

Theory Development in Nursing and Healthcare Informatics

A Model Explaining and Predicting Information and Communication Technology Acceptance by Healthcare Consumers

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About 110 million American adults are looking for health information and services on the Internet. Identification of the factors influencing healthcare consumers' technology acceptance is requisite to understanding their acceptance and usage behavior of online health information and related services. The purpose of this article is to describe the development of the Information and Communication Technology Acceptance Model (ICTAM). From the literature reviewed, ICTAM was developed with emphasis on integrating multidisciplinary perspectives from divergent frameworks and empirical findings into a unified model with regard to healthcare consumers' acceptance and usage behavior of information and services on the Internet. **Key words:** *e-health, healthcare consumers, model, technology acceptance, theory, the Internet*

UNTIL the early 1990s, only a small percentage of the population used the Internet. The number of Internet users has

grown significantly since the World Wide Web (WWW or "the Web") emerged in 1991.¹ As of June 2005, approximately 137 million Americans or about 68% of the adult US population reported using the Internet²; 80% of Internet users have used the Internet to search for health or medical information.³

Oh and colleagues⁴ explored the 51 definitions of e-Health: 10 from a systematic review of the peer-reviewed literature retrieved and 41 from the Google search. The authors identified 2 universal themes, health and technology. Pagliari et al⁵ also analyzed 36 definitions of e-Health thematically from a systematic review and found that a general theme relates to communication. Healthcare consumers seek consultations, social support, self-management, screening tools, and information about medications and specific diseases on the Internet.^{6,7} Data indicate that consumers even use the Internet-based health services to shape treatment preferences and select healthcare providers. Thus, the

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Internet has the potential to increase access to health and medical information, empower healthcare consumers, educate healthcare providers, and transmit health and medical information quickly and cost-effectively.

Recent studies have focused on the characteristics of online consumers as well as the use of the Internet in the healthcare arena.^{8,9} Using a sample ($n = 4764$) drawn from a national survey in 2001, Baker and colleagues⁸ examined the prevalence of e-mail use for healthcare and the effects of Internet and e-mail usage on the user's knowledge about healthcare matters and their actual use of the healthcare system. Results indicated strong relationships between higher education levels and higher rates of Internet use for health but no strong relationship with income. Conversely, higher-income households were less likely to use e-mail or the Internet for their health concerns.

Employing a subsample ($n = 385$) of a national full-probability sample ($n = 2817$) from the 2000 General Social Survey, Cotton and Gupta⁹ found that consumers seeking online health information were significantly younger, had higher incomes, and were more educated than the off-line group. Online information seekers were significantly more likely to be healthier than the off-line group.

SIGNIFICANCE OF THEORY TO NURSING AND HEALTHCARE INFORMATICS

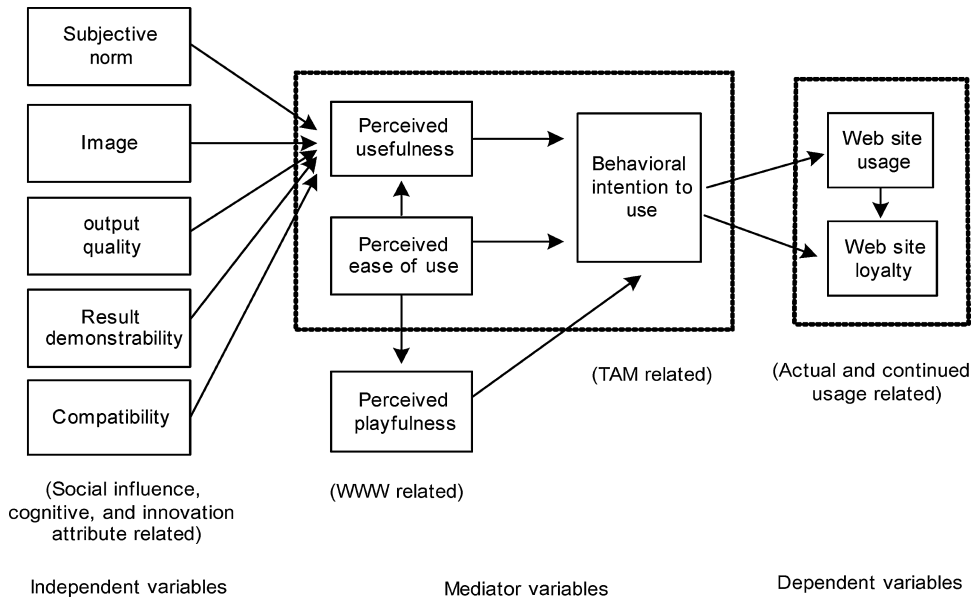
Although previous research has claimed that Internet technologies provide more informed and interactive resources to healthcare consumers and empower them to become more active in their care, Baker and colleagues⁸ found that among those who use health information on the Internet, very few reported impacts on measurable healthcare utilization, and more than 90% reported that Internet use had no effect on the number of physician visits or telephone contacts. Results indicated that the effects of online health information and related services on actual healthcare utilization may be less substantial than reported in previous research. When consumers use health information and ser-

vices on the Internet, they are accepting an innovation as well as a new information and communication technology (ICT).^{10,11} Therefore, identification of the factors influencing healthcare consumers' ICT acceptance is requisite to understanding their acceptance and usage behavior of e-Health.

Considering the multi/interdisciplinary nature of nursing and healthcare informatics,^{12,13} it is inevitable that the profession incorporates knowledge from other disciplines, such as social science, cognitive science, information science, and computer science into its own discipline. This approach enhances the generation of further knowledge from existing concepts.¹⁴ Of the models proposed and examined in healthcare research, Technology Acceptance Model (TAM), which was developed by Davis,¹⁵ and its derivatives appear to be the most promising model regarding an individual's *technology acceptance*.^{16,17} Most of the studies which employed TAM as a theoretical framework have investigated physicians' acceptance of telemedicine^{16,18} or electronic medical records.¹⁹⁻²¹ Recently, TAM was mentioned in nursing research²² with emphasis on nurses' *technology acceptance*; however, it was not used as an organizing conceptual framework for the study.

Introduction of information and communication technology acceptance model

In spite of many empirical findings related to TAM research, however, it is still necessary to extend the model's theoretical validity and applicability, particularly those involving different technologies, end-users, or study settings.²³ Taken together, the approach to extend TAM to the Information and Communication Technology Acceptance Model (ICTAM) illustrated in Figure 1 is worthy of examination. As discussed below, ICTAM was developed to provide a starting point for explaining and predicting consumers' acceptance and usage behavior of health information and services on the Internet.



Information and Communication Technology Acceptance Model (ICTAM)

Figure 1. Proposed theoretical framework. Reprinted with permission from IOS Press.²⁴

The conceptualization of the development of ICTAM is shown in Figure 2. The development of ICTAM, in addition to the direct research on the phenomenon within and outside of healthcare, is influenced by a number of theories previously developed in other disciplines, as depicted in Figure 2.

To conceptualize healthcare consumers' ICT acceptance in nursing and healthcare, diverse theoretical perspectives have been integrated in developing a framework that considers multidisciplinary viewpoints. Therefore, ICTAM integrates previous research with regard to healthcare consumers' *technology acceptance* and provides explanatory and predictive description of the phenomena of interest. A major impetus for its development was to provide a framework for further research and subsequent knowledge development in nursing and healthcare.

Turley's¹³ model in the field of nursing informatics was the conceptual basis of ICTAM. Since Turley¹³ built on Graves and Corcoran's¹² work for developing his

model, ICTAM also is linked to Graves and Corcoran's¹² conceptually oriented definition of nursing informatics that has been widely cited. Therefore, it is necessary to present the definition of nursing informatics proposed by Graves and Corcoran.¹²

A combination of computer science, information science, and nursing science designed to assist in the management and processing of nursing data, information, and knowledge to support the practice of nursing and the delivery of nursing care.^{12(p227)}

The definition emphasizes its multidisciplinary nature, suggests an information model indicating the interrelationships among data, information, and knowledge, and emphasizes the goal of nursing informatics by the use of technology. By adding cognitive science to the 3 sciences proposed in this definition, Turley's¹³ model highlights the interdisciplinary nature of nursing informatics "to optimize nursing information management and communication."^{26(p27)} Cognitive science is an interdisciplinary field with emphasis on

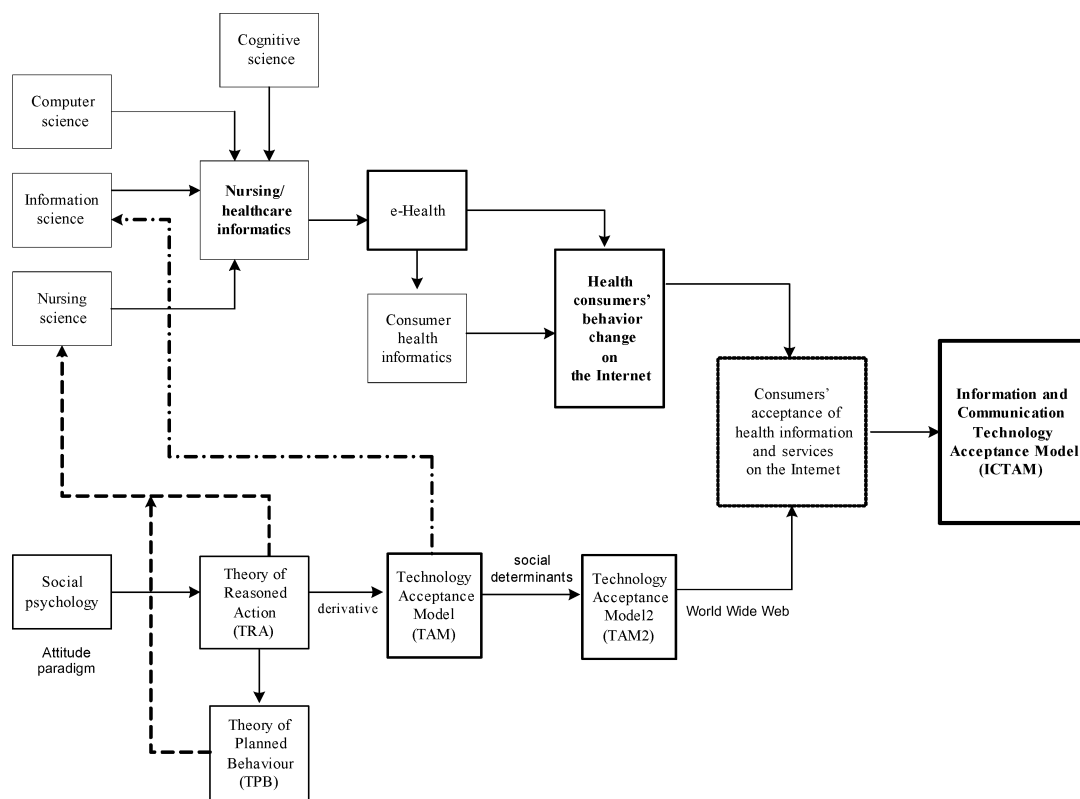


Figure 2. Conceptual background.

concepts and topics relevant to informatics including decision making and innovation adoption process.¹³

The delivery of nursing and healthcare necessarily should take into account information to and from healthcare consumers. Definitions previously proposed, however, do not emphasize the role of healthcare consumers in informatics and do not acknowledge the importance of information communication.^{26(p17)} Considering more participative consumers' usage behavior of healthcare in recent years, their roles should be explicit in model development.

Purpose

The purpose of this article is to describe the development of ICTAM, which was designed to explain and predict consumers' acceptance and usage behavior of health infor-

mation and services on the Internet. Toward this goal, a review of published TAM research, the theoretical constructs of ICTAM, and their interrelationships are presented. To increase the explanatory and predictive power of TAM in the domain of healthcare consumers on the Internet, ICTAM was developed with emphasis on integrating multidisciplinary perspectives from divergent frameworks and empirical findings into a unified model.

LITERATURE REVIEW

Databases including CINAHL, MEDLINE, PsycInfo, and Dissertation Abstract were used for the systematic review of published research. A total of 43 studies (from more than 100) were selected for the review using the following criteria: (1) TAM was used in a data-based study; (2) the integrity of the original model of TAM was respected; and (3)

the research methodology was thoroughly described. All studies used convenience samples. The majority of participants were white, middle-class students residing in the United States and majoring in information science or business.

Technology Acceptance Model

TAM has been widely used as the theoretical base of an individual's *technology acceptance*²³ because it provides theoretical linkages among beliefs, attitudes, behavioral intentions, and actual usage on how individuals accept a new technology.^{15,25} Many researchers have tested, validated, replicated, and extended TAM; therefore, TAM has evolved over time. Figure 3 represents the evolution of TAM as summarized from the literature reviewed.

In its original model, TAM has the following constructs: *perceived usefulness*, *perceived ease of use*, *attitude toward using*, *behavioral intention to use*, and *actual use*.¹⁵ From the literature reviewed, however, few studies incorporated all 5 constructs. In addition, there is no clear pattern of the constructs incorporated.²³ Subramanian,²⁹ for example, stated that *perceived usefulness*, not *perceived ease of use*, is a determinant of the future use of voice mail and dial-up systems. Szajna³⁰ found that a revised TAM, deleting *attitude toward using* from the model and adding a variable to account for experience with the technology, would be valuable to predict *intention to use* information systems.

A few studies examined *gender* differences in TAM research.^{31,32} For example, in the study conducted by Venkatesh and Morris,³² men's technology usage decisions were more strongly influenced by their *perceived usefulness* and less influenced by *perceived ease of use*. This finding was robust even after statistically controlling for key confounding variables (ie, income, occupation, and education levels).

While many studies have used and supported the original model of TAM, there also are many extensions of TAM. Findings

from empirical studies suggested that TAM should be extended to enhance its explanatory and predictive power with a goal of understanding an individual's acceptance and usage behavior of technology.^{23,33} Previous research,^{11,34} therefore, has tried to incorporate a few other theories including Innovation Diffusion Theory or Flow Theory. External variables, such as *system features*, *computer self-efficacy*, *objective usability*, and *direct experience*, also have been postulated in the model.^{28,35} Even though no clear pattern with respect to the choice of the external variables was found, the variables provide a better understanding to guide the directions of future TAM research.²³

Factors contributing to the acceptance of a new information technology (IT) are likely to vary with the technology, target users, and context. The Internet is seen as an emerging new IT, with such potency that it has made individuals change their information access methods.^{10,11} Recently, TAM has been validated to assess an individual's use of the Internet.^{10,11,31,33,36-38} A few studies presented both theoretical and empirical foundations for the influence of individual characteristics of *playfulness* as a new construct on the use of the Internet, such as *performance*, *affective responses*, or *interests* in human-computer interaction.^{11,35,39}

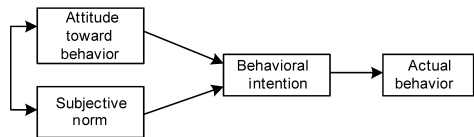
Technology Acceptance Model 2

Venkatesh and Davis²⁸ developed and tested an extension of TAM, incorporating theoretical constructs focusing on social influence (*subjective norm*, *voluntariness*, and *image*) and cognitive instrumental processes (*job relevance*, *output quality*, and *result demonstrability*). This model was referred to as TAM2. All the constructs, except *voluntariness* and *job relevance*, have been studied in TAM research; therefore, the definition and the theoretical rationale of each of the 2 constructs are addressed below.

TAM2 posits *voluntariness* as a moderating variable toward *intention to use*, defined as "the extent to which potential adopters

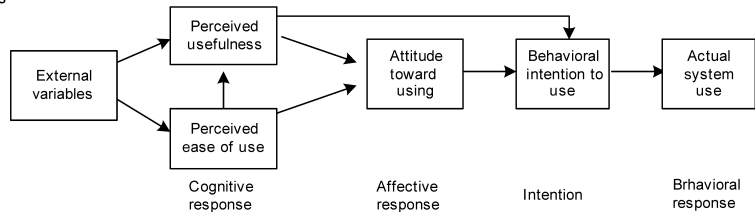
Theory of Reasoned Action (TRA)

Fishbein and Ajzen²⁷

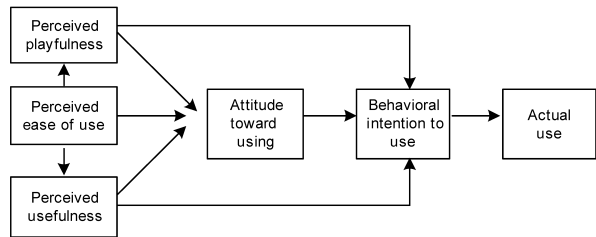


Technology Acceptance Model (TAM)

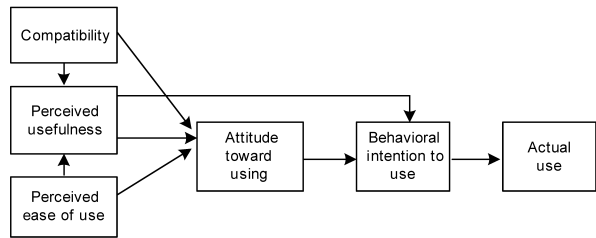
Davis¹⁵



Moon and Kim¹¹



Chen et al¹⁰



Technology Acceptance Model 2 (TAM2)

Venkatesh and Davis²⁸

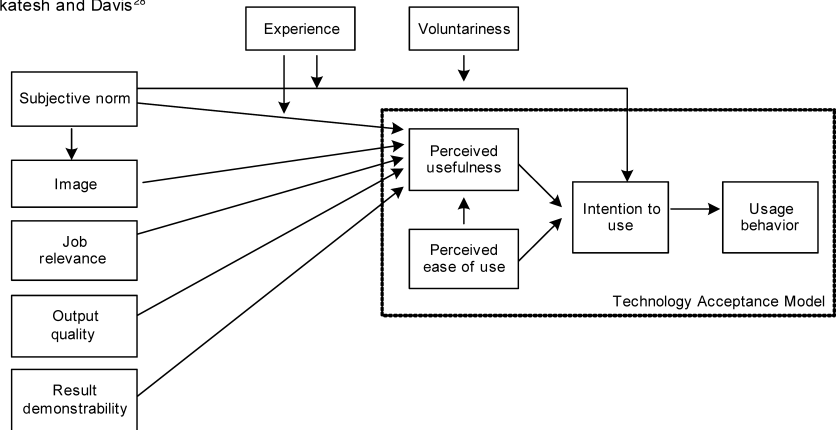


Figure 3. Evolution of Technology Acceptance Model.

perceive the adoption decision to be non-mandatory^{28(p188)} based on the previous studies.^{33,40} Venkatesh and Davis²⁸ tested its effect to distinguish *usage intentions*. Even when users perceive *actual use* to be mandated, *usage intentions* vary because some of the users are unwilling to comply with such mandates. *Job relevance* was defined as “an individual’s perception regarding the degree to which the target system is applicable to his or her job” in the study.^{28(p191)} Venkatesh and Davis²⁸ regarded *relevance* as “a cognitive judgment” that has a direct effect on *perceived usefulness*, distinct from social influence processes in the model. In the study, *job relevance* is conceptualized to be part of *compatibility* under adoption consideration.

Venkatesh and Davis²⁸ tested TAM2, using longitudinal data collected ($n = 156$) with regard to 4 different systems at 4 business settings including 2 field sites where usage of the system was voluntary and 2 where usage was mandatory. Self-report questionnaires were administered to measure the constructs of usage behavior at 3 points in time: after initial training, 1 month postimplementation, and 3 months postimplementation. To estimate the summary model, a pooled sample of 468 across the 3 time points was used because of the small sample size for each of the four samples. Results indicated that both social influence and cognitive instrumental processes significantly influenced an individual’s IT adoption and use as hypothesized; however, *subjective norm* did not show a significant direct effect on *usage intentions* for voluntary systems. They also demonstrated that system users incorporate social influences into their perceptions of *usefulness*. Results indicate that effects of cognitive instrumental processes remained significant over time. Taken together, TAM2 increased and accounted for 60% (on average) of the variance in *perceived usefulness* and 34% to 52% of the variance in *intention to use*. A meta-analysis indicated that TAM consistently explains about 40% of the variance in *usage intention* and *behavior*.²³

Previous TAM research indicates that the explanatory and predictive power could be enhanced by the addition of theoretical constructs such as social influences and innovation attributes. Second, to confirm the model’s validity, a number of studies have been conducted in business settings across various communication systems such as voice mail, word processors, spreadsheets, database management systems, and e-mail. Third, few studies targeted users of health-care. Therefore, there is a need to focus on the identification of additional constructs for TAM extension, various technology applications such as the Internet, and diversity of target populations (healthcare consumers on the Internet).

INFORMATION AND COMMUNICATION TECHNOLOGY ACCEPTANCE MODEL

ICTAM modifies TAM2 and incorporates 3 additional theoretical constructs in the model based on the literature review: *compatibility*,¹⁰ *perceived playfulness*,¹¹ and *Web site loyalty*.⁴¹ The relationships between the theoretical constructs in ICTAM are proposed as depicted in Figure 1, and every path posited in the model is supported by the empirical literature. The primary hypothesis is that ICTAM fits the sample data employing a structural equation modeling (SEM) technique, which can examine each hypothesis with a logical, theoretical, or empirical basis within the entire model.⁴² The theoretical definition of each construct of ICTAM was adapted from the literature reviewed. For the development of ICTAM, it was necessary to alter some wording of the definitions to refer to the Internet or the Web^{10,11,36} as shown in Table 1.

Independent variables

From TAM2 proposed by Venkatesh and Davis,²⁸ ICTAM includes as independent variables in the model the constructs related to social influence processes (*subjective norm* and *image*) and cognitive instrumental

Table 1. Variables and definitions of ICTAM

Variables	Definitions	References
Perceived ease of use	is defined as the degree to which consumers expect the use of health information and services on the Internet to be free of efforts	10,15,25
Perceived usefulness	is defined as the degree to which consumers' subjective probability that using health information and services on the Internet would increase his or her performance to improve his or her health	10,15,25
Behavioral intention to use	is defined as consumers' likelihood to use health information and services on the Internet	10
Subjective norm	is defined as the degree to which consumers believe that people who are important to them think they should use health information and services on the Internet	28
Image	is defined as the degree to which use of health information and services on the Internet is perceived to enhance his or her social status in their social group	28,40
Output quality	refers to consumers' perceptions that they will consider how well health information and services on the Internet are capable of performing their goal to improve his or her health	28,43
Result demonstrability	is defined as the results of using health information and services on the Internet are perceived to be amenable to demonstrate	28,40
Compatibility	is defined as the degree to which the use of health information and services on the Internet is perceived as being consistent with his or her existing values and beliefs, needs, and experiences of a health consumer	10,40
Perceived playfulness	is defined as the degree of consumers' statement relating to their perception about concentration, enjoyment, and curiosity while using health information and services on the Internet	11
Web site usage	refers to the frequency and the approximate hours using health information and services through a Web site during a given time period	10,36
Web site loyalty	is defined as a deeply held tendency to be loyal to a Web site, which is demonstrated by the intention to revisit or repatronize a Web site consistently	38,44,45

processes (*output quality* and *result demonstrability*). Only *job relevance* out of the cognitive instrumental processes was not included in ICTAM because healthcare consumers' use of health information and services on the Internet is not "task-oriented." Davis and Venkatesh,²⁸ however, concep-

tualized that *job relevance* was part of *compatibility* that is one of the important attributes as noted in their study. *Compatibility* has received little attention in previous TAM research although the importance of this construct has been demonstrated in the literature.^{10,40,46} Integrating a technology,

such as the Internet into daily life, is achieved through a process known as *Adoption of Innovation*, which is the acceptance into actual use and the continued use of an idea, practice, or object that heretofore had been perceived as new.^{47(pp416–468)} With this rationale, ICTAM includes *compatibility* in the model. Some of the constructs included in TAM2 also are a theoretically based set of innovation characteristics, which were empirically tested in previous TAM research, such as *image*,^{33,34,40} *output quality*,⁴³ and *result demonstrability*.^{33,34,40}

Studies in psychology found that social influence via *subjective norm* is important to explain *intention* and/or *behavior*.⁴⁸ Nonetheless, *subjective norm* was excluded in the original TAM³⁹ and has been found to be nonsignificant in TAM studies.¹⁷ However, recent studies suggest that TAM should include additional constructs related to social influence to improve the predictive power of TAM.^{10,28,32}

A possible influence of *compatibility on perceived usefulness* was demonstrated in the literature.^{10,40} Chen and colleagues,¹⁰ for example, examined that the path flowing from *compatibility to perceived usefulness* was significant. If consumers perceive that health information and services on the Internet are compatible with their existing values, experiences, and needs, they will perceive it as useful.

Mediator variables

ICTAM includes the following theoretical constructs as mediator variables in the model: *perceived ease of use*, *perceived use/illness*, *perceived playfulness*, and *behavioral intention to use*. The literature reviewed validates the mediating effect of the constructs.^{11,15,17,25,28,41} According to Davis,²⁵ TAM has 2 significant dimensions of cognitive response that emerged from an attitude paradigm of intrinsic (*perceived ease of use*) and extrinsic (*perceived usefulness*) motivation. Based on the results of 22 empirical TAM studies over the past 20 years, Legris

and colleagues²³ stated that *perceived ease of use and perceived usefulness* are important to understand an individual's acceptance and use of technology.

Moon and Kim¹¹ expanded the application of TAM to the Internet and proposed a new construct of *perceived playfulness* based on Deci's individual intrinsic motivation theory and Csikszentmihalyi's flow theory. *Playfulness*, which is an example of intrinsic motivation, highly correlates with the expected voluntary use. *Perceived playfulness* was validated in the study¹¹ showing a significant effect on *behavioral intention to use* the Internet. In addition, adding *perceived playfulness* to TAM yielded a significant improvement in variance explained in *behavioral intention to use* the Internet (a change from 35% to 39%, $P < .001$). Therefore, the construct of *perceived playfulness* was included in ICTAM since individuals who have more positive *playfulness* belief in the Internet would view its interactions more positively than those who interact less playfully.^{11,36}

The construct of *behavioral intention to use* is common to TAM research: 15 of 22 empirical studies conducted over the past 20 years included *behavioral intention*.²³ This construct is explained by *perceived ease of use and perceived usefulness* and directly affects an outcome variable, *actual use*.

Outcome variables

The ultimate objective of ICTAM is to predict *Web site usage* and *Web site loyalty*. One of the outcome variables, *Web site usage*, is usually measured by 2 or 3 items about the frequency of *actual use* and the amount of time spent in using the specific system. In the literature, most of the studies measure *actual use* by self-report scales. In addition to *Web site usage*, *Web site loyalty*⁴¹ was also included as one of the outcome variables. A few studies demonstrate that actual use as an outcome variable influences the other outcome variable, such as future usage,²⁹ future use intentions,³³ continued usage,³⁴ or Web site loyalty.⁴¹

The construct of *Web site loyalty* was adapted from brand loyalty^{44,49} in marketing research to predict consumers' tendency to revisit or repatronize a preferred Web site.⁴¹ According to Aaker,⁴⁵ brand loyalty is one of the brand equity dimensions. Using a "consumer-based" behavioral point of view, *brand equity* was defined as "consumers' different response between a focal brand and an unbranded product when both have the same level of marketing stimuli and product attributes."^{49(p1)} The phrase *consumer-based* means "measurement of cognitive and behavioral brand equity at the individual consumer level through a consumer survey."^{49(p2)} Aaker⁴⁵ also stated that brand equity provides value to customers by enhancing their interpretation and processing of information, confidence in the purchase decision, and consumer satisfaction.

Yoo and colleagues^{44,49} developed and validated a multidimensional "consumer-based" brand equity (MBE) scale drawn from Aaker's⁴⁵ conceptualizations of brand equity. The scale was reliable and valid^{44,49} across cultures.⁴⁹ From the scale, Lee⁴¹ adapted a 5-item instrument to measure *Web site loyalty* in the study. Loyal consumers who experience the successful prior use of a Web site show more favorable response to a Web site, visit a Web site routinely, and resist switching to another Web site.⁴¹ Therefore, *Web site loyalty* would be considered as more important than *actual use* because the long-term effect is implied.

IMPLICATIONS FOR RESEARCH

There is a general consensus that nursing and healthcare informatics are an emerging field. In addition, nursing informatics still struggles with definitions of concepts and theoretical underpinnings that guide research.^{26,50} Most of the nursing and healthcare informatics research retrieved generally borrowed a model from other disciplines; however, this multi/interdisciplinary approach ultimately will add strength by de-

scribing and explaining the phenomena of interest.^{14,50}

Consumers' intention to use health information and services on the Internet is worthy of examination. However, no theoretical model that addresses this question exists. Although research conducted outside of nursing has provided a fundamental basis for understanding *technology acceptance*, theoretical gaps still exist if an integrated understanding of the phenomenon of interest is to be considered. Therefore, the lack of a theoretical model with regard to health consumers' ICT acceptance represents a significant deficit in understanding consumers' behavior in interaction with the Internet to seek health information and services. In a new domain such as consumers using health information and services on the Internet, the development of ICTAM was viewed as an essential first step.

ICTAM with additional constructs of *perceived playfulness*, *compatibility*, and *Web site loyalty* may improve the explanatory and predictive power of TAM regarding consumers' acceptance and usage behavior of health information and services on the Internet. Therefore, it is essential to study the validity of ICTAM in the context of consumers seeking health information and services on the Internet. Also, this approach would support the continued use of ICTAM as a baseline model for future research.

A theory in nursing should include the following nursing meta-paradigm concepts: person-client, nursing-intervention, environment-context, and health-outcome.^{14,50} The *person* is represented by the individual user or community who uses health information and services on the Internet. By the intervention and/or behaviors of the healthcare providers or practitioners who engage in the area of interest, *nursing* is perceived. The *context* is conceptualized as virtual or cyberspace. One of the strengths of ICTAM is its specific applicability to guide research in the context of consumers using online health information and services for

the improvement or management and communication of their health. Finally, *health* is described with alterations occurring in healthcare consumers' perceptions and their functional status. Taken together, ICTAM provides an organizing framework and psychometrics for future research to understand, explain, and predict outcomes of ICT acceptance in nursing and healthcare by the inclusion of all aspects of the meta-paradigm in the model.

Ultimately, to enhance awareness of concepts and issues related to ICT acceptance in nursing and healthcare, this approach serves as preliminary research not only in academic settings but also in administration and across practice settings. Therefore, an area worthy of future investigation is to establish the utility of ICTAM in the domain of healthcare consumers on the Internet.

Suggestions for future research

The unit of analysis to test the validity of ICTAM should be an individual user. Familiarity with health information and services on the Internet is necessary; therefore, potential participants should optimally be individual users who have used health information and services on the Internet. In addition, they should have sufficient computer literacy, which was defined as "skills that allow individuals to use computer technology to accomplish tasks."^{26(p25)} For future research, therefore, a Web-based survey method would be preferred.

To provide a framework in the domain of consumers using health information and services on the Internet, it is necessary to validate the framework that considers the different type of consumers and the constructs that influence its applicability in a variety of healthcare settings.

The constructs in ICTAM could be influenced by latent variables such as development methodologies, individual characteristics, and the degree of user participation. Therefore, there is a need to examine the consistency of ICTAM with different populations

and/or subsamples across the various age groups, type of medical and psychiatric conditions, disease severity, and comorbidities. To assess the effectiveness of ICTAM, evaluation research on *usage* and *loyalty* for the utilization of Internet healthcare resources also should be conducted.

Regarding the statistical considerations for the validation of ICTAM, 2 different statistical techniques could be employed together in a study. For initial theory testing, the SEM technique should be employed. Using a stepwise multiple regression analysis, ICTAM can also be compared with most of the previous TAM studies conducted by the use of regression analysis. In addition, employing both of the techniques in a study, some of the significantly different paths flowing between the constructs in ICTAM could be examined.

Results of the previous studies imply that differences between men and women occur in their perceptions of *technology acceptance* and usage behavior. The *gender* differences were also presented in the context of the Internet users. For example, men use the Internet more frequently and for a greater number of tasks than women.³⁶ Since minimal research has focused on gender differences in TAM research,^{31,32,36} this remains a viable area for future ICTAM research and important in understating consumers' acceptance and usage behavior of health information and services on the Internet.

Finally, the studies reviewed were mainly conducted in the United States with primarily homogeneous samples. There are few studies that have emphasized diversity of *technology acceptance*. Straub and colleagues,⁵¹ for example, indicated that TAM is explanatory for Switzerland and the United States, but not for Japan. Therefore, future research conducted in the United States should include participants from diverse racial/ethnic, cultural, and socioeconomic backgrounds. Equally as important, future research should be conducted in a non-US context with culturally as well as geographically diverse populations to examine the external validity of ICTAM.

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