

# Physicians' Perceptions and Attitudes toward Use of Electronic Medical Record Systems in Riyadh

Yasser H. AlOtaib (1)  
Moteb M. AlSaedi (2)

(1) MPH, Department of Community Medicine, King Saud University, Riyadh, Saudi Arabia  
(2) MPH, King Faisal Specialist Hospital and Research Center, Saudi Arabia

## Corresponding author

Dr. Yasser H. AlOtaibi  
Department of Community Medicine, King Saud University,  
Riyadh, Saudi Arabia  
Email: dr.yasser.111@gmail.com

Received: November 2021; Accepted: December 2021; Published: January 1, 2022.

Citation: Yasser H. AlOtaibi, Moteb M. AlSaedi. Physicians' Perceptions and Attitudes toward Use of Electronic Medical Record Systems in Riyadh. World Family Medicine. 2022; 20(1): 109-120 DOI: 10.5742/MEWFM.2022.95218

## Abstract

**Aim:** This study explores the perceptions of physicians and their attitudes toward the implementation of the electronic medical record (EMR) in general hospitals in Riyadh to identify the perceived difficulties, burdens, and usefulness of implementing electronic medical records. It also aims to identify key demographic factors and training determinant predictors that may help explain physicians' perceptions of EMRs.

**Methods:** This cross-sectional survey was conducted in three general hospitals in Riyadh using a self-administered questionnaire. A pilot study was conducted to test the questionnaire's reliability, and random cluster sampling was used to build the sample. Responses were rated using a Likert-type scale.

**Results:** A total of 160 physicians filled out the questionnaire. The majority of physicians (91.3%) stated that they had heard of the EMR. Physicians rated their agreement on the usefulness of implementing the EMR positively (mean score, 3.8/5). Similar, most physicians generally agreed that the EMR could enhance their productivity (mean score, 3.6/5), prevent documentation error (mean score, 3.8/5), improve the quality of services (mean score, 3.8/5), improve the ease of finding patient records (mean score, 4.1/5), improve communication (mean score, 3.8/5), and save their patients' time (mean score, 3.5/5). However, physicians perceived lack of technical support and reliability of the information from other hospitals as potential burdens. Pearson's correlation test showed that greater belief in

the effectiveness of the EMR was significantly associated with greater belief in its usefulness ( $r = 0.81$ ,  $p < 0.01$ ). Likewise, greater physician perception of expected technical support was significantly associated with greater physician perception of effectiveness ( $r = 0.61$ ,  $p < 0.01$ ).

**Conclusion:** There is a necessity for formal educational programs to improve physicians' overall attitude toward the EMR.

**Key words:** Electronic medical record, Medical records, Riyadh City, Saudi Arabia

## Introduction

The healthcare industry faces several challenges in achieving its primary goal: the delivery of healthcare. On the other hand, there is a continuous improvement process and innovation to overcome such challenges. One of these innovations is the Electronic Medical Record (EMR), which simply uses information and communication technologies in a healthcare organization to facilitate rapid access to data and information for decision-making and problem-solving processes, either at the patient or organizational level. The Healthcare Information and Management Systems Society (HIMSS) defines EMR as “an application environment that consists of the clinical data repository, clinical decision support, controlled medical vocabulary, order entry, computerized provider order entry, pharmacy, and clinical documentation applications. This environment supports the individual patient’s electronic medical record across inpatient and outpatient environments, and is used by healthcare practitioners to document, monitor, and manage healthcare delivery within a healthcare organization” (1).

Many studies that have explored the effect of implementing the EMR in healthcare organizations have reported positive effects on the quality of healthcare, patient safety, and efficiency of healthcare services(2–9). However, despite positive effects resulting from the successful implementation of the EMR, it is estimated that the failure of its implementation in healthcare facilities ranges from 50–80%. This high failure rate demonstrates that technology alone is not enough to ensure successful and effective use of the EMR(10).

Like any innovation, there is a human–innovation interaction factor that affects the innovation diffusion process(11). Investigators found many barriers to adopting the EMR, one of which is the human factor, particularly physicians, due to their central role in healthcare delivery(12). In his book “Diffusion of Innovations,” Rogers defined the innovation–decision process as “the process through which an individual or other decision-making unit passes from first knowledge of an innovation, to forming an attitude towards the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision”(11). A systematic literature review that used Rogers’s theory of innovation diffusion to identify a knowledge-based classification of critical factors for adopting electronic records by physicians identified six critical adoption factors: user attitude toward information systems, workflow impact, interoperability, technical support, communication among users, and expert support (13).

Several studies on implementing the EMR have been conducted in the Kingdom of Saudi Arabia. Many of these studies showed that the most prevalent barriers that delayed or hindered the adoption and the successful implementation of the EMR were “human barriers,” including negative beliefs, behaviors, and attitudes of healthcare professionals toward such systems(14,15).

In this study, we aimed to explore the perceptions of physicians and their attitudes toward the EMR. The secondary objective of this study was to identify correlations between physicians’ demographic and training-related predictors that may help explain their overall perceptions of the usefulness of implementing an EMR.

## Materials and Methods

This cross-sectional survey was conducted in three general hospitals in Riyadh: Al-Yamamah Hospital, Al-Iman Hospital, and Al-Imam Abdulrahman Al-Faisal Hospital. These hospitals were randomly chosen from a total of six general hospitals reporting to the General Directorate of Health Affairs in Riyadh. Random cluster selection was used to select the target group, which included physicians working in these hospitals.

### Survey Tool

Primary data were collected by a self-administered questionnaire that was divided into two parts. The first part was used to collect demographic data and the second listed 27 statements that were assessed on a Likert scale. These items were selected considering critical factors that affected physicians’ adoption of the EMR, including user attitude toward information systems, workflow impact, interoperability, technical support, communication among users, and expert support(13). A pilot study was conducted to test the questionnaire’s internal consistency by using Cronbach’s alpha. The Cronbach’s alpha was 0.82, which is acceptable(16).

### Statistical Analysis

The data were analyzed using the Statistical Package for Social Sciences (IBM, SPSS Inc., Armonk, New York, version 21) and MS Excel. Means and standard deviations were used to describe continuous variables, whereas frequencies and percentages were used to describe categorical and binary variables. Associations between continuous variables, such as physicians’ perceived usefulness, barriers, difficulties, and burden from the EMR, were measured using Pearson’s correlation as a bivariate effect size statistic. Additionally, one-way ANOVA and t-tests were used to explore the main effects of demographic variables and other factors that were relevant to EMR use. Cronbach’s alpha test of reliability was used to test the internal consistency of the questionnaire.

Factor analysis (FA) and principal component analysis (PCA) were used to examine the factorial validity of the full questionnaire. Four main concepts were developed: “EMR usefulness,” “EMR expected effectiveness,” “expected technical support,” and “perceived burden and difficulty.” Summative analysis and recode features in SPSS were used to compute the means and standard deviations for each of the indicators that comprised the main perceptive concepts of the study. The average scores for the main concepts (domains) and their sub-concepts were computed using the total score divided by the number of indicators that comprised each sub-concept for every participant. Means and standard deviations were computed for these

main domain perceptions accordingly. Finally, multiple regression was used to determine the individual and joint relationships between physicians' characteristics when these independent variables were set as variates against the physicians' perception of usefulness and their perceived difficulties of EMR use. The alpha level was set to 0.05.

Exploratory factor analysis was used with the maximum likelihood method to identify the smallest but most meaningful, simple, and interpretable concepts from the 27-item questionnaire.

### Ethical Considerations

The Riyadh General Directorate of Health Affairs granted approval to conduct this study. Additionally, consent was obtained from every participant after providing full information about the aims of the study. The participants were informed that participation in the study was entirely voluntary, and they were assured of the confidentiality and anonymity of any information shared.

## Results

Out of the 450 questionnaires sent to physicians, only 160 complete records were returned, representing an overall response rate of 35.5%. Male respondents were strongly represented in the sample (68.8%). The respondents' ages ranged between 20–50 years, with most aged 31–40 years (40.6%). Their clinical roles varied, with resident physicians representing nearly half of the sample (48.1%). Only 40.6% of respondents were Saudi physicians, and most hailed from Al-Yamamah Hospital (46.3%). The majority of physicians (91.3%) stated that they had heard of the EMR (Table 1).

**Table 1. Physician demographics and work characteristics**

Variables	Frequency	Percentage
<b>Gender</b>		
Male	110	68.8
Female	50	31.2
<b>Age</b>		
20–30 years	47	29.4
31–40 years	65	40.6
41–50 years	33	20.6
> 50 years	15	9.4
<b>Role/Position</b>		
Resident	77	48.1
Specialist	55	34.4
Consultant	28	17.5
<b>Nationality</b>		
Saudi	65	40.6
Non-Saudi	95	59.4
<b>Hospital</b>		
Al-Yamamah Hospital	74	46.3
Al-Iman Hospital	37	23.1
Al-Imam Abdulrahman Al-Faisal Hospital	49	30.6
<b>Ever heard about the electronic medical record?</b>		
Yes	146	91.3
No	14	8.8

Of the 146 physicians who responded to questions about previous exposure to the EMR, 46.3% said they had knowledge of the EMR from their daily hospital practice, followed by 16.3% who reported studying the EMR in college. The distribution of other responses is displayed in Table 2.

**Table 2. Physicians' previous sources of information on the electronic health records (N = 146)**

Participants' Responses	Frequency	Percentage
During my study in college	26	16.3
I attended a course about it	8	5.0
Through media (TV, newspapers, social media)	13	8.1
From my friends	12	7.5
Websites search	7	4.4
In my daily practice in hospital	74	46.3
In a conference	4	2.5
Other	2	1.3

### EMR Usefulness

The mean rating of the physicians' perception of the usefulness of implementing the EMR was 3.8 out of five (Table 3). Furthermore, the physicians rated their expectation of the EMR to enhance their productivity positively (mean score, 3.6/5). However, 6.9% strongly disagreed, 10% disagreed, and 22.5% were neutral. The physicians generally agreed with the ease of documenting patient information using the EMR (mean score, 3.8/5). Most respondents either agreed (38.1%) or strongly agreed (30.6%) that documentation could be made easier with the EMR. When physicians were asked to rate error prevention when using electronic records, their overall rating was 3.8 out of five points. Most respondents either agreed (38.8%) or strongly agreed (31.3%) that medical errors could be prevented by implementing the EMR. The physicians generally agreed that EMR implementation improved quality of services (mean score, 3.8/5). The majority either agreed (40.6%) or strongly agreed (34.4%).

The respondents also rated their agreement with the improved ease of finding patient records using the EMR favorably (mean score, 4.1/5). Most respondents agreed (35.6%) or strongly agreed (41.9%) that the EMR could expedite access to patients' medical records. Moreover, the physicians rated their agreement with the time-saving capacity of the EMR favorably (mean score, 3.6/5), with 34.3% agreeing and 26.9% strongly agreeing that the EMR could potentially save time.

The respondents rated their agreement with the ability of the EMR to improve communication (mean score, 3.8/5). The majority either agreed (39.4%) or strongly agreed (30.6%). The respondents also rated their agreement with the ability of the EMR to expedite workflow (mean score, 3.7/5), with most either agreeing (43.1%) or strongly agreeing (25%).

Finally, the respondents rated their agreement with the potential of the EMR to save their patients' time (mean score, 3.7/5). The majority either agreed (35.8%) or strongly agreed (28.8%) that the EMR could potentially save their patients' time.

Table 3. Descriptive statistics for physicians' perceptions on the usefulness of the electronic health record

Item#	Electronic Health Record Usefulness	Mean (SD)					
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
		3.8 (1.0)					
5	Using electronic medical record will increase my productivity	3.6 (1.2)	11 (6.9%)	16 (10%)	36 (22.5%)	54 (33.8%)	43 (26.9%)
6	Using electronic medical record will be easier for documentation	3.8 (1.2)	9 (5.6%)	21 (13.1%)	19 (11.9%)	61 (38.1%)	49 (30.6%)
4	Using electronic medical record will reduce medical errors	3.8 (1.1)	3 (1.9%)	31 (19.4%)	14 (8.8%)	62 (38.8%)	50 (31.3%)
3	Using electronic medical record will improve the quality of care	3.8 (1.3)	23 (14.4%)	6 (3.8%)	11 (6.9%)	65 (40.6%)	55 (34.4%)
7	Using electronic medical record will be easier to find patient information	4.1 (1.1)	8 (5%)	9 (5.6%)	17 (10.6%)	57 (35.6%)	67 (41.9%)
8	Using electronic medical record will save me time	3.6 (1.3)	11 (6.9%)	29 (18.1%)	22 (13.8%)	55 (34.3%)	43 (26.9%)
12	Using electronic medical record will make communication with the team easier	3.8 (1.1)	8 (5%)	16 (10%)	22 (13.8%)	63 (39.4%)	49 (30.6%)
13	Using electronic medical record will make for smoother workflow	3.7 (1.1)	11 (6.9%)	12 (7.5%)	28 (17.5%)	69 (43.1%)	40 (25%)
10	Using electronic medical record will save patient time	3.7 (1.2)	9 (5.6%)	21 (13.1%)	26 (16.3%)	57 (35.8%)	46 (28.8%)

### Expected Effectiveness of EMR Interoperability

The physicians' mean rating of the expected effectiveness (interoperability) of the EMR for hospital operations, processing, distance consulting, and enhanced patient outcomes was 3.7 out of five (Table 4). The physicians rated their agreement with the duplicate record and documentation capacity of the EMR favorably (mean score, 3.9), with most agreeing that the EMR could prevent duplicate records.

Other components that the physicians rated favorably included the ability of the EMR to help them with remote consultations, prevent duplicate and unnecessary investigations, enhance referral system efficiency, improve patient access to health care, and improve patient outcomes.

**Table 4. Descriptive statistics for physicians' perceptions on the effectiveness of the electronic health record**

Item#	Mean (SD)	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Effectiveness of the electronic medical record	3.7 (0.9)					
29 Interoperability: will prevent the duplication of prescriptions	3.9 (1.1)	13 (8.1%)	9 (5.6%)	16 (10%)	72 (45%)	50 (31.3%)
27 Interoperability: can help to perform remote consultation	3.7 (1.2)	13 (8.1%)	10 (6.3%)	32 (20%)	67 (41.9%)	38 (23.8%)
25 *Interoperability: will not repeat unnecessary investigations	3.8 (1.1)	8 (5%)	16 (10%)	23 (14.4%)	65 (40.6%)	48 (30%)
28 Interpretability: referral system will be more efficient	3.7 (1.1)	9 (5.6%)	14 (8.8%)	29 (18.1%)	67 (41.9%)	41 (25.6%)
24 Interoperability: will improve patients' access to healthcare	3.6 (1.3)	19 (11.9%)	14 (8.7%)	23 (14.4%)	64 (40%)	40 (25%)
16 Using electronic medical record will improve patient outcomes	3.7 (1.2)	11 (6.9%)	13 (8.1%)	33 (20.6%)	59 (36.9%)	44 (27.6%)
19 Technical problems will disrupt our work	3.6 (1.2)	10 (6.3%)	16 (10%)	41 (25.6%)	50 (31.2%)	43 (26.9%)

### EMR-Related Difficulty and Expected Technical Support

The physicians rated their agreement with the notion that EMR would improve technical support (mean score, 3.1/5). Although they favorably rated their agreement with the adequacy of training on the EMR (mean score, 3.1/5), 8.1% strongly disagreed and 26.9% disagreed that the training would be enough (Table 5). Overall, 27.5% agreed and 16.9% strongly agreed that training would be satisfactory.

The physicians were undecided about whether technical support would be available 24 hours a day (mean agreement rating of 3.0/5). Overall, 20% strongly disagreed, 17.5% disagreed, and 23.1% were undecided. They rated their agreement on the timeliness of problem-solving for the EMR as 3.1 out of five. In most cases, physicians either agreed (20%) or strongly agreed (14.4%).

Similarly, the physicians favorably rated their agreement with the expected clarity of the instruction guidelines that would be provided by the information technology personnel about EMR (mean score, 3.3/5). In most cases, 34.3% agreed and 12% strongly agreed that the information technology team would provide clear guidelines.

Item#	Technical Support	Mean (SD)	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
18	Technical support: training for use the system will be enough	3.2 (1.2)	13 (8.1%)	43 (26.9%)	33 (20.6%)	44 (27.5%)	27 (16.9%)
17	Technical support will be available 24-hours	3.0 (1.4)	32 (20%)	28 (17.5%)	37 (23.1%)	33 (20.6%)	30 (18.8%)
20	Technical problems will be solved quickly	3.1 (1.1)	12 (7.5%)	43 (26.9%)	50 (31.3%)	32 (20%)	23 (14.4%)
23	There will be clear guidelines to use the system	3.3 (1.1)	11 (6.9%)	27 (16.9%)	43 (26.9%)	55 (34.3%)	24 (12%)
	<b>Burden/Difficulty</b>	<b>2.8 (0.8)</b>					
22	*Using computer is not my job	2.7 (1.1)	23 (14.4%)	60 (37.5%)	32 (20%)	38 (23.8%)	7 (4.4%)
21	*Technical support: Nobody will help me to use the system	2.9 (1.2)	14 (8.8%)	55 (34.5%)	42 (26.3%)	30 (18.8%)	19 (11.9%)
26	*I will not trust patient information from other hospitals	2.9 (1.2)	19 (11.9%)	47 (29.4%)	43 (26.9%)	36 (22.5%)	15 (9.4%)
15	Using electronic medical record will not add value to my medical practice	2.6 (1.2)	22 (13.8%)	68 (42.5%)	32 (20%)	23 (14.4%)	15 (9.4%)

Table 5. Descriptive statistics for the physicians' perceived expected technical support and difficulty of using the electronic health record

### Perceived Burden and Difficulty

The physicians rated their agreement with the expected burdens and consequences of EMR technical support as 2.8 out of five. In general, the physicians disagreed with the fact that using a computer was not their part of their job.

Moreover, the physicians rated their agreement that no one would help them use EMRs. The mean rating was 2.9 out of 5, with 18.8% agreeing and 11.9% strongly agreeing that nobody would help them use the system.

Similarly, the physicians were uncertain about whether they could trust EMR information from other hospitals. The mean rating was 2.9 out of five, with 18.8% agreeing and 11.9% strongly agreeing that they could trust data from other hospitals.

### Associations Between the Physicians' Perceptions of the EMR

Pearson's *r* test showed that a greater belief in the effectiveness of the EMR was significantly associated with a greater belief in its usefulness ( $r = 0.81, p < 0.01$ ). Physicians who perceived greater expected technical support were significantly more likely to perceive the usefulness of the EMR ( $r = 0.63, p < 0.01$ ). Likewise, greater physician perception of expected technical support was significantly associated with greater physician perception of effectiveness ( $r = 0.61, p < 0.01$ ). There was also a weak but significant negative association between expected difficulties with using the EMR and its effectiveness. Physicians who perceived greater difficulty were significantly more likely to perceive the EMR as less effective ( $r = -0.22, p < 0.01$ ).

### The Difference between Physicians' regarding their perception of the EMR

To determine whether the physicians perceived greater or lesser difficulty with using the EMR than their perceptions of its usefulness and efficiency, we used a paired-sample *t*-test. The means and standard deviations of these main concepts are as follows: perceived usefulness, 3.8 (1.0); perceived effectiveness, 3.7 (0.9); perceived expected technical support, 3.1 (1.0); and perceived burden/difficulty, 2.8 (0.8).

The paired sample *t*-test showed that the physicians perceived significantly greater usefulness from using the EMR (mean, 3.8; SD, 1) than its difficulty (mean, 2.8; SD, 0.8;  $p < 0.001$ ) (Table 6). Likewise, the physicians reported greater trust in the effectiveness of the EMR (mean, 3.7; SD, 0.9) than they perceived difficulties associated with using such electronic interfaces (mean, 2.8; SD, 0.8). The *t*-test showed that the difference between effectiveness and difficulty was statistically significant ( $p < 0.001$ ). Additionally, the physicians' perceptions of technical support (mean, 3.1; SD, 1) significantly exceeded their perceptions of difficulty (mean, 2.8; SD, 0.8;  $p < 0.001$ ).

**Table 6. Paired samples test comparing physicians' perceived usefulness, effectiveness, and expected support versus perceived difficulty and burden from the electronic health record**

	Mean Difference	95% Confidence Interval		<i>p</i>
		Lower	Upper	
Usefulness vs. burden/difficulty	.98325	.79728	1.16921	< 0.001
Effectiveness vs. burden/difficulty	.93862	.76708	1.11015	< 0.001
Expected technical support vs. burden/difficulty	.37813	.18805	.56820	< 0.001

Pearson's correlation test showed that greater belief in the effectiveness of the EMR was significantly associated with greater belief in its usefulness ( $r = 0.81, p < 0.01$ ). Likewise, greater physician perception of expected technical support was significantly associated with greater physician perception of effectiveness ( $r = 0.61, p < 0.01$ ), as shown in Table (7).

**Table 7. Correlations between Physicians perceptions of the E-HR's: Usefulness, effectiveness, expected technical support and difficulty**

	Usefulness	Effectiveness	Expected technical support
E-HR Effectiveness	0.81**		
Expected technical support	0.63**	0.61**	
Expected burden/difficulty	0.11	-0.22**	0.12

\*\* Correlation is significant at the 0.01 level (2-tailed).

Further analysis showed that younger physicians were significantly more likely to perceive the EMR as useful than older physicians when everything else was accounted for in the model ( $p = 0.003$ ). Likewise, consultant physicians were significantly more likely to perceive the EMR as useful than residents (reference group,  $p = 0.051$ ), but consultants were similar to specialists regarding their belief in the usefulness of EMRs ( $p = 0.347$  when everything else was kept constant). Of note, physician gender, academic level, nationality, and previous training were not significantly associated with the perception of EMR usefulness (Table 8).

**Table 8. Multivariate linear regression model explaining variations in physicians' overall perception of the usefulness of electronic health records**

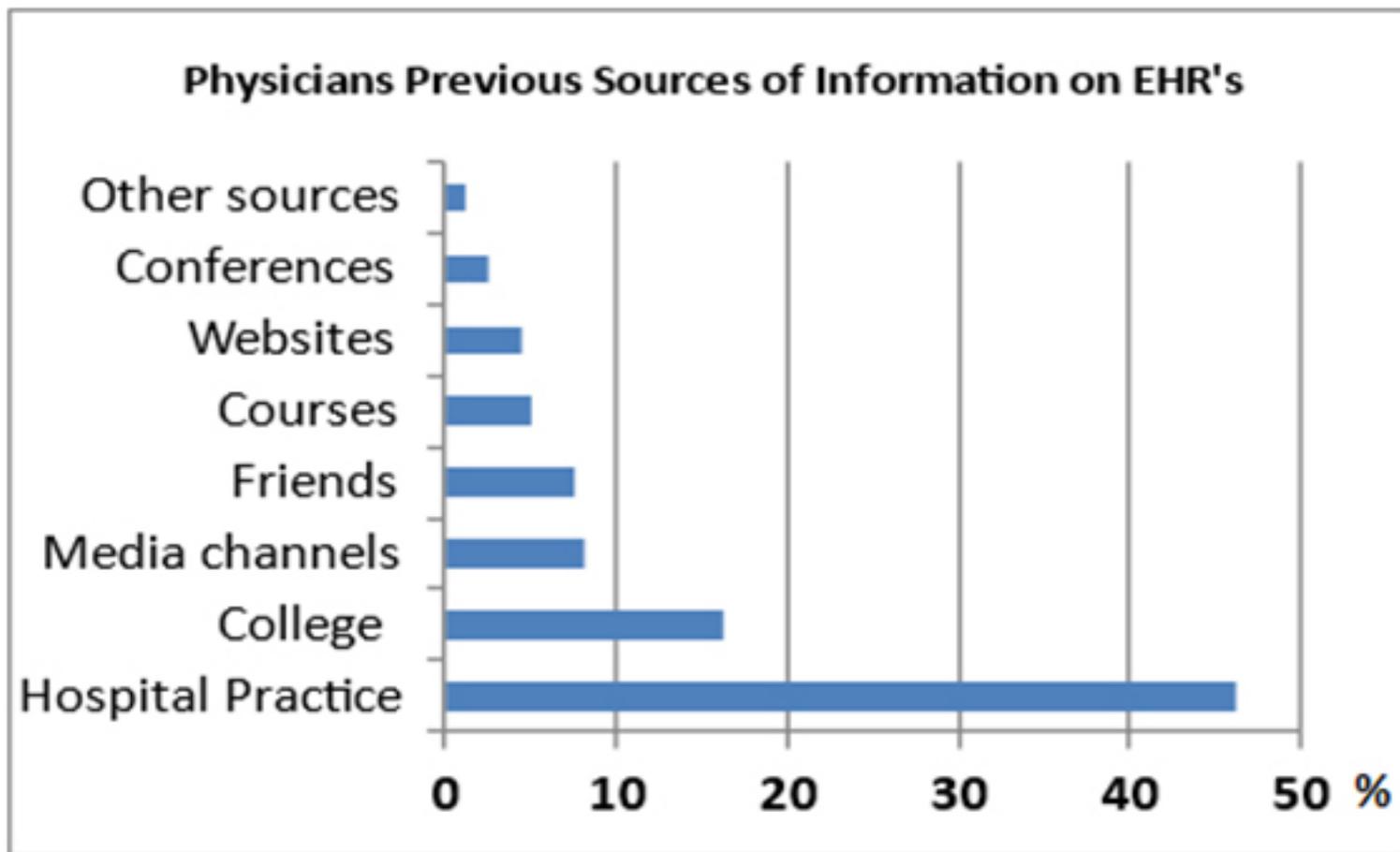
Variables	B	Standard Error	Standardized Beta	t-value	p-value
(Constant)	3.000	0.275		10.899	0.000
Age	-0.267	0.089	-0.332	-3.010	0.003
Sex: Male	0.066	0.107	0.041	0.620	0.536
Job: Specialist	0.137	0.145	0.087	0.944	0.347
Job: Consultant	0.419	0.213	0.213	1.969	0.051
Nationality: Non-Saudi	0.038	0.107	0.025	0.356	0.722
Yammama Hospital	1.002	0.120	0.669	8.387	0.000
Eman Hospital	0.702	0.139	0.396	5.062	0.000
Previous EHR training: Yes	0.201	0.184	0.076	1.094	0.276

Abbreviation: EHR, electronic health record.

We found a statistically significant difference between physicians' sources of information and their perceived usefulness of the EMR ( $p = 0.005$ ). Alternatively, the Welch adjusted ANOVA F-test showed statistically significant differences between physicians' previous sources of information regarding the EMR and their perceived usefulness of the EMR ( $p < 0.001$ ; Figure 1). A Games-Howell adjusted post-hoc pairwise comparison showed that physicians who reported having received information on the EMR during college training had a significantly higher perception of EMR usefulness than those who either learned from media channels ( $p = 0.006$ ) or from practicing elsewhere ( $p < 0.001$ ).

Those who reported learning from formal channels, such as courses and conferences, were significantly more likely to perceive the EMR as useful than those who learned from media channels such as newspapers, TV, and social media ( $p = 0.043$ ). Additionally, those who learned from practicing elsewhere were significantly more likely to perceive the EMR as not very useful than those who learned from formal training courses and conferences ( $p = 0.019$ ).

**Figure 1. Physicians' perception of electronic medical record and their source of knowledge of the electronic medical record**



## Discussion

A great proportion of the physicians in this study perceived EMRs to be useful and effective in terms of interoperability, and they expected greater technical support and trust in the EMR than those who perceived it negatively. Of note, the participants had either a negative attitude or were undecided about technical support. According to the innovation diffusion process, this is an area for educational and training interventions to ensure positive attitudes and, therefore, lower the risk of failure in adopting the EMR (11). Previous studies conducted in Saudi Arabia found that while physicians and other healthcare professionals were excited to use the EMR, there were concerns about the underutilization of many core functions of the system(17,18).

Our study adds to prior work by studying the predictors that may explain physicians' overall perceptions of the EMR, including barriers that precluded them from adopting the EMR and using it to document patient information.

We found that physicians generally agreed that the EMR facilitated the documentation of patient information, with most agreeing that they would trust information from other hospitals. Additionally, the physicians surveyed believed in the potential of the EMR to decrease patient waiting times and delays. However, we did not determine whether physicians used the EMR at the end of each encounter or during an encounter with their patients. Previous research suggested that EMR use during clinic visits was associated with worse

patient experiences (19). Indeed, a more recent report found that about 49% of primary care physicians and 36% of specialists reported that EMR use worsened the physician–patient interaction (20). Given that close to one-fifth of the physicians in the current survey did not believe that EMR use saved patients' time, it would be worth measuring the negative impact of EMRs on physician–patient interactions.

Prior work indicated that restricted access to technical support and system limitations were perceived barriers to EMR adoption (12). This underscores the need to provide technical support and EHR training to physicians. In fact, we found that physicians who perceived that they would need more technical support were significantly more likely to perceive the usefulness of the EMR. Similarly, physician perception of needing more technical support was significantly associated with a higher perception of the effectiveness of the EMR. Furthermore, we found that learning from educational channels, like courses and conferences, significantly increased perceived usefulness more than when physicians learned from media channels or from practicing elsewhere.

Multivariate linear regression model showed that younger physicians were significantly more likely to perceive greater usefulness of the EMR than older physicians. Our findings are consistent with those of other authors who reported that older physicians were less likely to use the EMR compared to younger physicians (21). Such findings suggest the need to consider individual characteristics such as age when developing strategies for EMR implementation.

Our results are also in line with those of other authors who found that a greater proportion of physician consultants used the EMR compared to residents and specialists (22–24). While there is no clear explanation for our observation, one study conducted in the United States suggested that federal initiatives, which specifically targeted certain subgroups of physicians, may contribute to higher use rates among these subgroups (22). We believe that if residents and specialists are not fully using the EHR of their health institutions, the potential for them to share information to improve health care is compromised. Future studies in our context should investigate why residents may not perceive value in using the EHR and how their perceptions of the EHR can be improved.

Our study has strengths and limitations. The main strength of this study is that the principal component analysis of questionnaire responses showed constructive validity, i.e., the four main concepts logically related to the theoretical construct of the questionnaire. Moreover, Cronbach's alpha is  $> 0.82$ , showing acceptable reliability (16). However, our study has limitations that should be discussed. First, it has all the limitations inherent to cross-sectional surveys. Second, the response rate was 35.5%, which is relatively low but acceptable as it is close to the average response rate for similar studies (average response rate = 35.7% and SD = 18.8) (21).

## Conclusion

Overall, physicians have a positive attitude toward most critical factors that can affect the adoption of the EMR. Additionally, no formal education on the EMR was offered to most physicians. There is a significant relation between physicians' source of information about the EMR and their perception of this technology, with greater perception associated with formal training. We recommend that the Ministry of Health offer an EMR education program targeting physicians to encourage physicians to use EMRs and, consequently, reduce the risk of adoption failure due to physicians' attitudes.

## References

- Garets D, Davis M. Electronic Medical Records vs. Electronic Health Records: Yes, There Is a Difference. *HIMSS Analytics*. 2006;1-14.
- Jones SS, Rudin RS, Perry T, Shekelle PG. Health information technology: an updated systematic review with a focus on meaningful use. *Ann Intern Med*. 2014;160(1):48-54. doi:10.7326/M13-1531
- Ford EW, Menachemi N, Phillips MT. Predicting the Adoption of Electronic Health Records by Physicians: When Will Health Care be Paperless? *J Am Med Inform Assoc*. 2006;13(1):106-112. doi:10.1197/jamia.M1913
- Thompson DI, Osheroff J, Classen D, Sittig DF. A review of methods to estimate the benefits of electronic medical records in hospitals and the need for a national benefits database. *J Healthc Inf Manag*. 2007;21(1):62-68.
- Hollenbeck SM, Bomar JD, Wenger DR, Yaszay B. Electronic Medical Record Adoption: The Effect on Efficiency, Completeness, and Accuracy in an Academic Orthopaedic Practice. *J Pediatr Orthop*. 2017;37(6):424-428. doi:10.1097/BPO.0000000000000679
- Ben-Assuli O. Electronic health records, adoption, quality of care, legal and privacy issues and their implementation in emergency departments. *Health Policy*. 2015;119(3):287-297. doi:10.1016/j.healthpol.2014.11.014
- Han JE, Rabinovich M, Abraham P, et al. Effect of Electronic Health Record Implementation in Critical Care on Survival and Medication Errors. *Am J Med Sci*. 2016;351(6):576-581. doi:10.1016/j.amjms.2016.01.026
- Adler-Milstein J, Everson J, Lee SD. EHR Adoption and Hospital Performance: Time-Related Effects. *Health Serv Res*. 2015;50(6):1751-1771. doi:10.1111/1475-6773.12406
- Castaneda C, Nalley K, Mannion C, et al. Clinical decision support systems for improving diagnostic accuracy and achieving precision medicine. *J Clin Bioinforma*. 2015;5:4. doi:10.1186/s13336-015-0019-3
- Greenhalgh T, Humphrey C, Hughes J, Macfarlane F, Butler C, Pawson R. How do you modernize a health service? A realist evaluation of whole-scale transformation in London. *Milbank Q*. 2009;87(2):391-416. doi:10.1111/j.1468-0009.2009.00562.x
- Rogers E. *Diffusion of Innovations*, 4th Edition. New York, US: Simon and Schuster; 2010. <http://www.simonandschuster.com/books/Diffusion-of-Innovations-4th-Edition/Everett-M-Rogers/9781451602470>. Accessed September 14, 2018.
- Boonstra A, Broekhuis M. Barriers to the acceptance of electronic medical records by physicians from systematic review to taxonomy and interventions. *BMC Health Serv Res*. 2010;10:231. doi:10.1186/1472-6963-10-231
- Castillo VH, Martínez-García AI, Pulido J. A knowledge-based taxonomy of critical factors for adopting electronic health record systems by physicians: a systematic literature review. *BMC Medical Informatics and Decision Making*. 2010;10(1):60. doi:10.1186/1472-6947-10-60
- Altuwaijri MM, Bahanshal A, Almehaid M. Implementation of computerized physician order entry in National Guard hospitals: Assessment of critical success factors. *J Family Community Med*. 2011;18(3):143-151. doi:10.4103/2230-8229.90014
- Khalifa M. Barriers to Health Information Systems and Electronic Medical Records Implementation. A Field Study of Saudi Arabian Hospitals. *Procedia Computer Science*. 2013;21:335-342. doi:10.1016/j.procs.2013.09.044
- Tavakol M, Dennick R. Making sense of Cronbach's alpha. *Int J Med Educ*. 2011;2:53-55. doi:10.5116/ijme.4dfb.8dfd
- Nour El Din M. Physicians' use of and attitudes toward electronic medical record system implemented at a teaching hospital in Saudi Arabia. - PubMed - NCBI. <https://www.ncbi.nlm.nih.gov/pubmed/18706293>. Accessed September 14, 2018.
- Shaker HA, Farooq MU, Dhafar KO. Physicians' perception about electronic medical record system in Makkah Region, Saudi Arabia. *Avicenna Journal of Medicine*. 2015;5(1):1. doi:10.4103/2231-0770.148499

19. Ratanawongsa N, Barton JL, Lyles CR, et al. Association Between Clinician Computer Use and Communication With Patients in Safety-Net Clinics. *JAMA Intern Med.* 2016;176(1):125-128. doi:10.1001/jamainternmed.2015.6186
20. Kruse GR, Hays H, Orav EJ, Palan M, Sequist TD. Meaningful Use of the Indian Health Service Electronic Health Record. *Health Serv Res.* 2017;52(4):1349-1363. doi:10.1111/1475-6773.12531
21. Venkatesh V, Sykes T, Zhang X. "Just What the Doctor Ordered": A Revised UTAUT for EMR System Adoption and Use by Doctors - Semantic Scholar. <https://www.semanticscholar.org/paper/Just-What-the-Doctor-Ordered%3A-A-Revised-UTAUT-for-Venkatesh-Sykes/a04f625de804166567a73dcd67f5615ce0100641>. Accessed September 14, 2018.
22. Decker SL, Jamoom EW, Sisk JE. Physicians in nonprimary care and small practices and those age 55 and older lag in adopting electronic health record systems. *Health Aff (Millwood).* 2012;31(5):1108-1114. doi:10.1377/hlthaff.2011.1121
23. Patel V, Jamoom E, Hsiao C-J, Furukawa MF, Buntin M. Variation in electronic health record adoption and readiness for meaningful use: 2008-2011. *J Gen Intern Med.* 2013;28(7):957-964. doi:10.1007/s11606-012-2324-x
24. Furukawa MF, King J, Patel V, Hsiao C-J, Adler-Milstein J, Jha AK. Despite substantial progress In EHR adoption, health information exchange and patient engagement remain low in office settings. *Health Aff (Millwood).* 2014;33(9):1672-1679. doi:10.1377/hlthaff.2014.0445