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# Understanding the Influence of Team Climate on IT Use*

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## Abstract

*This article contributes to the technology acceptance literature by providing an enriched understanding about how team climate for innovation affects end users' IT use. Empirical data collected from 103 physicians shows that team climate significantly affects the use of a computerized physician order entry system through the mediation of performance expectancy and facilitating conditions. Team climate also affects users' subjective norm, yet subjective norm is not found to have a significant impact on IT use. Our findings confirm the importance of users' proximal social network in voluntary settings, demonstrating that team climate influences IT use behaviors by changing users' cognitive perceptions rather than their normative beliefs.*

***Keyword***: *team climate for innovation, social influence, internalization, proximal social network, physician, IT use*

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# Understanding the Influence of Team Climate on IT Use

## 1. Introduction

Although organizations have made heavy investments in information technology (IT), the materialization of expected benefits from IT requires employees to use the technologies and assimilate them into their work routines (Devaraj and Kohli 2003; Liang et al. 2007). This seemingly simple requirement is a challenge due to the complex interactions among technology, organization, and individual users. Prior research has revealed that IT usually imposes its embedded business logic on adopting organizations and interrupts the organizations' existing workflows (Davenport 1998; Liang and Xue 2004). The disruptive nature of IT requires users to make substantial efforts from users to change their accustomed job routines and habits to adapt to the new technology, often giving rise to resistance to system use (Lapointe and Rivard 2005) and even failure of the IT investment (Xue et al. 2005). While organizations could mandate that employees use the IT that are critical to survival and success (Brown et al. 2002; Chae and Poole 2005), it is infeasible and sometimes impractical to make the use of every IT mandatory due to the complexity of IT-supported activities and user characteristics. First, certain activities such as knowledge sharing and transfer are highly complicated and difficult to control (Alavi 2001; Grover 2001); thus, the use of IT supporting such activities is usually not mandated by organizations (Malhotra and Galletta 2005). Second, certain users (e.g., physicians) possess inaccessible professional knowledge and are highly autonomous in performing their job-related tasks (Wallace 1995). Such professional autonomy makes it almost impossible to use formal rules or policies to enforce IT usage (Kirsch 1996; Ouchi 1979). Therefore, in many situations, IT use in organizations is inevitably characterized by some degree of voluntariness, and it is important to understand how to promote volitional IT use behaviors.

Previous information systems (IS) research suggests that social influence arising from users' proximal social networks, particularly their work teams in the organizational context, is effective in aligning their IT use behavior with organizational IT objectives (Kirsch et al. 2002; Kohli and Kettinger 2004; Sewell 1998). Sykes et al. (2009) contend that an individual's coworkers can be important sources of help in overcoming knowledge barriers related to complex system use and find that peer support within social networks plays a significant role in influencing employees' system use. To investigate how users' proximal social networks affect users' IT use behavior, we develop and test a research model derived from the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al. 2003). Based on social influence theories (Fulk 1993; Salancik and Pfeffer 1978), we contend that team climate for innovation is an important source of social influence. We empirically show that it has an impact on IT use through enhancing performance expectancy and facilitating conditions, based on longitudinal data collected from 103 physicians.

This study makes two important contributions to IS research and practice. First, we suggest that team climate for innovation affects IT use by shaping users' cognitive perceptions (i.e., performance expectancy and facilitating conditions) and normative beliefs (subjective norm) of the target technology. Our findings show that the effect of team climate is mediated by performance expectancy and facilitating conditions, suggesting that the underlying mechanism of team climate's influence on IT use in voluntary settings is changing users' cognitive perceptions rather their normative beliefs. Second, we empirically test our research model using a unique sample of knowledge workers–physicians. The results suggest that physicians' IT use is more likely to be determined by their own cognitive evaluations of the target IT than my pressure to comply with norms. These findings complement the existing IS literature, which shows that social influence is mute in the voluntary context based on the insignificant effect of subjective norm.

The rest of the paper is organized as follows. We review the relevant literature and provide a theoretical account on team climate for innovation and social influence in the next section. Then, we develop the research model and specific hypotheses. After that, we present the research methodology and results. We then discuss research findings and implications for IS research and practice. Finally, we end the paper with a brief conclusion.

## 2. Theoretical Development

### 2.1. Work Team: Source of Social Influences

Salancik and Pfeffer (1978) suggest that individuals' immediate social environment is an important source of information that they use to construct reality. This is because individuals need to be proximal to others' perceptions, attitudes, and behavior to be exposed to social influences. Social networks provide various channels for social information to be communicated and become contagious (Ibarra and Andrews 1993). When people face uncertainty and ambiguity, they tend to use similar others in their social networks for comparison. They assimilate information based on personal relevance – the more similar someone is, the more likely they are to believe that her information is credible and relevant (Festinger 1954). For example, Ibarra and Andrews (1993) find that the more a person interacts with her social network, the more strongly her job-related perceptions are affected by social influence. Kohli and Kettinger (2004) show that a technology champion who is also a physician helps to increase technology adoption among physicians because peer opinions appear more legitimate to physicians than opinions of others such as IT people and managers.

In organizational settings, employees' immediate social environment is the work team with whom they interact regularly to perform job-related tasks (Anderson and West 1998). Prior research in social psychology shows that social influence occurs within work teams, and among various social networks, individuals are likely to identify most closely with their work team and, thus, to trust the information circulated within the team (Fulk 1993). Work teams provide both relational and positional proximity to members (Rice and Aydin 1991). Relational proximity refers to the extent to which individuals interact directly and indirectly. People in the same work team tend to have high relational proximity because they interact repeatedly with each other as they process resources and information. Thus, they are strongly tied together and tend to agree with each other. Positional proximity refers to the extent to which individuals occupy similar roles and, thus, experience similar sets of obligations, status, and expectations. Work teams are created by division of labor, and team members work together to fulfill the same organizational function. Thus, team members typically have high positional proximity. Relational and positional proximity give rise to shared cognitions and similar behavior among group members. Rice and Aydin (1991)find that employees' perceptions are significantly influenced by the social information from their work unit but not from the overall organization. Fulk (1993) further argues that work teams produce the strongest social influence when individuals are attracted to their groups.

Social influence arising from work teams is particularly strong when individuals are knowledge workers whose specialized body of knowledge separates them from the public. Knowledge workers tend to believe that the information provided by peers in their work groups is more credible and relevant than that from non-peers. For example, physicians traditionally rely on their peers as the primary medium to acquire information about new technologies (Ford et al. 2006). In addition, research shows that clan control is a more effective way than formal controls to direct the purposive action of knowledge workers (Ouchi 1980; Sewell 1998). Clan control attempts to influence individuals by establishing common values, philosophies and approaches to problem solving within groups (Kirsch et al. 2002; Ouchi 1979). This suggests that the work team is an important source of social influence that changes knowledge workers' perceptions and behavior.

Diffusion theory has emphasized the importance of social networks in endorsing and enabling the diffusion of innovations (Rogers 2003; Van de Ven et al. 1999). Like any other organizational object or event, IT is socially constructed, and individuals rely on their proximal social network to obtain information used for understanding and sense-making. By processing and synthesizing information shared by team members, individuals develop cognitive perceptions about the target technology (Lewis et al. 2003). Hence, we contend that work teams engender potent social influences that affect individuals' IT use.

The supposed effect of social influence is based on two premises. First, individuals are adaptive organisms that adapt their attitudes, beliefs, and behavior to their social context (Salancik and Pfeffer 1978). Second, IT is not given but socially constructed (Fulk 1993; Orlikowski and Iacono 2001). The social constructivist view of IT submits that IT artifacts are both consequences and causes of human action (Orlikowski 1992). Because technologies are designed, constructed, and used by people, they are shaped by the interests, values, and assumptions of developers, investors, users, and other actors. IT artifacts are always embedded in specific social contexts, and their structure and meanings arise from interactions with social agents (Orlikowski and Iacono 2001). Since IT cannot be objectified and decontextualized, individuals cannot develop perceptions and attitudes of IT independent of the social context within which the target technology is used, and their perceptions and use of the target IT are inevitably susceptible to social influence. Give that the work team is the most proximal social context with which individuals frequently interact (Anderson and West 1998; Hulsheger et al. 2009), an individual is likely to adapt her attitudes, perceptions, and behaviors of IT use to be consistent with the attitudes, perceptions, and behaviors that are socially constructed by the team-based context. As a result, work teams can generate a strong social influence that affects members' IT-related perceptions, beliefs, and behaviors.

## 2.2. Research Model

This research is focused on understanding the role of team climate for innovation in influencing voluntary IT use. It has been established that team climate for innovation is one of the most important sources of social influence that affects users' innovation acceptance (Hulsheger et al. 2009; West and Anderson 1996). Team climate refers to an implicit frame that shapes individual perceptions, attitudes, and behaviors within the group context (Seibert et al. 2004). According to West (1990), team climate for innovation has four facets: shared vision, participative safety, support for innovations, and task orientation. Shared vision is "an idea of a valued outcome which represents a higher order goal and motivating force at work" (West 1990, p. 310). Participative safety refers to a nonthreatening psychological atmosphere within the team that is characterized by trust and mutual support. Support for innovation is defined as the "expectation, approval and practical support of attempts to introduce new and improved ways of doing things in the work environment" (West 1990, p. 315). Task orientation describes a "shared concern with excellence of quality of task performance in relation to shared vision or outcomes" (West 1990, p. 313).

As the most important team characteristic, team climate for innovation plays a significant role in influencing how individuals embrace innovations (Rogers 2003; Van de Ven et al. 1999). Specifically, team climate for innovation affords processes conducive for information sharing, which helps to formulate perceptions of innovations (West 1990; West and Anderson 1996). It also provides a favorable atmosphere that facilitates the implementation of innovations. Like any other organizational object or event, IT is socially constructed, and individuals rely on their proximal social network to obtain information used for understanding and sense-making. Hence, team climate for innovation may affect how individuals develop cognitive perceptions about the target technology.

We design a research model to delineate the effect of team climate on IT use behavior (Figure 1). The model is based on UTAUT (Venkatesh et al. 2003) and prior research on team climate (West 1990; Anderson and West 1998; West and Anderson 1996) and social influence (Fulk 1993; Salancik and Pfeffer 1978). According to the criteria proposed by Jarvis et al. (2003) to identify formative constructs, we model team climate as a formative second-order construct consisting of four reflective first-order constructs, because: (a) the causal direction is from the four components to team climate, (b) the components represent unique dimensions of team climate for innovation and are not interchangeable, (c) they do not necessarily co-vary, and (d) their antecedents and consequences do not have to be the same. We propose that team climate for innovation affects three cognitive perceptions – performance expectancy, effort expectancy, and facilitating conditions – and one normative belief – subjective norm. Different from UTAUT, we do not include behavioral intention in the model, because in IT acceptance research, we are ultimately interested in the IT use behavior. Behavioral intention as a predictor of actual behavior has limitations (Venkatesh et al. 2008) and has been criticized for an intention-behavior gap (Sheeran 2002). This study is focused on examining how team climate influences IT use. Therefore, we exclude behavioral intention from the research model and investigate the direct effects of user perceptions on IT use behavior.

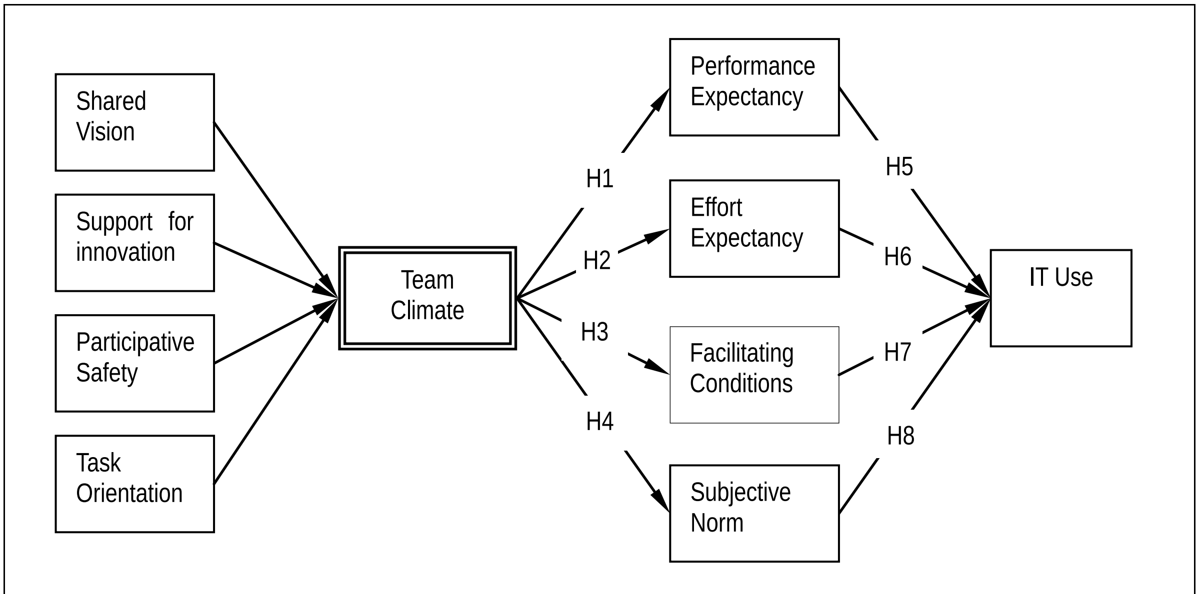


**Figure 1. Research Model**

### 2.3. Hypotheses

Team climate for innovation is based on individuals' cognitive schema and shared perceptions of their work environment regarding innovative ideas, processes, product or procedures (Anderson and West 1998). It consists of team members' collective cognition of the innovation and its surrounding environment (Fulk 1993; Rice and Aydin 1991; Salancik and Pfeffer 1978). In the IT context, team climate refers to team members' shared cognition about the target IT, which strongly influences each member's IT use behavior. As mentioned above, team climate for innovation consists of four subconstructs: shared vision, support for innovation, participative safety, and task orientation (West 1990; West and Anderson 1996). These subconstructs together influence individuals' perceptions and beliefs through both informational and normative channels. Through the informational channel, team climate influences performance expectancy, effort expectancy, and facilitating conditions. Through the normative channel, team climate influences subjective norm.

Performance expectancy refers to the degree to which individuals believe that IT use can help them attain goals in job performance (Venkatesh et al. 2003). We contend that all of the four subconstructs of team climate can enhance team members' performance expectancy. First, vision is "an idea of a valued outcome which represents a higher order goal and a motivating force at work" (West 1990). Within a work team, a vision reflects the shared cognition of all the team members. When a vision regarding IT use is well communicated within the team, it sends a signal that implies the instrumental value of the target IT. Team members tend to internalize the information conveyed by the vision because the team is a credible information source to them (Rice and Aydin 1991; Salancik and Pfeffer 1978). According to social influence research (Fulk 1993; Salancik and Pfeffer 1978), a vision helps to clarify ambiguity surrounding outcomes of IT use, draws attention to the benefits of the IT use, and provides guidance in interpreting IT outcomes. These processes assist individuals to make sense of the target IT by assimilating the information communicated by the vision into their own perceptions, thus, enhancing their performance expectancy of using the target technology.

Second, support for innovation is "the expectation, approval and practical support of attempts to introduce new and improved ways of doing things in the work environment" (West 1990). In the context of IT use, innovation refers to the target IT. A team that supports innovations is permeated with an atmosphere that makes members aware of the value of the target IT. Members then utilize this social cue to reconstruct their perceptions of the technology – "since everybody supports the use of this system, it must be useful." This can occur in four ways. First, the supportive environment helps team members socially construct their perceptions and beliefs about the target system through a social learning process, in which they acquire cognitive skills for evaluating the system from interactions with peers (Bandura 1986). Second, the innovation-friendly environment can increase salience of the target system's usefulness by calling attention to certain aspects of the system (Salancik and Pfeffer 1978). Third, in a team that supports innovations, an individual is likely to discover new ways to perform her job using IT, which enhances positive perceptions of the target IT. Finally, support for innovations reduces the possibility that the target IT is interpreted in negative terms. For example, the learning curve associated with IT use may be interpreted as a necessary investment to improve job performance rather than an obstacle and disruption to their existing work routines. In summary, members tend to develop a higher level of performance expectancy regarding the IT use in a supportive team environment.

Third, participative safety refers to the extent to which team members participate in decision making by interacting and sharing information with others in a nonthreatening interpersonal environment (West 1990). Participative safety is related to a nonjudgmental climate in which individuals feel comfortable to share their opinions and propose new ideas (Rogers 2003). With participative safety, team members tend to have more direct communications with others and more willingness to express their personal interpretations of the target IT. As communication increases and information flows freely within the team, an individual can acquire others' knowledge, experience, and interpretation of IT use vicariously, which helps her understand how to react to the complex IT artifact (Salancik and Pfeffer 1978). One's attention can be drawn to certain aspects of the IT use by communicating with others. A person might develop new needs for the IT after communicating with peers who actively propose new ways to use it. Therefore, the performance expectancy for IT use is likely to be increased.

Finally, task orientation is defined as "a shared concern with excellence of task performance in relation to shared vision of outcomes, characterized by evaluations, modifications, control systems and critical appraisals" (West 1990). It pertains to a general commitment to excellence in task performance through improving established work routines and methods (Anderson and West 1998). Task orientation drives intra-team advice and feedback to achieve a high standard of job performance. In the context of IT use, task orientation means that team members informally evaluate each other's IT use, provide critiques, and improve IT use by considering others' suggestions. Thus, individuals are exposed to others' understanding and interpretations of the target IT and are likely to internalize such information, thereby increasing their performance expectancy. Hence, we develop the following hypotheses.

*H1: Team climate for innovation positively affects performance expectancy.*

Effort expectancy is defined as the perceived degree of ease associated with IT use (Venkatesh et al. 2003). Team climate for innovation can help members overcome obstacles of IT use, thus, making it easy to use the target IT. In a supportive team environment, members assist each other to deal with cognitive and technical difficulties related to the IT use by sharing information and knowledge. As participative safety and task orientation increase, members are more willing to share information with others so that the team's overall job performance can be improved (Anderson and West 1998). Hence, each individual in the team will have better informational support regarding IT use and have a higher level of effort expectancy.

*H2: Team climate for innovation positively affects effort expectancy.*

In UTAUT, facilitating conditions are defined as the degree to which one believes that organizational and technical infrastructure is present to support IT use (Venkatesh et al. 2003). It reflects various aspects of the organizational environment that are designed to remove barriers to IT use. In teams that have a strong climate for innovation, members are expected to innovate using IT to perform their job routines, and they will receive practical support from the team as a whole (West 1990). Guided by task orientation, team members are willing to share information with each other so that overall team performance can be enhanced (Anderson and West 1998). The team will allocate sufficient resources to facilitate the use of IT, and members are ready to help when anyone encounters problems in IT use. Therefore, team climate for innovation is likely to increase members' perception of facilitating conditions.

*H3: Team climate positively affects facilitating conditions.*

In a team that has a strong shared vision, an individual's endorsement of the team vision suggests that she agrees that she should behave in accord with what the vision prescribes (Anderson and West 1998). That is, her personal norms are aligned with group norms to guide her IT behavior. Moreover, in a team with high participative safety, an individual is likely to identify with her work team when she has frequent interactions with other team members, and the sense of identification tends to align her personal norms with group norms (West 1990). The alignment of personal and team norms suggests that a person values her teammates' expectation of her behavior and will act accordingly. Therefore, we hypothesize that team climate for innovation leads to a higher level of subjective norm.

*H4: Team climate positively affects subjective norm.*

The UTAUT submits that behavioral intention fully mediates the effects of performance expectancy and effort expectancy on IT use behavior (Venkatesh et al. 2003). Since behavioral intention is irrelevant in our research context, we propose that performance expectancy and effort expectancy directly influence IT use. Prior research has theoretically validated the direct relationships between perceived usefulness and IT use as well as between perceived ease of use and IT use (Adams et al. 1992; Davis et al. 1989). Given that performance expectancy conceptually overlaps with perceived usefulness, and effort expectancy is akin to perceived ease of use, we develop the following hypotheses:

*H5: Performance expectancy positively affects IT use.*

*H6: Effort expectancy positively affects IT use.*

Facilitating conditions are conceptually similar to perceived behavioral control in the Theory of Planned Behavior (TPB, Ajzen 1991). In TPB, perceived behavioral control has a direct impact on actual behavior. In UTAUT, the direct relationship between facilitating conditions and IT use is theoretically justified and empirically validated (Venkatesh et al. 2003). Therefore, we propose the following hypothesis:

*H7: Facilitating conditions positively affect IT use.*

Subjective norm refers to the degree to which an individual perceives that important others expect her to use the target system (Venkatesh et al. 2003). It should be noted that subjective norm operates through a compliance process, which means that one may or may not agree with the expectations of important others even while deciing to behaviorally conform (Malhotra and Galletta 2005). Prior IS research confirms that the effect of subjective norm on intention is not significant in voluntary settings, while it is significant in mandatory settings (Venkatesh et al. 2000, Venkatesh et al. 2003). The UTAUT suggests that behavioral intention fully mediates the effect of subjective norm on IT use. It can be deduced that the direct relationship between subjective norm and IT use is not significant either.

*H8: Subjective norm has no effect on intention to use in voluntary settings.*

# 3. Methodology

## 3.1. Study Context

In this study, we choose to examine physicians' IT use, which presents a unique voluntary context. One characteristic that distinguishes physicians from other individuals is their high autonomy in performing professional tasks (Sharma 1997; Wallace 1995). High autonomy is the right of individuals to make independent decisions concerning their work-related tasks and activities. For example, a physician has full authority to decide how to deliver medical care to a patient without the uninvited outside influence (Mirvis 1993). Physicians traditionally form a close-knit social network that views external attempts to exert control as a challenge to its autonomy (Edwards et al. 2002). In such an organizational context, it is difficult for managers to monitor physicians' IT usage behavior because they do not fully understand the role of IT usage in physicians' work. In addition, outcomes of IT usage cannot be precisely defined and measured and are subject to multiple interpretations (Fulk 1993). Thus, physicians' IT usage is characterized by low behavioral observability and low outcome measurability. Given that formal organizational mechanisms such as behavioral and outcome controls rely on behavior observability and outcome measurability (Ouchi 1979), using organizational controls to influence physicians' IT usage behavior is unlikely to be effective. Forcing physicians to use a certain system is likely to result in strong resistance and lead to failure (Kohli and Kettinger 2004; Lapointe and Rivard 2005). Thus, physicians' IT usage is, to a large extent, voluntary.

We conducted a survey in a Level 3 general hospital in China, which had 429 physicians. Based on China's hospital classification standard, Level 3 hospitals are large and have the most advanced medical staff and resources (Liang et al. 2004). The hospital implemented a Computerized Physician Order Entry (CPOE) system in its outpatient departments to allow physicians to enter electronic prescriptions and lab orders. Use of the CPOE system was voluntary. CPOE is a complex system that can trigger profound social structure changes in hospitals. Davidson and Chismar (2007) find that CPOE leads to changes in clinical roles and interactions and increases multidisciplinary cooperation and user interdependence within the hospital. Thus, physicians are likely to seek information from their social environment to help them interpret the characteristics and consequences of CPOE. In addition, CPOE might mean drastically different systems to physicians in different hospitals because hospitals usually customize CPOE systems to fit their organizational specifics (Davidson and Chismar 2007). Thus, we selected a single hospital to ensure that the respondents were evaluating the same system when they took the survey.

Different from Western countries, almost all of the hospitals in China are controlled by the government (Liang et al. 2004). Physicians are hired by the hospital as salaried employees. Hospitals are structured based on medical specialties, and consist of a number of clinical departments. Each department is led by a head appointed by the hospital top management. Depending on the hospital size, the number of physicians in a department varies, ranging from a few to dozens. In the hospital selected for this study, physicians in the same department work as a team, because the performance of each department is evaluated at the hospital level. Physicians' work environment is also team-oriented. Several (usually two) physicians share one office to see outpatients, and physician offices of the same department are co-located. There are many interaction opportunities for physicians, including department meetings, joint diagnosis meetings, presentations by pharma representatives, or brief chatting in the hallway. Such an environment provides an ideal context within which our research model can be tested.

### 3.2. The Survey

We developed an English questionnaire, which was then translated into Chinese by an author. We hired a professional translator who knew nothing about our study to translate the Chinese questionnaire back to English. We found no semantic discrepancies when we compared the translated English questionnaire with the original English questionnaire, suggesting the Chinese questionnaire was equivalent to the original questionnaire.

The survey was administered at the hospital's outpatient departments of two different times, scheduled three months apart. At time 1, we asked the IT director of the hospital to distribute questionnaires to 200 randomly selected physicians. The questionnaires measured all the constructs in our model except usage. We attached a consent letter at the beginning of the questionnaire to inform respondents that participating in this survey was totally voluntary and the data would be confidential and only used for research purposes. The physicians were requested to return the questionnaire in a sealed envelope to a designated mail box. At time 2, we asked the IT director to conduct the second round data collection. Questionnaires measuring usage were sent to all the physicians who responded to the first data collection. A total of 103 physicians completed both questionnaires, for a 51.5 percent response rate.

We assessed non-response bias by verifying that (a) the responding physicians' demographic characteristics (i.e., age, gender, and education) were similar to the hospital's overall physicians' demographic characteristics as confirmed by the hospital's human resources department, and (b) early and late respondents were not significantly different (Armstrong and Overton 1976). All t-test comparisons between the means of the early and late respondents showed no significant differences.

The average age of the respondents is 37.11 years (SD = 8.08) and 68.4 percent of them are male. Their average CPOE using experience is 3.90 (SD = 4.29) months. As shown in Table 1, the respondents are from more than 20 different clinical departments. On average, these departments have 15.56 physicians each (SD = 9.99).

| Table 1. Clinical departments of the respondents | | |
|---|---|---|
| Department Name | N | Percent |
| Digestive system | 2 | 1.9 |
| Cardiovascular medicine | 4 | 3.9 |
| Respiratory medicine | 3 | 2.9 |
| Chemoradiotherapy | 8 | 7.8 |
| Renal medicine | 5 | 4.9 |
| Endocrinology | 5 | 4.9 |
| Neurology | 10 | 9.7 |
| Cardiothoracic surgery | 3 | 2.9 |
| General surgery | 9 | 8.7 |
| Orthopaedics | 10 | 9.7 |
| Urology | 3 | 2.9 |
| Burn | 2 | 1.9 |
| Pain clinic | 2 | 1.9 |
| Ophthalmology | 4 | 3.9 |
| Ear nose and throat | 1 | 1.0 |
| OB/GYN | 11 | 10.7 |
| Pediatrics | 6 | 5.8 |
| Infectious disease | 1 | 1.0 |
| Stomatology | 4 | 3.9 |
| TCM/Acupuncture | 4 | 3.9 |
| Other | 6 | 5.8 |
| Total | 103 | 100.0 |

### 3.3. Measurement Development

We developed all of the measurement scales of the constructs in our model based on prior studies. The scales for shared vision, support for innovations, participative safety, and task orientation were extracted from the short version of the team climate scale (Anderson and West 1998; Kivimaki and Elovainio 1999). These four reflective constructs jointly give rise to team climate, which is modeled as a formative second-order construct with four reflective first-order sub-constructs. E derived the scales for performance expectancy, effort expectancy, facilitating conditions, and subjective norm from Venkatesh et al. (2003). Drawing from measures used in prior research (Adams et al. 1992; Davis et al. 1989), we measured duration, frequency, and intensity of IT use. All of these UTAUT constructs are reflective, and we adapted the items to the CPOE context. The items for shared vision were measured by a seven-point semantic scale where one represents “to a very low extent” and seven represents “to a very high extent.” All the other items were measured by a seven-point Likert scale where one represents “strongly disagree” and seven represents “strongly agree” (see Appendix A).

## 4. Data Analysis

We use the Partial Least Squares (PLS) technique, specifically SmartPLS 2.0 (Ringle et al. 2005), for data analysis. PLS allows us to evaluate relationships between independent and dependent variables at multiple levels and to assess measurement errors and structural relationships simultaneously. PLS is considered a better approach than regression analysis, since it can estimate the measurement model and structural model together (Gefen et al. 2000). In addition, as a second generation SEM method, PLS is better suited for testing complex relationships, as it avoids two serious problems of covariance-based SEM methods: inadmissible solutions and factor indeterminacy (Fornell and Bookstein 1982). Another important reason to use PLS is that it allows us to estimate both reflective and formative constructs.

## 4.1. Evaluating Measurements

We evaluated convergent and discriminant validity and reliability of the measurement scales for reflective constructs following Gefen and Straub (2005). As Table 2 shows, all loadings of the measurement items are above .70, indicating acceptable convergent validity. Given that the items' loadings on their assigned constructs are greater than their cross loadings on other constructs, the scales demonstrate satisfactory discriminant validity (Chin 1998). Moreover, the square root of any construct's average variance extracted (AVE) is greater than all the correlations between the focal construct and other constructs, providing additional evidence for discriminant validity (see Table 3). We computed the composite reliability coefficients of the scales and found all of them exceeded Nunnally's (1978) recommended cut-off value of 0.70.

**Table 2. Factor loadings and cross-loadings**

| | V | S | PS | TO | PE | EE | SN | FC | U |
|---|---|---|---|---|---|---|---|---|---|
| V1 | **.94** | .39 | .51 | .33 | .24 | .08 | .08 | .29 | .24 |
| V2 | **.97** | .43 | .56 | .40 | .29 | .14 | .13 | .32 | .24 |
| V3 | **.96** | .42 | .55 | .40 | .32 | .01 | .07 | .23 | .21 |
| V4 | **.89** | .29 | .61 | .24 | .44 | -.06 | .31 | .33 | .29 |
| S1 | .43 | **.91** | .73 | .64 | .33 | .06 | .27 | .24 | .27 |
| S2 | .37 | **.97** | .59 | .81 | .14 | .18 | .10 | .17 | .05 |
| S3 | .37 | **.95** | .57 | .83 | .12 | .24 | .14 | .21 | .13 |
| PS1 | .55 | .42 | **.85** | .28 | .40 | .03 | .33 | .35 | .26 |
| PS3 | .41 | .50 | **.86** | .45 | .30 | .24 | .45 | .37 | .24 |
| PS4 | .56 | .75 | **.88** | .64 | .36 | .12 | .30 | .27 | .28 |
| TO1 | .43 | .75 | .51 | **.95** | -.01 | .08 | .03 | .13 | .05 |
| TO2 | .30 | .75 | .54 | **.94** | .06 | .23 | .16 | .17 | .07 |
| TO3 | .32 | .79 | .52 | **.94** | .09 | .17 | .09 | .13 | .05 |
| PE1 | .34 | .15 | .37 | -.01 | **.90** | .22 | .53 | .42 | .54 |
| PE2 | .25 | .15 | .33 | .00 | **.93** | .14 | .46 | .34 | .53 |
| PE3 | .32 | .16 | .33 | .02 | **.94** | .19 | .49 | .42 | .48 |
| PE5 | .30 | .28 | .42 | .18 | **.80** | .15 | .44 | .29 | .46 |
| EE1 | .13 | .20 | .16 | .17 | .16 | **.85** | .40 | .48 | .18 |
| EE2 | -.03 | .08 | .02 | .07 | .18 | **.87** | .36 | .52 | .21 |
| EE3 | .01 | .19 | .22 | .21 | .19 | **.87** | .40 | .56 | .10 |
| EE4 | .01 | .09 | .12 | .13 | .15 | **.93** | .45 | .53 | .14 |
| SN1 | .05 | .18 | .28 | .09 | .36 | .52 | **.76** | .55 | .38 |
| SN2 | -.04 | .06 | .18 | -.02 | .26 | .33 | **.73** | .45 | .18 |
| SN3 | .24 | .19 | .45 | .12 | .53 | .26 | **.88** | .54 | .45 |
| SN4 | .12 | .10 | .32 | .06 | .49 | .41 | **.86** | .67 | .39 |
| FC1 | .42 | .15 | .43 | .11 | .46 | .41 | .62 | **.89** | .48 |
| FC2 | .10 | .22 | .16 | .19 | .21 | .70 | .57 | **.80** | .29 |
| FC3 | .16 | .20 | .29 | .09 | .29 | .45 | .50 | **.79** | .27 |
| U1 | .34 | .14 | .27 | .05 | .51 | .16 | .41 | .45 | **.96** |
| U2 | .18 | .18 | .29 | .07 | .58 | .22 | .49 | .43 | **.97** |
| U3 | .23 | .13 | .32 | .06 | .54 | .14 | .44 | .42 | **.96** |

**Note:** V = shared vision; S = support for innovation; PS = participative safety; TO = task orientation; PE = performance expectancy; EE = effort expectancy; SN = subjective norm; FC = facilitating conditions; U = IT use

**Table 3. Correlations among constructs**

| | R | AVE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Shared vision | .96 | .88 | **.94** | | | | | | | | | |
| Support for innovation | .96 | .89 | .43** | **.92** | | | | | | | | |
| Participative safety | .89 | .74 | .55** | .69** | **.82** | | | | | | | |
| Task orientation | .96 | .89 | .39** | .82** | .62** | **.91** | | | | | | |
| Team climate | -- | -- | .76** | .86** | .86** | .81** | -- | | | | | |
| Perform. expectancy | .94 | .80 | .34** | .22* | .28** | .06 | .30** | **.81** | | | | |
| Effort expectancy | .93 | .77 | .07 | .21* | .22* | .20* | .20* | .23* | **.88** | | | |
| Subjective norm | .88 | .66 | .17 | .22* | .37** | .14 | .28** | .56** | .49** | **.80** | | |
| Facilitating conditions | .88 | .68 | .38** | .21* | .42** | .14 | .37** | .42** | .53** | .65** | **.82** | |
| IT Use | .98 | .93 | .27** | .19 | .30** | .07 | .27** | .55** | .24* | .48** | .50** | **.99** |

**Note:** * p < .05; ** p < .01; AVE square roots are in diagonal cells

The IS community has recently been paying close attention to formative constructs (Gable et al. 2008; Marakas et al. 2007; Petter et al. 2007). Traditional methods assessing construct validity and reliability are inappropriate for formative constructs whose causal direction flows from measures to constructs (Diamantopoulos and Winklhofer 2001; Jarvis et al. 2003). Following the formative measures assessment guidelines recommended by Petter et al. (2007), we evaluated team climate's construct validity and reliability. First, the PLS analysis shows that all of the four first-order constructs for team climate have significant weights (Figure 2), providing evidence for the construct validity of team climate (Diamantopoulos and Winklhofer 2001). Second, to assess multicollinearity, we computed latent variable scores for each first-order team climate component and then tested its variance inflation factor (VIF).[1] The VIFs for shared vision, support for innovation, participative safety, and task orientation are 1.45, 3.62, 2.29, and 3.05, respectively. As expected, support for innovation and task orientation have relatively high collinearity. This is because they share a certain degree of conceptual similarity in the context of IT use, although they seem to be theoretically distinct. It is recommended that the VIF statistic for formative measures should not exceed 3.3 (Diamantopoulos and Siguaw 2006). Since only the VIF of support for innovation (VIF = 3.62) is slightly greater than 3.3, the reliability of our ISI measurement model can be considered adequate.

Since all of the constructs are measured by single-source self-report data, common method variance (CMV) may bias the construct relationships (Podsakoff et al. 2003). We conducted the Harmon's one factor test (Podsakoff and Organ 1986) to evaluate whether CMV is a serious concern. We entered all the measurement items into a factor analysis using the Varimax rotation. No single dominant factor emerged from the analysis. We extracted six components, whose explained variance ranged from 4.02 percent to 20.68 percent, indicating that common method variance is unlikely to exist.

## *4.1.* Testing Hypotheses

The structural model testing results are shown in Figure 2. Team climate is found to significantly affect performance expectancy (b = .32, p < .01), facilitating conditions (b = .35, p < .01), and subjective norm (b = .29, p < .01), thus supporting H1, H3, and H4. Team climate is not found to significantly affect effort expectancy; thus H2 is not supported. The results show two significant determinants of IT use – performance expectancy (b = .41, p < .01) and facilitating conditions (b = .32, p < .01) – which provides support for H5 and H7. Since the effect of effort expectancy on IT use is not significant, H6 is not supported. Finally, as hypothesized, the link between subjective norm and IT use is not significant, providing support for H4. About 40 percent of variance in IT use can be explained by this model.

[1] $VIF_i = 1 / (1 - R_i^2)$ where $R_i^2$ is the variance explained from regressing the independent variable $X_i$ on all other independent variable Xs.

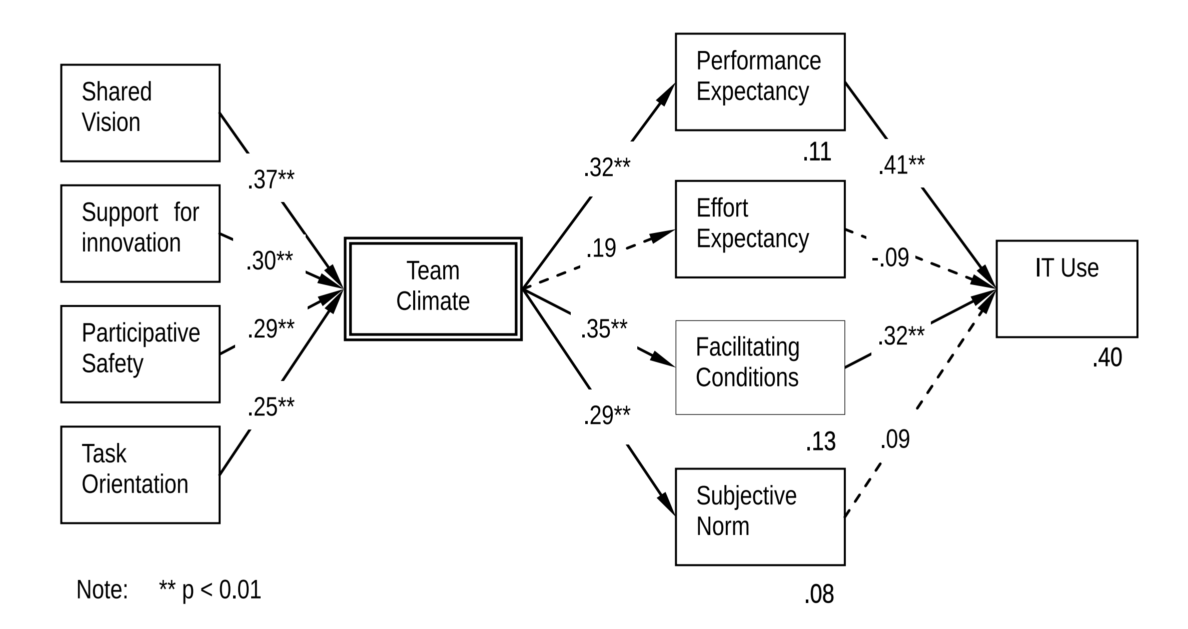


**Figure 2. Model Testing Results**

## 5. Discussion

This study intends to investigate the role of team climate for innovation in influencing individuals' IT use behavior. We find that team climate has a significant impact on both performance expectancy and facilitating conditions. Consistent with previous technology acceptance research (Davis et al. 1989; Venkatesh et al 2003), performance expectancy and facilitating conditions have significant effects on IT use. These findings suggest that physicians internalize the information provided by their proximal team environment to shape their perceptions of the target technology regarding IT use. This is consistent with both social influence research (Fulk 1993; Salancik and Pfeffer 1978) and theory of reasoned action (Fishbein and Ajzen 1975) which asserts that one important belief formation process is based on information provided by external sources.

We find that team climate for innovation significantly influences subjective norm. However, subjective norm has no influence on IT use, corroborating prior research that shows subjective norm does not affect voluntary IT use (Venkatesh et al. 2000; Venkatesh et al. 2003). These findings suggest that the indirect impact of team climate on IT use via normative beliefs is not salient. Therefore, the primary path through which work teams influence members' IT use is by shaping their cognitive perceptions of the target system.

It is notable that effort expectancy is not affected by team climate and has no effect on IT use. First, the effect of team climate on effort expectancy is achieved through social influence. Yet, prior research suggests that knowledge workers' perceived ease of use is determined by personal traits rather than social factors (Lewis et al. 2003). In this study, physicians are knowledge workers, and their effort expectancy, which is similar to perceived ease of use, probably depends on personal attributes more than team climate. This presumably explains why team climate does not affect effort expectancy. Second, precious studies have consistently found the effect of perceived ease of use on IT use to be insignificant. In seminal work, Davis (1989)finds that "the effect of ease of use on usage, controlling for usefulness, was non-significant" (p. 331). Adams et al. (1992) find that the effect of perceived ease of use on usage is complex – it is significant for some systems, and insignificant for others –.and they even question whether perceived ease of use is a determinant of use at all (p. 244). The non-significance of perceived ease of use is confirmed by studies on physicians, which reveal that perceived ease of use does not significantly influence user attitude and is unlikely to influence usage (Hu et al. 1999). These previous findings provide compelling evidence to support the non-significant relationship between effort expectancy and IT use.

### 5.1. Implications for Research

This study informs IS research in two ways. First, we conceptualize how the four components of team climate influence individuals' IT use behavior. Proposing that humans are adaptive organisms and IT artifacts are socially constructed, we describe various mechanisms through which individuals are influenced by information and norms from their proximal social networks. In particular, this paper proposes that social influence arising from the work team can have an effect on individuals' cognitive perceptions and normative beliefs. We hope that this conceptualization draws attention to the polymorphic nature of social influence. That is, social influence can operate through both normative and informative channels (Burnkrant and Cousineau 1975; Deutsch and Gerard 1955). Prior social influence research (Fulk 1993; Salancik and Pfeffer 1978) explicates that through the informational channel, individuals internalize external information, whereas through the normative channel, individuals try to comply with significant others' expectations. The key distinction is whether an individual's cognitive structure is altered due to the influence of her social environment. While the normative channel induces compliance behavior without changing one's cognitive perceptions and beliefs, the informational channel, allows one to use external information to shape or reshape her perceptions and beliefs which, in turn, lead to the rational behavior of IT use. Although we did not explicitly measure informational and normative social influences, our theorization and findings imply that work teams can influence members through both channels. Given that the existing concept of social influence in technology acceptance research is framed as a normative influence, highlighting the polymorphic nature of social influence will allow IS researchers to pursue a richer understanding of this concept.

Second, we provide empirical evidence to support the important role of team climate for innovation in voluntary settings. Consistent with prior research (Venkatesh et al. 2000, Venkatesh et al. 2003), we found that subjective norm has no significant effect on IT use in voluntary settings. However, we went one step further to demonstrate that this does not necessarily mean social influence is mute in voluntary settings. While team climate cannot influence IT use by altering individuals' subjective norms, it can still be influential by changing individuals' cognitive perceptions. Our empirical findings complement the traditional view of social influence in the extant IS literature and show how social influence indirectly affects IT use by shaping perceptions of performance expectancy and facilitating conditions. Thus, this study sheds light on the hidden role of social influence in voluntary IT settings, and provides new insights into the widely studied social influence phenomenon.

### 5.2. Implications for Practice

This study provides practical implications for IT management in organizations. We bring to light the importance of team climate in affecting IT usage. As our results demonstrate, team climate has indirect effects on IT use, suggesting that information shared across and embedded in an IT-friendly team is important to the continuance of IT use. More attention should be paid to cultivating the right team environment that values the shared vision, encourages peer interaction, supports IT innovations, and focuses on performance excellence.

Team climate is especially important for promoting the use of large-scale enterprise systems, which integrate complex work routines and business processes. On the one hand, the embedded "best practices" might conflict with users' work routines and habits developed over years, thus impeding IT use. In addition, users tend to feel uncertain about the outcomes of using such systems due to their complexity (Liang et al. 2007). In such cases, team climate should be exploited to help users realize the benefits of IT usage. Different from personal information systems, large scale systems achieve benefits through the integration and synergy of various components. It is difficult for individual users to realize such benefits from a personal viewpoint the team bridges the gap between the organization and the user in terms of communicating the benefits of enterprise systems. Peer support based on information exchange within work teams can help reduce knowledge hurdles to the use of complex systems (Sykes et al. 2009). Hence, organizations should take full advantage of the informational influence that teams can provide to increase users' system usage.

Issues related to IT management in the healthcare industry have drawn increasing attention from IS researchers (Chau and Hu 2002; Devaraj and Kohli 2003; Hu et al. 1999; Kohli and Kettinger 2004;

Menon et al. 2000). A salient characteristic of the healthcare industry is that the IT users are professionals who have specialized medical knowledge. Prior research suggests that knowledge workers such as physicians possess high professional autonomy and do not always comply with mandatory forces; therefore, it is difficult to impose formal controls over physicians (Kohli and Kettinger 2004; Lapointe and Rivard 2005). Mandatory pressures can even generate negative influences on IT use behavior (Malhotra and Galletta 2005). Thus, in organizations that are mainly staffed with knowledge workers, it is not a good idea to force user compliance. Instead, relying on informational social influence engendered by the work team to affect users' perceptions and personal norms of the target technology is likely to be more effective. Managers should define their roles as facilitators rather than controllers. They need to focus on making users believe in the system and leading them to choose to use the system on their own rather than pushing them to comply.

### 5.3. Limitations

Our findings should be interpreted in light of the study's limitations. First, the respondents of this study are physicians from a Chinese hospital. Caution should be taken when generalizing the findings to hospitals in other countries. Users' cultural backgrounds may affect their susceptibility to the influence of team climate. We acknowledge that the generalizabililty concern troubles all survey-based research, because it is extremely difficult, if not impossible, to obtain a sample that represents all populations. Future research should examine the effect of team climate in other organizational settings to confirm our findings.

Second, our empirical data were collected from physicians, who belong to a special profession. Professional attributes such as autonomy can possibly influence the effect of team climate. However, we did not measure any attributes of the medical profession and cannot empirically evaluate how those attributes affected our findings. Future research needs to investigate how professional attributes interact with different forms of social influence to affect IT use.

Third, this research is focused on social influence arising from the team environment. This is particularly meaningful when the IT users are specialized professionals such as physicians because information from peers appears more credible to them. Therefore, we studied team climate as one source of social influence. However, it should be noted that social influence is not confined within the team environment. It could come from other sources such as managers, friends, and counterparts in other organizations. While prior research suggests that team-based social influence has the strongest effect on individual behavior, future research is needed to examine whether this is true for different users and technologies.

Finally, our survey data are self-reported from single sources and may contain common method variance. Although we performed the Harmon's one factor test to show that common method variance is not a serious concern, this test has been criticized for being a weak method (Podsakoff et al. 2003). To completely eliminate common method variance, procedural strategies such as using multiple methods or collecting data from multiple sources should be employed (Burton-Jones 2009).

## 6. Conclusions

This paper highlights the importance of team climate for innovation in affecting individuals' IT use. The results show that team climate has a significant effect on performance expectancy, facilitating conditions, and subjective norm. IT use is significantly determined by performance expectancy and facilitating conditions, but not by subjective norm. The findings suggest that the mechanism through which team climate influences IT use is by modifying cognitive perceptions rather than normative beliefs of the target technology. Our findings generate new insights into the well researched technology acceptance phenomena and provide an enriched understanding of social influence.

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## Appendix A. Measurement Items

| |
|---|
| **Shared Vision** (Anderson and West, 1998; Kivimaki and Elovainio 1999**)** |
| 1. How clear are you about what your team's objective of using CPOE is?<br>2. How far are you in agreement with these objectives?<br>3. To what extent do you think these objectives can actually be achieved?<br>4. How worthwhile do you think these objectives are to the hospital? |
| **Participative Safety** (Anderson and West, 1998; Kivimaki and Elovainio 1999**)** |
| 1. We share information generally in the team rather than keeping it to ourselves<br>2. People feel understood and accepted by each other<br>3. Everyone's view is listened to even if it is in a minority |
| **Support for innovations** (Anderson and West, 1998; Kivimaki and Elovainio 1999**)** |
| 1. People in my team are always searching for fresh, new ways of looking at problems.<br>2. People in my team co-operate in order to apply CPOE in our job.<br>3. Team members provide practical support for the application of CPOE. |
| **Task Orientation** (Anderson and West, 1998; Kivimaki and Elovainio 1999**)** |
| 1. My team colleagues provide useful ideas and practical help to enable me to do the job to the best of my ability<br>2. My team critically appraise potential weaknesses in what it is doing in order to achieve the best possible outcome<br>3. Members of my team build on each other's ideas in order to achieve the best possible outcome |
| **Performance Expectancy** (Venkatesh et al., 2003) |
| 1. I would find the CPOE useful in my job.<br>2. Using the CPOE enables me to accomplish tasks more quickly.<br>3. Using the CPOE increases my productivity.<br>4. Using the CPOE increases quality of care I provide. |
| **Effort Expectancy** (Venkatesh et al., 2003) |
| 1. My interaction with the CPOE would be clear and understandable.<br>2. It would be easy for me to become skillful at using the CPOE.<br>3. I would find the CPOE easy to use.<br>4. Learning to operate the CPOE is easy for me. |
| **Subjective Norm** (Venkatesh et al., 2003) |
| 1. People who influence my behavior (e.g., boss, peer) think that I should use the system.<br>2. People who are important to me (e.g., boss, patient) think that I should use the system.<br>3. The senior management of this business has been helpful in the use of the system.<br>4. In general, the organization has supported the use of the system. |
| **Facilitating Conditions** (Venkatesh et al., 2003) |
| 1. I have the resources necessary to use the system. |
| 2. I have the knowledge necessary to use the system. |
| 3. A specific person (or group) is available for assistance with system difficulties. |
| **IT Use** (Adams et al. 1992, Davis 1989) |
| 1. I spend a lot of time using the CPOE every day |
| 2. I use the CPOE frequently every day |
| 3. I use the CPOE intensively every day |

**Note:** Items of Shared Vision are measured by a 7-point scale where 1 = "to a very low extent" and 7 = "to a very high extent". All other items are measured by a 7-point scale where 1 = "strongly disagree" and 7 = "strongly agree"

## About the Authors

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