



Adoption of unified electronic health record in Saudi Arabia: The residents perspective



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ABSTRACT

The government of Saudi Arabia has been working on the development of eHealth in the country which includes, the move from paper-based health records to Electronic Health Records (EHR). But, the implementation of EHR in the country is not much progressed. The present paper aims to measure adopting a unified electronic health record in Saudi Arabia from the resident's perspective. The descriptive study was conducted by the survey method in Saudi Arabia. The primary data was collected using a structured questionnaire. Self-administered online questionnaires were distributed to 300 respondents in various provinces via social media over a period of three months. The study used a Convenient Sampling technique and received 158 valid questionnaires from the respondents with a response rate of 58.66%. The data were analyzed using SAS version 0.4. The results show that 98.07% of the male participants and 88.88% of the female respondents were expressed their acceptance towards the adoption of EHR at the national level, whereas 68.26% of the male and 66.66% of the female respondents were expressed their acceptance at the global level. The study conducted the Logistic Regression and found no statistically significant differences between the gender, region, and education level of the respondents and acceptance of adoption of unified EHR at the national and global level. The study found that Saudi Arabia residents are supporting the adoption of unified EHR at both national and global levels. The findings are useful for policymakers to understand the people's perceptions about the adoption of unified EHR in the country.

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1. Introduction

With advancements in Information Technology, the application of Electronic Health Records (EHR) in health data management became an essential element of modern hospitals. An EHR refers to the complete set of information that resides in electronic form and is related to the past, present, and future health status or health care provided to a care subject. EHR's main purpose is the documentation, retrieval, transmission, linking, and processing of multimedia information to legitimate users for the delivery of knowledge and decision support that enhance efficient and secure health-related services, regardless of the healthcare model applied (Katehakis and Tsiknakis, 2006). According to

Healthcare Information and Management Systems Society (HIMSS), an EHR is a longitudinal electronic record of patient health information generated by one or more encounters in any care delivery setting (HIMSS, 2017). However, an EHR system includes demographic information, progress notes, complaints, medications, vital signs, laboratory results, past medical history, surgeries and procedures, immunization, and radiology reports (Ronquillo, 2012; Jha, 2011; Seto and Friedman, 2012; Menachemi and Collum, 2011).

The awareness about the advantages of implementing EHR has increased with the Health Information Technology for Economic and Clinical Health (HITECH) Act, 2009 (Ronquillo, 2012; Esquivel et al., 2012). An EHR's application can improve the management of patients' related data, reduce errors, and improve the overall quality of health services (Ronquillo, 2012; Jha, 2011). However, the literature review on EHR provides that the human, professional, technical, organizational, financial, and legal, and regulatory barriers are some issues in implementing EHR (Khalifa, 2013).

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Nevertheless, the revolution in EHR is challenged by issues related to security, patients' confidentiality, and identification.

1.1. Significance of electronic health record

The adoption of Electronic Health Records has become necessary due to its advantages over paper-based medical records in hospitals. The paper-based health record may increase the error due to improper documentation (Menachemi and Collum, 2011). A paper-based health record system is time-consuming and complicated. Physicians must review complex charts to understand the patient's case, especially in cases of referrals (Zheng et al., 2011). Moreover, the paper-based referral systems allow for limited sharing of clinical information, are difficult to be sorted and accessed (Esquivel et al., 2012). In the case of EHRs, it is easy to access, eliminating poor penmanship (Menachemi and Collum, 2011). Another crucial issue with paper-based medical records is that an inaccurate interpretation of hand-written instruction, especially in an in-patient setting, led to severe complications (Winslow et al., 1997; Rodríguez-Vera et al., 2002). Though the adoption of an EHR provides many potential advantages, three functionalities hold great promise in improving the overall quality of healthcare and reduce the cost of the healthcare systems, i.e., Clinical Decision Support System (CDSS), Computerized Physician Order Entry system (CPOE), and Health Information Exchange System (HIE). These three capabilities and other EHR potential benefits meet the fundamental requirement of the HITECH act 2009 (Menachemi and Collum, 2011).

However, the success of the EHR and Information Exchange System depends on its recognition of an increasing demand to remain patient-centered and responsive to clinician needs (Esquivel et al., 2012). The coding system used in EHR improves the quality of documentation and increased adherence to treatment guidelines (Delaney et al., 2012). Moreover, an EHR facilitates research activities that require the extraction of clinical data. It also facilitates the consenting process of research subjects because it allows for patient-doctor interaction. The consent form will be electronically stored and subjects can be easily identified if needed urgent care (Hoffman and Williams, 2011). If an EHR is updated continuously, it can provide a rich source to obtain data at both prospective and retrospective manners, which constitutes the foundation for a substantial longitudinal database that allows researchers to study the risk factors of common diseases, determine the course of the disease, and identify eligible subjects for clinical trials. The utilization of an EHR for research purposes should reduce the drop-out rate and facilitates recalls (Zheng et al., 2011). An EHR is important to monitor epidemic outbreaks, endemic, and elevate preventive protocols. The outcome of a particular medication or regime is best examined by investigating the

patients' responses. An EHR also is valuable in determining the population's attitude toward health practice. The overall rare disease pattern can be selected from data extracted from an EHR is also important for disease surveillance.

The organizational outcomes of an EHR implementation focus on cost reduction, revenue increase, and improved legal and regulatory compliance (Menachemi and Collum, 2011).

Increasing revenue is related to an improved billing system due to accurate documentation and close monitoring of cash flow (Erstad, 2003; Mildon and Cohen, 2001; Agrawal, 2002). The reminder system generated by an EHR improves patients' compliance to recall and follow-up visits (Agrawal, 2002). Cost reduction is related to access patient data electronically, eliminating the cost for mailing and faxing (Menachemi and Collum, 2011). Public health researchers are actively utilizing electronic data aggregated across populations to address health concerns and establish a strategic scheme for prevention and management. Patients' can access the results of their laboratory results and receive personalized recommendations (Menachemi and Collum, 2011).

The government of Saudi Arabia has been working on the development of eHealth in the country which includes, the move from paper-based health records to Electronic Health Records (EHR). In 2008, the government of Saudi Arabia declared its eHealth as a priority, but the implementation of EHRs in Saudi health care institutions remains low (AlSadrah, 2020). There are hardly any works available on the perception of Saudi residents about EHR. In this context, the present paper mainly aims to measure the adoption of unified electronic health records in Saudi Arabia from the resident's perspective.

2. Methods

The study is descriptive and based on primary and secondary data. The preliminary data was collected using a structured questionnaire using a convenient sampling technique. A self-administered online questionnaire was distributed via social media for over three months. The participants were Saudi citizens who were computer literates over the age of 18 years. The questionnaire was anonymous, and no personal information was collected. In order for participants to view the questionnaire, it was mentioned that the participant should agree to the introductory statement, which highlighted the topic of the study and ethical statement.

The questionnaire was composed of 16 questions and a mixture of open-and closed-ended questions. It includes details about the demographic characteristics and opinions of participants on the concept of unified medical records at the national and global levels. It was also mentioned that the questions related to demographic characteristics and justification of participants' opinions were optional.

The study targeted to collect 300 questionnaires from various provinces of Saudi Arabia, such as Northern, Central, Eastern, Western, Southern, and from the respondents who are not living in Saudi Arabia. After the distribution of online questionnaires via social media by expecting at least 50 responses from each province, including respondents who are not living in Saudi Arabia, the study received 158 valid questionnaires with a response rate of 58.66%. The participants' responses were quantified for the purpose of analysis. The number of children was matched to the marital status, and the responses were censored for those whose marital status is single. The data were analyzed using SAS version 0.4. The descriptive statistics were carried out to determine the demographic characteristics of the study respondents. The Linear Logistic Regression was performed to determine the association between the gender, region, and education level and acceptance of adoption of unified EHR at the national and global levels.

3. Results

The study received a total of 158 questionnaires from the respondents in a period of three months. The mean age of respondents was 30.51 years old. The majority of the participants belong to the age group that falls between 30 and 35 years. The majority of participants were male (65.82%). The respondents' distribution concerning marital status shows that nearly more than half of the participants were married (55.06%). The average number of children among married participants was approximately 3. Bachelor's degree holders constitute slightly more than fifty percent of the study populations i.e. 51.89%. Table 1 summarizes the demographic characteristics of the study population.

The study received responses from various Saudi Arabia provinces, such as Northern, Central, Eastern, Western, Southern, and from the respondents who are not living in Saudi Arabia. The majority of respondents were from Northern and Central provinces. Out of the total respondents, 25.94% and 24.05% were from the Northern and Central regions, respectively.

The results show that out of the total male participants (104), most of them would like to prefer to visit the private hospital (49.05%), followed by emergency departments at a government hospital (28.84%), Ministry of Health primary care clinic (16.34%) and lastly family physicians (5.76%) in case of unexpected medical events. In the case of female respondents (54), most of them would like to prefer to visit the private hospital (50%), followed by emergency departments at a government hospital (29.62%), Ministry of Health primary care clinic (12.96%), and lastly, they call for an appointment (7.40%) in case of unexpected medical events.

The results show that more than fifty percent (55.69%) of the respondents are not interested in

seeking treatment from the hospitals located outside their city/province. However, out of the total male respondents (104), 35.57% and 27.77% of the female respondents (54) seek treatment from the hospitals located outside their city/province.

Table1: Demographic characteristics of the study population

1- N=158	
Age (\pm SD)	30.51 (\pm 10.48)
2- Age group:	
• Age<20	15
• 20 \leq Age<25	34
• 25 \leq Age<30	31
• 30 \leq Age<35	37
• 35 \leq Age<40	18
• Age \geq 40	23
3- Gender:	
• Male	104
• Female	54
4- Marital Status:	
• Married	87
• Not married	71
No. of children (\pm SD)	2.78 (\pm 2.42)
5- Highest level of education:	
• Graduate/post-graduate studies	33
• Bachelor degree	82
• Post-secondary education	19
• High school certificate	20
• Less than high school	4
6- Province:	
• Northern	41
• Central	38
• Eastern	17
• Western	27
• Southern	14
• Not living in Saudi Arabia	21

SD: Standard Deviation

The results show that out of the total male and female respondents, nearly fifty percent of the male respondents, i.e. 46.15% and 50% females, reported that they had faced difficulties obtaining medical records in hospitals. However, a relatively 35.57% male and 33.33% female respondents said they did not need to request a healthcare facility's medical record.

The study attempted to measure the respondents' level of acceptance about adopting EHR at the national and global levels. The results show that out of the total male participants, 98.07% of the respondents were expressed their acceptance towards the adoption of EHR at the national, whereas 88.88% female respondents. However, it was a bit less compared to male respondents were expressed their acceptance towards the adoption of EHR at the national. When it comes to adopting EHR globally, 68.26% of the male and 66.66% of the female respondents have expressed their acceptance. However, a relatively 31.73% male and 33.33% female respondents have not expressed their acceptance of adopting EHR globally. It is found that the reasons for not accepting the adoption of EHR at the global level are the issues related to the patients' privacy and confidentiality and technical issues.

However, interestingly, more than fifty percent of male and female respondents, 56.73% and 57.40%, respectively prefer the mandatory unified electronic

health record systems at the national and global level, whereas 34.61 male and 35.18% of female respondents prefer that it must be optional if the government has approved the unified electronic medical record system. Table 2 summarizes the distribution of study parameters with respect to gender.

Table2: Distribution of study parameter with respect to gender

	Male	Female	Male
1-Age group:			
• Age<20	9	9	
• 20≤ Age<25	20	14	
• 25 ≤ Age<30	16	15	
• 30≤ Age<35	32	4	
• 35≤ Age<40	11	5	
• Age≥40	16	7	
2-Marital status:			
• Married	65	22	
• Not married	39	32	
3-Province:			
• Northern	25	16	
• Central	23	15	
• Eastern	11	6	
• Western	15	12	
• Southern	12	2	
• Not living in Saudi Arabia	18	3	
4-In cases of unexpected medical events:			
• Visit the Ministry of Health primary care clinic	17	7	
• Visit the emergency department at the government hospital	30	16	
• Visit family physician	6	0	
• Call for an appointment	0	4	
• Visit a private hospital	51	27	
5-Do you receive treatment at hospitals outside your city			
• Yes	37	15	
• No	55	33	
• I do not know	12	6	
6- Is it difficult to obtain a medical report			
• Yes	48	27	
• No	19	9	
• I did never needed to request a medical report	37	18	
7-Do you prefer the adoption of unified electronic health records at the National level in Saudi Arabia			
• Yes	102	48	
• No	2	6	
• I do not know	0	0	
8-Do you prefer the adoption of unified electronic health records at the Global level			
• Yes	71	36	
• No	33	18	
• I do not know	0	0	
9-If the unified electronic medical record system has been approved by the government, do you prefer that it becomes national and global level:			
• Optional	36	19	
• Mandatory	59	31	
• N/A	9	4	

N/A = Not applicable

The logistic regression was carried out to determine the association between the gender, region, and education level and acceptance of adoption of unified EHR at the national level. Regardless of the observed differences in the percentage of responses between males and females, there was no statistical significance difference at the gender level. Although the distribution of response

across different regions, logistic regression analysis indicated no statistically significant difference across various areas in relation to acceptance of adoption of unified EHR at the national level. Similar findings were reported concerning the educational level and found no statistical significance difference. Table 3 summarized the logistic regression output that examined the association between gender, region, and education level of the respondents and acceptance of adoption of unified EHR at the national level.

Table 3: Association between gender, the region of residence, and educational level and acceptance of adoption of unified EHR at a National level

Parameter	Odds ratio	S.E*	95% Confidence interval
Gender:			
Male	1(Reference)		
Female	3.188	0.93	0.516-19.71
Region:			
• Northern	1(Reference)		
• Central	2.22	1.25	0.19-25.58
• Eastern	<0.001	397.30	<0.001->999.999
• Western	1.54	1.43	0.092-25.693
• Southern	<0.001	685.90	<0.001->999.999
• Not living in Saudi Arabia	2.00	1.44	0.119-33.665
Educational level:			
• Bachelor degree	1(Reference)		
• Graduate studies	5.226	1.24	0.457-59.710
• Associate degree	4.500	1.44	0.27-75.38
• High school	3.857	1.44	0.23-64.26
• Less than high school	<0.001	1384.2	<0.001->999.999

*S.E = Standard Error

The logistic regression analysis that examined the association between gender, region, and education level of the respondents and acceptance of the adoption of unified EHR at a global level showed no statistically significant difference between males and females, different regions in Saudi Arabia, and different levels of education. Table 4 summarized the logistic regression output that examined the association between gender, region, and education level of the respondents and acceptance of adoption of unified EHR at the domestic level.

4. Discussion

The growing use of EHR is primarily motivated by the need for improving the quality of services in healthcare. The HITECH act, 2009, sets the foundation for the wide implementation of EHR [1, 2, 3]. However, the growing implementation of EHR unveiled the need to revise the number of inherent characteristics of current systems. The current EHR systems are institution-based that allow limited data sharing outside the institution, affecting the overall functionality and interoperability.

Despite the growing significance, there is less focus on the study of EHR. Hence the present study attempted to measure the level of acceptance and understanding of the concept of unified medical records at the national and global levels among the residents of Saudi Arabia.

The study found some exciting and valuable results. The study tried to understand the preferences of the respondents in cases of unexpected medical events. Interestingly the study identifies that the majority of participants prefer to visit private hospitals in case of unexpected medical events. It is found that the first preference for both male and female respondents is private healthcare facilities because of the shorter waiting time and quicker service. An emergency department at government hospitals is preferred as a secondary option for both male and female respondents in cases of unexpected medical events. The second option chosen by either gender can be explained by the ease of access and personal preference, but it requires further investigation.

Table 4: Association between gender, the region of residence, and educational level and acceptance of adoption of unified EHR at a global level

Parameter	Odds ratio	S.E*	95% Confidence interval
Gender:			
Male**	1(Reference)		
Female	1.24	0.35	0.62-2.47
Region:			
• Northern	1(Reference)		
• Central	0.69	0.45	0.29-1.68
• Eastern	1.34	0.65	0.38-4.78
• Western	0.52	0.52	0.19-1.44
• Southern	<0.001	646.80	<0.001->999.99
• Not living in Saudi Arabia	0.21	0.71	0.05-0.82
Educational level:			
• Bachelor degree	1(Reference)		
• Graduate studies	1.01	0.44	0.43-2.39
• Associate degree	1.51	0.51	0.55-2.11
• High school	1.49	0.48	0.58-3.86
• Less than high school	<0.001	1283.40	<0.001->999.99

*S.E = Standard Error

The study found that more than fifty percent of the respondents are not interested in seeking treatment from the hospitals located outside their city/province. This may be because of increasing media reports about the consumers' dissatisfaction with the quality of off-province referrals. The results show that 32.91% of the respondents, both male, and female, are interested in seeking treatment from the hospitals located outside their city/province. Adopting the EHR could benefit those who want to avail themselves of the medical services from outside their city/province.

The study shows other exciting results about obtaining medical records, which is an essential issue in hospitals. The results show that nearly fifty percent of the respondents (47.46%) had faced difficulties getting medical records in hospitals. However, the adoption of EHR could solve some/most of these issues in hospitals.

The majority of participants supports the adoption of unified EHR at the national level because they think it would improve referral procedure and data sharing and archiving, facilitate tracking of patients' history and medications by healthcare

professionals, save time, allows patients to continue on-going treatment at any health facility if they had to change their residence. Nearly almost all the respondents (98.07%) were expressed their acceptance towards the adoption of EHR at the national. Roughly three-quarters of participants supported the global unification of EHR systems in order to be able to obtain 2nd opinion from international expertise, facilitate collaborative research activities, and allow for easier retrieval and sharing of patient data. However, the remaining quarter of participants not favored adopting unified EHR at a global level because they fear breach in patients' confidentiality and privacy, associated technical problems, and language barriers.

However, the present study has few limitations, such as a small sample size, which could be related to the inherent low response rate associated with an online questionnaire and shot time; hence the results may not be generalizable, or it needs more in-depth study by covering more sample and time frame.

5. Conclusion

The present study attempted to study the significance of an EHR and measure the level of acceptance to adopt a unified electronic medical record among Saudi Arabia residents. The study found that Saudi Arabia residents support the adoption of unified EHR at both national and global levels. The present study also found that there were no statistically significant differences between the gender, region of residence, and education level, and acceptance of adoption of unified EHR at both national and global levels. Proper adoption of the unified EHR can increase the exchange and use of information among various health care organizations. However, challenges associated with patients' privacy and confidentiality and technical issues will limit the wide adoption of a unified EHR system until a user-friendly platform allows for controlled data sharing with maximum security. The study's findings could be useful for any proposal for developing an operation system-friendly platform that allows for the adoption of unified EHR at Kingdom levels where it could be supervised by the Ministry of Health and, subsequently, at a global level.

Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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