response rate of 95%. There were almost equal number of males and females with females making up 49.4% of total participants. Majority of respondents were between the ages of 20-24 years (51%). About 43% of participants were Medical School students with about 71% being Undergraduates. Sixty-five percent (65%) had no health sector working experience, majority (82.5%) owned a computer and about 55% of these used it 5-7 days a week. A good number were familiar with eHealth (62.4%) and had knowledge of more than three (3) communication techniques used in eHealth (63%). Details of socio-demographic characteristics can be found in Table 1.

 J Health Inform Afr. 2017;4(1):58-67. DOI: 10.12856/ JHIA-2017-v4-i1-166

3.1 Perception of Autonomy

About 40% of all students agreed on the perception that EMR would negatively affect physician's attitude due to security, legal and ethical concerns. There wasn't a significant difference in the level of agreement among males and females. Most students who were 30 years and older (60%) disagreed that EMR would affect physician's attitude, while 51% of participants below 20 years agreed with this statement. Students in Public Health (63%) also largely disagreed with this perception, while Medical (48%), Dental (43%) and Allied Health (48%) students moderately agreed. There was also a significant difference between perceptions of those with health sector work experience (50%) and those who did not have such experience (44%). Participants owning computers disagreed with this perception as well (30%). Familiarity with eHealth and knowledge of eHealth communication techniques did not show significant differences to influence this perception. Details in Table 1.

3.2 Perception of EMR effect on physician - patient relationship

In all, 41% of all participants agreed that EMR would likely interfere with physician – patient interactions. Among males and females, there was higher level of agreement. Participants who were 30 years and more, mostly disagreed (64%) with this assertion while those less than 20 years agreed (60%) there would be interference in interactions. In terms of School affiliation, those in Allied Health (51%), Dental (53%) and Medical (50%) School mostly agreed there would be negative effect on doctor-patient interactions while students in Public Health (68%) mostly disagreed. The details are shown in Table 1. There were significant differences in the levels of disagreement for ever working in the health sector (50%), more than 5 years health sector work experience (69%) and high agreement due to familiarity with eHealth, mHealth and Telemedicine.

3.3 Perception of Ease of Use (PEOU) of EMR

There was a generally positive high level of agreement on participant's perceived ease of use among all participants (71.3%). There was a significantly high agreement among participants based on the type of study ($p < 0.05$), frequency of computer use ($p < 0.01$) and knowledge of communication techniques used in eHealth ($p < 0.05$) (Table 1).

3.4 Perception of Usefulness (PU) of EMR

Similar to the high level of agreement on the PEOU of EMR, there was also a high level of agreement of participants on the usefulness of EMR to clinical practice. Overall, 74% of participants agreed that EMR would be useful for clinical practice. School affiliation ($p < 0.05$), frequency of computer use ($p < 0.05$) and knowledge of communication techniques ($p<0.01$) all showed significant differences between the levels of agreement and disagreement within the categories of the independent variables. Details in Table 2.

3.5 Attitude about EMR Usage

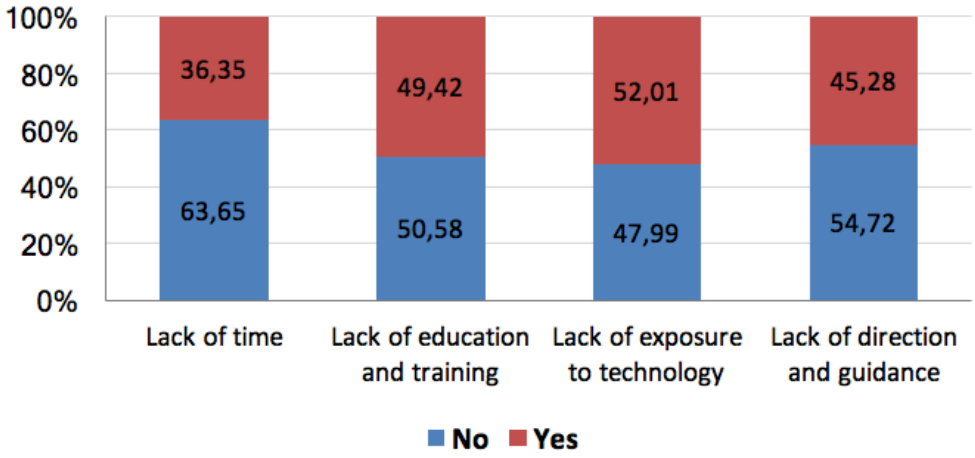
Attitude towards EMR usage was generally positive with 74% of participants showing a positive attitude. Participant's type of study ($p < 0.01$), frequency of computer use ($p < 0.05$) and knowledge of eHealth communication techniques ($p<0.01$) all showed significantly high levels of agreement. Details can be found in Table 2.

3.6 Barriers to eHealth Knowledge

As shown in Figure 1, participants indicated some barriers that were a hindrance to them in improving their eHealth knowledge. A lack of exposure to technology was indicated to be the biggest barrier to participants (52%). This was followed by lack of education (49%), lack of guidance (45%) and lack of time (36%).

 J Health Inform Afr. 2017;4(1):58-67. DOI: 10.12856/ JHIA-2017-v4-i1-166

Figure 1. Main barriers to improving eHealth Knowledge



 J Health Inform Afr. 2017;4(1):58-67. DOI: 10.12856/ JHIA-2017-v4-i1-166

Table 1: Relationships between respondents' characteristics and perceptions on EMR use

	Total	Autonomy (% of total)				Patient relationship (% of total)				Perceived ease of use (% of total)			
	N (%)	D	N	A	P-value	D	N	A	P-value	D	N	A	P-value
Sex					0.578				0.202				0.561
Female	382 (49.4)	28.3	19.4	39.0		30.1	18.9	38.2		2.6	13.1	72.5	
Male	383 (49.6)	25.6	21.2	41.8		26.9	16.7	44.9		3.9	13.8	70.2	
Age (years)					<0.001				<0.001				0.103
<20	144 (18.6)	13.9	21.5	50.7		12.5	15.3	59.7		1.4	10.4	75.7	
20 – 24	394 (51.0)	23.4	20.8	43.9		24.9	19.3	43.9		3.1	14.7	70.8	
25 – 29	111 (14.4)	30.6	22.5	34.2		32.4	20.7	33.3		8.1	10.8	66.7	
30+	89 (11.5)	59.6	12.4	20.2		64.0	13.5	15.7		2.3	14.6	76.4	
School					<0.001				<0.001				0.091
Allied Health	170 (22.0)	24.7	21.2	44.7		25.3	14.7	50.6		5.3	11.2	74.1	
Dental	51 (6.6)	9.8	31.4	43.1		11.8	19.6	52.9		2.0	21.6	62.8	
Medical	331 (42.8)	16.3	20.9	48.0		17.2	18.1	50.2		2.7	11.8	71.0	
Nursing	92 (11.9)	43.5	14.1	23.9		42.4	21.7	18.5		4.4	19.6	58.7	
Pharmacy	46 (6.0)	34.8	23.9	37.0		39.1	23.9	28.3		0.0	19.6	76.1	
Public Health	83 (10.7)	62.7	12.1	19.3		68.7	14.5	13.3		2.4	9.6	83.1	
Type of study					<0.001				0.002				0.028
Undergraduate	547 (70.8)	26.0	18.8	43.3		28.0	16.8	44.2		3.1	12.8	73.7	
Clinical/GEMP	179 (23.2)	22.9	26.8	33.0		24.0	23.5	33.5		4.5	17.3	59.2	
Postgraduate	47 (6.1)	55.3	8.5	34.0		51.1	8.5	38.3		0.0	6.4	89.4	
Ever worked in health sector					<0.001				<0.001				0.858
No	505 (65.3)	21.2	21.4	43.8		22.2	18.2	45.9		3.4	14.3	69.1	
Yes	168 (21.7)	50.0	17.3	22.6		50.0	19.1	22.0		4.2	13.7	72.6	
Health sector working experience (years)					0.050				<0.001				0.390
<5													
5+	86 (51.2)	41.9	22.1	23.3		34.9	24.4	29.1		5.8	15.1	67.4	
	74 (44.1)	62.2	10.8	21.6		68.9	13.5	13.5		2.7	12.2	79.7	
Frequency of computer use (days per week)					<0.001				<0.001				0.008
1-2													
3-4	56 (7.2)	21.4	26.8	28.6		35.7	23.2	23.2		5.4	23.2	51.8	
5-7	175 (22.6)	16.0	12.6	63.4		21.7	8.6	59.4		3.4	8.0	78.9	
	425 (55.0)	36.7	24.2	28.0		34.8	23.1	31.8		3.5	14.6	72.0	
Familiar with					0.202				0.003				0.919
e-health (electronic health)	482 (62.4)	28.6	22.0	42.1		29.7	19.3	44.2		3.9	14.1	75.3	
Telemedicine	450 (58.2)	26.2	22.7	44.2		26.4	20.0	47.3		3.8	14.2	76.2	
m-health (mobile health)	444 (57.4)	26.4	20.7	45.1		27.3	16.7	48.4		3.8	13.3	75.7	
Knowledge of communication techniques used in e-health					0.295				0.529				0.049
<3	285 (36.9)	27.0	15.8	37.2		27.7	14.7	36.5		3.5	15.8	60.7	
3+	488 (63.1)	27.1	22.5	42.2		28.9	19.7	44.3		3.1	12.1	77.5	
Total	773 (100.0)	27.0	20.1	40.4		28.5	17.9	41.4		3.2	13.5	71.3	

D=Disagree, N=Neutral, A=Agree. Missing value frequencies and percentages not shown.

 J Health Inform Afr. 2017;4(1):58-67. DOI: 10.12856/JHIA-2017-v4-i1-166

Table 2: Relationships between respondents' characteristics and perceptions on EMR use

	Total	Perceived usefulness (% of total)				Attitude about EMR usage (% of total)			
	N (%)	D	N	A	P-value	D	N	A	P-value
Sex					0.266				0.592
Female	382 (49.4)	1.6	9.2	75.1		2.4	9.2	71.7	
Male	383 (49.6)	3.4	10.2	73.9		3.4	8.1	76.2	
Age (years)					0.306				0.490
<20	144 (18.6)	4.9	6.3	75.0		2.8	6.3	75.0	
20 – 24	394 (51.0)	1.8	10.9	73.9		2.3	9.9	72.6	
25 – 29	111 (14.4)	1.8	10.8	73.0		3.6	10.8	71.2	
30+	89 (11.5)	2.3	7.9	82.0		4.5	5.6	82.0	
School					0.021				0.424
Allied Health	170 (22.0)	5.3	7.7	76.5		4.1	7.7	77.1	
Dental	51 (6.6)	0.0	9.8	70.6		0.0	7.8	72.6	
Medical	331 (42.8)	0.9	9.7	73.4		2.1	8.8	71.3	
Nursing	92 (11.9)	1.1	14.1	67.4		3.3	12.0	66.3	
Pharmacy	46 (6.0)	4.4	17.4	69.6		2.2	13.0	71.7	
Public Health	83 (10.7)	4.8	4.8	86.8		4.8	3.6	88.0	
Type of study					0.191				0.003
Undergraduate	547 (70.8)	2.7	8.6	77.0		2.9	7.9	76.1	
Clinical/GEMP	179 (23.2)	1.7	13.4	63.7		3.4	12.9	61.5	
Postgraduate	47 (6.1)	2.1	8.5	85.1		0.0	0.0	95.7	
Ever worked in health sector					0.715				0.449
No	505 (65.3)	2.6	10.7	71.9		2.6	9.5	71.1	
Yes	168 (21.7)	2.4	8.9	78.6		4.2	7.7	78.0	
Health sector working experience (years)					0.057				0.810
<5									
5+	86 (51.2)	0	11.6	74.4		3.5	8.1	74.4	
	74 (44.1)	5.4	6.8	83.8		5.4	6.8	83.8	
Frequency of computer use (days per week)					0.002				0.022
1-2									
3-4	56 (7.2)	7.1	16.1	57.1		5.4	14.3	58.9	
5-7	175 (22.6)	1.1	5.7	84.6		1.1	5.7	83.4	
	425 (55.0)	2.4	11.8	74.6		3.5	9.4	74.1	
Familiar with					0.872				0.318
e-health (electronic health)	482 (62.4)	3.5	10.0	79.5		3.9	9.1	78.8	
Telemedicine	450 (58.2)	3.6	11.3	78.7		3.8	9.8	80.0	
m-health (mobile health)	444 (57.4)	3.4	10.1	78.4		2.9	7.7	80.6	
Knowledge of communication techniques used in e-health					<0.001				<0.001
<3	285 (36.9)	4.9	9.1	63.9		5.6	10.2	60.4	
3+	488 (63.1)	1.0	10.0	80.5		1.2	7.6	81.8	
Total	773 (100.0)	2.5	9.7	74.4		2.9	8.5	73.9	

D=Disagree, N=Neutral, A=Agree. Missing value frequencies and percentages not shown.

 J Health Inform Afr. 2017;4(1):58-67. DOI: 10.12856/JHIA-2017-v4-i1-166

3.7 Important EMR Components for Participants Practice

In ranking the importance of various EMR applications or tools, Patient Registration was the most highly ranked tool among the various Schools. Participants in the Dental, Medical and Public Health Schools considered Patient Registration as the most important tool for their work. The Doctor's Clinical Documentation was also ranked 2nd most important tool by the Dental, Nursing and Public Health Schools. As would be expected, tools pertinent to specific job roles were ranked highest in their corresponding schools. For example, Pharmacy students ranked Pharmacy management highest followed by Drug registry and Drug/Allergy Alerts. Nursing students also ranked Nursing Documentation highest, followed by Doctor's Documentation and Patient Registration. Details can be found in Table 3.

Table 3. Ranking of applications/tools though to be most useful for respondents' work

	Ranking						
Application	Overall	Allied Health	Dental	Medical	Nursing	Pharmacy	Public Health
Patient registration	1	3	1	1	3	4	1
Doctor's clinical documentation	2	1	2	3	2	6	2
Appointment scheduling	3	2	4	2	6	11	4
Nursing documentation/charting	4	5	3	4	1	7	3
Pharmacy management	5	7	8	8	4	1	7
Drug/Allergy alerts	6	12	6	9	5	3	11
Drug registry	7	9	7	11	7	2	10
Medical imaging	8	6	11	5	9	13	8
Telemedicine	9	8	10	6	11	8	12
Laboratory documentation	10	4	9	10	10	10	6
Electronic billing and insurance e-claims	11	10	5	7	13	12	9
Physician order request	12	11	13	13	8	9	5
e-Prescribing	13	13	12	12	12	5	13

(1 = Most useful, 13 = Least useful)

4 Discussion

This study set out to determine factors influencing health trainee's perception of EMR use. Frequency of computer use, type of study, School affiliation, knowledge of eHealth communication techniques, age and working experience with the health sector generally were factors identified to influence student's perception of EMR use. Overall, sex of participants did not influence perception of autonomy, effect of physician-patient relationship, PEOU, PU and attitude.

Factors influencing perception of Autonomy and Physician-patient relationship were similar. Participants in the less than 20 age group were mostly undergraduates while the above 30 years group were mostly Post graduates students at the School of Public Health and had some health sector working experience [14]. The less than 20 age group are known to have better utilization and experience with ICT [15]. Their experience with ICT would feed into their perceptions of security challenges that could arise with the use of EMRs for patient care. These findings are however in line with a study of EHR use perceptions among 3rd year medical students who had been exposed to EHR documentation in their training [16]. Also, the above 30 age group and participants with health sector experience also largely disagreed to the lack of autonomy due to security challenges and negative impact on physician-patient relationship. This may be due to experience or exposure with EMRs in their various places of work. These varied perceptions may call for the students to be trained in using EMRs during their clinical

 J Health Inform Afr. 2017;4(1):58-67. DOI: 10.12856/ JHIA-2017-v4-i1-166

clerkship. There may also be the need to engage them with demonstration versions of real EMRs being used in health facilities in the country. EMR demonstrations were found to improve physician's, staff and patients knowledge and attitude to EMRs [5].

Few of the influencing factors identified in this study were significant on perceived ease of use. Participants largely agreed that EMRs would be easy for physicians to use in clinical practice. Differences among the sexes could not be found unlike other studies [17].The Undergraduate and Postgraduate students agreed very much with this statement, more than the clinical year students. There was a significant difference in the levels of agreement on frequency of computer use and knowledge of eHealth communication techniques. Participants using computers more than three times a week can be said to have a high computer efficacy and this can generally translate to higher expectations of ease of use [17, 18].

Perceived usefulness describes how useful a piece of technology is to an individual for use in a specific setting. Almost all participants in the various Schools agreed on the usefulness of EMR for clinical practice. Again, using computers 3 to 4 times a week was a significant factor influencing one's perception of the usefulness of EMRs for clinical practice. This could invariably mean a high self-efficacy which is a good influencer of PU among health care trainees [18]. In addition, having more knowledge about eHealth communication techniques was a good influencer of the perception of the usefulness for clinical practice. This shows students may have some knowledge about eHealth and this can be furthered by introducing them to medical informatics in their various fields of training.

Having a positive attitude about technology encourages its use [19, 20]. A greater number of postgraduate students agreed with the perception of physician's having a positive attitude towards EMR use. Type of study, frequency of computer use and knowledge about eHealth communication techniques have an effect on an individual's perception of EMRs being received with a positive attitude. PEOU and PU have been theorized to influence attitude to use technology for a specific purpose and a positive response is expected to result in actual use of the technology [21]. This can be expected to show smoother EMR adoption among these participants when they begin real world clinical practice.

The perceptions investigated are commonly found under the technology acceptance model (TAM) theoretical framework. The constructs in TAM focus on the causal relationships between PEOU, PU, attitude and actual use of technology systems [21]. Respondents in this study had similar perceptions with regards to the three constructs. If this study had been conducted within the context of the TAM theoretical framework, it could have shown a positive prediction for actual use of EMR. These results show promise for policy makers as attempts are being made to implement eHealth in various aspects of health care delivery in the country.

This study found that participants generally had positive perceptions on the ease of use, usefulness of EMRs and attitude towards EMR use. These show great promise for Ghana's health workforce as the country journeys towards a paperless health care delivery system. It will be crucial for health training institutions and teaching hospitals to incorporate health informatics curricula and as well introduce students to live EMR demonstrations to help them build experience for future use in clinical settings. Nursing informatics training should be encouraged for nursing training institutions in the country. The Ministry of Health and Ghana Health Service could consider providing infrastructure and resources for these training institutions in order that eHealth training could be improved. This would reduce training time and the learning curve for these future professionals when they are finally employed by the Service in facilities where these tools are being used.

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Statement on conflicts of interest

The authors declare there are no competing interests.

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