



# The moderating effects of demographic and individual characteristics on nurses' acceptance of information systems: A canadian study



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## ABSTRACT

**Objectives:** The purpose of this study was to educate on the moderating effects of demographic (i.e., educational level and age) and individual characteristics (i.e., years of nursing experience and computer knowledge) on nurses' acceptance of information systems (IS). The technology acceptance model (TAM) with its constituent variables such as perceived usefulness (PUSS) and perceived ease of use (PEOU) was the theoretical framework used for this study.

**Methods:** A cross-sectional study was conducted in Nova Scotia, Canada. Usable data was collected from 197 registered nurses (RNs). Relevant hypotheses were formulated and the partial least squares (PLS) technique was used for data analysis.

**Results:** The results of the hypothesized relationships showed that education and computer knowledge have positive moderating effects on the influences of PEOU and PUSS on nurses' attitudes toward IS (ATTI). The factors of nurses' years of nursing experience and age did not yield meaningful results. ATTI impacted behavioral intentions to use IS, which positively impacted nurses' use of IS. The nurses sampled in the study have positive IS use behaviors.

**Conclusions:** This study demonstrates that relevant demographic factors and individual characteristics, if incorporated into frameworks used for investigating nurses' acceptance of IS, could permit the emergence of useful insights for practitioners and researchers. Specifically, this study showed that nurses with higher educational attainments and more basic computer knowledge readily accept implemented IS at work. Hospital administrators benefit from insights such as the one presented in this study.

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## 1. Introduction

The use of healthcare-based technologies and information systems (IS), such as enterprise or electronic medical record (EMR) systems, electronic health record (EHR), clinical decision support (CDS), and patient care systems (PCS), have become critical resources for reducing costs and improving quality and standards in healthcare [5,36,15,20]. The diffusion of such technologies in healthcare has expanded dramatically across the world, and is expected to increase in the coming years [43,41]. Despite well-documented benefits of IS to healthcare, it has been reported that clinicians, including nurses, have not readily accepted such tools [51,30,28,32]. In some cases, nurses' resistance has led to the failure of several health IS implementations. At other times, underutilization, reluctance to use computers and IS, and even sabotage have been reported [51,2,48]. Clearly, the benefits of IS will not

be fully realized if those expected to benefit from such tools resist or underutilize them. It is critical for researchers to study factors that positively influence healthcare workers' behavior toward IS, in general [43,24,48,41]. Admittedly, the health sector has a variety of professionals; however, for illustrative purposes, this study focuses on registered nurses (RNs). Nurses are specifically targeted because they have specific uses for IS and tend to hold specific opinions on the use of such systems in their work settings [59,51,2,42]. For example, some researchers have noted that nurses tend to have unfavorable attitudes toward IS and computerization [59,2]; others offered a different view on the matter [42,33].

To assess health workers' acceptance or use behavior toward IS, several theoretical frameworks have been used [24]. Prominent among such frameworks is the Technology Acceptance Model (TAM) [16] and subsequent extensions of the framework (e.g., Ref. [60]). Although Davis [16] conceptualized the impacts of relevant antecedents on PUSS and PEOU, the literature shows that very few healthcare studies have examined the effect of antecedent factors on nurses' acceptance of IS [24,38,13,44]. This study argues that the exclusion of antecedent factors in healthcare research aiming

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to comprehend acceptance of IS among clinicians, including nurses, may limit understanding of the phenomenon of IS acceptance. In fact, individual characteristics (i.e., years of nursing experience, computer knowledge and expertise) and demographic factors (i.e., gender, education, and age) have been shown to impact nurses' acceptance of IS [18,4,2,46,35,30,32]. For example, to underscore the relevance of computer knowledge to nurses, Farokhzadian [20], p. 577) concluded that "Nurses do not have sufficient skills to search best evidence and to use the Internet and online databases for information seeking and retrieval." Likewise, years of nursing experience is positively linked to positive attitudes toward IS implementation and use [45,58].

Studies that used TAM to examine nurses' acceptance of IS have advanced knowledge in the area (see for example, in Refs. [62,24,35]; however, much remains unknown. It is worth noting the assumption in prior TAM studies of the existence of a one-way sequence of events between PUSS, PEOU, and attitude toward IS (ATTI) may be limiting. This study argues against the overuse of such conceptualization as the main approach through which IS acceptance in healthcare is studied and discussed. In fact, an extension of TAM proposed by Venkatesh et al. [60] is in agreement with this study's argument as their framework underscored the role of the moderating effects of variables, such as age, gender, and experience, in explicating an individual's acceptance of IS. Independent factors, such as PEOU and PUSS, do not act in isolation to influence IS end-user outcomes; in fact, the interacting effects of factors are present.

This study asserts that the moderating roles or interacting effects of individual characteristics and demographic factors on PUSS and PEOU would add more meaningful insights to the discourse of nurses' acceptance of IS at work. Not many researchers have studied the interacting effects of variables in healthcare contexts (e.g., [37]). This study is designed to contribute to current research in that regard, as it attempts to fill this lacuna in healthcare literature. Specifically, this study seeks to provide an answer to the following question: What are the moderating roles of individual characteristics and demographic factors on nurses' acceptance of information systems? It is hoped that findings and conclusions from this exercise would serve as useful input for hospital administrators when developing strategies and policies aimed at encouraging IS acceptance among nurses.

## 2. Literature review

For the purposes of illustration, individual characteristics and demographic factors considered in this study are as follows: age, years of nursing experience, education, and computer knowledge. These variables are among factors of note to IS acceptance among nurses; gender was not considered herein as this study's data indicated the predominance of one gender—females. Regarding the impacts of individual characteristics and demographic factors on nurses' acceptance of IS at work, the following information is offered. Several studies found age to be a major contributor to nurses' attitudes toward IS acceptance in work contexts [4,18,55,46,30,32]. However, other researchers [45,58,39,61] did not support this viewpoint.

As indicated, Sleutel and Guinn [58], Marasovic et al. [45], Kahouei et al. [29] reported that years of nursing experience positively influences attitude toward IS use. Kummer et al. [37] found nursing experience moderated the relationship between subjective norm and intention to use IS. In general, studies showed that more experienced nurses had more favorable attitudes toward IS implementation in their work environments [6,17,35]. However, Raja et al. [53] found computer attitude was not influenced by years of nursing service. Additionally, Simpson and Kenrick [56], Kivuti

and Chepchirchir [33] asserted that less experienced nurses had more positive attitudes toward IS than older counterparts. Studies by Alquraini et al. [2], Brumini and Kovic [4], Kaya [30], found educational levels to be a significant predictor of nurses' attitudes toward IS. Recently Kipturgo et al. [32] and Kahouei et al. [29] found that nurses' educational levels have positive associations with attitudes toward IS implementations and compatibility with acquired IS.

The positive impact of computer knowledge on nurses' attitudes toward IS and computerization is well documented in healthcare literature. For instance, Huryk's [26] comprehensive review of the literature found that computer experience was the most influential factor to nurses' positive attitudes toward IS use. Studies by Burkes [6] and Kaya [30] reported a significant relationship between nurses' exposure to computers and IS use. Sinclair and Gardner [57] showed that nursing students with prior computer training and knowledge were more likely to use IS. Eley et al. [19] indicated that nurses who received generic computer education during training believed that such exposure was relevant to their job needs as it pertains to IS use. In sum, computer knowledge continues to be viewed as an important factor that can enhance nurses' acceptance of IS at work [3,4,2,32,29].

### 2.1. Theoretical framework

Davis developed the technology acceptance model (TAM), which is considered a useful tool for understanding users' acceptance of IS in several fields including the healthcare sector [62,24,35,47]. TAM has several extensions; this study uses its original form. Despite its relative simplicity, recent studies have provided evidence to show that TAM remains a dominant model for predicting behavioral intent to accept IS in the healthcare sector [62,24,47]. TAM's constructs explain about 30–40% of the variance in individuals' acceptance of IS [62,24].

TAM posits that users' perceived usefulness and perceived ease of use (PEOU) are two major determinants of IS acceptance; these two factors are influenced by exogenous variables. Perceived usefulness (PUSS) refers to "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, p. 320). Perceived ease of use (PEOU) refers to "the degree to which a person believes that using a particular system would be free from effort" (Davis, p. 320). Both PUSS and PEOU influence attitude (ATTI), which represents an individual's positive or negative feelings toward engaging in a specified behavior, in this instance, using IS. Attitude (ATTI), in turn, influences behavioral intention (BEHI), which is considered the most proximal antecedent to IS use. BEHI positively influences IS use (ISUE).

## 3. Research model and hypotheses development

The study's research model shown in Fig. 1 highlights the direct and interacting effects of the study's constructs. Namely, relationships in the original TAM are indicated with full (→) while interacting effects are indicated by broken arrows (→→).

Discussions relating to the formulation of the research hypotheses are provided as follows. Studies of health informatics have consistently demonstrated that perceived usefulness of IS is positively associated with clinicians' attitudes toward IS tools [24,25,10,62,47]. In the same vein, nurses are more likely to develop favorable attitudes toward IS if the tangible benefits of IS are adequately appreciated. In fact, PUSS was found to be a strong motivator for predicting healthcare professionals' attitudes toward IS [10,1,24,25,47,38]. In healthcare research across the world, findings have consistently confirmed that clinicians who perceive implemented IS to be easy to use often develop positive attitudes toward

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