A Framework for the Adoption of EHRs by Primary Healthcare Physicians in the Kingdom of Saudi Arabia

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Abstract—Implementing Electronic Health Records (EHRs) in primary healthcare has the potential to improve the population health, and to enhance the overall healthcare system of the country. Current policy initiatives in the Kingdom of Saudi Arabia (KSA) are attempting major reforms in primary care with EHRs as a key component. Understanding human factors involved in the implementation process of technology is crucial for its successful implementation. The aim of this paper is to support current policy initiatives by investigating and identifying factors that are likely to affect primary care physicians’ acceptance of EHRs. Factors were identified based on extensive literature reviews and empirical findings. Three main stages of literature review were conducted: (1) factors influencing user adoption of IT, (2) factors affecting physician adoption of EHR, and (3) findings of relevant studies pertaining EHR adoption by physicians in the KSA. As a result, we developed a theoretical framework of eight factors that were proven to have a significant direct influence on physicians’ acceptance of EHRs: attitude, perceived usefulness, perceived ease of use, social influence, computer self-efficacy, perceived threat to physician autonomy, confidentiality concerns, and physician participation. The proposed framework will be of great potential to policy makers to make the transition to EHRs run smoothly.

Keywords—Saudi Arabia; Electronic Health Record; Electronic Medical Record; Primary Care; Physicians; Adoption

I. INTRODUCTION

An Electronic Health Record (EHR) is considered as the backbone integrating various information tools (e.g., computerized physician order entry, clinical decision-support, clinical documentation, digital imagery, patient portals, telemedicine) [1]. Benefits of EHRs have been well documented in the literature (e.g. optimizing the documentation of patient encounters, improving the availability and timeliness of information, reduction of errors) [1, 2]. However, in primary healthcare, an EHR has a specific importance. It improves the management of chronic diseases, facilitates continuity of care, enables reporting of population health, improves preventive care, and allows for the development of patient portals (e.g. personal health records) and adaptive awareness programs for patients [3]–[5]. Therefore, implementing EHRs in primary healthcare has the potential to improve the population health, and to enhance the overall healthcare system of the country [5].

Over the past several decades, many governments have been moving toward EHRs [6]. Particularly, the adoption of EHRs in primary healthcare centers has been a priority in many countries [7]. The healthcare system in the Kingdom of Saudi Arabia (KSA) has lagged significantly in this regard [8]. Primary healthcare centers under the Ministry of Health (MOH) are still using paper-based records and the uptake of Information Technology (IT) is rare [9]. However, recent policy initiatives are attempting major reforms in primary healthcare with EHR as a key component [10].

Studies on EHR implementation have shown the difficulty of the process [11]. The literature reports many cases of failure in EHR implementation due to the lack of end users’ adoption [12], [13]. The majority of EHR projects discontinue in early stages of implementation, with end users’ resistance usually a major contributing factor [1]. Therefore, understanding human factors involved in the implementation process of technology is crucial for its successful implementation.

Little is known about the factors that could increase or hinder healthcare professionals adoption of EHRs in the KSA. To the best of our knowledge, there has been no previous study that identifies these factors in the KSA. Because physicians are the main frontline user-group of EHRs, whether or not they adopt these systems will have a great influence on other user-groups in a primary care center [2].

The focus of this paper is to investigate and identify factors that are likely to influence the adoption of EHRs by primary healthcare physicians in the KSA based on extensive literature reviews and prior empirical studies. The findings of this study will be of great potential to policy makers to tailor implementation strategies toward factors that motivate adoption.

This paper is organized as follows: Section II discusses the methodology used for the construction of the proposed framework. Section III presents and explains the proposed framework, and Section IV discusses the importance of the proposed framework.

II. METHODOLOGY

The aim of this paper is to develop a theoretical framework of factors that are likely to affect the acceptance of EHRs by primary healthcare physicians in the KSA. Three stages were conducted in order to construct the appropriate framework for the current study as shown in Fig. 1. In stage 1, determinants of user adoption of Information Technology (IT) were identified based on theories and models of user adoption of IT. In stage 2,
determinants of physician acceptance of EHRs were identified based on prior theoretical models of physician adoption of EHRs. In stage 3, barriers to physicians’ acceptance and use of EHRs in the KSA were identified based on relevant empirical studies conducted in the KSA.

At the end of each stage, factors identified were filtered in order to remove those irrelevant to the purpose of the current study. Particularly, semantically duplicates were excluded. Also, because EHRs have not been introduced in primary healthcare centers, factors that are not applicable for the pre-implementation phase were excluded. Therefore, the aim of this research is to identify acceptance factors for EHRs, not use, similar to many previous studies [1], [14]–[16]. Because acceptance is the main, and possibly the only, predictor of IT systems use [17], [18], it is crucial to understand what influences acceptance of EHRs.

A. Stage 1: Determinants of User Adoption of IT

A number of theoretical models attempted to facilitate explaining and predicting users’ acceptance and use of a new IT. The most widely used explanatory theories are: the Theory of Reasoned Action (TRA) [19], the Theory of Planned Behavior (TPB) [20], the Technology Acceptance Model (TAM) [17], and the Unified Theory of Acceptance and Use of technology (UTAUT) [18].

Originating in social psychology, TRA [19] and TPB [20] posit that behavior (e.g. technology usage) is determined by behavioral intention (e.g. technology acceptance). According to TRA, behavioral intention is determined by two factors: attitude (i.e. positive or negative feelings toward using a particular system), and subjective norms (i.e. the influence of important others). The TPB is similar to TRA, but it identifies an additional determinant of behavior and behavioral intention: perceived behavioral control (i.e. perceived ease or difficulty of performing a particular behavior).

TAM [17] and UTAUT [18] were designed specifically to measure user acceptance of IT on the job. Similar to TRA and TPB, both TAM and UTAUT posit that technology usage is determined by usage intention (i.e. technology acceptance). According to TAM, usage intention is determined by attitude, which in turn is determined by two factors: perceived usefulness (i.e. the degree to which the system enhances personal performance on the job), and perceived ease of use (i.e. the degree to which the use of the system would be easy). The UTAUT identifies two similar determinants of usage intention to those identified by TAM: performance expectancy (similar to perceived usefulness in TAM), and effort expectancy (similar to perceived ease of use in TAM). However, the UTAUT identifies an additional determinant of technology acceptance: social influence (similar to subjective norms in TRA and TPB). In addition, UTAUT identified an additional determinant to technology usage: facilitating conditions (i.e. the presence of technical and organizational infrastructure to support the use of the system).

Collectively, IT adoption theories identify five key determinants of IT acceptance and use, as follows:

- Attitude toward technology, which is included in three models, TRA [19], TPB [20], and TAM [17].
- Perceived benefits of the system, such as perceived usefulness in TAM [17] and performance expectancy in UTAUT [18].
- Perceived usability of the system, such as perceived ease of use in TAM [17] and effort expectancy in UTAUT [18].
- Social factors, such as subjective norm in TRA [19] and TPB [20], and social influence in UTAUT [18].
- Controllability factors, such as perceived behavioral control in TPB [20], and facilitating conditions in UTAUT [18].
Because facilitating conditions is a determinant of IT usage, not acceptance [18], it is excluded from the proposed framework. Many authors consider facilitating conditions and perceived behavioral control as referring to the same concept [21]. The Decomposed Theory of Planned Behavior (DTPB) [22] decomposed perceived behavioral control into two factors: facilitating conditions and computer self-efficacy (i.e., judgment of one’s ability to use technology to accomplish a particular task). Computer self-efficacy was adapted from Social Cognitive Theory [23]. Based on DTPB’s definition of perceived behavioral control, and because facilitating conditions was excluded from the proposed framework, computer self-efficacy is included in the proposed framework instead of perceived behavioral control.

B. Stage 2: Determinants of Physician Adoption of EHRs

In order to identify prior theoretical models explaining physician adoption of EHRs, we searched three key search engines: Web of Science, PubMed, and Google Scholar. The following search query was used: (Physician AND (Adoption OR Acceptance OR Use) AND (“Electronic Health Record” OR “Electronic Medical Record” OR EHR OR EMR)). Titles and abstracts of the retrieved studies were screened for relevance. Also, the reference lists of the retrieved studies were screened for relevant studies. A study is selected for inclusion if: (1) the study focused on EHR or EMR (i.e., not other electronic systems used in medical practice), (2) the study is peer-reviewed (i.e., unpublished work was excluded), (3) the study is empirical, (4) the study sample is composed of physicians only (i.e., not other user groups), and (5) the study employed a theoretical model. As a result, nine studies were identified [1], [14]–[16], [24]–[28]. A summary of the findings from these studies is provided in Table 1.

Most determinants identified from technology adoption theories were supported by many studies, particularly: attitude [15], [24], perceived usefulness/performance expectancy [14]–[16], [25]–[28], perceived ease of use/effort expectancy [1], [14], [25]–[28], computer self-efficacy/Health IT experience [14], [15], social influence/social norms/professional norms [1], [14], [15], [25]. However, new determinants were identified, particularly: perceived threat to physician autonomy [16], [28], physician involvement [16], and privacy concerns [15].

Two studies [1], [14] where conducted by the same authors and applied approximately to the same population, but have shown conflicting findings regarding the significance of two factors: demonstrability of results and personal identity. Whereas demonstrability of results was found to be significant in [1], it was insignificant in [14], and vice versa for personal identity. Because there was no support for the importance of the two factors in many systematic reviews [2], [29], [30], they were excluded from the proposed framework.

Many factors are conceptually similar, such as perceived usefulness and performance expectancy, perceived ease of use and effort expectancy, and social influence, social norms and

<table>
<thead>
<tr>
<th>Study/Publication year</th>
<th>Country of data collection</th>
<th>Subjects/Analyzed responses</th>
<th>Theory</th>
<th>Key determinants of EHR acceptance</th>
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<tbody>
<tr>
<td>[16]/2009 USA</td>
<td>Physicians/239</td>
<td>Extended TAM</td>
<td>Perceived usefulness, Physician involvement, Perceived threat to physician autonomy</td>
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<tr>
<td>[24]/2009 USA</td>
<td>Physicians/102</td>
<td>Combined TAM+TPB</td>
<td>Attitude, Perceived behavioral control</td>
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<td>[25]/2011 USA</td>
<td>Physicians/141</td>
<td>Modified UTAUT</td>
<td>Performance expectancy, Effort expectancy, Social influence</td>
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<td>Physicians/150</td>
<td>Extended TAM</td>
<td>Perceived ease of use, Social norms, Demonstrability of results</td>
<td></td>
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<tr>
<td>[14]/2016 Canada</td>
<td>Physicians/278</td>
<td>Extended TAM</td>
<td>Perceived usefulness, Perceived ease of use, Social norms, Computer self-efficacy, Personal identity</td>
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<td>[26]/2011 Canada</td>
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<td>Extended UTAUT</td>
<td>Performance expectancy (non users), Effort expectancy (current users, non users), Perceived risk (current users)</td>
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<td>Physicians/204</td>
<td>Extended TAM</td>
<td>Perceived usefulness, Attitude, Social influence, Health IT experience, Privacy concerns</td>
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<tr>
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<td>Extended TAM</td>
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<td>Physicians/300</td>
<td>Extended TAM</td>
<td>Perceived usefulness, Perceived ease of use, Perceived threat to physician autonomy</td>
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professional norms. In this case, factors that were supported by most studies are considered for inclusion in the proposed framework. These were perceived usefulness, perceived ease of use, and social influence. Finally, computer self-efficacy and health IT experience provide a similar meaning; however computer self-efficacy was selected for inclusion as it was identified in Stage 1.

C. Stage 3: Barriers to Physician Adoption of EHRs in the KSA

The findings of relevant studies conducted in the KSA can enhance the proposed framework. We used the same methodology applied in Stage 2 to search for these studies, except that the search query used was: (“Electronic Health Record” OR “Electronic Medical Record” OR EHR OR EMR) AND “Saudi Arabia”). All inclusion criteria applied in Stage 2 were applied in this stage except criteria (5) as no previous study in KSA has employed a theoretical framework. As a result, two relevant studies were identified [31], [32].

Shaker and Farooq [31] surveyed 451 physicians in Makkah Province to identify their computer literacy needs. The study was conducted because physicians were resistant to enter patient-related information in the EHR system at different hospitals. The study findings indicate that “substantial” computer literacy improvement needed among the majority of settings and categories. Areas that need substantial improvement include word processing software skills, Internet search skills, and advanced e-mail management skills. El-Mahalli [32] surveyed 555 physicians in three major hospitals that have implemented EHRs in the Eastern Province of the KSA in order to assess the adoption levels and barriers to adoption. The findings indicate that was under-utilization of almost all functionalities of EHRs. Many barriers to adoption were identified, which can be categorized into five main factors: confidentiality concerns, lack of perceived ease of use (e.g. time and effort for data entry, complexity of use), lack of customizability, difficulty to use during consultation with patients, lack of perceived usefulness, lack of user support, and technical limitations of the software system (unplanned downtime, frequent system hanging up problems, slow system performance, functional limitations).

In summary, six barriers identified based on prior studies conducted in the KSA: lack of computer experience [31], lack of perceived usefulness [32], lack of perceived ease of use [32], confidentiality concerns [32], lack of user support [32], and technical limitations of the software system [32]. All identified barriers were included in the proposed framework except lack of user support and technical limitations, as they are not applicable for the pre-implementation phase.

III. THE PROPOSED FRAMEWORK FOR THE ACCEPTANCE OF EHRs BY PRIMARY HEALTHCARE PHYSICIANS IN THE KSA

Factors identified as a result of the framework construction process are shown in Table 2. The following subsections discuss each factor in detail.

A. Attitude Toward EHR Use

Attitude toward behavior refers to an individual’s positive or negative feelings about performing the target behavior [19]. According to TRA [19], TPB [20] and TAM [17], attitude toward using technology is the immediate determinant of technology acceptance. In their analysis of 68 studies to identify critical adoption factors of EHRs by physicians, Castillo et al. [30] found that physicians’ attitude toward EHR is the top critical adoption factor, and indicated that EHR adoption can be predicted based on it. Therefore, before implementation, primary health care physicians need to be aware of the capabilities of the EHR, and training programs must focus on influencing their attitudes toward the system.

B. Perceived Usefulness

Perceived usefulness refers to the degree to which an individual believes that using a particular system would enhance

| TABLE II. THE PROPOSED FRAMEWORK FOR THE ADOPTION OF EHRs BY PRIMARY HEALTHCARE PHYSICIANS IN THE KSA |
|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| Factor                                       | Definition                                   | Supporting models in IT acceptance literature | Supporting models in EHR acceptance literature | Supporting studies conducted in the KSA |
| Attitude Toward EHR Use                      | An individual’s positive or negative feelings about performing the target behavior [19]. | TRA [19], TPB [20], TAM [17] | [15], [24] |
| Perceived Usefulness                         | The degree to which an individual believes that using a particular system would enhance job performance [17]. | TAM [17] | [14]-[16], [27], [28] | [32] |
| Perceived Ease of Use                       | The degree to which an individual believes that using a particular system will be free of effort [17]. | TAM [17] | [11], [14], [27], [28] | [32] |
| Social Influence                             | The degree to which an individual perceives that most people who are important to him think he or she should use the new system [18]. | UTAUT [18] | [15], [25] |
| Computer Self-Efficacy                       | Self-evaluation by a person of his/her capacity to use the technology. | SCT [23] | [14] | [32] |
| Perceived Threat to Physician Autonomy      | The degree to which an individual believes that using a particular system would decrease his or her control over the conditions, processes, procedures, or content of his or her work [33]. | | [16], [28] |
| Confidentiality Concerns                    | The degree to which a primary care physician believes that using EHR would impose risk to the confidentiality of patients’ information. | | [15] | [32] |
| Physician Participation                     | The degree to which a primary care physician believes that his/her participation in the selection and planning of EHR is important for system acceptance. | | [16] |
job performance [17]. According to TAM, perceived usefulness is a significant determinant of both attitude and technology acceptance [17]. Gagnon et al., [14] pointed out that successful cases of EHR adoption were usually characterized by a clear understanding of the benefits of the EHRs by the users. Many studies support the critical influence of perceived usefulness on physician acceptance of EHR [14]–[16], [27], [28].

C. Perceived Ease of Use

Perceived ease of use refers to the degree to which an individual believes that using a particular system will be free of effort [17]. According to TAM, perceived ease of use is a significant determinant of both attitude toward technology and perceived usefulness [17]. Many studies reported a significant association between perceived ease of use and physicians’ acceptance of EHR systems [1], [14], [27], [28]. In the KSA, El-Mahalli [32] reported many instances of barriers to the adoption of EHRs by physicians which are related to perceived ease of use, such as time and effort for data entry, complexity of use, lack of customizability, difficulty to use the system during consultation with patients.

D. Social Influence

Social influence refers to the degree to which an individual perceives that most people who are important to him think he or she should use the new system [18]. According to UTAUT, social influence is a significant determinant of users’ acceptance of a new system [18]. In EHR acceptance research, social influence was a significant determinant of physicians’ acceptance of EHR in many studies [15], [25]. Sources of social influence that would affect to physicians acceptance of EHR include: colleagues and peers support [1], [14], [30], and top management support [16], [27].

E. Computer Self-Efficacy

Computer self-efficacy represents the self-evaluation by a person of his/her capacity to use the technology [23]. Many studies reported lack of physician ability and familiarity with EHR to be a major obstacle hindering EHR acceptance and use [2]. In a recent study [14], computer-self efficacy was a significant determinant of physicians’ acceptance of EHR, suggesting that physicians with high computer self-efficacy are likely to support EHR implementation. Therefore, training programs on computer literacy should be provided prior to system implementation to increase EHR acceptance.

F. Perceived Threat to Physician Autonomy

It has been recognized that physicians are characterized by their high professional autonomy [25]. Perceived threat to physician autonomy is the degree to which an individual believes that using a particular system would decrease his or her control over the conditions, processes, procedures, or content of his or her work [33]. The implementation of EHR involves substantial changes that could affect positions or power relations in the medical practice; therefore resistance is likely to occur [27]. Many studies have shown that perceived threat to professional autonomy have a significant negative impact on physicians’ decision to accept EHR [16], [28].

G. Confidentiality Concerns

Many studies reported confidentiality of patient information to be a major obstacle impeding physicians’ acceptance of EHR [2], [29]. Physicians are concerned that the EHRs could be accessible to those who are not authorized to obtain them; they are more concerned about confidentiality of patients’ information than patients themselves [2]. Existence of appropriate policies and regulations and informed consent from patients could serve as protective factors against confidentiality concerns.

H. Physician Participation

Physician participation in the implementation process creates a psychological ownership of the system. This psychological ownership has a significant positive effect on the perception of the system’s usefulness and ease of use [35]. Consequently, involving physicians early in EHR selection and implementation could enhance the utility and usability of the system. Morton and Wiedenbeck [16] showed that physician involvement has a significant positive influence on physicians’ attitude toward EHR.

IV. DISCUSSION

The main contribution of this study is the identification of key factors that are likely to influence primary healthcare physicians’ acceptance of EHRs in the KSA. The framework was developed following a comprehensive review of relevant literature pertaining to IT and EHR acceptance, and refined following empirical findings of relevant studies conducted in the KSA.

For theoretical frameworks explaining behavior change at the individual healthcare professional level, Eccles et al. [35] have defined three desirable attributes of such frameworks to be practically useful for implementation: (1) they should have proven effectiveness in predicting and explaining behavior change in other settings, (2) they should explain behavior in terms of factors that are changeable (e.g., knowledge, beliefs, attitudes) rather than non-modifiable determinants (e.g., age, gender, intelligence) as such factors are difficult or impossible to change, and (3) they should include non-volitional components (i.e., they should assume that healthcare professionals working in a healthcare organization do not always have a complete control over their action and allow an examination of external factors, such as patient preferences or organizational barriers and facilitators, on their behavior). The proposed framework meets all these criteria. All factors have proven to be significant predictors of EHR acceptance in other healthcare settings [1], [14]–[16], [24]–[28]. Also, all factors are changeable. The framework includes non-volitional components, particularly perceived threat to physician autonomy, confidentiality concerns, and physician participation.

The proposed framework provides an integrative view of acceptance factors important for the pre-implementation phase. Previous theoretical frameworks are limited in terms of providing an integrative view of acceptance factors. For example, most studies ignore organizational constraints (e.g., perceived threat to physician autonomy, physician participation) [1], [15], [24]–[26], individual constraints (e.g.
computer self-efficacy) [16], [25]–[28], legal constrains (e.g. confidentiality concerns) [1], [14], [16], [24], [25], [27], [28], or social factors [28]. The integrative view provided by the proposed framework will provide policy makers with key factors to focus on for the pre-implementation phase.

V. CONCLUSION

This research adds to the limited knowledge on change management for the pre-implementation phase of EHR systems. As all factors of the proposed framework have been validated in multiple studies internationally, the findings of this study will assist policy makers in the KSA to set a strong foundation for success and make transition to EHR systems run smoothly.

REFERENCES


