

Performance, Barriers, and Satisfaction of Health Care Workers Toward Electronic Medical Records in Jeddah, Saudi Arabia

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ABSTRACT

Background: Improvement in the quality of health care through utilizing an electronic medical record (EMR) system depends on getting the greatest number of physicians to effectively use the system.

Objectives: To assess performance, satisfaction, and barriers influencing the implementation of EMR systems in different departments and centers of a tertiary hospital.

Methods: A cross sectional analytic study was carried out across all sectors, departments, centers, and clinics of a tertiary hospital in Jeddah, Saudi Arabia, during the year of 2017. All health care providers ($n = 2553$) were invited to participate. A self-reporting questionnaire consisting of multiple choice closed-ended questions comparing EMR's to routine paper records was utilized through the institutional e-mail, using the Perseus online survey application.

Results: The study included 1010 health care providers out of the targeted 2553, giving a response rate of 39.6%. Of those surveyed, 49.1% aged below 35 years, 62% were females, and 53.1% were Saudis. Overall, 64.8% of the participants found the performance of some tasks easier when utilizing EMR compared to previous routines. Participants agreed to be satisfied with the system's information and terminology (68.6%), screen design and layout (72.9%), system capabilities (41.7%), technical support and service (50.7%), and ease of use (72.7%). Health care providers who have attended EMR

training expressed higher significant scores concerning the performance of EMR ($p < 0.001$). The highest agreed upon barriers by the participants were the temporary loss of access to patient records if the computer crashes or power fails (65.5%), privacy and security concerns (54.5%), and lack of proper doctor-patient communication (48.4%).

Conclusions: The performance of EMR and satisfaction with its use among the health care workers in Jeddah, Saudi Arabia, is generally acceptable, particularly among those who have attended training courses in EMR.

Keywords: Electronic Medical Record, Health Care Providers, Performance, Satisfaction, Barriers.


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INTRODUCTION

In the last two decades, notable advances in information communication technologies (ICTs) were made. Of these advances, the integration of the electronic medical system was the priority action in not only developed countries but also several developing countries.¹ An electronic medical record (EMR) system is defined as "an electronic record of health-related information on an individual that can be created, gathered, managed, and consulted by authorized clinicians and staff within one health care organization."² Users of EMR systems include administrative staff, medical staff, and patients. The main users are medical staffs as they incorporate physicians and nurses who are required to use EMR's to gain electronic access to patient health information.

Improvement in health care quality through the utilization of EMR systems depends on getting the greatest number of physicians to use the system in an effective way.^{3,4} If successfully achieved, EMR systems improve workflow, minimize medical errors, reduce treatment time, improve patient care by creating a better linkage to all health care providers, and reduce file space, supplies needed, and the number of workers required for filing medical records.^{5,6} Researchers have demonstrated that EMR systems contribute to medical error prevention through improving communication, facilitating the accessibility to knowledge and requirements for some information such as drug dosage, reducing the time performing checks, assisting with monitoring, offering support for

decision making, and the tracking and rapid responding to adverse outcomes.⁷ Despite the evident benefits of the EMR system, its adoption and incorporation into health facilities is internationally low. For instance, in the USA, the utilization of the EMR system is scarce; DesRoches et al indicated in their survey that only 4% of ambulatory physicians reported having an effective fully functional EMR system while 13% reported having a basic system.³ Even though EMR systems are currently available worldwide in several countries, there are still many obstacles to overcome before EMR systems can be implemented effectively and successfully. Several technological impacts and social issues have prevented and slowed the pace of the plan of widespread EMR implementation. Previous research,⁸ especially in the field of medical informatics, has identified some of the adoption barriers of health information systems (HIS) such as EMR systems among physicians. Among the most common reported barriers were the underestimation of the organizational capabilities and change management required, failure to redesign clinical processes and workflow to incorporate the technology systems, concern that systems will become obsolete, lack of skilled resources for implementation and support, and finally concern regarding negative unintended consequences of technology.

The awareness and perception of health care providers and especially physicians towards the transition from conventional paper medical records to electronic medical records have been studied extensively.^{9,10} The results of these studies can render them to be classified into studies with positive stances and views^{9,11} and studies with negative stances and views.^{10,12} The inclination of the studies' stances and views to either positive or negative was shown to be affected by a number of common expectations, for instance, confidentiality, ease of use, security, need for training, cost, and availability of useful extra-features.^{13,14} Saudi Arabia has prioritized the development of e-Health as well as the transition from paper-based health record to electronic health records. The Saudi government adopted the following mission for e-Health: "A safe quality health care system based on patient-centric care guided by standards, enabled by e-Health".¹⁵ The implementation of HIS's such as EMR systems has been progressing in Saudi Arabia over the last three decades.^{16,17} Even more, it is observed that there is a number of major hospitals and health care organizations that have attained distinguished achievement in EMR implementation in Saudi Arabia, including the tertiary hospital included in this study.^{17,18} The tertiary hospital's system in this study was awarded the Middle East Excellence Award in electronic health records.¹⁹ Even though several Saudi hospitals are adopting EMR's and despite that the use of EMR's has been prioritized by the Saudi government, there has been no formal evaluation of the use of these systems in Saudi hospitals. Therefore, this study has been performed to assess the performance and satisfaction towards implementing EMR's as well as to identify the barriers influencing the implementation of EMR systems among health care workers at a major tertiary hospital in Jeddah, Kingdom of Saudi Arabia (KSA).

SUBJECTS AND METHODS

A cross sectional study design was adopted and conducted during the year of 2017 at a tertiary hospital in Jeddah, KSA. All health care providers who were available during the study period ($n = 2553$) were invited to participate in the study.

A self-reporting questionnaire was distributed to all health care providers through their institutional e-mails, using the Peruses online survey application. Three follow-up e-mail reminders were sent to non-responders. The dependent variables in the questionnaire were EMR performance and the physicians' level of satisfaction toward EMR's. The independent variables were gender, age, nationality, job title, specialty, experience with computer, and attendance of EMR training. The first section of the questionnaire inquires about the physicians' demographics (age, gender, nationality, job title, specialty, level of experience with computers, and history of attending EMR training courses). The second part included multiple choice closed-ended questions (regarding system information and terminology, screen design and layout, system capabilities, technical support and service, ease of use, and the change in performance compared to previous routines) with Likert scale responses assigned with a number range of 1 to 5 to indicate the degree of acceptance of the item. The questionnaire has been previously applied in Saudi Arabia, and its validity and reliability were proved.²⁰

Approval from the Regional Research and Ethics Committee in King Abdullah International Medical Research Center Western Region was obtained, and ethical considerations were taken through all research steps.

Data were entered to work place computer by the researchers and was analyzed using SPSS (the Statistical Package of the Social Sciences) Version 22. Continuous variables were presented as means and standard deviations, while categorical variables were presented as frequencies and percentages. Scores of satisfaction were tested for normal distribution by Shapiro-Wilk test. Non-parametric statistical tests were utilized since the scores were abnormally distributed. Mann-Whitney test was used to compare score of two groups whereas Kruskal-Wallis test was used to compare scores of more than two groups. P values < 0.05 were considered significant.

RESULTS

The study included a total 1010 health care providers out of the targeted 2553, giving a response rate of 39.6%. Their socio-demographic characteristics of age, gender, nationality, and specialty are shown in [Table 1].

More than two-thirds (69.6%) of the respondent health care providers reported an average level of experience with computer whereas 28.4% reported high experience. As shown in [Figure 1], approximately two-thirds (67.9%) of them have attended EMR training.

Overall, 64.8% of the participants found the performance of some tasks either easier when utilizing EMR compared to previous routines. The health care providers' perspectives regarding the comparison between EMR and previous routines are summarized in [Table 2]. (81.2%) of them found that EMR to be easier than previous routines in reviewing patients' problems, seeking out specific information from patient records (82.21%), entering daily notes (77.9%), ordering laboratory analyses (56.5%), obtaining results from laboratory analyses (77.0%), ordering X-ray, ultrasound, or CT investigations (48.6%), obtaining results from X-ray, ultrasound, or CT investigations (69.8%), writing prescriptions (44.1%), reviewing currently received medications (68.4%), updating diagnoses (55.5%), finding patients with certain characteristics (60.8%), and making an appointment (55.0%).

Overall, the score of the performance of EMR compared to previous routines among health care providers ranged between 0 and 55 with a mean of 37 ± 14.8 . It was abnormally distributed as evidenced by using Shapiro-Wilk test ($p < 0.001$).

In [Table 3], it is shown that male physicians had higher scores than females regarding the performance of EMR compared to previous routines (mean rank was 516 versus 481). However, this difference did not reach statistical significance level ($p = 0.060$). Concerning health care providers' specialty, the highest score of the performance of EMR compared to previous routines was observed among internal medicine physicians (mean rank of 681.3), followed by obstetricians (mean rank of 636.8),

pediatricians (mean rank of 620.8) and family medicine/general practitioners (mean rank of 612.9). The lowest scores were reported by laboratory workers and pharmacists (mean ranks were 253.3 and 252.2, respectively). These differences were statistically significant, $p < 0.001$. Health care providers who attended EMR training expressed higher significant scores concerning the performance of EMR compared to previous routines than those who did not attend such training (mean rank was 528.8 versus 427.7), $p < 0.001$. Health care providers' age, nationality, and experience with computers were not significantly associated with the score of EMR performance compared to previous routines.

Table 1: Socio-demographic characteristics of the participants (n=1010)

Socio-demographic characteristics	Frequency (n)	Percentage (%)	
Age in years (n=1000)	<35	491	49.1
	35-50	410	41.0
	>50	99	9.9
Gender (n=1004)	Male	382	38.0
	Female	622	62.0
Nationality (n=997)	Saudi	529	53.1
	Non-Saudi	468	46.9
Specialty (n = 1010)	Surgery	81	8.0
	Internal medicine	123	12.2
	Pediatrics	58	5.7
	Dentistry	36	3.6
	Obstetrics/Gynecology	20	2.0
	Family med/general practitioner	45	4.5
	Radiology	45	4.5
	Nurse	254	25.1
	Laboratory	47	4.7
	Pharmacy	39	3.9
	Patient care technician	44	4.4
Assistant health care workers	218	21.6	

Table 2: Health care workers' perspectives regarding change in performance of some tasks when utilizing EMR compared to previous routines

	More difficult n (%)	No change n (%)	Easier n (%)	Don't know/Not applicable n (%)
To review the patients problems	95 (9.4)	34 (3.4)	821(81.2)	60(6.0)
To seek out specific information from patient records	91 (9.0)	35(3.5)	830(82.1)	54(5.4)
To enter daily notes	67 (6.6)	48(4.8)	787(77.9)	108(10.7)
To order laboratory analyses	66 (6.5)	25(2.5)	571(56.5)	348(34.5)
To obtain the results from laboratory analyses	50 (5.0)	32(3.2)	779(77.0)	149(14.8)
To order X-ray, ultrasound or CT investigations	47 (4.7)	36(3.6)	491(48.6)	436(43.1)
To obtain the results from X-ray, ultrasound or CT investigations	39 (3.9)	48(4.8)	706(69.8)	217(21.5)
To write prescriptions	62 (6.2)	31(3.1)	445(44.1)	472(46.6)
To review currently received medications	77 (7.6)	25(2.5)	691(68.4)	217(21.5)
To update diagnoses	42 (4.2)	47(4.7)	561(55.5)	360(35.6)
To find patients with certain characteristics	76 (7.5)	59(5.8)	614(60.8)	261(25.9)
To make an appointment	94 (9.4)	44(4.4)	546(55.0)	310(31.2)
TOTAL	806 (6.7)	464(3.8)	9583(64.8)	2992(24.7)

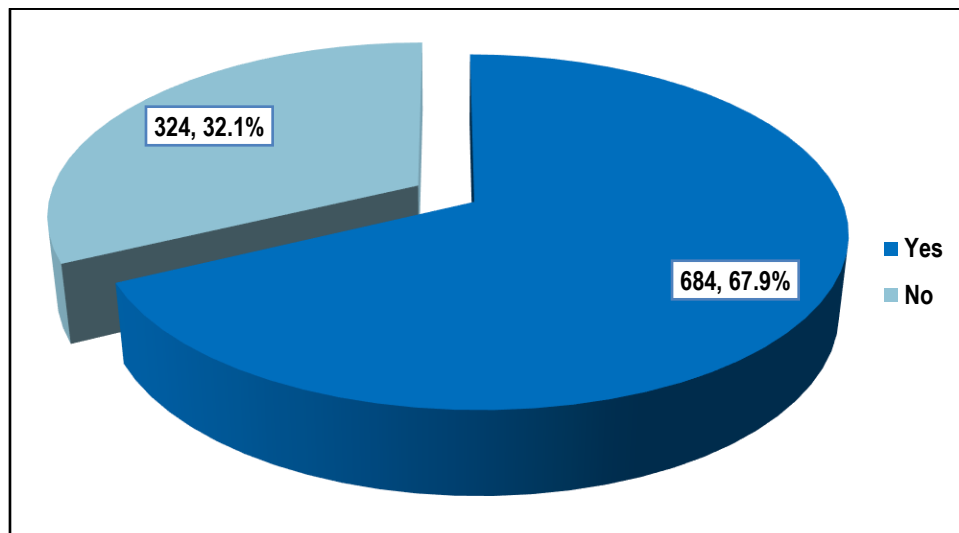


Figure 1: History of attendance of EMR training among the participants (n= 1008)

Table 3: Factors associated with health care providers` score of the performance of EMR compared to previous routine

		Performance of EMR versus routines score (0-60)			p-value
		Median	IQR	Mean rank	
Age in years	<35	44	34-54	495.7	0.841**
	35-50	44	31-55.75	492.5	
	>50	43	28.5-55.5	477.1	
Gender	Male	46	34-55	516	0.060*
	Female	43	31-54	481	
Nationality	Saudi	45	30-55	494.8	0.694*
	Non-Saudi	43	34-53	487.7	
Specialty	Surgery	45.5	37-54.75	535.6	<0.001**
	Internal medicine	54	46.75-60	681.3	
	Pediatrics	52	40-59	620.8	
	Dentistry	46	35-57.75	539	
	Obstetrics/Gynecology	48.5	41.75-60	636.8	
	Familymed/general practitioner	52.5	39.75-57	612.9	
	Radiology	31	25-45.5	337.3	
	Nurse	44	36-53.5	520	
	Laboratory	28	21-36	253.3	
	Pharmacy	27	19-39	252.2	
	Patient care technician	21	6-43.75	286.9	
Assistant health care workers	41	28-53	453.4		
Experience with computers	Low	40	21.5-49.75	787.7	0.212**
	Average	44	33-54	495.9	
	High	45	31.75-56	504	
Attendance of EMR training	No	40	29-51	427.7	<0.001*
	Yes	46	35-57	528.8	

* Mann-Whitney test; ** Kruskal-Wallis test; IQR: Inter-quartile range

From [Table 4], it is shown that participants agreed to be satisfied with the system information and terminology (68.6%), screen design and layout (72.9%), system capabilities (41.7%), technical support and service (50.7%), and ease of use (72.7%).

In regards to system information and terminology, 71.1% of the participants agreed that the system provided the precise information they need. Approaching two-thirds of them (63.4%) agreed that templates were well suited to their specialty, and

70.2% agreed that terminology was related to performed tasks. Slightly more than two-thirds of the health care workers (69.7%) agreed that the system increased their ability to add important content. Regarding screen design and layout, most of the agreed that the output was presented in a useful format (69.8%), information was clear (77.2%), screen organization was clear (73.0%), and screen sequence was clear (71.7%). Concerning system capabilities, only 30.6% of the health agreed that the

system was fast enough, and less than half of them (43.7%) agreed that unscheduled downtime rarely occurred. More than half of the health workers (51.0%) agreed that they rarely experienced difficulty in opening patient files when using the EMR system. As for technical support and service, more than half of the health workers (53.0%) agreed that the information technology department provided excellent ongoing technical support and services, and 48.4% of them agreed that system reference material was available. Concerning ease of use, most of the participants agreed that the system was user-friendly (71.8%), the system was easy to use (73.8%), and that they rarely used the paper-based medical record as an information source in their daily clinical work (72.5%).

As shown in [Figure 2], the overall score of health care workers' satisfaction with EMR's ranged between 0 and 80 with a mean of 50.1±12.4. It was abnormally distributed as evidenced by using the Shapiro-Wilk test ($p<0.001$). Overall, the mean rank of EMR satisfaction scores among physicians across the different specialties of surgery, internal medicine, pediatrics, dentistry, obstetrics/gynecology, family medicine/general practitioners, and radiology was 516.5, while the mean rank of EMR satisfaction scores among health care providers including nurses, laboratory technicians, pharmacists, patient care technicians, and assistant health care workers was 492.2. As shown in [Table 5], the highest EMR satisfaction score was observed among radiologists (mean

rank was 592.3), followed by physicians specialized in internal medicine (mean rank =578.2), patient care technicians (mean rank=566.2), and family physicians/general practitioners (mean rank=546.4). On the other hand, the lowest satisfaction score was reported among dentists (mean rank=414.2), surgeons (mean rank=426), and assistant health care workers (mean rank=428.7). These differences were statistically significant, $p<0.001$.

Health care providers who attended EMR training expressed higher significant scores concerning satisfaction with EMR than those who did not attend any EMR training (mean rank was 522.8 versus 465.8), $p=0.004$. Health care providers' age, gender, nationality and experience with computers were not significantly associated with the scores of EMR satisfaction.

Concerning benefits of EMR, the highest agreed upon benefit among the participants was that the system had a positive impact on the quality of care (weighted mean on a scale ranged between 1 and 5 was 3.83±0.81) whereas the lowest agreed upon was the ability of the participants to finish their work much faster than before (weighted mean was 3.61±0.99).

Regarding barriers of EMR's, the highest agreed upon barrier by the participants was the temporary loss of access to patient records if computer crashed or power failed (weighted mean was 3.76±0.94), followed by privacy and security concern (weighted mean was 3.50±1.04), and lack of proper doctor-patient communication (weighted mean was 3.40±1.09).

Table 4: Satisfaction with the electronic medical record among health care workers

	Disagree n (%)	Neutral n(%)	Agree n (%)
SYSTEM INFORMATION AND TERMINOLOGY			
System provides the precise information I need	53(6.3)	231(23.5)	701(71.1)
Templates are well suited to my specialty	86(8.7)	274(27.9)	623(63.4)
Terminology is related to performed tasks	42(4.3)	249(25.5)	686(70.2)
System increases my ability to add important content	51(5.2)	244(25.1)	676(69.7)
TOTAL	232(5.9)	998(25.5)	2868(68.6)
SCREEN DESIGN AND LAYOUT			
The output is presented in a useful format	63(6.4)	234(23.8)	687(69.8)
The information is clear	51(5.2)	174(17.6)	761(77.2)
Screen organization is clear	72(7.3)	194(19.7)	719(73.0)
Sequence of screens is clear	65(6.6)	211(21.6)	700(71.7)
TOTAL	251(6.4)	813(20.7)	2867(72.9)
SYSTEM CAPABILITIES			
The system is fast enough	374(37.8)	312(31.6)	302(30.6)
Unscheduled downtime rarely occurs	200(20.4)	352(35.9)	429(43.7)
I rarely experience difficulty in opening patient file in EMR system	181(18.5)	300(30.5)	501(41.6)
TOTAL	755(25.6)	964(32.7)	1232(41.7)
TECHNICAL SUPPORT AND SERVICE			
IT (information technology) department provides excellent ongoing technical support and services.	122(12.5)	340(34.6)	521(53.0)
System reference material are available	143(13.7)	358(36.9)	470(48.4)
TOTAL	203(10.4)	698(35.7)	991(50.7)
EASE OF USE			
The system is user-friendly	84(7.5)	195(19.7)	709(71.8)
The system is easy to use	75(7.6)	183(18.6)	728(73.8)
I rarely use the paper-based medical record as an information source in my daily clinical work	92(9.3)	179(18.2)	714(72.5)
TOTAL	251(8.3)	557(18.8)	2151(72.7)

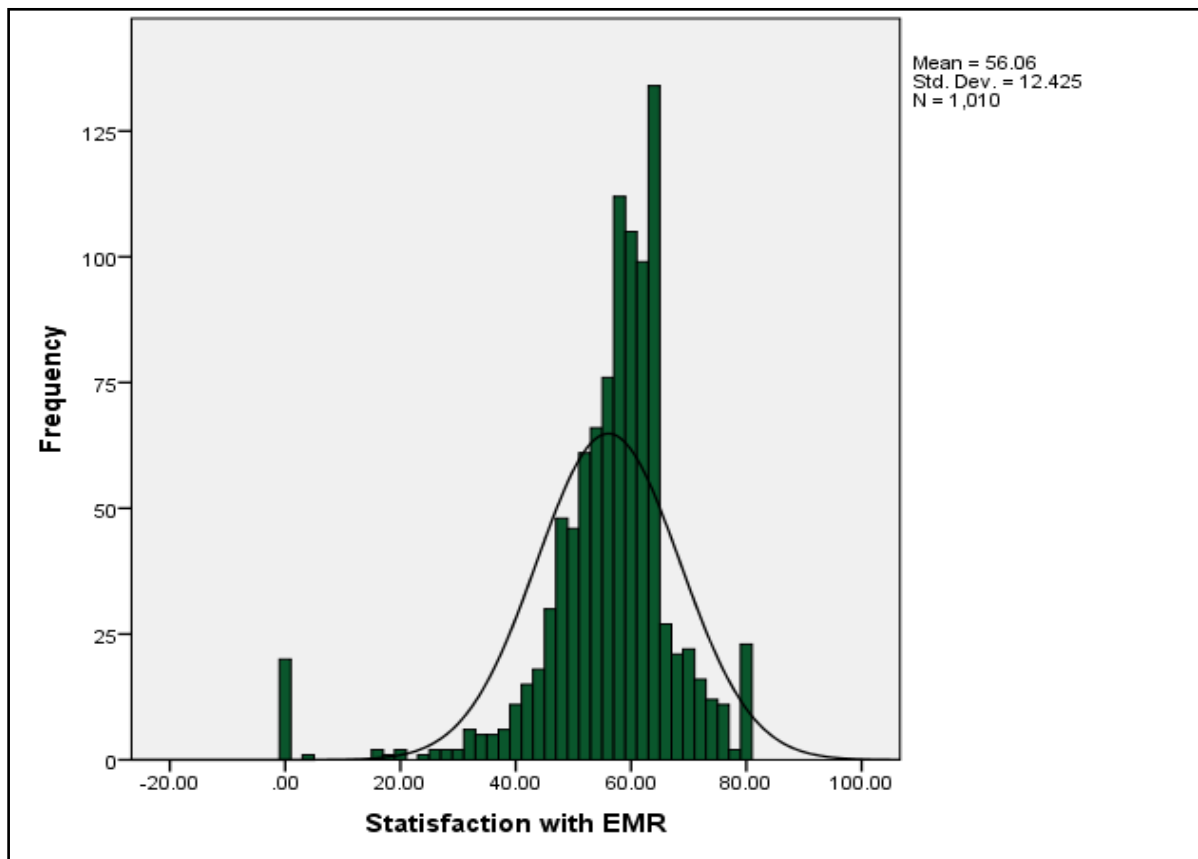


Figure 2: Distribution of the scores of healthcare providers regarding their satisfaction with EMR

Table 5: Factors affecting the score of satisfaction of health care providers with Electronic medical record

		Satisfaction with EMR score (0-80)			p-value		
		Median	IQR	Mean rank			
Age in years	<35	58	52-62	495.9	0.778**		
	35-50	58	50-64	508.1			
	>50	58	51-63	491.6			
Gender	Male	58.5	51-64	518.2	0.178*		
	Female	58	51.75-62	492.9			
Nationality	Saudi	58	52-64	510.5	0.179*		
	Non-Saudi	58	51-62	486			
Specialty	Surgery	56	49-60.5	426	<0.001**		
	Internal medicine	60	55-64	578.2			
	Pediatrics	58	53-61.25	513.7			
	Dentistry	56	47-60.75	414.2			
	Obstetrics/Gynecology	60.5	49-63.75	544.8			
	Family med/general practitioner	58	54-64	546.4			
	Radiology	60	53.5-64.5	592.3			
	Nurse	59	54-63	536.2			
	Laboratory	57	48-63	473			
	Pharmacy	60	52-65	456.9			
	Patient care technician	61	53-64	566.2			
	Assistant health care workers	55	49-60	428.7			
	Experience with computer	Low	56.5	50.5-61.75		459.2	0.177**
		Average	58	51-62		494.7	
High		58.5	52-64	529.9			
Attendance of EMR training	No	57	50-62	465.8	0.004*		
	Yes	58	52-63	522.8			

* Mann-Whitney test; ** Kruskal-Wallis test; IQR: Inter-quartile range

Table 6: Assessment of electronic medical record (EMR) benefits and barriers among participants

Statement	Disagree	Neutral	Agree	Weighted mean±SD
BENEFITS				
I am able to finish my work much faster than before	149(15.0)	204(20.6)	636(64.4)	3.61±0.99
EMR improves my productivity	98(9.9)	218(22.1)	669(68.0)	3.71±0.89
System has a positive impact on quality of care	57(5.8)	201(20.6)	717(73.6)	3.83±0.81
TOTAL	304(10.3)	623(21.1)	2021(68.6)	3.72±0.07
BARRIERS				
Lack of ability to achieve a complete paperless system	233(23.8)	286(29.2)	459(47.0)	3.26±1.01
EMR increases the risk of making errors	389(39.6)	268(27.3)	325(33.1)	2.93±1.06
Poor computer skills including typing ability	245(25.1)	332(34.0)	399(40.9)	3.24±1.06
Privacy and security concern	161(16.5)	283(29.0)	531(54.5)	3.50±1.04
Lack of proper doctor-patient communication	216(22.3)	284(29.3)	468(48.4)	3.40±1.09
Temporary loss of access to patient records if computer crashes or power fails	92(9.3)	247(25.2)	642(65.5)	3.76±0.94
TOTAL	1336(22.8)	1700(29.0)	2824(48.2)	3.35±0.04

DISCUSSION

The advantages of electronic medical records (EMR's) compared to routine paper records have been studied in several works. It has been documented that EMR utilization improves quality of health care.²¹ Also, it has been noted that EMR's lead to greater accuracy,²² higher correct information,²³ and easier and faster recovery of patient information.²⁴ In agreement with what has been mentioned, a great proportion of the health care providers in our study agreed that the EMR system has positively impacted the quality of care, improved their productivity, and enhanced their ability to finish work much faster than before.

Also in our study, most of health care providers reported that EMR's are easier than previous routines in seeking out specific information from patient records (82.1%), reviewing patients' problems (81.2%), entering daily note (77.9%), and obtaining results from laboratory analyses (77.0%). However, only 48.6% agreed that EMR is easier than previous routines in ordering X-ray, ultrasound or CT investigations and 44.1% agreed that EMR is easier than previous routines in writing prescriptions. These results agree with what has been reported previously in a study carried out in Taif, Saudi Arabia, by Alzobaidi et al²⁵ as well as in another study carried out among nurses in South Africa.²⁶

In our study, only 28.4% of the health care providers reported high level of experience with computer use and this could be explained by the fact that almost half of them aged 35 years and older.

Generally speaking, the attitude of the health care workers towards EMR is promising as more than two-thirds of the participants agreed that the EMR system provides the precise information they need, the templates are well suited to their specialty, terminology is related to performed tasks, and the system increases their ability to add important content. A similar positive attitude has been reported among physicians at a tertiary hospital in Taif, Saudi Arabia,²⁵ where all physicians believed that medical records should be computerized and perceived that the EMR system is useful for them. Also, in eastern Saudi Arabia, more than 75% of physicians expressed the positive impact of EMR on work and the quality of care.²⁷ In a study carried out in India, two-thirds of physicians believed in the computerization of medical records, but only half of them perceived their EMR system as useful.⁹

The positive attitude towards EMR observed in our study confirms what has been observed in similar studies carried out overseas in South Africa²⁸, Iran²⁹ and Israel.¹⁰ However; it contradicts what has been observed among health care workers in the Netherlands¹¹ and USA, Pennsylvania.³⁰

In our current study, preference of the EMR system over the routine paper system was more observed among males although not reaching a significant level. Moreover, preference of the EMR system over the routine paper system was more observed among physicians of some specialties such as internal medicine, obstetrics and gynecology, pediatrics, and family medicine/general practitioners. Preference of the EMR system over the routine paper system was also more observed among those who have attended EMR training than their counterparts who did not attend EMR training, indicating that training of physicians in EMR is warranted, particularly for those without prior computer experience. In a study conducted in Taif, sex, work department, and familiarity with computer technology were found to have a significant impact on the strength of some positive attitudes toward EMR.²⁵ Also in Pennsylvania,³⁰ a positive stance towards EMR was noted among health care workers who had previous computer experience. Experience with computers was also the factor significantly associated with the attitude of physicians towards EMR in eastern Saudi Arabia, while physicians' demographics were not related. In the same study, EMR training conducted at the hospital was not significantly related to the frequency of EMR system usage, and they attributed this finding to the ineffectiveness of the one-day EMR training conducted at the hospital.²⁷

Concerning satisfaction with EMR's, our study revealed that most of the participants agreed that the output of the screen is presented in a useful format, information is clear, screen organization is clear, and sequence of screens is clear. Concerning system capabilities, more than half of the health workers (51.0%) agreed that they rarely experienced difficulty in opening patient file in the EMR system, while 43.7% of them agreed that unscheduled downtime rarely occurs. However, only 30.6% agreed that the system is fast enough. In regards to technical support and services, 53.0% of the participants agreed that information technology department provides excellent

ongoing technical support and services, and 48.4% of them agreed that system reference materials are available. Concerning ease of use, most of the participants agreed that they rarely paper-based medical records as information sources in their daily clinical work (72.5%) and that the EMR system is user-friendly (71.8%).

Similar studies carried out nationally^{30,32} and internationally^{26,27} revealed that most physicians were satisfied with EMR services. Regarding the low speed of the system, it might be attributed to its design that is based on hierarchical database with low response time instead of relational databases.³³

As 64.8% of the participants found that tasks were easier when utilizing EMR's, 68.6% agreed to be satisfied with system information and terminology, 72.9% agreed to be satisfied with screen design and layout, 50.7% agreed to be satisfied with technical support and services, and 72.7% agreed to be satisfied with the system's ease of use. Therefore, the satisfaction of health care providers toward the EMR system in our study is acceptable. However, even though 68.6% of our sample population agreed on the benefits of EMR's while only 48.2% agreed on the presence of barriers in EMR's, improvements are needed to increase the proportion of satisfied health care workers, as noticed by the comparatively low percentage of participants who agreed to be satisfied by the system's overall capabilities (41.7%). Therefore, in order to increase satisfaction of health care providers toward EMR's, design and layout of EMR system screens should be improved to be more effective and easier, and the systems should be more user-friendly. Moreover, EMR systems should be faster to avoid loss of physicians' time and to shorten the waiting list of patients.

Regarding barriers in using EMR's, a considerable proportion of the respondents in our study mentioned that the temporary loss of access to patient records if the computer crashes or power fails (65.5%), privacy and security concerns (54.5%), and lack of proper doctor-patient communication (48.4%) were among the important barriers against optimal utilization of the EMR system, indicating that in order to improve physicians' use of EMR systems, certain aspects such as opening patient files, communication, and unscheduled downtime, should be improved. Different results were observed in other studies.

In Taif,²⁵ most physicians expressed their trust in security and confidentiality of EMR's. On the other hand, Woodward reported that most of health care providers were unsure about security and confidentiality.³⁴ In agreement with our findings, other studies reported concerns of health care providers about more security and confidentiality risks involved with EMR's than routine paper records.^{9,35} In Eastern Saudi Arabia,²⁷ a high proportion of physicians were dissatisfied with EMR systems' contents, communication, and technical support.

Among strengths of our study is the large sample size and inclusion of all health care providers, rather than physicians or nurses only. However, the study has some limitations as it included health care workers at one health care facility in one city of KSA. Even within the health care facility, the data was collected online through the institutional e-mail. Moreover, the response rate was relatively low (39.6%), which could be attributed to the dependence on an online approach to collect data. All these factors could affect the ability to generalize the results over other health care facilities and different cities of KSA.

CONCLUSION

Perception of EMR's and satisfaction with their use among health care workers in Jeddah, Saudi Arabia, is generally acceptable, particularly among those who have attended training courses in EMR systems. Specialty of health care workers is an important factor in determining the satisfaction and preference of EMR's utilization over routine paper records.

Temporary loss of access to patient records if the computer crashes or power fails, ongoing privacy and security concern, and lack of proper doctor-patient communication were the three main barriers reported by health care workers using EMR's.

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