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Emergent Research Forum (ERF)

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Abstract

Research studies investigating the acceptance of information systems mostly focused on systems designed for long-term use without considering systems designed for one-time or short-term use. However, systems designed for short-term use are part of the health information technology portfolio. We propose a theoretical model inspired by the D&M IS success model to investigate user satisfaction, as a measure of acceptance, with a web-based decision aid designed for short-term use to support "goals of care" decision-makers. We hypothesize that media richness, perceived social presence, and trust affect system quality and information quality, which affects user satisfaction and implementation outcomes. We propose a mixed-methods study to test our hypotheses using eye-tracking, surveys, and interviews.

Keywords

Short-term use, decision aid, user satisfaction, IS success model, health information technology.

Introduction

The adoption of health information technology (HIT) has been studied for decades using the technology acceptance model (TAM) (Davis 1989) and the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al. 2003). Both theories suggest that the variation in actual use of systems is affected by behavioral intent to use these systems. Despite many criticisms, these theories successfully explain the variation in actual use through perceptions of behavioral intent for many systems including HIT (Shachak et al. 2019). While these models work well in predicting actual use of systems that are intended for long-term use (e.g., Electronic Health Records, patient portals, or mobile health applications), it is not clear if they work as effectively in explaining acceptance of systems that are designed for one-time or short-term use. Especially in situations where the users unexpectedly find themselves faced with a new system that is not intended for continued use, focusing on satisfaction with the system after one-time or short-term use is necessary to explain variation in outcomes affected by system use. The DeLone and McLean Information System Success Model (D&M IS success model)(William and Ephraim 2003), with its focus on user satisfaction as a dependent variable, fits better in situations where intention to use is not expected given the context. In this research, we focus on assessing the impact of using a web-based decision aid (DA) to support the "goals of care" decision-making process for families of patients in the Intensive Care Unit due to a neurological condition (e.g., traumatic brain injury, stroke) (neuro ICU). The families are expected to decide between continuing invasive care for their patients or switching to comforting end-of-life care. It is difficult for them to process the clinical information provided during family meetings to make a life-or-death decision on life-support interventions for their loved ones. The DA is designed for use prior to the family meeting with a clinician to provide families with background information so that they are prepared to discuss care options for their loved ones. Similar DAs have been implemented for various health decisions (Stacey et al. 2017) to encourage communication between proxies and clinical staff to make an informed

decision based on the best accessible scientific evidence and patients' values and preferences (Kon et al. 2016). Given the use of similar DAs in healthcare, we propose a theoretical model to investigate how satisfaction with systems designed for one-time or short-term use affects decision-making outcomes.

Research Model and Hypothesis Development

William and Ephraim (2003) noted that the D&M IS success model provides a comprehensive framework for conceptualizing and operationalizing the success of a system. Measuring IS success or effectiveness is critical to the understanding of the value and efficacy of developed systems. Additionally, the D&M IS Success model identifies the interrelated relationships among six essential dimensions of IS success: information quality (IQ), system quality (SQ), service quality, use, user satisfaction, and net benefits. This model has been validated in different contexts, such as e-learning (Mohammadi 2015). Our proposed model, shown in Figure 1, is developed based on the D&M IS success model. Constructs SQ and IQ are selected to help explain the variation in user satisfaction in similar contexts. DA system facilitates shared decision-making between proxy decision-makers and clinicians about goals of care for patients in the neuroICU. We identified interrelated constructs (e.g., media richness (MR), perceived social presence (PSP), trust, SQ, IQ, user satisfaction, and implementation outcomes) and relevant measurements to evaluate the success of the DA system. In this proposed exploratory model, we are particularly interested in (1) how MR of the DA affects user engagement with the provided content, which will be measured with objective and subjective measures (e.g., eye-tracking and interviews); and (2) how these constructs are interrelated and impact satisfaction with the DA by using surveys.

Media Richness (MR)

Daft and Lengel (1986) defined MR as "the capacity to process rich information" (p.560). Research showed that creating MR facilitates communication (Liu et al. 2009) and increased MR in the system provides richer information, which stimulates trustworthiness (Lu et al. 2014). Visual design elements used in a website may increase emotional appeal to users (Garrett 2010). In the study, we will use image appeal (Cyr et al. 2009) to operationalize MR. Media elements (e.g., images or texts) could convey complex visual content, which may lead to cognitive and affective reactions (Cyr et al. 2009). Hence, human images on the website might lead to higher levels of PSP, which in turn leads to a higher degree of online trust (Hassanein and Head 2007). Hence, we hypothesize that perceived MR could enhance user experience and evoke emotion and PSP.

Hypothesis 1: As MR of the DA increases, PSP with the DA will increase.

Perceived Social Presence (PSP)

Interacting with HIT lacks human warmth and sociability, in other words, social presence, because it is impersonal and anonymous compared to face-to-face interactions (Hassanein and Head 2007). PSP refers to the sense of being with another (Biocca et al. 2003, p.456). PSP is essential for users to build a relationship and connection with HIT. We will evaluate PSP by the PSP scale adapted from Cyr et al. (2009). Integrating PSP into the website could positively impact the user's attitude towards the DA and help build connection and trust. Gefen and Straub (2003) suggested that the PSP is an enabler and a necessary condition for the development of trust, which was empirically validated in e-commerce (Cyr et al. 2009). Therefore, we hypothesize that increased PSP will result in increased trust with DA.

Hypothesis 2: As PSP of the DA increases, user's trust with the DA will increase.

Trust

Trust is essential for users when they process healthcare information. It would be difficult for users to use the DA to make a life-or-death decision for their loved ones if they don't trust the system. Trusting makes users willing to take the risk of engagement with the systems (Hassanein and Head 2007). Trust is difficult to define due to its dynamic, evolving, and multi-faceted nature (Kim et al. 2009). Cyr et al. (2009) defined trust as the general confidence a user has in the website (p.545). Petter et al. (2013) defined trust as the extent to which an individual has a positive view of technology, i.e., the use of technology in the individual's

best interest (p.16). They identified trust as a success factor that consistently impacts IS success. In their study, the relationships of trust with SQ, IQ, and user satisfaction had been supported. Moreover, Lee et al. (2007) defined trust in two categories: (1) willingness of being vulnerable to another; and (2) positive perceptions or beliefs about the attributes of another (P.729). They suggested that trust in an offline bank positively influences perceived online bank satisfaction. We will evaluate trust using trust survey from Walter et al. (2015). We come up with the following hypotheses:

Hypothesis 3a: As user's trust of the DA increases, SQ with the DA will increase

Hypothesis 3b: As user's trust of the DA increases, IQ with the DA will increase

Hypothesis 3c: As user's trust of the DA increases, satisfaction with the DA will increase

System Quality (SQ)

The DA under investigation is not a system that any user would like to adopt. Allowing users to rapidly learn the system and navigate it easily makes the SQ an important variable in the model. SQ refers to desirable characteristics of an information system to measure technical success and is an important variable of satisfaction (William and Ephraim 2003, p.10). In our study, we will use reliability, accessibility, flexibility, integration, timeline (Wixom and Todd 2005), ease of use (Loiacono et al. 2007), and usability (Brooke 2013) to operationalize SQ. Wixom and Todd (2005) indicated that SQ is a significant determinant of system satisfaction. Mohammadi (2015) also supported that SQ is the primary factor driving users' satisfaction in e-learning. Hence, we hypothesize that increased SQ will lead to increased satisfaction.

Hypothesis 4: As SQ of the DA increases, satisfaction with the DA will increase

Information Quality (IQ)

IQ refers to desirable characteristics of the system outputs (content, reports, dashboards) to measure semantic success and impact satisfaction positively (William and Ephraim 2003, p.10). Studies suggest that IQ, in addition to SQ, positively affects satisfaction (Wixom and Todd 2005). The measures that we selected to evaluate IQ of DA are relevance (Hong et al. 2002; Oenema et al. 2001), completeness, accuracy, format, currency, and usefulness (Wixom and Todd 2005). As a service and communication system, the DA is designed to facilitate communication and comprehension of complex medical information. Hence, we hypothesize that IQ will have a direct effect on user satisfaction.

Hypothesis 5: As IQ of the DA increases, satisfaction with the DA will increase

Satisfaction

User satisfaction in IS success model is designed to measure "effectiveness success" (William and Ephraim 2003, p.10). Sanchez-Franco (2009) defined satisfaction as the extent to which subjects believe that their needs, goals, and desires have been fully met (p.248). Wixom and Todd (2005) utilized system satisfaction and information satisfaction as survey items and measurement properties that related to SQ and IQ. We will use satisfaction scales from (Hess et al. 2005; Wixom and Todd 2005) to operationalize satisfaction. The DA aims to facilitate the conversations between the physicians/other providers and the proxies by preparing the proxies to process the information effectively using the DA before the family meeting. After using the DA, the proxies obtain a better information understanding, which makes the service delivered by clinicians easier to be accepted by the proxies and might result in better intervention outcomes. Therefore, the service intervention implementation outcomes (Weiner et al. 2017) is an important variable to evaluate. This leads to the following hypothesis:

Hypothesis 6: As satisfaction with the DA increases, the service implementation outcomes will increase

Intervention Implementation Outcomes

To fit in the short-term system-use context, we removed service quality, but it does not preclude evaluating service. We are interested in intervention service delivery and its outcomes. A prior implementation research framework distinguishes the outcomes into 3 types: implementation outcomes, service outcomes, and client outcomes. In our case, we focus on implementation outcomes and its measurement: acceptability

(Weiner et al. 2017). Implementation outcomes refers to "the effects of deliberate and purposive actions to implement new treatments, practices, and services" (Proctor et al. 2011, p.65).
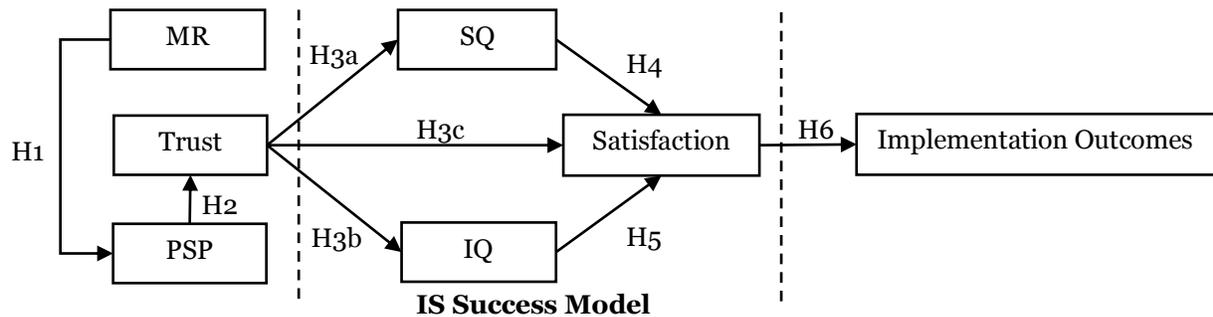

Figure 1 Proposed Research model

Further Research and Conclusions

We will utilize the proposed model in a study to assess the effectiveness of the DA in supporting goals of care decisions. We will recruit approximately 30 participants since for qualitative eye-tracking testing, five subjects will suffice and offer enough insight (Hey 2021). Preceding the task, participants will sit in front of a computer monitor preloaded with DA. After participants' gazes are calibrated, the eye-tracking starts. Participants will explore the DA independently as a medical proxy who must decide whether to continue life support for a loved one. Their eye movements will be tracked in a non-invasive, non-obstructive manner via video recording and pattern recognition. The video recording will be processed to create heatmaps and gaze pattern overlays of the computer screen to show where the user focuses during the test. In the end, we will collect surveys regarding constructs and conduct interviews about user experience of DA with gaze replay. Eye-tracking provides evidence that if MR catches more attention and generates PSP. The eye-tracking and interviews will be used to investigate if pages with multimedia engage users better compared to text-heavy pages. The surveys will be used in conjunction with results from the subject's eye-tracking record to analyze the subject's comprehension and cognitive strain. Eye-tracking data will be transformed and analyzed into excel files; survey data will be evaluated using SPSS, Excel, and basic statistical modeling; and interview data will be recorded, transcribed into transcripts, and coded in NVivo. Making life-or-death decisions for loved ones unavoidably brings significant cognitive and emotional strain. Identifying constructs that impact user satisfaction with DA would improve the usability of DA and help proxies make an informed decision. This study would significantly contribute to the implementation and success of web-based shared DA by improving MR, PSP, trust, IQ, SQ, and satisfaction. However, this experiment will be conducted in a laboratory setting using a small sample size, which will invariably limit the insights. This is only a preliminary test for the instruments (the DA and surveys). In the future, we will conduct a field study of the DA with real proxies in a hospital using a larger sample size.

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