



Electronic health record acceptance by physicians: Testing an integrated theoretical model



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ABSTRACT

Objective: Several countries are in the process of implementing an Electronic Health Record (EHR), but limited physicians' acceptance of this technology presents a serious threat to its successful implementation. The aim of this study was to identify the main determinants of physician acceptance of EHR in a sample of general practitioners and specialists of the Province of Quebec (Canada).

Methods: We sent an electronic questionnaire to physician members of the Quebec Medical Association. We tested four theoretical models (Technology acceptance model (TAM), Extended TAM, Psychosocial Model, and Integrated Model) using path analysis and multiple linear regression analysis in order to identify the main determinants of physicians' intention to use the EHR. We evaluated the modifying effect of sociodemographic characteristics using multi-group analysis of structural weights invariance.

Results: A total of 157 questionnaires were returned. The four models performed well and explained between 44% and 55% of the variance in physicians' intention to use the EHR. The Integrated model performed the best and showed that perceived ease of use, professional norm, social norm, and demonstrability of the results are the strongest predictors of physicians' intention to use the EHR. Age, gender, previous experience and specialty modified the association between those determinants and intention.

Conclusions: The proposed integrated theoretical model is useful in identifying which factors could motivate physicians from different backgrounds to use the EHR. Physicians who perceive the EHR to be easy to use, coherent with their professional norms, supported by their peers and patients, and able to demonstrate tangible results are more likely to accept this technology. Age, gender, specialty and experience should also be taken into account when developing EHR implementation strategies targeting physicians.

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1. Background

The electronic health record (EHR) is viewed as the backbone supporting the integration of various information tools (e.g., emergency information, test ordering, electronic prescription, decision-support systems, digital imagery, and telemedicine) that could improve the uptake of evidence into clinical decisions. Using such evidence in daily clinical practice could enable a safer and more efficient healthcare system [1–3]. International literature supports several benefits of EHR for patients [4–11]. One of the main benefits reported is the increased quality of care resulting from patients having their essential health data accessible to their different

providers, which can significantly improve the coordination of care [12,13] and increase the efficiency of primary care practice [14].

Based on relevant disease management programs [15,16], the EHR could support empowered citizens to actively take part in decisions regarding their health, and could be used to track the delivery of recommended preventive care across primary care practices [17]. The EHR is also a tool that facilitates knowledge exchange and decision making among healthcare professionals by providing them with relevant, timely, and up-to-date information [13].

1.1. Current knowledge on EHR acceptance

The implementation of EHR systems is currently supported in many high-income countries [13,18,19]. For instance, the Institute of Medicine in the US has qualified the EHR as “an essential technology” for healthcare [20]. Nevertheless, the rate of EHR

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acceptance by office physicians remains slow in countries such as the United States [20–22], United-Kingdom [14,23–27], and Canada [28–31].

An increasing body of knowledge on EHR implementation shows that a majority of projects are discontinued after the experimentation phase of their assessment [22,32]. Issues associated with the slow diffusion of the EHR include: important start-up investments, lack of financial incentives, uncertain payoffs, suboptimal technology, low priority, and resistance of potential users [33–35]. EHR acceptance by physicians requires significant financial investment and learning effort, but also introduces radical change to every single aspect of clinical work [14]. Also, perceptions towards the use of EHR may vary between health professionals groups, adding to the complexity of implementing this technology in a pluralist healthcare system [32,36,37].

EHR acceptance by healthcare professionals is an essential condition to ensure that the expected benefits will materialize [38,39]. Thus, understanding factors influencing EHR acceptance is one of the key elements in ensuring its optimal integration and, ultimately, measurable benefits within health system and population. Factors related to users and their working environment have to be considered because many previous EHR projects have failed due to the lack of integration into practices and organizations [40,41].

Previous studies have looked at individual factors affecting physician EHR acceptance [42–45], but few employed a theoretical model. Among studies that used a theoretical model most were based on the Technology Acceptance Model (TAM). The TAM hypothesises that user intended behavior predicts their actual system use [46]. It proposes two main factors that determine users' *behavioral intention* (BI) toward using a new technology, specifically *perceived usefulness* (PU) and *perceived ease of use* (PEoU) [47]. This theory suggests that external variables, such as human and social factors, indirectly determine attitude toward technology acceptance by influencing PU and PEoU [47,48]. The TAM is one of the most influential frameworks for predicting users' perceptions about information system use [46,47,49–51].

A study used variables from the TAM to assess factors associated with physicians' attitude toward using EHR [52]. Overall, PU explained 73% of the variance in physicians' attitude toward EHR use, whereas PEoU did not significantly influence attitude. None of the physicians' characteristics (age, years in practice, clinical specialty, health system relationship, and prior computer experience) were correlated with any of the TAM variables [53]. This study did not assess physicians' intention to use EHR.

Because physicians may differ from other types of users in terms of IT acceptance, some authors have suggested adding other constructs to the TAM [54–56]. Ilie et al. [57] found the most significant factors influencing physicians' intention to use an Electronic Medical Record (EMR) were attitude, PU, logical access and physical access. Walter and Lopez [58] have highlighted the role of perceived threat to professional autonomy as an important antecedent to PU, intention, and EMR usage. For their part, Price [59] observed that PEoU, PU, and perceived patient record privacy have moderate positive effects on physicians' intention to use an EMR.

Holden [60] conducted a qualitative study of the effect of social influence on physicians' EHR use and their results suggested that role beliefs and moral norms could both encourage or discourage use. Besides, a study by Seeman and Gibson [61] investigated the factors associated with their acceptance of EMR using two models: the TAM and the Theory of Planned Behavior (TPB). Results from their multiple regression analyses showed that the TPB was more powerful than the TAM in explaining physicians' acceptance, but that a framework combining both models was even more powerful. Attitude toward EMR use and perceived behavioral control were the most important predictors of physicians' intention to use an EMR.

Archer and Cocosila [62] compared EHR perceptions of Canadian physicians already using EMR systems with those not yet using them through an integrated theoretical approach inspired by the Unified Theory of Acceptance and Use of Technology (UTAUT), a model offering an extension to the TAM by including key concepts from other technology acceptance models [63]. Their theoretical model explained 55.8% of the variance in behavioral intention to use EHR among physicians who were EMR users, and 66.8% among non-EMR users. Effort expectancy (a concept similar to PEoU) was found to be the strongest determinant of intention among EHR users, while performance expectancy (equivalent to PU) was the strongest determinant for nonusers. However, this study did not assess the role of context, particularly normative influences, which characterize the medical profession and could have an impact on the intention to use EHR [56]. Contextual factors could also play an important role as barriers or enablers to EHR use [64].

The role of context and social influence was taken into account in a recent study by Chang and Hsu [46] suggesting that a modified UTAUT model is useful in predicting medical staff intention to use an information system (IS). These authors used a framework that integrated the constructs of facilitating conditions and perceived consequence from the Theory of Interpersonal Behavior (TIB) [65]. Their results showed that performance expectancy, effort expectancy, social influence, facilitating conditions and perceived consequences explained 31% of the variance in physicians' intention. In addition, including gender, age, experience, and occupation as moderators increased the explanatory power from 31% to 39% [46].

In a recent study on EMR acceptance by physicians, Venkatesh et al. [66], tested a modified UTAUT that also considered the specificities of the medical profession. Accordingly, they hypothesised that only age would have a moderating effect on the predictors of behavioral intention of physicians. Their modified model was effective in predicting physicians' acceptance and use of the EMR, with 45% and 47% of variance explained, respectively.

Overall, previous studies have shown some support to using the TAM and the UTAUT as theoretical models of EMR and EHR acceptance by physicians. However, these models are still limited in their predictive power and, according to Venkatesh, future technology acceptance research should attempt to integrate other theories [66].

1.2. Goals and objectives

The aim of this study was to explore the determinants of physicians' intention to use an EHR in the Province of Quebec (Canada) using four theoretical models. Specifically, this study examined and compared the original TAM, a modified TAM, a psychosocial model inspired by Triandis' TIB, and an integrated model that combines elements from the previous models. In this study, we operationalized physicians' EHR acceptance as their behavioral intention to use (BIU) the EHR system when it becomes available. In Quebec, very few medical practices have started to use an EHR system; hence we did not assess effective EHR use in this study.

1.3. Theoretical models

Given the validity and the robustness of the TAM proven by previous researches, in both mandatory and voluntary usage settings [50,51,54,63,67–71], we have chosen this model as the reference to develop our theoretical framework predicting physicians' intention to use the EHR.

The original TAM (Model 1) is presented in Fig. 1. While the TAM has been proven to have good predictability [71] it has some limitations when applied to healthcare professionals [54].

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