

A GROUNDED THEORY FOR UBIQUITOUS INFORMATION SYSTEMS (IS) ACCESS
IN HEALTHCARE

by

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(Under the direction of Richard T. Watson)

ABSTRACT

Throughout the Information Age, organizations have sought ubiquitous IS access, in one form or another (e.g., duplicate files and centrally located workstations), in order to increase efficiency and effectiveness of processes that in turn enhance task performance. Advances in communication technologies afford access to information anytime anywhere via wireless technologies. The phenomenon is referred to as ubiquitous IS access.

This research employs Grounded theory to develop perspectives concerning the impact of ubiquitous IS access, facilitated by wireless technologies, on performance of patient care tasks (i.e., patient registration, electronic charting, and medication administration in three departments of US hospitals).

Data are analyzed, relationships interpreted, and three perspectives emerge that represent stakeholder views of conditions associated with implementation, utilization, and performance impacts of ubiquitous IS access. From these perspectives the major findings are as follows:

- Ubiquitous IS access provides the caregiver with needed mobility, enhances comprehensiveness of documentation, reduces charting time, reduces the

likelihood of errors and reliance on memory, and affords the caregiver more time with the patient.

- Ubiquitous IS access helps to promote organizational goals such as patient safety and satisfaction, process efficiency, and recruitment and retention of nurses.
- Intervening conditions such as task environmental inhibitors and resistance to change can mitigate benefits of ubiquitous IS access.

Ubiquitous IS access ties together requirements for performing tasks when they are (1) information intensive, (2) interdependent, and (3) location, identity, and time dependent. In conclusion, ubiquitous IS access is a dovetailing technology, which is a technology that harmoniously fits the technology characteristics, organizational assets, and task performer capabilities with the requirements of the tasks, keeping in mind the organizational and individual drives that promote *optimal* performance. Ultimately, this research reveals that ubiquitous IS access fits ideally with the way work is actually done in the environments studied.

INDEX WORDS: Ubiquity, Ubiquitous IS access, Wireless Computing, Wireless Information System, Mobile Computing, Grounded Theory, Task Technology Fit

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To

My supportive husband, LCDR US Navy Craig Abraham; loving daughter, Dana Abraham;
praying parents, LTC US Army (Retired) William and Kathleen Akery
and SgtMaj US Marine Corps (Retired) James and Misako Abraham;
and other encouraging family and friends.

A special dedication goes to
the memory of my dear grandmother,
Mrs. Vernell Marie Steen, 21 December 1923 – 25 February 2004,
to whom I am indebted for her spiritual guidance throughout my every endeavor.

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CHAPTER 1

INTRODUCTION

Access to vital information at critical time periods has always been a concern of organizations across industries to afford flexibility to organizational members in performing tasks and improving efficiencies across the organization. However, traditional tethered information systems and networks have not always afforded needed flexibility to organizational personnel that are extremely mobile and who perform tasks that require accessing information from multiple sources at anytime. Not all tasks require untethered information systems or ubiquitous IS access for the users to effectively perform tasks, yet in others, it is becoming a necessity not only to the organization but also to those that the organization services.

The core business function of the healthcare industry is patient care. Patient care is an intensive technology that involves reciprocal interdependent tasks, which require massive coordination between individuals and units of the organization (Thompson, 1967). The healthcare industry is the selected focus of this research because (1) the perceived relative task technology fit of ubiquitous IS access is best observed in this type of task environment and (2) the current impetus (i.e., as of 2002, nearly one-third of all US hospitals ubiquitously access information facilitated by a WLAN with substantial growth expected (Gartner Healthcare, 2002)) noted in practitioner literature for wireless local area networks (WLAN) implementations in hospitals is a prime research opportunity for studying the phenomenon as it occurs in a natural setting.

Patient safety, accompanied by improved quality of care, is the primary concern within the healthcare industry. The US Institute of Medicine (IOM) reported in January 2001 and 2002, that as many as 98,000 Americans possibly die each year due to medical errors. Many of these errors may be due to inefficient means of accessing, recording, or manipulating essential patient data at the point of care because of antiquated methods of data management and transmission. In light of these figures and encouragement by the Department of Health and Human Services, many hospitals and healthcare providers are seeking sanctioned means (e.g., those in accordance with the US Health Insurance Portability and Accountability Act of 1996 (HIPAA)) to automate processes and increase their ability to access critical data at the point of care by employing innovative technologies that will aid in resolving these pressing issues. “As mobile professionals, healthcare providers are required often to make immediate, life-critical decisions away from a stationary information resource (Mobile CommerceNet 2001, pg. 3).” These critical decisions and critical tasks can be greatly facilitated by “ubiquitous IS access, which is the use of ubiquitous networks to support personalized uninterrupted communications and transactions between an organization and its various stakeholders to provide an enhanced value over, above, and beyond traditional information systems (Watson, et al., 2002).

Innovative technologies such as mobile devices and WLANs that facilitate ubiquitous IS access are used to provide real-time access to medical knowledge and patient data, thus potentially improving the effectiveness of medical care and efficiency of medical processes. Yet, we have insufficient knowledge of the best way to deploy these technologies.

CHAPTER 2

RESEARCH MOTIVATION

As with the emergence of any innovative technology or new research stream, there is not a true consensus on a title for the phenomenon of accessing information via wireless technologies; however, this research adopts the term “ubiquitous IS access”, which reflects the nature of how data are accessed and utilized in organizations. A search of academically oriented articles published in or after 2001, which is the year that the WLAN market had the most substantial growth, revealed a gap in the literature for studies concerning ubiquitous IS access in organizations (CTIA Daily News, Feb 2002). Keywords used for this search were ubiquity, ubiquitous IS access, ubiquitous IS access, wireless, wireless computing, wireless information system, organizational technology, enterprise computing, and mobile computing.

The search consisted of queries in the Academic and Business Search Premier databases that specifically targeted scholarly journals such as MIS Quarterly (MISQ), Journal of Association of Information Systems (JAIS), Journal of Strategic Information Systems (JSIS), Communications of the Association of Computing Machinery (CACM), Information Systems Research (ISR) and other journals sponsored by the Institute for Operations Research and the Management Sciences (OR/MS), which revealed only several academically oriented articles that concern the phenomenon (Waldo, 2001; Elliot, 2002; Tarasewich and Warkentin, 2002). All of the articles are conceptual (void of empirical analysis) and discuss the potential benefits of ubiquitous IS access within organizations in terms of efficiency in mobile workers accessing needed information. A search of conference proceedings in the digital libraries for the Americas

Conference of Information Systems (AMCIS), International Conference on Information Systems (ICIS), and the Hawaii International Conference on Systems Sciences (HICSS) revealed many articles on the technical aspects of the mobile architecture or ubiquitous IS access in relation to individual consumer behavior in e-commerce.

Recent adoption of improved wireless data transmission standards and supporting devices contribute to the current growth in the WLAN market for organizational implementations (i.e., 73% growth and \$2.8 billion in revenue in 2003 (Dataquest, 2003). Academics are beginning to take advantage of this opportunity to study ubiquitous information environments (e.g., mobile work environments and knowledge work) that will undoubtedly lead to a stream of research in this area. For example, Case Western Reserve University and the University of Texas at Austin host workshops and are publishing conference papers concerning the design, implementation, challenges, and strategies associated with ubiquitous IS access in organizations to promote research in this area (Williams and Burns, 2001; Avital, 2003; Chae, 2003; Cousins and Robey, 2003; Davis, 2003; Giles, 2003; Liberatore, 2003; Lyytinen, 2003; Sawyer, 2003; Shaw, 2003; Sorensten, 2003; Varshney, 2003; Yoo, 2003). Additionally, JSIS will publish a special issue on ubiquitous IS access in 2004.

A review of practitioner articles reveal a plethora of studies concerning organizational ubiquitous IS access implementations with perceived and actual benefits across various industries (e.g., warehousing, ground baggage transportation, field workforce for insurance sales and realtors, and healthcare) (Gross, 2002; Symbol Technologies, 2001; Sims, 2003; Brewin, 2003; Kleinberg, 2002; HIMSS, 2002; Turisco and Steinichen, 2002).

This review of literature emphasizes the need for an in-depth study of the ubiquitous IS access phenomenon. Qualitative methods are best applied when little is known about the

phenomenon, (Strauss and Corbin, 1990; Myers, 1994). This research applies Grounded theory, a particular qualitative research method, which can extend the current knowledge concerning ubiquitous IS access.

CHAPTER 3

RESEARCH DESCRIPTION

This research is a phased study that employs qualitative methods. The format for such research tends to vary. This research adapts the formats proposed in *Developing Effective Research Proposals* (Punch, 2000) and professed in *The Qualitative Report* (Heath, 1997) to present perspectives concerning ubiquitous IS access in the healthcare industry. “Grounded theory, in its later forms, has in fact become a highly developed, rigorous, and systematic methodology that incorporates a set of specific procedures for producing substantive theory of social phenomena. Although it still leaves place for openness, flexibility, creativity, and insight, this is not to say that ‘anything goes,’ i.e. that ‘we may indiscriminately and arbitrarily pick and choose data-gathering techniques and analytic operation’ (Locke, 1996, p.243). Far from this ‘anything goes’ approach, Corbin and Strauss (1990) argue that Grounded theory should be considered as a scientific method, for which the adequacy of the research process and the grounding of the research findings should be judged according to a set of specific evaluative criteria. Accordingly, IS researchers interested in using Grounded theory in their work should be as faithful as possible to the version of the methodology they choose, and make sure to suit its operational indicators and specific procedures.” (Boudreau, 2002). Since this research employs Grounded theory, which requires an iterative process for development of the explanation of the phenomenon, the format reflects the evolving nature of the research process.

Research Question

Innovative technologies may improve task efficiency and task effectiveness by automating or reengineering antiquated/manual processes, changing people's roles, and organizational structures (Bostrom and Heinen, 1977). Mobile devices and WLANs are examples of innovative technologies that are being coupled in a variety of environments because of the untethered nature of ubiquitous IS access (Watson, et al., 2002). This research explores the potential and actual tasks, roles and structural changes brought about by this coupling of wireless technologies and factors that promote and hinder efficiency and effectiveness of reciprocally interdependent tasks. Humans have limited ability to process information and ubiquitous IS access, facilitated by wireless technologies, can increase the capacity to assimilate critical information at vital times (Watson, et al., 2002). The potential benefits that this research explores are related to the individuals receiving care and the organizational stakeholders (i.e., healthcare providers in subunits and hospital administrators). Specifically, this study explores benefits such as reduction in documentation errors and effective use of medical knowledge at the point of care. However, the scope of this study is not limited to the aforementioned concepts and allows the stakeholders to define additional applicable themes and concepts.

The intention is to create knowledge for academics, government practitioners, and healthcare industry stakeholders concerning the necessity for ubiquitous IS access in a variety of tasks related to patient care. The initial research question guiding this study is as follows: *How does ubiquitous IS access, facilitated by wireless technologies, impact task performance?*

Task performance is assessed by measures of (1) task effectiveness (i.e., successfully matching information processing capacities with the information processing requirements of the

task), and (2) task efficiency (i.e., performing the task with minimal waste of technical and human resources) (adapted from Tushman and Nadler, 1977).

The following are some specific concepts that also guide the formulation of interview questions for this study:

- Values embodied by the intended users of the technology that may promote or interfere with technology use, task efficiency, and task effectiveness,
- Resistance to change prompted by factors such as increased liability, technology aversion, lack of training and support, task complexity, and restrictions of the physical environment that may interfere with the use/infusion of the technology and task performance,
- Changes in roles and decision-making structure because of the ubiquitous nature of the technology, and
- Identification of other tasks amenable to ubiquitous IS access.

In qualitative research, the research question(s) and concepts collectively form a frame of reference to delve into the underlying circumstances of the phenomenon but do not solely restrict research to only answering these questions. The research paradigm and Grounded theory methods call for a critical review of data in an iterative fashion that may lead the researcher to ask more informative questions.

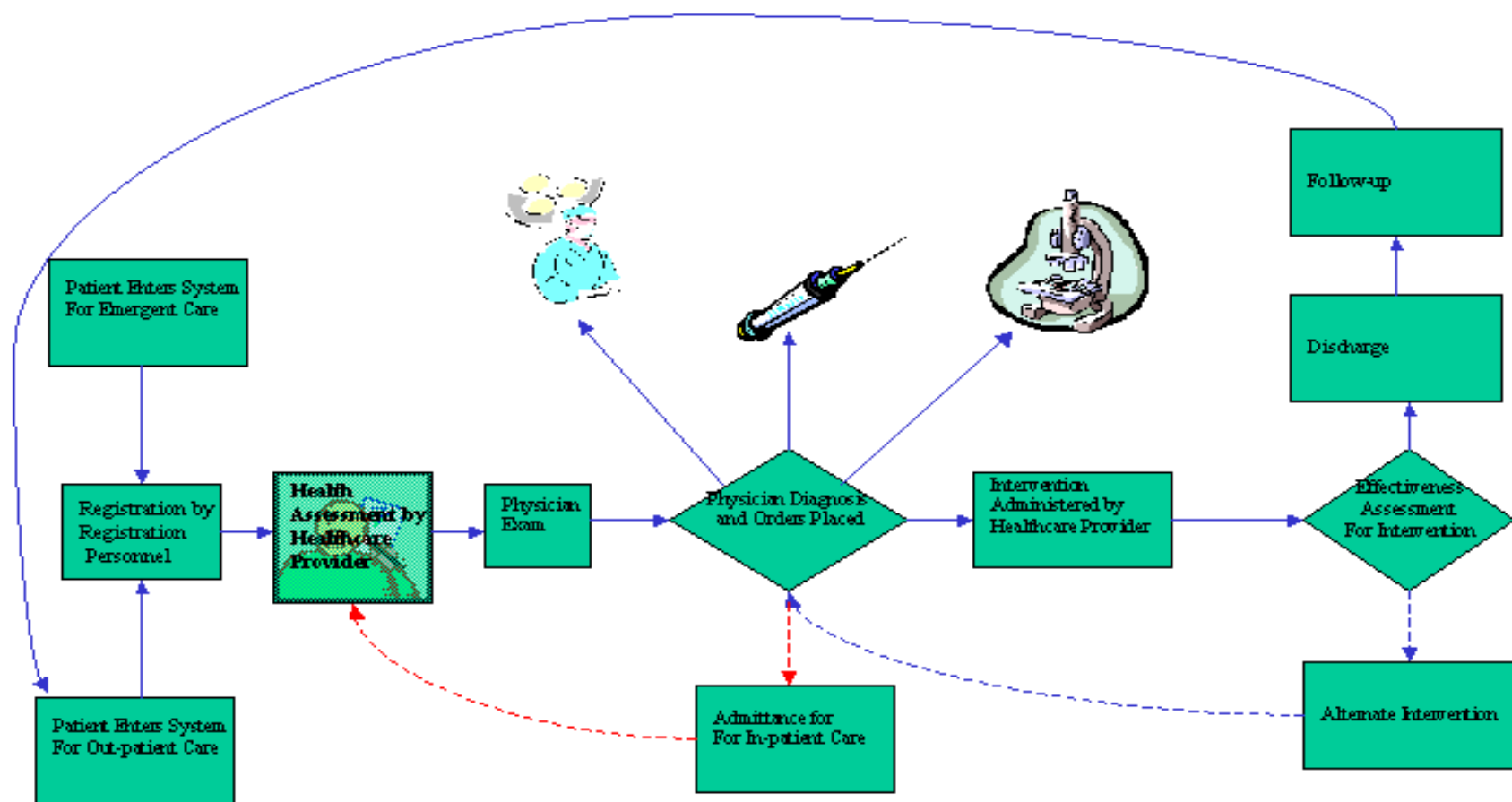
Unit of Analysis

The level of analysis is the system. Through the system, caregivers perform standard patient care related tasks (i.e., patient triage, electronic charting, and medication administration). These tasks necessitate ubiquitous IS access for data retrieval and manipulation that aid healthcare providers rendering services to the patient throughout the patient care system with the

information needed to make decisions about medical interventions for the patient. The system facilitates performance of tasks that require extensive coordination and mutual adjustment throughout the process of delivering care to patients. These types of tasks are also most demanding on communication and decision effort amongst those performing the task (Thompson, 1967).

This research generalizes the process for entering and receiving care. Documentation is critical at every point in the healthcare system. The technology implemented aids the caregiver in accessing and documenting vital information at various points in the patient care system. In comparison to manual methods, the system allows easier access in most cases to information when and where needed. It is not the claim of this research that ubiquitous IS access is possible for every task in all instances but for the tasks involved in this research under conditions outlined in the study, it can afford greater efficiency effectiveness in task performance.

Nurses provided face validity for the generalization of the patient care system. Each hospital has its own idiosyncrasies in the patient care process but for the most part patient enter, are cared for, and are discharged. The following figure depicts the typical process of interdependent tasks that comprises the patient care system.



Note: Documentation of all healthcare provider/patient interaction is continuous as the patient processes through the care system.

———— : Most probable process

- - - - : Alternate medical intervention that requires patient to re-cycle through care system

- - - - : Alternate process for more acute care

Figure 1 Patient Care System

CHAPTER 4

RESEARCH PARADIGM AND DESIGN

A paradigm, a set of basic beliefs (Miles and Huberman, 1984; Denzin and Lincoln, 1994), represents the researcher's view of the world and the actions of individuals within it. The four basic research paradigms (also referred to as philosophical beliefs or epistemological views) in the social sciences are as follows: positivism, interpretivism (i.e., postpositivism and constructivism), and critical theory (Guba and Lincoln, 1994; Orlikowski and Baroudi, 1991).

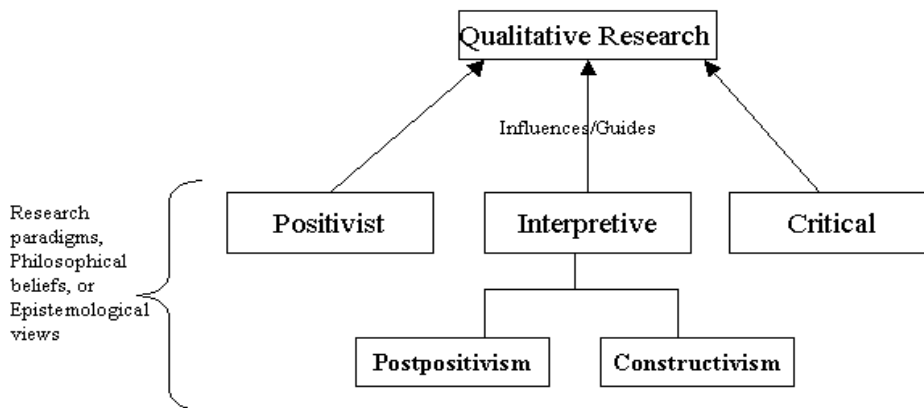


Figure 2 Qualitative Research Paradigms (Guba and Lincoln, 1994)

These research paradigms address three basic questions:

1. The ontological question: What is the form of nature and reality? What is there that can be known about it?
2. The epistemological question: What is the nature of the relationship between the knower (or the would-be knower) and what can be known?
3. The methodological question: What methods can the researcher use to determine

knowledge about the phenomenon?

This study assumes the postpositivist perspective that a reality exists but it is imperfect and bounded by rationality because it is impossible to know all contributing factors to any phenomenon. The aforementioned questions can be answered from the postpositivist perspective in the following manner:

- **Ontology:** For the postpositivist, research is done via critical realism, where one reality is assumed to exist but in an imperfect manner because knowledge is not all inclusive; therefore it is imperfectly comprehended due to flawed human intellectual mechanisms. With this in mind, one seeks to explain as much as possible under certain conditions to understand reality as closely as possible.
- **Epistemology** for the postpositivist means a modified dualist/objectivist research approach. Objectivity concerns the researchers ability to best fit the findings with preexisting knowledge, as well as the critical communities' perspectives (i.e. editors, referees, and professional peers).
- **Methodology** for the postpositivist emphasis is placed on triangulation (i.e. multiple sources of evidence). Data are collected in more natural settings, collecting more situational information, reintroducing discovery (exploration) as an element of inquiry, and determining the means and purposes that people ascribe to their actions. This is the basis for the qualitative research method known as Grounded theory methods (Strauss and Corbin, 1990).

Research Design

Data are collected in hospitals that have implemented ubiquitous IS access. The researcher entered the data collection sites at least two different time periods and interviewed several of the same individuals and persons not previously interviewed; thus change aspects are observed. (See Table 1 Research Schedule in the Phase II Description for specific entry times). Therefore, the study is longitudinal and designed to permit observation of the same phenomenon over an extended period of time (Babbie, 2001).

CHAPTER 5

RESEARCH METHOD

The research questions influences the type of method or method(s) selected that will bring about the most suitable findings. This research follows a qualitative phased approach to uncover and interpret rich contextual data. Phase I and II of this research use qualitative methods to study the phenomenon as it takes place in a social setting impacted by people, tasks, technology, and organizational elements such as culture and structure (Strauss and Corbin, 1990). The researcher develops theory grounded in systematic data collection and analysis pertaining to the phenomenon. Thus, the data collection, analysis, and theory development process are reciprocal (Strauss and Corbin, 1990).

In accordance with Lee and Baskerville (2003) assertions about generalizability of interpretive findings, this research method “involves generalizing a theory, confirmed in one setting, to descriptions of other settings.” Lee and Baskerville (2003) describe four different types of generalizability. One type entails “generalizing from description to theory and the generalizability of the resulting theory beyond the sample or domain that the researcher observes (such as the unsampled portion of the population or the parts of the organization where the field worker has neither conducted interviews nor collected data in other ways (Lee and Baskerville, 2003)).” The premise is to conduct research in a manner that allows one to generalize from empirical statements, rich in contextual data, to theoretical statements that are applicable in similar settings. Additionally, the transfer of theory across contexts is possible and should be the responsibility of the researcher in rigorous data collection and analysis (Boudreau, 2002).

Grounded theory is a research method that affords the development of rich contextually bound theoretical insights. However, they can transcend contextual boundaries to provide insight in other settings.

In Grounded theory, subcategories are linked to categories in a set of relationships. These links denote the interplay between conditions, phenomenon, context, intervening conditions, action/interaction strategies, and consequences. A paradigm model presented by Strauss and Corbin (1990) depicts procedures for creating a Grounded theory (i.e., a theory grounded in contextual data), in which three methods of data coding are applied (i.e., open, axial, and selective). All data are coded using ATLAS/ti 4.2, which is a powerful workbench for the qualitative analysis of large bodies of textual, graphical and audio data. It offers a variety of tools for accomplishing the tasks associated with any systematic approach for analyzing "soft" data.

Open Coding

Open coding refers to the naming and categorizing of phenomena through close examination of the data and recognition of key concepts that are defined in literature (if applicable). These concepts allow the formulation of questions or refinement of questions to not only describe what is observed but also suggest how phenomena might possibly be related to one another. During open coding, data are decomposed into discrete parts, closely examined, and compared for similarities (Strauss and Corbin, 1990). Open coding is a critical step that fractures the data and allows one to identify some categories, their properties, and dimensional locations by labeling concepts.

Axial Coding

Axial coding attempts to put the data back together in new ways by making connections between categories and its subcategories to begin to show relationships in phenomenon. In axial coding the focus is on specifying a category in terms of conditions that causes the phenomenon; the context (i.e., its specific set of properties); the action/interaction strategies by which the phenomenon is handled; and consequences of those strategies (Strauss and Corbin, 1990).

Definitions for each model component are as follows:

- Causal conditions (CC) represent “sets of events or happenings such as rules, regulations, beliefs, values, etc. that influence the phenomena (Strauss and Corbin, pg. 131).”
- Phenomena (PH) answers the question “What’s going on?” (Strauss and Corbin, 1998, pg. 130).
- Contextual conditions (CN) are the “specific sets of conditions (patterns of conditions) that intersect dimensionally at the time and place to create the set of circumstances or problems to which persons respond through actions /interactions, (Strauss and Corbin, 1998, pg 132).” The dimensions of the contextual conditions cause people to employ different strategies.
- Intervening Conditions (IC) are those that cause people to employ unexpected strategies that do not seem to have developed because of the impact of causal conditions on the phenomenon but rather from unexpected circumstances that occur after the phenomenon has taken place (Strauss and Corbin, 1998). “Intervening conditions may be unexpected events or factors that result in certain behavior or action/interaction strategies associated with the phenomena. However, they also may promote the normal behavior associated

with the phenomenon (Strauss and Corbin, 1998, pg. 132).” This research considers intervening conditions to have negative connotations that adversely influences strategies.

- Action/ Interaction Strategies (AS) are “strategic or routine responses made by individuals or groups to issues, problems, happenings or events that arise under those conditions (Strauss and Corbin, 1998, pg. 128).”
- Consequences (CO) are “outcomes or actions as to what happens as a result of those actions/interactions or the failure of persons or groups to respond to situations by actions/interactions, which constitutes an important finding in and of itself (Strauss and Corbin, pg. 128).”

The paradigm used by Strauss and Corbin is an essential tool in categorizing the codes and depicting the relationships or influences of conditions in Grounded theory. This paradigm **does not** equate to a causal model but rather gives an interpretation of the “assumptions of causality (Strauss and Corbin, 1998, pg. 133).” The 1990 paradigm model in e graphically illustrates these linkages in the following figure.

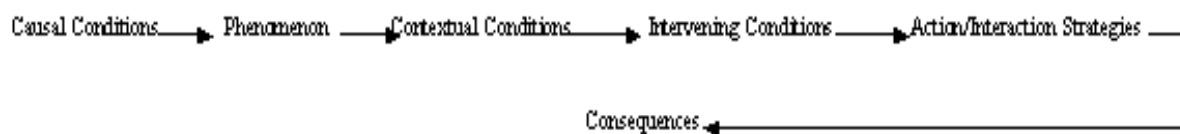


Figure 3 Paradigm Model (Adopted from Strauss and Corbin, 1990, pg. 99)

The 1990 first edition of Basics of Qualitative Research depicts contextual conditions (CN) as precursors to intervening conditions (IC). The paradigm is not depicted as a model in the 1998 second edition and the authors make a disclaiming statement, which says “the important issue for the analysts is not so much one of classifying conditions as causal, intervening or

contextual but rather the complex interweaving of events (conditions) leading up to a problem, an issue, or a happening to which persons are responding through some form of action/interaction, with some sort of consequence, pg. 132.” In the second edition, Strauss and Corbin (1998) state that both contextual and intervening conditions can mitigate the influence of causal conditions on action/interaction strategies, in light of the phenomenon (i.e., ICs and CNs can cause people to adopt strategies that are not influenced by the causal conditions that spurred the phenomenon, which may seem to be irrational decisions). Additionally, the authors do not account for direct influences of any condition (i.e., CC, CN, or IC) on consequences (CC). The influences of the conditions are realized through the action/interaction strategy chosen. Thus, to show a relationship between a causal condition such as task-technology fit (TTF) and performance impacts, as consequences, would not be consistent with the paradigm model. However, the data in this study substantiates a claim that the degree of actual TTF influences the strategy of utilization (e.g., if actual TTF is low then users do not depend on the system and if TTF is high then they do).

Based on the aforementioned, this research adapts the 1990 paradigm model in the following figure and uses this adapted model as the template for depicting the relationships between applicable codes in each stakeholder perspective. The figure does not claim that all contextual and intervening conditions should be depicted in this manner but rather takes liberty in conceptualizing these conditions as they pertain to this research. It may be that in subsequent research this format does not apply as effectively. However for this research, the following figure, as a depiction of how the models that describe the stakeholder perspectives, affords face validity for how the conditions impact the phenomenon.

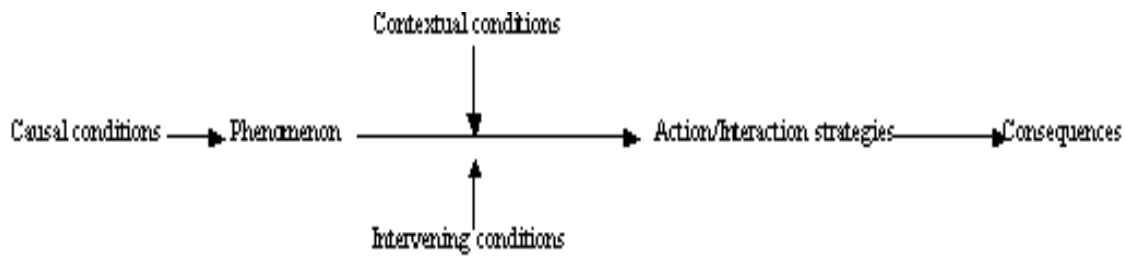


Figure 4 Adapted Paradigm Model

Selective Coding

Axial coding develops the basis for selective coding. Selective coding entails systematically developing the findings from axial coding of the data into a picture of reality (i.e., an explanatory model) that is conceptual, comprehensible, and grounded in the data; thus validated by the data (Strauss and Corbin, 1990). There are five main steps in selective coding, which are as follows:

1. Explicate the story line by creating a descriptive narrative about the central phenomenon of the story.
2. Relate subsidiary categories around the core category by using the paradigm model.
3. Relate categories at the dimensional level.
4. Validate those relationships against data and look for instances when these relationships are not apparent.
5. Fill in categories that may need further refinement and or development.

These steps may not be sequential and in reality the researcher moves back and forth between them throughout the explanatory model development of the Grounded theory (Strauss and Corbin, 1990).

Theoretical Sensitivity

Theoretical sensitivity derives from sources such as literature (i.e., published theoretical academic articles and practitioner articles) professional experience, and personal experiences related to the phenomenon. The diverse professional and personal experiences of the dissertation committee will also contribute to theoretical sensitivity. Theoretical sensitivity is necessary to create insight and recognition of the parameters of the evolving theory that the researcher deems relevant based on the data (Strauss and Corbin, 1990). The data are collected and analyzed in a phased approach, which allows for an iterative examination of relevant themes, concepts, constructs and relationships that explain the phenomenon.

Phase I Description

The researcher conducted pilot interviews, reviewed documentation, and examined practitioner reports concerning the different uses for ubiquitous IS access. Probable efficiency/effective gains were also researched. These pilot interviews and reviews began Spring 2001 and ended in Fall 2002. The subjects for the interviews were device vendors, consultants for wireless enterprise solutions for data transmission, executives and functional users from various industries that were either employing or reviewing wireless technologies for ubiquitous IS accessing of corporate data. The subjects were chosen from various industries and were perceived to have a need for ubiquitous IS access to corporate information. The rationale behind

examining multiple industries was to determine the generic need for ubiquitous IS access, potential and actual task effectiveness and efficiency gains from ubiquity, and to identify a specific industry for an in-depth study. The industries included in Phase I interviews were the military, aircraft maintenance, transportation (specifically, baggage maintenance and business traveler management for air travel), wireless business solutions, and healthcare (specifically, hospitals) (See Appendix A for background information on Phase I interviewees). The data from these interviews and reviews were open coded, which consists of concept labeling and categorization of concepts.

As noted earlier, the knowledge of theoretical terms from the literature aid in the open coding process and contributes to the validity of the coding for accurate representation of the data. The use of multiple coders to increase coding reliability is not used because this technique requires each coder to have extremely similar theoretical sensitivity, which is problematic and not a usual practice in qualitative research (Myers, <http://www.qual.auckland.ac.nz>). However, this research sought expert advice from the dissertation committee members who are familiar with the literature applied in this research to enhance theoretical sensitivity. The researcher and the dissertation committee conducted joint periodic reviews of selected transcripts to make certain that subtleties in the data were not overlooked and to ensure face validity of the concepts, categories, and codes. The open coding results for Phase I data in Appendix B suggested reviewing the following literature that aid in coding and theory development in Phase II: (1) Socio-Technical Systems Framework (Emery and Trist, 1960; Bostrom and Heinen, 1977), (2) Information Organizational Processing (IOP) (Galbraith, 1974; Tushman and Nadler, 1977), and (3) Task-Technology Fit (TTF) (Jarvenpaa, 1989; Goodhue and Thompson, 1995). Excerpts of

coded data and descriptions of the aforementioned theories are provided in the Literature section, which follows the Phase II Description.

Phase II Description

Strauss and Corbin (1990) stress the importance of site selection and note that it depends greatly on the main research question and goals, available access, and resources. The healthcare industry was chosen in Phase II based on all of the aforementioned criteria and expert advice from wireless solution providers (interviewed in Phase I) concerning industries with displayed utility for ubiquitous IS access. There are three data collection sites (Hospitals A, B and C) in which the researchers examine use of and strategies for improving task efficiency and effectiveness via ubiquitous IS access.

Hospital A

Hospital A is a 400+bed faith-based, not-for-profit health system that has been in operation for more than 87 years in north Florida. It is expanding its patient care area by nearly 40 percent and intends to implement ubiquitous IS access in its Emergency Department for computerized triage and patient triage for better/more efficient patient care. The IS department has undertaken an extensive planning schedule and incorporated the assistance of an established wireless information systems provider in the healthcare niche. IS personnel anticipated operability in late November 2003 but did not implement until February 2004.

Hospital B

Hospital B is a 124-bed not-for-profit community hospital. It offers medical care to more than 110,000 residents of one of the fastest growing counties in the nation, as well as the residents of adjoining counties. Over 7,500 people are admitted as inpatients each year. Hospital

B was the first hospital to implement ubiquitous IS access for creating electronic medical records (EMRs) in Georgia. Ubiquitous IS access has been fully operational since October 2001. The IS department was paying maintenance fees on additional features included in healthcare inventory systems software for several years and decided to utilize the additional features that afforded templates for creating electronic patient charts and medical records. Therefore, IS personnel and organizational managers jointly identified units of the hospital that had the most utility for ubiquitous IS access. The Ambulatory Care Unit and the Post Anesthesia Care units needed untethered means for nurses to create electronic medical records (EMRs) at the patients' bedsides to decrease the time associated with documenting patient assessments, facilitate tracking of medication administration, and an efficient means of ensuring quality assurance of care provided by the nurses.

Hospital C

Hospital C is a Federally funded medical center and the third fastest growing federal medical center in the US. It has 478 beds and serves eligible patients with medical, surgical and psychiatric needs. A variety of outpatient programs are also provided. It extends its services through outpatient clinics in two other communities in Florida. The hospital complex includes a 120-bed nursing home providing extended care. This hospital is a geriatric research site, education center, and clinical center. Ubiquitous IS access is federally mandated and has been in use for three years.

The research schedule for Phase II, which entailed interviews, observations, and supplementation documentation review to triangulate findings, is as follows:

Table 1 Research Schedule

Site	Subunits and Interviewees	Interview Dates	IT Implementation Stages (adapted from Cooper and Zmud, 1990)	Goal
Hospital A	<p>1 CIO 6 Organizational Manager 3 IS Personnel</p> <p>Emergency Department (ED) Triage in ED – 3 of 6 triage nurses on shift Registration in ED - 2 of 6 registration personnel</p>	<p>1st Entry: 22 May – 22 July 2003</p> <p>2nd Entry: 26 March 2004</p>	<p>Adoption – IT/IS decision reached to invest</p> <p>Adaptation –IT /IS development in process</p>	<p>1. Open code data for this site and begin axial coding</p>
Hospital B	<p>1 Director of MIS 1 Director of Perioperative Services PACU – 8 of 13 nurses</p> <p>ACU – 8 of 22 nurses</p>	<p>4-5 Nov 2002</p> <p>1st Entry: 4-8,11, 13 Nov 2002, 13 Dec 2002</p> <p>2nd Entry: 6-10 Jun 2003</p> <p>1st Entry: 18-22 Nov, 6 –13 Dec 2002</p> <p>2nd Entry: 11-14 Jun 2003</p> <p>Spoke with an ACU on 30 Oct 2003 to clarify relationships in axial coding</p>	<p>Routinization-IT/IS usage is encouraged or mandated</p> <p>Infusion – effectiveness derived from continued use of the IT/IS</p> <p>Adaptation –IT /IS development in process</p> <p>Abandonment – discontinued use of IT/IS</p>	<p>1. Open code new data for this site, refine axial coding, and begin selective coding 2. Develop initial explanatory model for the three perspectives</p>

Site	Subunits and Interviewees	Interview Dates	IT Implementation Stages (adapted from Cooper and Zmud, 1990)	Goal
Hospital C	1 Director of Nursing Informatics 5 IS Personnel 4 Floor Nurses	1 st Entry: 9-20 Oct 2003 2 nd Entry: 10 Dec 2003 Spoke with an Nurse Informatics person on 5 Feb 2004 to clarify issues about caregiver receptivity	Infusion Infusion	1. Open code new data for this site, refine axial coding, and refine selective coding for the three perspectives 2. Create storyline for the three perspectives

Note: 43 interviews total

CHAPTER 6

LITERATURE

As aforesaid, literature contributes to the theoretical sensitivity of the researcher. However, the aim is not to become so engrossed in existing literature that the researcher disregards other concepts and relationships imbedded in the data. In Grounded theory methods literature provides a basis for the concept/construct identification and labeling, question generation, theoretical sampling direction, and supplemental validation (Strauss and Corbin, 1990).

Initially, pilot interviews of organizational personnel from various industries were conducted in Phase I to discern major themes or concepts relevant to explaining the phenomenon. **It is imperative to state that the data collected and open coded in both phases guided the identification of relevant theory.** The initial data analysis of Phase I data revealed that the main bodies of literature that are applicable to this study derive from Organizational Theory (OT) and Management Information Systems (MIS). Phase II data substantiates this claim. These theories contribute greatly to the refinement of the interview questions and coding of data throughout Phase II of this study. Sample interview questions are as follows:

- What are the drivers for implementing wireless technologies in a medical facility?
- How did your organization decide on the specific wireless technology solution?
- What are the specific tasks facilitated by the wireless technology?
- Do you think the technology is right for the environment?
- What is a profile or individual characteristics of a typical user?

- What are/were impediments to implementation and use?
- How are efficiency and effectiveness defined and how does the wireless technology aid in achieving this goal?
- Has the implementation changed the organizational structure or job task?
- What are some organizational cultural/structural aspects that impact implementation?
- What do you value in your job?

Since the interview data actually guide the identification of applicable theories, the format for the literature section entails presenting interview excerpts from Phase II with imbedded themes/concepts that relate to the theory. This section then presents descriptions of the relevant theory based on the presence of these major themes/concepts in Phase II interview data.

Data Applicable to Socio-Technical Systems Framework (STS)

Hospital A, Informatics Nurse Manager

P5: “Documentation is seen as a burden to most nurse **(Tasks)**. It's time consuming and most of the nurses don't realize why it needs to be as detailed.¹ They feel like the documenting takes up too much time and it impacts their job, the care of the patient. They will not want to change even if we say oh this will save you so much time. They still will be very leery. A lot of them don't even type so to tell them they will have to document on a computer will cause a lot of frustration. It's a cultural issue really. People in this industry don't really like change. The majority of the nurses are in there 40s and 50s **(People)**. It never was really emphasized how important documentation is. You know documenting at the end of a shift or the time for the report at turnover is a social event. **(Social System)** That's your time to relieve some stress talk about what's happened in the day and kind of socialize with the other nurses on your shift or with the ones coming on. There was a study done when we eliminated the nightly report (i.e., a session of all the nurses at the end of a shift). The nurses hated it because that was their time to talk and let off some steam but from an organizational standpoint it really served no purpose because the charts were supposed to contain all necessary information. Well, the charts didn't and a lot of information got passed by word of mouth at the end of the shift during the report. Some areas

¹ Documentation refers to recorded information concerning the care given to the patient by the healthcare provider and status of the patient.

still do some form of the report and maybe not all information about the patient makes it into the chart but at least the oncoming nurse knows **(Output)**.”

Socio-Technical Systems Framework (STS) Description

These excerpts illustrate components of the Socio-technical Systems framework (STS) (Trist and Emery, 1960; Bostrom and Heinen, 1977), which has its roots in Organizational Theory but there have been many variants of the framework applied in MIS studies. STS emphasizes workplace interactions with various technologies and is espoused as a “realistic view of organizations and a way to change them (Bostrom and Heinen, 1977).” STS concerns the social system that is comprised of contributes of people (i.e. attitudes, skills, and values), the relationships among people, their roles in the organization, reward systems and authority structures (Bostrom and Heinen, 1977). STS is an intervention strategy in which technology implementations intervene within a work system to improve task accomplishment, productivity, work quality of life, and prompt supportive organizational structural changes. Thus, STS, which has a technology-social structure integrationist perspective, frames this entire research effort.

STS emerged from the Social Technology school of thought that originated from a series of studies relating work systems and work system/organizational efficiency in the 1950s (Emery and Trist, 1960). This postpositivist research involved methods such as action research and case studies to discover the relationship between social systems and technical systems in an organization and the conjoint impact on the efficiency of organizational processes and output during the Post WWII error.

The major case study that propelled this school of thought into mainstream academia is the Tavistock coal mining studies in which Trist and Emery researched methods to raise the productivity of industrial organizations that had been devastated by WWII. During this period

coal was the chief source of power and WWII had left the industry devastated. The three main levels focused upon in the studies were as follows (1) the primary work system (e.g., improving working conditions within subunits, structural relations between management and technicians, and empowerment of the technicians), (2) the whole organizations (e.g., increasing overall process efficiency and performance), and (3) the macro-social phenomenon within a changing environment (e.g., impacts of changes in society and the impact within an industry). The primary findings of the studies indicated that increases in organizational efficiency, productivity, and performance is contingent upon the congruence of the work system (i.e., managed subunits), the whole organization, and the social structure and its ability to adapt to changes in the environment. This premise serves as the core of STS.

STS is an open system theory, which assumes that the organization is open to and dependent upon flows between personnel, resources, and information from environment. The open systems model rests on the conviction that any environment contains more variables that can be comprehended at one time; thereby, processing capability depends on the level of organizational complexity and permeability of the boundary between the organization and the environment. The organization can only process a limited amount of information; therefore, it has to set bounds or define contingent circumstances that afford it to seek satisficing outcomes. The following figure depicts an organizational work system as open socio-technical system.

STS is not a cure-all for organizational problems, despite the notion that it appears to be all-encompassing (Bostrom and Heinen, 1977). The underlying assumptions that serve as the basis for the STS as an approach to bring about organizational change are as follows: (Concept 1) there must be a **felt need for change**, (Concept 2) view the **organization as a work system**, (Concept 3) a concern for the **quality of working life**, and (Concept 4) a willingness to adopt the

action-research approach (Bostrom and Heinen, 1977). The following figure depicts the major constructs derived from the aforementioned concepts and their relationships.

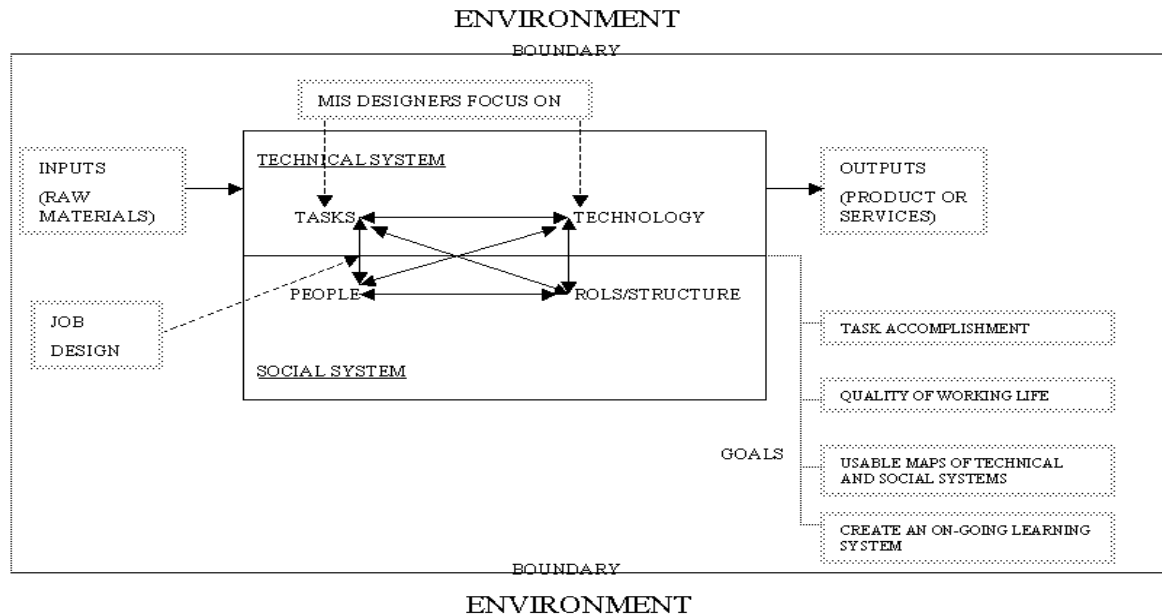


Figure 5 Organizational System as Open Socio-Technical System (Bostrom and Heinen, 1977)

Table 2 Constructs of STS (Bostrom and Heinen, 1977)

Concept/Construct	Description
Inputs	Raw materials transformed or consumed for product or service production
Technical System	Concerned with the processes, tasks and technology needed to transform inputs to outputs
Social System	Concerned with contributes of people (e.g., attitudes, skills, and values), the roles they enact, reward systems and authority structures.
Tasks	Actions/processes carried out by people to meet a need
Technology	Tools used to carry out tasks
People	Organizational workers (technicians, managers, and institutional decision-makers)
Roles/Structure	Job responsibility of the person performing the task and their position within the authority or decision-making hierarchy
Outputs	Result of joint interactions between these the technical and social systems.
Goals	Task accomplishment – achieving the desired outcome of the task Quality of working life – condition of the overall environment in

Concept/Construct	Description
	<p>which people perform tasks</p> <p>Usable maps of technical and social systems – procedures for how the technical and social systems should jointly interact</p> <p>Create an on-going learning system – recognize which maps (i.e., procedures) work best under what conditions for integrating the technical and social system and recognizing when these maps need to change based on environmental ques.</p>
Environment	Macro-social system in which the organization co-exists

Data Applicable to Information Organizational Processing (IOP)

Hospital A Nurse Manager A

P9: “Well, we have several areas that wireless will help us with. Basically, now we have a lot of redundant procedure done during patient care. A physician and nurse do something for a patient then they have to find a computer to document, do the charges, and the physician is supposed to place any orders for labs etc. It takes so much time to consolidate all of the needed information that was done for the intervention and then find a computer somewhere to input it all **(Information Processing Capacities of Structure)**. Either what was done is usually scribbled on the piece of paper and will eventually make it into the chart or someone tries to rely on memory until they can chart it. It takes so much time to do all of the administrative things for the patient that it detracts for the ability to give quality care. I mean the patient's care is always the most important to us but from an organizational standpoint we have a lot of redundancies in terms of how the information about the care is captured and processed which impacts service time **(Inter-Unit Task Interdependence)**. Registration is our first issue. Our registration personnel either go directly to the patient if they are emergent and get demographics, insurance, and some historical information write it down, then go back to their stations and enter, make wrist bands, copy everything and then go back to the patient for signature. It's time consuming and a lot of redundant writing and then keying in information **(Subunit Task Characteristics)**. Having that wireless device would streamline this process and speed the time to care up considerably. We lose money when patients aren't seen because we can't charge if they never get registered. Also we lose money if nurses don't charge for meds properly or for certain comfort items to the patient. They have to track these items or meds in order to charge properly and sometimes the nurse feels really badly for the patient and won't charge. The hospital loses money this way but most often the nurse genuinely forgets to add it into the patients record so that they are charged **(Efficiency)**. Having wireless will make it easier for the nurse to just document when they do what.”

Information Organizational Processing (IOP) Description

The nurse manager and director expressed utility of employing a wireless information system to improve efficiency in subunits of the organization. Aggregated subunit efficiencies contribute to organizational effectiveness. This is the underlying premise of IOP (Tushman and

Nadler, 1977), which is another contributor to theoretical sensitivity. IOP is also grounded in Organizational Theory, which emphasizes the fit between organizational processes and characteristics of the situation (Thompson, 1967; Lawrence and Lorsch, 1967; Galbraith, 1974; Schoonhoven, 1981; Perrow, 1986; Tushman and Nadler, 1977). Additionally, the fit between the organization's structure and contingent factors such as size, structure, technology, and environmental demands are of utmost importance. There are variations of IOP but this fit component is a central premise in all variations.

The primary goal of IOP according to Galbraith (1974) is to discern the best means of organizing to deal with environmental uncertainties that could cause the demise of the organization. The more prepared the organization is to deal with tasks that exhibit high uncertainty the greater the chances of survival or lesser the chance that the organization is negatively impacted (Galbraith, 1974). Therefore, Galbraith (1974) proposed a mechanistic model to deal with uncertainty at different echelons of the organizational structure in order to not overload the hierarchy (i.e., institutional organizational decision makers), which is detrimental to the sanctity of the organization. For routine problems of processing information, the organization can rely on standard rules and pre-planned programs. As task complexity or environmental uncertainty increases then problems are referred up the hierarchy to determine a solution. Due to the limited capacity of the hierarchy to process information and deal with mounds of uncertainty, the hierarchy can set goals for the managerial and technical echelons of the organization in order to allay problems of uncertainty, thereby reducing the need for information processing or increasing its capacity to process information. An organization can reduce its need to for information processing by either creating slack resources or creating self-contained tasks that can be processed by autonomous units. On the other hand, the organization

can increase the capacity to process information by investing in vertical information systems (i.e., technology) and create lateral relationships that afford open communication channels between the technical, managerial, and institutional levels. Either of these strategies is a part of organizational goal setting. A depiction of this mechanistic model (Galbraith, 1974) for dealing with environmental uncertainty is as follows.

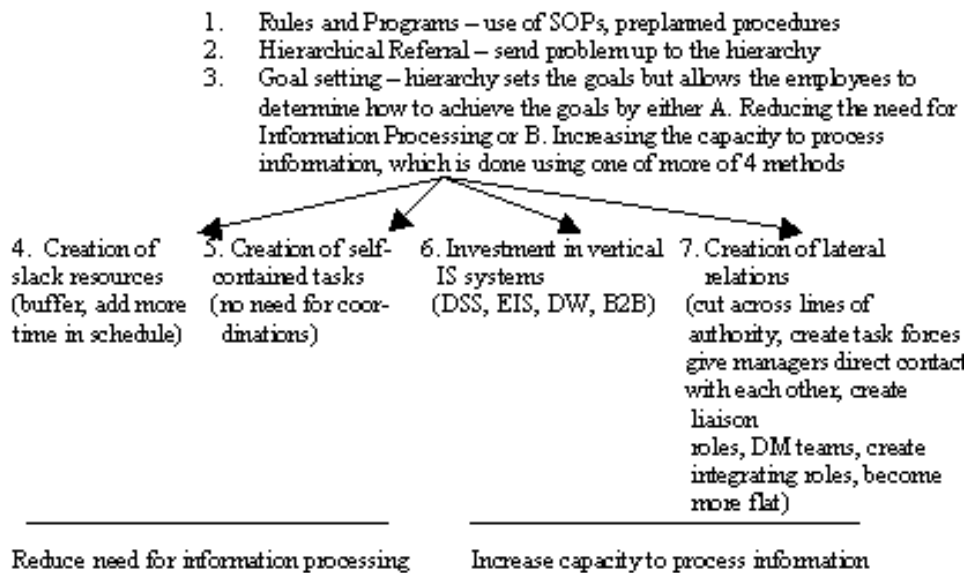


Figure 6 Organizational Design Strategies (Galbraith, 1974)

One variant of IOP defines effectiveness, in terms of the subunit, as successfully being able to match the information processing capacities of the units performing the tasks with the information processing requirements of the tasks, which are then aggregated as organizational output (Tushman and Nadler, 1977). Therefore, IOP makes an efficiency-based argument that relies on the concept of fit under certain conditions. IOP assumes that organizations are open systems in which the behaviors of members (i.e., people with varying job roles) are themselves interrelated and interdependent with the formal organization, the tasks to be accomplished, the

personalities of other individuals, and the unwritten social norms (Lawrence and Lorsch, 1967; Tushman and Nadler, 1977).

Organizations are comprised of differentiated subunits with goals that function as part of the whole. As systems become larger they differentiate into parts, which must be managed and coordinated in order to ensure that the subunit, and ultimately organizational goals, are met (i.e., effectiveness) and waste of resources is minimized (i.e., efficiency) (Lawrence and Lorsch, 1967). The organizational structure dictates how these subunits will be managed and coordinated (Tushman and Nadler, 1977). Additionally, organizations must be able to recognize when to adapt and how to adapt to changes in the environment (Lawrence and Lorsch, 1967; Galbraith, 1974; Tushman and Nadler, 1977). Since technology aids information processing, then it is an assertion of this research that technology is essential to a subunit's ability to attain effectiveness and efficiency in task performance and an organization's ability to manage and coordinate the efforts of subunits. The following figure depicts or describes an information organizational processing model according to Tushman and Nadler (1977), in which the task at the subunit level (i.e., the actual level of task performance) is associated with subunit effectiveness. One can logically infer from the model and literature base that the greater the ability of the subunits to perform tasks coupled with a suitable organizational design, the greater the overall organizational effectiveness. Even though this research does not extend further than the task level, the Tushman and Nadler IOP model aids in concept labeling. The following figure depicts the relationships between constructs.

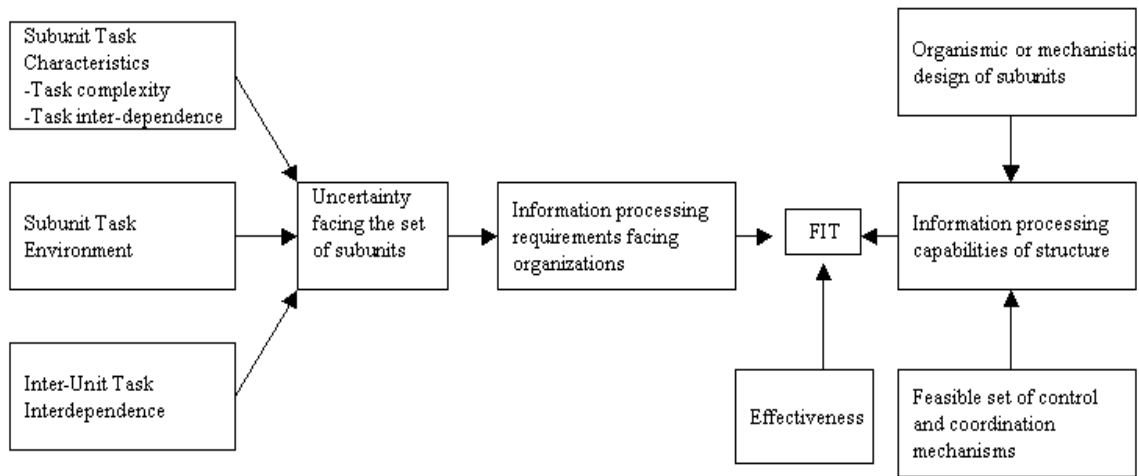


Figure 7 Information Organizational Processing Model (Tushman and Nadler, 1977)

Table 3 Construct Descriptions for Information Processing Model (Tushman and Nadler, 1977)

Construct	Description
Subunit Task Characteristics	Task complexity – degree of uncertainty in procedures to perform task (i.e., tasks that are not well understood) and need for information processing Task inter-dependence – degree of coordination needed between members of the subunit to process information and perform task
Task Environment	Those external factors attended to by organizational members, seen as source of uncertainty that impacts pre-planning
Inter-Unit Task Interdependence	Degree to which a subunit is dependent upon other subunits in order to perform its tasks effectively (can be either pooled, sequential, or reciprocal (Thompson, 1967)).
Uncertainty Facing Subunits	Aggregation of uncertainty in subunit task characteristics, subunit task environment, and inter-unit task interdependence
Information Processing Capacities of Structure	Degree to which the organizational structure affects the subunit's ability to attend to and deal with uncertainty
Organismic and Mechanistic Design of Subunits	Degree to which communication network is highly connected (i.e., organismic) that permits subunit members to be problem solvers
Feasible Set of Control and Coordination Mechanisms	Degree to which procedures are in place to coordinate and constrain the efforts of the subunit to ensure that they are in line with organizational goals and completing their tasks
Effectiveness	A function of matching information processing capacities with information processing requirements
Fit	Degree to which effectiveness is achieved

IOP is applicable in this research because it reveals possible constructs concerning how information-processing capabilities (confounded by job roles, personnel attributes, existing structure, and technology) could contribute to organizational effectiveness or ineffectiveness from a variety of perspectives.

Data Applicable to Task Technology Fit (TTF)

Hospital A Nurse Manager B

P9: “Currently the nurses write down notes while they are with the patient and then when they get some down time they transfer it to the records. What they do for the patient at the bedside does not constitute all of the information that is needed to complete records (**Task Characteristic**). They may need to look up some history on the patient or go into another system to get some information. A lot of them do their charting at the end of a shift. Sometimes they have to look for a free computer to get any existing information to put into the record. It's time consuming and they can make mistakes or leave important information out of the records because they try to remember everything they did. We are trying to stop them from charting at the end of a shift also because it causes them to have to work overtime. But with the wireless they can access the historical data they need and input the current data as they work. (**Technology Characteristic**)(**Task Technology Fit**)”

Task Technology Fit (TTF) Description

Task-Technology Fit (TTF) is a MIS theory that focuses on a more technological engineering perspective concerning derived benefit from the relationship between the task characteristics and the technology characteristics (Jarvenpaa, 1989; Goodhue and Thompson, 1995). TTF also adds to theoretical sensitivity, as it pertains to this research. TTF primarily depicts the relationship between characteristics of the task that is to be performed, the technology proposed to facilitate performance of the task, the individuals abilities pertaining to the task, the interaction between these constructs and their impact on actual utilization and performance. TTF explains the degree to which the technology aids the individual in accomplishing the task and thereby indicating the overall dependence (i.e., utilization) on the technology exhibited by the user. A central assumption is that the user will make a rational decision to choose a technology

that he/she believes will afford the greatest benefit. Utilization is not always voluntary and the extent to which use is not voluntary, performance impacts will depend increasingly on the *congruence* or *fit* between task and technology characteristics rather than overall dependence.

This *congruence* or *fit* concept was first introduced in the Organizational Theory literature and influenced the application of the concept to various phenomenon such as problem solving and jobs or role fulfillment (Jarvenpaa, 1989; Thompson, et.al., 1991). Application in problem solving pertains to the compatibility between the tools used in problem solving and the problem representation. Job fit occurs when there is congruence between information system and the individuals job responsibilities. Both of these manifestations of fit are likely to contribute to explaining the relationship between ubiquitous IS access and organizational efficiency and effectiveness. The following figure represents the theoretical model and explanation of the constructs, respectively.

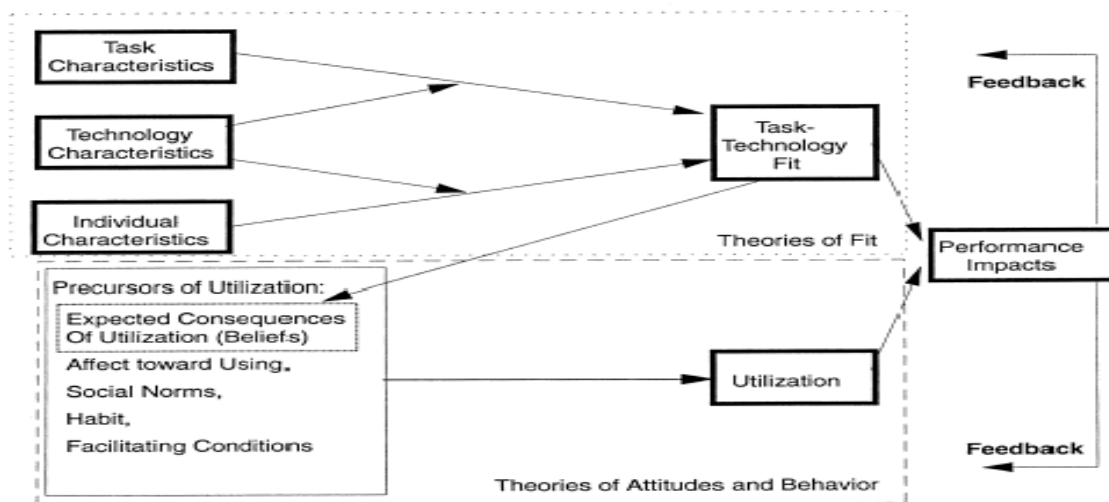


Figure 8 Task-Technology Fit Model (Goodhue and Thompson, 1995)

Table 4 Constructs of TTF (Goodhue and Thompson, 1995)

Construct	Description
Task Characteristics	Actions carried out by individuals that transform inputs into outputs
Technology Characteristics	Capabilities of the tools used to assist the individual in carrying out tasks such as hardware, software, data, user support services (i.e., documentation, help desk, training prior to use).
Individual Characteristics	Capabilities of the individual that assist him/her in carrying out tasks and using the technology such as individual training, computer savvyness or efficacy, and motivation.
Task-Technology Fit	The compatibility or correspondence between task requirements, individual abilities, and functionality of the technology.
Utilization	Overall dependence or reliance that the individual exhibits in using the technology.
Performance	Perceived impact of the technology on the individual's job effectiveness, productivity, and performance.

Data Applicable to Other Pre and Post Adoption Related Studies of Utilization Behavior

Hospital A Informatics Nurse

“Most of the nurses are 40 to 50 and they don't really like using computers anyway so we really had to make it easy for them. I knew we could make it easy enough for them but getting them to use it was still a problem because most of them couldn't even type” (User demographics)

Hospital A IS Manager

P4: “The demographics of a nurse is they're a 52 year old female who is relatively technology averse (**User Demographics**). And as you try to walk this population through all this quirkiness of a handheld, we've got these tablet type pens OS and you gotta go through 50 screens. Well the next thing, the process that use to take them 30 seconds on paper, now takes them several minutes on a handheld and they're just not gonna do that. I mean they're just gonna throw it in the corner and they're going to go back to paper before you can get out the door with your instructions (**Reluctance to use**). So, the devices that we have found that are being adopted on the broadest scale are the easiest to use devices and they have to use it for it to be effective (**Ease of Use**). Some of our client user groups commented that they feel more prepared to deal with complex situations because they have access to the information they need wherever they are. This can only increase the chance that they will continue to use it and not toss it in the corner.” (**Continued utilization and reliance on new technology - Infusion**)

Another area in MIS literature that adds to theoretical sensitivity is technology adoption. Most IS researchers conduct pre and post adoption related studies of utilization behavior at the individual unit of analysis. Utilization is normally a main effect in these studies. While this study is at the task level unit of analysis, this research contends that utilization of the technology under study is a must for observed technology use and performance. Continued utilization known as infusion, a concept described in post adoption behavior literature (Karahanna, et.al 1999), may be an indicator of reliance on the system but not necessarily task efficiency or effectiveness. However, infusion might indicate that the users are convinced that the technology actually affords increased use and task performance, *ceteris paribus*. Therefore, this research will seek evidence of infusion as well as standard utilization behavior.

A pre-adoption theory, the Technology Acceptance Model (TAM) (Davis, 1986; Davis, et.al 1989), is widely cited and provides a theoretical basis for utilization behavior. Thus, understanding the antecedents to utilization adds to theoretical sensitivity for this research. TAM is an adaptation of the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975), which asserts that attitudes towards the behavior based on personal beliefs, subjective norms based on beliefs about perceptions of others, and relative importance impact intentions that in turn directly correlates with behavior. TAM specifically addresses information systems usage and the underlying premise is that there are antecedents of system usage that determine user perceptions of usefulness and ease of use. These perceptions determine behavioral intentions, which in turn directly impacts actual system use (Davis, 1989; Davis, et.al 1989). A graphical depiction of TAM and descriptions of its constructs follow.

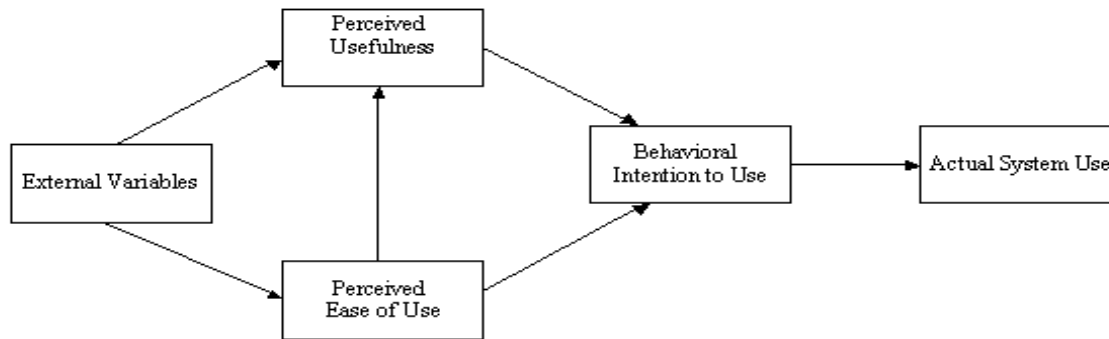


Figure 9 Technology Acceptance Model (Davis, 1989)

Table 5 Constructs of TAM (Davis 1989; Davis, et.al 1989)

Construct	Description
External Variables	Factors not explicitly included in the model, which include system design characteristics, training, documentation, and other types of user support.
Perceived Usefulness	Potential user's subjective probability that technology will increase his/her job performance.
Perceived Ease of Use	Degree to which the potential user expects the technology to not be difficult to manipulate.
Behavioral Intention to Use	Measure of potential user's intention to perform the behavior.
Actual System Use	Utilization of the technology.

Technology Impact Model (TIM) Description

Junglas (2003) integrated TTF and TAM to provide a theoretical base to better explain utilization. Critics of TAM assert that the importance of the task itself is absent from the model. TTF explains individual performance impact due to the characteristics of the task and how well the technology facilitates these meeting the needs of the task. However, TTF disregards the impact of the user's beliefs concerning the utility of the technology on individual performance. TIM integrates these models to provide a composite view of the most widely accepted

explanations for individual performance. Additionally, TIM incorporates ubiquity as part of the technology characteristic construct, thereby indirectly relating ubiquity to performance. A graphical depiction of TIM follows.

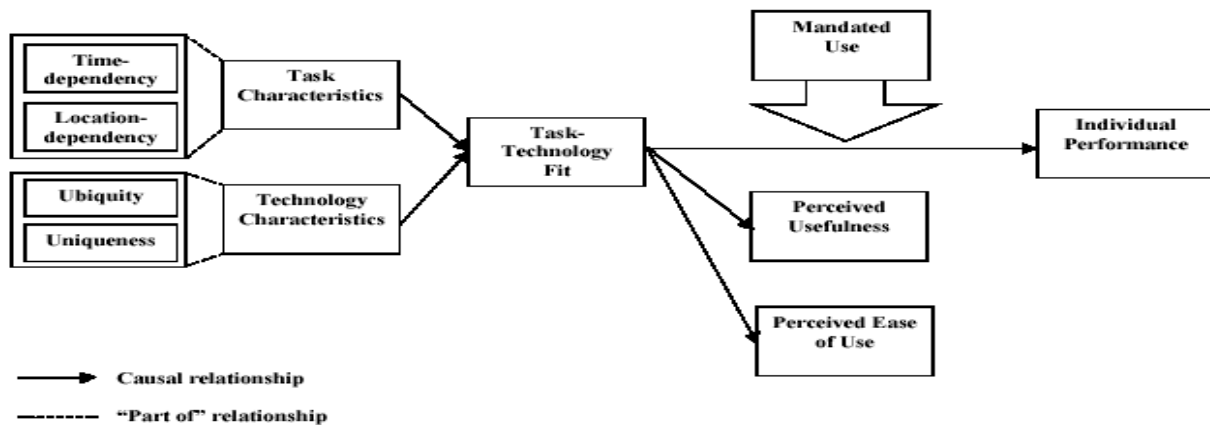


Figure 10 Technology Impact Model (Junglas, 2003)

TAM and related pre-adoption studies such as the research resulting in TIM examine the relationship between perceptions and utilization. These perceptions are impacted by external variables comprised of the user's beliefs. A value is a specific type of enduring belief that is preferable (Rokeach, 1973) and that may be associated with a consequence or desired outcome. These values can either promote or inhibit utilization of the technology. As aforesaid this study professes that utilization is necessary for evaluating the level of use and quality of task performance.

Seligman (2001) studied the relationship between perceived value impacts of a computer-based patient record system and acceptance (i.e. utilization) of that system by hospital physicians, nurses, and administrators. Additionally, the study concerned variant impacts of perceived values related to patient care, job performance, and organizational goals amongst sub-

organizational/occupational groups of a childrens' hospital. The health care industry as a whole has documented a common overarching value, which is more efficient and effective patient care (IOM 2001, 2002). The practitioner and academic medical literature create a taxonomy of values related to effective and efficient patient care, which also add to the theoretical sensitivity of this research (Seligman 2001). The most salient values from the pre-adoption studies within a healthcare context are as follows:

- Patient comfort (Raines, 1994)
- Minimization of patient risk (Griffith, 1995)
- Best achievable patient health (Pare and Elam, 1999)
- Staff relationship with patients (Dansky, et. Al, 1999)
- Time spent performing patient related task (Rice and Aydin, 1991)
- Minimization of legal risk based on care giver error or inefficient task performance (Griffith, 1995)
- A sense of achievement with task completion and technology use (Eliaison and Schubot, 1995)
- A sense of control over work environment because of availability of technology (Venkatesh, 2000)
- Preservation of caregiver's current roles within the organization (Pare and Elam 1999)

Understanding that these values have been previously documented and studied will aid in identifying those values that impact utilization and how organizational members define and evaluate the level of technology use and task efficiency and effectiveness.

CHAPTER 7

RESULTS

Grounded theory employs an iterative process for theory development. Open, axial, and selective coding are overlapping steps that aid in ensuring that all data are thoroughly examined and integrated in order to develop the theory grounded in the data. The data for this study derive from interviews, observations, and document analysis conducted in the three hospitals.

Interviewees consist of nurses who perform patient care tasks with the mobile carts and information system used for ubiquitous IS access, organizational managers and IS personnel who were involved in the implementation process. Descriptions of the specific units in which the interviewed nurses work are provided.

1. Post Anesthesia Care Unit (PACU):

PACU at Hospital B is a closed environment where no family or non-PACU personnel are allowed and the nurses monitor patient as they regain consciousness following general surgery. Utilization of ubiquitous IS access is high in this unit primarily due to effective program design, integral user involvement throughout the systems analysis and design lifecycle, and proper training.

2. Non – PACU Units:

Emergency Department (ED) at Hospital A (specifically, registration and triage for emergent care patients) have not yet completed the design of the information system to support ubiquitous IS access. Thus, use is not directly observed as of yet but factors attributing to perceived relative task technology fit are prevalent. Ambulatory Care Unit (ACU) at Hospital B conducts pre-surgery assessments and use is low in this unit due

primarily to poor program design and lack of user involvement in the systems analysis and design lifecycle.

Regular Floor Units (i.e., in-hospital patient care units) at Hospital C, which has mandated use of ubiquitous IS access via wireless technologies for medication administration for the past three years.

Open and Axial Coding Results

Interviews from Hospital A and B were transcribed and open coded simultaneously. When applicable, literature aided in labeling accepted constructs or concepts. The open coding process for Hospitals A and B began in October 2002 and was completed in July 2003. Data from these interviews were axial coded prior to data collection and the open coding of interviews in Hospital C, which began in October 2003. Appendix C contains axial coding results that categorize the codes from the open coding process. There are 126 codes represented in the data. Some codes changed categories during further analysis in the selective coding process. The most recent categorization and labeling for codes are reflected in the perspective models.

Selective Coding Results Overview

Theory evolves from the process of integration, identification of central elements (i.e., selective coding) and saturation of theoretical concepts (i.e., no new properties, dimensions, or relationships) (Strauss and Corbin, 1990). The researcher can present this theory in various formats. However, the format chosen should best depict the phenomenon. Strauss and Corbin (1990) suggest using diagrams, matrixes, tables and/or a storyline to effectively articulate the integration of the data. Once the data were open and axial coded, the researcher realized that the

explanations for the phenomenon differed based on the perspective of the interviewee. The interviewees were categorized as either a nurse, an organizational manager, or an IS person. Therefore, the researcher feels it most advantageous to present the theory concerning the phenomenon as three perspectives for each of the three stakeholders for ubiquitous IS access in hospitals. The data excerpts or quotes provided in the storylines are the quotes that are considered to show strong support for the code or relationship in question in comparison to other quotes; therefore not all quotes are provided in the write-up of the storyline. Additional supportive data are provided in the respective appendices. Also, the analyses provided throughout the storyline are interpretations of the relationships between the codes based on both quotes that explicitly show a relationship and the researcher's contextual understanding of the conditions attributing to and impacted by the phenomenon.

Selective Coding Results for the Nurse Perspective

The nurse perspective derives from the selective coding process of the data provided by the nurses interviewed across the three hospitals. Some of the organizational managers and IS personnel also are nurses that continue to practice and provide insights about ubiquitous IS access from multiple perspectives. This adds credence to the data. The following figure is a depiction of the nurse perspective concerning ubiquitous IS access (see Appendix D for additional data for the nurse perspective). After which, a storyline follows to further explain the perspective with integrated analysis.

Nurse Perspective Model

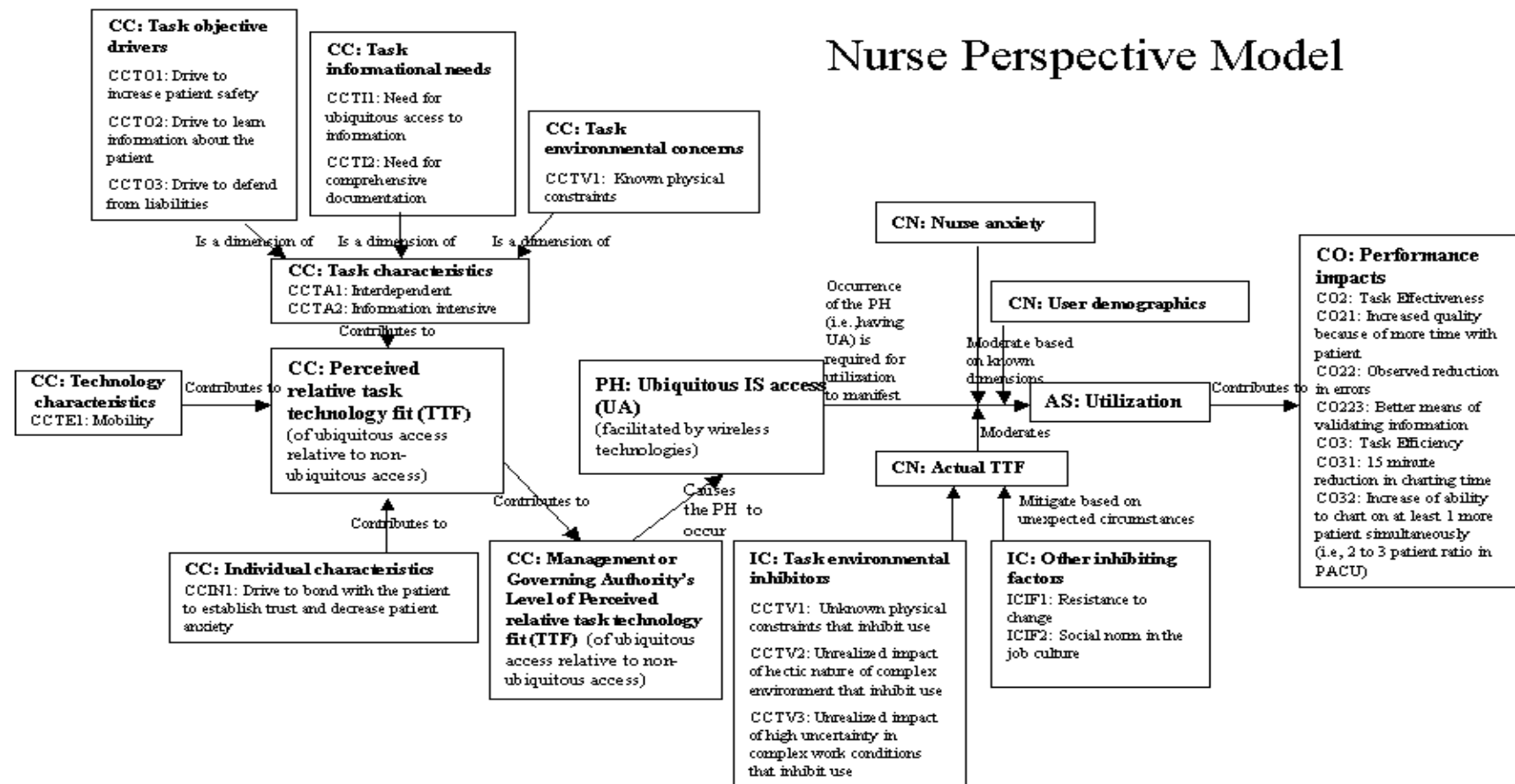


Figure 11 Nurse Perspective Model

The Storyline for the Nurse Perspective

The storyline integrates the findings in the data with the analysis of the researcher (Strauss and Corbin, 1990). Nurses provided comments concerning the following: (1) factors attributing to their perception of how well the technology fits with the tasks prior to implementation, (2) factors that influence utilization (i.e., overall dependence of ubiquitous IS access) after implementation, and (3) actual performance impacts. Once again the sample data pertaining to the codes in the model are presented first and then analysis follows in most cases.

Attributing factors to Perceived Relative Task Technology Fit (TTF)

Perceived relative task technology fit is the perceived compatibility or correspondence between task requirements, the functionality of the technology, and the individual characteristics of the user relative to prior technologies used for task performance (adapted from Goodhue and Thompson, 1995).² The main attributors to this perceived relative TTF are task characteristics, technology characteristics, and individual characteristics.

Task Characteristics

Task characteristics are features of a task that describe its nature and performance (e.g., interdependence, information intensity, and degree of uncertainty, adapted from Thompson, 1967; Goodhue and Thompson, 1995).³ Since the nurses are the primary persons performing the

² Goodhue and Thompson, 1995. TTF - The compatibility or correspondence between task requirements, individual abilities, and functionality of the technology.

³ Thompson, 1967. Interdependence - the extent to which departments depend on each other for resources or materials to accomplish their tasks. There are three types of interdependence (i.e., pooled, sequential, reciprocal). Reciprocal interdependence is the highest degree in which the output from one unit is the input for another and that output serves as input for units that processed the input previously. Task completion requires intensive information and frequent exchange between the units. Reciprocal interdependence occurs in organizations that perform intensive technologies or tasks,

tasks, they have first hand knowledge of the characteristics of tasks involved in patient care. Their comments can be categorized into three areas that delineate three dimensions for task characteristics (i.e., task objective drivers, task informational needs, and task physicality concerns).

Task Objective Drivers

The grouping of task objective drivers refers to goals of the task. This section discusses the main drivers that pertain to the goals of the task (i.e., the drive to increase patient safety, to learn information about the patient, and to defend from liabilities).

Drive to Increase Patient Safety

This drive refers to the motivation to protect the patient from harm while the patient is in the healthcare system. The following quote illustrates this drive.

Hospital C Floor Nurse A

P22: “I think they are really helpful in making sure that we don't make mistakes in giving meds to patients. It's really for patient safety but it does help us also. We have a good record of every med given to the patient since they have been in the system. With BCMA you can check prior orders and you have all the information you need about the patient right there at your fingertips. If you have any questions or concerns because you are still the person administering the meds, you can call the doctor or the pharmacy. You know who ordered what, when it was validated and who did it. If something doesn't make sense to you about the order when you go to give the med then it's now easier for you to find out if it's valid or not because you know who exactly to call and ask. All of that information is right there in the system. It just helps you not make any errors. It doesn't save anytime it's just so much safer and that's really what's important. It's better to be a little late than sorry.”

which provide a variety of products or services in combination to client such as a hospital in which coordinated services are provided in patient care. Goodhue and Thompson, 1995. Task characteristics - Actions carried out by individuals that transform inputs to outputs.

Nurses at Hospitals B and C commented that when they were told that the technology (i.e., ubiquitous IS access via wireless technologies) would be mandatory, the primary rationale was to aid in improving patient safety and affording more time rendering patient care as opposed to performing administrative tasks. The idea was that if the nurses were able to enter data at the point of care there would be less of a chance for the nurse to forget critical information to add to the chart. Additionally, there would be better access to needed information. These factors decrease the likelihood that the nurse would make a mistake such as administering incorrect medications or not being able to care for the patient's needs because of laborious, time-consuming documentation. Nurses view documentation as a necessary evil, if it is not done by exception (i.e., no long narratives but rather only indicating when something is an exception in the ordinary condition of the patient). The nurses perceived this technology as a good fit with the tasks they perform if it were going to help them be able to chart by exception at the bedside and if it would give them access to patient information that decreases the likelihood of them making errors.

Drive to Learn Information about the Patient

This drive refers to the desire to collect information, examine the environment, make observations, and sustain an ongoing internal and external dialogue about explanatory ideas and theories concerning the patient to assess their condition that aids in decision making concerning medical intervention (adapted from Lawrence and Nohria, 2002).⁴ The following quotes illustrate this drive.

⁴ Lawrence and Nohria, 2002. Drive to Learn – An expression of consciousness by emotion variously labeled inquisitiveness, wonder, and curiosity that pushes humans to collect information, examine their environment, make observations, and sustain an ongoing internal and external dialogue about explanatory ideas and theories.

Hospital B PACU Nurse Coordinator

P3: “The old way I always reviewed the narrative in the chart, which may be kinda long but with the electronic chart we chart by exception so it doesn't take me long at all when I need to look at a chart that one of the nurses complete. If I have a question quite often I just use a cart to look at the chart as opposed to asking a nurse or going to the manual file.... I can check the chart from any of the mobile carts. So if there is a question about something and I am with a patient I just pull up the record in question instead of going to the filing cabinet and pulling the record or leaving my patient to take a look at the other chart in some cases.

Hospital B ACU Nurse D

P29: “If it worked we could have been able to check those stats quicker. While you are waiting for a patient to stabilize you could go work with another patient and take the computer with you and be able to look at the other patient’s record to see if it’s about time to check the vitals again. It just would have been more convenient.”

The information learned about the patient aids the nurse in making assessments about the patient’s condition, validating treatment or medications to provide. The excerpts above illustrate that ubiquitous IS access could be used to aid the nurse in learning about the conditions of multiple patients as they work.

Drive to Defend from Liabilities

This drive refers to the desire to protect oneself and reputation from threats due to negligent accountability (adapted from Lawrence and Nohria, 2002).⁵ This quote illustrates this drive.

Hospital B PACU Nurse E

P18: “It's really important that you have a record of everything but also because you need to cover your own self. If someone asks why you did it then you have to back it some way and you can't remember everything thing so having it in the system or on the printout is necessary for us. I don't want to get in trouble either.”

⁵ Lawrence and Nohria, 2002. Drive to defend - innate drive to defend themselves and their valued accomplishments wherever they perceive them to be endangered.

The majority of the nurses do not have a true appreciation for how important documentation becomes until they are summoned to make a deposition about the care they provided. However, those that have been involved in a legal suit understand the necessity of having a record that attests to their care and patient interaction and perceived the technology as a good fit for maintaining records that they can rely upon if they need to defend their actions.

Task Informational Needs

Task information needs is a higher order code used for grouping that refers to requirements of the task. This section discusses the needs of the task (i.e., the need for ubiquitous IS access and the need for comprehensive documentation) that contribute to task characteristics.

Needs for Ubiquitous IS access

This need refers to necessary retrieval of pertinent data when and where a task is performed. The following quotes illustrate this need.

Hospital A Nurse Manager B (KV)

P5: “We have several areas that wireless will help us with. Basically, now we have a lot of redundant procedure done during patient care. A physician and nurse do something for a patient then they have to find a computer to document, do the charges, and the physician is supposed to place any orders for labs etc. It takes so much time to consolidate all of the needed information that was done for the intervention and then find a computer somewhere to input it all. Either what was done is usually scribbled on the piece of paper and will eventually make it into the chart or someone tries to rely on memory until they can chart it. It takes so much time to do all of the administrative things for the patient that it detracts for the ability to give quality care.”

Hospital B PACU Nurse A

P14: “Also, if they are with one patient then they don't have to leave that patient to access records for another patient. They can just look up the information in the system on the carts that they have with them. Often they need to remind themselves if a patient had a certain medication

or the last time vitals were recorded. Things like this are easy to forget and hard to find when you get busy comforting the patient.”

Hospital C Floor Nurse C

P24: “There are times when you need to know stuff right away to make a decision about what to do for the patient or to troubleshoot what's going on with the patient. You may not have time to hunt down the physician, a pharmacist, or another nurse to ask questions. The big thing with the computers is that if everyone does what they are supposed to do then all of the information you truly need about the patient is right there. I don't have to waste time asking someone else I can just look it up in the system. Also, no one has to ask me about Mr. So and So when I'm with another patient.”

Nurses are mobile workers and perform the bulk of their work at the patient's bedside. In order to most effectively perform patient care tasks such as assessments or administering medication, they need access to the patient's medical information while they are working. The patient care tasks are interdependent. Nurses quite frequently perform these interdependent tasks, in which other healthcare professionals rely upon their documentation concerning medical interventions or interactions with the patient to make proper decisions. Ubiquitous IS access affords needed information at the point of care during any point in the care delivery process.

Need for Comprehensive Documentation

This need refers to the necessity for complete information to perform tasks efficiently and effectively. These quotes illustrate this need.

Hospital A Nurse Manager B

P6: “We need to standardize a lot of what goes into the record and save them time by giving a lot of selections and making data fields mandatory. This way the record will be more thorough. We need thorough records. It's too often that they spend time briefing the next shift or someone realizes that something wasn't done or at least documented for a patient after the nurse had turned over. This greatly impacts the quality of the patient care.”

Hospital B PACU Nurse E

P18: "Well depending on what it is like giving a pain medication dosage could mean life and death. You have to be so careful with everything you do for and to the patient. You need to document it all."

Nurses need to make decisions about what interventions to take with a patient and having comprehensive documentation of prior interventions and their effectiveness aid the nurse in making his/her decision. Comprehensive documentation keeps the nurse from having to fill in gaps in the medical record or asking other nurses or doctors about what was done. Having to ask questions about the patient's record because information is missing detracts and delays the nurse from performing patient care. The most convenient and efficient manner to document this information is via ubiquitous IS access at the patient's bedside amidst the nurse rendering care. The nurse does not have to leave the bedside to document or make notes for data entry later, which is privy to errors. Additionally, legibility problems are thwarted as this next quote illustrates.

Hospital B Nurse Coordinator

P3: "...it's certainly more legible and I don't have to go searching through files to get the copy."

Task Physicality Concerns

Task physicality concerns refer to physical constraints that are identified as having a bearing on the how the task is performed. The following quote illustrates these concerns.

Hospital B PACU Nurse Coordinator

P3: "We opted for the wireless because everything is just so cluttered already on the walls and there is really no headspace for anything else, so we needed something that we could move in and out. I'm sure that you saw all of the equipment in the patient suites. We've got the suction apparatus and the oxygen cups so we felt that it would be way to inconvenient to have this system mounted at the patients head or at the bedside. We need that room for the other equipment."

The nurses noted the importance of surveying the physical layout of their work environment to ensure that whatever technologies were implemented would not be an impediment to their ability to get to the patient or to other medical equipment. Some of these concerns such as the limited wall space were known prior to implementation but some were not, which actually impeded utilization. These will be discussed later.

Technology Characteristics

Technology characteristics refer to features of a technology such as mobility afforded that describe its nature and performance (adapted from Goodhue and Thompson, 1995).⁶

Hospital C Floor Nurse B

P23: "I like the carts and being able to go from room to room. I don't really see any other way of being able to deliver medications because of all what we "have" to do in the process. The carts need to have more space on them though or a drawer so that you can sit the meds there and they don't fall off. Right now we have to keep going back and forth to the med cart to get the meds and then going into the patient's room."

The technology in this case, is a laptop mounted on a mobile cart that accesses a program for electronic charting, patient triage information, or patient information to include medication administration. The hardware must be able to meet the needs of the task by allowing access to patient information whenever and from wherever the nurse is working. In most cases, nurses noted that they requested carts that would allow them to secure medications and a desktop area for writing. Nurses commented that they needed to maneuver in between beds an in and out of patient rooms in order to use the computer at the point of care.

⁶ Goodhue and Thompson, 1995. Technology characteristics - Capabilities of the tools used to assist the individual in carrying out tasks such as hardware, software, data, user support services (i.e., documentation, help desk, training prior to use).

Nurses also noted that the mobile carts, which hold the wireless laptops, would be advantageous if they served multiple purposes for the nurses. The size and design of the carts were initially perceived to enable the nurse to write on the desktop and place other items needed to perform patient care tasks such as thermometers, blood pressure cuffs, medications and delivery apparatuses on the cart in addition to laptops mounted for ubiquitous IS access.

Individual Characteristics

Individual characteristics refer to the innate drives of the user, which also contributes to perceived relative TTF. The innate drives account for individual preferences for mechanisms used in task performance and internal motivators that ascribe to how the users perceive fit of the technology for tasks they perform. The primary individual characteristic that the nurses in this study share is the drive to bond with the patient to establish trust and decrease patient anxiety. The following quote shows how nurses truly value being able to spend time with the patient and mechanisms that appease this drive are perceived as beneficial.

Hospital B ACU Nurse A

P2: “The big push for this was that we were going to be able to take the carts into the patient's room and we would be able to spend more time with the patient. We were happy about getting something that would help us spend more time with patient.”

For nurses, the drive to bond with the patient impacts perceived relative TTF of ubiquitous IS access and is an impetus for establishing trust between the patient and the caregiver (adapted from Lawrence and Nohria, 2002).⁷ The following quote illustrates the importance of establishing patient/caregiver trust.

⁷ Lawrence and Nohria, 2002. Drive to bond - the innate drive to form social relationships and develop mutual caring commitments with other humans that is only fulfilled when the attachment is mutual.

Hospital B ACU Nurse A

P2: “If they don't trust that you are going to take care of them they their anxiety goes up, which is an emotion but this causes physical problems like blood pressure increase or nausea and you have to stabilize them before getting them ready for surgery so this delays the process.”

Chances that nurses will be able to establish a bond with the patient can decrease patient anxiety and make giving care easier. This bond enables the nurse to establish a mutual trust with the patient and ease the patient's anxiety about the upcoming medical treatment or insecurities about the competence of the nurse. Easing this anxiety allows for the nurse to care for the patient with less impediment. Therefore, nurses perceive any technology that will allow them to establish trust easier and faster as a good fit in performing patient care tasks. Prior to actual implementation at all sites, the majority belief was that ubiquitous IS access was perceived as a better fit for how they work in comparison to accessing a manual chart or using a computer at the nurses station to access information or document patient care.

Causes of The Phenomenon (i.e., Ubiquitous IS Access Facilitated by Wireless Technologies)

The nurses commented that the actual event that caused the phenomenon of ubiquitous IS access to occur in their departments was an organizational mandate as these quotes note.

Hospital B ACU Nurse A

P2: “We didn't have a choice. We had to use it.”

Hospital B PACU Nurse B

P3: “Our previous director had a vision for us to go to paperless charting. She thought it would speed up charting time and make things safer... with the vital stats charting there are very skinny lines on the graphs and you have to be very precise in drawing the graph. It's easier to make a mistake when drawing by hand... She [the previous director] said we [the nurses] would have to do it. We [the nurses] opted for the wireless because everything is just so cluttered already on the walls and there is really no headspace for anything else, so we needed something that we could move in and out.

Based on the comments provided from the nurses, it seems that the nurses believed that the organizational managers did take their perceptions about how ubiquitous IS access via wireless technologies was a better fit in their jobs in comparison to manual charting or having to access needed information away from the point of care as well as their reservations about using the technology. At Hospital B, a review of the pre-implementation documents revealed that the organizational managers and IS personnel held nurse focus group meetings prior to the implementation. One goal of the meetings was to have the nurses develop their own user interfaces via templates because they are the functional experts, according to one organizational manager. However, one can assume that the intent of these meeting was also to catalog the perceptions of the nurses, address issues, and gage overall receptivity of the nurses for the technology. The nurse coordinator in ACU of Hospital B voiced her opinion to her superiors and IS personnel prior to implementation that the technology was not a good fit for patient care in ACU based on experiences with the technology at another hospital. The following quote addresses her concern.

Hospital B ACU Nurse Coordinator

P3: "I use to live down south in Warner Robbins. And we started computerized nurses' notes way back then. When I came here in I think it was '98 and we started the self-computerized nurses' notes last year. I'm kind of like...I know what it is, but the thing is we started working in the department level upstairs (at the hospital in Warner Robins), you know on the pediatric floor, meds reg. floor, and actually we didn't do it in outpatient surgery (i.e., ACU). It seems to work better in an environment that you have more time to work with the patient and you aren't so stressed about the charting. It's to "busy" down here (i.e., in ACU) for it..."

This nurse coordinator noted that her unit was mandated to be the first unit for implementation. It is possible that the mandate was initiated because the organizational managers knew that if they made usage voluntary then the nurses would not use the technology especially since the nurse coordinator for the unit voiced opinions about its perceived

inappropriateness for patient care in ACU. Possibly they felt that her influence would preclude the nurses in ACU from using the technology. At Hospital C, an organizational manager who also has nursing experience noted that she still would have supported an organizational mandate of ubiquitous IS access because she felt the technology was more advantageous than the pre-existing methods for gathering needed information at the point of care. She was aware of the possible inhibitors to uses (i.e., a lot of nurses lacked typing skills, were intimidated by the technology, and would be frustrated with the change process). However, one could assume that based on her comments she would (1) support an organizational mandate because of the potential performance impacts from ubiquitous IS access and (2) realize that the nurses' perceptions could hinder them from using the technology if use were voluntary. The following quote discusses to this idea.

Hospital C Organizational Manager with Nursing and IS Experience

P28: "I think it would have been implemented because it's in conjunction with the other systems that we implemented for patient information that is all electronically stored and on-line. That is the only way we can function as an integrated healthcare system with 10 divisions. That being two medical centers and eight clinics so that you can have a patient who has primary care at Tallahassee show up at one of our emergency rooms and we have instant access to there information. This is the way we do business on our healthcare setting.... You've got nurses who finished school long before any of this technology became available and were putting it right in the middle of the core to what they do – giving medications to patients. It took away some of the steps that they used to follow and now we are bringing in this change and intervention. It slowed them down. So the perception that it would make things faster was not where our goal was. It was to make it safer. That was really hard to sell to them in addition to the patterns that they usually followed on paper were changed."

Despite the organizational mandates in each hospital, which actually caused the implementation of wireless technologies to support ubiquitous IS access, there are a number of intervening and contextual conditions that influence utilization (i.e., overall dependence on ubiquitous IS access).

Contextual and Intervening Conditions that Influence Utilization of Technologies Supporting Ubiquitous IS Access

There are a number of conditions that influences actual utilization after ubiquitous IS access is implemented in the work environment. They are (1) nurse anxiety, (2) user demographics, (3) actual TTF, which is influenced by other intervening conditions

Nurse Anxiety

Nurse anxiety is a contextual condition that has identifiable dimensions that contribute as expected to varying levels of utilization in light of the having ubiquitous IS access facilitated by wireless technologies. Nurse anxiety is the degree of nervousness and apprehension about being able to perform a task to the required quality level. The following quote illustrates how levels of nurse anxiety about being able to complete the task in light of having ubiquitous IS access influences utilization.

Hospital B ACU Nurse B

P15: "...when I tried using the "thing" in the rooms I always felt like the patient was watching my every move. I think to myself that the patient must think I'm stupid ... I know I would get upset if I were a patient and my nurse were fumbling ...I could see her frustration but at the same time this "computer" is taking her attention away from me...If the patient's blood pressure is too high we don't administer the anesthesia. We try to calm them down and talk to them basically reassure them that everything is going to be okay. If I can't get them assessed ...then the procedure is delayed, which delays other procedures."

ACU nurses at Hospital B noted that their anxiety about charting increased because of having difficulties entering the information either due to program design or program design coupled with poor typing skills. The flawed program design and/or poor typing skills increased nurse anxiety because they were unable to chart patient assessments in a timely manner (i.e., charting times increased on average from 20 to 40 minutes). This slowed patient throughput

(i.e., processing a patient into the system for care, rendering care or procedures, and outprocessing a patient for discharge or in-hospital stays) in ACU of Hospital B.

The nurses commented that when their anxiety increases in the presence of the patient due to frustrations associated with manipulating the technology, then the patient's anxiety increases. The nurses believe that the patient transcends an opinion about the nurse being incompetent with the technologies used for ubiquitous IS access to incompetence in their ability to render quality care. Increased patient anxiety has physical ramifications (e.g., increased blood pressure, nervousness, convulsions, vomiting, or frequent urination) on the patient and complicates the nurses' ability to render care.

PACU nurses commented that their anxiety decreased because they no longer were concerned about charting because ubiquitous IS access facilitated by wireless technologies enabled them to chart quicker and timelier. Additionally, the accessibility afforded by the mobility of the charts allowed for the nurses to chart on multiple patients simultaneously. The following quote illustrates the influence of decrease in nurse anxiety.

Hospital B PACU Nurse A

P14: "...because it's (the mobile cart used for ubiquitous IS access) there you can be more at ease about charting. You don't have to worry about 'Oh Lord I've had this patient for 30 minutes and I haven't charted a word.' It's just easy to catch up. You don't have to worry about charting in the case that you get a patient and they are really hurting or have problems with their tubes. You can care for the patient without stressing out about getting the chart completed."

User Demographics

User demographics as a code is another contextual condition that has identifiable dimensions that contribute as expected to varying levels of utilization in light of the having ubiquitous IS access facilitated by wireless technologies. User Demographics refers to similar characteristics or defining attributes such as age and technical capabilities that are common for a

sample of users and contribute to similar behavior.⁸ The following quote shows how user demographics influences utilization.

Hospital B ACU Nurse C

P12: "... there was very little that I liked about it (ubiquitous IS access). I'm from the old school. I can't type so it was hard for me and it just got in my way."

The demographics of the majority of the nurses interviewed at all hospitals are (1) an average age of 40 and (2) work experience of 15+ years. For these nurses, their initial training 15+ years ago did not emphasize the vital importance of documenting or the use of technology to aid in documentation. As a side note, for many of these nurses, patient information is deemed sacred to only the healthcare professional. Under this regimen of training, the patient's were not openly encouraged to view the record maintained by the healthcare professional. Due to recent healthcare regulation, the healthcare professional that maintains the health record must reveal all information contained in that record to the patient upon request. Nurse managers in all hospitals note that these nurses are now more cognizant of the "flavorful" language or descriptions that they use in the documentation because they know that the patient may request to read the record. However, nurse managers and coordinators note that they still struggle with stressing the importance of documentation to the nurses in this demographic. Their opinion is that the nurses do not respect the act of documenting, which makes them less likely to appreciate the mechanism that is used for documenting (i.e., wireless technologies supporting ubiquitous IS access).

The nurses trained under the "old" regimen (demographic A - trained under "old" regimen and intimidated by technology) still view documenting as a laborious task. The nurses

⁸ Adapted from definition of relational demography (Tsui Egan, and O-Reilly, 1992; Young and Buchholtz, 2002) similar characteristics such as age, gender, tenure, education, and race influence outcomes in individual performance.

in demographic A tend to view themselves to *not* be technically savvy using PC based information systems. However, they use PC based systems for other tasks such as monitoring vital statistics or maintaining an apparatus for intravenous drug administration. Yet the users view ubiquitous IS access via wireless technologies differently from these other systems. The nurses in demographic A in ACU of Hospital A commented that the aforementioned apparatuses directly aid them in doing their jobs because these apparatuses *output* vital data to them about the patient's status whereas the information system used for ubiquitous IS access requires them to *input* data and this hinders them from making eye-contact with the patient and rendering quality care because they are so consumed with entering data into the system.

For the nurses who are anomalies to the normal demographic (i.e., demographic B – trained under “new” regimen and less than 10 years of experience) in ACU of Hospital A who expressed this opinion did view themselves as somewhat technically savvy and contributed their non-use of the system to flaws in the program design. The nurses in demographic A of ACU in Hospital A rejected the information system used for ubiquitous IS access and only used the system when mandated primarily because they did not have typing skills and were technically intimidated but also felt the system was non “nurse friendly”. Some of the demographic B nurses commented that the demographic A nurses were so intimidated by technology that they would ask them to work with them and offer to do all the patient assessments if they (demographic B Nurses) would operate the information system for them. This is truly improper use of the information system used for ubiquitous IS access and inefficient use of the work force, which ultimately slowed patient throughput in the unit. Thus, the ACU coordinator lifted the mandatory usage policy several months after it's implementation. However, prior to that point,

if demographic A nurses did use the information system and mobile cart for ubiquitous IS access by themselves they did so in the halls of the unit and not at the point of care as intended.

Actual TTF

Nurses realized how well the technology actually fits after the technology was implemented and they had an opportunity to use it to perform patient care tasks. This contextual condition is the degree of this actual matching between the task, technology, and individual characteristics determined after use that influences utilization (i.e., overall dependence). Actual fit can influence utilization because of several factors innate to TTF (e.g., adequate program design, level of IS support, adequate training), task environmental inhibitors as well as other inhibiting factors (e.g., resistance to change and social norms in the job culture). The following quotes illustrate nurses' experiences and accounts of actual TTF relative to their prior methods for information access and document manipulation during patient care.

Hospital B ACU Nurse A

P2: "Having the computers there by the bedside kept us from doing our jobs to some degree. That's why from the beginning some people didn't take them into the rooms. When I had that computer I noticed that I was too concerned about getting the information into the computer and printed out before the patient went to surgery. The program was so cumbersome that it made things too difficult and you felt too rushed to deal with the patient. I don't like that. We all said that the patient is our priority not that computer...I can get a patient ready in 10 minutes but then with the computer it took me 25 to 30 minutes. I could be with a patient and something happens to the battery or something isn't on the screen that I needed. We had to keep going to Hanna and Dana to get stuff added on the screens. Another problem is that during assessments my descriptions may be different than others. You know an assessment is subjective. So when you are actually putting that into the computer you need to streamline it a bit. The biggest problem was that it wasn't charting by exception. A lot of the stuff was repetitive and it just took up too much time. It just didn't seem nurse friendly and it wasn't the right set up. ...A lot of the nurses didn't take them into rooms."

Hospital B ACU Nurse A

P2: “Apparently there was a miscommunication about how long we were going to need the computers each day. We needed them around the clock. The batteries kept dying on us and they would lock up. Then it got to the point that the batteries died out and we had to keep them plugged up all over the place. It looked so cluttered with computers plugged down the hall. The actual computer wasn't a problem itself.”

In ACU of Hospital B, nurses noted extreme difficulties in using the information system, which impeded patient throughput. Ultimately organizational managers banished the mandatory use policy in this unit because of slow patient throughput. Additionally, many nurses across all hospitals commented that when they move from room to room medications can slide off of the carts or there is not a place for IV bags, for example. This makes maneuverability challenging. Some nurses propose using handheld devices for medication administration, which they feel would be a more suitable device.

Poor program design, is characteristic of the technology that make usage difficult and does not promote high actual TTF. Poor program design is the result of poor procedures in the implementation process (i.e., no benchmarking, lack of user involvement in the design, lack of professional analyst and developers trained in systems analysis and design principles) as observed in ACU of Hospital B. However, good program design contributes to the utilizations by the realization of a good fit between the task and the technology.

Another area that contributes to the realization of actual TTF is the level of IS support. Nurses expected the IS personnel to render an adequate amount of support but this was not the case across all three hospitals. IS personnel have the responsibility of implementing an easy system that meets the needs of the users, maintaining the equipment in operable conditions, and providing aid to users when they encounter problems with the technology. The nurses at Hospital C commented that with each system update they receive more support from the IS personnel. Yet, IS support was consistently limited in ACU and PACU at Hospital B. Nurses in

both units commented that they are not “IT people” and it is not their jobs to develop software. They like being involved in the process in terms of facilitating questions about how appropriate the screens are for the task but they felt overwhelmed with the responsibility of designing the screens on their own. The following quote illustrates these points.

Hospital B PACU Nurse Coordinator

P3: “Our director told us that we would be using a system that we would have to design. We had a guy that was sent by the MIS department that told us that we would design our own screens but he was going to tell us how to operate the program that we would use to design the screens. We didn't know anything about computers but they told us how much faster our charting could be. All we needed to do is map out what needed to go on the screens and arrange then so it is most convenient for us. He walked us through the first couple of screens then we took over. We had to learn about how many characters we could use and how to arrange it on the screen so that we can see the fields that we needed. We had to design what our printouts would look like. ...At the time, we were like ‘excuse me.’ ...We designed the screens ourselves. We started and got the staff involved and tested it and I guess it took about 9 months to get the screens built and for us to be able to use it. We went live on Oct 8. We got input from the other nurses [in PACU] ...since we are a smaller staff as opposed to ACU we could just walk up to them and ask them what they thought.”

After implementation at Hospital B, there was more interaction between the nurses and the IS personnel, which primarily concerned the battery charge issues or glitches in the system that would cause cursors to disappear from screens. In PACU, these concerns did not negatively impact actual TTF but was a major contributor to system abandonment in ACU. Primarily, the difference was that the nurse coordinator and manager in PACU were more technically savvy and able to effectively design the program, the unit was smaller which enabled more user involvement, and PACU has less distracting impediments that would hinder realization of actual TTF.

The level of training is another component innate to actual TTF. The following quote illustrates how training promoted the realization of actual TTF, thus positively influencing utilization in PACU and negatively influencing in ACU.

Hospital B PACU Nurse D

P17: "I like it now. At first it was frustrating for me because I can't type. So I really wasn't use to the keyboard. It was kinda scary and I thought it would slow me down so much because we had to write a lot and that took a long time. But we had so much practice during our training. We had to do at least 3 charts a week on the computer and we did that for about four weeks. I got the hang of it and it was okay. Now I love it and would never want to go back to doing by paper."

Hospital B ACU Nurse B

P15: "Well, back here in endoscopy we only had one day of training. We were given an overview and told to that the system was really tailored for non-endoscopy patients but that it's flexible enough to make things fit our needs. The nurse manager went to a class and designed the screens. She took our assessment checklists and talked to us about what we want to add. She added then but it was overkill for us and it was very hard to use. ... I like computers but this system was so bad that it really made more work for us than anything. In fact, we went from having three sheets to six for just one patient. And the screens were arranged kinda weird so you would think you would out like items with like items but they were all over the place. It slowed us down so we stopped using them."

Due to the severe nursing shortage in the healthcare industry, nurses are very taxed and have limited time for training. Informatics and nursing education personnel at Hospital C commented that most effective training comes from first training the nurses in a classroom setting, which requires managerial support for excusing the nurses from the floor, then hands-on training on the floor, and finally advanced training about the software after they have become more comfortable with maneuvering the carts and operating the program. The nurses at Hospital C noted the effectiveness of this training method. Nurses in ACU of Hospital B commented that their training was inadequate, which hindered the realization of actual TTF. However, nurses raved about the appropriateness of the training in PACU of Hospital B. In PACU the training entailed charting three times per week with the mobile cart and information system used for ubiquitous IS access for several weeks prior to the live implementation.

A review of the training manual for the medication administration system at Hospital C revealed that the manual is very user friendly with detailed instructions on how to use both the

hardware and software. It also speaks to the purpose of the system and how the IS personnel vow to provide continuous support to the nursing staff. In Hospital B there was minimal interaction with the IS staff for training and no user manual explaining operation of the system for either unit. However, PACU nurses had extensive hands on training, which they developed themselves, that promoted the realization of a good fit between the task and the technology.

The following quotes illustrate positive impacts on utilization when there is actual TTF.

Hospital C Floor Nurse C

P24: "The computer is so convenient I think because I can go into the other program for the patient's records and look up patient information, check on the status of labs. I use it for everything I can really. ... The big thing with the computers is that if everyone does what they are supposed to do then all of the information you truly need about the patient is right there. I don't have to waste time asking someone else I can just look it up in the system.... But to be able to do this, you have to be able to trust what's in the computer and the only way this happens is if everyone puts in good information and doesn't try to circumvent the system. Garbage in is garbage out and the informatics guys try to stress that to us."

Hospital C Floor Nurse D

P25: "To me it's easier than the paper chart. I don't have to question what's written on the meds list or make any guesses. It's really much better than the way we used to do things. A lot of nurses say that it takes them longer. I don't mind because to me the fact that all of the information is right in the computer I can get to information much faster when I have a question. For example, if I think something is wrong with the order in the computer, I can find out right away who were the ordering physician and the validating pharmacist and get my questioned answered right away. It takes less time for the orders to go in and be validated. We don't have to wait for everything to get transcribed and then go to the pharmacists. Everything about the order is right there in the computer."

All nurses interviewed in this research are passionate about their jobs and put the patient's interests first. They all share the same attribute of being caring by nature, which seems to be characteristic of the job culture. They take pride in being able to care for patients and welcome any technology that will aid in this. However, if the technology is cumbersome, non "nurse friendly", and not a good fit relative to other means of accessing needed information then the

technology is rejected and seen as an inhibitor to their jobs. In this culture, the nurses value oral communication as part of the social structure but do feel burdened when they have to answer numerous questions that can be found in the patient's record. They value sharing knowledge about their patients amongst each other because it seems to give them a common bond and communications concerning interdependent tasks but oral communication is not always physically possible because of the hectic environment. However, patient information must be accurate and accessible when needed. Even though oral communication between the nurses concerning the patient's status is highly valued, job requirements necessitate having documented records; thus, using technologies that facilitate ubiquitous IS access at the point of care aids in the documentation requirement.

Task environmental inhibitors can mitigate realization of actual TTF. These are mitigating factors in the physical environment and/or external factors seen as sources of uncertainty that impact pre-planning and inhibit intentions or promote the need for alternative solutions (adapted from Tushman and Nadler, 1977).⁹ The concerns consist of unknown physical constraints that inhibit use, unrealized impact of hectic nature of complex environment that inhibit use, and unrealized impact of high uncertainty in complex work conditions that inhibit use. The following quotes illustrate how these concerns can influence realization of actual TTF.

⁹ Tushman and Nadler, 1977. Task environmental concerns - Those external factors attended to by organizational members, seen as source of uncertainty that impacts pre-planning and inhibit intentions

Hospital B ACU Nurse Manager

P20: "It seems to work better in an environment that you have more time to work with the patient and you aren't so stressed about the charting. It's to "busy" down here for it but we are trying to use it."

Hospital B IS personnel with Nurse Experience

P21: "We can't know every thing that is going to happen in a patient care scenario but we wanted to give the nurses the ability to capture as much as possible. In ACU it is more difficult to know all that needs to be done. A lot is exploratory but at least they can chart the patient admin things and look up generic medical info to help them make some initial decisions about how to immediately treat the patient. A lot is exploratory but at least they can chart the patient admin things. Some don't like to use it there because they have a lot of stuff going on all of the time. In PACU things are a little more stable because the patient is under anesthesia and there are more standard things to be done that are known as opposed to a patient's condition in the ACU, which can change erratically."

Hospital B ACU Nurse D

P29: "Another problem is that we don't have a lot of space in these rooms and it was a little hard to get them up to the bedside anyway, especially when there is the patient, their stuff, their family along with the monitors and just everything else in the room."

The following table shows the characteristics of the task environments for the nurses involved in this study followed by an explanation of how task environmental inhibitors intervene in realization of a good fit between the task, technology, and individual characteristics.

Table 6 Task Environment Characteristics

Task Environment Characteristic/ Hospital Unit	Volume of patients entering and leaving the patient care system per day	Physical Confines of Room Space	Access	Patient Status	Degree of acuteness of patients
Hospital A Emergency Department	High and uncertain	Confined by walled rooms, single patient rooms	Secured with limited visitation	Either conscious or unconscious	Critical or moderately acute
Hospital B ACU	High and certain because of	Confined by walls, large area, 3 main	Open to visitors	Conscious	Moderately acute

Task Environment Characteristic/ Hospital Unit	Volume of patients entering and leaving the patient care system per day	Physical Confines of Room Space	Access	Patient Status	Degree of acuteness of patients
	scheduled procedures	areas with single patient rooms			
Hospital B PACU	Moderate and certain because of scheduled surgery	Unobstructed by dividing walls, a lot of monitors in headspace, small area with single patient suites	Secured with no visitation	Unconscious	Critical to acute
Hospital C Regular Floors	Low and moderately predictable (i.e., they have lead time to prepare for patients being admitted)	Very Confined, multiple patients rooms	Open to visitors	Conscious	Moderately acute

PACU is a closed environment meaning no family or visitors are allowed in the general surgery recovery area. Additionally, the patient is still anesthetized when they enter PACU and are monitored as they regain consciousness. Therefore, there are virtually no distracting questions from the patient, their family or friends. The physical locations of the patient suites (i.e., the areas where the patients are placed and the nurses render bedside care) are not divided with physical boundaries. Using the laptop mounted on a mobile cart, the PACU nurses can move unobstructed from one suite to another. These suites are in very close proximity to each other as opposed to the actual rooms and separate bays in ACU. Since the patients come to PACU immediately following general surgery, there are many monitors and medical equipment that impede the nurse from maneuvering to the head of the bed. However, for the task of monitoring the patients after surgery it is more suitable for the nurse to use the mobile cart and

information system used for ubiquitous IS access at the foot of the bed where she/he has full view of all the monitors and the patient and can input data as needed.

All nurses interviewed in this study value face-to-face communication in their socially enriched task environments but the non-PACU nurses want to decrease the amount of questions being asked of them by the physicians or other servicing nurses concerning the patient because acquiring this information is time consuming in a very busy task environment. Giving appropriate users access to the information whenever and wherever via the wireless system increases productivity of the task environment, which is measured as quality patient care and number of patients cared for.

The physical environments of the non-PACU units are characterized by physical boundaries between rooms and limited headspace for systems and medical apparatuses because of the confines of the room. The technologies enabling ubiquitous IS access allowed the nurse to move the cart near the patient's bedside without having another system permanently mounted cluttering the headspace of bed. In areas where there is more than one patient in each room as in Hospital C, maneuverability becomes problematic. Some nurses at Hospital C noted that they would prefer smaller handheld devices because it is difficult getting the cart in between the beds within the room. However, very few nurses were observed using the mobile cart and information system used for ubiquitous IS access in the hallways of Hospital C. Those that were using it in the hallways were not doing so for medication administration but rather for querying for patient information because there was not enough space in the rooms to maneuver around at the time the nurse needed the information.

Also, the physical set up of the rooms and the length of the cords for the scanners impairs the nurses from getting to the patient's bedside in some instances to scan the patients

identification band in Hospital C. The IS personnel noted that they will be equipping the carts with wireless scanners but this does not allay the problems of maneuverability between beds within the rooms. A few nurses commented that some of the nurses manually input the SSN number as opposed to the required scanning of the identification band because it is too difficult to maneuver to the beds with the carts, which is an inappropriate use of the technology. However this is not a normal occurrence in Hospital C. The majority of the nurses felt that the mobile cart and information system used for ubiquitous IS access was suitable for the task of administering medications and used the mobile cart and information system used for appropriately (i.e., at the point of care). In this manner, the nurses do not have to return to the room to view a chart for information on a particular patient or search for a desktop computer to use near the nurse's station.

In all units, the needs of the patient are sometimes uncertain and the nurses must be able to deal with this uncertainty in changes of the patient's condition. Changes in the patient's condition from moderately acute to critical are characteristic of healthcare task environments. Having access to information ubiquitously affords the caregiver with critical information at the point of care to better deal with uncertain conditions related to the patient.

Utilization of Ubiquitous IS Access

Utilization is overall dependence or reliance that the individual exhibits in using the technology for the intended purpose (Goodhue and Thomson, 1995). The following quotes illustrate how the nurses have become dependent on ubiquitous IS access relative to prior methods for data access and manipulation.

Hospital B PACU Nurse Coordinator

P3: "...if we have to go to floors to the critical care units that don't have antennas or technical problems then we revert to manual charting. We hate that because now we are spoiled."

Hospital C Floor Nurse C

P24: "The computer is so convenient I think because I can go into the other program for the patient's records and look up patient information, check on the status of labs. I use it for everything I can really. ...When it goes down we hate having to go back to writing everything down. We still use the same process of validating we just have to write it all out. That's hard and time consuming."

Hospital C Floor Nurse D

P25: "Oh yes, we are dependent... we hate when something happens or it slows down."

Performance Impacts from Utilization

Performance impacts derive from of utilization of the technology. They are categorized as providing either task efficiency or task effectiveness.

Task Efficiency

Task efficiency is performing the task with minimal waste of technical and human resources (Tushman and Nadler, 1977). The following quotes illustrate how utilization contributes to task efficiency in patient care.

Hospital B PACU Nurse D

P17: "Even though I still have problems typing it's easy because we do exception charting. So then only time I have to really write something out as opposed to just checking or selecting something on the screen is when something out of the ordinary happens and we document it...it's really so convenient to use. I can move it between the suites that I work out of and it's my machine so I have it for my whole shift. I like being able to put the information in right away and not having to worry about forgetting something. It's just so much easier."

Hospital C Floor Nurse C

P24: "The computer is so convenient I think because I can go into the other program for the patient's records and look up patient information, check on the status of labs. I use it for everything I can really."

Hospital C Floor Nurse D

P25: "I like how it helps you make sure that you give the right medications properly. BCMA really decreases the likelihood that you can make a mistake. To me it's easier than the paper chart. I don't have to question what's written on the meds list or make any guesses. It's really much better than the way we used to do things."

In the cases above, utilization promotes positive performance impacts such as non-reliance on memory, more comprehensive charts, and decrease in errors. The following quotes note more efficiencies derived from ubiquitous IS access facilitated by wireless technologies.

Hospital B PACU Nurse Coordinator

P3: "So one of the biggest advantages of doing this is that it expedites the charting. If there is a lot going on with a patient, once you get the patient settled then you can more easily catch up on your charting. The old way it took a lot more time."

Hospital C Floor Nurse D

P25: "I don't have to question what's written on the meds list or make any guesses. It's really much better than the way we used to do things. A lot of nurses say that it takes them longer. I don't mind because to me the fact that all of the information is right in the computer I can get to information much faster when I have a question. For example, if I think something is wrong with the order in the computer, I can find out right away who were the ordering physician and the validating pharmacist and get my question answered right away. It takes less time for the orders to go in and be validated. We don't have to wait for everything to get transcribed and then go to the pharmacists. Everything about the order is right there in the computer."

Medications administered to patients sometimes go uncharged across all hospitals because nurses forget to charge due to oversights in the manual documentation that is written in a narrative form. These charge oversights are costly for the organization, either because the nurse failed to properly document the type and dosage or the nurse overlooks/misreads this information in the narrative of the servicing nurse's documentation. Therefore, having a technology that enables the nurse to document as he/she services the patient lessens the chances of forgetting to charge properly.

Charting by exception (i.e., electronic standardized document format that has inherent mandatory fields and automatic error notifications) with the mobile cart and information system used for ubiquitous IS access as opposed to writing narratives eliminates issues with legibility and precludes nurses from overlooking critical data for patient records. Additionally, charting by exception with the mobile cart and information system used for ubiquitous IS access decreases the overall time for charting (provided the program design is effective), which affords the nurse more time to care for the needs of the patient. This was directly observed in PACU of Hospital B where the information system used for ubiquitous IS access was effectively designed and the users were integral to development and properly trained.

Ubiquitous IS access allows for timelier queries that would normally take several minutes to identify when reading through a manual narrative in a patient's record that has to be physically located. Because of ubiquitous IS access (in light of its superlative program design) the nurses have efficiently decreased their charting time in PACU by 10 – 15 minutes. This efficiency allows for each nurse to care for at least one more patient increasing the potential nurse to patient ratio from 1:3. The patients in PACU receive scheduled surgery and there are a set number of surgeries per day. PACU has no control over this set number; therefore, even though efficiencies afforded by ubiquitous IS access may allow for a nurse to chart on more patients simultaneously there is no direct impact spurring increased volume of patients entering PACU. In subunits where the program design for the information system used for ubiquitous IS access is robust, nurses are able to document patient information easier and timelier with minimal error because of mandatory data fields.

Task Effectiveness

Task effectiveness is another aspect of performance impacts. The following quotes illustrate how utilization of ubiquitous IS access promoted task effectiveness.

Hospital B PACU Nurse Coordinator

P3: "I say on average it cuts down on about 15 minutes, which gives them more time to see after other patients or spend more time with the patient if they have complications like pain or nausea following the surgery. Also, if they are with one patient then they don't have to leave that patient to access records for another patient. They can just look up the information in the system on the carts that they have with them. Often they need to remind themselves if a patient had a certain medication or the last time vitals were recorded. Things like this are easy to forget and hard to find when you get busy comforting the patient."

Hospital C Floor Nurse A

P22: "I think they are really helpful in making sure that we don't make mistakes in giving meds to patients. It's really for patient safety but it does help us also. We have a good record of every med given to the patient since they have been in the system."

Task effectiveness is realized by conditions such as patient satisfaction with the care provided, the nurse manager's assessment of the care, patient safety assessed in terms of decreased errors in the documentation, and the ability of the nurse to pay more attention to the patient's condition than when manually documenting.

In PACU of Hospital B, the information system used for ubiquitous IS access is so "nurse" friendly that it is easy for the nurses to catch up on their charting if they have to deal with uncertainties associated with the patient such as complications following surgery. They do not worry about charting and can more effectively care for the patient. Additionally, with exception charting and the mobility afforded by ubiquitous IS access, nurses can enter in and access critical data when needed. The charts are comprehensive and readily available for access. Therefore, PACU nurses rely on the system for all electronic charting and documentation related to patient care tasks.

In Hospital C, the nurses commented that using the mobile cart and information system used for ubiquitous IS access for medication administration has truly decreased the likelihood of errors. Even though the process has increased the time it takes to administer medications because of the steps required for validation that the correct med is administered to the correct patient, the nurses feel more secure in administering the medications. They commented that their anxiety about ensuring administering medications is decreased because the system alerts them to when medications should be given and if there is a conflict with the medication when they attempt to administer. Also the mobility of the carts, despite some concerns about maneuverability in between the beds, keeps them from going back and forth to the medicine cart/cabinet or nurses station to retrieve information. Additionally, the nurses can rest assured that they will not be solely liable in the event of error because the physician and the pharmacist have validated the medication orders within the system prior to the nurse being able to administer the drug. All of this information can be accessed right at the point of care as opposed to having to locate the doctor and the pharmacist to ensure that the medication was correct or look up information at a desktop at the nurses' station. This was a frequent occurrence because quite often the order that the physician wrote was incorrectly transcribed by a technician or another nurse, which was then incorrectly validated by the pharmacists. Quite frequently the nurse, who is at the frontline for care, would question the order and have to track down the physician to verify the order, which then delayed patients from receiving their medications and possibly follow-on care or medical procedures.

Another area that nurses observe task effectiveness is in the patient/caregiver relationship, which this next quote depicts.

Hospital C Organizational Manager with Nursing and IS Experience

P28: “You can use the computer system to be a part of the patient/physician relationship. You develop interfaces with graphics that the doctor can use to better explain conditions to the patient. For example, you can create a graph of depicting how a patient's blood sugar is not under control based on historical data. You can show them and ask what are they doing are they not taking the medication. Or you can say you are doing very well on this weight reduction for the past three years and you can show that to them in terms and schematics that they can understand. The patient becomes engaged that way in their own healthcare information.”

This excerpt illustrates how technology aids in reassuring the patient that the care the physician is providing is in accordance with the prognosis for the patient. This reassurance can transcend to the patient/nurse relationship when the nurse is the primary caregiver. Nurses at Hospital C noted that because they (1) have ubiquitous IS access at the point of care (i.e., precludes the need to track down information from other locations) and (2) must perform more precautionary steps, they spend more time in the patient’s room when administering medications and the patients seem to be more content with the amount of attention they perceive they are receiving from the nurses.

The nurse perspective provides a contextually rich interpretation of how ubiquitous IS access in patient care *truly* impacts task performance. The nurses provide tangible evidence that for the most part supports utilization of ubiquitous IS access in healthcare environments. At the same time the nurses’ comments attest to impediments encountered with use that mitigate utilization and negatively impact task performance.

The nurse perspective provides the most useful information in comparison to the other perspectives. This will be discussed later in the cross analysis of the perspectives. Even though each perspective gives insights, the nurse perspective provides the greater details concerning system acceptance, utilization, and performance impacts at the task level.

Selective Coding Results for the Organizational Manager Perspective Model

The organizational manager perspective derives from the selective coding process of the data provided by the organizational managers interviewed across the three hospitals. Some of the organizational managers are also nurses that continue to practice and provide insights about ubiquitous IS access from multiple perspectives. The organizational managers are able to provide a more overarching view of factors prompting their decision to support the implementation of the technology. Additionally, the organizational managers provide more comprehensive input concerning how performance improvements on the task level impact organizational performance in terms of employee/caregiver satisfaction and process improvements.

Even though the organizational managers operate at a higher level than the primary user group, the majority of them are still practicing nurses and occasionally use the system. This allows them the unique ability to experience the system as a user and compare their experiences with those of the nurses that substantiates the claims of the nurses. They also can identify unique benefits/drawbacks of the technology that derive from aggregating the performance impacts at the user level.

The following figure is a depiction of the organizational manager perspective concerning ubiquitous IS access. A storyline follows to further explain the perspective with integrated analysis. See Appendix E for more data associated with this perspective.

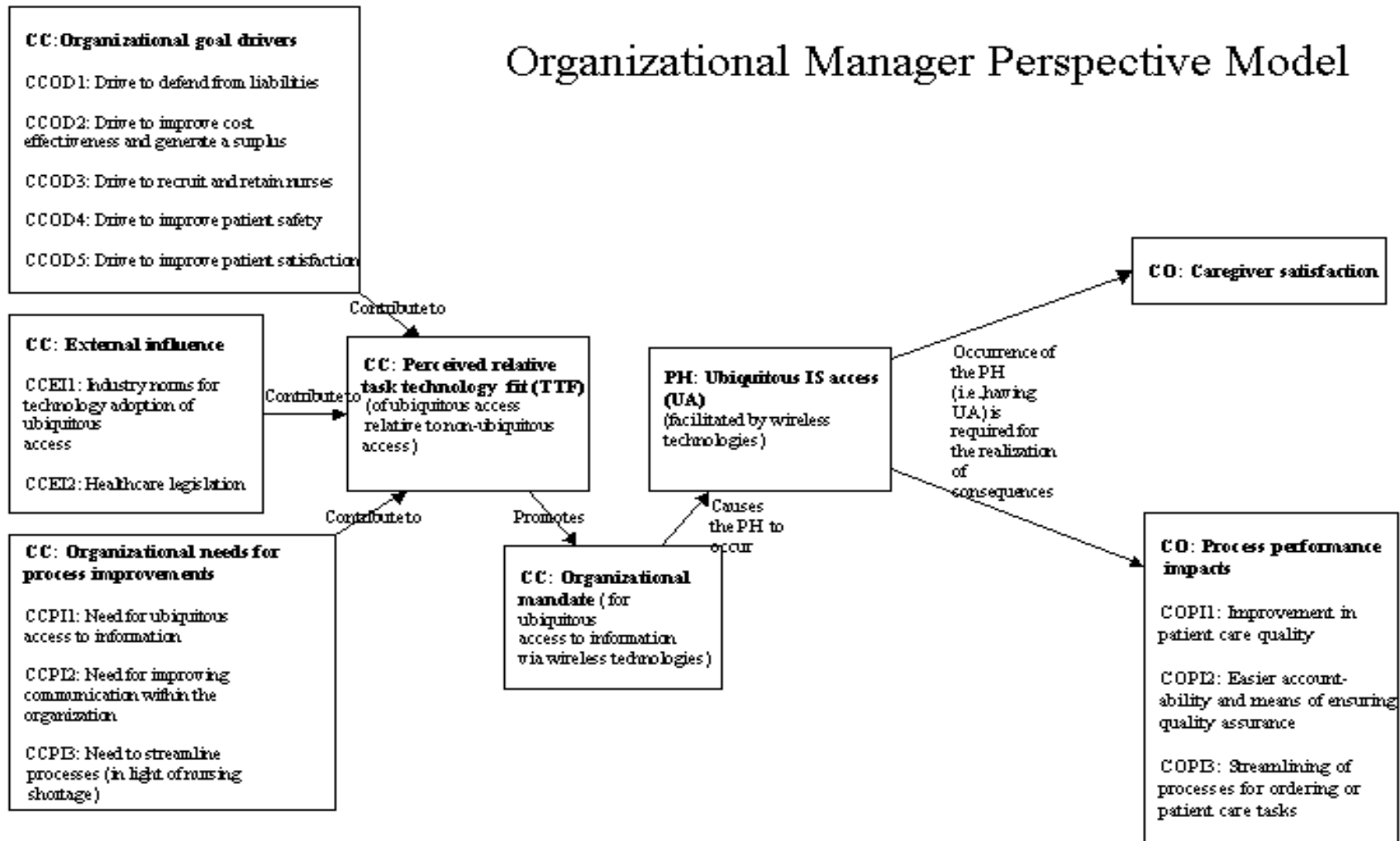


Figure 12 Organizational Manager Perspective Model

The Storyline for the Organizational Manager Perspective

This storyline explains the codes and relationships that comprise the Organizational Manager Perspective Model (illustrated in Figure 12), which is based on analysis of the insights provided by organizational managers concerning how ubiquitous IS access, facilitated by wireless technologies, impacts task performance. These organizational managers are primarily concerned with ensuring the overall welfare of the hospital and servicing its stakeholders (patients and healthcare providers). Therefore, this perspective composes a much higher level of explanation and is not solely focused on explaining how well the technology works. The managers provide comments that afford a more holistic perspective than the frontline nurses and note the aggregated impacts of task performance for the organization. Additionally, the comments reflect their attempt to justify their adoption decisions. They provide their perceptions of (1) factors attributing to their perceived relative task technology fit for ubiquitous IS access via wireless technologies, (2) how this perception promotes the organizational mandate, (3) how this mandate causes the phenomenon to occur, (4) how ubiquitous IS access is necessary for the realization of performance impacts.

Organizational Goal Drivers and Perceived Relative TTF

Organizational managers note that there are number of drivers that contribute to their perceptions about the task technology fit of ubiquitous IS access relative to non-ubiquitous IS access facilitated by wireless technologies for patient care. These drives extend from organizational goals are as follows: (1) the drive to defend the organization from liabilities, (2) the drive to improve cost effectiveness and generate a surplus, (3) the drive to recruit and retain nurses, (4) the drive to improve patient safety, and (5) the drive to improve patient satisfaction.

The organizational managers comment that it is incumbent upon them to seek solutions that aid in appeasing these drives. Organizational managers in this study perceive ubiquitous IS access as a nearly ideal fit because the use of the wireless technologies at the point of care can (1) aid the organization or its members legal defense, (2) promote cost effectiveness by improving inefficient processes (thereby improving work conditions which helps to recruit and retain nurses, improves patient safety and satisfaction), and (3) possibly generate revenue because of the increased number of patients serviced.

Drive to Defend from Liabilities

The drive to defend refers to the desire to protect the resources of any group from threats (Lawrence and Nohria (2002)). The following excerpt illustrates how the drive to defend from liabilities as a financial performance concern is associated with the perceived relative TTF of ubiquitous IS access vs non-ubiquitous IS access.

Hospital C Nursing Education Manager with Nurse and Nursing Informatics Experience

P26: "The one thing that we teach the nurses is that the "use of the technology" adds to your safety and your licensing now because when you go to give that med there is a doctor who says it should be given, a pharmacist has verified it and then you give it. In the old days it was just you in that boat and now there are at least two other people in there with you. It's less prone for error and protects you as the nurse as well as the patient. In those days you as the nurse took on all of the responsibility. You made sure you interpreted what the doctor wrote was right and that what the pharmacy sent you was what you interpreted it to be. You were in the boat by yourself. With this technology I can build a progress notes and I can build it with all of the bells and whistles that you need to get into your charting that protects you legally as opposed to giving you a sheet of paper and saying now write a progress note you having to remember everything you did. So that you can protect yourself some 5 years from now when some lawyer's got you on the stand."

This organizational manager highlights the concern for protecting the organization from threats to its economic sanctity in addition to the stature of its employees. The primary threats in

this instance are acts of the caregiver that could result in harm to the patient, which can jeopardize not only their professional licensing but also the reputation of the hospital. Quite often, the hospital is the target for legal action and not the individual care provider. Conversely, the documentation at the point of care afforded by wireless technologies can serve to disprove negligence. This organizational manager perceives ubiquitous IS access via wireless technologies as advantageous in defending the hospital and the healthcare provider from liabilities. The rationale is that the technology enables the nurse to access needed information to validate medications prior to administration at the point of care granted by ubiquitous IS access. This access also affords the nurse with a means to easily identify and contact the physician, pharmacist, or nurse that administered medications to the patient previously if there is a need for clarification. The prior method of administering medications did not provide these sources of information readily for the nurse and validation for questionable prescriptions was a lengthy process, which often delayed subsequent medication administration and/or medical procedures, and made medication administration gravely vulnerable to error, thereby increasing the likelihood of negligent acts.

Drive to Improve Cost Effectiveness and Generate a Surplus

This drive refers to desire to eliminate unwarranted expenses, rectify erroneous expenses, and acquire revenue that protects the economic sanctity of the organization. The following excerpt illustrates how this drive associates with the perceived relative TTF for ubiquitous IS access.

Hospital A CIO

P8: "It happens a lot that the patient may be ready to go home but one more test is ordered and because it was ordered late in the day the X-ray machine isn't ready until the next day, now the patient has stayed over night and they are charged more. They aren't happy, the insurance companies aren't happy with them or us and over time this could impact the reputation with our customers, the patients. Not to mention insurance companies forbidding patients to come to us because of this 'over' charging due to our inefficiencies. Wireless can at least give us a better means of avoiding these situations because the physician or nurse can enter data right there at the patient's bedside during care."

This organizational manager notes how inefficient processes due to the lack of needed information at critical times impacts how long the patient remains in the patient care system and how this ultimately contributes to increased costs for the hospital. Patient care tasks are interdependent meaning one task ultimately relies on the results of another task as this excerpt illustrates. These tasks are also highly information intensive and not having the necessary information at critical times in locations where the task is being performed impairs the quality of care. A delay in one task can prove costly and imperils the patient's safety. For example, if certain medications cannot be administered because the nurse has a question about its validity, then subsequent medical procedures such as labs in preparation for medical procedures are also delayed. These medical procedures may be crucial or even life threatening and this delay can endanger the patient.

The following excerpt illustrates how the organizations want to generate financial surpluses, despite being not-for-profit and how they perceive ubiquitous IS access vs non-ubiquitous IS access as an enabler.

Hospital A Organizational Manager C

P9: "We lose money when patients aren't seen because we can't charge if they never get registered. Also we lose money if nurses don't charge for meds properly or for certain comfort items to the patient. They have to track these items or meds in order to charge properly and sometimes the nurse feels really badly for the patient and won't charge. The hospital loses money this way but most often the nurse genuinely forgets to add it into the patients record so that they

are charged. Having wireless will make it easier for the nurse to just document when they do what.”

This organizational manager emphasizes that the hospital, despite being classed as not-for-profit, still desires to generate moderate revenue. When patients leave the emergency department without being seen because of long waits then the hospital loses potential revenue. This can ultimately impact the reputation of the hospital that is a deterrent to potential patients, which can have long standing economic ramifications. Additionally, if nurses forget to charge for certain items because they did not have a means to document the services rendered at the point of care then this “free” service is absorbed financially by the hospital. As the excerpt illustrates, the organizational manager perceived ubiquitous IS access facilitated by wireless technologies as advantageous in allaying these problems.

Drive to Recruit and Retain Nurses

Organizational managers of this study are cognizant of the need to attract nurses for employment within the organization and to prevent them from leaving due partly to work conditions. Nurses are in high demand and organizations find it difficult to recruit and retain them most often due to less than favorable work conditions and low salaries (statement by Sandra Feldman, President of the American Federation of Teachers/AFT Healthcare on the Joint Commission on Accreditation of Health Organizations Report on Nursing Shortage, May 2002). The Department of Health and Human Services projects the nursing shortage to reach 400,000 by 2020 (Fackelman, 2001). This shortage contributes to longer and more frequent shifts and the assumption of more administrative tasks for nurses. Nurses are at the frontline of care and must perform under dire stress. Organizational managers in this study realize this state of affairs and

seek mechanisms to relieve nurses of some of these necessary but taxing responsibilities by improving work conditions. One such way is by enhancing the technologies that they use for documenting and administrative tasks. At Hospital B, electronic charting by exception at the point of care via wireless technologies reduces the laborious task of documentation, which enables the nurses to spend more time caring for the physical needs of the patient – the primary job of the nurse.

An offline conversation with an organizational manager revealed that hospitals compete to attract nurses and the use of innovative technologies that automate previously painstaking manual tasks can be used as a recruiting and retention tool. This is provided that the nurse has a healthy appreciation for technology. This appreciation is most likely cultivated by exposure to technology in their professional training.

Drive to Increase Patient Safety

This drive to increase patient safety is a motivating force for organizational managers to pursue new avenues that greatly decrease the likelihood of caregiver error. Any mechanism that can alleviate administrative tasks and grants the caregiver more personalized service with the patient is perceived as advantageous over previous methods. The following excerpt illustrates this idea.

Hospital C Nursing Informatics Manager

P27: “We were told to get this software up and running and do it over 13 floors by the end of the Summer. Quite honestly in the government the main driver is just to do it when you are told to and that's what my perception is. However, I think the driver for the VA mandating it for nationwide use is that certainly the intention was that the VA is taking a stand on the numerous errors that were jeopardizing the safety of the patients and this is one way that we can be even safer.”

This organizational manager commented that even if the mandate were not enforced, she believed the organization would still employ wireless technologies to give ubiquitous IS access to the nurses administering medications because (1) of the perceived relative advantage over manual documentation for error prevention and (2) documented improvements in task performance in other VA hospitals.

Drive to Improve Patient Satisfaction

Organizational managers involved in this study recognize the need to more effectively service the patients and attain confirmation of the degree of their contentment with the quality of care provided by the healthcare professional. Hospitals are in the business of servicing patients; yet, like any other business, inefficient processes impede them from attaining desired levels of customer satisfaction. Long waits in an emergency room and frustrations with delayed procedures because the caregiver is missing or cannot access a vital piece of data at critical times detracts from patient satisfaction. Poor patient satisfaction can cause the patient to be even more disgruntle, in light of being ill this can compound the physical ailments and make treatment that much more problematic. This excerpt illustrates this point.

Hospital A Organizational Manager B

P6: "The main problem we have here with patient satisfaction is that the wait is too long in the ED and often the patients leave without receiving any care. I think the real benefit is in patient satisfaction. Basically, in my opinion, if the patients get to a room faster they believe that they are getting better care and that makes them more cooperative to our registration personnel and the nurses. Now since it takes so long to be seen, the patients often are very irritable with the registration personnel because they see it as having to do all of this paperwork, which is a big delay to their service. They really give them a hard time. So if we can bypass the registration cubicles and get them into beds quicker they will feel better about how diligently we are working to care for them."

This organizational manager perceives the wireless technologies for ubiquitous IS access and for documenting by the registration personnel in the Emergency Department of Hospital A as a better fit over the current process of gathering information at the registration cubicles before the patient is seen by medical personnel. This lengthy process can potentially delay actual care provided by the nursing staff. Delays in triaging or initial assessments by the nursing staff hinder the physicians from examining the patient. Once again this illustrates the interdependent nature of patient care.

External Influences and Perceived Relative TTF

The label External Influences is a higher order code that refers to external sources that influence perceptions of organizational members. The main external influences that contribute to the organizational managers' perceptions of the fit for ubiquitous IS access information via wireless technologies in patient care are based on (1) industry norms for technology adoption of ubiquitous IS access and (2) healthcare legislation.

Industry Norms for Technology Adoption of Ubiquitous IS access

This influence refers to actions such as particular technology adoptions amongst other like organizations that have a bearing on the behavior of management (adapted from DiMaggio and Powell, 1991).¹⁰ Actions such as particular technology adoptions in similar organizations have a bearing on the behavior of management (DiMaggio and Powell, 1991). Organizational managers note that hospital administrations are relatively risk averse and want to see proven

¹⁰ Dimaggio and Powell, 1991. - Institutional Theory and isomorphism says that organizations become increasingly similar through institutional forces exhibited by the movement towards, and the maintenance of, institutional norms through coercive, mimetic and normative processes.

success before they alter internal process to accommodate technology innovations in IS. Since patient safety is a primary concern, they want proof of success in practice before employing new technologies especially in the area of IS. The following excerpt illustrates these points.

Hospital A Organizational Manager A

P5: “We think we know what we want to do but we like hearing about what other hospitals are doing. All hospitals want to see successful implementations elsewhere before they try anything new.”

Hospital B MIS Department Director

P21: [When asked about influences to the adoption decision] “I would say it's probably kind of mixed because we've had you know one group of people that are almost...hey the hospital up the road has it so we need to have it. You know I just came back from a conference and all those other hospitals are doing it.”

In addition to the desire for demonstrated success in the industry, skepticism about new implementations is high also because of the need to preserve funds. Implementations need to be deliberate and well thought out in order to conserve resources because of notoriously low budgets for the IT/IS departments in comparison to other departments in hospitals, as the following quotes notes.

Hospital A Organizational Manager A

P5: “Hospitals are notorious for having low IT or IS budgets. It's historically it's been about 2 or 300K [for special projects]. It's getting better but we are not there yet. We have to do wonders on small budgets to justify more funding.”

The organizational managers noted above comment that hospitals are very skeptical about employing new technologies that have not been widely accepted across the industry. They also want to know lessons learned prior to implementing once again because they are very concerned about wasting resources. As this research revealed there is not a volume of research or practitioner data concerning the use of wireless technologies for ubiquitous IS access in

hospitals. Therefore, there is no established approach for implementation across the industry. The most identifiable pattern for implementation is departmental (i.e., in contained areas where documentation is critical) and not enterprise wide usage. Once again, this research associates that with the low IT budgets and the necessity to show productivity in relatively short time periods. Organizational managers are swayed in terms of their perceived relative advantage for ubiquitous IS access by the success and failures of other organizations that have already implemented.

Healthcare Legislation

Healthcare legislation (i.e., government regulations that dictate standards for management of medical information or processes orchestrated by healthcare professionals and administrators) dictates how organizational managers orchestrate the affairs of the hospital. The managers have to remain cognizant of mandates or “highly encouraged suggestions” from governing institutions to remain in compliance with government standards. A substantial amount of funding at the not-for profit hospitals comes from echelons (i.e., local, state, and federal) of government and non-compliance to standards jeopardizes their funding. Organizational managers in this study noted that they are willing to consider any technology that will aid organizational members in better adhering to government regulations or following the spirit of its vision concerning patient safety. This following excerpt illustrates these points.

Hospital A CIO

P8: The IOM report¹¹ came out that said the fifth leading cause of death in the US is being in a hospital...this has really caused our government to look into improvements in healthcare and a lot can be helped by using new technologies to streamline processes.

As this organizational manager notes, the US government recognizes the importance of patient safety and the need for hospitals to be more vigilant in improving processes to promote better quality of care. Having ubiquitous IS access at the point of care increases the likelihood that critical data will be available when needed and more accurate information will be documented.

Organizational Needs for Process Improvements and Perceived Relative TTF

Issues related to process improvements greatly account for how organizational managers perceive relative fit for ubiquitous IS access facilitated by wireless technologies. The primary needs for improvements that organizational managers identified are (1) the need for ubiquitous IS access, (2) the need for improving communication within the organization, and (3) the need to streamline processes.

Need for Ubiquitous IS access

Ubiquitous IS access refers to accessing information when and where a task is performed. Organizational managers in this study noted the necessity of process improvements. They identified departments in the hospital in which processes were hindered because of inadequate access to needed information or the inability to document while performing tasks. Managers in

¹¹ In 2002, the Institute of Medicine (IOM), Committee on Quality of Health Care in America published a report "To Err is Human" in that concluded that 40,000 to 90,000 people die each year due to medical errors by healthcare professions rendering care to patient in hospitals.

each hospital indicated that in the initial planning stages they gathered input from departments in the hospital as to how best to employ wireless and decided on departments that showed the most utility for accessing information and documenting information at the point of care. The following excerpt illustrates this point.

Hospital A CIO

P8: “Well let's take this emergent situation. A patient comes in with some sort of trauma. And let's say they were a patient before so we have some historical medical records. We can scan the barcoded id, scan the meds to be administered or query and assign a medication, and "boom" the system tells them that there is a problem based on the allergy history and actually notes an alternative med. The beauty of wireless is that this can be done right there at the bedside at the point of care all within a subsecond response time. This absolutely requires wireless. Yeah, it could be on a PC on a stick but truly to have and be there you don't want to have to find a PC on a stick or a PC at the nearest nurse's station. You need it right there.”

This organizational manager noted a situation for one of the departments in the hospital (i.e., the Emergency Department) and how crucial it becomes for the caregiver to have information at the point of care. This excerpt also depicts the nearly ideal fit of ubiquitous IS access facilitated by wireless technologies relative to the use of standard tethered computers.

Need for Improving Communication within the Organization

The need for improving communication within the organization refers to the desire to provide organizational members with a more accessible and timelier means of exchanging information. The organizational managers all noted that hospitals employ very antiquated methods of information transfer and communication (e.g., relying on manual documentation, technical devices such as pagers, or mere verbal exchange). However, they also noted that one reason for seemingly antiquated communication technologies is the concern of electromagnetic compatibility (EMC) of devices and technologies that can cause medical equipment to

malfunction. They rely on IS personnel to make determinations about devices and EMC.

Despite these concerns, they still recognize the potential for high TTF of ubiquitous IS access to allay communication issues. The following excerpt illustrates the importance of communication due to the nature of the tasks.

Hospital A IS Manager

P4: “It was more to communicate with whomever like if a radiologist has a question about an order from a physician and no one can find the physician. The same [is required] between the doctors and the nurses. They make calls back and forth or can't find a transporter to move the patients around. Cell phones interfere with the medical devices so we looked at a system called Vocera. It's similar to StarTrek days because you tap the device, which is like a pendant to call whomever. They need to be able to track down essential personnel to get information from them at critical times. Physicians need to make their rounds and don't have time to wait on nurses or other personnel to give them the information they need concerning the patient. They have to have access to these people.”

Since patient care is comprised of highly interdependent and information intensive tasks, communication amongst those performing the tasks is critical to task performance, which in this case directly impacts the quality of care rendered to the patient. This organizational manager illustrates the necessity for unobstructed and timely communication. If caregivers delay passing needed information along to the next individual that is to service the patient, then ultimately the patient and those other patients that are waiting for care are negatively impacted.

Need to Streamline Processes

Eliminating steps in processes that waste resources and impede task completion is a goal of organizational managers involved in this study. The purpose of business process redesign and re-engineering is to eliminate unneeded steps in processes to make them more efficient with the use of technology. These organizational managers recognize processes that are laden with

numerous steps that can be streamlined to reduce the amount of time required to find the desired information or to document relevant data. The following excerpt illustrates this point.

Hospital A Organizational Manager B

P6: "The philosophy is that they will be able to place some orders procedures and testing in a more timely fashion and be able to get the results back even faster. In some cases they would be able to order procedures before the patient sees the doctor. This is after they have been triaged by a nurse. If the guidelines are established for basic procedures that need to be done then theoretically the registration personnel can go ahead and order some of those things and have them ready for the doctor. For example, if someone comes in with a broken hand and they are triaged as such, once they are registered then the registration personnel can go ahead and order an X-ray. This would be much faster than what happens now. A patient comes in and waits in the ED waiting room to get checked in. They are then triaged by a nurse and then they go to registration to give all proper insurance info. Or if they are critical care patients then they are immediately seen in the back by a doctor and by triage and bypass the registration desk. Currently, the registration personnel either ask the next of kin or the patient if it's possible wherever the patient is being seen and then take those notes back to the registration cubicles and keys in the data."

This organizational manager denotes inefficiencies in the patient care scenario based in the Emergency Department (ED). The time to service is critical to patient satisfaction in any hospital and any technology that will aid in eliminating steps to streamline the process so that a patient can be seen and treated quicker is perceived as a good fit to aid in task performance. The idea is for the registration personnel to ubiquitously access information systems to perform the bulk of the registration task in a more timely fashion and order basic labs and test based on the nurses' triage notes as opposed to waiting until after the physician's initial assessment. The triage nurse assessments will be electronic and accessible by the registration personnel via their wireless devices. The current frustration is that the administrative tasks needed to order the tests and labs take an exorbitant amount of time, which delays the physician's ability to make a diagnosis. The physicians will still order other labs at their discretion but at least the basic tests will be done based on the triage assessment in the hopes of timelier care.

Perceived Relative TTF and Organizational Usage Mandate

In the context of this study, the organizational managers assess the benefits of having caregivers use wireless technologies for ubiquitous IS access to perform patient care tasks as opposed to methods belabored by (1) tedious manual documentation that is later transcribed into an electronic format at a fixed location away from the place where the task is being performed and (2) timely methods for gathering data needed at a location away from where the task is performed. The organizational managers ubiquitous IS access as a better fit relative to former methods. The following excerpt illustrates this point.

Hospital C Nursing Education Manager with Nurse and Nursing Informatics Experience
P26: "Technology is increasing day by day and you may hear the staff say that the system increased their workload because there are more steps that you "have" to do now but it also decreases the work. In the old days you had to take the scribbles from the doctor, transcribe it correctly, fax down to pharmacy, wait for pharmacy to transcribe it again and when pharmacy sent that medication up to you on the floor you had to check if the pharmacy interpreted the same way that you did. So there were a lot more problems there."

Organizational managers in this study mandate use of wireless technologies for ubiquitous IS access in their respective departments. The governing institution for Hospital C mandated use in all hospitals within its healthcare system. Organizational managers at Hospital C associated this with what they perceived to be a high degree of perceived relative fit for ubiquitous IS access and felt that mandating use was imperative to bring about desired performance impacts. A common theme with the organizational managers is that people in the healthcare industry are resistant to change. One can assume that because of the high degree of perceived fit for the technology and the presumption of resistance to change, organizational managers felt voluntary use would not be sufficient. Since patient care is highly information intensive and interdependent, documentation within the IS must be accurate and consistent. One

can assume based on the interpretations of the organizational managers comments that if caregivers were allowed to choose their methods for documenting then there would no doubt be data integrity problems because those resistant or technologically intimidated persons would most likely opt for manual documentation. The IS is only as useful as the data that it maintains. If half the staff does not maintain data within the IS then the likelihood of incomplete records, or even worse, conflicting information is highly possible, which can lead to patient endangerment. The organizational managers noted that employing the system's use on a voluntary basis would be problematic due to the nature of resistance to change amongst the organizational members. The following excerpts substantiate this notion.

Hospital B MIS Department Director

P21: "This feature could help in speeding up the time it takes to chart a patient's status, create the initial record, and any type of documentation that the nurses must do...It was a new system so there's that whole change is seen somewhat as a negative; just change for anybody is going to be difficult. ...It's not voluntary. They have to use it."

Hospital C Organizational Manager with Nursing and IS Experience

P28: "(When asked if she still would have supported a mandatory implementation even if the governing institution did not force the mandate) The whole focus of this is not about the innovative aspect of wireless. It's about patient safety. ... I think it would have been implemented because it's (the wireless technologies used for ubiquitous IS access) in conjunction with the other systems that we implemented for patient information that is all electronically stored and on-line. That is the only way we can function as an integrated healthcare system with 10 divisions.... You've got nurses who finished school long before any of this technology became available and were putting it right in the middle of the core to what they do – giving medications to patients... That was really hard to sell to them (the nurses)...but they have to use it."

This organizational manager stresses how important it is for caregivers to have access to integrated data in order to properly function. The organizational manager at Hospital C stated that Veterans and their dependents (i.e., their patients) might be seen for medical care at any Veteran Administration medical facility; however, most likely they are assigned to a particular

hospital near their residence. Therefore, this healthcare system has a genuine need for integrated data and a means of accessing this data with ease when performing patient care tasks at whichever medical facility the veteran may enter. Wireless technologies better enables them to service veterans and their dependents for care at any VA medical facility location and virtually any department within that facility.

Caregiver Satisfaction as a Consequence of the Phenomenon

Caregiver satisfaction as a consequence of ubiquitous IS access refers to the observations and opinions of the management concerning the overall contentment of the caregivers with the new technology. This following excerpt illustrates this point.

Hospital B MIS Department Director

P21: "I hear they [the nurses] are happy and feel more productive. The director and lead nurses now have a better means of tracking the actions of the staff and catching errors quicker because they can go right to any cart and pull up the files that any one nurse put in for review, which is a legal requirement of the director and head nurse. ...I think they've gotten pretty much use to it. I wouldn't go so far to necessarily say that if we took it away they'd...all of them would be upset, but I think they're getting use to it and they see the value in the use of it. ...I think they're pretty much using it appropriately and getting their money worth out of it.

There was no formal assessment of user satisfaction or utilization in Hospital B; however, this organizational manager earnestly felt that the nurses in each department were pleased with the implementation and were using the technology as it was intended.¹² Hospital C periodically solicited feedback, which revealed areas of improvement that organizational managers supported to promote satisfaction.

¹² The nurse perspective revealed that ACU nurses were overwhelmingly discontent with the information system, primarily due to poor program design, which overshadowed the mobility benefit derived from the wireless technologies.

Performance Impacts as a Consequence of the Phenomenon

There are a number of performance impacts organizational managers note about affording the caregivers with ubiquitous IS access, which are (1) improvements in patient care quality, (2) easier accountability and means of ensuring quality assurance, and (3) streamlining of processes for ordering or patient care tasks.

Improvement in Patient Care Quality

The organizational managers in this report have not performed any metrics to date on the actual improvements in patient care quality. However, they feel confident in attributing ubiquitous IS access to improvements in patient care quality as highlighted in the following excerpt.

Hospital C Organizational Manager with Nursing and IS Experience

P28: “You can use the computer system to be a part of the patient/physician (or caregiver) relationship. You develop interfaces with graphics that the doctor can use to better explain conditions to the patient. For example, you can create a graph depicting how a patient's blood sugar is not under control based on historical data. You can show them and ask what are they are not taking the medication. Or you can say you are doing very well on this weight reduction for the past three years and you can show that to them in terms and schematics that they can understand. The patient becomes engaged that way in their own healthcare information.”

This organizational manager feels that the technology allows for the caregiver to better relate information to the patient at the point of care. This adds credence to the advice or instructions that the caregiver is giving to the patient. The availability of this information allows the caregiver to better assess the patient's condition, which reduces the likelihood of misdiagnosis due to a lack of relevant data and promotes improved quality of care.

Easier accountability and means of ensuring quality assurance

The organizational managers also note easier accountability of any care provided to the patient. Accountability in this context is actual evidence of a better means of assessing responsibility for actions and monitoring services provided associated with patient care and reviewing documentation for compliance with standards and thoroughness. The following excerpt illustrates this point.

Hospital C Organizational Manager with Nursing and IS Experience

P28: [Speaking of the primary organizational benefit] “Accountability!!! Once you have something in a database you can retrieve it and timeline it...[When asked about quality assurance assessments for accreditation] Either the information is there or it's not there (for the accreditation review team to review). You can't back enter anything but at least its more accessible to whomever is doing the assessments... We can track every medication given to them since we had this system. From my office I can look up anything on a patient and I don't have to go to the ward or call Tallahassee. The accessibility to information is phenomenal. We have our billing office remote from here. They don't have to track down charts to code and bill.”

This organizational manager notes the ease of accessing needed information via the wireless information system in comparison to drudging through manual charts. The wireless technologies in place allow accreditation teams reviewing records and standards' compliance with an easy means to access the needed information with limited reference to manual documentation. Additionally, this access also enables the organizational managers to more easily consolidate information to develop needed reports.

Streamlining of processes for ordering or patient care tasks

Another performance impact is the streamlining of processes for ordering or patient care tasks. The following excerpt notes actual evidence of eliminated steps in processes that wasted resources and impeded task completion.

Hospital C Organizational Manager with Nursing and IS Experience

P28: “You could get interrupted easier with the paper documentation and you were more prone to error because things could be forgotten. When you put this together with the fact that the physicians were ordering electronically, we then developed a seamless system where there was no chance for human error or intervention because the doctors were ordering electronically. There was not a unit secretary transcribing to send to the order to pharmacy. The order is sent directly to pharmacy, the pharmacy validates it and then the nurse could view it. This eliminated steps in the process for meds validation by the nurse.”

This organizational manager suggests how ubiquitous IS access facilitated by wireless technologies has allowed the reduction of steps in the process for prescription validation.

Medication administration is a tedious process that requires great attention to detail.

Organizational managers realize that caregivers can access needed detail and that ubiquitous IS access helps to prevent the nurses from having to leave the patient’s bedside to validate information about a prescription.

Even though organizational managers cannot provide first hand experiences about task performance, they provide a picture of how they (1) envisioned ubiquitous IS access to be a mechanism for meeting organizational goals and (2) and if the implementation met their expectations. The comments provided by the organizational managers seemed to justify their adoption decisions but at times were out of synch with perceptions of the actual users (i.e., the caregivers), which is discussed in the nurse perspective. Yet, the organizational manager perspective provides an overarching lens, which adds richness to understanding the phenomenon in this complex environment.

Selective Coding Results for the IS Personnel Perspective Model

The IS personnel perspective derives from the selective coding process of the data provided by the IS personnel interviewed across the three hospitals. Some of the IS personnel

and are also nurses that continue to practice and provide insights about ubiquitous IS access from multiple perspectives.

The IS personnel provide comments that address implementation issues and insights concerning user acceptance. Since many of the IS personnel were practicing nurses, there comments were filtered for and only the comments related to IS issues are incorporated in this perspective. The IS personnel were either directly involved or closely related to the implementation and subsequent implementations of the technology in their respective hospitals. This perspective is not as rich in detail as the two other perspectives but that is expected considering the IS personnel were not daily users of the technology. The richer comments are provided by the IS personnel that had nurse experience, which is expected. The level of involvement with the users and support varied across the hospitals, which impacted the different levels of systems acceptance. As with the richer comments, the hospitals that employed IS personnel with nurse experience on the implementation teams (i.e., functional experts) had greater instances of system acceptance.

The following figure is a depiction of the IS personnel perspective concerning ubiquitous IS access. A storyline follows to further explain the perspective with integrated analysis. The integrated analysis has been filtered to show comments pertaining directly to IS issues.

See Appendix F for more data associated with this perspective. In Appendix F, the data is unfiltered and comments concerning other issues may be intermingled.

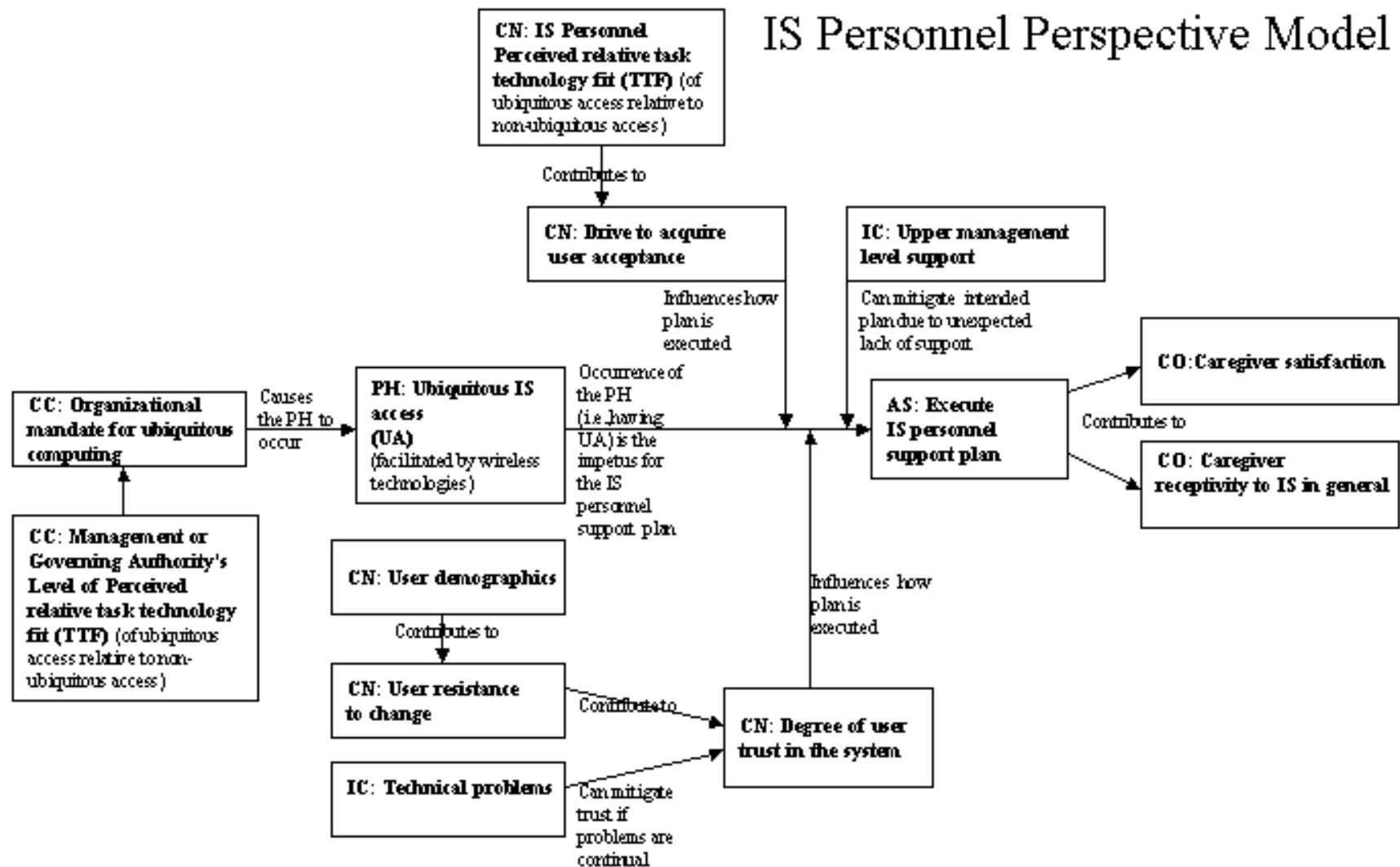


Figure 13 IS Personnel Perspective Model

Storyline for the IS Personnel Perspective

This storyline explains the codes and relationships that comprise the IS Personnel Perspective Model (illustrated in Figure 13), which is based on analysis of the insights provided by IS personnel concerning various aspects of ubiquitous IS access via wireless technologies in their organizations. The IS personnel are those directly involved in the implementation process and their comments reflect justification for their implementation decisions. They provide their perceptions of (1) why organizational mandates were the impetus for the implementing the technology, (2) the factors attributing to their ability to execute a strategy to render IS support the nurses, and (3) the performance impacts related to their strategy for support.

Management Perceived Relative TTF and Organizational Mandate for Ubiquitous IS access

The IS personnel note that the phenomenon occurred because of organizational mandates for caregivers to ubiquitously access information systems via wireless technologies. They believe that management perceived a high degree of fit for ubiquitous IS access relative to methods nurses employed to gather needed information at the point of care. IS personnel commented that this high degree of perceived relative TTF spurred the management or governing authorities to mandate the implementation and use of technologies that provide caregivers with ubiquitous IS access, as noted in the following quote.

Hospital C Nursing Education Manager with Nurse and Nursing Informatics Experience P26: “By the time Barcode Medication Administration (BCMA)¹³ came around we had already moved towards computerized patient information with these other two systems. BCMA augments these systems by showing the nurse the meds that have been ordered and validated, dosages are there, and specific times when they are to be administered. With BCMA no longer is there so much room for error. The VA saw the benefit in this wireless system and then pushed it for a VA nationwide implementation.”

¹³ BCMA is an application that allows caregivers to scan and validate identification information for the patient and medication prior to administering the medication to the patient. Caregivers access BCMA via a laptop mounted on a mobile cart.

Conditions Influencing the Strategy to Execute the IS Support Plan

IS personnel in this study note the importance of supporting their user groups (i.e., the nurses in these implementations) in order to bring about desired outcomes or consequences.

From an IS perspective, there are several conditions that influence the execution of the plan to support ubiquitous IS access. These conditions are as follows: (1) the perceived relative TTF of the IS personnel, (2) the influence of this perceived fit on their drive to acquire user acceptance, (3) upper management level support, and (4) and the degree of user trust in the system, which is directly or indirectly influenced by user demographics, resistance to change, and technical problems with the technology.

Perceived Relative TTF for Ubiquitous IS Access

For the most part, IS personnel in this study understand the nature and components of the task and are able to determine appropriate technology to accommodate task performance. They realize the compatibility or correspondence between task requirements, individual abilities, and functionality of the technology, which influences their perceptions of fit of ubiquitous IS access.

The following excerpt notes this idea.

Hospital C Nursing Education Manager with Nurse and Nursing Informatics Experience

P26: “You would technically have to plug up and sign in and out at each bedside. It's impractical to have the nurses hop scotch up and down. We tried wiring each room at Lakeside but it was really outrageous for us to expect the nurse to plug in and out at every bedside. We went to wireless so that the nurse is in constant contact with her computer. She's not tethered and she can move up and down the ward as needed. If a nurse is with a patient and another patient asks something, she doesn't have to disconnect and go plug in at that patient's location. The nurse can access the patient information from wherever they are in working in the ward.”

This IS person is very adamant about meeting the needs of the nurses. He indicates the infeasibility of non-wireless alternatives to access needed information in patient care. This demonstrates his comprehension of the tasks that the nurses must perform and the capabilities of wireless technologies to aid in documenting and accessing patient information (i.e., the degree of TTF attainable).

Drive to Acquire User Acceptance

This drive refers to the desire to seek the approval and promote the usage of an implemented technology by demonstrating added value (adapted from Lawrence and Nohria, 2002).¹⁴ All of the IS personnel at Hospital C perceived ubiquitous IS access as highly beneficial because of their understanding that the technology is a nearly idea fit for the nurses' tasks (i.e., management's perception of relative TTF).¹⁵ Therefore, they were extremely motivated to gain user acceptance. This is evident in their implementation plan, which called for extensive hands-on training to familiarize the users with both software and hardware capabilities, diligence in maintaining equipment operability, and accommodating the recommendations of the nurses concerning needed system improvements. The following quote relates this idea.

Hospital C Nursing Informatics Manager with Nurse Experience

P27: "National sent a book out with version 1 that was really thick. We are now on version 3. You have to skinny things down for nurses so we have another book that we developed to train with. Nurses don't have a lot of time and training them on the floor does not work because they get interrupted too often. You have to pull them off of the floors for training. That's what happened in version 1, some nurses had to train in the hall. In version 2 we told management

¹⁴ Lawrence and Nohria, 2002). – The Drive to Acquire is defined as the desire to seek, take control, and retain objects and personal experiences humans value.

¹⁵ The rationale is that they are more motivated to seek the approval and promote the usage of an implemented technology by demonstrating added value because they truly believe that ubiquitous IS access is a favorable alternative to normal processes.

that there was too much to learn in version 2 and we could not effectively train nurses on the floor. The nurses still didn't really know how to use the carts and understand the concept of how to change the batteries. There weren't any real directions that came with the carts before. So we did a survey after version 2 and got good feedback about our training manual like "it had good pictures" and "it was thinner". There were a lot of "how to" parts. After version 1 we knew better how to use the system ourselves so we ended up making our own training material. We took some material that other VAs had incorporated and focused on the carts themselves in the class. We had an advanced class in my first year here. The purpose for that class is that when you first train people and then they use it for a while their brains can better accept what you teach them after they have had experience with the it. I wish we could do more of that."

Upper Management Level Support

Upper management level support is an intervening condition that refers to the backing from management to provide funding that aids them in attaining implementation success and desired outcomes or consequences. IS personnel note that unexpected changes in upper management support can mitigate intended plans for IS support. In order for the IS personnel to operationalize the vision of improving patient care using this technology, they need management to provide sufficient funding for equipment, more personnel in some cases, and realistic implementation schedules. The following excerpt illustrates these points.

Hospital C Nursing Informatics Manager with Nurse Experience

P27: "I found that from being at two different hospitals with major implementations that the organizational leaders have to realize that you have to get support and resources. It is going to take a lot of money and time in order not to make everyone mad. You don't want your staff to be leaving and having a high turnover rate because there is already a nursing shortage. You've got to invest upfront. And I find that a lot of organizations are not willing to do that. ...The positive is that the executive leadership agreed to let us wait and now we as the IS support system know the system better than we did back then and can provide better support to ICU."

This IS person comments on how the upper management support is instrumental in the amount of support that the informatics department is able to provide to the nurses, especially in light of mandated uses by its governing institution. The IS personnel at this hospital were concerned about the safety of implementing these technologies without a thorough analysis of

what was needed for the transition to barcode medication administration. The concern spurred from the amount of change to be encountered in the process for validation and instrumentation required for medication delivery. Initially, the time allocated for implementation was not sufficient to ensure that the staff was properly trained and mechanisms were in place to prevent user error that could endanger the patient. The IS personnel felt that it was incumbent upon them as both technical experts and practicing nurses¹⁶ to inform upper management about their concerns that, if unrecognized, could jeopardize their ability to support the implementation.

IS personnel noted that the budgets for these implementations were low (i.e., no more than \$250,000) in comparison to other technology implementations across multiple departments that operate 24 hours a day. They believe upper management must provide recurring funding for them to be able to properly maintain the equipment and/or replace equipment with more suitable devices if deemed necessary based on user feedback. IS personnel made their best judgment about the specific types of devices to employ, which they attempted to account for in their project budgets. They stress that upper management must realize that with new technologies there are a lot of unknowns. IS personnel in this study noted that upper management must be cognizant of this fact and be prepared to allocate additional resources if needed to continue support of the project and have a positive impact on performance. The following excerpt illustrates this point.

Hospital C Organizational Manager with Nursing and IS Experience

P28: “[When asked about upper management level support] The biggest issue was that the equipment wasn't fastest enough to support what we wanted to do. Now you have to view it as an equipment replacement budget plan opposed to you trying to buy something with the best of what you can at the time. The equipment would break down and it really has to be looked at as a

¹⁶ Many of the IS personnel in the Nursing Informatics departments and the MIS departments in all three hospitals were also practicing nurse who performed clinical nursing at least once a month to keep their licenses current.

concern for a recurring budget. The patient is the center of everything you do. You really have to have a passion for this to make it work. You have to have a passion to bring this into the minute-by-minute nursing operations and support this effort. If not the nurses will see this as interference.”

This manager, speaking from an IS personnel perspective, stressed the importance of framing the budget plan to upper management as “recurring” because of the need to replace the equipment that endures wear and tear 24 hours a day. She noted that without working equipment the benefits of ubiquitous IS access at the point of care is a moot point because the caregivers are unable to use the wireless devices; thus performance benefits will be non-existent.

Conditions Attributing to User Trust in the System

Trust in the system refers to the confidence a user has in the accuracy of the information maintained in the information system and in the ability of the technology to operate appropriately. Patient care may call for decision-making in life-threatening situations, which requires not only “access” to needed information but “accuracy” of the data. IS personnel stress to the nurses that the information in the system is only as reliable as the data entered and they, as the users, have to take some responsibility in making the system operable (e.g., following data entry guidelines). Thus, it seems that establishing trust in the system is a partnership between the IS personnel and the system users. The IS personnel have the responsibility of ensuring proper design of the software, hardware functionality, sufficient training, and timely support for trouble calls. Yet, IS personnel in this study indicate that establishing trust in the system is still arduous to obtain in these environments primarily due to resistance of change and technical problems encountered in the implementation, as the following quote illustrates. It seems that that degrees of trust influences how they employ their support plan (e.g., if trust is low then they more actively pursue training initiatives and eagerly respond to trouble calls).

Hospital C Nursing Education Manager with Nurse and Nursing Informatics Experience
P26: “Initially there was a lot of distrust amongst the staff. ...The trust in the system was the thing to overcome.”

Influence of Resistance to Change

The innate aversion of the users to modify or adopt new methods of performing tasks due possibly to fear of not knowing the outcome or an uneasiness about unknown factors can hinder the development of trust the users hold in the system. IS personnel note that user demographics play a role in resistance to change that indirectly hinders trust in the system. The majority of the nurses did not have typing skills and their professional training did not expose them to technologies used in data management and processing. IS personnel emphasize that hospitals are very technically rich environments in terms of medical equipment but many of the organizational members (nurses and physicians alike) do not view information systems used merely for data access and retrieval (i.e., those used for documenting tasks) as essential when compared to those systems used for diagnosis or treatment related to patient care tasks, as these next excerpts show.

Hospital A IS Manager

P4: “They [the nurses] don't realize that just about every system or device they use in this hospital is PC based. They have become very dependent on the technology but if the technology is something that they see as necessary to help them take care of the patient then it's essential. They just don't like change even if it's for the better. Here is an example, in the ED [Emergency Department] they have told us that yes they think it will make their jobs easier but they don't want to have to be responsible for these devices. They even went as far to say not to rely on them to plug them in. They want a dedicated IT staff to deal with recharging them. That's insane but they don't see these types of systems as their own they don't want to take ownership of them like they would a defibrillator. It's strange.”

Hospital A IS Personnel B with Nursing Experience

P5: “The monitor gives them information to make their jobs easier and they can see how critical it is to the patient but the wireless system is there for documenting, which they don't truly respect in the first place and when you add on how they feel about computers then it's intimidating as well.”

IS personnel recognize resistance to change as a major inhibitor to trust but another significant challenge is the amount of technical problems encountered in use.

Influence of Technical Problems

IS personnel recognize that repeated technical problems prompt the notion amongst the users that the system is not reliable, thus why use it. The problems the nurses encountered with the battery failures in the wireless devices, slow processing speeds, poor program design, inept supporting equipment, like the mobile carts that impede mobility between the beds and storage of medical supplies and batteries that repeatedly lose charges, influenced the diminishing of the trust that the system is advantageous to use. In terms of data accuracy, the aforementioned factors in some cases hindered the nurses ability to input data – which led to incomplete or inaccurate patient records. In ACU of Hospital B, the nurses reverted to using manual charts and checklists because of the extreme technical problems encountered with system use. It is interpreted that in this case, the nurses did not establish trust in the system's abilities to meet their needs during task performance, which is evident by their comments and abandonment of system usage. This is an extreme case of the impacts of technical problems on trust. The following excerpt from an IS personnel discusses issues with the battery charges and description of the program design that can influence user trust in the system. The quote also speaks to how these conditions influence the methods they take to support the implementation (i.e., what IS personnel propose to enhance usability and trust).

Hospital C Nursing Education Manager with Nurse and Nursing Informatics Experience
P26: "The biggest problems are that the battery packs lose charges. ...The system determines if it's the right patient based on the SSN on the barcode on the wristband and the right med based on the barcode on the meds packaging. It has fail-safes to check the times to ensure the meds are being administered within the allowable times. There are reminders that in case you got busy or the patient was off the ward and when they got back you were busy and a med was skipped..

Initially there was a lot of distrust amongst the staff. ...one night I was on call and Betty an LPN in one of the wards said that she couldn't find a med in the med record that she knows the patient gets. So I went down and Betty was there in front of her computer saying that the system doesn't have the med there for the patient but she was certain that the patient gets morphine for pain. Well, I said let's minimize this and go into the patients orders and of course his narcotic had expired at midnight. I explained that this is an example of how the system keeps you from making mistakes because the med had actually expired so it dropped off the list of valid meds to give to the patient. She said "Oh, okay." The trust in the system was the thing to overcome. ...The nurses have problems scanning sometimes because either the cords aren't long enough or they just can have a hard time getting in between the beds with the carts. We are getting them cordless scanners."¹⁷

Caregiver Satisfaction

The IS personnel provide accounts of their observations and perceptions concerning the overall contentment of the nurses with ubiquitous IS access via wireless technologies. The aforementioned quotes pertaining to actions (i.e., continual training and 24 hour on call support) that the IS personnel at Hospital C take to support the nurses show their earnest quest to promote nurse satisfaction. Caregiver satisfaction makes the effectiveness of the IS support plan evident. The following quotes are IS personnel perceptions about caregiver satisfaction.

Hospital C Nurse Informatics Manager with Nurse Experience

P27: "Even though, this makes more work for them [the nurses] because of the added steps required for the bar code scanning, they understand that it's much safer for the patients and that makes them want to use it. ...they've told me that it's so much easier for them to get information at the bedside if they have a question or need to check something before administering the med."

¹⁷ The entire system is battery operated but currently the handheld scanners are attached to the mounted laptops via a cord and USB port connection. The nurses have requested wireless scanners as well because the cords length on the handheld scanners are too short in some cases to reach patient's wristbands.

Caregiver Receptivity to IS in General

Caregiver receptivity to IS in general refers to observations and opinions of the IS personnel concerning user openness to IS realized by the decrease in technology aversion. IS personnel noted that training and their level of support is beneficial in decreasing technology aversion, which is interpreted to be an outcome or consequence of their support plan. The following quote speaks to this idea.

Hospital C Nurse Informatics Personnel

P30: [When asked to clarify statements made by the Nursing Informatics Manager in the P27 file¹⁸ concerning “super user” nurses (i.e., those who transfer from the floors to ICU) and user receptiveness to subsequent implementations in other areas in the hospital, P27’s replacement answered as follows] “Some of the nurses who are now our super users were very intimidated by the technology at first but they overcame this in time. Training helped as well. We have really tried to make this an easier transition for them. Word of mouth about what to expect when the wireless carts come helps to get the ICU nurses on board. It's been an easier process implementing this in ICU than on the floors. Overall they don't seem to be as intimidated by the system or us.”

IS personnel made comments about performance impacts such as “they [the nurses] have better documentation”, “human errors are decreased”, or “they [the nurses] can spend more time with the patient”. However, there were no metrics assessing pre-and post performance behavior regarding the aforementioned performance impacts. Also, not every IS person had a medical background to validate these comments pertaining to actual task level performance impacts. Even though these comments are perceptions of the IS personnel (like all other comments provided) they are not included in the IS Perspective Model as consequences because it is

¹⁸ Hospital C Nursing Informatics Manager with Nurse Experience

P27: We have quite a few nurses that were using the barcode system on the floor at some point in the last 3.5 years and now they migrate into the ICU and have experience with it. So we have nurses who have experience with it. The want to go to more complex environments so we are utilizing them in our training as super users to increase our effectiveness of training the ICU personnel.

interpreted that the IS personnel accounts of caregiver satisfaction and general receptivity for IS are much more substantiated by the data. This is expected because these consequences (i.e., caregiver satisfaction and general receptivity to IS) as performance impacts are more salient to IS personnel as opposed to actual assessments of task efficiency or effectiveness.

The IS personnel perspective provides another lens to examine conditions attributing to the phenomenon of ubiquitous IS access, conditions influencing the employed strategy, and consequences of that strategy. This perspective forefronts implementation issues as well as unique qualities associated with the technology, which will be elaborated on in the Discussion section.

CHAPTER 8

DISCUSSION, FUTURE RESEARCH, AND CONCLUSION

The Discussion section addresses (1) statement concerning changes in focus during the study, (2) assessment of bias, validity and reliability, (3) an interpretive cross analysis of the three perspectives, (4) the academic contribution concerning ubiquitous IS access facilitated by wireless technologies, (5) summarized study findings, and (6) recommendations for practitioners. Finally, references to future research and a conclusion to the study are provided.

Study Change in Focus

Initially, this study focused on the task as the unit of analysis and on assessing task performance in light of system utilization. However, the various perspectives reveal that the unit of analysis is actually the system for which all of the tasks are used. Also more factors contributing to system acceptance and utilization were prevalent as opposed to task performance. This is not atypical in grounded theory research because the goal is not to prove or disprove hypotheses but to explore the phenomenon in its context and allow the data to define the focus and explanation for happenings.

Assessment of Bias

The research goal in presenting the three perspectives is to depict views of the stakeholders while understanding the biases of the interviewees and personal biases of the researcher. A common criticism of the qualitative inquiry is that the studies do not adequately

address bias (Schwandt, 1997). The following table describes the three common categories of bias as espoused by Schwandt (1997) and one other in addition to assessments specific to this study.

Table 7 Assessments of Biases

Bias Type	Assessment
1. Bias resulting from (a) an over reliance on accessible or key informants, (b) selective attention to dramatic events of the inquirer in the site of the investigation, or (c) both (Schwandt, 1997)	<p>(a) Of the 47 total quotes used in the Nurse Perspective (NP), 19 are from nurse managers or managers who are practicing nurses and 28 are from non-manager clinical nurses practicing everyday. Even though the nurse managers were more accessible because they could be readily contacted and their interviews were 45 minutes longer on average than the clinical nurses' interviewees, the bulk of data (i.e., approximately 60%) used in explaining the NP derived from the clinical nurses, as expected because the primary task of the clinical nurses is to perform patient care. An over reliance (i.e., 11 of the 47) is detected for the use of quotes from Hospital B PACU Nurse Coordinator (P3). This interviewee is a key informant and was interviewed for an average of 45 minutes longer than the average clinical nurse during two interviews at two different time periods indicated in the research schedule in Table 1. P3 also had a wealth of knowledge both as a practicing nurse who uses the technology and as a manager that was directly involved in the implementation decisions, which contributes to the reliance on her comments. The Organizational Manager Perspective does not reveal an over reliance on any particular respondent (i.e., quotes used in the write-ups averaged 2 to 3 per respondent). However, an over reliance is detected in the IS Personnel Perspective for quotes provided from the Nursing Education Manager with Nurse Experience (P26) (i.e., 4 of 11 or 36% of the quotes used to explain the IS perspective derived from P26). P26 is a key informant that also serves as the secondary point of contact for Hospital C. He possessed a wealth of knowledge as a practicing nurse experienced with and without ubiquitous IS access and as an IS person concerning implementations of the technology in multiple sites and varying task environments.</p> <p>(b) No selective attention to significant events is recorded.</p>
2. Biasing effects from the presence of the inquirer in the site of the investigation (Schwandt, 1997)	One interviewee from a clinical ACU Nurse at Hospital B and one from a Floor nurse at Hospital C were excluded from the data set because the nurses seemed to be overly concerned with managerial repercussions about their comments. Despite providing them with a confidentiality statement and ensuring them that I was not a member of the organization but rather an academic conducting research these two nurses seemed intimidated by my presence, which was evident by their terse answers and demonstrated nervousness (i.e., fidgeting, low eye contact, and pencil biting). These nurses requested that their comments not be taped or recorded in writing. These

Bias Type	Assessment
	<p>nurses did not provide constructive comments worth inclusion in the study.</p> <p>The other nurses in the study seemed to appreciate the inquiry into how they assess the fit of the technology and provided noteworthy comments. Patient/caregiver confidentiality and safety concerns precluded me from entering patient rooms to observe usage of the technology; however, I observed from the halls and my presence did not seem to change how the nurses used the technology to perform patient care tasks. In most cases the nurses were unaware of my presence and observations.</p> <p>Organizational managers and IS personnel at Hospitals A and C were eager to speak with me about their adoption and implementation decisions. Their candid comments did not reflect a bias based on my presence. However, this effect was detected from the MIS Director at Hospital B, who was overly positive about the impact of the technology in PACU and ACU and seemed a little reluctant at first to authorize the interviews with the user groups.</p>
3. Biases stemming from the effects of the respondents and the site on the inquirer (Schwandt, 1997)	<p>I do admit a bias that has resulted in the over reliance of quotes from the PACU administrator at Hospital B. Since she had experience with ubiquitous IS access in both ACU and PACU and I interviewed her extensively prior to entering ACU, I believe I had a pre-conceived notion about the fit of the technology in ACU prior to entering ACU. However, I do not feel that that this notion manifested into a predisposition that tainted the data in anyway. I used the same questions as a frame for guiding the interviews and spent on average the same amount of time with each ACU nurse as I did with each PACU nurse.</p> <p>I will note that I gained great respect for the nurses and their dedication to their profession that I believe that this was demonstrated in my dealings with each of them, which aided me in establishing trust with interviewees. This trust allowed them to uninhibitedly provide comments, in most cases.</p>
4. Over-sensitization to theory	<p>One can argue that the salient literature base, which theoretically sensitizes the researcher, also contributes to researcher bias. The knowledge of this literature base not only aid in concept labeling but also can predisposition the researcher (e.g., spur a pro-technology bias especially for an IS academic conducting IS research). However, the goal is to minimize the impact of over-sensitization of theory by applying systematic data analysis (e.g., data gathering in multiple sites, ensuring trustworthy data sources that provide multiple perspectives for content richness, periodic external reviews to detect a research bias (e.g., committee review), and the use of multiple data artifacts for triangulation).</p>

Some prejudice is an inescapable condition of being and knowing but it is incumbent upon the qualitative researcher to pro-actively distinguish enabling from disabling prejudicial bias to adequately depict the reality presented by the study participants (Gadamer, 1988).

“Fieldwork requires the active, sustained and long-term involvement of the inquirer with respondents and the cultivation of empathy with an attachment to the people one studies to gain access to their own understandings of their life ways (Schwandt, 1997, pg. 9).”

Another source of bias derives from the respondent selection and can be a limitation of this study. Organizational points of contact at Hospitals A and C selected the interviewees. However, the points of contact at Hospital A and C were told that in order to ensure the integrity and present an accurate view of the phenomenon each interviewee selected must be able to give constructive/relevant comments and unbridled by organizational propaganda concerning the phenomenon. Hospital B allowed nurses to volunteer for study participation and allowed the researcher to randomly select participants. All study participants were assured that their statements were confidential and all organizational titles and individual names would be masked. Yet, it was essential to note that positions would be used that aid in sorting the data for the perspectives. Even under the circumstances regarding study participant selection in all three hospitals, it is believed that the study participants gave honest comments, without fear of organizational repercussions, which resulted in true depictions of their perceptions regarding the phenomenon.

Assessment of Validity

In social science, validity is an epistemic criterion that assesses the truth and certainty of the findings of the inquiry (Schwandt, 1997). *Truth* pertains to how accurately the findings represent the phenomena to which they refer. *Certainty* addresses how well the evidence supports the findings and there are no good grounds for doubting the findings (Schwandt, 1997). “In the case of qualitative observations, the issue of validity ... is a question of whether the

researcher sees what he or she thinks he or she sees (Kirk and Miller, 1986, pg. 21).” The following table describes two types of validity according to Kirk and Miller (1986) and four characteristics that aid in evaluating validity by Leininger (1994) in qualitative research accompanied by assessments particular to this study.

Table 8 Assessment of Validity

Validity Type	Assessment
1. Apparent/Face Validity - assesses whether the claim (1) accurately represents the social phenomenon and (2) if its plausible and credible given the nature of the phenomenon being investigated, the circumstances of the research; however, interpretative research does not make absolute claims of truth but rather the best depiction of the phenomenon based on conditions in a particular context (Kirk and Miller, 1986)	<p>The use of the three perspectives that emerge from the data lend credence to the idea that no one single truth explains the social phenomenon. It is plausible that these views differ in some regards because of the different paradigms of the stakeholders. The dissertation committee and the primary point of contact for research sponsored by the Center of Healthcare Management at IBM who possesses a wealth of knowledge on IS issues in healthcare reviewed the models and attest to the plausibility of the perspectives and certainty of how well the data supports the findings.</p> <p>The interviewees either have first-hand or observant knowledge of task performance with and without the ubiquitous IS access and express utility for the technology. Because of this expressed utility for ubiquitous IS access and the wealth of practitioner literature that notes the potential utility for the technology, healthcare providers in hospitals are credible sources for data.</p>
2. Theoretical /Construct Validity – assesses whether there is substantial evidence that the theoretical paradigm rightly corresponds to observations (Kirk and Miller, 1986)	<p>Since Grounded theory is the primary method, theory serves to sensitize that aids in the identification and labeling of concepts in the data that parallel existing constructs. Where applicable, the codes and relationships are labeled in accordance with existing theory and are accompanied by definitions of the respective construct and contextual adaptations of the definitions when necessary. The dissertation committee, which possesses knowledge of the applicable theory also assesses (1) how well the codes and relationships correspond with interpretations of the data and (2) proper usage when codes and relationships parallel constructs that exist in established literature.</p>
3. Credibility - refers to the accuracy or credibility of the findings, or it can be described as a “truth formulating process” between the researcher and the informants (Leininger, 1994)	<p>This validity criterion is very similar to apparent/face validity. The main difference is the second interpretation concerning the “truth formulating process” between the informants and the researcher, which is addressed as follows. I made initial contact with IS personnel (e.g., the CIO at Hospital A, the MIS Department Director at Hospital B, and the Manager for Nursing Informatics at Hospital C) in each hospital to determine the status of their wireless implementations and possibilities of interviewing their user groups. The organizational POCs identified the departments and personnel that they deemed to be credible sources of information</p>

Validity Type	Assessment
	<p>because they had first hand pre-and post implementation knowledge. Prior to actual interviews, each hospital required review of my research proposal and credentials either in a formal institutional review board (IRB) process or with selected organizational members that would potentially be involved in the study. The organizations wanted to ensure that I was a credible academic with the sole intention of conducting benign research that would protect the confidentiality of the study participants and the organization. Since I do not possess a healthcare background, the IS personnel formally introduced me to the primary nurse manager POCs, with whom I dealt extensively over the past year. These nurse manager POCs authorized the clinical nurses to speak with me and initiated our rapport. With the exception of two nurses, the majority gave candid answers about the technology, the implementation process, and organizational support. They also seemed eager to provide their opinions. Knowing that I did not have a medical background the nurses were very descriptive about the tasks they performed with and without ubiquitous IS access or pre-and post implementation of the technology. Repeated entry and periodic updates as to my research progress with the nurse manager POCs who relayed this to the clinical nurses aided in establishing a good relationship with the study participants. Additionally, allowing the nurses to ask questions of me concerning the study or my background, using a mix of semi-structured and open-ended questions aided in establishing a “truth formulating process.</p>
<p>4. Confirmability - means reaffirming what is interpreted by the researcher concerning the phenomenon is accurate (Leininger, 1994)</p>	<p>There are 38 interviews total. After each session of interviews at each hospital the nurse manager POC and/or the IS personnel POC was briefed on any significant findings and the general conduct of the interviews. POCs were forwarded transcripts of their interviews at the end of the data collection for both time periods to confirm that the recordings were accurate. Periodically during transcription or data analysis I would have to contact the interviewee or POC to clarify or confirm an interpreted concept. Throughout the development of the perspectives, I used the dissertation committee to confirm the coding of the theoretical concepts based on actual data excerpts.</p>
<p>5. Meaning in context - means that the data become understandable with relevant meanings to the informants within their familiar and natural living and environmental context (Leininger, 1994)</p>	<p>To be able to meet this criterion, the researcher has to understand the situations and activities described and be able to transfer them to a reader audience. The interviewees always clarified my questions about their vernacular or acronyms to help discern actually what was entailed in patient care task and the role that they deemed ubiquitous IS access played. Gaining insight into the three perspectives of the three different stakeholder groups afforded a greater contextual understanding of this phenomenon from varying views. The fact that the interviews took place in the task environment of the observed phenomenon and that pictures were taken of the environment aids in constructing meaning in context.</p>
<p>6. Recurrent patterning refers to documented evidence of repeated patterns, themes, and acts over time reflecting the consistency of lifeways or</p>	<p>The coding of the data in accordance with the paradigm model allowed for the emergence of documented evidence concerning recurring patterns, themes, and relationships over the period of data collections and analysis. This validity criterion is also related to diachronic reliability, which is discussed in the Assessment of Reliability Section.</p>

Validity Type	Assessment
patterned behaviors (Leininger, 1994)	
7. Saturation - refers to content-rich knowledge about the phenomenon studied. It means that the researcher has conducted an exhaustive investigation and there is no further data or insights coming from the informants or situations (Leininger, 1994)	I continued data collection during each time period until the interviewees did not produce any new information and there was clarity concerning their perspective. I deem the quality of comments provided by the informants as more pertinent to the validity of the study as opposed to the quantity of informants. Additionally, triangulation (via varying methods of data collection such as artifact review and observation) provided a means to identify new concepts and/or confirm saturation. See the Synchronic Reliability for more discussion on triangulation.
8. Transferability refers to whether or not the findings of the study will have similar meanings and relevance in another similar situation or context (Leininger, 1994)	The purpose of a qualitative study is to elicit in-depth knowledge about the phenomenon studied not knowledge that can be generalized (Leininger, 1994). However, the perspectives denote concepts that are applicable in explaining the phenomenon of ubiquitous IS access in other contexts. Phase I identified other industries, professions, and contexts that the perspectives could aid in explaining the phenomenon in similar task environments that require appeasement of stakeholder drives on various level. The Contribution to Academic Research section discusses this concept and the application of ubiquitous IS access as a technology in other contexts.

Assessment of Reliability

In social science, “reliability is an epistemic criterion thought to be necessary but not sufficient for establishing the truth of an account or interpretation of social phenomenon (Schwandt, 1997, pg. 226).” Traditionally, an account is reliable if it is replicable. Yet, some social scientists believe that reliability in qualitative study is a fiction because no investigator can ever literally replicate another’s fieldwork (Schwandt, 1997). Kirk and Miller (1986) emphasize the importance of repeatability of observations within and across data sets to demonstrate how the researcher reaches theoretical sensitivity (i.e., the state at which no new data emerges). The following table addresses two types of reliability advocated by Kirk and Miller (1986) accompanied by assessments specific to this study.

Table 9 Assessment of Reliability

Reliability Types	Assessment
<p>1. Synchronic Reliability – assesses the similarity of observations within the same time period across different methods (e.g., observation, interview, and artifact review) (Kirk and Miller, 1986)</p>	<p>Triangulation of data derived from artifacts such as training manuals and implementation plans with observations of use and actual quotes attest to the reliability of the interpretations depicted in the perspectives.</p> <p>For example, a review of the implementation plan and training manuals at Hospital C revealed how the IS personnel intended to support the implementation to promote user acceptance, how training should be conducted, and a schedule for implementation. The following quote illustrates drive for user acceptance that is evident in the documented artifacts.</p> <p>Hospital C Nursing Informatics Manager P27: National sent a book out with version 1 that was really thick.... You have to skinny things down for nurses so we have another book that we developed to train with. Nurses don't have a lot of time and training them on the floor does not work because they get interrupted too often. You have to pull them off of the floors for training. That's what happened in version 1, some nurses had to train in the hall. In version 2 we told management that there was too much to learn in version 2 and we could not effectively train nurses on the floor. The nurses still didn't really know how to use the carts and understand the concept of how to change the batteries. There weren't any real directions that came with the carts before. So we did a survey after version 2 and got good feedback about our training manual like "it had good pictures" an "it was thinner". There was a lot of "how to" parts. After version 1 we knew better how to use the system our selves so we ended up making our own training material. We took some material that other VAs had incorporated and focused on the carts themselves in the class. We had an advanced class in my first year here. The purpose for that class is that when you first train people and then they use it for a while their brains can better accept what you teach them after they have had experience with the it. I wish we could do more of that.”</p>
<p>2. Diachronic Reliability – assesses the similarity of observations across data drawn from different time periods</p>	<p>The research schedule in Table 1 reflects the two time periods in which data were collected. There was no significant change in the perceptions of fit amongst the healthcare providers reflected in the data from the two time periods for PACU of Hospital B and the floor units at Hospital C, most likely this is because the technology had been in use for over a year at Hospital B and over three years at Hospital C during the 1st entry; thus, the 2nd entry confirmed findings from the 1st entry. However, the perceptions of the fit of ubiquitous IS access became increasingly negative in ACU of Hospital B from the 1st entry compared to the 2nd entry, which resulted in system abandonment as the following quotes illustrate.</p> <p>Hospital B ACU Nurse Manager during 1st entry P20: “We went live last October of 2001. So we're a good year now on</p>

Reliability Types	Assessment
	<p>the computers...Unfortunately we lose our charge here on our batteries sometimes and we've learned a little, it's not as great as what we were anticipating. But we try to do all of our documentation using the new system... anything that we do on the patient we document here in our [wireless] computers.”</p> <p>Hospital B ACU Nurse B during 2nd entry P12: “I mainly work in the GI lab and because we work at such fast pace it took so much longer for us to do our assessment on the computer. It was mainly the program. It just wasn't friendly. You had to type in everything and before we had printout with the information and we didn't have to write all of that out on the assessment checklist. But with the computer all of that was time consuming.... I loved the wireless part of it. I could go from patient suite to suite and if the thing didn't have so many bugs in it I could see where it really would have reduced charting time and potential for errors. Even with the assessment checklist, occasionally you would miss something and a lot of nurses put important information in the narrative. So if the doctor asked you a particular question and maybe you didn't do the initial assessment and had to look it up. It would be in the narrative, which takes a while to get through. We were told that it would make charting faster and we could take it with us from patient to patient. So you could have the information when you needed. If the system worked the way it was supposed to that would have been so great...we didn't use it long.”</p>

An Interpretive Cross Perspective Analysis

The stakeholders in this study provided comments salient to their involvement and perceptions concerning ubiquitous IS access within their organizations and depicts the differences in how the groups of stakeholders view ubiquitous IS access. The nurses gave accounts pertaining to actual use - in essence answering the question “Does it work or not?” Where as, the organizational managers’ answers addressed “Why they did it?” (i.e., adoption decision justifications). The IS personnel spoke about “How it was done?” This research shows the funneling effect that relates organizational goals to mechanisms in place to accomplish those goals both at the organizational and task level. Based on this research, one can envision how performance impacts, due to the use of a technology that provides high task-technology fit, are

aggregated and contributes to organizational goal accomplishment. There is a mutual adaptation process (between the organizational goals, strategies to facilitate goal accomplishment, required tasks, and individual characteristics) that makes ubiquitous IS access fit in environments that require point-of-service/care work even before the technology is appropriated.

Differences in Core Model Components

Perceived relative task technology fit (TTF) is a common condition noted in all perspectives but has different connotations in each. The nurses' comments are interpreted to show that their perceived relative TTF influenced the perceived relative TTF of the organizational managers that ultimately called for implementation and mandatory use of the technologies supporting ubiquitous IS access. In this case, perceived relative TTF is a causal condition. However, despite many of the nurses being intimidated by the technology, they did believe that the technology would be advantageous over prior methods for accessing data at the point of care and thought that their perceptions contributed to the organization's decision to mandate use. One may question if these nurses earnestly felt this way or if they were buying into the organizational propaganda. From examining body language in the interviews and analyzing the statements, the majority of the nurses truly saw the potential benefit and this impacted the perceptions of use more so than simply agreeing with the "party line" perception (i.e., the perceived fit espoused by the organizational managers). One possible reason is that nurses see this as an attempt by the organization to improve work conditions, which organizational managers know is imperative to recruiting and retaining nurses. The organizational managers also see perceived relative TTF as a causal condition that promotes the organizational mandate.

However, the IS Personnel Perspective depicts perceived relative TTF not as a causal condition, but as a contextual condition. In all cases, the IS personnel were mandated to implement the technology. Therefore, their perception of how advantageous ubiquitous IS access was not the cause for the technology implementation, but rather a factor that contributed to their drive for acquiring user acceptance. For example, at Hospital C, the governing institution in the Federal government mandated use and provided a set of non-descriptive guidelines for the implementation. All of the IS personnel interviewed at Hospital C possessed both technical knowledge about ubiquitous IS access and practical knowledge because they clinically practiced periodically, either in Hospital C or other local hospitals, to maintain their clinical licenses. Thus, they have dual knowledge of the utility of ubiquitous IS access. They commented on how they perceived ubiquitous IS access as a better fit for accessing and manipulating patient information during patient care as opposed to previous methods and could understand why their governing organization deemed it necessary to implement and mandate the technology. These IS persons had a high degree of perceived relative fit as opposed to the IS personnel at Hospital B, whose comments indicated that they had moderate perceived relative TTF.

The IS personnel at Hospital B were not adequately involved in the implementation process and, based on nurse comments, did not seem to be overwhelmingly concerned with ensuring user acceptance. This may possibly due to the lack of clinical nursing experience amongst the IS personnel at Hospital B. Only one IS person interviewed had practical healthcare experience but she was not actively practicing. After the initial interview of IS personnel at Hospital B, this IS person became the Administrator of Perioperative Services. Her comments did not reflect an overwhelming desire to seek user acceptance even though she acknowledged ubiquitous IS access as a better fit for data access to support the way nurses work. Her

comments were consistent with the MIS Department Director at Hospital B. The IS personnel at Hospital C were diligent in their involvement to promote user acceptance because of their perceptions of fit were grounded in their technical and practical judgment of utility. IS personnel at Hospital A also exhibited a high perception for relative TTF and are industriously employing methods to promote user acceptance such as extensive user involvement in systems development, device selection, and beta testing. Additionally, nurses comments about the level of support rendered by their respective IS departments attests to the differences in the IS personnel drives to acquire user acceptance.

One point that is evident in each perspective is that the stakeholders' views of technology are based on the purpose it serves (i.e., diagnosis, treatment, or document). The IS personnel and organizational managers note how nurses do not view technology for documenting as important as systems that diagnose or treat patients, which was substantiated by the nurses as the following quotes illustrates:

Hospital B PACU Nurse Coordinator

P3: "I guess if someone said I had a choice of a system to go down I would choose the wireless because we need the monitors to track the vitals and we could always go back to manual charting if we had to."

Based on the three perspectives, it appears that upper management or the executive leaders also share the same perception of the nurses that information systems used for documentation are not as essential as technologies used for diagnosis and treatment, which is consistent with conservative management. Conservative management often entails not viewing IS as essential to the core of business but rather a peripheral mechanism that merely aids in but is

not essential to achieving goals.¹⁹ Possibly this is the reason for the low budgets provided by the executive leadership to fund purely IS/IT endeavors, which organizational managers and IS personnel noted. Until ubiquitous IS access becomes the dominant design for the healthcare industry, upper management's view of the technology is unlikely to change.

Dominant design is a concept, which states that a technological innovation is realized after a subsequent era of ferment in an industry (i.e., a basic architecture of product or process that becomes the accepted market standard) (Abernathy and Utterback, 1978). Even though nearly 30% of all US hospitals are implementing in some part of their organizations, it still is not dominant across all departments within hospitals or throughout the industry. Yet, one can assume that ubiquitous IS access will become the dominant design due to the nearly ideal perceived relative TTF and actual performance outcomes depicted in all perspectives but only if mitigating conditions such as technical problems are overcome.

A point common across all perspectives is the absence of a consequence noting a change in the decision-making or authority structure within the departments. The data do not support any evidence of organizational structural changes. This may be due to the fact that despite the better means of accessing patient information, the nurses cannot change physician orders or prescribe for a patient. Decisions about major medical interventions are the responsibilities of the physicians and not the nurses. However, ubiquitous IS access aids the nurses in timelier means of accessing and accurately documenting patient information, which can provide the physician with needed information to more effectively diagnose patients.

The perspectives reveal that the high TTF provided by ubiquitous IS access promotes performance outcomes but only if specific strategies are employed (i.e., success is not guaranteed

¹⁹ Concepts of conventional management noted in "Management in the 1980s" by Leavitt and Whisler (1958).

in all contexts and under all conditions). Initially, it seemed that ubiquitous IS access was a poor fit for nurses in ACU of Hospital B because of its hectic environment, high degree of distractions from the patient and their family/friends, and significant technology intimidation amongst the nurses; however, further analysis of the data revealed that the poor performance impacts related to use of the technology were primarily because of software and hardware flaws that made use cumbersome. The floor nurses at Hospital C operate in virtually the same type of environment as the ACU nurses in Hospital B (see Table 6 for task environment descriptions). However at Hospital C there were minimal software and hardware problems contributing to realization of high fit. An ACU nurse at Hospital B even commented that if the system worked properly, mobility could have been beneficial:

Hospital B ACU Nurse A

P2: “We were happy about getting something that would help us spend more time with patient. But this wasn't the case...Apparently there was a miscommunication about how long we were going to need the computers each day...We needed them around the clock. The batteries kept dying on us and they would lock up. Then it got to the point that the batteries died out and we had to keep them plugged up all over the place... I noticed I wasn't making as much eye contact and I stopped bringing it into the room... The program was so cumbersome that it made things too difficult and you felt too rushed to deal with the patient... The biggest problem was that it wasn't charting by exception. A lot of the stuff was repetitive and it just took up too much time. It just didn't seem nurse friendly and it wasn't the right set up. The sell of the whole idea was that it was going to be quicker, more efficient, less writing so less of a chance of making errors or having legibility problems. The program itself didn't work well. It was totally disorganized and even though I could take it where I needed to go (when the battery was charged) the program on the computer was just cumbersome ...it was very overwhelming.... It is a shame really that it wasn't "nurse friendly". Yeah, you now sometimes you get asked if such is ready yet or more frequently is the patient ready for discharge and you might get asked when you are away from the chart. So yes, if the software worked then it would be easier to get to the documentation about the status.”

A noted difference across the three perspectives is the assessment of performance. Since these are different perspectives, it is expected that each would indicate different outcomes associated with the ubiquitous IS access. For nurses, the outcomes are purely task oriented,

where as the organizational managers note satisfaction and general process improvements, and IS personnel indirectly associated the technology to general user receptivity of other enabling IS. What we learn from the three perspectives concerning performance assessment is that this technology provides benefits on varying levels. However, this is not to say that these perspectives show that ubiquitous IS access is a “magic bullet kind of technology” but rather a significant improvement in how data are accessed and manipulated during patient care, which is a vehicle for successful task completion because it fits the way nurses do their work. Additionally, the perspectives reveal the aggregated benefits resulting from successful task completion that contributes to sub-unit and organizational goal accomplishment.

Similarities and Differences in Insights Provided by the Perspectives

As far as expectations of the system facilitating ubiquitous IS access, the organizational manager and IS personnel perspectives reveal expected factors that are common to nearly all information systems. They both disclose goals or drives that influence perceptions of fit and expected performance impacts that do not necessarily highlight the unique nature of ubiquitous IS access. In essence, the organizational manager and IS personnel perspectives contribute little to extending knowledge concerning technology adoption, acceptance, and ultimate realization of performance benefits. This is primarily because the organizational managers and IS personnel are somewhat removed from actual performance of the task and cannot expound on real impacts of environmental factors and human drives of the actual caregivers on perception of fit, actual fit, utilization, or performance. It is only the nurses, the most affected by the system, whose perspective divulges the impact of environment and suggests that human drives can reign

superior, influence perceived and actual fit, thwart system use and hinder performance under certain conditions in light having ubiquitous IS access.

Lawrence and Nohria (2002) assert that four fundamental human drives (i.e., drive to acquire belongings for well-being, the drive to bond with other human beings, the drive to learn about our environment, and the drive to defend from threats) impact all human behavior. The nurse perspective reveals insights about the influence of the drive to bond, the drive to learn, and the drive to defend on perceived relative task technology fit for ubiquitous IS access. The data show that in certain environments (e.g., closed like PACU vs open like ACU and the regular in-patient hospital floors) and for different tasks the strength of the drive can greatly influence the extent of use and realized performance. The following table notes the influence of the human drives in context across different environments based on the nurse perspective.

Table 10 Influence of Drives Across Different Environments

Environment Vs Drive	Drive to Bond (with the patient to establish trust and lower patient anxiety to enable task performance with less impediment)	Drive to Learn (information about the patient)	Drive to Defend (from liabilities because of ability to thoroughly document patient/caregiver interaction)
Closed - Secured to visitors - Anesthetized patients - Little distractions from other caregivers or other patients - Low nurse to patient ratio (i.e., low work volume)	<i>-Drive Characteristic</i> Low or unnecessary because of the unconscious status of the patient. None of the 8 PACU nurses interviewed noted the need to bond with the patient to ease anxiety or establish patient/caregiver trust. <i>-Impact on Perception and Realization of System Fit</i> Bonding is not a driver because of the patient's	<i>-Drive Characteristic</i> High because of the need to rely on documentation because the patient cannot provide or validate information due to their unconscious state. 8 of the 8 nurses interviewed in PACU noted the importance of learning about the patient or accessing patient information via the system. <i>-Impact on Perception and Realization of System</i>	<i>-Drive Characteristic</i> Moderate because the majority of nurses did not view the benefits of using the system to guard from liabilities unless they had been called to deposition in a legal suit and required to provide documentation of their patient interaction. Only 3 of the 8 PACU nurses interviewed noted any relationship between ubiquitous IS access and appeasing a drive to defend against liabilities and these 3 nurses had all been

Environment Vs Drive	Drive to Bond (with the patient to establish trust and lower patient anxiety to enable task performance with less impediment)	Drive to Learn (information about the patient)	Drive to Defend (from liabilities because of ability to thoroughly document patient/caregiver interaction)
	<p>status. However, use is high because of adequate design, lack of distractions, no aversion to using the system despite technology aversion because of no fear of appearing incompetent to patients due to the patient's status.</p> <p>- <i>Supporting Data</i></p> <p>Hospital B PACU Nurse Manager: "I think it's great. The best thing is that you can do bedside charting. The nurse to patient ratio for us is very low compared to PACU. ...we have a small contained unit. We don't have a lot of distractions like over there [referring to ACU]."</p> <p>Hospital B PACU Nurse C: "Most of what we do is monitor [because the patients are anesthetized] so having the wireless system helps us stay right there at all times at the patient's bedside and be able to chart. ...I am not used to computers at all but this system is really easy."</p>	<p><i>Fit</i></p> <p>Learning is the superior driver because of poor fit relative to alternative methods of gaining patient information. Use is high because of adequate design that incorporates charting by exception, which allows easy access to data and ability to quickly document as they work.</p> <p>- <i>Supporting Data</i></p> <p>Hospital B PACU Nurse C: "I think it's wonderful. Sometimes I won't know what a particular code is and as opposed to asking someone I just look it up on the computer. I can wheel it with me to each area that I go into. I think it's great and it is so much better than writing or looking through a chart. I feel like I don't miss anything."</p>	<p>involved in a deposition process.</p> <p>-<i>Impact on Perception and Realization of System Fit</i></p> <p>Defending is second to Learning as a driver. The ability to learn about and assess task efficiency and effectiveness of caregivers performing patient care overrides the desire to defend from liabilities and the primary driver influencing perception of fit and system use.</p> <p>- <i>Supporting Data</i></p> <p>Hospital B PACU Nurse D: "Nowadays all the legal stuff that goes with healthcare it's critical that you be able to justify everything that you do. Because you know with all the law suits nowadays everything you do ill be looked at and you have to say why you did this and that. It's better if you have it all documented. I like this system because I know it's hard to miss something so itreally covers us. Before either you might overlook something because a lot was done by narrative or you just forgot because you didn't have time to write it down. Everything is really there for you and if you forget to put something in put</p>

Environment Vs Drive	Drive to Bond (with the patient to establish trust and lower patient anxiety to enable task performance with less impediment)	Drive to Learn (information about the patient)	Drive to Defend (from liabilities because of ability to thoroughly document patient/caregiver interaction)
			something in that doesn't make sense it will tell you. I mean you can't go pass that part. It really helps us out and kinda takes the burden off of having to remember so much or take down notes and then write it on a chart when you get a chance. Especially when you get busy it's hard to remember every little detail of what you did or what the patient did.”
Open - Nonsecured to visitors - Unanesthetized patients - High distractions from other caregivers and other patients - Medium to high nurse to patient ration (i.e., high work volume)	<p><i>-Drive Characteristic</i></p> <p>High or necessary because of the conscious status of the patient. All of the 8 nurses interviewed in ACU noted the importance of bonding with the patient to ease anxiety and establish trust.</p> <p><i>-Impact on Perception and Realization of System Fit</i></p> <p>Bonding is the superior driver because of the patient’s status. It is necessary to bond and establish trust with the patient to calm the patients’ anxieties that if unattended impairs the nurses’ abilities to render proper care. This in turn can impede services and slow patient throughput. Poor program design and numerous environmental</p>	<p><i>-Drive Characteristic</i></p> <p>Moderate because the need to rely on documentation is not as crucial as in PACU because patients can provide or validate information like level of pain or confirmation of medications taken due to their conscious status. All of the 8 nurses interviewed mentioned the need to learn information about the patient and the varying methods for doing so (i.e., via the manual chart, asking the patient, or from the system). Since the system was deemed as a poor fit, the drive to learn about the patient using it was not superior.</p> <p><i>-Impact on Perception and Realization of System Fit</i></p>	<p><i>-Drive Characteristic</i></p> <p>Moderate because the majority of nurses did not view the benefits of using the system to guard from liabilities unless they had been called to deposition in a legal suit and required to provide documentation of their patient interaction. Only 1 of the 8 ACU nurses interviewed noted any relationship between ubiquitous IS access and appeasing a drive to defend against liabilities and this 1 nurse was the unit manager and that personally designed the screens for the system with very little input from the unit. The data from the non-manager type nurses in the unit vehemently show her comments are not a true depiction of the impact of the technology in ACU).</p>

Environment Vs Drive	Drive to Bond (with the patient to establish trust and lower patient anxiety to enable task performance with less impediment)	Drive to Learn (information about the patient)	Drive to Defend (from liabilities because of ability to thoroughly document patient/caregiver interaction)
	<p>distractions can hinder the nurses' ability to attend to the patient's needs, thus ubiquitous IS access or use of the system at the bedside becomes an impediment in the patient/caregiver relationship. Use is low under these circumstances because the nurses fear blemished their image with the patient (i.e., fear of appearing incompetent to patients due to the conscious patient's status).</p> <p>- <i>Supporting Data</i></p> <p>Hospital B ACU Nurse A: At first I would take them into the room because I was comfortable with...I noticed I wasn't making as much eye contact and I stopped bringing it into the room when the patient was conscious. When we are not making eye contact with the patient and making eye contact is crucial to easing the patient's nerves about their upcoming surgery. Our patients come in very nervous and we like to talk to them ask about their kids and let them get to know us. If they don't trust that you are going to take care of them they their anxiety goes up which is an emotion but this causes physical</p>	<p>Learning is the second to bonding because if the system is poor fit as in ACU the nurse can revert to gathering and validating information directly from the patient. Use was low and later non-existent because of low actual fit in this environment (i.e., inadequate design that did not incorporates charting by exception and caused the low patient/caregiver eye contact in light of high levels of distractions.</p> <p>- <i>Supporting Data</i></p> <p>Hospital B ACU Nurse B: "I felt like it always took my attention away from the patient. I didn't make eye contact because I would have to fiddle with the computer. I like computers but this system was so bad that it really made more work for us than anything. In fact, we went from having three sheets to six for just one patient. And the screens were arranged kinda weird so you would think you would out like items with like items but they were all over the place. It slowed us down so we stopped using them. I need to talk to the patient to make sure they are okay and calm them down</p>	<p>-<i>Impact on Perception and Realization of System Fit</i></p> <p>Defending was not mentioned as a primary drive or concern in ACU in ?. The ability to learn about and assess task efficiency and effectiveness of caregivers performing patient care is overrides the desire to defend from liabilities and the primary driver influencing perception of fit and system use.</p> <p>- <i>Supporting Data</i></p> <p>None</p>

Environment Vs Drive	Drive to Bond (with the patient to establish trust and lower patient anxiety to enable task performance with less impediment)	Drive to Learn (information about the patient)	Drive to Defend (from liabilities because of ability to thoroughly document patient/caregiver interaction)
	<p>problems like blood pressure increase or nausea and you have to stabilize them before getting them ready for surgery so this delays the process. Having the computers there by the bedside kept us from doing our jobs to some degree. When I had that computer I noticed that I was too concerned about getting the information into the computer and printed out before the patient went to surgery. The program was so cumbersome that it made things too difficult and you felt too rushed to deal with the patient. I don't like that. We all said that the patient is our priority not that computer."</p>	<p>a little so we can administer the anesthesia for the procedures. If I'm fumbling with the computer then I can't do that."</p>	

Table 11 Influence of Drives Across Different Tasks

Task Vs Drive	Drive to Bond (with the patient to establish trust and lower patient anxiety to enable task performance with less impediment)	Drive to Learn (information about the patient)	Drive to Defend (from liabilities because of ability to thoroughly document patient/caregiver interaction)
Electronic Charting (observed in ACU and PACU of Hospital B)	<p><i>-Drive Characteristic</i></p> <p>The Drive to Bond is very important when charting on conscious patients and not a major concern when charting on unconscious patients based on data from ACU and PACU. All 8 of the ACU noted influence of the drive to bond with the patient but none of the 8 interviewed in PACU noted it as a concern in charting.</p> <p><i>-Impact on Perception and Realization of System Fit</i></p> <p>Nurses performing e-charting in all of the units involved in this study initially perceived ubiquitous IS access as advantageous for charting because of the convenience in documented provided by the system. Having ubiquitous IS access and incorporating charting my exception aids nurses in PACU to chart effectively and efficiently while they perform patient assessments with less impediments, which has resulted in a decrease in time to complete charts, more time attending to the physical needs of the</p>	<p><i>-Drive Characteristic</i></p> <p>The Drive to Learn is very important regardless of the status of the patient to maintain data on the patient's condition that is used to determine the type of intervention and to assess medical interventions. All 16 PACU and ACU nurses interviewed noted the importance of learning about the patient to be able to chart properly.</p> <p><i>-Impact on Perception and Realization of System Fit</i></p> <p>Nurses performing e-charting in all of the units involved in this study initially perceived ubiquitous IS access as advantageous for charting because of the accessibility to consolidated real-time patient information on patients as they work irregardless of location. PACU must rely on documentation and other devices to learn about the patient's status until the patient regains consciousness. Ubiquitous IS access allowed PACU nurses to learn about the patient</p>	<p><i>-Drive Characteristic</i></p> <p>The Drive to Defend against liabilities is not very important to the majority of nurses in PACU and ACU. Only 4 of the 16 PACU and ACU nurses interviewed noted the concern of defending from liabilities in charting.</p> <p><i>-Impact on Perception and Realization of System Fit</i></p> <p>The benefits of ubiquitous IS access pertaining to its impact on the ability to better defend oneself from liabilities because of being able to thoroughly document without having to rely on memory or manual charting, which is error-prone, was never emphasized to the PACU and ACU nurses. So perception of fit for this drive as it pertains to e-charting is not overwhelmingly substantiated by the data.</p> <p><i>- Supporting Data</i></p> <p>Hospital B PACU Nurse E: "You are in this business because you care about people and you don't want to hurt them so it's really</p>

Task Vs Drive	Drive to Bond (with the patient to establish trust and lower patient anxiety to enable task performance with less impediment)	Drive to Learn (information about the patient)	Drive to Defend (from liabilities because of ability to thoroughly document patient/caregiver interaction)
	<p>patient as vital statistic monitors indicate, and an easier means of assessing quality of care in patient/caregiver interaction but there is no real influence from a Drive to Bond between the patient and nurses because of the unconscious state of the patient. In ACU, ubiquitous IS access was a poor fit for e-charting because of the non “nurse-friendly” design of the application in light of prevalent environmental distractions but the bond is essential to ensuring that the nurse can chart effectively or with less impediment.</p> <p>- <i>Supporting Data</i></p> <p>Hospital B PACU: No data</p> <p>Hospital B ACU Nurse D: “I thought it would help me care for the patient better but it didn't work like that. The program was so hard to use and really didn't help us at all...I suppose if the system was working right then it would have given us more time with the patient because we could document quicker. We could just take care of the</p>	<p>and record patient data as they work allaying the problems associated with reliance on memory, having to read though long narratives, or asking other caregivers. ACU nurses learn from both the patient and initially thought they would be able to use the system to learn about the patient’s status because the ability to ubiquitously access and record patient information. This was not the case.</p> <p>- <i>Supporting Data</i></p> <p>Hospital B PACU Nurse:</p> <p>Hospital B ACU Nurse D: “...we have to know if they are in pain or if they have followed the instructions given to them to prepare for the surgery like if they ate anything when they were told not to. Sometimes we have to monitor them for a while before we can administer certain medications to prep them...If it worked we could have been able to check those stats quicker. While you are waiting for a patient to stabilize you could go work with another patient and take the computer with you and be able to look at the</p>	<p>important that you have a record of everything but also because you need to cover your own self. If someone asks why you did it then you have to back it some way and you can't remember everything thing so having it in the system or on the printout is necessary for us. I don't want to get in trouble either.”</p> <p>Hospital B ACU: No data</p>

Task Vs Drive	Drive to Bond (with the patient to establish trust and lower patient anxiety to enable task performance with less impediment)	Drive to Learn (information about the patient)	Drive to Defend (from liabilities because of ability to thoroughly document patient/caregiver interaction)
	<p>patient or just talk to them or the family for a while to get them to feel comfortable with you. Some come in really grumpy or in pain and it's helpful if they are comfortable with you because then they kind of let their guards down and they aren't so hard to deal with...when they are like that it can take a while to get your assessments done. Anytime the patient's are upset about something it kinda affects you too. We are trained to deal with this but sometimes it does get to you. You really are concerned about getting the patient comfortable and getting your assessment done because that's the first step in them being able to get the procedure done. If you take a long time doing the assessment then it takes longer to get them in for the procedure. Everybody gets upset about that and so we try to not let that happen.”.</p>	<p>other patient's record to see if it's about time to check the vitals again. It just would have been more convenient.”</p>	
<p>Medication Administration</p> <p><i>(observed on regular in-patient stay floors of Hospital C)</i></p>	<p><i>-Drive Characteristic</i></p> <p>The Drive to Bond is very important to assuring the patient that they are receiving the correct medications. All of the 4 nurses interviewed mentioned the impact of this drive in medication</p>	<p><i>-Drive Characteristic</i></p> <p>The Drive to Learn is very important in medication administration because of the need to know what medications are valid prescriptions and the history of their effectiveness regarding</p>	<p><i>- Drive Characteristic</i></p> <p>The Drive to Defend is very important in medication administration because of the need to ensure that the errors do not occur which can be detrimental to patient safety and even fatal. 3 of</p>

Task Vs Drive	Drive to Bond (with the patient to establish trust and lower patient anxiety to enable task performance with less impediment)	Drive to Learn (information about the patient)	Drive to Defend (from liabilities because of ability to thoroughly document patient/caregiver interaction)
	<p>administration.</p> <p><i>-Impact on Perception and Realization of System Fit</i></p> <p>Nurses performing medication administration involved in this study initially perceived ubiquitous IS access as advantageous because it allows them to validate medication information as they are administering that gives them more confidence in assuring the patient that they are providing the correct medication. Having the system that provides ubiquitous IS access to information allows aids the caregiver serves as a mechanism to establish the patient/caregiver relationship because the patient can visually see there own prescriptions, which have been validated by a pharmacists, and compare that to the actual medication that the caregiver intends to administer. The system also allows the patient to view their own medical history, which includes effectiveness of previous medications.</p> <p><i>- Supporting Data</i></p> <p>Hospital C Floor Nurse</p>	<p>the patient's condition. All of the 4 nurses interviewed mentioned the impact of this drive in medication administration.</p> <p><i>-Impact on Perception and Realization of System Fit</i></p> <p>Nurses performing medication administration involved in this study initially perceived ubiquitous IS access as advantageous because of the notion of being able learn about the patient's status and prescriptions ordered to treat the patient's condition.. Having ubiquitous IS access enabled nurses to learn pertinent information regarding who, what, and when meds are given at the point of care.</p> <p><i>- Supporting Data</i></p> <p>Hospital C Floor Nurse A: "...you can check prior orders and you have all the information you need about the patient right there at your fingertips. If you have any questions or concerns because you are still the person administering the meds, you can call the doctor or the pharmacy. You know</p>	<p>the 4 nurses noted the importance of defending from liabilities in medication administration.</p> <p><i>-Impact on Perception and Realization of System Fit</i></p> <p>Nurses performing medication administration involved in this study initially perceived ubiquitous IS access as advantageous because of the ability to record patient information that aids in establishing comprehensive documentation that serves as evidence to about the caregiver/patient interaction. This documentation can be used to defend the caregiver's actions if ever questioned for liability purposes.</p> <p><i>- Supporting Data</i></p> <p>Hospital C Floor Nurse C: "Using BCMA [barcode medication administration system] is the safest way to give meds though and it protects you as the nurse. I know that the physicians and the pharmacists have okayed these medications for me to give. I still make sure that they pass the common sense test but the system has so many alerts that you really don't have to worry about messing up and giving the wrong med</p>

Task Vs Drive	Drive to Bond (with the patient to establish trust and lower patient anxiety to enable task performance with less impediment)	Drive to Learn (information about the patient)	Drive to Defend (from liabilities because of ability to thoroughly document patient/caregiver interaction)
	<p>B:</p> <p>“To me the patients seem more comfortable with us using the computer to give them the medications. They ask questions about what they are getting and you can show them what the doctor's ordered. Calm their nerves by showing them this and then saying and the pharmacist validated it and now I look at it a third time before I give it to them. They seem to like this idea. Actually with the computer you spend even more time with the patient sometimes. Since the process takes a little longer you end up spending more time in the patient's room. With the charting you it's easier and less distracting to do it right there at the bedside as opposed to back at the nurse's station.”</p>	<p>who ordered what, when it was validated and who did it. If something doesn't make sense to you about the order when you go to give the med then it's now easier for you to find out if it's valid or not because you know who exactly to call and ask. All of that information is right there in the system. It just helps you not make any errors. It doesn't save anytime it's just so much safer and that's really what's important.”</p>	<p>if you follow the procedure.”</p>
<p>Patient Triageing</p> <p><i>(observed in the Emergency Department of Hospital A)</i></p>	<p><i>-Drive Characteristic</i></p> <p>The Drive to Bond is important when the patient is conscious to be able to calm the patient enough to gather abbreviated information about their condition in a short amount of time upon initial entry into the patient care system. In one regard, having access</p>	<p><i>-Drive Characteristic</i></p> <p>The Drive to Learn is very important in triaging because the purpose of this initial assessment is to gain information to assess the patient's current condition and view medical history to most effectively determine which area of the patient care system</p>	<p><i>- Drive Characteristic</i></p> <p>The Drive to Defend is a concern because of the need to ensure that the errors do not occur, which can be detrimental to patient safety and/or delay the patient from receiving proper treatment because of inaccurate triage information. 2 of the 3 triage nurses interviewed</p>

Task Vs Drive	Drive to Bond (with the patient to establish trust and lower patient anxiety to enable task performance with less impediment)	Drive to Learn (information about the patient)	Drive to Defend (from liabilities because of ability to thoroughly document patient/caregiver interaction)
	<p>to historical information on patient's who have been previous patients at the hospital enables the triage nurse to reassure the patient that they (the caregivers) are cognizant of their pre-existing conditions, which allows the triage nurses to validate critical information that the patient may have forgotten to mention to the nurse. In this regard, the bulk of the onus is not on the patient to provide all information, which is often difficult for them considering their level of pain and inability to communicate. All 3 triage nurses interviewed believe that the ability to access information and not having to totally rely on the patient to provide needed information lessens the patient's frustration with them as nurses in the triage process. However, for triage the 3 nurses noted that gaining the information about prior care and medical history is more important than bonding at this initial assessment.</p> <p><i>-Impact on Perception and Realization of System Fit</i></p> <p>Nurses performing triage</p>	<p>(i.e., acute or critical) is more amenable to their physical needs. All 3 triage nurses interviewed emphatically noted the necessity to learn about factors in the medical history (e.g., allergies, prevailing ailments, etc) that are critical to procedures taken by the attending nurse and/or physician during immediate care.</p> <p><i>-Impact on Perception and Realization of System Fit</i></p> <p>Nurses performing triage involved in this study initially perceived ubiquitous IS access as advantageous because of the notion of being able learn about the patient's status and historical medical information to properly make initial assessments and appropriately categorize the patient for treatment. Having ubiquitous IS access enabled nurses to learn pertinent information regarding the ailment at the point of care.</p> <p><i>- Supporting Data</i></p> <p>Hospital A ED Nurse B: "Some of the patients come in by rescue, or unconscious, or the old</p>	<p>noted that having ubiquitous IS access or the system helps to protect them from making liable actions.</p> <p><i>-Impact on Perception and Realization of System Fit</i></p> <p>Nurses performing triage involved in this study initially perceived ubiquitous IS access as advantageous because of the ability to record and access historical medical data that aids in establishing comprehensive documentation that serves as evidence to about the caregiver/patient interaction. This documentation can be used to defend the caregiver's actions if ever questioned for liability purposes.</p> <p><i>-Supporting Data</i></p> <p>Hospital A ED Nurse B: "It's just less papers to lose and less the chance of you leaving something out. You feel reassured that you can enter it right there with the system. The information is just so more accessible and legible, which keeps us from making mistakes in treatment... I am concerned about the automatic times that the system generates because</p>

Task Vs Drive	Drive to Bond (with the patient to establish trust and lower patient anxiety to enable task performance with less impediment)	Drive to Learn (information about the patient)	Drive to Defend (from liabilities because of ability to thoroughly document patient/caregiver interaction)
	<p>in the ED involved in this study initially perceived ubiquitous IS access as advantageous because it promised to allow them the ability to gather and process information about a patient upon initial entry into the patient care system at the patient's location (i.e., in ED waiting room, in critical care unit, or near EMS or patient vehicles), which would allow them more quality time triaging as opposed to processing data at the triage nurse station. For triage, the system observed fit the environment and did provide the needed mobility to triage patients at their physical location, which allowed the patients to be serviced faster (i.e., no extended waiting room stays for the patient). Additionally, having ubiquitous IS access allayed the problem of the triage nurse having to rely on memory, transcribe hurriedly written notes, and/or make excessive trips back and forth from a critical care patient's location to process data at the nurse triage stations that often added to the frustration of the nurse and the patient. The nurse could better assure the patient that</p>	<p>person that forgets and you can't get the needed information to triage them. It would take us hours to look through records if they were a previous patient. Now you can look it up in the system and read down the list and confirm that they are still on certain medications or they had a procedure done in the past. We could read the charts and if we have to often make changes because the patient either forgets to tell you something or they didn't understand the question the first time. So you had a lot of scratch throughs, can catch information like they are an HIV patient, Hepatitis, or TB patient and they don't want to tell you that at triage...It's great for that because we have to know these things to figure out the best treatment."</p>	<p>sometimes treatment starts in the car and you've gotten the patient stabilized before any information is ever entered in the system but those things don't become an issue until somewhat gets sued."</p>

Task Vs Drive	Drive to Bond (with the patient to establish trust and lower patient anxiety to enable task performance with less impediment)	Drive to Learn (information about the patient)	Drive to Defend (from liabilities because of ability to thoroughly document patient/caregiver interaction)
	<p>existing patient data was known and that their current condition is appropriately annotated.</p> <p>-Supporting Data</p> <p>Hospital A ED Nurse A: “The nurses got really excited about it, even though people don’t like change and the computer part scared us but it was a system that would make things legible and we wouldn’t have to rewrite the same common data every time the patient came. We can go to the patient as opposed to waiting for the patients to come to us at the triage desk if needed. We still use the computers at the triage desk but I think we go to them it kind of makes them feel more comfortable. If we have critical patients we go to them anyway but at least we can take the system with us and do all of the triaging right there with the patient as opposed to scribbling it on some paper or just trying to remember stuff and then coming back to triage [the triage nurse station] to enter it. ... You know along the way from the patient’s room or wherever they are back to triage [the nurse triage station] you might get</p>		

Task Vs Drive	Drive to Bond (with the patient to establish trust and lower patient anxiety to enable task performance with less impediment)	Drive to Learn (information about the patient)	Drive to Defend (from liabilities because of ability to thoroughly document patient/caregiver interaction)
	interrupted numerous times and could easily forget things that then you have to go back to the patient once again. It was very frustrating for us and the patient. But now it's great because I can do it right at the there [the point of care]. Some of the family members get really upset because they think you can deal with the computer later and the urgency of taking care of the patient is more important. I think these same people would react the same if you manually triaged with a chart. But I reassure them that their family member can get better care if I assess correctly and the computer helps me do that. ”		

The major insight drawn from segmenting the data, in the manner reflected in Tables 10 and 11, is that certain drives bare differently on human behavior in light of dissimilar environments and in the performance of various tasks. Succinctly stated, certain drives will have more of an influence on human behavior based on the environment and task being performed. The key points from these tables that expose the connection between human drives and IS acceptance and use are as follows:

- In closed environments in which there are very few distractions to impede task performance, the drive to learn is the dominant drive that will promote the nurse to accept and continue to use the system for documentation.
- In open environments in which there are many distractions to impede task performance, the drive to bond is the dominant drive that will hinder the nurse from accepting and continuing to use the system for documentation.
- Regardless of the environment (i.e., either closed or open), the drive to defend is not dominant because the majority of nurses had not been called to deposition and did not view using the system to guard from liabilities as a major benefit. However, the drive to defend is very important in medication administration (compared to its influence in the electronic charting and patient triaging) and promotes system acceptance and use because of the magnitude of detriment for both the nurse and the patient associated with erroneous medication administration.
- Also for medication administration, the drives to bond and learn are very important. The fact that the nurse can use the system at the point of care to reassure the patient that the correct medication is being administered, which enables the nurse to render care with less impediment, and to learn about the effectiveness of prior medications or other historical information promotes acceptance and continued use of the system.
- For electronic charting and patient triaging, the strength of the impact of the drive to bond on IS acceptance and use depends on the status of the patient. If the patient is conscious then the bond is overpowering and impedes acceptance and

continued use of the system by the nurse. However, if the patient is not conscious then the drive to learn has a greater influence on the acceptance and continued use of the system for documentation by the nurse.

The Nurse Perspective provides a number of other insights pertaining to the system used for ubiquitous IS access. For one, the physical environment requires the bundling of technologies to reap the most benefit from ubiquitous IS access. The mobile carts serve multiple purposes (i.e., a desktop for writing, an area to hold medications, a mounted laptop to access the application, and scanners for patient and medication identification). Additionally, the design of the carts in most instances is sufficient to maneuver in and out of patient rooms or suites but there are instances in Hospital C where maneuverability in rooms with multiple beds is problematic. Since the hospitals are not equipped with wireless access to the application across the entire campus, nurses must still print hardcopy forms that accompany the patient throughout the care system as part of their medical chart. The printers often become backlogged, which can delay the patient from continuing to their next destination in the patient care system. Bundling information goods and/or technologies allows the user to efficiently transfer input into the desired output and provides convenience in the process (Rogers, 1995; Bakos and Brynjolfsson, 2000).²⁰

A second insight is the impact of the technology on the nurses' self image in two regards. For one, ACU nurses commented that they were concerned that their "fumbling" with the computer in the presence of the patient would manifest into the patient developing perceptions

²⁰ Rogers (1995) discusses bundling of technologies as part of the commercialization of product. Bakos and Brynjolfsson (1999) discuss the factors attributing to pricing, profit generation, and efficiency of bundled information goods in the consumer market.

that the nurse was incompetent in his/her ability to provide care. This fumbling added to the frustration of the ACU nurses, which hindered utilization (i.e., overall dependence). A more positive insight is that the nurses in PACU of Hospital B and ED of Hospital A noted that their confidence in their technical abilities was greatly improved because of using the system at work. These nurses shared the same demographics (i.e., initial training 15+ years ago and little typing skills) and comfort level with computers for data processing; however, PACU nurses and ED nurses attained adequate training and the systems in PACU and ED are extremely “nurse friendly” thereby promoting use despite technology aversion.

A third insight is the emergence of the system as a mechanism to strengthen the patient/caregiver relationship. This allows the patient to become engaged in the medical intervention, which allowed the nurses to render care with less impediment because the patient seems more reassured that the medication or prescribed care is in accordance with the physician’s order. Additionally, the patients are assured that nurses can access historical information and not have to rely on them (i.e., the patients) in their disoriented or unconscious state to provide pertinent data about previous medical interventions or ailments.

A fourth insight is the impact on patient privacy. Having ubiquitous IS access at the caregiver’s location allays problems of patient privacy infringement because the likelihood that the nurse would have to ask someone questions about a patient in the presence of another patient is decreased, which prevents others from overhearing or eavesdropping. Healthcare patient safety regulations stipulate that patient information be preserved as confidential to the patient and their caregivers only. It is incumbent upon the nurses to ensure that they conceal patient information from unlawful viewing by locking the laptops or ensuring the data are not visible to unauthorized personnel. In this regard, since the system stays with the nurse, it is more secure

from unauthorized viewing than the patient's manual chart clipped to a bed or on a banner in the hall outside of their room.

A fifth insight is the likelihood of the reduction of errors because of having ubiquitous IS access as the nurses perform patient care. This benefit is primarily because of (1) the non-reliance on memory for recalling medical interventions because of the cumbersome process of collecting data in one location and entering it into the system at another location, (2) the ability to validate information real-time or at least access needed information to obtain validation such as physician and pharmacist contact data, and (3) overcoming legibility problems that result in erroneous triage assessments, incorrect transcriptions for physician orders, and misunderstandings about what previous medical interventions for the patient entailed.

Finally, ubiquitous IS access provides the needed mobility. Caregivers perform tasks that require them to be mobile and are both by nature intrinsic (i.e., about the person performing the task – the caregiver) and extrinsic (i.e., about someone else – the patient or another caregiver) (Junglas, 2003). Junglas (2003) provides descriptions for tasks that are evenly yoked with mobile technologies and visually represents these concepts in a task cube (see figure 14).

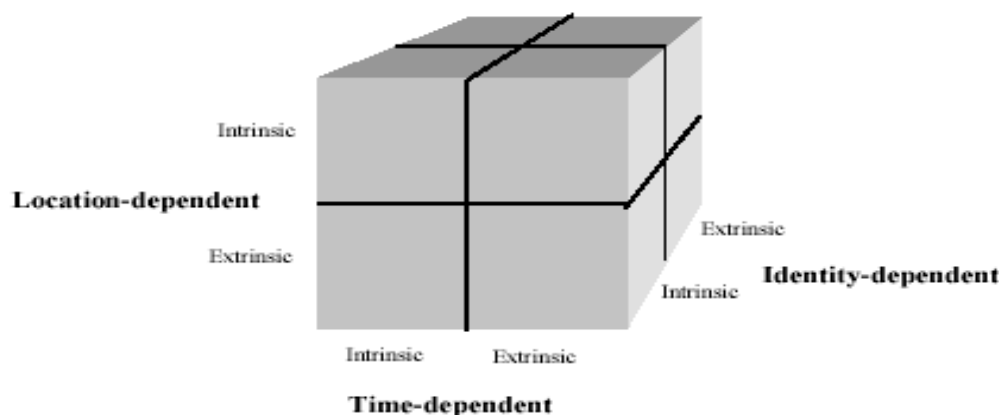


Figure 14 Task Cube (Junglas, 2003)

This task cube concept serves as a basis for describing tasks amenable to ubiquitous IS access. The data were not initially coded using the task cube dimensions. Future research will entail recoding the data pertaining to task characteristics in a finer level of analysis to correspond with the task cube dimensions. Such recoding is typical of the extended analysis following the initial analysis of a grounded theory study. Table 12 shows the task characteristics appeased by ubiquitous IS access in patient care and includes the current labels for codes/concepts that are conceptually similar to the task cube dimensions, which will most likely be recoded in future research.

Table 12 Task Characteristics Appeased by Ubiquitous IS Access

Characteristics	Definition	Current Labels for Similar Codes/Concepts in Data	Relevance to Patient Care
Location dependent	Depending on the physical location of that being or thing for which the task is performed (Junglas, 2003)	Point of care work Need to afford staff with flexibility	Patient care is location dependent because the technology needs to go with the caregiver (i.e., <i>intrinsic</i> - pertaining to the location of the task performer) to the point of care, which is dictated by the physical location of the patient (i.e., <i>extrinsic</i> –pertaining to the location of the task receiver). Wired systems do not provide this mobility. Thus, the great degree of mobility afforded by ubiquitous IS access is a unique quality.
Time dependent	The requirement for the fulfillment of the task at critical times (Junglas, 2003)	Need for subsecond response time at point of care	Patient care is time dependent because medication or medical interventions are prescribed for delivery at specific times during the shift of the caregiver (i.e., <i>intrinsic</i> – pertaining to the required times that the task performer must perform the task) and critical times for the patient (i.e., <i>extrinsic</i> – pertaining to the required times that the task receiver must have the task performed).

Characteristics	Definition	Current Labels for Similar Codes/Concepts in Data	Relevance to Patient Care
			Patient care is time sensitive in most cases (i.e., medication administration and charting for vitals at particular time periods). Because the is most likely with the nurse, alerts/reports can be built into the system and accessible, via ubiquitous IS access, which prevents the caregivers for missing times for vital checks and to pass meds or notification when it is/is not safe to administer.
Identity dependent	The requirement for validation for whom and by whom the task is performed (Junglas, 2003)	Patient identification validation	<p>Patient care is identity dependent because caregivers must validate who they are for security and quality assurance purposed for every patient/caregiver interaction (i.e., <i>intrinsic</i> – pertaining to the identity of the task performer) and verify the identity of the patient to ensure that all care given is in accordance with prescriptions for that particular patient (i.e., <i>extrinsic</i> – pertaining to the identity of the task receiver).</p> <p>Scanning patient ID bands or using some type of patient identification mechanism and being able to match it with valid data at the point of care is a true way to ensure the identity of the patient. Checking a manual chart or simply asking the patient is not as effective or always reliable. Additionally, documentation requirements dictate that the caregiver's identity is captured for each patient/caregiver interaction. It is inefficient and infeasible in most cases to wire a computer in every location that a patient may be and require the caregiver's to sign in and out. Ubiquitous IS access affords the ability to capture and access this information whenever needed without having to sign in an out of a tethered system for every instance the caregiver rendered care and needed to document.</p>
Interdependent	The output from one	Interdependence	Patient care is interdependent because

Characteristics	Definition	Current Labels for Similar Codes/Concepts in Data	Relevance to Patient Care
	process serves as input for subsequent processes, which requires extensive coordination and mutual adjustment (Thompson, 1967)		what one caregiver does for the patient impacts what the next must do, which is continual as the patient processes through the care delivery system.
Information intensive	The imperative need for access to information and ability to manipulate data while performing tasks (Thompson, 1967)	Need for comprehensive documentation	Documentation is required to assess, diagnose, and treat patients effectively at the point of care; therefore, patient care is also information intensive. Ubiquitous IS access is the most effective and efficient means of accessing and documenting needed information at the point of care.

Contribution to Academic Research

This section takes a step back from the analysis to answer the age-old question, “What’s the contribution?” Ubiquitous IS access provides mobility to the caregiver. Yet, the fact that ubiquitous IS access facilitates performing tasks with the aforementioned characteristics is its defining quality. Healthcare has made gradual process and performance improvements in patient care by providing caregivers with technologies that automate manual processes, which provide access to data from central locations via tethered systems. However, these technologies do not afford a high fit for the way caregivers work or how patient care actually takes place. Tasks involved in patient care have always required mobility of the caregiver, but tethered systems do not possess the characteristics needed to ideally meet all of the requirements of the task. Yet, overall ubiquitous IS access adoption is still relatively slow in the healthcare industry.

This research reveals the many factors that hinder acceptance but it also shows that once ubiquitous IS access is accepted performance benefits greatly overshadow those of prior technologies in this context, provided that the technology is amenable the task and that human drives are appeased. Thus far, there are no hospital wide implementations known that enable ubiquitous IS access and the healthcare industry continues to award hospitals for being “most wired.” These accolades are proof that access to information is vital to the way hospitals do business but the tethered technologies cannot deliver the state of performance needed. Is it managerial myopia? Maybe hospital administrators are comfortable with the performance benefits of the tethered systems in which they have invested. They know that these technologies are not the best options but this way of computing has become institutionalized in the industry. It is acceptable and proven beneficial across the industry (i.e., the status quo). In other words tethered computing is a *sustaining technology* – (i.e., one that maintains the rate of historical performance improvements that stakeholders have come to expect (Christensen and Bower, 1996). Therefore, for many hospital administrators ubiquitous IS access may be viewed as a *disruptive technology*.

A disruptive technology is one that “disrupts an established projectory of performance improvements or redefines what performance means (Christensen and Bower, 1996).” Organizations do not seek to disrupt their work environments when they implement new technologies. They are seeking performance benefits so disruptive technologies, even though they change the scope of the implementation and overtake the market, may not be the most effective technology to bring about desired performance benefits without massive trade-offs. Christensen and Bower (1996) state, “sustaining technologies appealed to established customers in existing mainstream markets and disruptive technologies rarely could be employed in these

markets.” Thus, to very conservative industries and organizations within these industries like healthcare, disruptive technologies are risky and less than ideal.

Disruptive technologies for information systems, despite affording better processing methods, often require business process re-engineering, the restructuring of the technical infrastructures, or interoperability with existing systems in order to derive great benefit, which can be financially and structurally taxing. However, disruptive technologies can yield high fit that better meets all conditions for task performance relative to prior methods. But managerial myopia keeps administrators from viewing these technologies in this manner. They need a paradigm shift to view these technologies, not as *disruptive* but as *dovetailing*.

Webster’s dictionary defines *dovetailing* as “the act of connecting or combining precisely or harmoniously.” Applied in the context of technology implementations, dovetailing pertains to a desired convergence between the technology characteristics, organizational assets, and task performer capabilities with the requirements of the tasks keeping in mind the organizational goals and human drives. Essentially, a technology that affords this convergence of factors (i.e., dovetailing), in similar context to that described in this study, disrupts the old economics of the task without disrupting the task environment.

If effectively employed and under conditions similar to those described in this research, ubiquitous IS access can be used as a technology that conjoins the ability to perform tasks when they have the aforementioned characteristics with organizational goals and individual characteristics that manifest from human drives. In this sense, ubiquitous IS access promotes dovetailing of these pertinent factors. However, it is not the intent of this research to present a technologically deterministic view, which notes that technology plays an active role in the social system by embodying rules guiding action, limiting choice alternatives, and monitoring human

action. Simply implementing ubiquitous IS access does not promote performance benefit. The data reveals that ubiquitous IS access can be an impediment to task performance under certain conditions where the impact of human drives, such as the drive to bond with the patient, overrides the choice to use the system in the presence of the patient (as observed in ACU of Hospital B). The technology is a mere vehicle to support those using it in their quest to successfully accomplish a task or reach a goal at a particular time (i.e., time dependency), in a particular context (i.e., location dependency), and by a particular individual (i.e., intrinsic identity dependency) for a particular individual (i.e., extrinsic identity dependency).

This research makes the claim that, in the context for highly mobile task environments such as healthcare, and when effectively employed, ubiquitous IS access *can* promote a high degree of fit between the (1) characteristics inherent to it (i.e., technology characteristics), (2) the way work is done (i.e., task characteristics), and (3) the innate drives of the stakeholder (such as the drive to learn about and bond with a patient or openness to any mechanism that aids in patient safety.) Additionally, this research has shown that under certain conditions, certain drives will dominate the choice to accept the technology. In this manner, the notion of ubiquitous IS access as dovetailing extends TTF espoused by Goodhue and Thompson (1995) by emphasizing how factors converge to promote a fit between the task and human drives. Organizations seek this convergence when they implement information systems and ubiquitous IS access, as described in the context of this study, has been unmatched by existing tethered systems in accomplishing this goal. The following figure depicts the dovetailing convergence that can be realized when this technology (i.e., ubiquitous IS access) mutually appeases human drives and task characteristics.

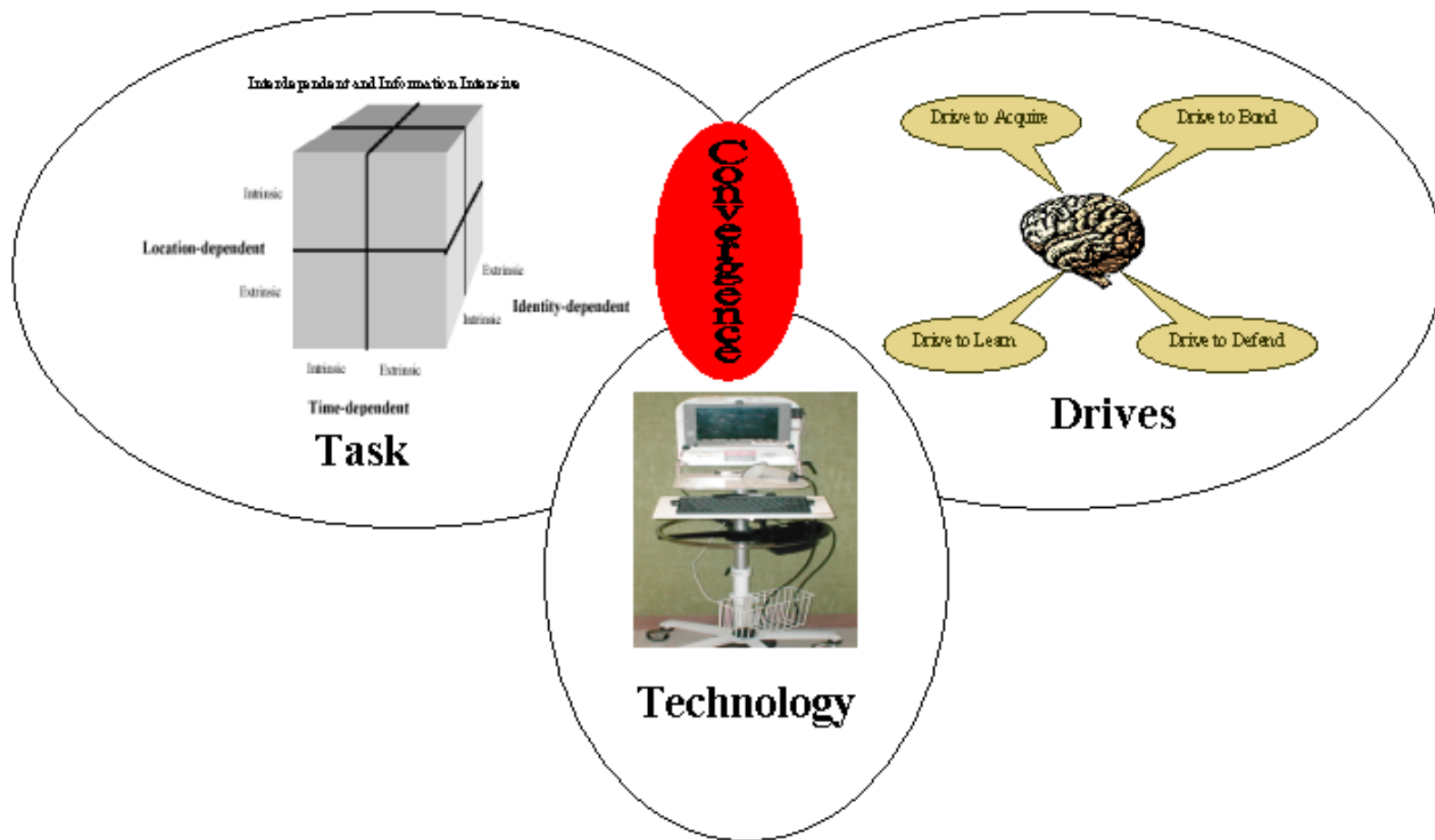


Figure 15 Task Technology and Drive Convergence

Figure 15 depicts the convergence concept provided by ubiquitous IS access, which serves as a basis for developing a simplified diagram (i.e., Figure 16) taking in consideration the major insights inherent in the nurse perspective. Figure 16, the Task Technology Individual Environment (TTIE) Fit model extends the Technology Impact (TIM) Model that incorporates TTF (see Figure 10), by reflecting the dimensions of the task, technology, individual, and environment based on finding in this study. The most apparent contributions of the TTIE Fit model are (1) the inclusion of Environmental Characteristics as a contributing factor to TTIE Fit and (2) the addition of Individual Characteristics mediating the Environmental Characteristics/TTIE Fit relationship due to the influence of mainly three drives (i.e., the drive to bond, the drive to learn, and the drive to defend).

The TTIE Fit Model highlights the influence of human drives concerning the perception of how a technology fits with a task in light of environmental factors. This research has shown that even though a technology may be conceptually the most befitting for a particular task, a person may not choose to use the technology because of innate feelings that are compounded by environmental factors. This research brings to light that fact that human drives are powerful forces at play in human computer interaction.

Future research will expound upon this concept and note other contextual settings in which human drives influence perception of task technology fit, system acceptance, utilization, and ultimately performance impacts.

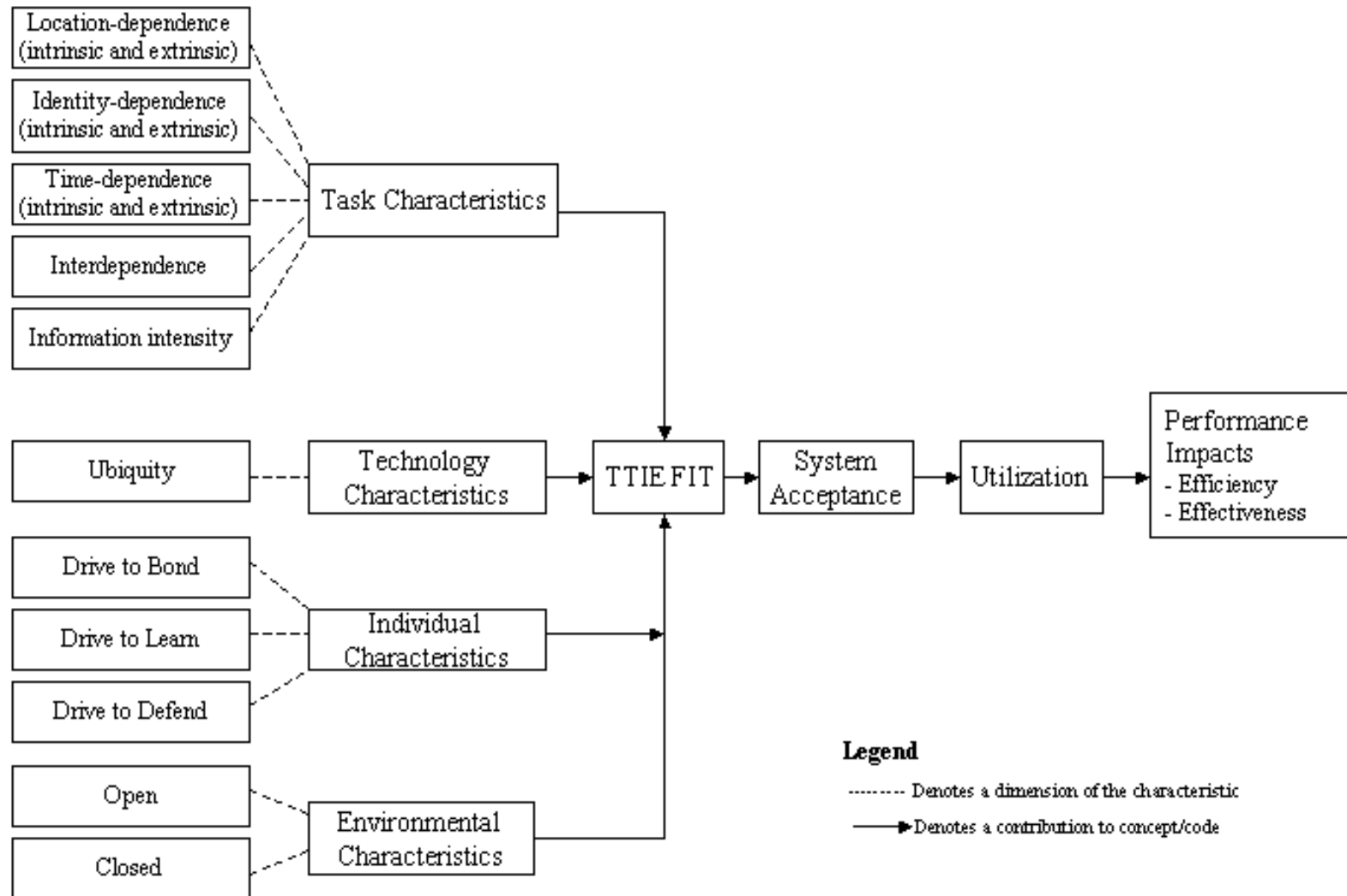


Figure 16 Task Technology Individual Environment (TTIE) Fit Model

There are number of other professions or contexts that serve as examples for the application of ubiquitous IS access as a dovetailing. For example, the Ground Transportation and Baggage Handling Services of Delta Airlines, Inc. at Hartsfield International Airport in Atlanta, GA provide ubiquitous IS access to travel and baggage identification information to baggage handlers on the flight line (Tagami, 2003).²¹ The organization contributed lost or late baggage to inefficiencies in their re-routing process (Tagami, 2003). In an attempt to reconcile poor customer satisfaction due to these process inefficiencies, the organization implemented a Wi-Fi supportive network architecture and equipped baggage handlers with wireless devices that they can use to access travel information such as alternate flights to route misplaced baggage to final destinations without having to return to the terminal to access this information (Tagami, 2003). Another example, are the many rental car companies that use WI-FI technologies that enable clerks to check cars in and out and print receipts at the point of service (i.e., when and where the car is returned) (Tagami, 2003). This provides convenience for the travel and real-time information about the availability status of rental cars.

Yet, another example is the wireless systems affording ubiquitous IS access used by police while on duty in cruisers. Have you ever pulled beside a police officer at a traffic light and witnessed them anxiously typing away on a laptop ergonomically mounted in their cruiser and then watched them pull a vehicle over most likely because of a subsecond response that indicates some violation? This ability to access information helps the police to better (1) service their communities and (2) alerts them of precautionary measures to take.

²¹ A Delta Technologies official provided comments in Phase I of this research, which reflected the organizational goals appeased by ubiquitous IS access prior to actual implementation. See Appendix A for more details.

Another possible example of a dovetailing technology that provides ubiquitous IS access is in the commercial market for music distribution. Apple Computer's iPod and iTunes combination capitalizes on the way people experience music. In this case the information accessed ubiquitously is music or music related. This technology gives Apple greater distribution and the advantages of scale in manufacturing of the devices and in negotiations with record companies (Teather, 2004). Additionally, this technology allows Apple to "grasp the opportunity of the online market due to lack of vision in the recording industry, which steadfastly refuses to view digital distribution as anything other than a threat (Teather, 2004)." ²² In this example, this possible dovetailing technology also grants competitive advantage, at least for now. However, one can argue that, from a market perspective, this technology is disruptive as opposed to dovetailing. Future research will fully expand the concept of dovetailing convergence as compared to disruptive technologies.

Summarized Study Findings

The following section summarizes the findings in this study. These findings are grounded in the data provided by the interviewees or artifacts, which appear in the results section, and contribute mostly to practitioners interested in implementing wireless technologies to provide ubiquitous IS access in patient care or for those seeking improvements to current implementations.

²² The sustaining technology is actually piracy (i.e., downloading music from the Internet for free), which was once itself a disruptive technology to acquiring music.

Finding One: Ubiquitous IS access provides needed information to nurses at the point of care.

Nurses are mobile workers and perform the bulk of their work at the patient's bedside whether it be to assess the patient's medical status, treat the patient with medications, or document any medical intervention. In order to most effectively perform patient care tasks such as assessments or administering medication, they need access to the patient's medical information while they are working. It is ineffective to have to locate a computer in the midst of providing care to validate information or to have to write notes/rely on memory to document the patient's record after the care is given.

Finding Two: Ubiquitous IS access can improve patient safety by helping the nurse create comprehensive records decreasing the likelihood of caregiver error.

Nurses at Hospital B and Hospital C commented that when they were told that ubiquitous IS access would be mandatory, the primary rationale was to aid in (1) improving patient safety and (2) affording more time rendering patient care as opposed to performing administrative tasks. The idea was that if the nurse were able to enter data at the point of care there would be less of a chance for the nurse to forget critical information to add to the chart and there would be better access to needed information. These factors decrease the likelihood that the nurse would make a mistake such as administering incorrect medications or not being able to care for the patient's needs because of laborious, time-consuming documentation. Nurses view documentation as a necessary evil, if it is not done by exception (i.e., no long narratives but rather only indicating when something is an exception in the ordinary condition of the patient). The nurses perceived ubiquitous IS access to be advantageous if it were going to help them chart by exception at the bedside and if it would give them access to patient information that decreases the likelihood of them making errors.

Finding Three: Ubiquitous IS access that enables electronic exception charting promotes comprehensiveness of documentation, charting time reduction, and documentation readability.

Nurses need to make decisions about minor interventions to take with a patient and having comprehensive documentation of prior interventions and their effectiveness aids the nurse in making his/her decision. Comprehensive documentation keeps the nurse from having to fill in gaps in the medical record or asking other nurses or doctors about what was done. Having to ask questions about the patient's record because information is missing detracts and delays the nurse from performing patient care. The most convenient and efficient manner to document this information is via electronic exception charting facilitated by ubiquitous IS access at the patient's bedside amidst the nurse rendering care.

Finding Four: Task environment dictates usability and performance benefits of ubiquitous IS access.

The technology employed in all departments in this study, is a laptop mounted on a mobile cart that accesses a program for electronic charting, patient registration and triage information, or patient information to include medication history and physician orders. Conditions in the task environment (e.g., physical constraints and hectic nature of the environment) impact actual intended use of the mobile cart and the information system used for ubiquitous IS access.

Finding Five: Technical characteristics such as cart mobility and duality of use are fitting in most cases but problems such as poor battery life and poor program design impede use.

The mobile carts serve multiple purposes for the nurses. In PACU at Hospital B, the size and design of the carts enable the nurse to write on the desktop and place other items needed to perform patient care tasks such as thermometers, blood pressure cuffs, medications and delivery

apparatuses on the cart in addition to laptops mounted for ubiquitous IS access. In PACU at Hospital B, nurses do not have to maneuver between beds like in Hospital C and the volume of medications is not as great as medications required by patients on acute care or nursing home floors. In ACU at Hospital B, technical problems greatly contributed to system abandonment.

Finding Six: Ubiquitous IS access aids in reducing the time required for charting, which reduces nurse anxiety, affords the nurse more time with the patient, and the ability to chart on more patients simultaneously, if needed.

Ubiquitous IS access allows for sub-second response times (in most cases) for queries that would normally take several minutes to identify when reading through a manual narrative in a patient's record that first has to be physically located. Because of ubiquitous IS access (in light of its superlative program design) the nurses have efficiently decreased their charting time in PACU by 10 – 15 minutes. This efficiency allows for each nurse to care for at least one more patient increasing the potential nurse to patient ratio from 1:3. The patients in PACU receive scheduled surgery and there are a set number of surgeries per day. PACU has no control over this set number; therefore, even though efficiencies afforded by ubiquitous IS access may allow for a nurse to chart on more patients simultaneously there is no direct impact spurring increased volume of patients entering PACU. PACU nurses commented that their anxiety decreased because they no longer were concerned about charting.

Finding Seven: User characteristics such as lack of typing skills, genre of professional training, and technology aversion hinder ubiquitous IS access.

The demographics of the majority of the nurses interviewed at all hospitals are (1) an average age of 40 and (2) work experience of 15+ years. Since fewer and fewer nurses are entering the profession, these averages will be expected to rise in coming years (Bass, 2001).

For these nurses, their initial training 15+ years ago did not emphasize the vital importance of documenting or the use of technology to aid in documentation and they lack typing skills, which contribute to user resistance to change due to technology aversion.

Finding Eight: Ubiquitous IS access aids in decreasing time to validate questionable medication prescriptions and medical interventions that can delay the patient from receiving care.

Nurses at Hospital C commented that sometimes they would question the validity of the prescription because of either knowing the physician's intent or from their professional experience. The nurse would have to locate the physician, which then may have to correct the prescription, after which the pharmacist revalidates and issues the new prescription. This is a very timely process than can delay patients from receiving their medications and possibly follow-on care or medical procedures. Ubiquitous IS access allays this problem.

Finding Nine: Ubiquitous IS access aids in maintaining documentation to help the nurse and the organization in defending themselves from liabilities of negligent care.

Nurses at Hospital C can rest assured that they will not be solely liable in the event of error because the physician and the pharmacist have validated the medication orders within applications that interface with BCMA prior to the nurse being able to administer the drug. All of this information can be accessed right at the point of care as opposed to having to locate the doctor and the pharmacist to ensure that the medication was correct or look up information in a computer at the nurses' station. Hospital C nurses notes that this was a frequent occurrence prior to ubiquitous IS access because quite often the order that the physician wrote was incorrectly transcribed by a technician or another nurse, which was then incorrectly validated by the pharmacists. Administering the wrong medication to a patient can be detrimental if not fatal. It

was incumbent upon the nurse to ensure that the prescription was valid before it was administered. Having access to critical data and information concerning what the physician actually entered into the database gives the nurse a better sense security.

Finding Ten: Ubiquitous IS access makes quality assurance easier.

Nurses and their managers note the ease of accessing needed information via ubiquitous IS access in comparison to drudging through narratives in a manual chart. Also ubiquitous IS access allows for accreditation teams reviewing records and standards compliance with an easy means to access the needed information with limited reference to manual documentation. This access also enables nurse managers to more easily consolidate information to develop needed reports for medication effectiveness, late medication administration, schedule for patient assessment times, and inventory related data.

Finding Eleven: Ubiquitous IS access can aid in improving the patient/caregiver relationship.

Ubiquitous IS access can be used to enhance the patient/caregiver relationship and allows the patient to learn about their own condition via data displays. With this technology, caregivers can ease patient anxiety and better answer the patients' questions at the point of care.

Finding Twelve: Ubiquitous IS access will still not provide needed efficiencies unless technologies that support the tasks are properly bundled.

Nurses and registration personnel need to print documents that require signature and need to accompany the patient to the next unit in the hospital. Printing of these documents across all hospitals was problematic. Despite having ubiquitous IS access at the point of care, nurses and registration personnel would still have to leave the patient to retrieve printed documents.

Backlogs occurred and often the documents were misplaced by the time the nurse or registration

personnel attempted to retrieve them. In this case if technologies are not bundled properly bundled (e.g., with mobile printers, scanners, and copiers) then the overall feeling is that ubiquitous IS access will not be as useful because of the inconveniences of having to return to central area to perform administrative parts of the patient care or registration process.

Contribution to Practice

This section provides recommendations based on the study findings. Primarily the recommendations are contributions targeted for practitioners.

Recommendation 1: Integrate IS for documentation into nursing curricula.

Organizational managers and IS personnel noted the lack of exposure to information systems used for documentation that nurses received in their professional training. They believe that if nurses are exposed to the systems in their formal training they will learn to appreciate the technology, thereby making usage second nature and thwarting technology aversion problems in user acceptance. Organizational managers in this study noted that an insufficient number of nursing programs include basic information systems classes that expose nurses to PC usage for data management in their curricula. However, in their opinion, the exposure is somewhat an improvement over training programs 20+ years ago but still is not sufficient enough to reduce technology intimidation. Nursing informatics is available as a separate discipline but the nurses in this track do not conduct clinical tasks daily. At the very least, an organizational manager at Hospital C suggested that nursing schools partner with hospitals that are employing ubiquitous IS access in patient care tasks to establish a rotation for the nurses to be exposed to the technology.

Recommendation Two: Employ the high TTF of ubiquitous IS access as a recruiting and retention tool.

A 2002 statement by the President of the American Federation of Teachers/AFT Healthcare on the Joint Commission on Accreditation of Healthcare Organizations Report in Nursing Shortage reports the following statistics:

- One in five registered nurses plan to leave the profession
- 53% of nurses say the job is too stressful
- 20% of nurses say irregular hours are problematic
- 35% comment on poor work conditions
- 81% of the potential leavers report poor morale
- 64% say they do not have enough time to spend with the patient
- 60% note the paperwork burden

These alarming statistics are projected to get even worse. Based on the findings in this study, ubiquitous IS access directly aids in relieving the paperwork burden and allowing the nurse to spend more time with patients, which contributes to improvements in work conditions. Hospitals that can show the efforts they put forth to improve working conditions like implementing ubiquitous IS access to aid nurses in patient care are more likely to recruit and retain nurses. In light of the nationwide shortage, nurses are very cognizant of the impacts of poor work conditions, which is a real consideration in their employment decisions. Nurses in this study commented that despite their technology aversion (mainly from low computer self-efficacy and lack of technology exposure), they have grown to appreciate ubiquitous IS access because of the mobility, information accessibility and mechanisms that eliminate laborious

documentation and affords more time doing what nurses do best – caring for patients. In PACU at Hospital B and at Hospital C, nurses commented that they would hate to have to revert to the days of “double work” (i.e., manually documenting and then hunting for a computer to transcribe from notes) or having to leave the patient amidst care to locate vital information.

Recommendation Three: Create a nurse vision statement emphasizing use benefits and show importance of nurse involvement.

A nursing informatics manager from a hospital not directly involved in this study, stated that with large scale IT/IS implementations that seemingly have organizational wide benefits, nurses must have their roles articulated to them in order to gain their buy-in. This is not because nurses have problems comprehending their roles but because hospitals must take a stand and demonstrate how critically important nurses are in the care delivery system.

Nursing Informatics Personnel at a Large Healthcare System in the Northeast

“You have to make it salient to them (nurses) and explain how what they do or don’t do impacts the whole care delivery process but you have to show how you are going to support them in supporting the organization. It has to work both ways especially because they feel under appreciated anyway. You just can’t dump the technology there and expect them to use it especially if you are replacing this chart they use to carry around now with a computer on a stick. They tend to think the technology isn’t for their benefit anyway. They think you are giving them more to do in attempts to make the physicians’ jobs easier.”

To some extent the last part of this statement is true but *nurses* are on the frontlines of care. Improving efficiencies in their jobs such as conducting patient assessments required prior to a doctor’s examination, administering prescriptions for medications or medical interventions, or just providing comfort to the patient does afford the physician with a more efficient and effective means of treating the patient.

Recommendation Four: Explore “wearables” to free hands of the nurses and/or provide better cart design to hold needed medications and medical paraphernalia.

At Hospital C some nurses noted difficulties in maneuvering the carts between beds and inadequate design that makes transporting medications on the cart cumbersome. These nurses propose using wearable devices for medication administration (i.e., a handheld scanner and small tablet that can be clipped onto a waistbelt) to free their hands to scan, deliver the med, or aid the patient. One of the researchers has observed mechanics at a US Air Force Air Base in the southeast using wireless tablet devices to afford the mechanics with access to technical data while performing maintenance on aircraft parked on flightlines or in hanger bays. Mechanics have the same need for mobility and access to critical information (provided by ubiquitous IS access) at the point of service, as do nurses at the point of care. These mechanics wear tools on their belts but also have mobile tool cabinets located near the area in which they are working. This setup may be effectively employed for medication administration when cart maneuverability in between beds is difficult.

A solution in environments where the nurse has to administer a lot of meds per patient, use the hand-held tablet wireless device and a mobile cabinet-like cart with internal shelving that holds sufficient amounts and varying types of medication/delivery apparatuses. Slenderly designed carts that have a fold out desktop for writing, if need, and cabinet like shelving below to hold the medications is more suiting for maneuverability on floors with multiple beds per room.

Recommendation Five: Bundle technologies (e.g., scanning, label and document printing, copying, and electronic signatures) to support tasks.

Nurses and an administrator for the registration processes at Hospital A noted the importance of bundling technologies to streamline administrative processes. ACU at Hospital B noted that despite the benefits of mobility ubiquitous IS access provided, they still would have to go back and forth to the nurses station to retrieve printed documents that are needed to accompany patients to units that do not have access to the wireless application, which maintains patient assessment data. Since systems were not integrated at Hospital B and ubiquitous IS access is localized, manual records accompanied patients outside of ACU. The same process is true of patients leaving PACU going to either ACU for assessment and discharge or to a floor for hospitalization following general surgery. Printing the documents and then retrieving these documents is problematic and often delays the patients from being transported to the next destination in the patient care system. Electronic signature capability is also needed for maintaining sensitive documents.

At Hospital A an administrator for the registration processes noted concerns that unless printing, label, and copying capabilities were bundled with ubiquitous IS access then the registration personnel would still have to return from a patient's room to the registration cubicles near the ED waiting room to complete the registration process. Registration requires validating patient identification and insurance information, making copies of the documents or cards, printing labels for the wristbands, and signatures on documents. This is a timely process that can be expedited if technologies affording these capabilities could be bundled on a single cart giving the registration personnel full benefits of ubiquitous IS access.

Recommendation Six: Use thin clients and or more random access memory (RAM) to speed up processing time and extend battery lifespan.

Hospital A IS personnel intend to use thin clients in the ED department for ubiquitous IS access to allay processing speed concerns of the devices. At Hospital C nurses noted that the data processing times slowed with each software upgrade. Thin clients require the processing of transactions on a server as opposed to the individual PC. This allows faster processing speeds that help in appeasing user frustration. Additionally, the IS personnel note that using thin clients extends the lifespan of the batteries because the device itself does not process data. They also note that thin clients are more economical, as the following quote notes.

Hospital A IS Manager

P4: "For the ED we will no doubt do thin clients because with the thin clients the batteries lifespan is greater. If the device doesn't have to do processing then we can extend the battery life and it's cheaper to have thin clients anyway."

Recommendation Seven: Use ubiquitous IS access for other tasks in healthcare in which people must be mobile in performing tasks that are location dependent, time dependent, identity dependent, interdependent and information intensive.

The following table describes other task that healthcare professionals in this study indicated as being amenable to ubiquitous IS access. The table outlines the current processes that do not allow ubiquitous IS access processes in addition to the envisioned processes.

Table 13 Tasks Amenable to Ubiquitous IS Access

Task	Current Process	Envisioned Process
Inpatient meal ordering	<ul style="list-style-type: none">- Food administration personnel (FAP) make rounds in hospital gathering meal requests from patients or patient records meal request and forwards to FAP.- FAP reconciles physician ordered meal restrictions with patient meal	<ul style="list-style-type: none">- FAP carries WIS on rounds that provide real-time information about food item availability and physician orders concerning patient meal restrictions.

Task	Current Process	Envisioned Process
	request. - FAP then sort orders and prepare requests based on food availability. - Main drawback is no real time access to availability of certain food items.	- Other FAP in kitchen can access information to simultaneously prepare meals as other FAPs are gathering meal orders. - Main benefit is real-time access to information about food availability and meal orders that decreases time to service and improved patient satisfaction.
Medical supplies inventory	-Inventory personnel or healthcare provider manually inventories medical supplies and enters data into IS. - Main drawback is no real-time access to information and extremely time consuming.	-Implement inventory system that integrates barcode and wireless technology and provides automatic inventory levels (e.g., totals, low item alerts, etc). - Main benefit is accurate inventory stock levels.
Patient transport within hospital	-Transport personnel use walkie-talkies to communicate with nursing stations and transport base about patient transport requests. -Manual records maintained concerning patient's information and transport instructions. -Main drawback is long wait times for transport because of inefficient routing of transport personnel.	-Transport personnel access patient and transport request information via wearable device. -Main benefit is better means of dispatching transport personnel and ability for transport personnel to view real-time transport request information.
Physical therapy	- Therapist maintains manual patient information concerning physician orders for physical therapy, patient health assessment, and progress tracking. -Main drawback is time-consuming records management and inability to wirelessly access needed information while performing therapy tasks.	-Therapists wirelessly accesses patient information via wearable device while rendering care to patient. -Main benefit is real-time access to information and ability to record patient progress at the point of care.

Recommendation Eight: Institute an adequate training plan to increase the likelihood of user acceptance for ubiquitous IS access.

Another issue is adequate training. Due to the severe nursing shortage in the healthcare industry, nurses are very taxed and have limited time for training. Informatics and nursing

education personnel at Hospital C commented that most effective training comes from the following; first, training the nurses in a classroom setting for orientation to ubiquitous IS access, which requires managerial support for excusing the nurses from the floor; second, hands-on training on the floor; and finally, advanced training about the software after they have become more comfortable with maneuvering the carts and operating the program. They also note the effectiveness of going to the floors periodically to reinforce good usability techniques at various stages during the nurses exposure to the technology. They suggest, from experience, relying solely on hands-on training in the work environment is not effective and actually detrimental because of the greater likelihood of technology misuse that could result in patient endangerment. The nurses at Hospital C applauded the training methods and support of the Informatics and Education personnel.

Nurses in ACU of Hospital B commented that their training was inadequate, which hindered their ability to use the technologies for ubiquitous IS access. However, nurses raved about the appropriateness of the training in PACU of Hospital B. In PACU the training entailed charting three times per week with ubiquitous IS access for several weeks prior to the live implementation.

Based on a review of the training manual for the medication administration system at Hospital C, the manual is very user friendly with detailed instructions on how to use both the hardware and software. It also speaks to the purpose of the system and how the IS personnel vow to provide continuous support to the nursing staff. At Hospital B there was minimal interaction with the IS staff for training and no user manual explaining operation of the system for either unit. However, PACU nurses had extensive hands on training, which they developed

themselves, that promoted the realization of a good fit between the task, technology and their individual capabilities.

Recommendation Nine: Include automated barcode-scanning technology or some type of person identification mechanism (e.g., Radio Frequency Identification – RFID)²³ to ensure nurses are charting on the correct patient.

Manual charts stay at patients' bedsides or in boxes outside of the patients' rooms. So these charts do not go with the nurse typically as she/ he makes rounds. As nurses make rounds with the carts for ubiquitous IS access, mechanisms must be in place that ensure they are charting on the right person. With ubiquitous IS access, nurses are no longer retrieving charts at the patient's bedside or that are secured in lock boxes at the entrance to the room – essentially, they roll all the information in with them. Nurses using ubiquitous IS access for electronic charting noted rare occasions when they accidentally began charting on the wrong patient because possibly there were two John Smith's in the unit. Once they realized the problem then they corrected the erroneous entries. However, this is not a fail-safe method for ensuring that nurses are charting on the correct patient.

BCMA requires barcode scanning to ensure that the correct patient's data is displayed during medication administration. Despite the obvious benefits of ubiquitous IS access, no system is advantageous unless it is used properly, whether it's intentional or unintentional use. Using some form of identification (i.e., barcoded wristband or an RFID tag) that (1) remains on the person to ensure that they can be identified at all times and at all stages in the patient care

²³ Reading of RFID tags do not require line of sight as does barcode scanning of patient ID bands that can provide patient identification irregardless of their location within the hospital (i.e., in the waiting room, in transport, in the operating room, etc.), which can prevent erroneous medication administration and intervention; thus reducing liabilities (cited from discussion with Dr. Rolf Wigand, Chair and Distinguished Professor of Information Science and Management at the University of Arkansas).

system and (2) can be decoded and validated by security features built into the wireless system is imperative to ensuring patient safety and protecting the caregiver from making unintentional mistakes.

Recommendation Ten: Safeguard devices with security and location identification features.

In order to keep devices from being stolen or used inappropriately employ location and identification based mechanisms to safeguard devices from theft. Employ good safeguarding principles like user logins and encrypted passwords that are outlined in the HIPAA²⁴ compliance instructions.

Future Research

As indicated in the previous section, future research will seek to further demonstrate the idea of dovetailing convergence. For example, an area to examine could be Education, in which Blackboard and WebCT are not really ideal technologies. These technologies do not really match the way knowledge transfers from teacher to student. Future research will seek to identify other professions or areas that can benefit from ubiquitous IS access as a dovetailing technology.

Another aspect of future research that is directly related to the patient care would be to (1) recode the data based on the task cube dimensions to support the TTIE Fit model, and (2) using quantitative methods test the TTIE Fit model as a causal model, which is based on the concept of dovetailing convergence and findings in the Nurse Perspective. An increasing number of hospitals are considering ubiquitous IS access in various capacities to improve patient

²⁴ The US Health Insurance Portability and Accountability Act of 1996 (HIPAA) that outlines suggestions for securing confidential patient information.

care and allay inefficiencies. A representative sample of the organizations could serve as study participants.

Conclusion

Specifically related to patient care, this research reveals that ubiquitous IS access via wireless technologies, which incorporate effective program design and suitable devices, allays errors that can be fatal, improves patient safety, and enhances the overall quality of care.

Additionally, ubiquitous IS access in this capacity gives a comprehensive view of the patient's medical information, which is imperative for healthcare providers to effectively and efficiently service the patient at every point in the patient care system.

The academic contribution from this research is (1) the identification of a genre of technologies (i.e., those that provide dovetailing convergence) that harmoniously promotes a nearly ideal fit between the tasks, technologies, and drives of the organization and its stakeholders, (2) the influence of the environment in which the task is performed on fit of the technology, and (3) the impact of human drives in light of the environment and its influence on fit of the technology. Additionally, this research has practical implications for both public and private sector hospitals that seek the means to assess the gains from ubiquitous IS access or those that are considering implementing innovative technologies to support this method of data access. The findings and recommendations provide regulatory bodies in the healthcare industry and government insight into applicability of ubiquitous IS access via wireless technologies to improve interdependent tasks such as patient care. The insights can transcend industry boundaries and help to transform subunits and their respective organizations into more efficient and effective institutions.

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APPENDIX

A BACKGROUND INFORMATION ON PHASE I INTERVIEWS

Industry	Date	Organization / Expressed Need for Ubiquity/Project Status	Job Description	Recording Method
Military	092101	<p>Organization: Georgia Department of Defense (GA DOD) http://www.dod.state.ga.us/index.html</p> <p>GA DOD is comprised of approximately 500 state employees, and 12,000 Army and Air National Guardsmen and women that are considered state resources to perform state related defense initiatives mandated by the governor of GA.</p> <p>Expressed Need for Ubiquity:</p> <ul style="list-style-type: none"> • Armories (i.e., military work facilities) under refurbishment but tethered networks costly to refurbish • Need to facilitate mobile work environments in field conditions. <p>Project Status:</p> <ul style="list-style-type: none"> • Project still under review 	CIO of the GA DOD and Interim CIO of the Army National Guard	Field notes – 35min
Aircraft maintenance	030701	<p>Organization: Technology and Industrial Support Directorate (TISD) of Aircraft Mechanics, Robins Air Force Base, Georgia</p> <p>TISD is directly responsible for all IT related projects that aid aircraft mechanics in servicing military aircraft Robins Air Force Base.</p> <p>Expressed Need for Ubiquity: All technical data for aircraft maintenance resided on terminals or hardcopy tech manuals in trailers along the flight line or in a hanger bay, which</p>	Lead Project Manager for wireless implementation flight lines for aircraft maintenance	Field notes- 2hrs

Industry		Organization / Expressed Need for Ubiquity/Project Status	Job Description	Recording Method
		<p>caused delays in service because mechanics had to physically retrieve technical data</p> <p>Delay in services causes decrease in throughput (i.e., number of planes serviced in a week) and is costly.</p> <p>Desired an untethered, portable solution that allowed mechanics to retrieve tech data electronically while on flight line</p> <p>Project Status: Project was halted due to security concerns after terrorist attacks on Sept 11 2001.</p>		
Transportation	032602	<p>Organization: Delta Technologies, Atlanta, Georgia:</p> <p>A subsidiary of Delta Airlines that develop and manage IT projects for selected divisions other than internal airport services of Delta Airlines.</p> <p>Expressed Need for Ubiquity: Delta had dysfunctional baggage system that required cumbersome process for re-routing bags that was not real time. Handlers had to trace baggage locations and destination inside terminal. Process had high error rates and high associated costs.</p> <p>Needed untethered, real-time solution for re-routing bags while they are on the flight line</p> <p>Project Status: Project was halted due to economic impacts of terrorist attacks on Sept 11 2001.</p>	Lead Project Manager for wireless projects for ground transportation of baggage and business travelers	Tape recorded – 1hr
Wireless Business Solutions	280201	<p>Organization: Synchrologic, Inc. http://www.synchrologic.com/</p> <p>Synchrologic provides mobile infrastructure solutions to create competitive advantage by increasing mobile worker productivity and decreasing total cost of ownership of mobile devices. The company's product</p>	Research and Development Company Representative	Tape recorded – 30min

Industry		Organization / Expressed Need for Ubiquity/Project Status	Job Description	Recording Method
		<p>line mobilizes enterprise email and applications, automates the delivery of documents and Web sites, delivers relevant travel information for mobile professionals, and provides mobile systems management tools -- for laptops, handhelds, and smart phones.</p> <p>Purpose for Interview: Rep identified client organizations that could be potential case study sites and statements concerning the level of use and quality of performances gains from ubiquitous IS access</p>		
Wireless Business Solutions	300902	<p>Organization: EMS Wireless http://www.emswireless.com/english/index.htm:</p> <p>EMS Wireless, a division of EMS Technologies, is recognized globally as a leading supplier of RF solutions. The product line consists of a variety of solutions ranging from base station antennas to complete in-building solutions.</p> <p>Purpose for Interview: Rep identified client organizations that could be potential case study sites and statements concerning from ubiquitous IS access</p>	Lead Systems Analyst for wireless implementation at Henry Medical Center	Tape recorded- 1hr
Healthcare	211002	<p>Organization: Athens Regional Medical Facility, Athens, Georgia http://www.armc.org/:</p> <p>Athens Regional Medical Center is a 315 bed, 2000+ employee referral center serving the northeast Georgia area. As a full service health care facility, Athens Regional provides the community a vast array of specialized medical, surgical and diagnostic procedures.</p> <p>Expressed Need for Ubiquity:</p> <ul style="list-style-type: none"> Needs untethered means to create EMRs at patients location to improve 	Lead Project Manager for wireless implementations for patient care systems	Tape recorded- 45min

Industry		Organization / Expressed Need for Ubiquity/Project Status	Job Description	Recording Method
		<p>time to service</p> <ul style="list-style-type: none"> Needs untethered means to track medication administration on floor that helps to reduce erroneous medications given for liability purposes and track dosages to improve cost efficiency <p>Project Status:</p> <ul style="list-style-type: none"> Project for pharmaceuticals or meds administration in initiation stage Plagued by resistance to change No funds budgeted for mobile devices to create EMRs CIO and Project Manager very reluctant to approve case study at the time of this interview because of aforementioned problems Researcher advised to inquire about possibilities of case study in Summer 2003 		
Healthcare	1411102	<p>Organization: Henry Medical Center, Henry County, Georgia http://www.henrymedical.com/:</p> <p>Henry Medical Center is a 124-bed not-for-profit community hospital. A volunteer Board of Directors leads the hospital. It offers medical care to more than 110,000 residents of one of the fastest growing counties in the nation, as well as the residents of adjoining counties. Over 7,500 people are admitted as inpatients each year. Henry Medical was the first hospital to implement a wireless application for creating electronic medical records in the state of Georgia.</p> <p>Expressed Needs for Ubiquity:</p> <ul style="list-style-type: none"> Needs untethered means to create EMRs at patients location to improve time to service in two subunits (Ambulatory Care Unit (ACU) or Emergency Services Unit (ESU) and Post Anesthesia Care Unit (PACU)) Needs untethered means to track medication administration on floor 	Director of MIS Department	Tape recorded – 1hr and 10min

Industry		Organization / Expressed Need for Ubiquity/Project Status	Job Description	Recording Method
		<p>that helps to reduce erroneous medications given for liability purposes and track dosages to improve cost efficiency</p> <ul style="list-style-type: none"> • Needs to create ad hoc and standard reports for quality assurance and financials <p>Project Status:</p> <ul style="list-style-type: none"> • In data administration in PACU • In initiation in ACU • Organizational leaders agreed to be case study site • Varying degrees of acceptance and infusion in subunits 		

APPENDIX

B PHASE I OPEN CODING RESULTS

Concept	Code	*Frequency
Need for real time access anywhere anytime	Ubiquity	4
Need for customer satisfaction	Task Effectiveness	2
Need for mobility	Ubiquity	4
Improved operational task performance	Task Efficiency	2
WLAN usage	Utilization	1
Streamlining decision making process	Organizational Structure	1
Cost reductions	Task Efficiency	3
Governmental regulation compliance	Regulatory Compliance	4
Security of organizational IT assets	Task Efficiency	3
Anxiety concerning use	Personal Affect	1
Improved computer self-efficacy	Personal Affect	1
Seamless integration and asset specificity issues	Technology Characteristic	5
Critical System	Technology Characteristics	1
Ease of Use	Technology Characteristic	3
Fragmented network and disparate systems	Technical Infrastructure	2
Improved service quality and doing task to standard	Task Effectiveness	4
Decreased time for service	Task Efficiency	4
Decrease time for documentation process	Task Efficiency	4
Decrease time querying for information	Task Efficiency	4
Ability to add, modify, and delete information	Task Characteristic	5
Cross functional area communication	Organizational Structure	3
Supportive management	Organizational Culture	6
Differing methods of conducting business in a single industry	Industry Heterogeneity	1
Training for system use	Organizational Culture	2

Concept	Code	*Frequency
Involvement of users in development process	Organizational Culture	3
Physicality of work environment	Task Environment	5
Type of customer being serviced	Task Environment	1
Matching task with proper technology	Task Technology Fit	3
Reluctance to use	Resistance to change	3
Compounding tasks vs standard tasks	Task Complexity	3
Providing info to next subunit or other parts of organization	Task inter-dependence	2
Continued utilization and reliance on new technology	Infusion	1
Increase confidence in ability to deal with uncertainty because of technology characteristics	Personal Affect/Professionalism	2
Improving technical savvyness and confidence in one's ability to use technology	Professionalism	2
Age and technical savvyness of users	Demographics	1
Patient status at time of care	Task Environment	1
Desire to have more time to comfort patient as opposed to performing administrative tasks	Value	1
Desire to minimize any risks due to error reduction for patient (i.e., patient safety) and resulting liabilities	Value/Task Efficiency	2
Desire to improve relationship with patient by respecting patient's space, decreasing patient anxiety, and increasing patient confidence in health care provider	Value	1

APPENDIX

C AXIAL CODING RESULTS

Causal Conditions	Phenomena	Contextual Conditions	Intervening Conditions	Action/Interaction Strategies	Consequences
“... represent sets of events or happenings such as rules, regulations, beliefs, values, etc. that influence the phenomena (Strauss and Corbin, pg. 131).”	“... answers what’s going on, her (Strauss and Corbin, pg. 130)?”	“... the specific sets of conditions ... that create the set of circumstances pertaining to a phenomena (Strauss and Corbin, pg. 132).”	“... mitigate or otherwise alter the impact of causal conditions on the phenomena. (Strauss and Corbin, pg. 131). They may be unexpected events or factors that result in certain behavior or action/interaction strategies associated with the phenomena. However, they also may promote the normal behavior associated with the phenomenon (Strauss and Corbin, pg. 132).”	“...strategic or routine responses made by individuals or groups to issues, problems, happenings or events that arise under those conditions (Strauss and Corbin, pg. 128).”	“...outcomes or actions as to what happens as a result of those actions/interactions or the failure of persons or groups to respond to situations by actions/interactions, which constitutes an important finding in and of itself (Strauss and Corbin, pg. 128).”
CC1: Decrease patient care costs due to organizational inefficiencies CC2: Drive to increase patient safety CC3: Drive to defend he organization from	PH: Ubiquitous access to information facilitated by wireless technologies	CN: Patterns for use demographics CN: Patterns of Nurse anxiety CN: Degrees of actual TTF CN: Degree of perceived relative TTF of management and	IC1: Having a nurse vision statement that articulates the importance of documentation, the utility of ubiquitous IS access, and the nurse's role IC2: Governmental Funding	AS: Utilization AS1: Business Process Re-engineering AS2: Use of WIS for intended purpose of ubiquitous IS access at the point of care	CO: Performance Impacts CO1: Infusion CO2: Task Effectiveness CO2a: Errors reduction CO2b: Better Decision Making Capabilities CO2c: Comprehensiveness of Chart CO2c: Decreased reliance

Causal Conditions	Phenomena	Contextual Conditions	Intervening Conditions	Action/ Interaction Strategies	Consequences
“... represent sets of events or happenings such as rules, regulations, beliefs, values, etc. that influence the phenomena (Strauss and Corbin, pg. 131).”	“... answers what’s going on, her (Strauss and Corbin, pg. 130)?”	“... the specific sets of conditions ... that create the set of circumstances pertaining to a phenomena (Strauss and Corbin, pg. 132).”	“... mitigate or otherwise alter the impact of causal conditions on the phenomena. (Strauss and Corbin, pg. 131). They may be unexpected events or factors that result in certain behavior or action/interaction strategies associated with the phenomena. However, they also may promote the normal behavior associated with the phenomenon (Strauss and Corbin, pg. 132).”	“...strategic or routine responses made by individuals or groups to issues, problems, happenings or events that arise under those conditions (Strauss and Corbin, pg. 128).”	“...outcomes or actions as to what happens as a result of those actions/interactions or the failure of persons or groups to respond to situations by actions/interactions, which constitutes an important finding in and of itself (Strauss and Corbin, pg. 128).”
liabilities CC4: Rising Costs of Healthcare to Providers and Patients CC5: Need for improvements in the patient/provider relationship because WIS can be a tool for explaining patient's condition to the patient CC6: Mandated Use CC: Influence of others CC7: Manufacturing		executive leaders CN: Degrees of user resistance to change CN: Degree of user trust in the system CN: Level of drive to acquire user acceptance	IC3: Task Environment Concerns IC3a: Acute Condition of Patients IC3b: High volume of patients to care for IC3c: Closed Environment IC3d: Physical Confines of the Work Environment IC3e: Disturbances that interfere with patient care IC3f: Patient Status IC3g: High degree of uncertainty	AS3: Use of WIS as a Tool to Strengthen the Patient/ Provider Relationship AS4: Inappropriate Use of Technology AS: Execution of IS Support plan	on memory for documenting CO2d: Improved patient care giver relationship CO2e: Improvement in patient care quality CO2f: No legibility problems CO2g: Reduction of nurse anxiety CO3: Task Efficiency CO3a: Ability to pay more attention to patient's condition CO3c: Easier Accountability CO3d: Decrease in time

Causal Conditions	Phenomena	Contextual Conditions	Intervening Conditions	Action/Interaction Strategies	Consequences
“... represent sets of events or happenings such as rules, regulations, beliefs, values, etc. that influence the phenomena (Strauss and Corbin, pg. 131).”	“... answers what’s going on, her (Strauss and Corbin, pg. 130)?”	“... the specific sets of conditions ... that create the set of circumstances pertaining to a phenomena (Strauss and Corbin, pg. 132).”	“... mitigate or otherwise alter the impact of causal conditions on the phenomena. (Strauss and Corbin, pg. 131). They may be unexpected events or factors that result in certain behavior or action/interaction strategies associated with the phenomena. However, they also may promote the normal behavior associated with the phenomenon (Strauss and Corbin, pg. 132).”	“...strategic or routine responses made by individuals or groups to issues, problems, happenings or events that arise under those conditions (Strauss and Corbin, pg. 128).”	“...outcomes or actions as to what happens as a result of those actions/interactions or the failure of persons or groups to respond to situations by actions/interactions, which constitutes an important finding in and of itself (Strauss and Corbin, pg. 128).”
perspective of organization to get patients in and out as soon as possible CC8: Need for improving communication within the organization CC9: Need for comprehensive documentation CC10: Need for Integrated Data and ISs CC11: Need for tools to train nurses			IC3h: Volume of medication changes IC5a: Computer Self-Efficacy IC5b: Preference for face-to-face communication over dependence of information system used for ubiquitous IS access IC5c: Technical Savvyness IC5d: Adequate typing skills IC6a: Differences in how Users view IS		for patient charting CO3e: Decreased chance of not inputting critical data because of mandatory data CO3f: Increase number of patients serviced CO3g: More accurate charge captures CO3h: Streamlining of Processes for Ordering or Patient Care Tasks CO3i: Patient Volume Increase because of Efficiencies in Patient Registration CO3j: Quality Assurance

Causal Conditions	Phenomena	Contextual Conditions	Intervening Conditions	Action/Interaction Strategies	Consequences
“... represent sets of events or happenings such as rules, regulations, beliefs, values, etc. that influence the phenomena (Strauss and Corbin, pg. 131).”	“... answers what’s going on, her (Strauss and Corbin, pg. 130)?”	“... the specific sets of conditions ... that create the set of circumstances pertaining to a phenomena (Strauss and Corbin, pg. 132).”	“... mitigate or otherwise alter the impact of causal conditions on the phenomena. (Strauss and Corbin, pg. 131). They may be unexpected events or factors that result in certain behavior or action/interaction strategies associated with the phenomena. However, they also may promote the normal behavior associated with the phenomenon (Strauss and Corbin, pg. 132).”	“...strategic or routine responses made by individuals or groups to issues, problems, happenings or events that arise under those conditions (Strauss and Corbin, pg. 128).”	“...outcomes or actions as to what happens as a result of those actions/interactions or the failure of persons or groups to respond to situations by actions/interactions, which constitutes an important finding in and of itself (Strauss and Corbin, pg. 128).”
due to high nurse turnover CC12: Need for Ubiquitous IS access CC13: Need to afford staff with flexibility CC14: Need to Improve Cost Effectiveness CC15: Need to Improve Data Entry Processes CC16: Need to improve patient satisfaction CC17: Need to			IC6c: Ability to trust quality of data in the system IC6d: Resistance to Change IC6e: Super Users ad their Usefulness in Training IC6f: Technology Intimidation IC7: TTF IC8: Trust between the patient and the caregiver IC9: Technology Characteristic IC9a: Architecture IC9b: Battery Life		CO4: Increase for FTEs which causes an increase in overhead expenses CO5: Easier access to information for accreditation assessment teams CO6: Increase in time to service patients for making patient assessments and administering medications CO7: Increased Chances of Germ Transfer because of Mobile Equipment CO8: Interference with quality of care because of

Causal Conditions	Phenomena	Contextual Conditions	Intervening Conditions	Action/Interaction Strategies	Consequences
<p>“... represent sets of events or happenings such as rules, regulations, beliefs, values, etc. that influence the phenomena (Strauss and Corbin, pg. 131).”</p>	<p>“... answers what’s going on, her (Strauss and Corbin, pg. 130)?”</p>	<p>“... the specific sets of conditions ... that create the set of circumstances pertaining to a phenomena (Strauss and Corbin, pg. 132).”</p>	<p>“... mitigate or otherwise alter the impact of causal conditions on the phenomena. (Strauss and Corbin, pg. 131). They may be unexpected events or factors that result in certain behavior or action/interaction strategies associated with the phenomena. However, they also may promote the normal behavior associated with the phenomenon (Strauss and Corbin, pg. 132).”</p>	<p>“...strategic or routine responses made by individuals or groups to issues, problems, happenings or events that arise under those conditions (Strauss and Corbin, pg. 128).”</p>	<p>“...outcomes or actions as to what happens as a result of those actions/interactions or the failure of persons or groups to respond to situations by actions/interactions, which constitutes an important finding in and of itself (Strauss and Corbin, pg. 128).”</p>
<p>streamline processes in light of nursing shortage CC18: Recruiting and retention of nurses by using innovative technologies as a tool CC19: Drive to generate revenue CC: Drive to Bond CC: Drive to Learn CC: Drive to Acquire User Acceptance</p>			<p>IC9c: Bundled Technologies Requirement IC9d: Sufficient keyboard IC9e: Mobility IC9f: Multiple uses for mobile cart IC9g: Processing ability for thin clients IC9h: Problems with ensuring security of WLAN from hacking IC9i: No need to sign in and out on computers in each room IC10: Task</p>		<p>inadequate program design CO9: No Impact on Decision Making Structure</p>

Causal Conditions	Phenomena	Contextual Conditions	Intervening Conditions	Action/Interaction Strategies	Consequences
<p>“... represent sets of events or happenings such as rules, regulations, beliefs, values, etc. that influence the phenomena (Strauss and Corbin, pg. 131).”</p>	<p>“... answers what’s going on, her (Strauss and Corbin, pg. 130)?”</p>	<p>“... the specific sets of conditions ... that create the set of circumstances pertaining to a phenomena (Strauss and Corbin, pg. 132).”</p>	<p>“... mitigate or otherwise alter the impact of causal conditions on the phenomena. (Strauss and Corbin, pg. 131). They may be unexpected events or factors that result in certain behavior or action/interaction strategies associated with the phenomena. However, they also may promote the normal behavior associated with the phenomenon (Strauss and Corbin, pg. 132).”</p>	<p>“...strategic or routine responses made by individuals or groups to issues, problems, happenings or events that arise under those conditions (Strauss and Corbin, pg. 128).”</p>	<p>“...outcomes or actions as to what happens as a result of those actions/interactions or the failure of persons or groups to respond to situations by actions/interactions, which constitutes an important finding in and of itself (Strauss and Corbin, pg. 128).”</p>
			<p>Characteristics IC10a: Charting By Exception IC10b: Diagnosis Task IC10c: Information Management Task IC10d: Interdependence IC12: Program Design IC12a: Degree of Ease of Use IC12b: Lack of user involvement in design IC12c: Redundant Data IC12d: Query capabilities IC12e: Screen Size IC12f: Appropriate</p>		

Causal Conditions	Phenomena	Contextual Conditions	Intervening Conditions	Action/Interaction Strategies	Consequences
<p>“... represent sets of events or happenings such as rules, regulations, beliefs, values, etc. that influence the phenomena (Strauss and Corbin, pg. 131).”</p>	<p>“... answers what’s going on, her (Strauss and Corbin, pg. 130)?”</p>	<p>“... the specific sets of conditions ... that create the set of circumstances pertaining to a phenomena (Strauss and Corbin, pg. 132).”</p>	<p>“... mitigate or otherwise alter the impact of causal conditions on the phenomena. (Strauss and Corbin, pg. 131). They may be unexpected events or factors that result in certain behavior or action/interaction strategies associated with the phenomena. However, they also may promote the normal behavior associated with the phenomenon (Strauss and Corbin, pg. 132).”</p>	<p>“...strategic or routine responses made by individuals or groups to issues, problems, happenings or events that arise under those conditions (Strauss and Corbin, pg. 128).”</p>	<p>“...outcomes or actions as to what happens as a result of those actions/interactions or the failure of persons or groups to respond to situations by actions/interactions, which constitutes an important finding in and of itself (Strauss and Corbin, pg. 128).”</p>
			<p>screen flow IC12g: Inadequate testing IC13: Perceived relative advantage IC14: Patient Anxiety IC15: Organizational Manager Support IC15a: Encouragement from Champions IC15b: Funding Requirements for Implementation and Maintenance IC16: Organizational Issues IC18: Job Culture</p>		

Causal Conditions	Phenomena	Contextual Conditions	Intervening Conditions	Action/Interaction Strategies	Consequences
<p>“... represent sets of events or happenings such as rules, regulations, beliefs, values, etc. that influence the phenomena (Strauss and Corbin, pg. 131).”</p>	<p>“... answers what’s going on, her (Strauss and Corbin, pg. 130)?”</p>	<p>“... the specific sets of conditions ... that create the set of circumstances pertaining to a phenomena (Strauss and Corbin, pg. 132).”</p>	<p>“... mitigate or otherwise alter the impact of causal conditions on the phenomena. (Strauss and Corbin, pg. 131). They may be unexpected events or factors that result in certain behavior or action/interaction strategies associated with the phenomena. However, they also may promote the normal behavior associated with the phenomenon (Strauss and Corbin, pg. 132).”</p>	<p>“...strategic or routine responses made by individuals or groups to issues, problems, happenings or events that arise under those conditions (Strauss and Corbin, pg. 128).”</p>	<p>“...outcomes or actions as to what happens as a result of those actions/interactions or the failure of persons or groups to respond to situations by actions/interactions, which constitutes an important finding in and of itself (Strauss and Corbin, pg. 128).”</p>
			<p>IC18a: Drive for Entering the Profession IC18b: Value of Face-to-Face Communication between Nurses at end of shift IC19: IS Personnel Support IC20: Industry Culture IC21: Implementation Issues IC21a: Lack of benchmarking IC21b: Adequate training IC22: Healthcare Legislation</p>		

Causal Conditions	Phenomena	Contextual Conditions	Intervening Conditions	Action/Interaction Strategies	Consequences
“... represent sets of events or happenings such as rules, regulations, beliefs, values, etc. that influence the phenomena (Strauss and Corbin, pg. 131).”	“... answers what’s going on, her (Strauss and Corbin, pg. 130)?”	“... the specific sets of conditions ... that create the set of circumstances pertaining to a phenomena (Strauss and Corbin, pg. 132).”	“... mitigate or otherwise alter the impact of causal conditions on the phenomena. (Strauss and Corbin, pg. 131). They may be unexpected events or factors that result in certain behavior or action/interaction strategies associated with the phenomena. However, they also may promote the normal behavior associated with the phenomenon (Strauss and Corbin, pg. 132).”	“...strategic or routine responses made by individuals or groups to issues, problems, happenings or events that arise under those conditions (Strauss and Corbin, pg. 128).”	“...outcomes or actions as to what happens as a result of those actions/interactions or the failure of persons or groups to respond to situations by actions/interactions, which constitutes an important finding in and of itself (Strauss and Corbin, pg. 128).”
			IC23: Flawed business processes IC24: Need for adequate number of devices provided for use		
<p>Key: (Note -The labeling convention simply aids the researcher in sorting codes. The numbering scheme does not reflect importance of any code over another code.)</p> <p>CC - Causal Condition PH - Phenomena CT – Contextual Condition IC – Intervening Condition AS – Action/Interaction Strategy CO – Consequence</p> <p>Some codes changed categories in selective coding. The most recent categorization and labeling for codes are reflected in the perspective models.</p>					

APPENDIX

D NURSE PERSPECTIVE MODEL DATA

Sample Data Attributing to Code Label and Definition	Code	Definition
	CC: Task objectives	Higher order code used for grouping that refers to goals of the task
<p>P22: “I think they are really helpful in making sure that we don't make mistakes in giving meds to patients. It's really for patient safety but it does help us also. We have a good record of every med given to the patient since they have been in the system. With BCMA you can check prior orders and you have all the information you need about the patient right there at your fingertips. If you have any questions or concerns because you are still the person administering the meds, you can call the doctor or the pharmacy. You know who ordered what, when it was validated and who did it. It something doesn't make sense to you about the order when you go to give the med then it's now easier for you to find out if it's valid or not because you know who exactly to call and ask. All of that information is right there in the system. It just helps you not make any errors. It doesn't save anytime it's just so much safer and that's really what's important. It's better to be a little late than sorry.”</p> <p>P23: “I think it's not really a time issue though. It's more a patient safety issue. It makes you be very careful. There are a lot of alerts that will tell you if something is wrong. Some things you may not have caught before like an expired medication that needs to be renewed.”</p> <p>P24: “Using BCMA is the safest way to give meds though and it protects you as the nurse. I know that the physicians and the pharmacists have okayed these medications for me to give. I still make sure that they pass the common sense test but the system has so many alerts that you</p>	CCTO1: Drive to increase patient safety	The motivation to protect the patient from harm while the patient is in the healthcare system

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<p>really don't have to worry about messing up and giving the wrong med if you follow the procedure. ... You as he nurse are at the frontline of patient safety. I mean sometimes it does happen that the doctor meant to give another med and it does get validated by the pharmacists but you know something it's quite right so you can check it easier. With bedside charting that can be done right at the bedside and it's really important to do that for critical care patients where you can't afford to miss something in the patient's condition."</p>		
<p>P 3: "The old way I always reviewed the narrative in the chart, which may be kinda long but with the electronic chart we chart by exception so it doesn't take me long at all when I need to look at a chart that one of the nurses complete. If I have a question quite often I just get use a cart to look at the chart as opposed to asking a nurse or going to the manual file."</p> <p>P14: "I don't have to carry the chart with me or leave it at the bed, which is inconvenient when you have to get some information off of the chart. I just look it up right there wherever I am."</p> <p>P23: "To me the patients seem more comfortable with us using the computer to give them the medications. They ask questions about what they are getting and you can show them what the doctor's ordered. Calm their nerves by showing them this and then saying and the pharmacist validated it and now I look at it a third time before I give it to them. They seem to like this idea. Actually with the computer you spend even more time with the patient sometimes. Since the process takes a little longer you end up spending more time in the patient's room."</p> <p>P24: "There are times when you need to know stuff right away to make a decision about what to do for the patient or to troubleshoot what's going on with the patient. You may not have time to hunt down the physician, a pharmacist, or another nurse to ask questions. The big thing with the computers is that if everyone does what they are supposed to do then all of the information you truly need about the patient is right there. I don't have to waste time asking someone else I can just look it up in the</p>	<p>CCTO2: Drive to learn information about the patient</p>	<p>The desire to collect information, examine the environment, make observations, and sustain an ongoing internal and external dialogue about explanatory ideas and theories concerning the patient to assess the condition that aids in decision making concerning medical intervention</p> <p>Adapted from:</p> <p>1. Drive to Learn (Lawrence and Nohria, 2002) – An expression of consciousness by emotion variously labeled inquisitiveness, wonder, and curiosity that pushes humans to collect information, examine their environment, make observations, and sustain an ongoing internal and external dialogue about explanatory ideas and theories</p>

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system. Also no one has to ask me about Mr. So and So when I'm with another patient.		
<p>P18: It's really important that you have a record of everything but also because you need to cover your own self. If someone asks why you did it then you have to back it some way and you can't remember everything thing so having it in the system or on the printout is necessary for us. I don't want to get in trouble either.</p> <p>P24: Using BCMA is the safest way to give meds though and it protects you as the nurse. I know that the physicians and the pharmacists have okayed these medications for me to give. I still make sure that they pass the common sense test but the system has so many alerts that you really don't have to worry about messing up and giving the wrong med if you follow the procedure.</p>	CCTO3: Drive to defend from liabilities	<p>The desire to protect oneself an reputation from threats due to negligent accountability</p> <p>Adapted from:</p> <p>1. Lawrence and Nohria (2002) - innate drive to defend themselves and their valued accomplishments wherever they perceive them to be endangered</p>
	CC: Task informational needs	Higher order code used for grouping that refers to requirements of the task
<p>P8: "Well let's take this emergent situation. A patient comes in with some sort of trauma. And let's say they were a patient before so we have some historical medical records. We can scan the barcoded id, scan the meds to be administered or query and assign a medication, and "boom" the system tells them that there is a problem based on the allergy history and actually notes an alternative med. The beauty of wireless is that this can be done right there at the bedside at the point of care all within a subsecond response time. This absolutely requires wireless. Yeah, it could be on a PC on a stick but truly to have and be there you don't want to have to find a PC on a stick or a PC at the nearest nurse's station. You need it right there."</p> <p>P13: "... if they are with one patient then they don't have to leave that patient to access records for another patient. They can just look up the information in the system on the carts that they have with them."</p> <p>P12: "So if the doctor asked you a particular question and maybe you</p>	CCTI1: Need for ubiquitous access to information	The need to a retrieve pertinent data when and where a task is performed

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<p>didn't do the initial assessment and had to look it up. It would be in the narrative, which takes a while to get through. We were told that it would make charting faster and we could take it with us from patient to patient. So you could have the information when you needed.”</p> <p>P22: “With BCMA you can check prior orders and you have all the information you need about the patient right there at your fingertips. If you have any questions or concerns because you are still the person administering the meds, you can call the doctor or the pharmacy. You know who ordered what, when it was validated and who did it. It something doesn't make sense to you about the order when you go to give the med then it's now easier for you to find out if it's valid or not because you know who exactly to call and ask. All of that information is right there in the system.”</p> <p>P26: “We went to wireless so that the nurse is in constant contact with her computer. She's not tethered and she can move up and down the ward as needed. If a nurse is with a patient and another patient asks something, she doesn't have to disconnect and go plug in at that patient's location. The nurse can access the patient information from wherever they are in working in the ward.”</p> <p>P28: “You have to be driven by the idea that technology can help keep the patients safer or help the nurses get timely information to help them make better decisions or help them communicate something about the patient to providers or the patient. From my office I can look up anything on a patient and I don't have to go to the ward or call Tallahassee. The accessibility to information is phenomenal.”</p>		
<p>P5: “You know you can't package this as it will just save time documenting but rather link to more time with the patient and a means to get a more thorough chart done... So we emphasize comprehensiveness of the chart and more time with the patient.”</p> <p>P17: “Nowadays all the legal stuff that goes with healthcare it's critical</p>	CCTI2: Need for comprehensive documentation	The need for complete information required to accomplish a task efficiently and effectively.

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<p>that you be able to justify everything that you do. Because you know with all the law suits nowadays everything you do ill be looked at and you have to say why you did this and that. It's better if you have it all documented.”</p> <p>P18: “Well depending on what it is like giving a pain medication dosage could mean life and death. You have to be so careful with everything you do for and to the patient. You need to document it all. But the good thing about the system is that you don't have to write it all down. You just point and click and add the stuff you need to.”</p> <p>P18: “If someone asks why you did it then you have to back it some way and you can't remember everything thing so having it in the system or on the printout is necessary for us.”</p> <p>P18: “...it means a lot when you take that patient to the floor and pass the chart to the attending nurse. If they can't read what you wrote or have to hunt through the narrative it slows them down and they have to call you and ask.”</p>		
<p>P3: “We opted for the wireless because everything is just so cluttered already on the walls and there is really no headspace for anything else, so we needed something that we could move in and out. I'm sure that you saw all of the equipment in the patient suites. We've got the suction apparatus and the oxygen cups so we felt that it would be way to inconvenient to have this system mounted at the patients head or at the bedside. We need that room for the other equipment.”</p>	CC: Task physicality concerns	Factors in the environment in which the task is performed such as physical constrain that are identified as having a bearing on the how the task is performed
<p>P4: “The areas that we think wireless will be most suitable for are in positive patient identification (bar code type technology), patient tracking, medication administration, charge capture for tests meds, etc., anything that will give the physician sub second response time for information they need, physical therapy (in fact, our sister hospital St.V's in Birmingham is using wireless devices in the physical therapy department for tracking data during the patients therapy), also the dietary is a big one. Right now it is so inefficient how they gather meal requests, they go to the patient with a checklist everyday. They have a team of</p>	CC: Task characteristics	<p>Features of a task that describe its nature and performance (e.g., interdependence, information intensity, and degree of uncertainty).</p> <p>Adapted from:</p> <p>1. Thompson (1967)-</p>

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<p>people that go through the request and create labels for each meal. It's preposterous. We are looking for some packaged software that can handle this and then put them on a thin client give it to the tech that goes in to the rooms to collect the order. It would be a time save and much more efficient."</p> <p>P5: "Well, currently the nurses write down notes while they are with the patient and then when they get some down time they transfer it to the records. What they do for the patient at the bedside does not constitute all of the information that is needed to complete a record. They may need to look up some history on the patient or go into another system to get some information. A lot of them do their charting at the end of a shift. Sometimes they have to look for a free computer to get any existing information to put into the record."</p> <p>P20: "...well honestly in nursing you tend to do your charting...you don't always have the opportunity to do it at the bedside. So you basically, you'd come back with your clipboard and do your charting. The computers are here because of being portable and we could go to the bedside and be able to type in."</p> <p>P21: "I had a meeting just earlier today where we were talking about wireless and possibly using that for bedside registration types of issues for the admissions department to be able to go to the patient bed, maybe in the ER or possibly even up to a room or something. And actually do the registration process there instead of still, and that's why I'm not sure exactly on the process, but to hear them talk they have to get up and take their notebook or whatever and go over and get the data and then they come back and have to key it in. So if that truly is the process then they should get some good gains there."</p> <p>P22: "Usually 1 LPN is the med nurse and she can give up to 28 people their meds. It's not really safe for them sometimes because we are always full and there are so many meds to give. The RN takes care of the any PRNS or pre-med for procedures that frees the LPN up to do the</p>		<p>Interdependence means the extent to which departments depend on each other for resources or materials to accomplish their tasks. Three types of interdependence (i.e., pooled, sequential, reciprocal). Reciprocal interdependence is the highest degree in which the output from one unit is the input for another and that output serves as input for units that processed the input previously. Task completion requires intensive information and frequent exchange between the units. Reciprocal interdependence occurs in organizations that perform intensive technologies or tasks, which provide a variety of products or services in combination to client such as a hospital in which coordinated services are provided in patient care.</p> <p>2. Goodhue and Thompson (1995) - Actions carried out by individuals that transform inputs to outputs</p>

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<p>normal med pass. So we need a computer for whoever is helping the LPN.”</p> <p>P24: “ It now takes me longer to give the meds but I know it's safer so it's worth it. Now some time savings come when you use computer to do the assessments and type everything in right then as you assess. That's in another program though for the patient records. You have to assess the patient before you give meds because for example the blood pressure has to be within parameters before you can give some meds. If I can get through that without having to write everything then it makes up for the time that I spend actually scanning and giving the medications.”</p> <p>P25: “A lot of nurses say that it takes them longer. I don't mind because to me the fact that all of the information is right in the computer I can get to information much faster when I have a question. For example, if I think something is wrong with the order in the computer, I can find out right away who were the ordering physician and the validating pharmacist and get my questioned answered right away. It takes less time for the orders to go in and be validated. We don't have to wait for everything to get transcribed and then go to the pharmacists. Everything about the order is right there in the computer.”</p> <p>P26: “Technology is increasing day by day and you may hear the staff say that the system increased there work load because there are more steps that you "have" to do now but it also decreases the work. In the old days you had to take the scribblings from the doctor, transcribe it correctly, fax down to pharmacy, wait for pharmacy to transcribe it again and when pharmacy sent that medication up to you on the floor you had to make check if the pharmacy interpreted the same way that you did. So there was a lot more problems there.”</p> <p>P28: “When you put this together with the fact that the physicians were ordering electronically, we then developed a seamless system where there was no chance for human error or intervention bc the doctors were ordering electronically. There was not a unit secretary transcribing to</p>		

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<p>send to the order to pharmacy. The order is sent directly to pharmacy, the pharmacy validates it and then the nurse could view it. This eliminated steps in the process for meds validation by the nurse but did it make it faster, NO. Because you still had to follow a changed process which was not the flow that they had before. It was that perception that anytime you use "technology" it's meant to be faster. It was never meant to do that – it was meant to be safer, not more efficient but more effective and safer.”</p>		
<p>P2: “The fields on the screens were really disorganized whereas on the paper checklist it was ordered based on the procedure. We had different checklists for each procedure. The system about tripled the time it took to chart. Apparently there was a miscommunication about how long we were going to need the computers each day. We needed them around the clock. The batteries kept dying on us and they would lock up. Then it got to the point that the batteries died out and we had to keep them plugged up all over the place.”</p> <p>P3: “Our department is not that large but we still like being able to wheel the carts with us from station to station. ACU is much larger and they have three main bays as opposed to ours. Their nurses have to go all over the place down there. Here our stations are relatively close but the benefit is that each nurse takes a cart with them and keeps it with them until their shift is over. Otherwise they would have to come over to the nurses' station and sign in and out on the desktops to do their charting. It's just more convenient with the carts. When we were implementing that one of the things we were thinking about was if we wanted something mounted on the wall or the wireless. We opted for the wireless because everything is just so cluttered already on the walls and there is really no headspace for anything else, so we needed something that we could move in and out. I'm sure that you saw all of the equipment in the patient suites. We've got the suction apparatus and the oxygen cups so we felt that it would be way to inconvenient to have this system mounted at the patients head or at the bedside. We need that room for the other equipment. We had several vendors come out and we chose the wireless carts. They are really small laptops computers that fit</p>	<p>CC: Technology characteristics</p>	<p>Features of a technology such as mobility afforded that describe its nature and performance.</p> <p>Adapted from:</p> <ol style="list-style-type: none"> 1. Goodhue and Thompson (1995) - Capabilities of the tools used to assist the individual in carrying out tasks such as hardware, software, data, user support services (i.e., documentation, help desk, training prior to use).

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<p>onto carts that we can roll from station to station.”</p> <p>P4: “For the ED we will no doubt do thin clients because with the thin clients because the processing speed is quicker.”</p> <p>P5: “But with the wireless they can access the historical data they need and input the current data as they work.”</p> <p>P6: “Well, for one unless we can package a label printer and a scanner along with the laptop then we can't really get the benefits of being wireless because the registration personnel have to take the information, make copies of the insurance and ID, and then print out labels for the arm band and for the chart. So regardless of being wireless they still have to go back to the cubes to get the printout and come back so I'm not sure if it will really save time. Our IT people have been describing the type of devices that could work in this environment. We looked at some device that actually was wall mounted and folded into a space in the wall because we have very limited space in these rooms. We also looked at the PCs on a Stick but haven't and tablet. The tables were just too heavy to lug around. We haven't played around with the other devices. We are still trying to determine which device would be better. But whatever it is we rally need to be able to get to a printer that's close or have a printer and a scanner with each device to really get any benefit.”</p> <p>P20: “Unfortunately our charge here on our batteries...we've learned a little, it's not as great as what we were anticipating. And so we're having a little difficulty with the charge holding so the unit has to be plugged in wherever we're using it and sometimes that's not always accessible in a room to plug it in because of other equipment. So we are having to come back to the computer unfortunately and not always being able to do it at the bedside.”</p> <p>P21: “...when we were looking at the wireless equipment, we did have EMS bring in the demo piece. We had at least one other company bring in a demo piece. There's I think was Data Vision. I think that it was more</p>		

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<p>like a writing tablet type laptop and to me it looked real cute and high-tech, but it wasn't very functional. Cause it just kind of, the writing surface area you get with the MS product just wasn't there, just much smaller surface to be able to put it, and then you printed chart on there or anything else that the nurses have while they're working on it.”</p> <p>P23: “I like the carts and being able to go from room to room. I don't really see any other way of being able to deliver medications because of all what we "have" to do in the process. The carts need to have more space on them though or a drawer so that you can sit the meds there and they don't fall off. Right now we have to keep going back and forth to the med cart to get the meds and then going into the patient's room.”</p> <p>P25: “One thing though is that we need cordless scanners. The scanners don't reach very far and sometime it's hard to reach over the patient or get to the item we need to scan. Oh we need drawers on the carts too. Some of the meds are fluids that could slide off or go in intravenously and we need space on the cart to hold these. We need the computers to stay working all the time and the batteries go down so that gets in the way.”</p> <p>P29: “I like the laptops but maybe the carts could be a little slimmer or maybe something that's not on the cart that you can put in your pocket.”</p>		
	CC: Individual characteristics	Higher order code used for grouping that refers to innate drives of the user
<p>P 2: “A lot of the nurses didn't take them into the rooms. They would leave them plugged in outside of the rooms in the hallways or at the nurses' station... a lot of them never took it into the room from the beginning because they thought it took away from them being able to make eye contact with the patient... When we are not making eye contact with the patient and making eye contact is crucial to easing the patient's nerves about their upcoming surgery. Our patients come in very nervous and we like to talk to them ask about their kids and let them get to know us. If they don't trust that you are going to take care of them they their</p>	CCIN1: Drive to bond with the patient to establish trust and decrease patient anxiety	The desire of the nurse to form and maintain an interpersonal relationship with the patient that (1) promotes mutual confidence that the patient and the caregiver will act appropriately and in the best interest of the other and (2) calms the patient’s nervousness

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<p>anxiety goes up which is an emotion but this causes physical problems like blood pressure increase or nausea and you have to stabilize them before getting them ready for surgery so this delays the process.”</p> <p>P 5: “So therefore, you can devote more time to comforting the patient because after all that's what matters. The patient wants to feel reassured that you are paying attention to them. And the nurse's first priority is to take care of the physical needs of the patient but they need to understand that documentation is still very important but they have been trained to care not to document. These are nurses and they like people. They want to be there when the patients needs them.”</p> <p>P12: “Being able to chart and assess quicker because of not having to do all of that writing would give you more time with the patient. That's the important thing. Back here patients are coming in for day surgery and a lot of them are really nervous so the more time you can have just easing their nerves the better.”</p> <p>P13: “I like to be right in there with the patient you have to tend to them first because they get scared about the surgery. I don't have time to mess with the computer.”</p> <p>P15: “I felt like it always took my attention away from the patient. I didn't make eye contact because I would have to fiddle with the computer.”</p> <p>P20: “Honestly, probably from most of the nurses' standpoints, they prefer not to take the computers into the room. They feel like it takes away from your rapport when you're continuously looking at a computer screen instead of eye to eye with them. And they, I think not only because of technology they prefer not to and they...we actually, they use a piece of paper and take their notes down for what's going to need to go in. Most of them don't like taking the computers in the room.”</p> <p>P23: “To me the patients seem more comfortable with us using the</p>		<p>and apprehension about upcoming events, the quality of the services provided, and the effectiveness of the outcomes.</p> <p>Adapted from:</p> <p>1. Drive to Bond (Lawrence and Nohria, 2002) - the innate drive to form social relationships and develop mutual caring commitments with other humans that is only fulfilled when the attachment is mutual</p>

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<p>computer to give them the medications. They ask questions about what they are getting and you can show them what the doctor's ordered. Calm their nerves by showing them this and then saying and the pharmacist validated it and now I look at it a third time before I give it to them. They seem to like this idea. Actually with the computer you spend even more time with the patient sometimes. Since the process takes a little longer you end up spending more time in the patient's room.”</p> <p>P29: “It's very important because you just need to make sure their vitals are okay to do whatever procedure they are having done. Also when they are being assessed for discharge their vitals have to be monitored as well. I suppose if the system was working right then it would have given us more time with the patient because we could document quicker. We could just take care of the patient or just talk to them or the family for a while to get them to feel comfortable with you. Some come in really grumpy or in pain and it's helpful if they are comfortable with you because then they kinda let their guards down and they aren't so hard to deal with.”</p>		
<p>P2: “At first I would take them into the room because I was comfortable with the computer but when the other nurses started talking about losing eye contact with the patient and how using the computer at the bedside was cumbersome when they were trying to comfort the patient.”</p> <p>P4: “ We are trying to afford the care provider a way of working more efficiently without being bogged down by the clerical work they have to go and find at a workstation. When tablets came out we thought they would be non-intrusive and they weren't. They are heavy and if the application isn't totally operated by drop downs and other selection areas then you need a keyboard. They are hard to enter data into. We gave these to some of the nurses and they gave them back to us by the time they reached the end of the hallway. They were too heavy and the nurses wanted a decent sized keyboard.”</p> <p>P5: “Well, currently the nurses write down notes while they are with the patient and then when they get some down time they transfer it to the</p>	<p>CC: Perceived relative task technology fit (TTF) (of ubiquitous access relative to non-ubiquitous access)</p>	<p>The perceived compatibility or correspondence between task requirements, the functionality of the technology, and the individual characteristics of the user relative to prior technologies used for task performance</p> <p>Adapted from:</p> <p>1. Goodhue and Thompson (1995) - The compatibility or correspondence between task requirements, individual abilities, and functionality of the technology.</p>

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<p>records. What they do for the patient at the bedside does not constitute all of the information that is needed to complete a record. They may need to look up some history on the patient or go into another system to get some information. A lot of them do their charting at the end of a shift. Sometimes they have to look for a free computer to get any existing information to put into the record. It's time consuming and they can make mistakes or leave important information out of the records because they try to remember everything they did. We are trying to stop them from charting at the end of a shift also because it causes them to have to work overtime. But with the wireless they can access the historical data they need and input the current data as they work.”</p> <p>P 6: “The main problem we have here with patient satisfaction is that the wait is too long in the ED and often the patients leave without receiving any care. I think the real benefit is in patient satisfaction. Basically, in my opinion, if the patients get to a room faster they believe that they are getting better care and that makes them more cooperative our registration personnel and the nurses. Now since it takes so long to be seen the patients often are very irritable with the registration personnel because they see it as having to do all of this paperwork, which is a big delay to their service. They really give them a hard time. So if we can bypass the registration cubicles and get them into beds quicker they will feel better about how diligently we are working to care for them. This lowers their anxiety and the anxiety of the registration personnel because they are dealing with much less irritable people. Using wireless saves the time it takes to enter data that you get from the patient.”</p> <p>P19: “But if we standardize charting and give them a more convenient way of charting like with a wireless application then I think documentation will be much easier for them (as opposed to manual charting). Not to mention the managers or coordinators that have to review some of these charts for quality assurance.”</p> <p>P24: “I liked the idea that something was going to help us give medications safer. When they told us about what it was supposed to do</p>		

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<p>for us, I thought it was going to be great.”</p> <p>P29: “At first, everybody was telling us that it was going to save us too much time in documenting we would be able to spend so much more time just caring for the patient or doing what we have to get the patient ready for surgery. A lot of the nurses from the beginning were very skeptical but they kept telling us that it was really going to make what we do easier. We would also be able to look at the patient's record from wherever we were working and not have to go check the chart. It sounded great and I was looking forward to using because I thought it would help me care for the patient better but it didn't work like that.”</p>		
<p>P2: “We didn't have a choice. We had to use it.”</p> <p>P3: “Our previous director had a vision for us to go to paperless charting. She thought it would speed up charting time and make things safer... with the vital stats charting there are very skinny lines on the graphs and you have to be very precise in drawing the graph. It's easier to make a mistake when drawing by hand... She [the previous director] said we [the nurses] would have to do it. We [the nurses] opted for the wireless because everything is just so cluttered already on the walls and there is really no headspace for anything else, so we needed something that we could move in and out.</p> <p>P12: “It was mandatory.”</p> <p>P22: “The VA told us we had to do it.”</p>	<p>CC: Management or Governing Authority's Level of Perceived relative task technology fit (TTF) (of ubiquitous access relative to non-ubiquitous access)</p>	<p>Management dictate for sub-unit or organizational wide use of wireless technologies for information management</p>
<p>P22: “We use the wireless to get the information about the patient's meds.”</p> <p>P16: “We chart with the wireless and can get to other patient charts on there as well.</p>	<p>PH: Ubiquitous access (UA) to information (facilitated by wireless technologies)</p>	<p>The occurrence of the event that answers the question “What's going on?” in the environment (Strauss and Corbin, 1998)</p>
<p>P 2: “When I had that computer I noticed that I was too concerned about getting the information into the computer and printed out before the</p>	<p>CN: Actual TTF</p>	<p>The degree to which the technology actually</p>

Sample Data Attributing to Code Label and Definition	Code	Definition
<p>patient went to surgery. The program was so cumbersome that it made things too difficult and you felt too rushed to deal with the patient. I don't like that. We all said that the patient is our priority not that computer."</p> <p>P15: "For us, we only have four rooms that we work out of and we just plugged them up outside the room. Since the system really didn't fit our needs anyway we just kept it out in the hallway."</p> <p>P16: "...if I get busy it's okay to do the charting later because it's easy to get caught up."</p> <p>P29: "The other thing is that regardless of being able to chart at the bedside you still had to go back to the printer because a paper copy of the chart had to go with the patients into surgery. We don't have a lot or at least enough printers and we were having to run back and forth. A lot of times you would go to get your printout and couldn't find it because someone placed it to the side. It was a nightmare. ... Well if the program had worked right then it would have been great to take them with you as you did assessments because you could document as you go. I wanted to take them but the batteries would conk out and so either you had find a place to plug them in the room. Another problem is that we don't have a lot of space in these rooms and is was a little hard to get them up to the bedside anyway, especially when there is the patient, their stuff, their family along with the monitors and just everything else in the room. We just mainly kept them plugged up in the hallway, which to me kinda defeated the purpose of having them in the first place."</p> <p>P23: "I like the carts and being able to go from room to room. I don't really see any other way of being able to deliver medications because of all what we "have" to do in the process. The carts need to have more space on them though or a drawer so that you can sit the meds there and they don't fall off. Right now we have to keep going back and forth to the med cart to get the meds and then going into the patient's room."</p>		<p>contributess to task completion, which the user realizes after actual use (in this case after the phenomenon occurred), that influence subsequent strategies employed</p> <p>Adapted from definition of TTF (Goodhue and Thompson, 1995) and Contextual conditions (Strauss and Corbin, 1998)</p>

Sample Data Attributing to Code Label and Definition	Code	Definition
<p>P 3: “But because it's there you can be more at ease about charting. You don't have to worry about "Oh Lord I've had this patient for 30 minutes and I haven't charted a word." It's just easy to catch up. You don't have to worry about charting in the case that you get a patient and they are really hurting or have problems with their tubes. You can care for the patient without stressing out about getting the chart completed.”</p> <p>P9: “Anytime the patient's are upset about something it kinda affects you too. We are trained to deal with this but sometimes it does get to you. You really are concerned about getting the patient comfortable and getting your assessment done because that's the first step in them being able to get the procedure done. If you take a long time doing the assessment then it takes longer to get them in for the procedure. Everybody gets upset about that and so we try to not let that happen.”</p> <p>P13: “I'll admit it scared me to use and I would get so frustrated trying to use h the thing. No I didn't want the patient seeing that so like I said I really only tried to use it a couple of time.”</p> <p>P15: “Well, when I tried using the "thing" in the rooms I always felt like the patient was watching my every move.”</p> <p>P18: “...it helps because I can chart right there while I'm working with a patient. I'm not stressing about the charting if I have a patient that needs a lot of attention. I know that I can get caught up quickly.”</p>	<p>CN: Nurse anxiety</p>	<p>The nurse’s degree of nervousness and apprehension about being able to perform a task to the required quality level.</p>
<p>P 5: “The majority of the nurse are in their 40s and 50s they don't and were training this way. It never was really emphasized how important documentation is.”</p> <p>P 5: “A lot of them don't even type so to tell them they will have to document on a computer will cause a lot of frustration.”</p> <p>P13: “Well, there was very little that I liked about it. I'm from the old school.”</p>	<p>CN: User demographics</p>	<p>Similar characteristics or defining attributes such as age and technical capabilities that are common for a sample of users and contribute to similar behavior</p> <p>Adapted from:</p>

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<p>P19: “Most of the nurses are 40 to 50 and they don't really like using computers anyway so we really had to make it easy for them. I knew we could make it easy enough for them but getting them to use it was still a problem because most of them couldn't even type.”</p> <p>P20: “Basically here I think our nursing staff age range would be early 30s to mid-50s. So this was a challenge for this generation with the computers to learning. But they have all done exceptionally well...really have picked up their speeds on computers. But it was not thought of highly by a lot of them because they were very computer illiterate if I can say that.”</p> <p>P23: “I was kinda scared about using it because I am not really used to the computer.”</p> <p>P24: “I'm okay with computers. They don't scare me like some of the others. I used computers at my nursing school.”</p> <p>P25: “A lot of us can't type so it was hard adjusting to doing this on the computer. A lot of us don't even use computers and we were never really trained in nursing school to operate this way. The younger nurses seem to be much more comfortable with the technology.”</p> <p>P28: “You've got nurses who finished school long before any of this technology became available and were putting it right in the middle of the core to what they do – giving medications to patients.”</p>		<p>1. Relational demography - similar characteristics such as age, gender, tenure, education, and race influence outcomes in individual performance (Tsui Egan, and O-Reilly, 1992) and corporate governance (Young and Buchholtz, 2002)</p>
<p>P 4: “A lot of the data technicians or aids are not really excited because they think this will streamlining the process especially in the dietary area will eliminate their need. Some people aren't happy about that idea because it means we can eliminate some full-time and part-time positions that are just data entry related. In ED, this may be possible too. <i>(ICIF1: Fear of losing job)</i>. Another area is just basic change. Healthcare people don't like to change because they are content with doing things a certain way. Even if this is easier and more efficient for</p>	<p>IC: Other inhibiting factors</p>	<p>Mitigating conditions that impact the user's approval and usage of the technology for task performance such as fear of losing job, resistance to change, social norms in the job culture, and inadequate training.</p>

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<p>them to use, they feel somewhat threatened by new technology (<i>ICIF2: Resistance to change</i>). They don't want a lot of oversight either. They know that it takes entirely too long to process patients for registration and that this system will reduce that time. But they still complain because we told them that they will have to plug the carts in to recharge them. I don't understand. They don't want ownership of the wireless carts. The managers are eager to get them but the registration personnel don't want to have to be responsible for them....To me the view of technology in this industry has not kept up with the changes in technology. Becoming more efficient usually means someone will lose their job. It's intimidating. They don't realize that just about every system or device they use in this hospital is PC based. They have become very dependent on the technology but if the technology is something that they see as necessary to help them take care of the patient then it's essential. They just don't like change even if it's for the better. Here is an example, in the ED they have told us that yes they think it will make their jobs easier but they don't want to have to be responsible for these devices. They even went as far to say not to rely on them to plug them in. They want a dedicated IT staff to deal with recharging them. That's insane but they don't see these types of systems as their own they don't want to take ownership of them like they would a defibrillator. It's strange.”</p> <p>P 5: “Documentation is seen as a burden to most nurses. It's time consuming and most of the nurses don't realize why it needs to be as detailed. They feel like the documenting takes up patient. They will not want to change even if we say oh this will save you so much time. They still will be very leery. ...It's a cultural issue really. People in this industry don't really like change... You know documenting at the end of a shift or the time for the report at turnover is a social event. That's your time to relieve some stress talk about what's happened in the day and kind of socialize with the other nurses on your shift or with the ones coming on. There was a study done when we eliminated the nightly report (i.e., a session of all the nurses at the end of a shift). The nurses hated it because that was their time to talk and let off some steam but from an organizational standpoint it really served no purpose because the</p>		<p>Adapted from:</p> <p>1. Davis et.al, (1989) – External variables (such as training, documentation, availability of user support) and internal variables (derived from user perceptions of the ease of use and usefulness) contribute to the likelihood that the intended user will reject the system.</p>

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<p>charts were supposed to contain all necessary information. Well, the charts didn't and a lot of information got passed by word of mouth at the end of the shift during the report. Some areas still do some form of the report and maybe not all information about the patient makes it into the chart but at least the oncoming nurse knows" (<i>ICIF2: Resistance to change</i>)</p> <p>P13: "I would just still use my checklist. I'll admit it scared me to use and I would get so frustrated trying to use the thing. No I didn't want the patient seeing that so like I said I really only tried to use it a couple of time. Everybody said it didn't work anyway so I didn't even bother really." (<i>ICIF3: Social norms of the job culture</i>)</p> <p>P15: "Well, back here in endoscopy we only had one day of training." (<i>ICIF4: Inadequate training</i>)</p>		
<p>P20: "So I think as, in comparison to other units, our number of pages that we've used screens was very much larger than most other units because we do encompass a lot of patients. I think on the most part they like it. The early complaints are things that are out of our control as far as what we're dealing with, with our charges. And then of course if you the system goes down then it kind of causes a little chaos here for a little while, but we resort back to paper. And it has happened and that is our backup...we resort the assessment tools we were using before; we'll go to paper. And when it's gone down it's only been for usually a short amount of time, but there is a time period if we're getting someone ready we have to have things done in order for them to go to surgery. So we'll just document on paper ...I use to live down south in Warner Robbins. And we started computerized nurses' notes way back then. So when I came here in I think it was '98 and we started the self-computerized nurses' notes last year. I'm kind of like...I know what it is, but the thing is we started working...when we started in the department level upstairs, you know on the pediatric floor, meds reg. floor, and actually we didn't do it in outpatient surgery. It seems to work better in an environment that you have more time to work with the patient and you aren't so stressed</p>	<p>IC: Task environmental inhibitors</p>	<p>Mitigating factors in the physical environment and/or external factors seen as source of uncertainty that impact pre-planning and inhibit intentions or promote the need for alternative solutions</p> <p>Adapted from 1. Tushman and Nadler (1977)- Those external factors attended to by organizational members, seen as source of uncertainty that impacts pre-planning and inhibit intentions</p>

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<p>about the charting. It's to "busy" down here for it but we are trying to use it." (CCTV2: <i>Unrealized impact of hectic nature of complex environment that inhibit use</i>)</p> <p>P21: "We can't know every thing that is going to happen in a patient care scenario but we wanted to give the nurses the ability to capture as much as possible. In ACU it is more difficult to know all that needs to be done. A lot is exploratory but at least they can chart the patient admin things and look up generic medical info to help them make some initial decisions about how to immediately treat the patient. A lot is exploratory but at least they can chart the patient admin things. Some don't like to use it there because they have a lot of stuff going on all of the time. In PACU things are a little more stable because the patient is under anesthesia and there are more standard things to be done that are known as opposed to a patient's condition in the ACU, which can change erratically." (CCTV3: <i>Unrealized impact of high uncertainty in complex work conditions that inhibit use</i>)</p> <p>P29: "Another problem is that we don't have a lot of space in these rooms and it was a little hard to get them up to the bedside anyway, especially when there is the patient, their stuff, their family along with the monitors and just everything else in the room." (CCTV1: <i>Unknown physical constraints that inhibit use</i>)</p>		
<p>P20: "We do all of our documentation using the new system. In all of our assessment, anything that we do on the patient we document here in our computers. I think on the most part they like it. The early complaints are things that are out of our control as far as what we're dealing with, with our charges. And then of course if you the system goes down then it kind of causes a little chaos here for a little while, but we resort back to paper. And it has happened and that is our backup... we resort the assessment tools we were using before; we'll go to paper. And when it's gone down it's only been for usually a short amount of time, but there is a time period if we're getting someone ready we have to have things done in order for them to go to surgery. So we'll just document on paper....as far as documentation, a lot of our old forms that we did on</p>	AS: Utilization	Overall dependence or reliance that the individual exhibits in using the technology for the intended purpose (Goodhue and Thomson, 1995)

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<p>paper were more charting by exception. You do checks so it was really fast also. It's probably about the same amount of time. And unfortunately it may be more prolonged with the computers when we do have computer glitches it's slowing the time. We have a real big turnover in our department. It's a very fast paced unit so we unfortunately have to move fast and get things documented quickly.”</p> <p>P24: “The computer is so convenient I think because I can go into the other program for the patient's records and look up patient information, check on the status of labs. I use it for everything I can really.”</p> <p>P24: “When it goes down we hate having to go back to writing everything down. We still use the same process of validating we just have to write it all out. That's hard and time consuming.”</p> <p>P25: “Oh yes, we are dependent... we hate when something happens or it slows down.”</p>		
<p>P 2: Yes, the coordinator never was very enthusiastic about having to use the technology and felt like it wasn't appropriate for this department. She used something similar at Warner Robins Medical and said it was great on the floors because you have more time to use it. I can get a patient ready in 10 minutes but then with the computer it took me 25 to 30 minutes. I could be with a patient and something happens to the battery or something isn't on the screen that I needed.”</p> <p>P 3: “We don't have a wireless cart for each patient station, we have six carts but normally this is more than enough. It's convenient for the wireless to be on wheels so we can move from station to station. We can definitely do the charting much faster. We designed the screens ourselves, actually we built them and we actually designed how to chart in the system. The biggest difference between the old way and now is the charting by exception. That means that if something unusual happens during the patient's stay we document that but otherwise everything on the chart and every detail that we need for our records is already built into the system and we don't have to put it into the narrative. So one of</p>	CO: Performance impacts	Impact of use of the technology on task efficiency (i.e., performing the task with minimal waste of technical and human resources (Tushman and Nadler, 1977)) and task effectiveness (i.e., successfully matching information processing capacities with the information processing requirements of the task (Tushman and Nadler, 1977))

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<p>the biggest advantages of doing this is that it expenditures the charting. If there is a lot going on with a patient, once you get the patient settled then you can more easily catch up on your charting? The old way it took a lot more time. Even for people who can't type they still are getting their charting done faster. I say on average it cuts down on about 15 minutes, which gives them more time to see after other patients or spend more time with the patient if they have complications like pain or nausea following the surgery... it's certainly more legible and I don't have to go searching through files to get the copy. I can check the chart from any of the mobile carts. So if there is a question about something and I am with a patient I just pull up the record in question instead of going to the filing cabinet and pulling the record or leaving my patient to take a look at the other chart in some cases... they were so excited about not being bogged down with all of the writing that was required with the paper chart. My staff wants to tend to the patient and anything that will help them do that is welcomed. So this was the major reason why they wanted to use the system because they could have to time doing other things for the patient rather than writing forever. They didn't have to worry about getting behind and rushing to get the chart done bc with the wireless they could easily come back to it.”</p> <p>P 3: “I can see anybody's chart and get to it from any of the cart even when we take the carts upstairs to accompany the patient. But the chart only stays in the system for a day. I cannot see a chart from the previous day because at midnight the system purges itself but we keep the hardcopies anyway. So we aren't paperless but it's been easier for us to complete a chart. The system has enhanced our ability to care for the patient when they need it... it puts my mind at ease because I guarantee you that with the old way if I hadn't done any charting in 45 minutes I would be freaking out and would definitely finish that patient before I could check another in. The system is so streamlined now it allows me to catch up so quickly and not make errors because it's all by exception.”</p> <p>P16: “I suppose because you are less likely to miss something in the</p>		

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<p>patients behavior or movement that would indicate a problem because you are right there charting at the bedside as opposed to entering data at the nurses station or something.”</p> <p>P20: “I think our assessments are a lot more clear because you're forced on the computer to address each of the areas. So I really think that legally and as far as thoroughness, I think are assessments are better now. Because you are forced to enter and move on and to address things where I think when we're probably missing on the other forms. And I think of course being legible to read is so much better. I mean I think the documentation is a lot better. So it's definitely improved that.”</p> <p>P22: “With BCMA, it makes you more thorough and careful. Sometime here you get so busy and can makes mistakes or forget to give meds but BCMA makes you slow down and take a breath, which we need to do sometimes to make sure we don't make mistakes.”</p> <p>P24: “Now BCMA makes you take longer to give medications but it's so much safer.”</p> <p>P25: “For example, if I think something is wrong with the order in the computer, I can find out right away who were the ordering physician and the validating pharmacist and get my questioned answered right away. It takes less time for the orders to go in and be validated. We don't have to wait for everything to get transcribed and then go to the pharmacists.”</p>		

APPENDIX

E ORGANIZATIONAL MANAGER PERSPECTIVE MODEL DATA

Sample Data Attributing to Code Label and Definition	Code	Definition
	CC: Organizational goal drivers	Higher order code used for grouping that pertains to organizational objectives
<p>P9: I stress to the nurses all the time make sure your charts are clear and legible and that you write everything down that you did for the patient. We have classes that each nurse takes as annual training to stress this to them. Some lawyers give the glass because they need to know how important it is for them to document well to be able to defend what they do and say regarding a patient. They don't realize it until someone gets summoned to a deposition for a patient that's suing the hospital for wrongful care. I really don't think the nurses still understand the importance of documenting... As managers it's always at the forefront of our minds.</p> <p>P26: The one thing that we teach the nurses is that the "use of the technology" adds to your safety and your licensing now because when you go to give that med there is a doctor who says it should be given, a pharmacist has verified it and then you give it. In the old days it was just you in that boat and now there are at least two other people in there with you. It's less prone for error and protects you as the nurse as well as the patient. It those days you as the nurse took on all of the responsibility. You made sure you interpreted what the doctor wrote was right and that what the pharmacy sent you was what you interpreted it to be. You were in the boat by yourself. With this technology I can build a progress</p>	CCOD1: Drive to defend from liabilities	The desire to protect the resources of any group from threats (Lawrence and Nohria (2002) organizational level definition)

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<p>notes and I can build it with all of the bells and whistles that you need to get into your charting that protects you legally as opposed to giving you a sheet of paper and saying now write a progress note you having to remember everything you did. So that you can protect yourself some 5 years from now when some lawyer's got you on the stand.</p>		
<p>P5: They need to understand that what they do or don't do has consequences. If they don't charge properly the hospital loses revenue and our costs go up so we charge even more for care or the pharmacist who has to take a loss in inventory because the nurse failed to document a charge.</p> <p>P8: It happens a lot that the patient may be ready to go home but on more test is ordered and because it was ordered late in the day the X-ray machine is ready until the next day, now the patient has stayed over night and they are charged more. They aren't happy, the insurance companies aren't happy with them or us and over time this could impact the reputation with our customers, the patients. Not to mention insurance companies forbidding patients to come to us because of this "over" charging due to our inefficiencies. Wireless can at least give us a better means of avoiding these situations because the physician or nurse can enter data right there at the patient's bedside during care.</p> <p>P9: Charge captures will be greatly reduced the amount of "free" service that is given away. The nurse sometimes forget like I said before because they write what was given to the patient and rely on notes or memory until they could put it into the charge system back at the nurse station. Having the wireless system will enable to them to do it right there.</p> <p>P21: We came to use this feature, because the wireless application that we use for inventory has a feature for</p>	<p>CCOD2: Drive to improve cost effectiveness and generate a surplus</p>	<p>The desire to eliminate unwarranted expenses, rectify erroneous expenses, and acquire revenue that protects the economic sanctity of the organization</p>

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<p>patient charting. This feature could help in speeding up the time it takes to chart a patient's status, create the initial record, and any type of documentation that the nurses must do. (Code: Task Efficiency) We were paying maintenance on the software feature but had not used it. So we decided to develop it and tailor it as much as possible for the needs of our four other units in the hospital that deal with some type of patient admin (i.e., charting on records) or some need to document care. We needed our solution to work with the WLAN we already established.</p> <p>P8: Contrary to common belief, the idea on the business end is "get them out of here as soon as possible". We operate like a factory any backlog during the process impedes of from taking in more. Healthcare makes money on volume not the prolonged stays.</p> <p>P9: We lose money when patients aren't seen because we can't charge if they never get registered. Also we lose money if nurses don't charge for meds properly or for certain comfort items to the patient. They have to track these items or meds in order to charge properly and sometimes the nurse feels really badly for the patient and won't charge. The hospital loses money this way but most often the nurse genuinely forgets to add it into the patients record so that they are charged. Having wireless will make it easier for the nurse to just document when they do what.</p>		
<p>P27: You don't want your staff to be leaving and having a high turnover rate because there is already a nursing shortage.</p> <p>P28: We have high turnover in staff because of the competition that we have in the community. We are one of the largest healthcare systems in the state. (Note: An offline discussion with this organizational</p>	CCOD3: Drive to recruit and retain nurses	The desire to attract nurses for employment within the organization and to prevent them from leaving due partly to work conditions

Sample Data Attributing to Code Label and Definition	Code	Definition
<p>manager revealed that this hospital competes with other co-located healthcare systems and they have a need to recruit and retain nurses due mostly to the dire nursing shortage overall in the profession. Practitioner literature (Buerhaus, et.al, 2003) notes that there are nearly 90,000 unfilled nurse positions in the US and over 9,000 of those positions are in the state in which this organizational manager works.)</p>		
<p>P5: (Speaking of how they achieved executive level buy-in for the wireless implementation) You have to tie this implementation into patient safety and patient quality of care. We stressed being able to reduce errors with the documenting and decreasing the time to register in ED will definitely improve the chances of a patient being seen.</p> <p>P27: I think the driver for the VA mandating it for nationwide use is that certainly the intention was that the VA is taking a stand on the numerous errors that were jeopardizing the safety of the patients and this is one way that we can be even safer.</p> <p>P28: You have to be driven by the idea that technology can help keep the patients safer or help the nurses get timely information to help them make better decisions or help them communicate something about the patient to providers or the patient. The whole focus of this is not about the innovate aspect of wireless. It's about patient safety. So the perception that it would make things faster was not where our goal was. It was to make it safer.</p>	CCOD4: Drive to increase patient safety	The motivation to protect the patient from harm while the patient is in the healthcare system
<p>P6: The main problem we have here with patient satisfaction is that the wait is too long in the ED and often the patients leave without receiving any care. I think the real benefit is in patient satisfaction. Basically, in my opinion, if the patients get to a room faster they believe that they are getting better care and that makes them more cooperative our registration</p>	CCOD5: Need to improve patient satisfaction	The desire to more effectively service the patients and attain conformation of the degree of their contentment with the quality of care provided by the healthcare professional

Sample Data Attributing to Code Label and Definition	Code	Definition
<p>personnel and the nurses. Now since it takes so long to be seen the patients often are very irritable with the registration personnel because they see it as having to do all of this paperwork, which is a big delay to their service. They really give them a hard time. So if we can bypass the registration cubicles and get them into beds quicker they will feel better about how diligently we are working to care for them.</p> <p>P9: Another concern of ours is improving patient satisfaction with the care we give them. If we can get them in the door in the Emergency Department and at least get them to a room right away for the emergent then the patient is more likely to be satisfied. And the faster we can get them registered the faster they can actually be seen.</p>		
	CC: External influence	Higher order code that refers to external sources that influence perceptions of organizational members
<p>P5: We think we know what we want to do but we like hearing about what other hospitals are doing. All hospitals want to see successful implementations elsewhere before they try anything new.</p> <p>P20: (When asked about the drivers for the WIS implementation) I think it was more just we were trying to stay up with everyone else... I think the idea for us to start here was with just modern technology...a lot of institutions are going with computer charting.</p> <p>P21: (When asked about the drivers and industry culture based issues that impacted the decision to implement) Would say it's probably kind of mixed because we've had you know one group of people that are almost...they the hospital up the road has it so we need to have it. You know I just came back from a conference and all those other hospitals are doing it and it's going to save us so much</p>	CCEI1: Industry norms for technology adoption of ubiquitous access	<p>Actions such as particular technology adoptions amongst other like organizations that have a bearing on the behavior of management</p> <p>Adapted from:</p> <p>1. DiMaggio and Powell (1991) discussion of Institutional Theory and isomorphism – organizations become increasingly similar through institutional forces exhibited by the movement towards, and the maintenance of, institutional norms through coercive, mimetic and normative processes.</p>

Sample Data Attributing to Code Label and Definition	Code	Definition
money.		
<p>P4: The information in the patients record was sacred to the healthcare provider but with HIPAA the patient has the right to review and contest whatever was written in the record. Now they really have to be careful about what goes into the record because they are held much more accountable.</p> <p>P8: The Institute of Medicine (IOM) report came out that said the fifth leading cause of death in the US is being in a hospital...this has really caused our government to look into improvements in healthcare and a lot can be helped by using new technologies to streamline processes.</p> <p>P9: For one you as a manager are always to looking for security concerns and trying to rectify any problems that would put you in violation. Like when HIPAA came out, we had to change the way we arranged the registration cubicles so that no personal information could be seen by anyone other than the registration personnel and the patient. We are always concerned that charts aren't exposed or even that the documents needed for registration aren't left on the copier or out in plain view. HIPAA is just one thing to worry about you still have to be mostly concerned about making sure all the necessary information on the patient is documented.</p> <p>P28: It's (wireless technology) going to be a big part of patient safety in healthcare. Review the Crossing of the Quality Chasm (the follow up to the IOM report). This definitely talks about how technology will play a major role in improving the quality of care and patient safety. We need it everywhere in healthcare.</p>	CCEI2: Healthcare legislation	Government regulations that dictate standards for management of medical information or processes orchestrated by healthcare professionals and administrators

Sample Data Attributing to Code Label and Definition	Code	Definition
	CC: Organizational needs for process improvements	Higher order code used for grouping that refers to required operational enhancements
<p>P3: If they (the nurses) are with one patient then they don't have to leave that patient to access records for another patient. They can just look up the information in the system on the carts that they have with them. Often they need to remind themselves if a patient had a certain medication or the last time vitals were recorded.</p> <p>P4: It could change how often they have to ask the nurse but I really think it will depend on the personality of the doctor. Some will continue to ask the nurse and some will go right to the system. It depends. ... It's in their benefit to share information because ultimately the nurse can't write orders (i.e., labs, referrals, etc.) for a patient. It's the doctor who writes orders. Always having to fetch for the physician takes time and takes you away from your patient.</p> <p>P8: Well let's take this emergent situation. A patient comes in with some sort of trauma. And let's say they were a patient before so we have some historical medical records. We can scan the barcoded id, scan the meds to be administered or query and assign a medication, and "boom" the system tells them that there is a problem based on the allergy history and actually notes an alternative med. The beauty of wireless is that this can be done right there at the bedside at the point of care all within a subsecond response time. This absolutely requires wireless. Yeah, it could be on a PC on a stick but truly to have and be there you don't want to have to find a PC on a stick or a PC at the nearest nurse's station. You need it right there.</p>	CCPI1: Need for ubiquitous access to information	The need to access information when and where a task is performed

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<p>P28: Being two medical centers and eight clinics so that you can have a patient who has primary care at Tallahassee show up at one of our emergency rooms and we have instant access to there information. This is the way we do business on our healthcare setting. ... You (as a manager) have to be driven by the idea that technology can help keep the patients safer or help the nurses get timely information to help them make better decisions or help them communicate something about the patient to providers or the patient. From my office I can look up anything on a patient and I don't have to go to the ward or call Tallahassee. The accessibility to information is phenomenal. We have our billing office remote from here. They don't have to track down charts to code and bill. The charts are on-line and electronic.</p>		
<p>P4: (When asked about the driver for the WIS) It was more to communicate with whomever like a radiologist has a question about an order from a physician and no one can find the physician. The same between the doctors and the nurses. The make calls back and forth or can't find a transporter to move the patients around. Cell phones interfere with the medical devices so we looked at a system called Vocera. It's similar to StarTrek days because you tap the device, which is like a pendant to call whomever. They need to be able to track down essential personnel to get information from them at critical times. Physicians need to make their rounds and don't have time to wait on nurses or other personnel to give them the information they need concerning the patient. They have to have access to these people.</p> <p>P24: (Speaking of the biggest advantage of the WIS)</p>	<p>CCPI2: Need for improving communication within the organization</p>	<p>The desire to afford organizational members with a more accessible and timelier means of exchanging information</p>

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Honesty, it's 'communication'.		
<p>P6: The philosophy is that they will be able to place some orders procedures and testing in a more timely fashion and be able to get the results back even faster. In some cases they would be able to order procedures in before the patient sees the doctor. This is after they have been triaged by a nurse. If the guidelines are established for basic procedures that need to be done then theoretically the registration personnel can go ahead and order some of those things and have them ready for the doctor. For example, if someone comes in with a broken hand and they are triaged as such, once they are registered then the registration personnel can go ahead and order an X-ray. This would be much faster than what happens now. A patient comes in and waits in the ED waiting room to get checked in. They are then triaged by a nurse and then they go to registration to give all proper insurance info. Or if they are critical care patients then they are immediately seen in the back by a doctor and by triage or the registration desk. Currently, the registration personnel either ask the next of kin or the patient if it's possible wherever the patient is and then takes those notes back to the registration cubicles and keys in the data.</p> <p>P8: From a healthcare aspect, it's still very much a manufacturing aspect, where it's still volume and throughput and anything that slows down the throughput is wasting time, resources, and money. Having physicians log in and out or even the nurses for e-charting is a step but not in the right direction because we have wireless devices that can support this. ...The other thing that is very closely related and could be more efficient with wireless is the Physician Order Entry System, where the physician is forced to enter orders to drugs and labs for patients. Today in 95% of the places they write a little note on a piece of</p>	CCPI3: Need to streamline processes	The desire to eliminate steps in processes that waste resources and impede task completion

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<p>paper and have the nurse do it or they write it in a chart for the nurse to do. The nurse then hands it to a unit clerk and they clerk is then suppose to decipher the physicians handwriting. The clerks have about enough medical training to say "okay yeah that seems to make sense, I think it's" And they give it their best guess. There are some built I system checks but a lot of time it doesn't. Even if the computer does give system alerts the alert is seen by the person entering the data, which is a clerk. Now the clerk has to send the Physician an email to clarify and this holds of the order. When the order gets held up then the patient's care is delayed. There is so much room for error this way and it's because the docs don't have time to do it themselves before they move on to another patient. So computerized Physician Order Entry is something that would improve healthcare and provided we have the devices to support this at the point of care. Again wireless devices allowing access to a system with some decision support features is the only way this is really going to work. Yeah it could be done with PCs in every room but that has drawbacks.</p> <p>P27: You've got to invest upfront. And I find that a lot of organizations are not willing to do that.</p>		
<p>P5: (When asked why there is a difference in how the nurses view the monitors and the WIS since both are technical devices) The monitor gives them information to make their jobs easier and they can see how critical it is to the patient but the wireless system is there for documenting which they don't truly respect in the first place and when you add on how they feel about computers then it's intimidating as well. I believe they will come to like it because it will standardize things but it will take some getting use to.</p>	<p>CC: Perceived relative task technology fit (TTF) (of ubiquitous IS access relative to non-ubiquitous IS access)</p>	<p>The perceived compatibility or correspondence between task requirements, the functionality of the technology, and the individual characteristics of the user relative to prior technologies used for task performance</p> <p>Adapted from:</p> <p>1. Goodhue and Thompson (1995) - The compatibility or correspondence between task requirements, individual abilities, and functionality of the</p>

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<p>P8: The benefits of not having to sign in and out is the most unique quality of wireless. HIPAA now comes into play because in healthcare we have to know who is placing the order. If it takes 30 seconds to sign in and get authorizations and then a physician has to go to next patient and doesn't log out. There is potential for the system to keep tracking but with the wrong care giver. This is in violation of HIPAA and makes it a hell of a task to do accurate charges for care. Also it becomes a problem if the caregiver forgets to sign out and can't sign in at the next patient location. We can fix it with 5 concurrent sessions but that again violates HIPAA because that means there are 4 access points that are logged on by the same account. A lot of security issues arise. Wireless could get rid of all of this hassle and we can build more secure features into our infrastructure to ensure we are within HIPAA standards. It's much more efficient.</p> <p>P19: If we standardize charting and give them a more convenient way of charting like with a wireless application then I think documentation will be much easier for them. Not to mention the managers or coordinators that have to review some of these charts for quality assurance.</p> <p>P26: Technology is increasing day by day and you may hear the staff say that the system increased there work load because there are more steps that you "have" to do now but it also decreases the work. In the old days you had to take the scribbles from the doctor, transcribe it correctly, fax down to pharmacy, wait for pharmacy to transcribe it again and when pharmacy sent that medication up to you on the floor you had to make check if the pharmacy interpreted the same way that you did. So there were a lot more problems there.</p>		<p>technology.</p>
<p>P19: "They have to use it."</p>	<p>CC: Organizational</p>	<p>Management dictate for sub-unit or organizational wide use of wireless technologies for information</p>

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<p>P21: "No, it's mandatory."</p> <p>P28: ...it's (the wireless implementation) in conjunction with the other systems that we implemented for patient information that is all electronically stored and on-line. That is the only way we can function as an integrated healthcare system with 10 divisions. (Note: Every hospital mandated use.)</p>	<p>mandate (for ubiquitous access to information via wireless technologies)</p>	<p>management</p>
<p>P21: We have the wireless system in 3 departments (ACU, PACU, and the OR).</p> <p>P28: We are wireless.</p>	<p>PH: Ubiquitous IS access (UA) to information (facilitated by wireless technologies)</p>	<p>The occurrence of the event that answers the question "What's going on?" in the environment (Strauss and Corbin, 1998)</p>
<p>P28: (When asked about continued upper management level support) The biggest issue was that the equipment wasn't fastest enough to support what we were doing. Now it had to be viewed as an equipment replacement budget plan opposed to you try to buy something with the best of what you can at the time. The equipment would break down and it really has to be looked at as a concern for recurring budget. That was probably the most frustrating thing is that the equipment we had when we implemented was part of the inhibitor to them (the nurses) using it.</p>	<p>IC: Continued upper management level support</p>	<p>The unremitting backing from management to continue to provide encouragement and funding for equipment maintenance and additional support personnel after the initial mandate and implementation to promote desired performance impacts</p>
<p>P19: The fact that they if any little thing is wrong with how well it's running or if the battery packs go out then they let us know right away. I suppose if they didn't like it they wouldn't care when it goes down. I have heard that they are really dependent and would hate to have to go back to</p>	<p>CO: Caregiver satisfaction</p>	<p>Observations and opinions of the management concerning the overall contentment of the caregivers with ubiquitous IS access via wireless technologies</p>

Sample Data Attributing to Code Label and Definition	Code	Definition
<p>manual charting all of the time.</p> <p>P21: I hear they (the nurses) are happy and feel more productive. The director and lead nurses now have a better means of tracking the actions of the staff and catching errors quicker because they can go right to any cart and pull up the files that any one nurse put in for review, which is a legal requirement of the director and head nurse. ...I think they've gotten pretty much use to it. I wouldn't go so far to necessarily say that if we took it away they'd...all of them would be upset, but I think they're getting use to it and they see the value in the use of it. ...I think they're pretty much using it appropriately and getting their money worth out of it.</p>		
	CO: Process performance impacts	Higher order code used for grouping that refers to actual testament of enhancements contributed to ubiquitous IS access
<p>P28: You can use the computer system to be a part of the patient/physician relationship. You develop interfaces with graphics that the doctor can use to better explain conditions to the patient. For example, you can create a graph of depicting how a patient's blood sugar is not under control based on historical data. You can show them and ask what are they doing are they not taking the medication. Or you can say you are doing very well on this weight reduction for the past three years and you can show that to them in terms and schematics that they can understand. The patient becomes engaged that way in their own healthcare information. ...You can have a patient who has primary care at Tallahassee show up at one of our emergency rooms and we have instant access to there information. ... This is the way we do business on our healthcare setting. From my office I can look up anything on a patient and I don't have to go to the ward or call Tallahassee. The accessibility to information is</p>	COP11: improvement in patient care quality	Actual testament of enhanced conditions of the care provided by the healthcare professional

Sample Data Attributing to Code Label and Definition	Code	Definition
phenomenal.		
<p>P4: Now that we have these devices we can track how long it takes people to be registered and how many are done in a particular time period and by whom.</p> <p>P28: (Speaking of the primary organizational benefit) Accountability!!! Once you have something in a database you can retrieve it and timeline it.</p> <p>P14: One thing I can do that has been really beneficial is review the work for quality assurance much easier. I don't have to go through all of these narratives and I can actually review these if I need to from wherever I am. So if I have some downtime from charting I can check to make sure that the meds are getting charged or see if they are using the narrative section of the program the right way.</p> <p>P28: (When asked about quality assurance assessments for accreditation) Either the information is there or it's not there (for the accreditation review team to review). You can't back enter anything but at least its more accessible to whomever is doing the assessments.</p>	COPI2: Easier accountability and means of ensuring quality assurance (CO3j)	Actual evidence of a better means of assessing responsibility for actions associated with patient care and reviewing documentation for compliance with standards and thoroughness
P28: You could get interrupted easier with the paper documentation and you were more prone to error because things could be forgotten. When you put this together with the fact that the physicians were ordering electronically, we then developed a seamless system where there was no chance for human error or intervention bc the doctors were ordering electronically. There was not a unit secretary transcribing to send to the order to pharmacy. The order is sent directly to pharmacy, the pharmacy validates it and then the nurse could view it. This eliminated steps in the process for meds validation by the nurse.	COPI3: Streamlining of processes for ordering or patient care tasks	Actual evidence of eliminated steps in processes that wasted resources and impeded task completion

APPENDIX

F IS PERSONNEL PERSPECTIVE MODEL DATA

Sample Data Attributing to Code Label and Definition	Code	Definition
<p>P26: By the time Barcode Medication Administration (BCMA) came around we had already moved towards computerized patient information with these other two systems. BCMA augments these systems by showing the nurse the meds that have been ordered and validated, dosages are there, and specific times when they are to be administered. With BCMA no longer is there so much room for error. The VA saw the benefit in this wireless system and then pushed it for a VA nationwide implementation.</p> <p>P27: Well, Dave and our other partner were told to get this software up and running and do it over 13 floors by the end of the summer. Quite honestly in the government the main driver is just to do it when you are told to and that's what my perception is. However, I think the driver for the VA mandating it for nationwide use is that certainly the intention was that the VA is taking a stand on the numerous errors that were jeopardizing the safety of the patients and this is one way that we can be even safer.</p>	CC: Organizational mandate for ubiquitous computing	Management dictate for sub-unit or organizational wide use of wireless technologies for information management
<p>P4: The key area is in the Emergency Department and doing bedside registration for the critical patients initially then for all patients. We intend to have the registration personnel use the device and go to the patient's bedside. The application that will be running on it will not change just the way the information is collected.</p> <p>P27: We are wireless across all thirteen floors.</p> <p>P28: The VA went to wirelessbeing two medical centers and eight clinics so that you can have a patient who has primary care at Tallahassee show up at one of our emergency rooms and we have instant access to there information. This is the way we do business on our healthcare setting.</p>	PH: Ubiquitous access (UA) to information (facilitated by wireless technologies)	The occurrence of the event that answers the question "What's going on?" in the environment (Strauss and Corbin, 1998)
P21: (Referring to the amount of support rendered from the help desk for trouble calls) We're probably just seeing and answering more (requests for IS support) just because there's more equipment to support with the carts. And now that we've had the	AS: Execute IS personnel support plan	The IS personnel strategy to maintain assistance to the users in terms of the following for example:

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<p>carts for about a year, we're starting to run into some battery issues where they're not holding the charges as long as they initially did. So it's more, we're seeing more to support the new equipment not really any data problems per se.</p> <p>P26: We did a two hour class and we had actual test patients and test meds. The staff got hands on training of being able to pull up a patient's medication record and scanning the patient and meds.</p> <p>P27: We expected a lot of that (user resistance) but part of the issue here was that anybody knew how much time and energy it was going to take to make this system work. They (the nursing staff) didn't have enough support; they didn't have overnight support from IS when they went live. They (the nursing staff) didn't even have a beeper and didn't know who to call if something happened to the system during the night shifts. The personnel here did what they could with what they had. Over the last year we have been trying to make it a better support system. We have pagers and have people on call for support the users.</p>		<ol style="list-style-type: none"> 1. Service for trouble calls 2. Repair and maintenance of equipment 3. Adequate training
<p>P8: The benefit of not having to sign in and out is the most unique quality of wireless. HIPAA now comes into play because in healthcare we have to know who is placing the order. If it takes 30 seconds to sign in and get authorizations and then a physician has to go to next patient and doesn't log out. There is potential for the system to keep tracking but with the wrong care giver. This is in violation of HIPAA and makes it a hell of a task to do accurate charges for care. Also it becomes a problem if the caregiver forgets to sign out and can't sign in at the next patient location. We can fix it with 5 concurrent sessions but that again violates HIPAA because that means there are 4 access points that are logged on by the same account. A lot of security issues arise. Wireless could get rid of all of this hassle and we can build more secure features into our infrastructure to ensure we are within HIPAA standards. It's much more efficient.</p> <p>P26: You would technically have to plug up and sign in and out at each bedside. It's impractical to have the nurses hop scotch up and down. We tried wiring each room at Lakeside but it was really outrageous for us to expect the nurse to plug in and out at every bedside. We went to wireless so that the nurse is in constant contact with her computer. She's not tethered and she can move up and down the ward as needed. If a nurse is with a patient and another patient asks something, she doesn't have to disconnect and go plug in at that patient's location. The nurse can access the patient information from wherever they are in working in the ward.... We used to go to the patient with a list of meds and doses, check charts, the arm band and/or ask patients to make sure it's the right person, give the med then initial that we gave it. There is a lot</p>	<p>CC: Perceived relative task technology fit (TTF) (of ubiquitous access relative to non-ubiquitous access)</p>	<p>The perceived compatibility or correspondence between task requirements, the functionality of the technology, and the individual characteristics of the user relative to prior technologies used for task performance</p> <p>Adapted from:</p> <ol style="list-style-type: none"> 1. Goodhue and Thompson (1995) - The compatibility or correspondence between task requirements, individual abilities, and functionality of the technology.

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<p>of room for error this way, which puts the patient and the nurse in jeopardy. A registered nurse who was returning home from a travel engagement returned her rental car she was returning her car at Hertz and was so amazed when the guy scanned something in the truck, gave her the paperwork, and got her on her way in less than 5 minutes. When she got back to her VA and consulted pharmacist and IS personnel about doing something similar to track when and how meds are given then do all the documentation that is needed. They put something together and implemented it successfully. ... Wireless has a lot of other issues like timing out because of the security mechanism but really it's the most effective way to administer meds and minimize errors in the process. To get around the drawbacks with wireless you would have to hard wire, which causes those problems of plugging up in each room or having a computer in each room, which just isn't efficient. I see potential for more injuries such as tripping over wires or having to reach over patients. So wireless is the best technology for administering meds.</p>		
<p>P4: We are trying to afford the care provider a way of working more efficiently without being bogged down by the clerical work they have to go and find at a workstation. When tablets came out we thought they would be non-intrusive and they weren't. They are heavy and if the application isn't totally operated by drop downs and other selection areas then you need a keyboard. They are hard to enter data into. We gave these to some of the nurses and they gave them back to us by the time they reached the end of the hallway. They were too heavy and the nurses wanted a decent sized keyboard. (Note: This shows how the IS personnel are truly concerned with ensuring user acceptance because they have actually taken the time to get user input but this was not the case at all times in the other hospitals.)</p> <p>P27: National sent a book out with version 1 that was really thick. We are now on version 3. You have to skinny things down for nurses so we have another book that we developed to train with. Nurses don't have a lot of time and training them on the floor does not work because they get interrupted too often. You have to pull them off of the floors for training. That's what happened in version 1, some nurses had to train in the hall. In version 2 we told management that there was too much to learn in version 2 and we could not effectively train nurses on the floor. The nurses still didn't really know how to use the carts and understand the concept of how to change the batteries. There weren't any real directions that came with the carts before. So we did a survey after version 2 and got good feedback about our training manual like "it had good pictures" and "it was thinner". There were a lot of "how to" parts. After version 1 we knew better how to use the system our selves so we ended up making our own training material. We took some material that other VAs had incorporated and focused on the carts themselves in the class. We had an advanced class in my first</p>	<p>CN: Drive to acquire user acceptance</p>	<p>The desire to seek the approval and promote the usage of an implemented technology by demonstrating added value</p> <p>Adapted from:</p> <p>1. Lawrence and Nohria (2002) – The Drive to Acquire is defined as the desire to seek, take control, and retain objects and personal experiences humans value</p>

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<p>year here. The purpose for that class is that when you first train people and then they use it for a while their brains can better accept what you teach them after they have had experience with the it. I wish we could do more of that.</p>		
<p>P27: I found that from being at two different hospitals with major implementations that the organizational leaders have to realize that you have to get support and resources. It is going to take a lot of money and time in order not to make everyone mad. You don't want your staff to be leaving and having a high turnover rate because there is already a nursing shortage. You've got to invest upfront. And I find that a lot of organizations are not willing to do that.</p> <p>P27: ...when we were told to do this by national, we as IS personnel felt the need to tell organizational leaders what really was going on and how realistic it was for us to implement in the time they gave us. We presented along with pharmacy that actually to the organization what our choices were and consequences of those choices. The pharmacy was instrumental in this because BCMA is just a picture of the record that has been put in by the pharmacy software and the physician orders. We didn't do a vision statement but we sure "visualized" for them what the current issues were with trying to implement this system in just several months and why it was not "safe" for us to do.</p> <p>P27: National not only wanted us to put BCMA across all 13 floors but at the same time wanted us to put it in all 4 ICUs. We were saying no way! We are a third fastest growing VA in Florida. We are always full. The ICUs were even more complex environments, more changes in the medications occur and when something changes about the medication then the order changes in the system. We gave them options. Option 1 was we could do it by Nov 30th like national says and gave them the impacts and benefits. Option 2 was we can split it just do the floors and the ICUs later. We could do one floor at a time but that wouldn't work because it's really an all or nothing kinda thing because of the central server. But what really got them and these were the top directors were the pharmacy piece. They each got a little basket with medications that were all labeled and pharmacy did a little demonstration of guess what happens if this code on this little pill isn't right and by the end they were all shaking their heads like "wow". This really proves that if you speak up and have a supportive executive leadership then you can make a change. After this they allowed 4 of us to travel to VAs that had already gone live to look at learned lessons and it really proved well for us. Till this day we got an extension on version 2 and we haven't put our ICUs on the wireless. Actually one of our ICUs will be going wireless next week.</p>	<p>IC: Upper management level support</p>	<p>The unremitting backing from management to provide funding and encouragement to promote use of the technology amongst the desired users. Unexpected changes in upper management support can mitigate intended plans for IS support.</p>

Sample Data Attributing to Code Label and Definition	Code	Definition
<p>P27: The positive is that the executive leadership agreed to let us wait and now we as the IS support system know the system better that we did back then and can provide better support to ICU. We are trying to account for that great amount of change. Another helper is that we asked (executive leadership) for multiple FTEs (full-time employees) and we said we needed 5 more people on the informatics team. We got 2 of the 5. Specifically we needed more pharmacists on the off shifts. We needed pharmacy techs that could help keep track of when meds are given late. We expect success more now than if we had to implement three years ago.</p>		
<p>P19: Most of the nurses are 40 to 50 and they don't really like using computers anyway so we really had to make it easy for them. I knew we could make it easy enough for them but getting them to use it was still a problem because most of them couldn't even type.</p> <p>P21: (Speaking of user demographics) It's all over the board from you know "I'm just a nurse" and "all I want to do is patient care," "don't make me touch the computer" to some folks that are totally savvy with the computer or those who are becoming less adverse to technology because they use this "wireless technology" at work. Of course then there are some of them are like well why are we using this DOS product. Because in this case this piece of it is a DOS based program.</p>	CN: User demographics	<p>Similar characteristics or defining attributes such as age and technical capabilities that are common for a sample of users and contribute to similar behavior</p> <p>Adapted from:</p> <p>1. Relational demography - similar characteristics such as age, gender, tenure, education, and race influence outcomes in individual performance (Tsui Egan, and O-Reilly, 1992) and corporate governance (Young and Buchholtz, 2002)</p>
<p>P4: They don't realize that just about every system or device they use in this hospital is PC based. They have become very dependent on the technology but if the technology is something that they see as necessary to help them take care of the patient then it's essential. They just don't like change even if it's for the better. Here is an example, in the ED they have told us that yes they think it will make their jobs easier but they don't want to have to be responsible for these devices. They even went as far to say not to rely on them to plug them in. They want a dedicated IT staff to deal with recharging them. That's insane but they don't see these types of systems as their own they don't want to take ownership of them like they would a defibrillator. It's strange.</p> <p>P5: The monitor gives them information to make their jobs easier and they can see how critical it is to the patient but the wireless system is there for documenting which</p>	CN: Resistance to change	<p>The innate aversion of the users to modify or adopt new methods of performing tasks due possibly to fear of not knowing the outcome or an uneasiness about unknown factors</p>

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<p>they don't truly respect in the first place and when you add on how they feel about computers then it's intimidating as well.</p> <p>P27: was a project manager and I was really eager to get out to my customers, which was the staff. The main challenge was "change". With any new system, change will come about but this was drastic. We went from putting our initials on a piece of paper that I gave Mr. Smith his mertopralov and put our name at the bottom of to sign in, clear here, scan this and now take this big piece of metal with you. All of this stuff has to get to the bedside (not just the sheet of paper)... There were all these new factors that were never before. It was very drastic. I talked to people and they we like "aahhhh".</p>		
<p>P26: The biggest problems are that the battery packs lose charges. ...The system determines if it's the right patient based on the SSN on the barcode on the wristband and the right med based on the barcode on the meds packaging. It has fail-safes to check the times to ensure the meds are being administered within the allowable times. There are reminders that in case you got busy or the patient was off the ward and when they got back you were busy and a med was skipped. ...The nurses have problems scanning sometimes because either the cords aren't long enough or they just can have a hard time getting in between the beds with the carts. We are getting them cordless scanners.</p>	IC: Technical problems	Unexpected troubles with the mechanics of the system such as software flaws (e.g., poor program design), hardware ailments (e.g., poor processing capabilities and short battery operability) that impede system usage
<p>P26: One example that I still use in training is one night I was on call and Betty and LPN in one of the wards said that she couldn't find a med in the med record that she knows the patient gets. So I went down and Betty was there in front of her computer saying that the system doesn't have the med there for the patient but she was certain that the patient gets morphine for pain. Well, I said let's minimize this and go into the patients orders and of course his narcotic had expired at midnight. I explained that this is an example of how the system keeps you from making mistakes because the med had actually expired so it dropped off the list of valid meds to give to the patient. She said "Oh, okay." The trust in the system was the thing to overcome.</p>	CN: Degree of trust in system	The degree of confidence a user has in the accuracy of the information maintained in the information system and in the ability of the technology to operate appropriately
<p>P21: I don't know what exactly but I hear they are happy and feel more productive. The director and lead nurses now have a better means of tracking the actions of the staff and catching errors quicker because they can go right to any cart and pull up the files that any one nurse put in for review, which is a legal requirement of the director and head nurse. ...I think they've gotten pretty much use to it. I wouldn't go so far to necessarily say that if we took it away they'd...all of them would be upset, but I think they're getting use to it and they see the value in the use of it. ...I think they're pretty much using it appropriately and getting their money worth out of it.</p> <p>P27: Even though, this makes more work for them (the nurses) because of the added</p>	CO: Nurse satisfaction	Observations and opinions of the IS personnel concerning the overall contentment of the caregivers with ubiquitous access via wireless technologies

Sample Data Attributing to Code Label and Definition	Code	Definition
<p>steps required for the bar code scanning, they understand that it's much safer for the patients and that makes them want to use it. It's mandatory so they have to use it but they've told me that it so much easier for them to get information at the bedside if they have a question or need to check something before administering the med.</p> <p>P28: From an IS perspective, the biggest issue was that the equipment wasn't fastest enough to support what we (referring to facilitating ubiquitous access for nurses) wanted to do. That was probably the most frustrating thing (for the nurses) is that the equipment available to implement on a wide scale basis was part of the inhibitor to them (the nurses) using it.</p>		
<p>P21: (Comment refers to User demographics but alluded to receptivity of IS in general –see italicized portion of the quote) It's all over the board from you know "I'm just a nurse" and "all I want to do is patient care," "don't make me touch the computer" to some folks that are totally savvy with the computer or <i>those who are becoming less adverse to technology because they use this "wireless technology" at work.</i></p> <p>P27: We have quite a few nurses that were using the barcode system on the floor at some point in the last 3.5 years and now they migrate into the ICU and have experience with it. So we have nurses who have experience with it. The want to go to more complex environments so we are utilizing then in our training as super users to increase our effectiveness of training the ICU personnel.</p> <p>P30: (When asked to clarify statements concerning “super user” nurses (i.e., those who transfer from the floors to ICU) and user receptiveness to subsequent implementations in other areas in the hospital, P27's replacement answered as follows) Some of the nurses who are now our super users were very intimidated by the technology at first but they overcame this in time. Training helped as well. We have really tried to make this an easier transition for them. Word of mouth about what to expect when the wireless carts come helps to get the ICU nurses on board. It's been an easier process implementing this in ICU than on the floors. Overall they don't seem to be as intimidated by the system or us.</p>	<p>CO: Nurse receptivity to IS in general</p>	<p>Observations and opinion of the IS personnel concerning user openness to IS realized by the decrease in technology aversion</p>