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EMR continuance usage intention of healthcare professionals

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\section*{ABSTRACT}

Electronic medical records (EMRs) have been proven to be effective tools for improving the safety and quality of healthcare despite their relatively low usage rate in hospitals. The long-term development by EMRs depends on the continued use of healthcare professionals. In this study, technology continuance theory (TCT) was used to evaluate the short-term and long-term continuance acceptance of EMRs among healthcare professionals. Data were gathered by surveying 195 medical professionals in Iran. The data were analyzed using the partial least squares (PLS) technique. The analysis showed that the TCT provided a deep understanding of user continuance intention toward EMRs. In addition, the findings illustrated that the determinants of continuance intention vary between short-term and long-term users. The theoretical and practical implications of the study are discussed.

\section*{KEYWORDS}

Continuance intention; electronic medical records; Iran; technology continuance theory

\section*{Introduction}

Electronic medical records (EMRs) are claimed to constitute a technology that will significantly change the future of the healthcare industry (1). A comprehensive EMR system with functionalities including electronic clinical documentation, electronic test results and images, computerized physician order entry, and decision support has the potential to be used in other capacities, such as in increasing the delivery of care that adheres to guidelines and principles, enhancing the capacity of healthcare providers to perform surveillance for disease conditions and care delivery, improving information exchange and reuse for improved and more cooperative services, reducing rates of medication errors, and decreasing the abuse of medical resources (2–6). However, despite the positive effects of EMR usage in medical practice, the use of such systems remains low and meets resistance from caregivers, especially physicians (7).

The process of information system (IS) adoption and use is critical to deriving the benefits of IS. The IS user adoption behavior life cycle differs in the pre- and post-adoption stages. User behavior in the post-adoption stage can differ between short- and long-term users. Although the pre-adoption of IS is an important first step toward the successful implementation of IS, long-term viability and success depends both on initial acceptance and continuation of use (8). The use of the same or misdirected managerial tactics to facilitate adoption behavior across various stages may result in negative consequences and may reduce IS effectiveness (9). The initial acceptance of an IS does not guarantee continuance thereafter because users may re-evaluate their earlier acceptance decision or experience psychological motivation changes after their initial acceptance (8,10). However, although numerous studies have investigated the EMR pre-adoption behavior of healthcare professionals (11), studies on post-adooption behavior remain lacking. Without a clear understanding of the adoption behavior of EMR users over time, policy-makers and hospital managers will fail to enhance the usage of EMRs in hospitals. Therefore, this study investigates the EMR...
continuance usage intention of healthcare professionals. By considering user experience with EMRs, the investigated behavior of short- and long-term users could provide effective information on different stages of post-adoption.

**EMR system in Iranian hospitals**

Given the broad application of information and communications technologies (ICTs) in healthcare systems, the Ministry of Health and Medical Education in Iran has equipped teaching hospitals with a hospital information system (HIS). HISs were first developed in Iran in 1998 and have been an essential part of hospital information management and administration (12). The systems were used to manage patient finance and hospital inventory.

An EMR was introduced in some selected Iranian teaching hospitals by the government 5 years ago. The system was expected to support all clinical and administrative processes involved in the hospital stay of a patient. The system consisted of several key subsystems, including the computerized physician order entry (CPOE), nursing information system (NIS), pharmacy information system (PIS), laboratory information system (LIS), picture archiving and communication system (PACS), and clinical data repository (CDR). All patient data and clinical information are saved in the CDR and shared by all of the subsystems, which are seamlessly connected via the hospital intranet. The CPOE enables physicians and residents to conduct diagnosis, order laboratory and radiology tests, prescribe medications, and provide dictations. The NIS functionalities include patient registration, admission/transfer/discharge, bed assignment, care planning and reporting, and medication administration. Nurses can view physician orders and dictations fed from the CPOE into the NIS. Nurses may also double-check laboratory and medication orders in the NIS to eliminate computer input errors before being submitted to laboratories or pharmacies. The orders will be processed by relevant units, such as the hospital laboratory and pharmacy. The results will be sent back to the EMR after another round of checking at the NIS. The system enables physicians to search and view specific clinical information to facilitate their decision-making. For example, physicians can view detailed nursing reports, medication history, periodical vital sign changes, and medical images before deciding on whether a patient should be discharged. Despite being implemented in specific hospitals, this system is not being used broadly because Iranian hospitals are still using patient medical records in both electronic and manual forms.

**Model conceptualization**

This study aims to investigate the post-adoption behavior of healthcare professionals towards the EMR system. Three models of technology acceptance model (TAM), expectation confirmation model (ECM), and cognitive model (COGM) are the most common theories that have been used in previous studies that explain the continuance intention as regards ISs. TAM was developed by Davis et al. (13) on the basis of theory of reasoned action (TRA) (14). Davis et al. (13) claimed that perceived usefulness (PU) and perceived ease of use (PEU) are two external factors that can motivate the individual attitude and behavioral intention to use IS. TAM has been applied to examine continuance and post-adoption behavior (15,16). TAM, with its focus on the initial acceptance of an IS, theorizes that system use is directly determined by the behavioral intention to use and is in turn motivated by user attitude toward system use (9). A limitation of the TAM is its incapability to consider the effect of external variables and barriers to technology adoption (17). Thus, many previous studies have concluded that TAM can have an enhanced explanatory power when used in combination with more external factors (18–20).

ECM (8) has recently been proposed to describe user behavior to “continue to use” an IS. ECM was introduced to assess the continuance intention of an individual to use a system, proving that user satisfaction is the most critical factor determining user intention for continued use. ECM is adapted from the consumer behavior literature and integrated with theoretical and empirical
findings from prior IS usage research to theorize a model of IS continuance (8). The model suggests that the continuance intention of users is determined by their satisfaction with the use of IS and the PU of continued IS use. User satisfaction, in turn, is influenced by confirmation of expectation from prior IS use and PU. In contrast to TAM, ECM focuses on requirements that affect retention and constancy because the long-term viability and success of an IS depends on continued use rather than on first-time use alone (8,9). COGM developed by Oliver (21) proposed that the behavioral intention of an individual should be defined as a function of both attitude and satisfaction.

In this research, technology continuance theory (TCT) is used as a basis for evaluating the continuance usage intention of EMRs among healthcare professionals. TCT was suggested as an enhanced model for IS continuance that is suitable for the entire life cycle of adoption (9). Three models of TAM, ECM, and COGM with their six constructs, namely, confirmation, satisfaction, PU, PEU, and attitude, are synthesized to establish a reduced model. The main strength of TCT is that it combines the two central constructs of attitude and satisfaction into one continuance model while retaining the well-established constructs of PU and PEU as first-level antecedents (9). TCT was selected as the basis of this study for its higher explanatory power than that of TAM, ECM, and COGM for the entire life cycle adoption. A study by Liao et al. (9) showed that TCT presents a substantial improvement over the TAM, ECM, and COGM models both quantitatively and qualitatively to explain user behavior at different stages of adoption. Quantitatively, TCT provides high explanatory power not only for behavioral intention but also for attitude and satisfaction. Qualitatively, a major theoretical contribution of TCT is that it combines two central constructs, namely, attitude and satisfaction, into one continuance model.

**Hypothesis development**

Attitude refers to “the degree of a person’s positive or negative feelings about performing a target behavior” (13). TAM has suggested that the behavior toward system use can be determined by user attitude. Previous studies have shown that attitude has a significant effect on the adoption and use of IS (9,22). When individuals form a positive attitude toward a new technology, they will have a stronger intention to use it (22). As such, it is expected when healthcare professionals form positive attitudes toward an EMR system, they will have a stronger intention toward using it. Therefore, the following hypothesis is proposed:

H1: The attitude of healthcare professionals toward an EMR system is positively related to their continued EMR system usage intention.

PEU refers to the degree to which a person believes that using a technology will be free of effort (13), whereas PU refers to individual perceptions about a specific technology that will help them perform their jobs better. Previous research has suggested that PU and PEU are especially important measures of users’ intention toward using the system (13,22,23). A significant number of studies have identified that perception of usefulness and ease of use are positively related to the acceptance and utilization of a new technology, and PU has proven to be the most prominent of the two TAM variables (13,24,25). When users believe that using a specific IT device can enhance their productivity, they may want to continue to use it (8,10). In addition, Roca and Gagné (26) and Lee (22) found a positive relationship between perceived usefulness and intention to use new technology.

Healthcare professionals need to see the EMR system as a useful tool that can improve their healthcare services, improve information exchange, reduce rates of medication errors, and decrease the abuse of medical resources. Moreover, healthcare professionals need to feel that the EMR system is easy to use. Both PU and PEU are beliefs that, according to TRA, will affect user attitude and intention to use. Thus, we posit that:
H2: PU among healthcare professionals is positively related to their continued EMR system usage intention.

H3: PU among healthcare professionals is positively related to their attitude toward an EMR system.

H4: PEU among healthcare professionals is positively related to their attitude toward an EMR system.

IT is generally perceived as more useful if it is easy to use. Previous studies have shown strong empirical support for a positive relationship between PU and PEU (27–30). Hung et al. (30) studied previous research articles on TAM and found that among 39 articles, more than 30 claim that PEU among users positively affects PU. Based on above results, hypothesis 5 is presented as follows:

H5: PEU among healthcare professionals is positively related to their PU of the EMR system.

User satisfaction refers to an overall evaluation of an IS that reflects an emotion-based response about the target IS (32). User satisfaction has been studied by other researchers as an indicator of user perception of the effectiveness of IT (33,34) and as an important indicator of success in the adoption of IT in a mandatory environment (35). ECM suggests that user continuance intention is determined by their satisfaction with IS use and PU of continued IS use. Oliver (35) and Lee (22) states that user satisfaction with IS usage is a critical source that shapes IS continuance intention. Given that an EMR system is a kind of IS, we derived the following hypothesis from the ECM:

H6: Satisfaction of healthcare professionals with an EMR system is positively related to their continued EMR system usage intention.

Previous research studies have demonstrated that user satisfaction with IT is strongly correlated with PU (8,28). An individual who perceives a given type of IT to be useful is more likely to be satisfied with it than one who does not (22). Types of IT that individuals perceive to be more useful are more likely to be used by those individuals (13). Thus, the following hypothesis is developed:

H7: PU of an EMR system among the healthcare professionals is positively related to their satisfaction with an EMR system.

ECM posits that user satisfaction is determined by two constructs: expectation of the IS and confirmation of expectation following actual use. Expectation provides the baseline level, against which confirmation is assessed by users to determine their evaluative response or satisfaction. Confirmation is positively related to satisfaction with IS use because it implies the realization of the expected benefits of IS use, whereas disconfirmation denotes failure to achieve expectation (8). The study of Liao et al. (9) on IT adoption behavior life cycle postulates that after a certain period of usage experience, the perceived performance of the IS is comparable with pre-adoption expectations. The evaluation results in confirmation or disconfirmation result in the adjustment in the satisfaction level of the individual. Therefore, user satisfaction is influenced by a confirmation of expectations from prior IS use and PU. The confirmation of expectations suggests that healthcare professionals obtained expected benefits through their usage experiences with the EMR system, thus resulting in a positive effect on their satisfaction. Hence, the following hypothesis is developed:

H8: Confirmation of the expectations of healthcare professionals is positively related to their satisfaction with the EMR system.
Although some studies consider attitude and satisfaction as synonymous with each other (37), most believe the two are different from a conceptual standpoint. Satisfaction is a transient and experience-specific affect, whereas attitude is relatively more enduring and transcends all prior experiences (9). Attitude is one’s perceptual evaluation of a product or service, whereas satisfaction is one’s post-purchase evaluation of a product or service (38). However, although attitude and satisfaction are posited as two distinct constructs, the effects of these parameters on user behavior can possibly be synthesized. Therefore, the following hypothesis is developed:

H9: Satisfaction among healthcare professionals is positively related to their attitude toward an EMR system.

Confirmation is a cognitive belief reflecting the extent to which user expectation of IS use is realized during actual use that is derived from prior IS use (8). Just as the cognitive beliefs in IS acceptance contexts, such as PU and PEU, are related (13), those in IS continuance contexts, such as confirmation and PU, may also be related (8). Perceived usefulness of IS could be adjusted by confirmation experience, particularly when the users’ initial perceived usefulness is not concrete due to the uncertainty over what to expect from using the IS (8). For example, users may have low initial usefulness perception of a new technology, mainly because they are unsure of what to expect from its use. However, users may still want to accept it with the intent of making their usage experience a basis for forming more concrete perceptions. Although usefulness perception is expected to be low in the initial stages of IS use, such perceptions might be adjusted as a result of the confirmation experience when users determine that their initial perceptions were unrealistically low. In other words, confirmation tends to elevate user PU, and disconfirmation will reduce such perceptions. Therefore, the following hypothesis is developed:

H10: Confirmation of the expectations of healthcare professionals is positively related to their perceived usefulness of the EMR system.

Research methodology

Measure of constructs

The survey instrument consisted of two parts with a total of 30 items: the first part asked demographic questions about the respondent, whereas the second part included items to measure the theoretical constructs of TCT. Demographic information included gender, age, marital status, academic qualification, job tenure, length of experience in using the EMR system, and job title. The items were adapted from previous studies to ensure content validity. The scale for both PU and PEU were adapted from Venkatesh and Davis (23,38). CON, SAT, and INT items were adapted from Bhattacherjee (8) using three, four, and three items, respectively. Finally, ATT was measured using a four-item scale adapted from Taylor and Todd (16). Each item was measured using a five-point Likert scale. The measurement items are included in Table 1.

Procedure and data collection

Approval for this study was obtained from the Tehran Medical Science University and the Department of Research and Education of selected hospitals that had been chosen for this study. Although the Ministry of Health and Medical Education has implemented an EMR system in teaching hospitals, only hospitals that had been using the system for more than 2 years had been chosen. Given that the length of caregiver experience with EMRs was important in the study, Amir Alam, Sina, Moheb, Arash, and Hasheminezhad Hospitals were chosen. The survey respondents were healthcare professionals, including physicians, nurses,
and medical technicians, who had worked for more than 2 years with the EMR system in selected hospitals in Tehran. The respondents were chosen for their long-term usage of the EMR system, which highly depends on their continuance acceptance of EMRs.

At the top of the survey questionnaire, we provided a detailed explanation of its purpose and presented details about the EMR system with examples of its different parts that are used by the respondents. In addition, when the survey was conducted, time was allotted to explain the details of the system to help the respondents recall their experience with EMRs and express the degree to which they agree with each of the statements. The survey was conducted using questionnaires that were distributed through hospital administrators or human resource departments using the drop and pickup method. The data collection started on February 1, 2015, and ended on March 31, 2015.

**Statistical methods**

The structural equation modeling technique of partial least squares (PLS) was applied to test the research model using a SmartPLS, version 3.0. This technique has been used for its suitability to analyze a complicated model ([40](#)). In addition, the sample size of short-term users is 103 and that of long-term users is 92; PLS is the preferred method for small sample size ([41](#)).

The two-step approach was utilized in data analysis, as suggested by Hair et al. ([41](#)). The first step involves the analysis of the measurement model, whereas the second step tests structural relationships among the latent constructs ([42](#), [43](#)). The two-step approach aims at establishing the reliability and validity of the measures before assessing the structural relationship of the model.

**Results**

Out of 250 questionnaires sent out to the hospitals, 203 questionnaires were collected. Among them, eight questionnaires were only partially completed and were thus unusable, leaving a total of 195 usable responses or a 76.0% usable response rate. Male respondents comprised 47.7%, whereas female respondents comprised 52.3% (Table 1). In terms of age, 2.6% of the respondents were under 30 years of age, 47.7% were between the ages of 30 and 39 years, 39.4% were between the ages of 40 and 49 years, and 10.3% were over 50 years. As regards job titles, 13.3% of the respondents were physicians, 47.2% were nurses, and 39.5% were medical technicians. The job tenure of 45.1% of the respondents was less than 10 years, whereas 54.9% had tenure of more than 5 years. The length of experience of 52.8% of the respondents with the EMR system was less than 1 year (short-term users), whereas 47.2% had usage experience of above 1 year (long-term users).

<table>
<thead>
<tr>
<th>Respondents’ characteristics</th>
<th>Short-term users</th>
<th>Long-term users</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency (%)</td>
<td>Frequency (%)</td>
<td>Frequency (%)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>51 (49.5)</td>
<td>42 (45.7)</td>
<td>93 (47.7)</td>
</tr>
<tr>
<td>Female</td>
<td>52 (50.5)</td>
<td>50 (54.3)</td>
<td>102 (52.3)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 30 years</td>
<td>1 (1.0)</td>
<td>4 (4.4)</td>
<td>5 (2.6)</td>
</tr>
<tr>
<td>30–39 years</td>
<td>48 (46.6)</td>
<td>45 (48.9)</td>
<td>93 (47.7)</td>
</tr>
<tr>
<td>40–49 years</td>
<td>40 (38.8)</td>
<td>37 (40.2)</td>
<td>77 (39.4)</td>
</tr>
<tr>
<td>More than 50 years</td>
<td>14 (13.6)</td>
<td>6 (6.5)</td>
<td>20 (10.3)</td>
</tr>
<tr>
<td>Job title</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physicians</td>
<td>14 (13.6)</td>
<td>12 (13.0)</td>
<td>26 (13.3)</td>
</tr>
<tr>
<td>Nurses</td>
<td>50 (48.5)</td>
<td>42 (45.7)</td>
<td>92 (47.7)</td>
</tr>
<tr>
<td>Medical technicians</td>
<td>39 (37.9)</td>
<td>38 (41.3)</td>
<td>77 (39.5)</td>
</tr>
<tr>
<td>Job tenure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 10 years</td>
<td>43 (41.7)</td>
<td>45 (48.9)</td>
<td>88 (45.1)</td>
</tr>
<tr>
<td>Above 10 years</td>
<td>60 (58.3)</td>
<td>47 (51.1)</td>
<td>107 (54.9)</td>
</tr>
</tbody>
</table>
Measurement model results

The reliability and validity of the reflective constructs were assessed. Composite reliability (CR), which is similar to Cronbach’s alpha, needs to be assessed in connection with internal reliability. The CR values of all constructs were above 0.7 (Table 2), satisfying the rule of Hair et al. (41). Hair et al. (40) suggested the acceptance of items with loadings of at least 0.7. Given that the loadings associated with each of the scales were all greater than 0.7, individual item reliability was judged to be acceptable. The convergent validity was evaluated using the average variance extracted (AVE). The AVE of all constructs was above 0.5, signifying a satisfactory degree of convergent validity (44).

To assess the discriminant validity of the constructs, two approaches were used. First, the cross-loadings of the indicators were examined. This finding revealed that no indicator loads are higher on an opposing construct (45). Second, following the Fornell and Larcker (44) criterion, the square root of AVE for each construct exceeded the intercorrelations of the construct with the other constructs in the model (Table 3). Both analyses confirmed the discriminant validity of all constructs.

The main concern for investigating the behavior of short- and long-term users of ERM system is whether these two groups have meanings for the survey items (46). If invariance cannot be established, whether the differences observed are attributable to true differences or to different psychometric responses

### Table 2. Measurement model evaluation.

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Items</th>
<th>Factor loadings</th>
<th>CR</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirmation (CON)</td>
<td>My experience with using EMR was better than what I expected.</td>
<td>0.897</td>
<td>0.942</td>
<td>0.845</td>
</tr>
<tr>
<td></td>
<td>The service level provide by EMR was better than what I expected.</td>
<td>0.965</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Overall, most of my expectations from using EMR were confirmed.</td>
<td>0.894</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived usefulness (PU)</td>
<td>Using EMR improves my performance in my work place.</td>
<td>0.849</td>
<td>0.903</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td>Using EMR improves my productivity in my work place.</td>
<td>0.792</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Using EMR enhances my effectiveness in my work place.</td>
<td>0.792</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Using EMR system would improve the quality of the tasks I perform.</td>
<td>0.837</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I find EMR to be useful in my work place.</td>
<td>0.757</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived ease of use (PEU)</td>
<td>My interaction with EMR is clear and understandable.</td>
<td>0.820</td>
<td>0.957</td>
<td>0.819</td>
</tr>
<tr>
<td></td>
<td>Interaction with EMR does not require a lot of mental effort.</td>
<td>0.907</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I find it easy to get EMR to do what I want it to do.</td>
<td>0.907</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I find EMR to be easy to use in the hospital.</td>
<td>0.942</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Learning EMR system would be easy for me.</td>
<td>0.943</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfaction (SAT)</td>
<td>My overall experience of EMR use was: very satisfied.</td>
<td>0.821</td>
<td>0.935</td>
<td>0.783</td>
</tr>
<tr>
<td></td>
<td>My overall experience of EMR use was: very pleased.</td>
<td>0.945</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>My overall experience of EMR use was: very contented.</td>
<td>0.957</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>My overall experience of EMR use was: absolutely delighted.</td>
<td>0.805</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude (ATT)</td>
<td>Using EMR in hospital rather than paper medical records would be a good idea.</td>
<td>0.950</td>
<td>0.958</td>
<td>0.852</td>
</tr>
<tr>
<td></td>
<td>Using EMR in hospital rather than paper medical records would be a wise idea.</td>
<td>0.895</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I like the idea of using EMR rather than paper medical records.</td>
<td>0.930</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Using EMR would be a pleasant experience.</td>
<td>0.916</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuence intention (INT)</td>
<td>I intend to continue using EMR rather than discontinue its use.</td>
<td>0.892</td>
<td>0.886</td>
<td>0.723</td>
</tr>
<tr>
<td></td>
<td>My intentions are to continue using EMR than use any alternative means.</td>
<td>0.897</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>If I could, I would like to continue using EMR as much as possible.</td>
<td>0.754</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. CR, composite reliability; AVE, average variance extracted.

### Table 3. Discriminant validity coefficients.

<table>
<thead>
<tr>
<th></th>
<th>CON</th>
<th>PU</th>
<th>PEU</th>
<th>SAT</th>
<th>ATT</th>
<th>INT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CON</td>
<td>0.919</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PU</td>
<td>0.699</td>
<td>0.806</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEU</td>
<td>0.655</td>
<td>0.716</td>
<td>0.905</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAT</td>
<td>0.727</td>
<td>0.692</td>
<td>0.723</td>
<td>0.885</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATT</td>
<td>0.716</td>
<td>0.680</td>
<td>0.681</td>
<td>0.686</td>
<td>0.923</td>
<td></td>
</tr>
<tr>
<td>INT</td>
<td>0.522</td>
<td>0.415</td>
<td>0.663</td>
<td>0.459</td>
<td>0.646</td>
<td>0.851</td>
</tr>
</tbody>
</table>

Note. Diagonals (in bold) represent square root of the AVE.
to the items may be difficult to determine. Invariance test was performed, and out of 24 items, 2 have a significant difference between short- and long-term users. The findings suggest that the data have partial measurement invariance, which is a compromise between full measurement invariance and complete lack of measurement invariance (47). The literature suggested that full measurement invariance is frequently difficult to achieve, such that researchers should determine at least partial measurement invariance (47). Therefore, the measurement invariance is not a concern between short- and long-term users.

**Assessment of the structural model**

With the satisfactory results of the measurement model, the structural model was subsequently evaluated. The predictive accuracy of the model was evaluated in terms of the portion of variance explained. The results suggest that the model is capable of explaining 69.4% and 74.1% of the variance in continuance intention for short- and long-term users. Aside from estimating the magnitude of $R^2$, recent research has included predictive relevance developed by Stone (48) and Geisser (49) as an additional model fit assessment. This technique represents the model adequacy to predict the manifest indicators of each latent construct. Stone–Geisser $Q^2$ (cross-validated redundancy) was computed to examine the predictive relevance using a blindfolding procedure in PLS. Following the guidelines suggested by Chin (50), a $Q^2$ value of greater than zero implies that the model has predictive relevance. In the present study, values of 0.432 and 0.563 were obtained as an average cross-validated redundancy (for all endogenous variables) for short- and long-term users, respectively. These values are far greater than zero. In sum, the model exhibits acceptable fit and high predictive relevance for both groups.

Nonparametric bootstrapping was applied (51) with 2000 replications to test the structural model. The path coefficients and $R^2$ values for the two levels of experience are shown in Figure 1. EMR continuance intention (INT) is determined jointly by PU (H2: $\beta = 0.621$, 0.712), SAT (H6: $\beta = 0.356$, 0.686), and ATT (H1: $\beta = 0.110$, 0.463). The effect of PU, SAT, and ATT clearly becomes more dominant for healthcare professionals with greater experience. Notably, the effect of ATT on INT for short-term users is insignificant. In addition, the effect of PU on INT is significantly greater than the effect of SAT, whereas the effect of SAT is greater than that of ATT on both user groups. PU, SAT,
and ATT jointly explain 69.4% and 74.1% of the variance in INT for short- and long-term users, respectively. PU, PEU, and SAT are determinants of attitude (ATT). PEU’s beta coefficients (H4) are 0.911 and 0.085. PU’s coefficients (H3) are 0.587 and 0.535. SAT’s beta coefficients (H9) are 0.321 and 0.324. PEU affects only the attitude of short-term users. Although significant, a greater effect of PU and SAT on ATT is observed with increasing experience. Jointly, PEU, PU, and SAT determine 68.0% and 57.7% of the variance in ATT among short- and long-term users, respectively. SAT is determined by CON (H8: $\beta = 0.053, 0.481$) and PU (H7: $\beta = 0.642, 0.477$), which jointly explain 42.3% and 78.4% of the variance in INT among short- and long-term users, respectively. CON has a significant effect on satisfaction only among long-term users. In addition, the effect of PU on SAT weakens as experience increases. Finally, CON and PEU are antecedents to PU. CON’s beta coefficients (H10) are 0.006 and 0.196, whereas PEU’s coefficients (H5) are 0.633 and 0.712. The effect of PEU on PU is strong and becomes greater with increasing experience. Meanwhile, the influence of PEU on PU is consistently strong, whereas the influence of CON is fairly weak but insignificant among short-term users. PEU and CON jointly explain 51.1% and 61.2% of the variance in PU among short- and long-term users, respectively.

**Discussion**

The results identify the determinants of continuance usage intention of EMR systems by caregiving professionals in the healthcare organization. In general, all hypotheses in the TCT model are supported for both short- and long-term users with few exceptions. In addition, the explanatory power of the model for short- and long-term users is high. This finding shows that the TCT model is powerful in explaining EMR system continuance usage intention of both short- and long-term users.

The results show that the effects of satisfaction, attitude, and PU of healthcare professionals on continuance intention to use are positively influenced by user experience. These effects are dominant for professionals with greater years of experience with the system. In particular, the behavioral intention of short-term users is collectively determined by PU and satisfaction. The short-term users are concerned that the EMR system is useful to enhance their job performance in addition to their general satisfaction with the system. After significant use, the usefulness and the improved performance of an EMR system in comparison with paper medical records is proven for long-term users of EMRs in the hospital. In addition to PU and satisfaction, user attitude toward the performance of an EMR system will affect continuance intention to use. Thus, user perception of usefulness and satisfaction is more stable and becomes vital determinant of behavioral intention. The effect of user attitude on behavioral intention depends on user experience. This result is consistent with assimilation theory, which states that attitude can only change slowly across time (21). Furthermore, for both short- and long-term users, usefulness of the system is a key determinant of intention for continuous use.

Attitude is collectively determined by PEU, PU, and satisfaction. While PEU is a key determinant of attitude for short-term users, PU is a key determinant among both short-term and long-term users. PEU and PU are important in encouraging professionals to use an EMR system in the initial stages. As these professionals gain more experience with the system, working with the system becomes a routine for them. These medical professionals would become familiar with the features of the EMR system, such that ease of use is no longer a concern. At this time, attitude is determined by PU and satisfaction. PEU is no longer an active determinant of attitude. This result is consistent with the findings of Lin (52), who indicated that PEU is a more important factor in determining attitude for less experienced users than for more experienced users.

In the TCT model, satisfaction is determined by confirmation and PU. Confirmation only has a significant effect on satisfaction among long-term users, which is in line with ECM (8) that user satisfaction is influenced by their confirmation of expectation from prior IS use. Thus, confirmation, which considers pre-expectation behavior, is a stronger predictor of satisfaction than post-expectation behavior (9). PU has a significant effect on user satisfaction relative to an EMR system. This result suggests that, consistent with a prior study by Son et al. (29), greater satisfaction is gained
through beliefs that a system is useful. In other words, ensuring that an EMR system is useful is an important criterion that providers and vendors should consider before adopting the devices to increase satisfaction among healthcare professionals. One way for healthcare organizations to improve their employee perceptions on satisfaction may be to facilitate close collaboration with EMR vendors who can develop and provide systems that are useful to healthcare professionals. In addition, the effect of PU on satisfaction weakens with increasing experience, whereas the effect of satisfaction is strengthened. A plausible explanation may be that by increasing experience, the confirmation of the system is enhanced by the effect of expectation, and consequently, the effect of confirmation is increased and the function of PU is decreased. However, further research may be needed to validate this argument.

Confirmation and PEU are antecedents to PU. PEU has a positive effect on PU, which is in line with the study of Wu et al. (53). This effect becomes stronger with increasing experience. This finding indicates that healthcare professionals recognize the usefulness of an EMR system when the technology is easy to use. From this perspective, healthcare providers should place more effort into making their devices and systems easier to use, which can lead to better beliefs on usefulness and provide great satisfaction. The influence of confirmation on PU is fairly weak and is insignificant among short-term users.

The present study has several academic implications. First, the empirical results show that the TCT model supports all the hypotheses and has good explanatory power for not only EMR continuance intention but also for attitude, satisfaction, and perceived usefulness toward it. This finding implies that the TCT provides a novel theoretical basis to explain EMRs. Second, the results show that the effects of proposed factors on EMR continuance intention are different among short- and long-term users. Future studies may explore the potential reasons for this difference by conducting a qualitative study. In addition, the findings suggest the need to control for the effect of experience on relationships among EMR continuance intention and its determinants in future empirical studies to achieve more trustworthy results. Third, the results show that PU has the strongest effect on continuance intention to use for both short- and long-term users. Given that confirmation and PEU are critical antecedents to PU, future research may explore the factors that influence these variables.

This study provides several implications for policy-makers and managers in the healthcare industry. Recognizing the determinants of continuance EMR system usage intention among short- and long-term users will help policy-makers understand the factors that result in the ongoing use of an EMR system after adoption. Consequently, the policy-makers can adjust their strategies and policies for the successful implementation of this system in hospitals. Moreover, this understanding can help managers successfully promote the EMR system in their hospitals on the basis of user experience with the system.

Conclusions and limitations

The goal of this study is to investigate the EMR continuance usage intention of healthcare professionals. By considering user experience with EMRs, the behavior of short- and long-term users was also investigated to provide effective information on different stage of post-adoption. In this pursuit, the TCT was analyzed. A major theoretical contribution of TCT is that it combines the two central constructs of attitude and satisfaction into one continuance model while retaining the well-established constructs of PU and PEU as first-level antecedents. This study clarified the variations in user adoption behavior across various stages of IS usage.

This study has certain limitations that should be considered prior to generalizing its results. First, the work was conducted using a short-term snapshot of user behavior. Additional research efforts with longitudinal studies would provide a clearer picture of how the users and the relationships among variables change over time. Second, the development of hospital ISs in Iran is in its early stages. Despite considerable progresses during recent years, most hospitals remain highly dependent on paper medical records and have not yet adopted this new
technology. Therefore, future research on the determinants of EMR system adoption may aid in developing a more complete understanding of the factors that are critical to the success of EMR systems in the healthcare industry.

Declaration of interest
The authors have disclosed no potential conflicts of interest, financial or otherwise.

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