

# Solutions to Overcome Technical and Social Barriers to Electronic Health Records Implementation in Saudi Public and Private Hospitals

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**Abstract. Background:** The Kingdom of Saudi Arabia (KSA) is one of the countries facing several barriers for implementing electronic health records (EHR) in public and private hospitals. Such barriers can be social, technical, managerial, financial, organizational or even political [1]. Previous studies identified a number of such barriers in Saudi hospitals. This study aims at identifying solutions to overcome both technical and social barriers hindering EHR implementation in the Saudi public and private hospitals.

**Research Design:** A quantitative questionnaire was designed and used to collect data from six public and private hospitals in Jeddah city, where 30 questionnaires were distributed among staff of each hospital.

**Results:** A total of 114 (76%) completed surveys were received, while only 84 (56%) were considered for the purpose of this study, and 30 were excluded due to unreliability.

**Conclusion:** The solutions, concluded by this study, offer solutions to overcome the technical and social barriers hindering EHR implementation in KSA. Lack of knowledge and experience in using EHR systems is considered the most important barrier of all. Solutions to overcome such a barrier were suggested, which can also help in overcoming other EHR barriers in Saudi hospitals. Moreover, further considerations and investigations are required to overcome other barriers to facilitate a complete and successful implementation of EHR to assist in improving the healthcare service delivery process.

**Keywords.** Electronic Health Records, barriers to implementation, solutions and Saudi Arabia.

## 1. Introduction

Numerous hospitals worldwide have implemented EHR systems to increase efficiency of the data recording process [2]. Some hospitals have successfully implemented EHR systems whilst others have not [3]. However, it is crucial to identify the barriers in order to attain successful EHR implementation [2]. KSA is currently working to achieve safe and successful EHR implementation in several hospitals [4].

KSA has a highly-developed healthcare system with more than 400 public and private hospitals serving the Saudi population [4]. Published literature indicate that the majority of the Saudi health organizations manage patient records manually using a

paper-based system [4]. The reason for such low use of EHR systems, in KSA, is that there are several technical, social, managerial, and financial barriers that inhibit EHR implementation and development [4].

Currently, there is no Saudi national EHR system in place, and most hospitals and clinics use the “pen and paper” trail for recording patient information [5]. However, some major hospitals have implemented complete EHR system, such as King Faisal Specialist Hospital and Research Centre (KFSH & RC) in Riyadh, and the National Guard Health Affairs (NGHA) hospitals [4]. Furthermore, some hospitals use basic EHR systems in order to manage regular tasks such as patient admissions [4]. In 2000, the Health Reform Committee was formed to review the Saudi healthcare system, and discuss lack of technology applications to manage patient health records in hospitals and clinics [6]. The committee submitted recommendations to improve the Saudi health informatics statutes [6]. Some of recommendations included establishing health informatics centres, creating a professional society and enhancing the Telemedicine network [6].

Previous studies identified various factors behind the low use of EHR systems in KSA [7]. A key factor is that the Saudi hospitals implement and use different systems that complicate interoperability solutions [7]. Moreover, most of such systems focus on administrative aspects rather than clinical informatics initiatives [4]. Most importantly, all the initiatives and efforts, regarding EHR and health informatics, are neither coordinated nor cooperative, accordingly, causing relevant difficulties and obstacles to achieve quality EHR isolations [6]. Nonetheless, the Saudi Ministry of Health (MOH) has been focusing on this issue, and emphasizing the importance of adopting a unified information system in hospitals that can ultimately link all hospitals within the MOH jurisdiction [8].

As mentioned above, there are several barriers hindering EHR implementation in Saudi hospitals. These include social, technical, financial or organizational factors [4]. Most of such barriers are considered significant factors negatively-affecting EHR implementation [7]. For instance, high cost of EHR implementation, lack of awareness of importance and usefulness of EHR systems, and hospital policies and awareness of patient information confidentiality [7].

Furthermore, as the adoption of EHR systems is increasing rapidly worldwide, this study suggests solutions to overcome, or minimise, social and technical barriers in order to support any future EHR implementations in KSA. Therefore, this study was designed to examine barriers that hinder developing EHR use in KSA. The main focus was on the social and technical barriers, and determining possible strategies to overcome them. Such a study would assist current or new EHR implementations in KSA. It can also assist in EHR implementation in other countries that are facing similar technical and social barriers, such as the neighbouring Gulf and Middle Eastern countries. Furthermore, it would help IT experts to identify which aspects of EHR systems need improvement, and what types of improvement are supported by EHR users.

The relevant literature indicates that there are five technical barriers, and two social barriers, hindering EHR implementation in KSA [4]. Since the aim of this study is to identify solutions and strategies to overcome technical and social barriers, nature of such barriers are further explained in the following literature review.

**Instability of EHR vendors** was one of the most significant barriers to adopting EHR systems in KSA [4]. Some physicians, and other healthcare providers in Saudi hospitals, assume that EHR system vendors are constantly replaced by others that have more improved systems. They also assume that this would create difficulties, for EHR users, to frequently adjust to constantly-changing software systems [4]. According to recent studies in the United States, this barrier can be solved if the hospital management, and the IT team, select the best vendor in the market (9). Additionally, hospitals need to plan for obsolescence and undertake regular minor improvements and updates to the system [9]. There will always be new and improved systems in the market, and this is why instability of EHR vendor is considered a significant barrier [9]. Thus, it is essential to consider an effective strategy to overcome this issue [9].

**Inferiority and complexity of EHR software** was the second technical barrier identified in the literature [4]. In some Saudi hospitals, the implemented EHR software does not have all the required features [7]. According to an investigation by Vreeman et al. (11), inadequate and complicated software is a critical factor that can lead to failure of EHR implementation and adoption. For example, the Texas Institute for Rehabilitation and Research (TIRR) reported that EHR users are constantly facing problems and difficulties with the system [10]. Furthermore, some users could not use or access the system until other users finish using the system [10]. Accordingly, users struggle with the system, and ultimately demand an instant solution or system replacement [10]. If EHR software has the ability to support clinical activities without disturbing service workflow, this would support EHR implementation within organizations, and would help with overcoming the software barrier [11]. It is also worth-mentioning that having adequate and superior software can save around 30% of potential expenses such as labour costs and supporting programs [12].

**Security concerns in accessing and using EHR systems** were the third technical barrier identified by previous research [4]. According to a study, a number of physicians, and EHR users in KSA, believe that the implemented EHR system does not have the ability to offer secure access to patient records [4]. In order for any healthcare organization to overcome this barrier and guarantee patient privacy, the organization need to develop internal privacy and security rules for EHR users, and penalties for anyone who breaches such rules [11]. In Norway, a study concluded that security concerns comprise a significant barrier for EHR systems, and decreases the overall benefits of the system [13]. In 2004, the Department of Computer and Information Science, in Norway, developed a method to "semi-automate" EHRs [13]. This method offered the ability to store and retrieve patient information without validating a patient's privacy, by using abbreviations of any sensitive information in the system [13]. Thus, secure access to EHR systems is achievable if appropriate strategies were applied.

**Lack of adopting standardized and uniformed systems** was the fourth technical barrier identified in the literature [4]. There is a concern amongst some Saudi healthcare personnel regarding the linking of EHR systems, together with other

departments or even other healthcare organizations [4]. The reason for their concern is the lack of a standardized system or software in Saudi hospitals [4]. Lack of systems interoperability creates additional barriers for EHR adoption [14]. In Canada, the federal government has established the Infoway organization to develop, support, and offer solutions for EHR implementation [15]. Infoway has a special department called the Infoway Standards Collaborative (SC) [15]. The SC ensures that EHR systems amongst hospitals have the ability to interoperate, and sustain the availability of uniformed standards and maintenance services for EHR standards [15]. By implementing such a system, it is easier for healthcare organizations to choose the most convenient software that will eventually be linked to other organizations [15]. Therefore, concerns regarding EHR standards would be decreased, and more hospitals would be encouraged to adopt EHR systems, if a similar system was implemented [15].

**Lack of backup plans in downtime or maintenance periods** was the fifth and last technical barrier identified in the literature [4]. This barrier was considered as a significant barrier to EHR implementation in a number of Saudi hospitals [4, 16]. Therefore, there is a need for essential operating procedures in case of sudden breakdowns or outages [12]. In the USA, a study reported that 44% of hospitals, that do not have EHR systems, indicated high maintenance costs, where such costs acted as a barrier to use EHR systems [12]. In order to overcome this maintenance burden, there is a need for operating procedure in situations of sudden breakdown. This is because the used hardware, or even networks, may breakdown at any time [12]. In this regard, sufficient annual-budget funds need to be allocated for regular repairs to avoid any risks or errors in the future [3]. Additionally, it would be more effective if the relevant IT services plan for regular upgrades and continuous monitoring of the system performance and effectiveness [11]. Having reviewed the identified technical barriers of EHR implementation in Saudi hospitals, the social barriers will be presented below.

**Resistance to using new technologies** was one of the two social barriers identified to be obstructing EHR implementation in KSA [4]. As part of any organizational change, various employees resist new systems [17]. Some staff members may refuse to use new technology such as EHR system [18]. This type of negative attitude is one of the barriers to EHR implementation in some Saudi hospitals [7]. In the US, several studies have identified resistance to electronic systems such as EHRs [19]. The same study also mentioned that such a resistance is very common, and it hinders EHR adoption [19]. Recent research reported that various physicians refused the use electronic systems in hospitals because they assume that these systems will disturb workflow [20]. Furthermore, some physicians assumed that a “pen and paper trails much faster, and it is time-consuming to implement such a system due to the required training sessions to learn how to use it [20].

**Lack of knowledge and experience in using computers amongst healthcare personnel** was the second identified social barrier [4]. It was found that a correlation, between the fact that some of the physicians and other healthcare providers who have neither the required knowledge of EHR software nor experience with the use of computers, and the necessary level for the success of EHR implementation in Saudi hospitals, does exist [4]. Various studies have shown that when individuals do not have the required skills and knowledge to use computers and electronic systems, such as EHRs, their organizations have failed to adopt the new system [19]. In Germany,

various health organizations have reported similar difficulties in adopting EHR systems [15]. Examples of these difficulties include unqualified users, insufficient time to introduce and plan the implementation, and lack of focus on physicians and EHR users and evaluating their usage [15]. The literature indicates that such difficulties can be solved by establishing change-management programs from the outset of the implementation [15]. It was also indicated that difficulties could be overcome through other approaches [15]. In this regard, such approaches may include providing sufficient attention to EHR users through considering their needs and concerns as an effective tool that can support a successful implementation [21].

## **2. Aims and Objectives**

The aim of this study is to investigate the extent of barriers to implementing EHRs in KSA, particularly social and technical barriers, in order to determine possible solutions to overcome them.

## **3. Research Design**

The study was conducted in 2010. A cross-sectional questionnaire was deployed. Thirty questionnaire copies were distributed among staff of each of six public and private hospitals in the Saudi city of Jeddah. Those hospitals were chosen based on factors of their longevity, size, bed capacity, and sector. Such a hospital diversity supports better analysis of results, which in turn assists in identifying solutions to overcome technical and social barriers for adopting EHRs in different health organizations.

### *3.1 The study's population sample*

The study's sample included different health personnel such as physicians, nurses, laboratory technicians and scientists, administrative staff, and pharmacists. The participants' identities were kept anonymous to ensure objectivity of their responses, and most importantly, to protect the participants from any potential risks to their careers. Moreover, the participants were only asked to declare their job category, not their job title, which further protected their anonymity.

### *3.2 The questionnaire*

The study questionnaire was designed using guidelines for developing and structuring surveys (22 & 23). In fact, the questionnaire design closely aligns with earlier research of Alanazy (2006), so that comparative results can be discussed and validated [4]. The questionnaire included the following sections:

### *3.2.1 Section A: General Information*

This section required ticking (✓) the appropriate response concerning the participants' demographics such as participant's gender, age group, and English language level.

### *3.2.2 Section B: The system and its barriers*

This section also required ticking (✓) the appropriate response indicating aspects such as the availability of EHRs, or any similar system, current EHR barriers, and ranking each barrier according to its priority for a solution, by encircling the sequential number of each priority level, as shown below:

First to be solved <--- 1 ----- 0 ----- -1 ---> Last to be solved.

### *3.2.3 Section C: Strategies and Solutions*

This section also required ticking (✓) the preferred solution, or solutions, to overcome the barriers that were ticked (✓) in the previous section, and rate the effectiveness of each ticked solution. The solution effectiveness rating used the following scale [22].

( ) Poor ( ) Fair ( ) Good ( ) Excellent

### *3.3 Data analysis*

In order to extract, manage, and organize questionnaire data, the Microsoft Excel program was used as a tabulating and analysis instrument. This program was chosen because it has several important functions that can store and calculate data, determine minimum, maximum, and average values, and develop charts [23].

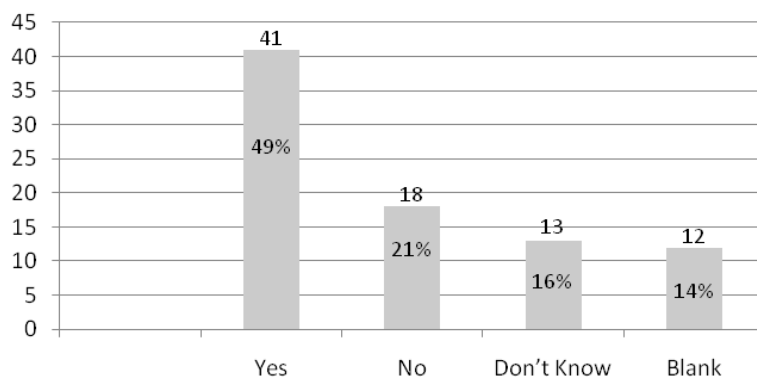
### *3.4 Approvals for questionnaire distribution*

The research project and questionnaire were submitted for ethical approval from the Griffith University Human Research Ethical Committee. An application was submitted to the Saudi Director of Health Affairs (DOHA), Ministry of Health, to approve the questionnaire distribution to health staff. Both approvals were obtained prior to the survey distribution.

#### 4. Results

A total of 150 surveys were distributed (30 surveys per hospital), with 114 completed surveys were received (76% response rate). Out of the 114 returned surveys, only 84 were included and 30 were excluded due to incompleteness or inconsistent responses. Overall, the included and analysed questionnaire response rates were (56%), and (69%) were completed in Arabic language, with the rest being completed in English. More than half of the participants (60%) were between the ages of 20–39 years, with only (14%) aged between 50–59 yrs.

As previously mentioned, the aim of the second section, of the questionnaire, was to identify the EHR system access, function, and associated barriers. Of all respondents, (6%) declared that they did not know if there was any EHR system in their hospitals. Furthermore, the participants were asked if there were any barriers to implementing or improving EHRs, or any other similar systems, at the hospital where they work, with (49%) of the respondents indicating the availability of EHR barriers, as shown in Figure 1.



**Figure 1:** Response rate concerning EHR barriers.

Figure 2, below, demonstrates that the EHR barrier, identified with the highest percentage of (52%) was reflective of lack of knowledge and experience in using computers by the health personnel. Also, the lack of adopting a standardized and uniform system was reflected in the lowest percentage of (37%) as a barrier. In addition, the results show that both technical and social barriers were (19%) more evident in public hospitals than in private Figure 3. Furthermore, Figure 3 shows that, of all barriers, the inferiority and complexity of EHR software were identified by (58%) of private hospital respondents, than in public hospitals (53%).

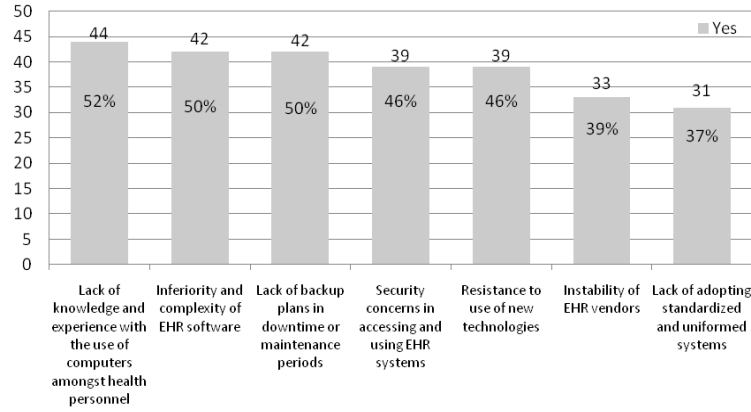


Figure 2: Response rates per EHR-related barrier.

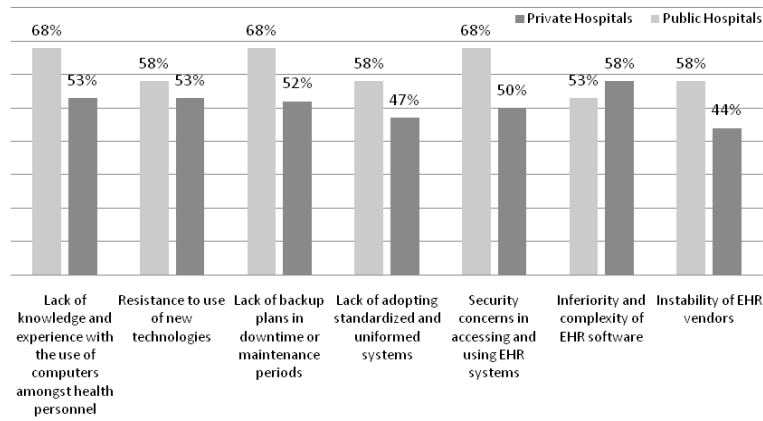


Figure 3: Response rate for each barrier's presence in public and private hospitals.

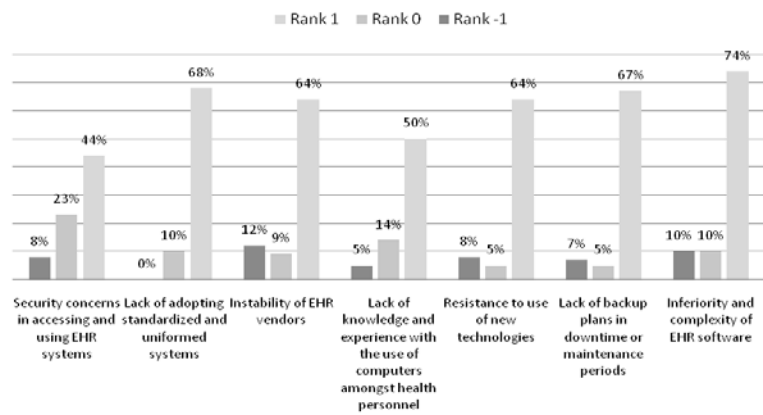


Figure 4: Rank response rate per barrier.

The inferiority and complexity of the EHR software barrier was the highest among barriers identified by (74%) of the respondents. On the other hand, the barrier of security concerns, in accessing and using EHR systems, had the lowest priority (44%) for the need to be solved, Figure 4.

Figure 5 shows the most commonly-accepted solutions that can be used to overcome the EHR technical barriers, as identified by previous research [4]. Solutions were identified from the literature. Of all offered solutions, to the instability of EHR vendors' barrier, Solution "a" was the most identified (51%), where the effectiveness of this solution was ranked "Excellent" by (37%) of all respondents. For the inferiority and complexity of EHR software barrier, both solutions "a" and "b" were identified by (60%) and (61%) of the respondents, respectively.

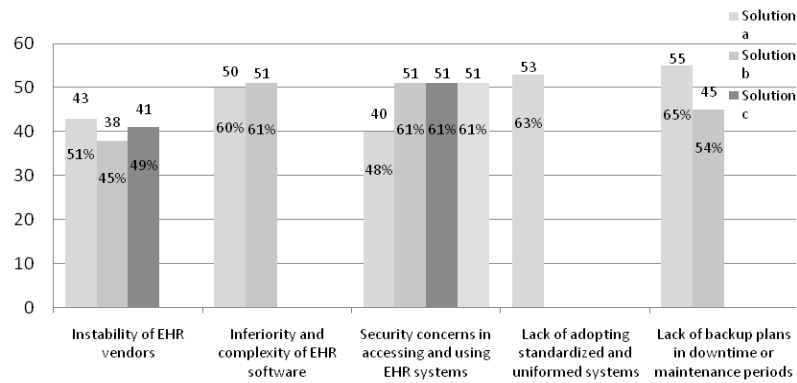
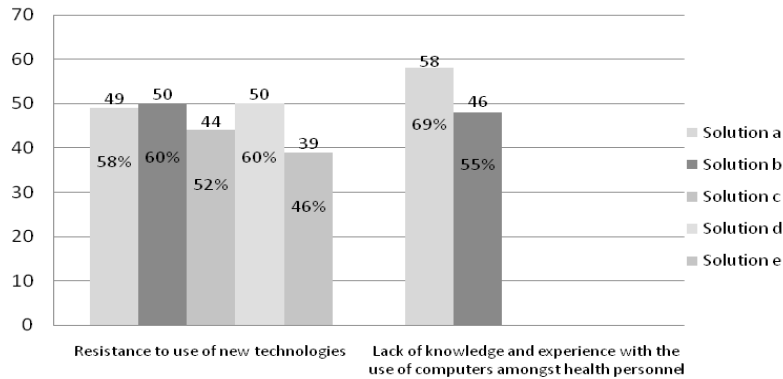


Figure 5: Response rates per solution to technical barriers.

Figure 6 demonstrates the response rate for solution for each of the social barriers identified in previous research [4]. Solutions (b) and (d), as resistance to using new technologies barrier, received acceptance of (60%) of respondents, and the first one was ranked (6%) more as an excellent solution. For solutions to other barriers, the response rate for solution (a) was (69%) and ranked by (59%) as an excellent solution. Solution (b) received (55%) acceptance from all respondents, and (28%) for being excellent on the effectiveness scale.



**Figure 6:** Response rates per solution to social barriers

Figure 6 shows that the effectiveness level for solution "b" is higher than solution "a". Moreover, solution "b" was accepted by (43%) of the respondents, while only (2%) considered it as a poor solution. Furthermore, (36%) of all respondents had ranked collation "a" as "Good", while (6%) ranked it as "Poor".

Furthermore, based on the participant responses, there were other barriers obstructing EHR implementation and development, as listed below:

- Lack of resources such as print papers, ink, etc.
- Lack of human resources, training sessions, password access, and required skills.
- Lack of sufficient number of computers to be used by the staff.
- Time limits, as doctors have to see numerous patients in a limited time.

All of the previously-mentioned barriers were ranked, by the respondents, as major barriers, that have a priority for solutions.

## 5. Discussion

Based on the respondents' job category, the study results showed that (70%) of the excluded responses were from nurses (Fig. 2). A whitepaper presented, in the United States by Anders and Daly (2009), mentioned that until that time, many nurses did not realize the important role and advantages of using EHRs [24]. The same authors also mentioned that if those nurses began to use EHRs, they would save a lot of time and effort, as well as improve their work efficiency. Furthermore, nurses are critical stakeholders who can affect EHR implementation either positively or negatively, and significant attention should be directed to them in EHR adoption [24]. Therefore, it would be better if hospital managements and government bodies pay attention to the nurses' needs, inform them of the advantages of using EHR systems and, last but not least, provide them with training sessions to improve their computer literacy [25].

Another unexpected result was that the average of the returned questionnaires from private hospitals was (70%) and around (30%) from public hospitals. Further research is needed to investigate reasons that the public hospitals are less interested, or involved with EHR issues, than the private hospitals. Similar to the EHR issues with the nurses, consideration and efforts need to target public hospitals more than private hospitals.

Additionally, the study results show that all of the technical and social barriers, identified in published international studies, are still current in Saudi Arabia, with new barriers been identified. The study results present both most and least important barriers based on their priority for a solution. Furthermore, some proposed solutions were well-accepted by the respondents, while others were not.

### *5.1 The barrier of lack of knowledge and experience to use computers by health personnel, and its solution/s*

The lack of knowledge and experience, with using computers as a social barrier, was identified with the highest percentage of all other barriers (Fig. 4). This finding conforms to the one previously identified by other studies (4 & 7). Therefore, this barrier is still present and widespread across healthcare personnel and hospitals in Saudi Arabia. It is also worth-noting that since the response rate of the prevalence of this barrier was (15%) higher in public hospitals than in private hospitals, further considerations and initiatives need to concentrate on the public hospitals to overcome this barrier.

#### **Solution/s**

There were two solutions offered to this particular barrier. However, results of this study show that preparing, educating and training the staff to use a new system was a preferable option for the respondents. This means that there is a need to develop strategies to apply this solution. If a hospital wanted to adopt it, there are a few steps to be considered, before, during, and after the system is implemented [26]. First, the hospital management need to undertake an assessment to determine the level of staff knowledge and computer literacy in the context of EHR implementation [26]. Then, an appropriate training package need to be selected based on the identified staff needs [18]. Finally, there is a need also for a post-training and implementation user evaluation to identify any additional training needs [26]. This would be an important step to ensure that education sessions have fulfilled the stated purposes and goals, delivering improved productivity, efficiency, and effectiveness [18]. Alternatively, governments could consider developing and facilitating EHR education and training sessions through professional development courses at all healthcare departments/schools of universities [27]. Doing so would reduce the training barrier and eventually would eliminate it, since everyone, who graduates to get work in any healthcare organization, will have basic knowledge about using computers and EHRs [27].

### *5.2 The inferiority and complexity of EHR software barrier and its solution/s*

According to the participants' responses, this barrier was the next most important barrier hindering EHR implementation and improvement (Fig. 4). It has also been noticed that healthcare staff struggle with using the EHR software [4]. In this study, (74%) of the users believed that EHR software is too complex to use and that this issue needs to be solved as a matter of priority. The issue also concerns the staff as there are numerous software vendors currently available worldwide, and staff that move between hospitals may have to master different EHR software systems [28].

#### **Solution/s**

Based on the results, two solutions were identified. Both offered solutions have almost the same response rate (60% and 61%) (Fig. 5). Since both solutions are based on each other, they will be considered and discussed below. Several international studies have indicated that testing software performance and quality, prior to the implementation process, is a crucial step [11]. Additionally, this testing process should also be based on specific staff needs [11]. The other solution suggests conducting interviews with users to investigate if the software meets their needs or not [10]. Conducting interviews with users is also a superior strategy to overcome the complexity of EHR software barrier [10]. It is also worth-mentioning that if both previous solutions are effectively implemented, sufficient time to train the staff on the selected software is a necessary step during the implementation process [28].

### *5.3 Lack of backup plans in downtime or maintenance period barrier and its solution/s*

This barrier came third of all barriers, and was (15%) more prevalent in public hospitals than in private hospitals (Fig. 3). This barrier was also previously identified in Saudi hospitals [4]. Since the study results indicated this barrier's priority was high (67%), as the third highest, it is important to examine this barrier and design strategies to overcome it [28]. In 2009, research conducted in the United States also determined that lack of required procedures, for avoiding any system maintenance consequences, is a critical oversight in EHR implementation (32). To address the issue, it is imperative to have routinely tested downtime plans and work procedures, and ensure that there is ongoing funding for system maintenance and enhancement [29].

#### **Solution/s**

This research found that out of the two proposed solutions, establishing operating procedures, in case of sudden system breakdown, had the highest percentage (65%) of all other solutions (Fig. 5). These procedures can include several aspects. For example, the World Health Organization (WHO) has issued a manual, for the developing countries to tackle the issue of EHR implementation. The manual recommended implementing safeguard procedures for the EHR system, including a backup system for all information stored in the system [19]. Another procedure is to develop short- and long-term technical support plans, including regular system evaluation to avoid any potential breakdowns [30].

#### *5.4 The barrier of resistance to use new technologies, and its Solution/s*

The results show that this barrier had a response rate of (46%) for its occurrence (Fig 4). However, the occurrence of this barrier varies slightly from what Alanazy (2006) mentioned before [4]. Alanazy (2006, p. 114) stated that the healthcare personnel, that were included in his study in Saudi Arabia did not consider resistance to new technologies as a barrier, although they believed that technophobia might have an impact on the implementation of EHR systems. It is very common that an individual, or an organisation, resists any type of change, even if they are indicating a willingness to change [31]. Worldwide studies have proven that one of the most common and pervasive barriers, to implementing health information technologies, is staff resistance to a new system. In fact, this study has also confirmed existence of such a barrier in the Saudi hospitals [32].

#### **Solution/s**

As the study results show that most of the response rates of the five offered solutions to overcome this barrier were high (Fig. 6), two of them had high and similar percentages. Participants believed that solving this barrier is more effective by offering strong, committed and positive leadership to lead the implementation process. An adequate, strong, committed and positive leadership team is a critical success factor for EHR implementation [33]. It is also worth-mentioning that the team should consist of an EHR implementation leader, engineers, training supervisors, and client support personnel [32]. By considering all these aspects and issues, it is more likely to reduce and resolve the resistance barrier, while also implementing the system in an optimistic, welcoming environment [32]. The second solution was conducting education and training sessions to instruct the users [32]. Results of this study, added to their consistence with various pervious findings as well, have shown that in order to overcome the resistance to the use of new technologies in hospitals, offering qualified leadership and comprehensive education and training for staff to use the new EHR system, would be an appropriate solutions to overcome this barrier.

#### *5.5 The barrier of security concerns in accessing and using EHR systems, and its solution/s*

The results of the respondents' responses, of this and previous studies [4], have indicated that security concerns in accessing and using the EHR system is a technological barrier obstructing EHR implementation and improvement in Saudi hospitals. Research results [34] examined these concerns too, and stated that healthcare workers at Saudi hospitals are concerned about the confidentiality aspect of patient information in the system. They also believed that paper-based patient record systems are more secure and safe [34]. Taking all of this into account, all these facts imply that this barrier is still present and widespread, and is hindering EHR implementation in Saudi hospitals.

### **Solution/s**

Two solutions were found to have the highest and similar rate of acceptance (60%), and both of them are considered solutions for this barrier (Fig. 5). These solutions are:

- Requiring access passwords from the users:

The acceptance rate for this solution was (71%) as being excellent (Fig. 6). Authorisations and password access is the most secure procedure, as a feature offered by an EHR system [13]. Password access should be addressed by the government through a regulation, and as an essential requirement to be applied by any healthcare organizations planning to implement an EHR [13].

- Securing patient information transmission:

Offering a secure and safe transmission procedure for patients' information is essential for EHR implementation, to ensure such information confidentiality [35]. This secure transmission procedure was addressed by many studies and government bodies such as the Australian Office of the Federal Privacy Commissioner (OFPC), which confirmed its importance [36].

#### *5.6 The barrier of instability of EHR vendors, and its Solution/s*

The response rate for this barrier was (39%) of all responses (Fig. 3), and that the ranking rate for its priority to be solved was (64%) (Fig. 5). The results of previous research also indicated that this barrier was widespread amongst healthcare personnel and they tended to believe that the implemented software is influenced by the EHR provider [4].

### **Solution/s**

The participants preferred and selected two of the offered solutions. The first preferred solution received the highest acceptance (51%), which involved choosing an effective and qualified vendor that offers all the required features (Fig. 6). As there is no doubt about this fact, most of the international successfully-implemented EHR software had considered it [11].

In order to ensure selecting a qualified vendor, several questions need to be asked before deciding and selecting a software vendor [37]. For example, if the vendor have the following characteristics [37]:

- PCs, wireless internet broadband and scanners;
- Ongoing services such as maintenance, consultations, and upgrades; and
- Initial training programs offered to all, or some of, the potential users [28].

Another preferred solution, to overcome the barrier of instability of EHR vendors, was conducting regular minor improvements and updates to the system. This solution was also used and recommended by several studies and experiences of other countries such as Belgium [38]. Yet, all users should be well-informed and retrained if necessary about the new updates to avoid any further complications [39].

### *5.7 The Lack of Adopting Standardized and Uniformed System Barrier and its Solution/s*

This barrier is the last barrier of all the included barriers in this study, and it received the lowest percentage (37%) for its priority Figure 3. This barrier was also previously identified as being an obstacle for further improvements and implementations for EHRs within Saudi hospitals [4, 16]. Standardised, uniform systems and terminologies is an important aspect and need to be considered by EHR implementation managers and policy makers [33]. The reason for its significance is that standardized systems will allow different departments within a hospital and different hospitals to share and link their systems and activate effective interoperability [33].

#### **Solution/s**

Since the barrier is a lack of standardized systems, the only offered solution was selecting software that offers standardized medical terminologies, terms and codes [11]. To ease the selection and identification of the best software that offers these standards, government bodies should be part of this, and be responsible for such investigations based on hospital needs and requirements [30]. This will assist all hospitals achieve interoperability, easily spreading nationwide, and overcoming the lack of adopting a standardized system barrier as well [33]. Since EHR interoperability is very difficult and complicated to achieve [40] and also noting that this barrier had the lowest percentage, it is recommended that other barriers and their solutions be targeted first.

## **6. Conclusion**

Based on participants' perspective, it was considered that the lack of knowledge and experience with using computers barrier was the main barrier of all. These finding is alliance with Alazany's finding in 2006 [4]. This could mean that some of the current or potential users in Saudi hospitals have low knowledge for using EHR systems. Such a finding could assist with future EHR implementations, since the more experienced and knowledgeable the staff; the more they would use the system. Additionally, complexity of the used EHR system was the second barrier obstructing EHR implementations. Participants believed that such a barrier can be solved by testing the system's ease of use prior to the implementation. In addition, participants believed that conducting interviews with the end-users and obtain their feedback regarding the system, is also an essential step to overcome the complexity of the used EHR system barrier. Such interviews would help identifying wither end-users are knowledgeable

and/or experienced to use the system effectively. This could also lead to overcoming the main barrier, which is the lack of knowledge and experience barrier.

Furthermore, providing training sessions to end-users is an approach need to be considered. By having well-trained EHR end-users, this would assist overcoming several barriers such as staff resistance to use of new technology and lack of experience barriers.

All in all, EHR implementation requires consideration of these differences in barrier priority to be solved. Additionally, there is a need for further considerations of other proposed barriers by the participants. This would help to ensure better and more successful EHR adoption, since without a well-structured, planned and effective implementation process, any implementation is most likely to fail sooner rather than later.

It would be beneficial to be aware that successful EHR system implementation consists of more than just implementing a single system. Overcoming current and potential difficulties to these implementations are significant factors for implementation to succeed and last. Solutions from this research may help overcome these factors. Although it would take a long duration for these systems to become widespread nationally in Saudi Arabia, or even in any other country, efforts and considerations need to target overcoming EHR barriers. This is because of the numerous benefits and improvements that would follow.

## **7. Limitation of the Study**

1. No advanced analyses was conducted, due to time constrains.
2. The quantity of the allocated survey was 30 copies in each hospital due to the tight timeframe for conducting this study.
3. The research demographics were only limited to five public and private hospitals in Jeddah, Saudi Arabia.
4. The research population only focused on six different health personnel types, including physicians, nurses, laboratory staff, pharmacists, administrators and receptionists.

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