

‘Just What the Doctor Ordered’: A Revised UTAUT for EMR System Adoption and Use by Doctors

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Abstract

Electronic medical record (EMR) systems can deliver many benefits to healthcare organizations and the patients they serve. However, one of the biggest stumbling blocks in garnering these benefits is the limited adoption and use by doctors. We employ the unified theory of acceptance and use of technology (UTAUT) as the theoretical foundation and adapt the theory to the context of EMR system adoption and use by doctors. Specifically, we suggest that age will be the only significant moderator, and gender, voluntariness and experience will not play significant moderating roles. We tested our model in a longitudinal study over a 7-month period in a hospital implementing a new EMR system. We collected 3 waves of survey data from 141 doctors and used system logs to measure use. While the original UTAUT only predicted about 20% of the variance in intention, the modified UTAUT predicted 44%. Both models were comparable in their prediction of use. In addition to contributing to healthcare IT and UTAUT research, we hope this work will serve as a foundation for future work that integrates UTAUT with other theoretical perspectives.

1. Introduction

It was recently reported that less than half of all medical practices in the U.S. with four or more physicians use electronic medical records (EMR) systems [33], which are computer-based systems that digitize entire patient records. This is the case despite the numerous benefits of such systems, such as greater security, increased speed of patient encounters, better access to medical records and reduced incidents of adverse drug effects in in- and out-patient settings [36, 45]. The U.S. government is keen to promote universal EMR system use, with the government enacting a major initiative culminating in a National Health Information Infrastructure (NHII) goal of achieving shared information by 2014 [38]. Yet, one key stumbling block to the success of EMR systems is adoption and use by doctors [3, 22, 23]. Thus, research on this topic will be of great practical importance.

Prior research examining the adoption and use of EMR systems has used many theories to study a broad range of factors at the organizational and individual levels [e.g., 14]. Theories of individual adoption and

use, such as the technology acceptance model [TAM; see 41] and the unified theory of acceptance and use of technology [UTAUT; 41], have been used to gain an understanding of the adoption and use of EMR systems [14]. Many early studies sought to use TAM to explain the adoption of EMR systems [e.g., 18, 31], with many finding that the model did not explain much variance possibly due to the different context, or because other, more important factors that were not captured in TAM were relevant in this context [17, 26, 28]. More recent work has used the more comprehensive UTAUT. However, these studies have not included all the moderating factors that are integral to UTAUT [10, 37, 43], thus resulting in incomplete tests of the theory. Further, given that UTAUT was developed outside the healthcare context, it is important to understand its generalizability, the differences and/or limitations associated with using UTAUT in this context.

It is important to examine the external validity of theories by studying their generalizability across contexts, time and populations [see 7, 25, 32]. More recent perspectives on how to advance theories have further underscored the importance of examining theories in new contexts [see 2, 20]. Specifically, Johns [20] has noted that a particular context of study can result in many changes, such as relationships going from significant to non-significant or positive to negative or stronger to weaker. Alvesson and Kärreman [2] have further noted that examining theories in new contexts can result in their breakdown and opportunities for the creation of new knowledge. There have been several instances of researchers finding that specific contexts have led to differences. Even when UTAUT was applied in U.S. vs. China, Venkatesh and Zhang [42] found that some of the original UTAUT relationships had to be modified. The key, however, is rather simply observing what the changes were, in their paper, there was an exposition about why the theory would need to be modified for the context of a Chinese organization: cultural differences between the U.S. and China.

Taken together, this backdrop suggests that studying UTAUT in the specific, important context of EMR system adoption by doctors can not only help contribute to the knowledge on UTAUT [41] but also further our understanding of the phenomenon of healthcare IT implementations. Thus, the objectives of this work are to:

- (a) Adapt UTAUT to the context of EMR system adoption by doctors; and
- (b) Empirically test the model in a longitudinal study in a hospital implementing a new EMR system.

2. Background: Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh et al. [41] presented UTAUT as an integration of eight different models of acceptance and use of technology. UTAUT was tested and validated in two sets of studies, with data collected via three waves of surveys and objective use data from six organizations. UTAUT explained about 70% and 50% of the variance in intention and use respectively. In recent times, UTAUT has become the most widely cited recent model of individual technology adoption and use. While TAM is the most widely cited adoption model, it is contained within UTAUT, thus making UTAUT an appropriate and comprehensive starting point to understand doctors' EMR system adoption.

UTAUT, shown in Figure 1, identifies three direct determinants of behavioral intention to use a technology—i.e., performance expectancy, effort expectancy and social influence—and two direct determinants of technology use—i.e., behavioral intention and facilitating conditions—and four contingencies—i.e., gender, age, experience and voluntariness—that alter the effect of the determinants on intention to use a system and/or system use.

Performance expectancy is defined as the degree to which an individual believes that using the system will help him or her better attain significant rewards and performance expectancy was found to be a significant determinant of behavioral intention, with its effect varying across gender and age such that the effect is strongest for younger men. Effort expectancy is defined as the degree of ease associated with the use of the system and it was found that the effect of effort expectancy on behavioral intention varies across gender and age such that the effect is strongest for older women in early stages of experience. Social influence is defined as the degree to which an individual perceives that important others believe he or she should use the new system and it was found that the effect of social influence on behavioral intention was found to be contingent on gender, age, experience, and voluntariness, such that it is the strongest for older women in early stages of experience in mandatory contexts. Facilitating conditions is defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system and it was found that the

effect of facilitating conditions on technology use was moderated by age and experience.

We used both Web of Science and Google Scholar to understand how UTAUT has been used in prior research. As of August 2010, we found that the Venkatesh et al. [41] paper was cited nearly 1,000 times per Web of Science and about 3,000 times per Google Scholar. In fact, *MIS Quarterly* lists this paper as the 2nd most cited paper ever published in the journal. It was clear from our review that UTAUT has been applied to study a variety of technologies. However, it is interesting to note that most of these were applications of UTAUT without too much a priori considerations to the context, particularly in terms of changes necessary to the theory, especially in terms of moderating relationships. We did notice there have been several efforts to add constructs to extend UTAUT to specific contexts. Finally, it is worth noting that despite these several efforts to apply and extend UTAUT, there have been few, if any, faithful and complete replications of UTAUT.

One other aspect related to UTAUT studies that is worth mentioning is the theorizing about UTAUT for specific contexts. Leveraging a general theory like UTAUT and tailoring it to specific contexts will not help increase the generalizability of the theory but also make it more practically useful. One recent UTAUT example is Venkatesh and Zhang [42]: they theorized that although the effects of performance expectancy, effort expectancy and facilitating conditions on intention will be similar to what was theorized and found in the original UTAUT, in China, social influence will only be moderated by experience, and gender, age and voluntariness will not be significant moderators due to the collectivist nature of the society. This prediction was supported in a Chinese organization.

3. How will UTAUT change? Contextualizing to Doctor's EMR system adoption and use

In this section, we discuss the mechanisms proposed in the original UTAUT and contextualize the theory for doctors' EMR system adoption and use. We discuss how the mechanisms related to each of the four moderators proposed in UTAUT will either be the same or non-significant in this new context. Table 1 shows the original UTAUT relationships, as shown in Figure 1, and the changes that we propose for this specific context. Specifically, we theorize that gender, voluntariness and experience will not be significant moderators and only age will be significant in the doctors' EMR system adoption context.

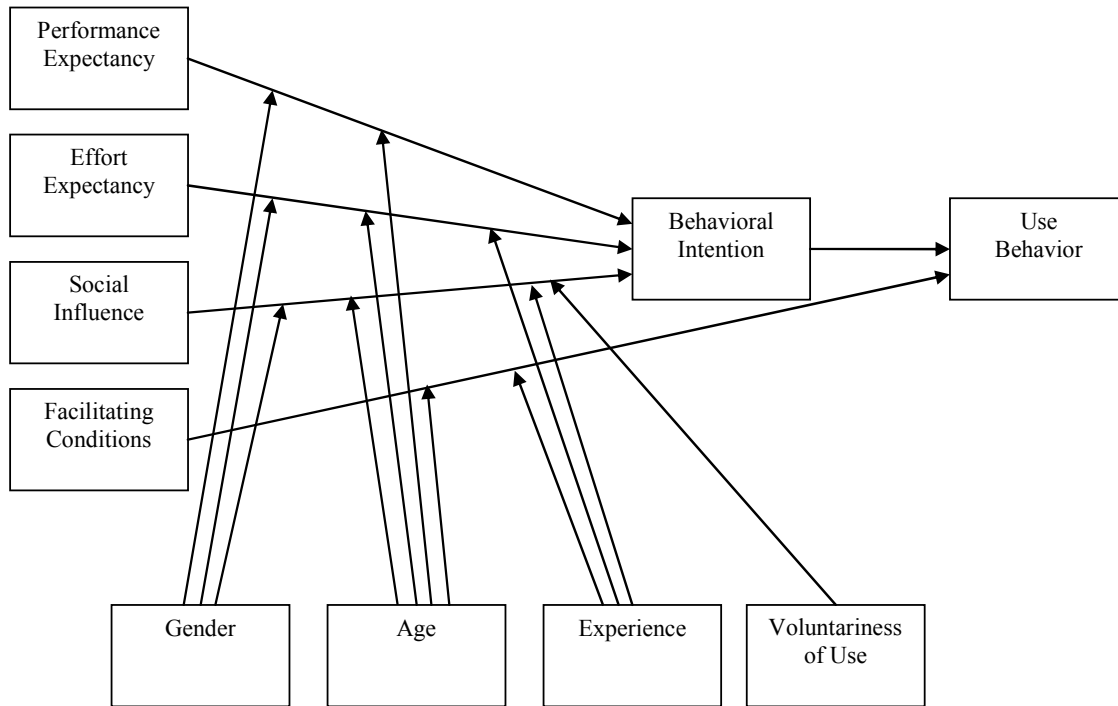


Figure 1. Original UTAUT

Note: All interactions shown are higher-order terms.

3.1. Gender effects

In UTAUT, gender moderates all relationships into intention. The theoretical mechanisms and justifications surrounding the moderation by gender center strongly around gender stereotypes and the associated differences between men and women in terms of their beliefs and values about various things, including the workplace. In the context of doctors, however, we expect that such gender stereotyping will give way to professional acculturation [13, 27], i.e., values and beliefs imparted as part of doctors' professional training, commitment to the profession (being a doctor) and professional associations. Thus, there will be no gender differences among doctors in the factors that are important, i.e., the gender effects in UTAUT will not be significant among doctors.

3.2. Age effects

In UTAUT, age moderates all the relationships. In UTAUT, the mechanisms related to the effects of age were articulated as considerations related to the difficulty in adapting to change, reliance on the opinions of others and a focus on the process among older people [41]. These reasons will hold true among doctors. The reason for this is that older doctors were more likely trained in the days before EMR systems were part of medical training and

practice [1]. For the longest time, EMR systems have been known to upset the rhythm of the process and flow of medical practice [3], the age-related mechanisms will be particularly salient to older doctors. In contrast, due to their greater interaction with technologies growing up and in medical school, younger doctors are likely to feel more comfortable and able to adopt and use an EMR system [15, 30]. Thus, age effects in UTAUT will hold among doctors.

3.3. Voluntariness effects

In UTAUT, voluntariness moderates only the effect of social influence on intention. Unlike employees in typical work settings, doctors operate with considerably more autonomy [e.g., 4] and can always do as they see fit given that the "doctor knows best" and is the ultimate decision maker with regard to patient care [19]. Consequently, no amount of pressure from perceived organizational mandate is likely to have any sort of impact on doctors' decisions to use an EMR system [12, 21]. This is not to suggest social influences will not be important as doctors have a strong professional bond with each other that in turn will have them relying strongly on the opinions of their peers [44]. Thus, the moderation by voluntariness proposed in UTAUT will not be present among doctors.

Table 1. Proposed Differences: Original UTAUT vs. UTAUT for Doctors

	Original UTAUT				Revised UTAUT for Doctors			
	GDR	AGE	VOL	EXP	GDR	AGE	VOL	EXP
PE-BI	✓	✓				✓		
EE-BI	✓	✓		✓		✓		
SI-BI	✓	✓	✓	✓		✓		
BI-USE								
FC-USE		✓		✓		✓		

3.4. Experience effects

In UTAUT, experience moderates all relationships except the usefulness-intention relationship. The fundamental mechanism underlying experience as a moderator is that as an individual gains in experience, problems that existed in the early stages and the need for others' views will dissipate, thus rendering the effects into intention to be weaker over time but the focus on process issues will become stronger in driving use over time [41]. However, it is worth noting that the original UTAUT study spanned only 5 months and the systems studied, and perhaps most systems in general, create less change in business processes and are significantly less disruptive to the typical routine than EMR systems have been for years now [see 3]. Thus, the moderating effects of experience will not be prevalent among doctors and the effects observed in early stages of experience will continue to exist for months or even years after the implementation.

4. Method

4.1 Setting, participants and data collection

We collected data from a private hospital. The hospital employed about 200 full-time doctors and 50 contracted doctors who typically worked at the hospital 1 or 2 days of the week. The hospital also employed about 800 para-professionals and about 200 administrative staff members. There were about 800 beds in the hospital and it provided a variety of all healthcare services, including emergency care. Our data collection occurred in conjunction with the hospital's implementation of an enterprise-wide healthcare IT solution, which we term E-HealthSys. The system supported all aspects of patient care, including patient health information, health records, treatment plans, billing and follow-up. The system was developed by a leading vendor and was customized to fit the needs of the specific hospital. Management decided that no major changes were to be made to the system; only bug fixes would be done.

Table 2 presents our data collection timeline and major activities associated with the implementation. Given that the hospital administration was interested in this study, they strongly supported our data collection. The hospital hired a market research firm to help with data collection to ensure that employees felt comfortable with the privacy and confidentiality of the data. In turn, this was expected to lead to a higher response rate and in leading to employees providing honest feedback. Two different sources, namely surveys and system logs, were used to collect data, thus minimizing biases. Training sessions, customized to the needs of specific user groups, was offered before the rollout of the system. There were several sessions, with each session lasting about 4 hours, available over the course of a month. To make it feasible for as many people as possible to attend the training, four training sessions were held each day while the hospital did not run at full capacity during this month. Trainer variability was minimized by using an identical training script to deliver training materials. E-HealthSys was implemented after the all training sessions were completed. Our sampling frame was the list of 202 full-time doctors employed. Of them, 141 provided responses in all waves of the data collection for a response rate of approximately 70%. We checked for non-response bias and found no significant differences in demographics between respondents and non-respondents.

4.2. Measurement

All UTAUT predictors, i.e., performance expectancy, effort expectancy, social influence and facilitating conditions, and behavioral intention were measured (Likert agreement scale where 1 was strongly disagree and 7 was strongly agree) using reflective indicators adapted from prior research [41] in a survey at T1. We build on the original UTAUT paper and more recent work has recommended employing multiple indicators [40]. We thus employed three different formative indicators of E-HealthSys use from archival system logs: duration, number of features used and frequency of use of each feature [40, 41].

Table 2. Data collection timeline

T1: Month 1 (pre-impl.)	T2: Months 2-3	T2: Months 4-5	T3: Months 6-7
<ul style="list-style-type: none"> Training takes place, with several sessions available. After training, <i>survey</i> is administered. Roll-out occurs after training. 	<ul style="list-style-type: none"> E-HealthSys is available on all computers. Use data collected from <i>system logs</i>. At the end of month 3, survey is administered. 	<ul style="list-style-type: none"> Use data collected from <i>system logs</i>. At the end of month 5, survey is administered. 	<ul style="list-style-type: none"> Use data collected from <i>system logs</i>.

Table 3. Measurement model estimation

	ICR	Mean	S Dev	PE	EE	SI	FC	Gdr	Age	Exp	Vol	BI	Use
PE	.91	4.03	1.10	.80									
EE	.91	4.05	1.33	.33***	.82								
SI	.80	4.20	1.05	.35***	-.14*	.80							
FC	.77	4.02	1.01	.22**	.31***	.17*	.83						
Gdr	NA	NA	NA	.10	.11	.05	.09	NA					
Age	NA	40.55	10.40	-.22**	-.25***	.23***	-.20**	.10	NA				
Exp	NA	2.00	1.00	.14*	.12*	.04	.07	.06	.04	NA			
Vol	.75	3.40	1.45	.05	.03	.03	.10	.02	.04	.07	.74		
BI	.91	3.54	1.44	.40***	.30***	.34***	.25***	.02	-.24***	.13*	.15*	.80	
Use	NA	7.90	4.66	.37***	.20**	.30***	.16*	.05	-.23**	.14*	.07	.57***	NA

Notes:

1. ICR: Internal consistency reliability. * $p < .05$; $p < .01$; $p < .001$.
2. Diagonal elements are the square root of the shared variance between the constructs and their measures; off-diagonal elements are correlations between constructs.
3. PE: Performance expectancy; EE: Effort expectancy; SI: Social influence; FC: Facilitating conditions; Gdr (0: men): Gender; Exp: Experience; Vol: Voluntariness of use; BI: Behavioral intention to use the system.

5. Results

We used the same data analysis procedure as the original UTAUT study [41]. We used partial least squares (PLS) to analyze the data and used Smart-PLS as the tool [29]. The measurement models were examined in conjunction with the structural models tested. The data were analyzed such that the use data corresponding to any given observation was lagged (i.e., from a subsequent time period).

Table 3 shows the measurement model for the data, pooled across time, used to test the complete UTAUT. All internal consistency reliabilities were above .70. The inter-construct correlations were greater than the square root of the average variance extracted, thus supporting convergent and discriminant validity. The loadings in each time period were greater than .70 and all cross-loadings were lower than .35 (details not shown due to space constraints), thus again supporting validity. This clean factor structure was consistent with prior work [see 41]. Use was modeled using formative indicators, and all weights were significant into the latent variable and between .43 and .58.

UTAUT was estimated using data pooled across time. Table 4 shows the results of different structural

model tests predicting intention and use. Also shown in Table 4 are the results reported in the original UTAUT study [41]. As is evident from the results, the full UTAUT was not well supported among doctors, with the variance being explained being only 21%, which is much lower than the 70%+ in Venkatesh et al. [41]. We estimated the model with subsets of moderators. As we expected, gender, voluntariness and experience did not play significant moderating roles. With each moderator being dropped, the model performed better at predicting intention and use. Finally, the revised UTAUT, which is shown in the last column in Table 4, with only age as a moderator, performed the best and explained 44% and 47% of the variance in intention and use respectively. The proposed changes to UTAUT, shown in Table 1, are thus supported.

It was important to conduct a power analysis given that our modifications to UTAUT are null effects. We found, based on Cohen [11], that we would have detected medium effects in the full UTAUT test and medium to small effects in the revised UTAUT. This is not a major concern given the recent emphasis in the IS literature of not just finding statistically significant effects but effects large enough to be of practical significance [16].

Table 4. Structural model tests (Please note that the table spans across two pages)

	DV: Intention					
	Original Venkatesh et al. [41] study	This Study				
		Original UTAUT	Main effects only	AGE, VOL, EXP as moderators	AGE, EXP as moderators	AGE as moderator
R ²	.76	.21	.32	.29	.35	.44
Performance expectancy (PE)	.18*	.13*	.28***	.17**	.25***	.28***
Effort expectancy (EE)	.04	.12*	.22***	.13*	.15*	.17*
Social influence (SI)	.01	.11*	.17**	.14*	.16*	.20**
Facilitating conditions (FC)	.04	.01	.12*	.03	.04	.05
Gender (GDR)	.01	.02	NA	NA	NA	NA
Age (AGE)	.00	.02	NA	.03	.02	-.13*
Voluntariness (VOL)	.00	.01	NA	.07	NA	NA
Experience (EXP)	.00	.02	NA	.08	.04	NA
PE X GDR	.02	.01	NA	NA	NA	NA
PE X AGE	.01	.03	NA	-.30***	-.32***	-.33***
GDR X AGE	.06	.02	NA	NA	NA	NA
PE X GDR X AGE	.55***	.08	NA	NA	NA	NA
EE X GDR	.02	.02	NA	NA	NA	NA
EE X AGE	.04	.03	NA	.14*	.23***	.43***
EE X EXP	.02	.03	NA	.04	.01	NA
GDR X AGE	Earlier	Earlier	NA	NA	NA	NA
GDR X EXP	.02	.02	NA	NA	NA	NA
AGE X EXP	.01	.06	NA	.05	.04	.05
EE X GDR X AGE	.01	.05	NA	NA	NA	NA
EE X GDR X EXP	-.10	-.07	NA	NA	NA	NA
EE X AGE X EXP	-.02	-.02	NA	.05	.04	NA
GDR X AGE X EXP	-.06	-.04	NA	NA	NA	NA
EE X GDR X AGE X EXP	-.27***	-.07	NA	NA	NA	NA
SI X GDR	.02	.02	NA	NA	NA	NA
SI X AGE	.02	.04	NA	.16*	.34***	.53***
SI X VOL	.06	.05	NA	.04	NA	NA
SI X EXP	.04	.02	NA	.04	.06	NA
GDR X AGE	Earlier	Earlier	NA	NA	NA	NA
GDR X VOL	.01	.04	NA	NA	NA	NA
GDR X EXP	Earlier	Earlier	NA	NA	NA	NA
AGE X VOL	.02	.01	NA	.02	NA	NA
AGE X EXP	Earlier	Earlier	NA	Earlier	Earlier	NA
VOL X EXP	.02	.02	NA	.01	NA	NA
SI X GDR X AGE	.04	.04	NA	NA	NA	NA
SI X GDR X VOL	.01	.04	NA	NA	NA	NA
SI X GDR X EXP	.01	.02	NA	NA	NA	NA
SI X AGE X VOL	.06	.03	NA	.02	NA	NA
SI X AGE X EXP	.01	.02	NA	.01	.08	NA
SI X VOL X EXP	.00	.03	NA	.04	NA	NA
GDR X AGE X VOL	.00	.02	NA	NA	NA	NA
GDR X AGE X EXP	Earlier	Earlier	NA	NA	NA	NA
GDR X VOL X EXP	.00	.03	NA	NA	NA	NA
AGE X VOL X EXP	.01	.04	NA	.02	NA	NA
SI X GDR X AGE X VOL	.04	.02	NA	NA	NA	NA
GDR X AGE X VOL X EXP	.02	.01	NA	NA	NA	NA
SI X GDR X AGE X VOL X EXP	-.28***	.04	NA	NA	NA	NA

	DV: Use					
R ²	.53	.41	.39	.41	.41	.47
Behavioral intention (BI)	.52***	.55***	.56***	.55***	.55***	.55***
Facilitating conditions (FC)	.11	.13*	.14*	.13*	.13*	.16*
Age (AGE)	.08	.02	NA	.02	.02	.05
Experience (EXP)	.06	.03	NA	.03	.03	NA
FC X AGE	.02	.15*	NA	.15*	.15*	.25***
FC X EXP	.00	.02	NA	.02	.02	NA
AGE X EXP	.01	.03	NA	.03	.03	NA
FC X AGE X EXP	.23**	.04	NA	.04	.04	NA

Notes:

1. “Earlier” indicates that the term has been listed earlier in the table, but is included again for completeness as it relates to higher-order interaction terms being computed. NA: not applicable
2. * $p < .05$; $p < .01$; $p < .001$.

6. Discussion

We adapted UTAUT to the context of EMR system adoption and use by doctors. We conducted a longitudinal field study in a hospital among doctors in conjunction with a hospital’s implementation of an EMR system. We found that although the original UTAUT did not perform well in explaining intention, our substantially more parsimonious version, that included only age as a moderator, performed better in explaining the intention and use of an EMR system among doctors and explained 44% of the variance in each of these two dependent variables.

This work makes significant contributions to both critical streams in which this work is rooted: healthcare IT and UTAUT. Our first and most important set of contributions are to healthcare IT research. It has long been suggested that doctors represent a key piece of the puzzle when it comes to success of EMR systems [9, 24]. Thus, explaining what drives doctors’ decisions to adopt and use EMR systems is a significant contribution. In this context, the fact that age is a key moderating variable is an encouraging finding and a note of caution. On the one hand, it suggests that the future generation of doctors is more likely to embrace EMR systems based on its quality. On the other hand, experienced (older) doctors possess important knowledge that must be passed on to the future generation of doctors. With EMR systems playing a disruptive role in medical practice, it could harm interaction among doctors and the apprenticeship (formal and informal) through which doctors learn. Further, given that older doctors are often the best at what they do due to their experience and expertise, interrupting their workflow can greatly affect the quality of care that is delivered. The pattern of moderating effects did not change with experience and sustained over the first seven months of the implementation that we studied. This too is a cause for concern as process issues, particularly ease of use,

remained a driver in all three waves—this is in contrast to typical findings related to technology acceptance where ease of use ceases to be important after just a few months [see 41]. Perhaps in a way, this underscores the fact that ease of use may be more important in the context of EMR system adoption than in other types of information systems.

The second set of contributions is to UTAUT and its generalizability. It has been noted recently that despite being widely cited, empirical tests of UTAUT are fairly limited [34]. Our searches of the academic literature confirmed this, particularly when it comes to a complete test that includes all moderators. By theorizing about context-driven changes to UTAUT, we contribute to this body of knowledge. Context has long been recognized as an important boundary condition for the generalizability of theories. However, it is only recently that theorists have advocated taking a proactive approach in considering context in theory development [e.g., 20]. By doing exactly this for UTAUT and leveraging the critical context of EMR system adoption among doctors, we extend UTAUT. This work can serve as a springboard to study UTAUT among other employees, e.g., para-professionals, in the healthcare context and also in other contexts where again it is likely that UTAUT may need to be altered. An important area for follow-up research emerges from the 44% variance in intention and use explained by the modified UTAUT vs. the 76% explained in the original Venkatesh et al. [41] study. This is due to the fact that the primary differences between the original UTAUT and what was theorized and found to be supported in the context of doctors’ adoption and use of UTAUT were all effects that were rendered non-significant in this context [see 2, 20].

Building on the suggestions above, there are several possible fruitful future research directions. To use a medical metaphor, age is not a cause but likely a symptom of what we have observed. Future research should examine the causes that could include years until retirement rather than age itself. Future work

should thus attempt to integrate different other theories to enrich UTAUT and its applicability to this context. For instance, given that doctors develop norms through professional socialization, have a strong bond with other doctors and a strong sense of professional commitment, it stands to reason that social networks may be a useful theoretical lens that should be integrated [35]. Further, inductive work could unearth other useful factors that are relevant to the context of doctors' adoption and use of EMR systems. Based on such inductive work and the findings that emerged here, it is essential for future research to focus on interventions to foster greater acceptance and use of EMR systems by doctors, especially given the enormous cost-saving and life-saving role that EMR systems can play. Interventions will need to particularly target problematic areas [39]. In our work, the fact that older doctors have certain preferences suggests that the design and training should be sensitive to these issues. Also, EMR systems themselves are fairly complex and comprise several modules. It is possible that the reactions of doctors are different and driven by different factors when it comes to using different modules. For instance, it is possible that doctors react differently to a computerized physician order entry (CPOE) module that is less disruptive to the standard flow of care-giving when compared to modules that are more directly involved and, therefore, more disruptive in the traditional practice and flow of care-giving. Another direction for future work is to carefully understand a variety of dependent variables. Some have argued that as use becomes mandated, intention is no longer a relevant variable and satisfaction would be the variable to study [8]. Further, it is important to study the impacts of use on various metrics of quality of care, such as errors and patient satisfaction. While it is long believed that EMR systems contribute favorably to patient care, systematic long-term evidence is still somewhat lacking. By controlling for pre-implementation quality of care and examining the impacts of use on quality of care, future work can expand the nomological network. Such work will be an important theoretical and empirical data point in the ongoing research on the use-performance relationship or more broadly, the business value of IT.

Some ideas for future research emerge from the limitations of this work. As we have already noted, the fact that the crux of the modifications to UTAUT point to null effects with the power only to detect medium effects, future research should address this limitation by conducting studies using larger samples. Another limitation is that if the notion of context were taken to an extreme, everything observed in this work may only be applicable in this one hospital and that too using this one EMR system. Field studies are always plagued by

this limitation as the idiosyncrasies of the study context cannot be ruled out. Only future research in other hospital settings and with other EMR systems among other sets of doctors can help fortify the theoretical claims made in this work and the empirical findings that emerged. Finally, this study only reports on the findings among doctors. Care-giving is a complex process and involves para-professionals in critical support roles. Studying their reactions and the interplay between the viewpoints of doctors and para-professionals and the consequent impact on the use by both user groups is an important next step in this line of inquiry.

A broader implication of this work is the focus on context and uniqueness vs. generalizability. As we noted at the outset, researchers have tended to emphasize generalizability of theories. Emphasizing the context and its uniqueness has typically been considered to be a limitation rather than a strength. More recent thought on theories has, however, challenged this notion and called for theories that are context-sensitive. We concur with this view and call for IS researchers to re-examine theories in the context of specific technologies and implementation contexts. For instance, it is possible that theories of adoption, such as UTAUT, could operate differently for collaboration technologies [see 5, 6]. Likewise, there may be differences that are necessitated based on specific other contexts, such as home PC adoption in China. It is important to note that we do not simply call for empirical work in new contexts but rather, we call for work that will carefully consider important contexts and theorize about its uniqueness in order to adapt and extend existing theories to the new context.

Our findings also have implications for practice. It is clear that hospital management will have to approach the deployment of EMR systems among older doctors keeping in mind the different set of factors that play a role amongst them. Further, given their known negativity toward such systems, perhaps just as much as older doctors serve as mentors to younger doctors, younger doctors can help older doctors better understand the system so they may be more likely to embrace the system.

7. Conclusions

UTAUT is a key recent theoretical advance in IS. It reflects the accumulated knowledge of years of research on individual technology acceptance and use. By theorizing about how it should be altered to fit the context of EMR system adoption among doctors, we contribute significantly to both healthcare IT and UTAUT research. It is clear that UTAUT in its original form is far too expansive and minimally useful in

explaining adoption and use of EMR systems among doctors. However, the changes to UTAUT proposed in this work, particularly by simplifying the theory, did a much better job of explaining intention and use. We hope this work will serve as a basis for researchers to leverage the context in modifying UTAUT.

8. References

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