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The perceived benefits of healthcare information technology adoption: construct and survey development

So-Ra Jung

Louisiana State University and Agricultural and Mechanical College, sjung4@lsu.edu

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**THE PERCEIVED BENEFITS OF
HEALTHCARE INFORMATION TECHNOLOGY ADOPTION:
CONSTRUCT AND SURVEY DEVELOPMENT**

A Thesis

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Master of Science

in

The Department of
Information Systems & Decision Sciences

by
So-Ra Jung
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ABSTRACT

This paper is a part of a large study, which examines healthcare professionals' attitudes regarding the adoption, use and perceived benefits of healthcare information technology (HIT). To date, literature on HIT has shown many important benefits related to quality and efficiency as well as limitations related to generalization and to a lack of empirical data on benefits. The aim of this paper is to develop a survey instrument focused the perceived benefits of HIT adoption. We exhaustively reviewed the construct of perceived benefits in various research areas to identify established approaches to predicting individual's intentions to adopt technology. The items of perceived benefits taken from previous studies were developed and modified, and three benefit dimensions (direct, indirect and strategic benefits) were described. The questionnaire addressed the following issues: demographic information, perceived benefits of computerized physician/provider order entry (CPOE), and intent to adopt CPOE. We present a survey instrument containing the perceived benefits construct targeting healthcare executives. This is developed and validated by the translational validity test that attempts to assess the degree to which we accurately translated our construct into the operationalization. The Importance of the instrument for perceived benefits of HIT adoption as well as its limitations is also presented.

1. INTRODUCTION

Over the last few decades, information technology (IT) has significantly altered the nature of work and existing organization structures in many industries (Wheeler, 2002). One such industry that has seen dramatic changes in technology is the healthcare organization. IT is seen as an enabler of change in healthcare organizations, and Healthcare Information Technology (HIT) is currently receiving great attention and playing an important role in healthcare organizations. Many research papers (Betes, 2000, Johnston et al., 2003, Overhage et al., 1996, Wong et al., 2003, and Menachemi and Brooks, 2006) reported that IT in healthcare has significant potential to improve patient safety, organizational efficiency, and patient satisfaction. And the realization of these benefits is especially important to successful HIT adoption. In 2004, President Bush introduced the initiative to make Electronic Health Records (EHR) available to U.S. residents within the next ten years and through the executive order created the National Coordinator of Health Information Technology. The Administration worked to expand the use of HIT to increase efficiency, reduce medical errors, and improve quality of care while protecting patients' privacy and personal information. The National Coordinator presented the framework for the strategic action that established four goals for national adoption of HIT and the most important roles in the widespread adoption of HIT include: (1) establishing a motivation and providing the leadership necessary for its accomplishment; (2) facilitating the development of standards for EHR and promoting their interoperability; (3) using HIT as the largest purchaser and provider of healthcare, including the deployment of high technical solutions; and (4) providing different environments and incentives that will expedite the cost-effective adoption of HIT and the realization of its potential benefits (Rash, 2005).

Despite the enormous interest and effort in adoption of HIT, and continuous introduction of HIT at a comparatively rapid pace, many physicians and healthcare professionals are uncertain about how to adopt HIT to catalyze the transformation, and many still doubt physicians and practitioners are ready for the widespread deployment. The healthcare industry has been also slow to adopt HIT, and little evidence of the significant productivity improvement and potential benefits has been identified in the massive healthcare sectors, because the assessment of the number of healthcare professionals and hospitals that have adopted HIT are diverse and unreliable (Brailer and Terasawa, 2003). Only a small number of U.S. healthcare providers have fully adopted HIT as there are significant financial, cultural, technical and legal barriers to its adoption. These include a lack of access to capital, a lack of data standards, and resistance from healthcare providers.

The potential benefits of the widespread adoption of HIT make it essential to investigate the evidence that currently supports the benefits of HIT across healthcare environments, and many survey methodologies are aimed at obtaining estimates of population parameters in rigorous fashion. To estimate the amount of resources needed to adopt HIT, we need to investigate the perceived benefits of HIT adoption across healthcare organizations. The purpose of this study is to develop a survey instrument that could be used to determine the healthcare professionals' perception of HIT adoption, in relation to perceived benefits of using CPOE. To address the need for the investigation of perceived benefits of HIT adoption, we develop a survey instrument based on a priori construct of perceived benefits glanced from the review of perceived benefits in diverse research areas. This paper outlines the broad understanding of HIT, the current state of HIT adoption, the constructs of perceived benefits, and the development of an instrument to investigate perceived benefits of HIT adoption. This study focuses only on the development of the modified construct of perceived benefits salient to healthcare and the survey instrument.

2. LITERATURE REVIEW

2.1 Healthcare Information Technology (HIT)

2.1.1. Background of Health Information Technology

In accordance with the increased attention to patient care, new devices and technologies have provided more accurate information about patients for better healthcare delivery. Information technology plays a significant role in managing information, and new technology has continued to evolve in healthcare industry. In the 1960s, computer-based experiments in medical recordkeeping and management began, and Shortliffe and Detmer (1991) reported the technology improvement in healthcare as a strategy for coping with the cost and inefficiency of healthcare systems, however most hospital operated manually and only largest providers had implemented automated billing systems. In the 1970s, patient records began to be used both medical and administrative data for the increasing number of review and audit purposes (Blois, 1984). As personal computers appeared in the late 1970s, physicians began adopting EHR systems and most medical facilities in the 1980s maintained both paper and computer-based record system. By the late 1980s, ideal computer-based patient records had to be designed so as to provide some combination of time-oriented, source-oriented and problem-oriented (Stead and Hammond, 1983). However, until the end of the 1980s, important benefits from the computer-based patient records had been only partially achieved, so the Institute of Medicine (IOM) established the Patient Record Project to develop generally acceptable computer-based patient records in 1989.

During the last decades, various aspects of quality management have been introduced into healthcare organizations, and HIT is one of challenges which could change dramatically in healthcare. Healthcare providers have applied a number of diverse technological innovations that have influenced both clinical and administrative aspects of delivery of

medical services. HIT includes a variety of integrated data sources and has been shown as a solution to improve patient safety and to reduce inefficiencies. Therefore, it has a great potential to improve the quality of care, to support healthcare IT infrastructure, and to save money on administrative costs. Healthcare information technology is defined by the Government Accountability Office (GAO) as “technology used to collect, store, retrieve, and transfer clinical, administrative, and financial health information electronically” and also refers to “the application of information processing involving both computer hardware and software that deals with the storage, retrieval, sharing, and use of healthcare information, data, and knowledge for communication and decision-making” (Brailer D, 2004). Six types of HIT are categorized by Felt-Lisk (2006):

- **Electronic Prescribing:** E-prescribing is defined as “Entering a prescription for medication into automated data entry systems such as PC, PDA or other, and thereby generating a prescription electronically, instead of handwriting the prescription on paper” (First Consulting Group, 2001). It is also known as Computerized Physician/ Provider Order Entry (CPOE). E-prescribing applications have basic functions in common, and involve Clinical Decision Support to the clinicians such as a drug database for prescribing, formulary checking, drug interaction checking, and a drug reference database.
- **Electronic Lab Results:** Any test report received by a physician is printed on paper and sent by a printer, fax or mail. With electronic lab results, clinicians may have advantages of significant time-saving that is realized between the instant of ordering the test and obtaining the final result.
- **Electronic Clinical Note Systems:** Clinical notes are central and important parts of Electronic Health Records (EHR), and E-clinical health systems include information on patients’ demographics, clinical notes, medical history and follow-up orders.

- **Electronic Images:** E- clinical images include CT, MRI, and PET scans and improve the image quality and quality efficiency of electronic images.
- **Electronic Lab Orders:** Physicians can electronically order tests, manage their laboratory testing need, and receive results by eliminating hassles associated with paper requisitions and reports.
- **Electronic Reminders for Guideline-Based Intervention:** Patient-specific electronic clinical reminders are delivered directly through EHR to better integrate clinical decision support and physician workflows. Patient summary screening helps physicians be able to click on the reminders to obtain more information about the content or to turn the reminders off.

Figure 1 shows the percentage of hospitals with clinicians using the six selected types of IT. The researchers conducted telephone interviews with around 650 peoples of hospital quality improvement directors and senior executives in hospitals in the 50 states and District of Columbia. In this report, almost 90 percent of hospitals used at least one of the listed technologies. The graph shows that electronic lab results were most common (88 percent of hospitals) and electronic prescribing was least common (21 percent of hospitals). From this study, they reported that the adoption of electronic reminders and e-prescribing was more delayed than other types of HIT due to implementation difficulties.

HIT has the potential to make healthcare safer and more efficient, but has been limited by a lack of knowledge about how to implement it successfully. According to the Department of Health and Human Services (HHS), only a few U.S. healthcare organizations have fully adopted HIT due to significant financial, technical, cultural, and legal barriers to its adoption such as a lack of access to capital, a lack of data standards, and resistance from healthcare providers (Powner, 2006). The current state of HIT adoption and related issues will be discussed in section 2.1.3.

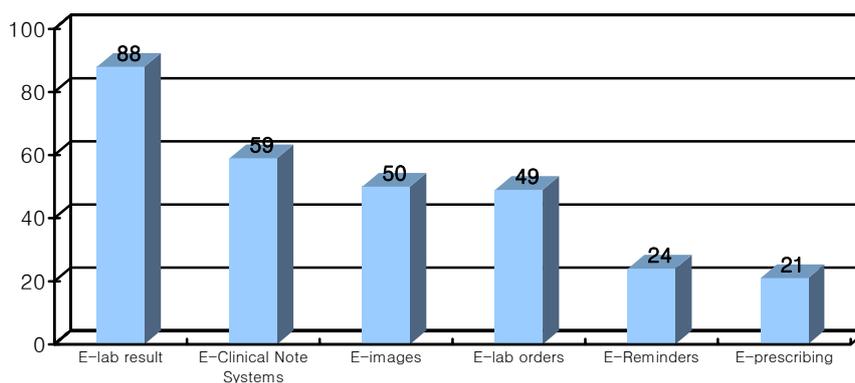


Figure 1. Hospitals with Clinicians Using Selected IT Capabilities (Felt-Lisk, 2006)

2.1.2 Benefits of Healthcare Information Technology

Many findings in the literature concerning HIT implementation contain empirical data and evaluations on benefits, and effects of HIT use on the healthcare professionals' performance (Leapfrog Group, 2006, RAND health, 2005, and Menachemi and Brooks, 2006). Review of the literature suggests that most benefits from using HIT fall under one of the following categories: *quality of care* (Chertow et al., 2001 and Evan et al., 1999, Dexter et al., 2004, Overhage et al., 1996, Schriger et al., 2000, and Leapfrog, 2006), *effect on efficiency* (Wong et al., 2003, Leapfrog, 2006), *effect on cost* (Erstad, 2003, Agrawal, 2002, RAND health, 2005, Menachemi and Brooks, 2006, and Jacobs et al., 2000), and *additional benefits* (Bates et al., 1998, and Agrawal, 2002). The following discussion of benefits is organized by four categories:

2.1.2.1 Quality of Care

In recent years, there has been greater attention paid to quality of healthcare. Despite investing over \$1.7 trillion annually and spending more on healthcare than any other nation, the U.S. ranks much lower than other countries on several health measures (RAND health, 2005). There have been many complaints that patients often do not receive proven

therapies or preventive measures, and that the rate of preventable medical errors remains high. Many researchers are focused on how providers, patients, and policies can affect the great number of factors that influence the quality of care. This includes the training of healthcare personnel, improving delivery system processes, and attention to systemic level factors such as technologies and medical records. Specific benefits of HIT concerning the quality of care include:

- **Medical Error Reduction**

The Agency for Healthcare Research and Quality (AHRQ) has noted that insufficient or improper point-of-care treatment information is a frequent and significant cause of medical errors. Communication problems and access to information are easy to cause most medical errors; therefore new information management technologies must be implemented and smoothly integrated within the existing healthcare infrastructure. According to studies, HIT also decreased medical errors by improving medication dosing such as antibiotics and anti-coagulations (Chertow et al., 2001 and Evan et al., 1999).

- **Adherence Support**

HIT can improve quality of care by increasing adherence to guideline-based care. The Decision Support functions which were embedded in EHRs or CPOE are a part of adherent studies that show the effect of HIT on enhancing preventive healthcare delivery (Dexter et al., 2004, and Overhage et al., 1996).

- **Effective Disease Management**

In addition to benefits mentioned above, the use of HIT systems also provides enormous potential in improving clinical decision making and disease management. The disease management delivers healthcare services with analysis of relevant data and cost-effective technology to improve the health outcomes of patients with specific diseases. One of

studies showed that the use of HIT systems was found to increase documentation advice and recommendations for laboratory testing and treatment (Schriger et al., 2000).

2.1.2.2 Effect on Efficiency

The pursuit of efficiency has become a central objective within most healthcare systems. However, the analysis and measurement of efficiency is a complex task due to the multiple objectives of healthcare organizations and the many gaps in HIT systems. The following is an improvement in efficiency saving.

- **Efficiency Saving**

Efficiency saving delivers to achieve the same performance with fewer resources. Through adoption of HIT, healthcare organizations can potentially reduce healthcare professionals' administrative time such as documentation-related nursing time (Wong et al., 2003), the delivery of treatment through CPOE (Kuperman et al. ,1999), and hospital stays from the result of increased patients' safety and coordination of patient care.

2.1.2.3 Effect on Cost

The effect on cost can also be realized when implementing HIT. The following is a discussion of the potential increased revenue opportunities related to HIT implementation.

- **Improved Productivity**

Productivity means the result of an individual's labor and the measurement of individual's work or output. HIT can improve workflows through better resource utilization and by reducing redundancies (Erstad, 2003); therefore, healthcare professionals are more productive when they generate greater results by using HIT, and improved productivity will lead to cost saving.

- **Paper Reduction**

Time spent organizing, retyping information in medical records, and looking for the paper-

based charts are reduced when using HIT, and the cost of maintaining medical records which include the cost of paper, and printing paper can be reduced.

- **Reduced Transcription Costs**

The process of transcription is widely known to be expensive, slow, inefficient, and error-prone communications. When physicians and nurses directly enter their notes into EHR, transcription costs can be reduced by utilizing structured flow sheets, and point of care documentation (Agrawal, 2002). Therefore, transcription cost saving can be a significant, depending on the implementation of HIT.

- **Drug Utilization**

The most obvious evidence of drug utilization is to improve patient care and reduce overall drug costs by CPOE and Clinical Decision Support (CDS) functions of EHR through structuring medication selections. Physicians can be also advised about the cost-benefits of specific drugs, and can be given recommendations of alternative drugs when they order through CPOE or CDS (RAND health, 2005).

- **Improved Laboratory Tests**

EHR, CPOE and CDS have the potential to reduce redundant tests by making clinicians aware of current results and by alerting them of excessive new orders. One study found the potential for considerably reduced costs and time using a portable micro analyzer for all routine laboratory tests without any changes in the quality of care (Jacobs, et al., 2000).

2.1.2.4 Additional Benefits

Many additional benefits exist that can be acquired by utilization of HIT. Discussions of these additional benefits follow.

- **Improved Patient Safety**

To improve patient safety is one of the most urgent issues facing healthcare today. Increased safety results from the safety alerts and reminders by EHR and CPOE systems for

medications. CPOE can offer warnings about a potential adverse reaction with patient are other drugs; therefore CPOE can achieve medical error reductions and thereby can increase the patient safety (Bates, et al., 1998).

- **Improved Regulatory Compliance**

According to increased security of data and better patient confidentiality, the use of HIT systems can allow for compliance with federal regulations, including Health Insurance Portability and Accountability Act (HIPAA) for record keeping and reporting (Agrawal, 2002), and can assist in regulatory policies.

2.1.3 Computerized Provider/ Physician Order Entry (CPOE)

Computerized Provider/Physician Order Entry (CPOE) is a prescription ordering system that allows physicians to enter an order for a medication and clinical laboratory or radiology test directly into a computer instead of handwriting which can cause medication errors. The National Coordinating Council for Medication Error and Prevention (NCCMERP) has approved the definition of medication errors¹. Baxter International reported that 39 % of medication errors arise from prescribing, 23% occur during transcribing or compounding by pharmacists, and 38% occur during administration by nurses. As patient safety is a matter of a primary concern in healthcare, patient safety focuses on reducing medication errors, and healthcare professionals expect that progressive technology would provide better solutions. The Leapfrog Group encouraged the use of CPOE as clinical

¹ “Any preventable event that may cause or lead to inappropriate medication use or patient harm, while the medication is in the control of the healthcare professional, or patient. Such events may be related to professional practice, healthcare products, procedures, and systems including: prescribing; order communication; product labeling, packaging and nomenclature; compounding; dispensing; distribution; administration; education; monitoring; and use.”

information systems can provide all kinds of decision support to the care- givers of patients, and CPOE is a structural and control improvement to enhance patient safety (Leapfrog Group fact sheet, 2006). CPOE can help physician's decision support at the point of ordering and also provide the latest information about a drug and cross reference allergies, interactions, and other problems of a patient with the chemical entity being prescribed (Bates, 2000). In addition to these benefits mentioned above, improved efficiencies afforded by CPOE are: (1) to allow interaction checking such as drug-drug or drug-allergy; (2) to reduce the turnaround time from ordering and to improve this process; (3) to eliminate illegible handwriting, observations for duplicated orders or redundancy; and (4) to reduce healthcare costs.

Despite these potential benefits, many healthcare organizations have delayed CPOE implementation due to the following reasons. CPOE is expensive, a highly complex application that must include physicians, nurses, and other healthcare professionals in the phase of the system development, educate clinicians about the system, and keep them informed during all phases of the development and the implementation within an organization. There may be also organization cultural barriers of CPOE implementation such as physician resistance to computer usage when they order prescriptions. CPOE implementation takes time, and the process is complex and difficult. However, healthcare organizations, researchers and policymakers have many opportunities to speed nationwide adoption of CPOE as patient-safety intervention, thus they must encourage promoting adoption of CPOE.

2.2 Healthcare Information Technology Adoption

2.2.1 Problems to Evaluate HIT

It is important that precise evaluation needs not only the understanding of HIT adoption but also behavioral processes that are affected by technologies. However, evaluation of IT in healthcare organizations is not easy to perform due to the complex healthcare environment, different healthcare professional groups with different practices, and

external factors such as economic constraints, regulatory issues, and the growing gaps between communities' access to technologies. These may cause problems to evaluate and analyze HIT and its adoption. For example, different researchers or stakeholders may have different opinions and views of successful HIT implementation. Many studies of HIT have problems during evaluation, and one main problem is to choose suitable evaluation methods (Ammenwerth and Keizer, 2004). Wyatt (1994) reported that to develop clear evaluation criteria is often difficult to address in studies due to the complexity of the evaluation research; therefore, adequate evaluation methods such as quantitative or qualitative methods and research designs, and evaluation criteria and clear motivation for the study must be required to evaluate HIT adoption.

2.2.2 The Current State of HIT Adoption

In this section, the studies regarding the estimation of HIT adoption are reviewed. It is important to note that the value of HIT depends on how well healthcare organizations adopt and implement it, and how well clinicians in their practices use it. The adoption concentrates on the challenge of getting clinicians and customers to use electronic applications and information networks to keep medical records, to access relevant information about a patient's data and illness, and to offer patient safety and better decisions. The adoption includes the need to train physicians, nurses and healthcare staffs until they are comfortable with any HIT systems, and to provide technical support and other, and to make healthcare professionals and customers aware of the benefits of HIT systems. The widespread adoption of HIT can result in significant healthcare cost savings and improved patient health and safety. Nevertheless, the adoption of HIT has been slow, because several barriers are still present: the high costs of investment in HIT, the maintenance required in all information systems, security and privacy issues, and decreased productivity because healthcare staffs need time to adapt to new systems. According to RAND Corporation

(2005), complex healthcare technologies make it difficult to measure the adoption due to multiple functions and several particular aspects of such implementation in HIT and the diversity of opinions on the definition of adoption. In addition, healthcare organizations present a particularly difficult challenge due to their existing organizational structure, assumptions about clinical work processes, and financial challenges.

In the leadership survey of Corporate Information Officers (CIO) (Healthcare Information and Management System Society (HIMSS), 2004), the researchers reported the results on HIT adoption in healthcare facilities. 60 percent of respondents indicated that they have either developed a plan to implement an electronic medical record (EMR) system or they have begun to install EMR hardware and software. Figure 2 shows status of the EMR implementation. 19 percent of healthcare organizations have fully operational systems, 37 percent of healthcare organizations have begun installation, and 23 percent have a development plan to implement. Surprisingly, 21 percent still do not plan to adopt EMR, and we consider that this actual state of no plans to implement EMR may be caused by significant barriers such as the lack of adequate funding and resources, difficulties in finding and evaluating EMR solutions, and problems in changing the existing organization structure.

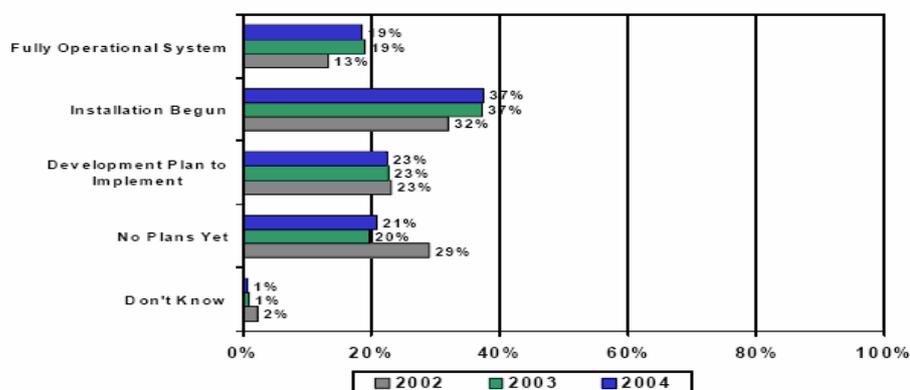


Figure 2. Status of Electronic Medical Record Implementation (HIMSS Leadership survey, 2004)

In the report by Blumenthal et al. (2006), the researchers assessed the quality of existing surveys and their data, and estimated current levels of EHR adoption based on collected surveys. 36 existing studies were determined by reviewing existing definitions of EHR and the meaning of the term 'adoption'. They reported that 8.6 percent of approximately 1,000 Community Health Centers (CHC) in the U.S. have a fully implemented EHR, and 15.9 percent report have a partial EHR system in the most recent data.

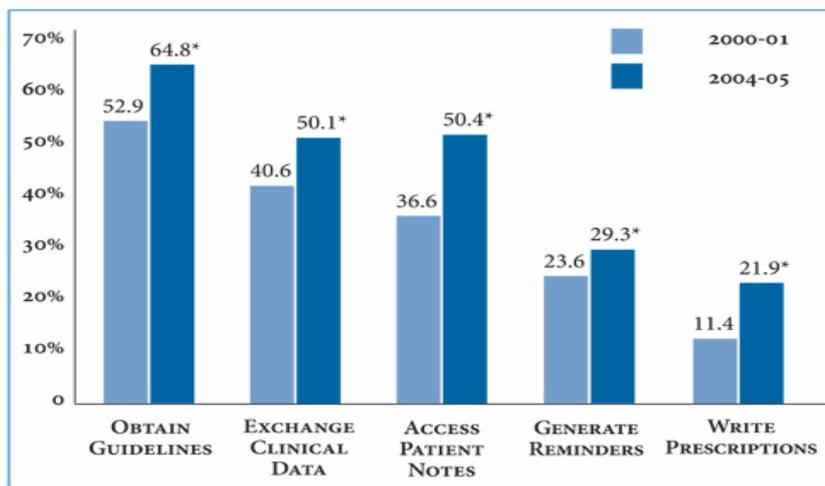
The Medical Records Institute (MRI) released the survey of Electronic Health Record Trends and Usage and compiled data from 1383 individuals, excluding vendors and consultants to reduce bias. The survey revealed the following findings in regard to the adoption of EHR applications and functions.

- Most used EHR administrative and financial applications with the greatest increase in use were compared to last year appear to be the following applications: billing and accounts receivable (57.2 %), scheduling (56.4 %), patient appointments (55.4 %), and claims processing (53.9 %).
- Most planned EHR administrative and financial applications were reported: patient eligibility (27.2%), charge capture and/or coding (26.2%), master person index or enterprise directory to support multiple facilities (22.0%).

However, in this study we must carefully consider that a straightforward test for unbiasedness of data is verified because results of the survey in the EHR implementation were not interpreted as a measure of the actual implementation levels of EHR components, and were included non-U.S. providers as about 10.4 % of its sample.

Clinical Information Technology (CIT) systems, the subset of HIT, include a variety of applications above EHR and CPOE. According to the Center for Studying Health System Change (HSC), a nonpartisan policy research organization made a data bulletin known for findings on the topic: Growing Availability of Clinical Information Technology in Physician

Practices. The researchers reported that the percentage of physicians' access to IT for each of the five clinical activities increased at least five percent between 2000-01 and 2004-05. Figure 3 shows the percentage of physicians with each clinical activity. Despite the higher rate of growth in five clinical activities, the researchers reported that nearly 80 percent of physicians lacked IT to write prescriptions in 2004-05; however, there has been rapid diffusion in public and private efforts to promote CIT adoption in physician practices which can drive forces in development and implementation of Clinical IT systems.



* Change from 2000-01 is statistically significant at $p < .0001$.
 Source: Community Tracking Study Physician Survey

Figure 3. Percent of Physicians in practices with IT for Specific Clinical Activities in 2000-01 and 2004-05 (Marie et al., 2006)

There are many other sources of HIT adoption data, but many reports have survey design flaws and response problems. The RAND Corporation (2005) recommended the HIMSS-Dorenfoest database which seems to have the highest quality of data, and to represent the most clinical HIT adoption in hospitals and integrated healthcare delivery systems. The reviewing in this section shows the most current data of HIT adoption from each different approach in the variety of HIT applications, but must to review carefully what each study targeted on, and what types of technology they investigated and analyzed.

2.3 Perceived Benefits

When it comes to the origin of the term ‘perceived benefit’, the construct of perceived benefits is very common in health behavior theories, and it is a core measurement of the health belief model (HBM) with perceived barriers. The HBM was developed by social psychologists Hochbaum, Rosenstock and Kegels at the U.S. Public Health Services in the 1950s, and Hochbaum first researched on the HBM with the aim to identify factors related to the decision to obtain a chest X-ray for the early detection of tuberculosis. HBM developed originally as a systematic method, is a psychological model that attempts to explain and predict a given health-related behavior and to focus on individuals’ attitudes and beliefs within value expectancy structures. For example, when assessing the circumstances, a person may believe that benefits from the recommended behavior outweigh the costs and inconvenience, and they are indeed possible and within their controls. In the HBM, the definition of perceived benefits is one's belief in the efficacy of the advised action to reduce risk or seriousness of impact (Glanz et al., 2005), and the direction of action that person adopts will be influenced by the beliefs regarding the action. From the construct of perceived benefits originated from HBM, the modified construct of perceived benefits for healthcare are proposed to investigate the healthcare professionals’ perception of HIT adoption in the healthcare organization.

The effective use of IT is essential for the provision of high quality care in the increasingly complex healthcare field (Martin et al., 2004). One of ways to understand the marketplace is to look at the tools that are packaged in different ways, since the benefits that can be achieved are related to the types of product or tools employed. Many of IT products for healthcare are available as either standalone functionality or in combination with others, and available IT products in healthcare organizations are mostly designed with larger physician groups, with associated costs and technological complexity. In addition,

technology improvements and additional benefits are desired when more comprehensive multi-task products like EHR is needed for a higher practice level for healthcare professionals. However, the opportunities for IT solutions for healthcare professionals' practices could hardly be achieved at a better time. Many factors related to this issue are revealed by many studies. Among factors that affect healthcare professional's adoption of HIT, we proposed the factor of perceived benefits in conceptualized healthcare information technology (HIT) adoption model which is called HIT Gumbo Model conceived by Dr. Sonja Wiley-Patton and the researchers for the widespread use in healthcare. We hypothesize that predicting benefits is one of the important and specific constructs in conceptualized HIT model. Therefore, we reviewed the literature regarding the construct of perceived benefits and its items in various research areas to obtain validated benefit items and to develop the construct of perceived benefits for better understanding in healthcare professionals' perception of HIT adoption. From literature review of perceived benefits, the following definitions are relevant to set up our study; perceived benefits refer to the anticipated advantages that the application can provide the organization (Chwelos et al., 2001), the positive impact of implementation (Casedesus and Karapetrovic), and the characteristic that most influences the adoption (Mehrtens et al., 2001).

2.3.1 Perceived Benefit Data Synthesis

2.3.1.1 Literature Selection and Construct Approach

Three search engines were used to perform exhaustive literature review using a keyword of 'perceived benefit(s)' in any research areas to understand the usage as a measurement of each area. Articles were collected up to June, 2006. Among 532 articles that were identified by titles and abstracts for perceived benefit(s), 363 articles were rejected during the initial screening from titles and abstracts because they were irrelevant. During the second screening, 122 articles were rejected. Rejected 122 articles were divided in several

reasons: 5 articles for duplication, 59 articles for unable to interpret, 23 articles for not reporting relevant outcomes, and 35 articles for miscellaneous reasons. Final 36 articles were chosen to carefully review for definition, scales and studies of perceived benefits, and details of the selected 36 articles were appraised. This review step aimed to bring the same level of rigor to reviewing research evidence in the first place. Quality step reviews took advantages to find all relevant studies published, assess each study, synthesize the findings from individual studies, and in present a balanced and impartial summary of the findings. After all possible study reports had been identified, each article needed to be evaluated for eligibility, study quality and reported findings. Figure 4 shows the search flow for literature review of perceived benefits. Through this step, studies were summarized by the following categories: (1) theory and definition of perceived benefits, and research area, (2) description of studies, and (3) perceived benefit items where the aim of the summary is to focus on benefit scales and items as an independent variable.

2.3.1.2. Description of Models and Studies Using Perceived Benefits

The stream of research focused on perceived benefits as measurement in research areas, and each literature review made important and unique contributions to the literature review on perceived benefits. The goal of this stream was to understand usage of perceived benefits as the measurement. The review resulted in the identification of models using the construct of perceived benefits. Table 1 describes the theory, core constructs, source, research areas, and definition of perceived benefits that the researchers identified or applied, and Table 2 summarizes the description of studies. Six of the 36 adherence studies examined the perceived benefits of Information Systems: central cataloguing system, enterprise system (ES), three cases of electronic data interchange (EDI), and Internet. One study (Staples et al., 2002) was conducted to examine the effect of new information systems on the user expectation, an important factor affecting perceived benefits arising from the use of new

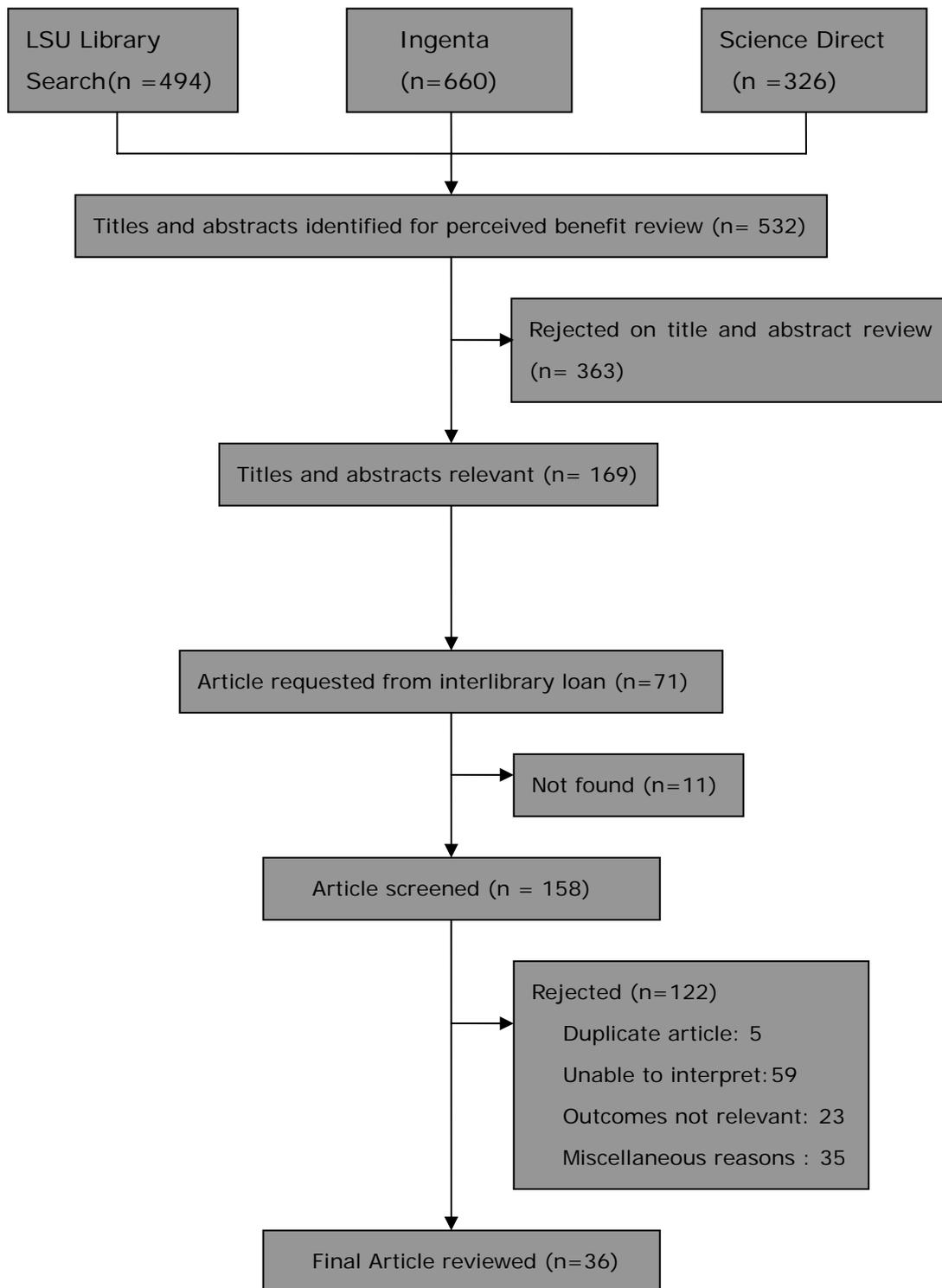


Figure 4. Search Flow for Literature regarding Perceived Benefits

information systems. Shang and Seddon (2002) focused on the benefits that organizations may achieve from their investment in enterprise systems (ES) with their own ES benefits framework which provides the list of benefits that was combined into five benefits dimensions: operational, managerial, strategic, IT infrastructure and organizational benefits. This benefit framework contributes to IS knowledge about the impacts of ES on organizations. Two studies examined benefits of EDI and its adoption. Fearon and Philip (1998) reported that EDI 'benefit success' always represents the achievement of a significant number of high strategic and operational benefits. And the researchers emphasized that strategic understanding of how the theoretical benefits of expectations from EDI can be entirely operationalised (Masseti and Zmud, 1996). Two studies analyzed the benefits from EDI adoption. One study (Jiménez-Martínez and Polo-Redondo, 2004) investigated why EDI was not very widespread, and they hypothesized that this must be due to the fact that these benefits were hard to perceive after the technology adoption. Last, Chwelos et al. (2001) identified and organized the factor of perceived benefits as a determinant of the adoption of EDI and this determinant was found to be a significant predictor of intent to adopt EDI.

Five studies examined perceived benefits with behavioral intentions in psychology; career decision making, risk-taking behaviors (RTB), smoking cessation, salient value similarity (SVS), and planned behavior. Only one study (Gati et al., 2003) assessed the technology, Internet-based interactive career planning systems, and the composite perceived benefit was found to be positively associated with the user decidedness at the completion of the dialogue with the Making Better Career Decision (MBCD) systems. In the study of risk-taking behavior (Parsons et al., 1997), perceived benefits accounted for the significant variance in behavioral intentions for overall RTB.

Five studies in the health area examined perceived benefits, and the following are topics being studied in health; the health belief model (HBM), the health impact assurance (HIA), the behavior theory, the normative behavior theory, and the physical activity. One study (Hay and Kitcher, 2004) discussed the construct of perceived benefits as the joint approach to the assessment for HIA which is a tool for assessing the health impacts of projects, policies and developments where health is not the primary objective (Taylor and Blair-Stevens, 2002). Hudmon et al. (1996) reported participants' perceptions of a phase I colon cancer chemoprevention trial using a calcium intervention, and identified that the level of perceived benefits was positively associated with reported interest in participating in future trials of the same and longer durations. According to Brown (2005), the measurement of perceived benefits as a variable, was not frequently standardized. For each study, the customized measure of perceived benefits was usually formulated. However, the customized measurement could cause several problems such as reliability and validity of the measurement; therefore, the researcher suggested that the accurate and valid measurement of perceived benefits would be required to prevent these problems.

Four studies examined the measurement of perceived benefits in the marketing area: Internet, the banking service model, the efficient consumer response (ECR), and the gene technology. One of these four studies showed the public attitudes towards emerging technologies, and post-experimental attitudes were assessed on perceived overall benefits of the gene technology in food production. The results indicated that people who interest the use of the gene technology in food production were more likely to trust an information source (an industry association, a consumer organization, or a government source) promoting its benefits (Frewer et al., 2003).

Three studies in management investigated the perceived benefits in the following topics: The Internet context, ISO 9000, and E-commerce. One of three studies examined

how partnership attributes (e.g. partner interdependence, coordination, trust, and commitment) influence perceived benefits of B2B e-commerce, and these benefits had three dimensions, namely informational, transactional, and strategic benefits. In this study, the perceived benefit was the perceptual measurement of benefits not only for capturing user satisfaction, but also for capturing other dimensions such as IT effectiveness.

Three studies in nursing examined the perceived benefits in the following topics: two cases of the health promotion model (HPM) and the health behavior. One of these three studies showed that satisfaction with nursing care and nurse-patient interactions influenced perceived benefits, and supported the effects of the patient satisfaction and nurse-patient relationships on perceived benefits. The researchers concluded that perceived benefits more importantly determined health behaviors (Zrinyi and Horvath, 2003).

The rest of studies examined the construct of perceived benefits in various research areas such as education, accounting, communication, sociology, nuclear engineering, food science, tourism, and nutrition. One study was recommended to take items to our study: The study (Lee, 2003) looked into perceived benefits derived from International Organization for Standardization (ISO) 14001 registrations for firms with in a newly industrialized Malaysia. ISO 14001 is the most important standard within the ISO 14000, series of environmental management standards developed. ISO 14001 specifies the requirements of an environmental management system (EMS) for small to large organizations. The benefits are classified into three dimensions: environmental benefits, competitive advantages, effective operation and improvement in the company's image. A review of the perceived benefits reported by firms certified with ISO 14001 in industrialized countries was re-sent and all these companies in this study agreed that they had benefited greatly from implementing ISO 14000 systems from effective environmental management, and reduction of damage to the environment, as well as improvement of the company's image and operations.

No literature regarding perceived benefits in HIT could be found that attempted to measure healthcare professional's perception of perceived benefits of HIT, although it is frequently discussed. In MIS, terms of perceived usefulness and perceived ease of use from Technology Acceptance Model (TAM) (Davis 1986, 1989) are the best known for users' perception. Even though constructs of perceived benefits we reviewed are not directly associated with HIT, we believe that the usage of perceived benefits in each study could be a guideline as the significant measurement or the factor that we apply to healthcare fields. It is also reasonable to believe that people make choices based on their perceptions, and attitudes towards adoption of HIT and this should be explained why organizations or individuals make decisions to adopt HIT, focusing on perceived benefits.

2.3.1.3 Perceived Benefit: Items Modification & Adaptation

There are many different studies exploring the perceived benefits of a technology. For the purposes of this study, validated items of perceived benefits were collected from the literature, and we particularly focused on the items of perceived benefits as an independent variable that helps to predict the individuals' intention toward the technology adoption. Table 3 shows the detail items of perceived benefits each study applied. The following are types of benefits taken from the literature (Dearing, 1990, Chwelos et al., 2001, Shang and Seddon, 2002, and Jiménez-Martínez, Polo-Redondo, 2004), and the three main benefit dimensions are direct benefits, indirect benefits, and strategic benefits:

Direct Benefits

Direct benefits are the easiest to identify, to track, and to measure (Jiménez-Martínez and Polo-Redondo, 2004); direct benefits also can be demonstrated by a result that is closely related with technologies or applications by cause and effect. These benefits include operational cost savings and other internal efficiency such as reduced paperwork, data re-entry, and error rates (Chwelos et al., 2001). The following are relevant examples of direct

benefits taken from the literature review on perceived benefits:

- Paper Reduction and Saving
- Data Re-keying
- Error reduction
- Saving time of data entry and re-entry
- Avoiding filing costs and maintenance
- Decreased information overload and paper documentation
- Decreasing support costs
- Better financial and operational results
- Reduced training time

Indirect Benefits

Indirect benefits include returns that can't be directly observed, such as worker productivity. These benefits are less tangible than direct benefits (Jiménez-Martínez and Polo-Redondo, 2004) and come from enabling the technology or the application to change the way people do business (Dearing, 1990). Indirect benefits can be also opportunities that arise from the use of the technology such as improved customer services (Chwelos et al., 2001). The following are relevant examples of indirect benefits taken from the literature review on perceived benefits:

- Improvement in operational efficiency
- Improved work cultures
- Efficient flow of information
- Improving service levels
- Improved customer services
- The potential for process reengineering
- Better business control

- Reducing the purchasing/sales cycles (ordering, delivery and invoice)
- Reducing inventor breaks
- Increasing productivity
- Enhancing employee empowerment
- Improved customer/ employee satisfaction

Strategic Benefits

Strategic benefits are closely related to indirect benefits, and may be the most significant benefit even though they are hard to measure. These benefits are for the strategic relationship with providers, suppliers, customers, and others rather than for the measurable cost savings (Dearing, 1990). Strategic benefits include the large amount of information generated, the faster response and access to information (Jime´nez-Marti´nez, Polo-Redondo, 2004), and market share expansion through the strategic use of information and lower costs. Company’s costs can be minimized and its benefits can be maximized not only by increasing strategic benefits to the business as a whole, but also by implementing the technology as company issues rather than IT issues (Dearing, 1990). The following are relevant examples of strategic benefits taken from the literature review on perceived benefits:

- The higher the familiarity of the customer-retailer relationship
- Increased business relationships with other companies using same applications or technologies
- Faster response and access to information
- Improved customer loyalty
- Improved the company’s image
- Enhanced ability to compete with competitor’s technology or its strategy

Table 1. Models and Theories Using Perceived Benefits

Theory/ Topic	Core Constructs	Definition	Source	Research Area
1. Career Decision Making	Perceived Benefit	Associated with degree of decidedness after the dialogue	Gati, I., Kleiman, T., Saka, N., and Zakai, A., 2003	Psychology
2. Electronic Performance Support System (EPSS)	Perceived Benefit	Data/information base and an advisory system of job-oriented or problem-solving components	Chang, C., 2004	Education
3. Cognitive Model Outcome of a variance investigation affects cognitively-perceived benefits resulting from the investigation expenditure	Level of benefit	The level of benefit perceived from the audit was associated with framing the audit time in terms of a 'cost' or 'loss'	Jones, 2005	Accounting
4. Buyer- seller relationships	Relational Benefit	Including confidence benefit, social benefit, and special treatment benefits	Colgate, M., Buchanan-Oliver, M., and Elmsly, R., 2005	Management
5. Socio-spatial Knowledge Network(SSKNs)	Informational Benefits	Enable to challenge or reframe their thinking about professional and business issues	Sligo, F., Massey, C. and Lewis, K., 2005	Communication
6. Continuous Traumatic Stress Syndrome(CTSS)	Perceived Benefit	Implications for achieving outcomes : reducing fear, increasing control, restoring connections (with young children as a response to community trauma)	Stewart, and Thomson, 2005	Sociology
7. Health Belief Model(HBM)	Perceived Benefit	The believed effectiveness of strategies designed to reduce the threat of illness	Lambert, L., Safaii, S., and Geary, E., 2005	Health and welfare
8. Health Promotion Model	Perceived Benefit	Positive or reinforcing consequences of physical activity	Pender, 1996	Nursing
9. Management Techniques	Perceived Benefit	Positive impact of implementation	Casesdesus, and Karapetrovic, 2003	Management
10. Multivariate discriminant Model	Perceived Benefit	How student perceives the rewards	Ahemed, K., Alam, K., and Alam, M., 1997	Accounting education

(table continued)

Table 1

Theory / Topic	Core Constructs	Definition	Source	Research Area
11. Public attitude Model	Perceived Benefit	'How much necessary' or 'how much beneficial'	Choi, Y. S., Lee, S.H., Cho, N.Z., and Lee, B. W. ,1998	Marketing
12.Customer-service provider relationship Model	Perceived Benefit	<ul style="list-style-type: none"> • An outcome variable of customer's experience • Perceived benefits that are recognized by the customer are significant factor that affects the customer –web retailer relationship by bringing the customer to closely connect with the company 	Ha, H., 2004	Nuclear Engineering
13. Consumer Decision Making	Perceived Benefit	To be important in influencing consumer acceptance	Frewer, L.J., Howard, C., Hedderley, D., and Shepherd, R., 1997	Food Science
14. Banking Service Model(BSM)	Perceived Benefit	<ul style="list-style-type: none"> •A priority benefit perceived by the consumer as accruing to him/her by the information assisting the consumer to evaluate choices and attributes, thereby making better purchase decisions •These benefits include the ability to reduce to find the best purchase for the consumer's needs 	Beatty and Smith, 1987; Duncan and Olshavsky, 1982 Srinivasan and Ratchford ,1991	Marketing
15. Risk-taking behaviors (RTBs)	Perceived Benefit	Important determinants and the best predictors of behavioral intentions	Parsons, J. T., Siegel, A.W., and Cousins, J.H., 1997	Psychology
16. ISO 140001 Standards	Perceived Benefit	The benefits reported by the responding firms can be classified into three dimensions namely environmental benefits, competitive advantage, effective operation and improvement in the company's image	Tan, L.P., 2005	Business

(table continued)

Table 1

Theory / Topic	Core Constructs	Definition	Source	Research Area
17. Health Behavior	Perceived Benefit	<ul style="list-style-type: none"> •Perceived benefits more importantly determined health behavior •Patient satisfaction with nursing care and nurse-patient relationships are important determinants of perceived benefits of a healthy lifestyle. 	Zrinyi, M. and Horvath, T., 2003	Nursing
18. Disconfirmation theory	Perceived Net Benefit (PNB)	An idealized comprehensive measure of the sum of all past and expected future benefits, less all past and expected future costs, attributed to the use of an information technology application. Any use of resources (including time) in building, learning to use, and /or using the system is the cost.	Staples, D.S., Wong, I., and Seddon, P.B., 2002	Information System
19. Social Exchange Theory	Perceived Benefit	Perceived benefit has a positive association with support for casino's development	Lee,C. , and Back, K., 2006	Tourism
20. Efficient Consumer Response (ECR)	Perceived Benefit	Falling into two categories: general benefits and benefits related to efficient replenishment	Luhtia, R., Xie, T., and Subramaniam, R., 2004	Marketing
21. Health Impact assessment (HIA)	Perceived Benefit	Perceived benefits that the joint approach to the assessment of the effectiveness of the Health Impact Assessment has brought as a result the decision to co-lead the assessment	Hay, L. and Kitcher, C., 2004	Health & Environment
22. Transtheoretical Model(TTM)	Perceived Benefit	<ul style="list-style-type: none"> •Two orthogonal factors representing the perceived benefit (pros) and barriers (cons) of change •Main perceived benefits of a higher fruit and vegetable intake to be nutritional value, a sense of well-being, health , and weight loss 	Velicer et al., 1985 Ling and Horvath, 2001	Nutrition

(table continued)

Table 1

Theory / Topic	Core Constructs	Definition	Source	Research Area
23. Smoking cessation	Perceived Benefit	Associated with motivation and treatment outcome	McKee, S.A., O'Malley, S.S., Salovey, P., Krishnan-Sarin, S., and Mzaure, C.M., 2005	Psychology
24. Health Promotion Behavior(HPB)	Perceived Benefit	Perceived benefits are believed to motivate women to take care of their health	Murdaugh and Verrarn , 1987	Nursing and Health
25. Salient Value Similarity(SVS)	Perceived Benefit	<ul style="list-style-type: none"> •Negative correlations among judgments of risk and judgments of benefit have been found for a number of different technologies •If people prefer consistency among their beliefs, this results in devaluation of risks and the elevation of benefits for technologies perceived as favorable. 	Alhakami and Slovic, 1994; Frewer et al., 1998; Gregory and Mendelsohn, 1993 Siegrist, M., Cvetkovich, G., and Roth, C., 2000	Psychology
26. Enterprise System	Perceived Benefit	Net organizations achieve from their investment in enterprise systems (ES) and acquisition through ES implementation	Shang, S. and Seddon, P.B., 2002	Information System
27. Genetic modification	Perceived Benefit	Perceived benefit can only be a consequence of the quality of risk management when it is defined in terms of “net benefit”	Frewer,L.J., Scholderer, J., and Bredahl, L., 2003	Consumer Behavior
28. Theory of Planned Behavior	Perceived Benefit	Psychological determinant	De Bourdeaudhuij, L., Sallis, J., and Vandelanotte, C. , 2002	Psychology / Sports
29. Behavior Theory	Perceived Benefit of participation	The anticipation of a positive therapeutic response in treatment trials	Rosenstock, I.M., 1974	Health
30. EDI adoption	Perceived Benefit	Anticipated advantages that application can provide the organization	Chwelos, P., Benbasat, I., and Dexter, A.S., 2001	Information System

(table continued)

Table 1

Theory / Topic	Core Constructs	Definition	Source	Research Area
31. Structural equation modeling	Perceived Benefit	<ul style="list-style-type: none"> •Benefits of IS implementation can be classified into three objectives: informational, transactional and strategic benefits •Perceived Benefit is the characteristic that most influence its adoption •Perceived benefit is a perceptual measure of benefit. It not only captures user satisfaction, but also captures other dimensions such as IT effectiveness 	Lin, H., Lee, G., and Lee, C. , 2005 Mehrtens et al., 2001 Staples et al., 2002	Management
32. Normative Social Behavior	Perceived Benefit	Individual's beliefs about the benefits that are likely to accrue if they engage in the behavior	Rimal, R. N., Lapinski, M.K., Cook. R. J., and Real, K. 2005	Health
33. Physical Activity	Perceived Benefit	Individual's evaluation of the potential gains associated with engaged in a particular health behavior	Brown, S. A., 2005	Health
34. EDI adoption	Perceived Benefit	Direct, Indirect, and strategic benefit	Jimeénez-Martínez, J. , Polo-Redondo, Y., 2004	Information System
35. Benefit planning gap	Benefit Success	A synergistic measure of the actual strategic and operational benefits a company has achieved	Fearon, C., and Philp, G., 1998	Information System
36. Internet Adoption	Perceived Benefit	<ul style="list-style-type: none"> •Three types of perceived benefit fell out as natural categories: relative advantage, communication, and as a business tool •The characteristics that most influenced its adoption 	Mehrtens, J., Cragg, P.B., and Mills, A.M., 2001 Rogers, 1991	Information System

Table 2. Description of Studies Using Perceived Benefits

Industry	Practical Area	Sample Size	Technology Description
1. Internet	Internet-based interactive career planning systems	712 individuals	MBCD (Making Better Career Decision)
2. Organization	Integrated support tool to assist employees by embedding performance and learning assistance within the system itself	182	EPSS (Electronic performance support system)
3. Accounting	Performance Evaluation / Auditing	47	None
4. Bank	Internet based relationships	240	Internet context
5. Dairy Farm	Farmers on small and medium-sized farms perceived the benefit of information from their interpersonal networks and other sources	None	None
6. Counseling Service	Therapeutic group work with young children in response to acute community trauma	10 referrals	NOVA, a Barnardo's (Northern Ireland) trauma support service
7. Special Supplement Nutrition Program	WIC (Women, Infants and Children) Program to support participants' weight loss efforts	25 participants	None
8. Schools	Relationships among interpersonal influences, behavior specific cognitions, competing, demands, and physical activity	832 participants	None
9. International Organization	Perceived benefits of ISO 9000 with the passage of time	399 companies	ISO 9000
10. Education	Investigating factors that influence accounting students' career choice	295 students	None
11. Nuclear Safety	The structure of public attitude towards nuclear power plants	1342	None
12. E- commerce	To examine the factors influencing a customer-web relationship	243 respondents	Internet
13. Food industry	The influence of consumer benefit in different food processing technologies	120 consumers	The novel food product of emerging technology (Genetic engineering, protein engineering and traditional selective breeding)

(table continued)

Table 2

Industry	Practical Area	Sample Size	Technology Description
14. Bank	To examine how certain variables influence the extent of external information search for banking services	661 Students	Banking Service Model
15. School	To assess predictive utility of perceived benefits and risks of risk-taking behaviors(RTBs) on behavioral intentions and behavioral change	187 adolescent college students	None
16. Organizational environmental Management	Perceived benefits derived from ISO 14001 registrations for firms with in a newly industrialized country	38 companies	ISO 14001 Standards
17. Healthcare	To determine which factors best predict perceived benefits of implementing a healthy lifestyle at discharge	135 participants	None
18. University Library	The effect of implementing a new system on its users by comparing pre-implementation expectations with post-implementation perceptions	140 responses	Central cataloguing system
19. Casino	To reconfirm the structures of residents' attitude toward casino development in terms of social, economic, and environmental impacts and to examine causal relationships between the impact variables and benefits	Two casino communities	None
20. Grocery	To examine the current status of ECR in Japan	63 responses	Efficient Consumer Response(ECR)
21. Health	To discuss perceived benefits of a joint approach to the assessment	Multi-disciplinary steering group	Health Impact Assessment (HIA)
22. Nutrition	To develop and validate scales to assess perceived benefits and barriers for increasing fruit and vegetable consumption	796 Chinese households	None
23. Health	To examine gender differences in perceived risks and benefits of smoking cessation and their relationship	93 participants	None

(table continued)

Table 2

Industry	Practical Area	Sample Size	Technology Description
24.Health	To determine health promotion behavior(HPB) and the best predictors of HPB in women without prior history of coronary heart disease(CHD)	119 women	None
25.Social Research	Positive perceived benefit and negative perceived risk influencing by social trust	261 Students	None
26.Information Systems	Benefits that organizations may achieve from their investment in enterprise system(ES)	Case study of 4 organizations	Enterprise system software
27.Food	Public attitudes toward emerging technologies	1405 Consumers	Gene Technology
28.Sports	To examine tracking in physical activity and psychological determinants over a 7-year period	172 Respondents	None
29.Healthcare	To assess participants' perception of a Phase I Colon Cancer chemoprevention trial	64 participants	None
30.E-commerce	Three factors as determinants of the adoption of electronic data interchange (EDI)	1772 members	EDI
31.B2B E- commerce	How partnership affect the perceived benefits of B2B e-commerce	157 IS executives	E- commerce
32.Health	Direct test of a component of the theory of normative social behavior	174 Students	On-line Study
33.Health	To evaluate the psychometric properties and relationship to physical activity levels of the exercise benefits/ barriers scale	673 Students	None
34.Commercial (Retail)	To analyze the benefits to be gained from the use and adoption of EDI	300 companies	EDI
35.Information system	To evaluate the benefit success associated with Electronic Data Interchange (EDI)	9 companies	EDI
36.Internet	To determine the significant factors that influenced the Internet adoption	4 IT case firms	Internet

Table3. Perceived Benefit: Root Constructs, Definitions, and Items

Construct	Definition	Items
1.Perceived Benefit (Gati et al. ,2003)	Associated with degree of decidedness after the dialogue	1. Using MBCD system would be beneficial in their career decision processing 2. Perceived benefit is positively associated with the degree of decidedness after the dialogue
2.Perceived Benefit (Chang, C., 2004)	Data/information base and an advisory system of job-oriented or problem-solving components	1. Decreasing information overload and paper documentation 2. Reducing Training time 3. Increasing productivity 4. Improving job performance 5. Enhancing employee empowerment 6. Decreasing training costs 7. Improving individual competence 8. Improving customer satisfaction 9. Decreasing support cost(e.g. help desk) 10. Enhancing the transfer and retention of learning 11. Institutionalizing best practice 12. Change employee's work
3. Level of benefits (Jones, K., 2005)	The level of benefit perceived from the audit was associated with framing the audit time in terms of a 'cost' or 'loss'	1. A greater benefit to the firm will be perceived when significant audit time over budget results in significant finding than when no finding resulted.
4.Relational Benefit (Colgate, M. et al., 2005)	Including confidence benefit, social benefit, and special treatment benefits	1. The dimensionality of traditional perceived benefit is confidence, social, and special treatment, with all three being received by customers. 2. The dimensionality of internet based relational benefits is confidence, special treatment and social- with social benefits being of least significance and confidence the most important

(table continued)

Table 3

Construct	Definition	Items
5. Informational Benefits (Sligo et al., 2005)	Enable to challenge or reframe their thinking about professional and business issues	<ol style="list-style-type: none"> 1. A solution to my problems 2. Alerted me to other potential sources of information 3. Helped me look at a problem differently 4. Helped me feel comfortable about discussing my own ideas 5. Trustworthy information as coming from an expert
6. Perceived Benefit (Stewart, D., and Thomson, K., 2005)	Implication for achieving outcomes : reducing fear, increasing control, restoring connections (with young children as a response to community trauma)	<ol style="list-style-type: none"> 1. Communication 2. Emotional support 3. Management techniques 4. Understanding and meaning
7. Perceived Benefit (Lambert et al., 2005)	The believed effectiveness of strategies designed to reduce the threat of illness	<ol style="list-style-type: none"> 1. Higher self perception/social interaction 2. Physical movement (ability to be mobile without discomfort and higher levels of energy) 3. Physical health (Decreased medical conditions) 4. Cultural environment
8. Perceived Benefit (Wu and Pender, 1996)	Positive or reinforcing consequences of physical activity	<ol style="list-style-type: none"> 1. Exercise improves my physical appearance
9. Perceived Benefit (Casedesus and Karapetrovic, 2003)	Positive impact of implementation	<ol style="list-style-type: none"> 1. Operational results 2. Financial results 3. Customer relations 4. Workers

(table continued)

Table 3

Construct	Definition	Items
10. Perceived Benefit (Ahemed et al., 1997)	How student perceives the rewards	<ol style="list-style-type: none"> 1. There is challenge to the work in the first few years 2. One is a dynamic adviser to business 3. Accountants are trusted business advisers 4. To become chief executive of large business
11. Perceived Benefit (Choi et al. ,1998)	‘How much necessary’ or ‘how much beneficial’	<ol style="list-style-type: none"> 1. Economic generation
12.Perceived Benefit (Ha, 2004)	<ul style="list-style-type: none"> • An outcome variable of customer’s experience • Perceived benefits that are recognized by the customer are significant factor that affects the customer –web retailer relationship by bringing the customer to closely connect with the company 	<ol style="list-style-type: none"> 1. The greater the perceived customer benefits from the online retailer, the higher the familiarity of the customer-online retailer relationship
13.Perceived Benefit (Frewer et al., 1997)	To be important in influencing consumer acceptance	<ol style="list-style-type: none"> 1. Reduced production time 2. Reduced cost 3. Reduced environmental impact
14. Perceived Benefit (Henry and Goldsmith, 1999)	<ul style="list-style-type: none"> •A priority benefit perceived by the consumer as accruing to him/her by the information assisting the consumer to evaluate choices and attributes, thereby making better purchase decisions(Beatty and Smith, 1987 ; Duncan and Olshavsky, 1982) •These benefits include the ability to reduce to find the best purchase for the consumer’s needs (Srinivasan and Ratchford ,1991) 	<ol style="list-style-type: none"> 1. I’m more certain of making the best choice 2. I can get what I want 3. There is too much to lose by being ignorant 4. It pays to make inquiries

(table continued)

Table 3

Construct	Definition	Items
15.Perceived Benefit (Parsons et al., 1997)	Important determinants and the best predictors of behavioral intentions	1. Perceived benefit to itself would account for significantly greater variance in both behavioral intentions and behavioral changes
16.Perceived Benefit (Tan, L. P., 2005)	The benefits reported by the responding firms can be classified into three dimensions namely environmental benefits, competitive advantage, effective operation and improvement in the company's image	<ol style="list-style-type: none"> 1. Better business control 2. Transparency / Openness 3. Marketing advantages 4. Cost reduction 5. Less injuries / environmental accidents 6. Improvement in operations efficiency 7. Company's image improved 8. Improved work culture
17.Perceived Benefit (Zrinyi and Horvath, 2003)	<ul style="list-style-type: none"> •Perceived benefits more importantly determined health behavior •Patient satisfaction with nursing care and nurse-patient relationships are important determinants of perceived benefits of a healthy lifestyle. 	1. Patient's perceptions of benefits to implementing a healthy lifestyle are significantly increased while perceptions of barriers are significantly decreased between admission and discharge.
18.Perceived Net Benefit (PNB) (Staples et al., 1997)	An idealized comprehensive measure of the sum of all past and expected future benefits, less all past and expected future costs, attributed to the use of an information technology application. Any use of resources (including time) in building, learning to use, or using the system is the cost.	<ol style="list-style-type: none"> 1. The new system will be a cost effective solution to my needs 2. The advantages of using the new system will outweigh the disadvantages 3. I will be able to get along quite well without the new system 4. The new system will be efficient 5. The new system will be effective 6. The new system will not be worthwhile 7. I expect to have no difficulty telling others about the results of my use of this system 8. Overall, I expect to be satisfied with the new system

(table continued)

Table 3

Construct	Definition	Items
19. Perceived Benefit (Lee and Back, 2006)	Perceived benefit has a positive association with support for the casino's development	<ol style="list-style-type: none"> 1. Various job opportunities 2. Personal benefits 3. Community benefits
20. Perceived Benefit (Lohtia et al., 2004)	Falling into two categories: general benefits and benefits related to efficient replenishment	<ol style="list-style-type: none"> 1. Eliminating data entry errors 2. Efficient flow of information 3. Accurately processing transactions 4. Improving service levels 5. Establishing paperless system 6. Increasing efficiency at distribution center 7. Increasing profit
21. Perceived Benefit (Hay and Kitcher, 2004)	Perceived benefits that the joint approach to the assessment of the effectiveness of the Health Impact Assessment has brought as a result the decision to co-lead the assessment	<ol style="list-style-type: none"> 1. Networking and contacts 2. Knowledge exchange 3. Pooling of resources 4. Credibility
22. Perceived Benefit (Velicer et al., 1985, Prochaska et al., 1994, and Herrick et al., 1997)	<ul style="list-style-type: none"> • Two orthogonal factors representing the perceived benefit (pros) and barriers (cons) of change • Main perceived benefits of a higher fruit and vegetable intake to be nutritional value, a sense of well-being, health, and weight loss 	<ol style="list-style-type: none"> 1. A sense of well being 2. Nutritional value
23. Perceived Benefit (McKee et al., 2005)	Associated with motivation and treatment outcome	<ol style="list-style-type: none"> 1. Self-esteem 2. Finances

(table continued)

Table 3

Construct	Definition	Item
24. Perceived Benefit (Murdaugh and Verran, 1987)	Perceived benefits are believed to motivate women to take care of their health	1. Healthy lifestyle: health responsibility, physical activity, nutrition, interpersonal relations, spiritual growth, and stress management
25. Perceived Benefit (Siegrist et al., 2000)	<ul style="list-style-type: none"> • Negative correlations among judgments of risk and judgments of benefit have been found for a number of different technologies • If people prefer consistency among their beliefs, this results in devaluation of risks and the elevation of benefits for technologies perceived as favorable 	<ol style="list-style-type: none"> 1. Artificial Sweetener Model 2. Nuclear Power Model 3. Pesticide Model
26. Perceived Net Benefit (Shang and Seddon, 2002)	Organizations achieve from their investment in enterprise systems (ES) and acquisition through ES implementation	<ol style="list-style-type: none"> 1. Operational benefits 2. Managerial benefits 3. Strategic benefits 4. IT infrastructure benefits 5. Organizational benefits
27. Perceived Benefit (Frewer et al., 2003)	Perceived benefit can only be a consequence of the quality of risk management when it is defined in terms of “net benefit”	<ol style="list-style-type: none"> 1. Applying gene technology to produce food products will prove beneficial to the environment, myself, and other people that are important to me 2. To offer great benefits to the environment, myself, and other people 3. To prove advantageous to the environment, myself, and other people
28. Perceived Benefit (Bourdeaudhuij et al., 2002)	Psychological determinants	<ol style="list-style-type: none"> 1. Competition 2. Psychological 3. Health 4. Pleasure and social

(table continued)

Table 3

Construct	Definition	Item
29. Perceived Benefit of participation (Rosenstock, I. M., 1974)	The anticipation of a positive therapeutic response in treatment trials	<ol style="list-style-type: none"> 1. The possibility of lowering one's chance of getting cancer again 2. The possibility of preventing others from getting cancer in the future 3. Being a part of a research effort
30. Perceived Benefit (Chwelos et al., 2001)	Anticipated advantages that application can provide the organization	<ol style="list-style-type: none"> 1. Direct benefits: operational cost savings and other internal efficiencies 2. Indirect benefits: opportunities that emerging from the use of application, such as improved customer service and the potential for process reengineering
31. Perceived Benefit (Lin et al., 2005) (Mehrtens et al., 2001) (Staples et al., 2002)	<ul style="list-style-type: none"> • Benefits of IS implementation can be classified into three objectives: informational, transactional and strategic benefits • Perceived Benefit is the characteristic that most influence its adoption • Perceived benefit is a perceptual measure of benefit. It not only captures user satisfaction, but also captures other dimensions such as IT effectiveness 	<ol style="list-style-type: none"> 1. Informational benefits 2. Transactional benefits 3. Strategic benefits
32. Perceived Benefit (Rimal et al., 2005)	Individual's beliefs about the benefits that are likely to accrue if the engage in the behavior	<ol style="list-style-type: none"> 1. High benefit conditions 2. Low benefit conditions
33. Perceived Benefit (Brown, 2005)	Individual evaluation of the potential gains associated with engaged in a particular health behavior	<ol style="list-style-type: none"> 1. Physical performance 2. Feel better 3. Task improvement 4. Fatigue 5. Pleasurable Activity 6. Facility obstacles 7. Preventive Health

(table continued)

Table 3

Construct	Definition	Item
34. Perceived Benefit (Jimenez-Martinez and Polo-Redondo, 2004)	Direct, Indirect, and strategic benefit	<ol style="list-style-type: none">1. Direct benefits (paper saving, avoiding filing costs and maintenance)2. Indirect benefits (avoiding errors, improved cash flow)3. Strategic (Increasing business relationships, customer loyalty and the quality and quantity of information)
35. Benefit Success (Fearon and Philip, 1998)	A synergistic measure of the actual strategic and operational benefits a company has achieved	<ol style="list-style-type: none">1. Which benefit states are companies experiencing and why?2. Which implementation methods were used to achieve benefit success?
36. Perceived Benefit (Mehrtens et al., 2001) (Rogers, 1991)	<ul style="list-style-type: none">• Three types of perceived benefit fell out as natural categories: relative advantage, communication, and as a business tool• The characteristics that most influenced its adoption	<ol style="list-style-type: none">1. Relative advantages of Internet2. Communication aspect3. A business tool (The technology was seen as something that should be used as an integral part of every business day to support business objectives)

3. RESEARCH APPROACH

3.1 Research Survey Design

In order to create an effective survey, we applied the key principles of the survey design that are Dillman (1999). Use of the web-based survey provides enormous opportunities as well as challenges, and respondent-friendly questionnaire design is aimed to decrease the occurrence of measurement and nonresponse error in the survey (Dillman, 1999). In this approach, three general stages in the development of the perceived benefits of HIT adoption survey instrument are (1) stage 1: survey design and preliminary planning, (2) stage 2: pre-testing, and (3) stage 3: final survey design and planning.

3.1.1 Stage 1: Survey Design and Preliminary Planning

This stage includes a specific research problem and the research questions that the survey will address. First, the goals of the research must be decided; then step-by-step directions must be established on how best to accomplish these goals within the time available. Next, resources must be determined to improve the performance. In this case, the goal of developing a survey instrument is to investigate healthcare professionals' perceptions towards HIT adoption. This study focuses on perceived benefits as a small part of Dr. Sonja-Wiley Patton's NSF grant research (Award No. 0426593). The construct of perceived benefits in the survey is also intended to contribute to the conceptualized HIT Gumbo Adoption Model. The focus of this survey is as follows: (1) demographics, (2) the intention to adopt HIT, (3) perceived benefits of CPOE, (4) attitudes towards the adoption of HIT, and (5) computer, EHR, CPOE and HIT self efficacy. The following is the discussion of designing the questionnaire in stage one:

• Designing the Questionnaire

The types of information we need to collect from respondents and how to elicit that

information are key decisions in the survey design phase. We use closed-ended questions, which mean respondents choose from a list of provided responses. Since open-ended questions require both specific times and specific circumstances when these questions are appropriate, these types of questionnaires are irrelevant in the context of healthcare organizations due to the healthcare professionals' urgent business. We should also determine what types of demographic information we need, as demographics can help to support basic knowledge, attitudes, or behaviors regarding questionnaires of perceived benefits. This information will affect our choice of data collection methods. We will discuss in greater detail the development of our questionnaire in section 3.1.2, construction of questionnaire.

3.1.2 Stage 2: Pre-Testing

Pre-testing is one of the most important components of the survey. The purpose of this stage of the process is to get feedback on each questionnaire item. Pre-testing can be done in several ways and steps. In this stage, we test our initial design decisions and items to determine how well the process is working. We review past studies with the same or similar research problems; this enables us to develop our initial drafts of questionnaires by borrowing and modifying validated questions from previous studies. We continue conducting pretest interviews with several healthcare professionals, expert researchers and colleagues until we feel comfortable with our questionnaires. We must first conduct pre-test questionnaires in order to ensure that the respondents understand the questions. This helps us to determine what we are trying to achieve before we begin the data collection.

3.1.3 Stage 3: Final Survey Design and Planning

The results from our pre-test can be used to improve the survey design and implementation of plans, and to estimate how long it takes to complete a survey in either an online or a paper-based survey. During pre-testing, we can also discover factors that affect

response rates and data quality, and be prepared to make adjustments accordingly. In this stage, final changes of questionnaires and plans for analyzing the data should be made.

3.1.4 Defining Criteria for the Assessment

It is important to define criteria for the assessment. Seddon et al. (1999) suggested that it is necessary to answer each of Cameron and Whetten’s (1983) seven questions when measuring organizational performance. The aim of answering these questions is to measure organizational performance, and we applied these criteria into our study as well since these criteria are relevant to apply to healthcare organizations and the estimation of HIT adoption. Table 4 shows criteria we set forth, followed by discussions of each question:

Table 4. Seven Questions for the Assessment (Source: Cameron and Whetten, 1983)

Seven Questions for measuring organizational performance	Answers in this study for developing a survey instrument for perceived benefits of HIT adoption
1. From whose perspective is effectiveness being judged?	Healthcare executives (also known as healthcare administrators, and healthcare managers) from Our Lady of the Lake (OLOL) Regional Medical Center, Baton Rouge
2. What is the domain of activity?	HIT, focusing on CPOE
3. What is the level of analysis	Organizational, Functional and Individual level
4. What is the purpose of evaluation?	Investigation, Management and Improvement
5. What time frame is employed?	Ongoing installation and implementation of CPOE and other HIT applications
6. What types of data are to be used?	Validated and perceptual data
7. Against which referent is effectiveness to be judged?	First Consulting Group(2003), Leapfrog Group (2004), and RAND health (2005)

• From whose perspective is effectiveness being judged?

To answer this question, we carefully developed benefit items that we consider from the points of view of what respondents call healthcare executives (also known as healthcare administrators, and healthcare managers). Healthcare executives are skilled and trained professionals who have deep understanding about the quality of care, and help community

members about important healthcare issues such as patient safety and technology issues. During the review of perceived benefit items, we developed and modified items of perceived benefits from previous studies (Chang, 2004, Chewelos et al., 2001, Our Lady of the Lake Regional Medical Center presentation, 2006, Mehrtens et al., 2001, Tan, 2005). We took into consideration that the perspectives of perceived benefit items, most taken from Chewelos et al. (2001) were senior purchasing managers who have experience with EDI (Electronic Data Interchange) and the decision of its adoption. Therefore, we focused on the administrative levels of healthcare professionals, such as healthcare executives who manage the hospital, healthcare organizations, and decisions of HIT adoption with their experience. Healthcare executives are also responsible for proposing plans to adopt and implement HIT. Evaluating HIT adoption at this level is such that perceptions of perceived benefits are based on the needs and interests of those individuals, who have a comprehensive understanding of benefits of HIT and current situations for HIT adoption.

• What is the domain of activity? , and what is the level of analysis?

In our study, the domain of activity is the HIT systems, especially focusing on CPOE at Our Lady of the Lake Regional Medical Center. The level of analysis is at the organizational, the functional, and the individual level. It is necessary to view these levels, as some benefits such as strategic benefits may be assessed at the organizational level, while others such as direct and indirect benefits can be assessed not only at the organizational level but at the functional and individual levels as well. For example, reduced medical errors in CPOE may result from the improved function of CPOE; therefore we may this benefit shows up at the functional level. In addition, the character of each benefit for each function may be different in the point of view by observing each level; therefore, benefits must be considered and evaluated at different levels.

- **What is the purpose of evaluation?**

The purpose of evaluation is to investigate perceived benefits from the adoption of HIT, and to help healthcare professionals have a better understanding of benefits in HIT applications. The construct of perceived benefits in HIT will assist in identifying the various types of benefits, and to contribute to increase the adoption of HIT.

- **What time frame is employed?**

We do not establish an exact time frame for evaluation. Currently, the plan for the adoption of CPOE and other HIT is ongoing that the hospital is making efforts to install and to implement HIT systems at Our Lady of the Lake Regional Medical Center, Baton Rouge. We are monitoring adoption patterns, and are seeking better solutions to improve adoption of HIT from the study. And other researchers will continue to perform this study to collect implementation results data in the next year, 2007.

- **What types of data are to be used?**

For assessing perceived benefits, validated and perceptual data will be used. The appropriate wording of the questions relevant to healthcare area will be developed. Some benefits of HIT adoption such as financial measures are difficult to quantify because they are intangible; therefore, perceptual data must be also included in the evaluation.

- **Against which referent is effectiveness to be judged?**

It is difficult to answer this question since our study only focused on Our Lady of the Lake Regional Medical Center and benefits of CPOE. If benefits were to compare the performance of CPOE or overall HIT systems, we would use the following reports of First Consulting Group (2003), Leapfrog Group(2004) and RAND Health(2005) as referents: (1) *Computerized Physician Order Entry: Cost, benefits, and Challenges* (2003), which reported to assess the ability of implemented CPOE systems to avoid medication-related adverse events originating in orders for hospitalized patients, and to provide benefits of CPOE

already documented by early adopters of the technology, (2) *Fact sheet of CPOE* (2004), which reported the key facts about medical errors and effectiveness of CPOE, standards, and challenges to implement CPOE, and (3) *Extrapolating Evidence of Health Information Technology Savings and Costs* (2005), which reported to quantify the benefits of HIT by extrapolating findings from the literature in the national level. All referents can be valued as referents for assessing perceived benefits from HIT adoption.

3.1.5 Construction of Questionnaire

Before developing a questionnaire, we should be certain that the word choice in the questions is unambiguous, that respondents are able to read the questions smoothly, and the survey has a clear instruction for the responses. As we develop the questionnaire, we must consider that we have introduced bias in the data gathering process. The development of the survey focuses on formulating and categorizing key research questions clustered around the concept of perceived benefits in HIT, and the survey variables and items are evaluated and refined.

For the respondent-friendly design of web questionnaires, we applied Dillman's principles. Dillman's principles are (1) to introduce web questionnaire with well-designed welcome screen, (2) to present each question in a conventional format, (3) to limit line length for the respondents' browser, (4) to provide specific instructions, (5) to use graphical symbols or words for the completion progress, and (6) to be cautious about using question structures (e.g. check all-that apply and open-ended questions). It makes aspects of response task easy and interesting for the respondent to complete the survey, and reduces errors such as nonresponse error, measurement error, sampling error and coverage error (Groves, 1989).

The Questionnaire was based on findings identified and validated in the literature review in each research area. A modified version of the questionnaire was then developed. The questionnaire was intended to provide data about HIT and its adoption, and to enhance

understanding of the factor of perceived benefits related to HIT adoption. In our survey, HIT covers a wide range of clinical applications but limited to: EHR, Health Information Exchange (HIE), Clinical Decision Support System (CDSS), and CPOE. Although numerous HIT applications exist, selected applications have received the most attention in the healthcare industry and literature related to healthcare because of their potential benefits.

We must approach the developing questionnaires not as an isolated effort, but in the context of achieving our research goals within our resources. Two goals guided the development of the questionnaires:

- To ensure the usefulness of the data by addressing issues of HIT adoption throughout the healthcare organization
- To contribute to the overall NSF research for developing the conceptualized HIT adoption model

In keeping with these goals, the background questionnaire addressed the following broad issues:

- Demographic Information
- Perceived Benefits of CPOE
- Intent to Adopt CPOE

3.1.5.1 Demographic Information

Demographic information is an essential snapshot of a healthcare professional's work environment; it demonstrates the organization's diversity and culture. The inclusion of demographic variables makes it possible to describe the groups of healthcare organizations, and the data allows for the investigation of issues such as experience with computers, CPOE and HIT. With this data, we can hypothesize how this data is correlated with the level of perceived benefits. In this part, we state the question as directly as possible, and the answer of each question is given in terms of the answer choices provided. The demographic

information collected includes the following:

- Percentage of time respondents spend doing their jobs
- Primary specialty
- Years of personal experience in respondent's occupation
- Gender
- Age
- Highest level of academic achievement
- Years of hands-on experience with computers, CPOE, and HIT
- Level of knowledge with laptop computer, the Internet in general, HIT, CPOE, EHR

3.1.5.2 Perceived Benefits of CPOE

The construct of perceived benefits is the most critical part of this survey, and decisions and assumptions are considered to design the questionnaire of perceived benefits. Underlying the first draft of the questionnaires is our assessment of what respondents will know, what words they will understand, what sorts of information they can provide, and what response tasks they can perform. One thing we carefully considered is the respondent's ability to provide good answers to our questions. Therefore, items must be valid and reliable so as to interpret the question as intended.

In this category, we focus only on CPOE to measure the perceived benefits. The reason for this is that although HIT is broad and includes a wide range of clinical applications, a selected number of HIT applications such as EHR, CPOE, and CDSS have received the most attention in the literature. An ongoing project in Our Lady of the Lake Regional Medical Center is establishing efforts to implement CPOE, and healthcare professionals are seeking to find the best way for the widespread adoption of CPOE and overall HIT. Items are developed for two purposes: (1) to develop more reliable measures of the relevant construct under the study, and (2) to facilitate the task of interpreting results. To answer the

questions of perceived benefits, importance rating scales are designed. It is also reasonable to add the option of ‘don’t know’ category because we consider each question from the perspective of possible situations to judge whether all or most respondents will be able to answer the question in the expected manner. We will discuss further the process of the item development in section 3.2.

3.1.5.3 Intent to Adopt CPOE

This category is developed for the study to investigate healthcare professional’s intention to adopt HIT. We assume that the intent to adopt CPOE is determined by the factor of perceived benefits. However, the measurement of the intent to adopt CPOE with only one factor of perceived benefits is not inappropriate to examine the overall CPOE adoption as there are many factors which determine the adoption of CPOE. Therefore, the response result of intent to adopt CPOE will be analyzed only for the purpose of investigating the current stage of CPOE adoption in Our Lady of the Lake Regional Medical Center. The scale of items ranges from 1 (no intent to adopt CPOE) to 7 (definite intent to adopt CPOE). And the scale contains the option of the ‘don’t know’ category for the fair rating if respondents are unsure about this question. The category of the intent to adopt CPOE includes the following:

- The stage of CPOE implementation
- Intent to adopt CPOE
- Anticipated period of the CPOE implantation

3.2 Description of Perceived Benefit Questionnaire Design

3.2.1 Item Development

The generation of items may be an important part of the developing questionnaire design. In the item generation, the primary concern was the reliability and validity of

contents, which may be viewed as the minimum requirement for measurement adequacy, and was the first step in the construct validation of the measure. The phase of item development was a trial and error process in which we attempted to identify gathering of items that had consistent and coherent contents. Our first task was to sort items from literature review into three benefit dimensions: direct benefits, indirect benefits, and strategic benefits. Benefits are both direct and indirect benefits in nature (Chwelos et al., 2001), and many healthcare organizations focus on business strategy; therefore we carefully consider strategic benefits. The survey contained 24 items, and Table 5 shows the items of perceived benefits categorized by three benefit dimensions. Most items of perceived benefits were acquired from Chewelos, Benbasat and Dextor (2001). We also reflected the presentation of Our Lady of the Lake Regional Medical Center by Dr. Stephanie Mills and Dr. Sonja Wiley-Patton (2006): *Delivering Quality & Patient Safety through IT*. In the study (Chewelos et al., 2001), the construct of perceived benefits were developed using the reflective construct. The reflective construct means that the direction of causality is from the construct to the measure, and reflective indicators used to measure the latent variable are reflective in nature. Reflective items can measure a single trait, and respondents should answer each item similarly. All reflective items of perceived benefits must be consistent with correlations among indicators for a particular latent variable (Direct, Indirect, and Strategic Benefits).

Perceived benefits are defined as outcomes with the adoption or the implementation of CPOE and CPOE may be expected to produce direct, indirect, and strategic benefits. Direct benefits are realized when implementing CPOE, and are closely related to applications. Since the investment in HIT provides business benefits by speeding up processes, substituting labors, and raising outputs, it is evidence that cost reduction and operational cost savings are clearly results of the adoption. Indirect benefits and strategic benefits may appear difficult to distinguish their own characteristics as many attributes of benefits can't be observed

directly. Indirect benefits focused on organizational or individual benefits are from the use of CPOE that can change the way people do business. CPOE can play an active role in accelerating better healthcare organizational circumstance. And indirect benefits may appear in the healthcare professionals' development of the shared information and perception

Table 5. Items of Perceived Benefits

Dimension	Items	Source
Direct Benefits	• Reduced Medical Error	Chewelos, Benbasat and Dextor (2001)
	• Paper Reduction	
	• Reduced Patient Data Re-keying	
	• Reduced Pharmacy Inventory Cost	
	• Reduced Medical Records Staff Expenses	Gans, Kralewski, Hammons and Bryan (2005)
	• Reduced Medical Records Storage Costs	
	• Reduced Transcription Costs	
Indirect Benefits	• Improved Quality of Care	Chewelos, Benbasat and Dextor (2001)
	• Improved Access to Data	
	• Increased healthcare professional's Productivity	
	• Improved Patient Service	
	• Enhanced Ability to Compete with Regional Healthcare Organizations	
	• Greater Integration of Clinical Systems	
	• Potential for Clinical Work-Flow process Reengineering	
	• One-Stop Shopping for Patient Data	OLOL presentation by Dr.Mills (2006)
	• Improved Medication Reconciliation	
	• Enhanced healthcare professional's Job Satisfaction	Chang (2004)
	• Increased Patient Satisfaction	
	• Reduced Error-Prone Communication	Mehrtens, Cragg and Mills (2001)
	Strategic Benefits	• Improved Core Measure Performance
• Improved Patient Safety		
• Enhanced Ability to Collaborate with Regional Healthcare Organizations		
• Faster Response to Physician's Clinical Orders		Chewelos, Benbasat and Dextor (2001)
• Improved Hospital Images		Tan (2005)

of CPOE use for the future of the hospital and better communication between healthcare professionals. Finally, strategic benefits which can be attained during or after the implementation of CPOE are most significant benefits in the healthcare organizations. CPOE and overall HIT have the potential to assist in achieving strategic benefits through providing a new opportunity for achieving competitive differentiation by offering better patient safety and services, and by speeding up the clinical work process.

3.2.2 Item Revisions and Iterations

The response choices for several items were also revised to improve the interpretability of results. Qualitative activities such interviewing procedures were conducted to modify the items of perceived benefits. Qualitative activities with several healthcare professionals were used to ensure that respondents understood the intent of questionnaires, and to provide an opportunity how questions can be better to convey respondent's intended meaning. The purpose of this discussion was to determine if the change in the response to given items of perceived benefits was due to a lack of the item clarity. This item revision process was essential in order to obtain increasingly accurate information throughout the data collection phase of the study.

3.3 Instrument Validation

The general concept of validation was traditionally defined as "the degree to which a test measures what it claims or purposes to be measuring" (Brown, 1996). We must translate the theoretical construct into a functioning and operating reality. We must also carefully consider how accurate we did a translation. Since there is some confusion in methodological literature, this step is necessary to preparing the measurement. In this section, we will discuss face validity, content validity, pre-test and final instrument.

3.3.1 Face Validity

Face validity is making a decision about the appropriate use of the measuring

instrument through the process of the simple inspection of the instrument. It also explains how a measure or procedure appears. Through face validity, we observed what seemed to be a reasonable way to gain the information we were attempting to obtain. We were then able to determine whether or not our survey seemed well designed. With face validity, we observed whether the survey seemed like a good translation of the construct of perceived benefits. The items of perceived benefits were examined by colleagues with their knowledge in the survey format and questionnaires design. The reviewers pointed out some minor grammar errors in questionnaires and statements. Suggestions were made about the design of a survey format such as color choices, missing logos of LSU and Our Lady of the Lake Regional Medical Centers, and redundant wording in the instruction. Several colleagues complained and suggested that four items of perceived benefits (enhanced nurse job satisfaction, enhanced physician job satisfaction, increased physician productivity, and increased nursing productivity) were ambiguous to measure each individual's level of satisfaction and productivity to healthcare executives. During the initial stage of the item development, we assumed that there were differentiations between nurses and physicians in terms of the satisfaction and productivity. However, the level of respondents are healthcare executives rather than the individual levels of healthcare professionals, and these items seem ambiguous to measure nurses' and physicians' own satisfaction and productivity to the respondents; therefore, these items were modified for the perspective who judges the items. The following are questions we discussed during face validity: 1) Clear, concise, easy instructions, 2) Color choices in the survey format, 3) Clear Questions and statements, 4) Appropriate options for selecting and scales, 5) Missing values and grammar errors, 6) Appropriate or appealing formatting, 7) Informed consent statement, 8) Level of understanding in research questions or propositions from the survey content, and 9) Estimated time to conduct a survey.

3.3.2 Content Validity

Content validity is based on the extent to which a measurement reflects the specific intended domain of content (Carmines and Zeller, 1991), and must be built into the measure through the development of items. As such, any measure must adequately capture the specific domain of interest which contains no extraneous content. Several academic expert researchers and one Ph.D. student with extensive experience and knowledge of the survey development and HIT gave advice on the items of perceived benefits during the development of the instrument. Several healthcare professionals also continued to review the items of perceived benefits while developing the instrument. Questionnaires were modified with valuable feedback from all participants during content validity.

3.3.3 Pre-Test

This step requires preparing the sampling frame, record-keeping forms, and survey questions; we then test the items to see how well the process is working. Two faculty members who have knowledge in HIT, research design, statistical analysis, development of questionnaires as well as the survey instrument carefully reviewed the initial draft of the instrument. Colleagues, reviewers, and several physicians and healthcare executives as mentioned earlier provided valuable feedback. It is important to keep in mind that what thoughts occurred to respondents or reviewers as questions are read to them. And understanding this process that respondents or reviewers use in answering questions helps us to write better questions and therefore collect better data.

3.3.4 The Final Instrument

The final version of the survey consists of five pages (See Appendix A). The final instrument offers the options of both a paper-based and an online survey, and contains twelve questions grouped by three categories: demographics, perceived benefits of CPOE, and intent to adopt. The first page of the survey contained the statement of the research purpose,

instruction, definition of HIT to offer clear understanding, and contact and return information. Four pages were divided into three parts: Pages two and three contained demographic information. Page four provided perceived benefits with Likert 7 importance rating scale, including a separate section for 'don't know' option. The last page contained information on intent to adopt.

4. DISCUSSION

In our view, it is apparent that the perceived benefits of HIT adoption must be considered as an important factor in the continuing process of improving and implementing HIT systems, in an effort to improve the quality of healthcare. HIT systems are in a phase of rapid development, with many unresolved questions in terms of functionality and management. In addition to unanswered questions, it is somewhat ambiguous as to what motivates individual healthcare professionals in making technology acceptance decisions. Many studies have been directed towards understanding the user's perception of adopting new technologies (Menon et al. 2000). HIT systems must begin to focus more on the information needs, decision processes, and practice patterns of healthcare professionals. The expected or perceived benefits from the implementation of HIT are realized only when healthcare professionals adopts their intended HIT well, and subsequently use systems.

There continues to be a distinct need to develop a useful assessment instrument that can be better used to understand the challenges of adopting the complex HIT systems and the maintenance needs experienced by individuals. This research was an attempt to develop and test a survey instrument for measuring perceived benefits of HIT adoption. The aim of review on perceived benefits was to identify established approaches to questionnaire design. This enabled us to identify, analyze and synthesize evidence for ways in which the quality of survey data such as validity, reliability, and lack of bias could be developed. In addition, we could evaluate the extent to which the approaches from other studies were to be transferable to a healthcare context in particular to the adoption of HIT assessment. Our instrument was designed to investigate the healthcare professionals' perception of HIT adoption regarding perceived benefits in the healthcare organization in order to determine the extent to which the survey items are reliable and valid, as well as to refine the instruments before conducting a

large-scale pilot test in Our Lady of the Lake Regional Medical Center. Within the adoption of HIT assessment, the questionnaire survey was frequently the method of choice for gathering primary quantitative data from healthcare professionals. Questionnaires used in this context must provide valid, reliable and unbiased data from a representative sample of respondents. To obtain better features of the survey method, the criteria for selecting the sample is fixed and objective with statistical analysis. The sample of units for which data are collected is more than one hundred, and the procedures for collecting information are explicit, systematic and standardized.

Through careful attention to the design and layout of questionnaires in our survey instrument, the risk of errors in interpreting questions and in recording and coding responses will be reduced. Consistency in the presentation of information and the understanding of the questionnaire is also considered. To enhance response rates, it is important to give the importance and interest of the survey to the respondents. In addition, higher response rates can increase the accuracy of the factor of perceived benefits, and therefore can reduce the risk of non response bias.

Limitation

One limitation of our research was the exhaustive review when focused on a limited number of databases. We may have failed to identify a number of relevant studies. Several articles in journals included only on other electronic databases, could not have been identified. If such a bias were to have occurred in the identification of studies, we would lack the ability to estimate the effects of perceived benefits under investigation. Moreover, within our chosen databases, our decision to confine the search strategy and to measure the term of perceived benefits within titles and abstracts, rather than conducting a more detailed search of key terms within whole articles, may be only as good as the key wording employed by chosen databases.

Another limitation is that insufficient validation work has been performed. Due to the time constraint and hospital conditions, we could not conduct the pilot test of the survey on healthcare executives at this time. Other researchers will continue to conduct the survey in Our Lady of the Lake Regional Medical Center, as more work on establishing the construct validity of the scale is required. We believe that even with these limitations, our instrument represents an important contribution to the research on perceived benefits of HIT adoption, given the paucity of accurate data-based studies on the topic of benefits from the HIT adoption.

For the conclusion of this project, and the results from measurements made on the sample will be summarized statistically. In addition, the results of the survey will serve to make the survey instrument available to healthcare professionals and researchers regarding perceived benefits of the adoption and the implementation of HIT, with the expectation that the instrument will provide baseline data to assist them.

5. CONCLUSION

This paper reviewed the construct of perceived benefits in various research areas, overall HIT, and the current state of HIT adoption. The identification of key sets of perceived benefit items contributed to the development of modified construct of perceived benefits for healthcare organizations. Designing and pre-testing the survey instrument so that we were able to meet the objectives of this survey as outlined in perceived benefits of HIT adoption has been challenging. The development process of the survey instrument was presented, and the three dimensions of benefits that were associated with CPOE and overall HIT adoption were described. We are optimistic that the quality of the survey instrument will be sufficient to test in the practical healthcare area, due to the test of translation validity which attempts to assess the degree to which we accurately translate the perceived benefit construct into the healthcare organization, as well as the pre-test questionnaire evaluation we conducted. It is our hope that respondents can more easily understand the questions and perform the requested tasks necessary to provide accurate answers to the survey. Our original objectives are to develop the construct of perceived benefits for healthcare organizations, and to design the perceived benefit questionnaire that could improve the potential for HIT adoption. We are confident that these goals have been met, and it is necessary to conduct a quality assessment of HIT in the survey instrument in order to determine the extent to which those goals are met. This instrument may be a useful tool for healthcare professionals and researchers to assess the benefits of HIT adoption. Whether the questionnaires will lead to additional changes in the instrument is still under discussion; however, we strongly believe that further steps for statistical analysis will enhance validation of the instrument.

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APPENDIX: QUESTIONNAIRE

PERCEIVED BENEFITS OF HIT ADOPTION



LOUISIANA STATE UNIVERSITY

Are the Benefits of Healthcare Information Technology (HIT) Adoption Perceived or Real?

The purpose of this survey is to investigate healthcare professionals' perceptions regarding the adoption and use of Healthcare Information Technology (HIT). As defined by the Department of Health and Human Services (DHHS), Healthcare Information Technology (HIT) covers a range of clinical support applications including but not limited to; Electronic Health Records (EHR), Health Information Exchange (HIE), Clinical Decision Support System (CDSS) and Computerized Provider/Physician Order Entry (CPOE).

As a *healthcare executives* (also known as healthcare administrators, and healthcare managers), Your expert knowledge is vital to the success of this Healthcare and Information Technology adoption research, which aims to explore perceived benefits of the HIT adoption. Please take 10 minutes to answer the following questions. Your cooperation is voluntary and confidential. All survey response data will be for statistical purposes only. A copy of our findings is available to you upon request.

If you have any questions regarding this survey or general research area, please feel free to contact my supervising professor, Dr. Sonja Wiley-Patton at Louisiana State University, Dept. of Information Systems and Decision Sciences. Email: swpatton@lsu.edu and Phone: 225-578-2512

Thank you in advance for your valuable contributions.

So-ra Jung, MS Candidate

Department of Information System & Decision Science
Louisiana State University - Baton Rouge, LA 70803

Please return this survey to the:

Medical Staff Office

Our Lady of the Lake Regional Medical Center

5000 Hennessey Blvd., Baton Rouge, LA 70808

Phone: (225) 765-8871

Electronic version of this survey can be completely by entering the following web link:

<http://cvoc.bus.lsu.edu/SS/wsb.dll/SoraJung/hit.htm>

DEMOGRAPHICS

The following demographic questions are necessary to maximize the usefulness of your survey responses.

1. Please give the percentage of time you spend doing your jobs.

Role	Percentage of Time
Patient Care and Treatment	_____ %
Teaching	_____ %
Supervision	_____ %
General Administration	_____ %
Others	_____ %
Total= 100 %	

Other (Please specify your roles): _____

2. If applicable, what is your primary specialty? (Select one)

- | | | |
|---|--|---|
| <input type="checkbox"/> Internal Medicine | <input type="checkbox"/> Neurology | <input type="checkbox"/> Pediatrics |
| <input type="checkbox"/> Pulmonary Medicine | <input type="checkbox"/> Hematology/Oncology | <input type="checkbox"/> Emergency Medicine |
| <input type="checkbox"/> Psychiatry | <input type="checkbox"/> Cardiology | <input type="checkbox"/> Hospitalist |
| <input type="checkbox"/> Geriatrics | <input type="checkbox"/> Radiology | <input type="checkbox"/> Podiatry |
| <input type="checkbox"/> Others (Please specify): _____ | | |

3. How many years have you worked in this occupation? (Select one)

- | | | |
|---|--------------------------------------|--|
| <input type="checkbox"/> Less than 1 year | <input type="checkbox"/> 1- 5 years | <input type="checkbox"/> 6-10 years |
| <input type="checkbox"/> 11-15 years | <input type="checkbox"/> 16-20 years | <input type="checkbox"/> Over 20 years |

4. Gender (Select one): Male Female

5. Your age group (Select one)

- | | | | | |
|--------------------------------|--------------------------------|--------------------------------|--------------------------------|----------------------------------|
| <input type="checkbox"/> 20-30 | <input type="checkbox"/> 31-40 | <input type="checkbox"/> 41-50 | <input type="checkbox"/> 51-60 | <input type="checkbox"/> Over 60 |
|--------------------------------|--------------------------------|--------------------------------|--------------------------------|----------------------------------|

DEMOGRAPHICS

6. Your highest level of academic achievement (Select one)

- High School Associate Degree Bachelor's Degree
 Master's Degree Medical Doctorate Degree Doctorate Degree (Ph.D.)
 Professional Certification Others (Please specify): _____

7. How many years of *hands-on* experience do you have with the following?

	None	Less than 1 year	1-5 years	6-10 years	11-15 years	16-20 years	Over 20 years
Computers in general	<input type="checkbox"/>						
CPOE <small>(Computerized Provider/Physician Order Entry)</small>	<input type="checkbox"/>						
HIT <small>(Healthcare Information Technology)</small>	<input type="checkbox"/>						

8. How *knowledgeable* (tech-savvy) do you consider yourself to be about the following?

Rating: 1='Not at all'
to 7='Extremely'

	1 Not at all	2	3	4 Moderately	5	6	7 Extremely
Laptop Computer	<input type="checkbox"/>						
The Internet in general	<input type="checkbox"/>						
HIT <small>(Healthcare Information Technology)</small>	<input type="checkbox"/>						
CPOE <small>(Computerized provider/ Physician Order Entry)</small>	<input type="checkbox"/>						
EHR <small>(Electronic health Record)</small>	<input type="checkbox"/>						

PERCEIVED BENEFITS OF CPOE

9. Please rate the **importance** of achieving each of the following *benefits* in terms of your decision to adopt and use **CPOE**.

Rating: 1='not important at all'
to 7='extremely important'

	Not important at all			Moderately Important			Extremely Important	Don't know
	1	2	3	4	5	6	7	
Improved Core Measures Performance	<input type="checkbox"/>							
Reduced Medical Errors	<input type="checkbox"/>							
Improved Patient Safety	<input type="checkbox"/>							
Improved Quality of Care	<input type="checkbox"/>							
One-Stop Shopping for Patient Data	<input type="checkbox"/>							
Improved Access to Data (<i>Anytime & Anywhere</i>)	<input type="checkbox"/>							
Enhanced Healthcare Professionals' Job Satisfaction	<input type="checkbox"/>							
Increased Healthcare Professionals' Productivity	<input type="checkbox"/>							
Reduced Medical Records Staff Expenses	<input type="checkbox"/>							
Reduced Medical Records Storage Costs	<input type="checkbox"/>							
Increased Patient Satisfaction	<input type="checkbox"/>							
Paper Reduction	<input type="checkbox"/>							
Reduced Transcription Costs	<input type="checkbox"/>							
Reduced Patient Data Re-Keying	<input type="checkbox"/>							
Reduced Pharmacy Inventory Cost	<input type="checkbox"/>							
Improved Patient Service	<input type="checkbox"/>							
Faster Response to Physician's Clinical Orders	<input type="checkbox"/>							
Reduced Error-Prone Communication	<input type="checkbox"/>							
Improved Medication Reconciliation	<input type="checkbox"/>							
Improved Hospital Image	<input type="checkbox"/>							
Enhanced Ability to Compete with Regional Healthcare Organizations	<input type="checkbox"/>							
Enhanced Ability to Collaborate with Regional Healthcare Organizations	<input type="checkbox"/>							
Greater Integration of Clinical Systems	<input type="checkbox"/>							
Potential for Clinical Work-Flow Process Reengineering	<input type="checkbox"/>							

INTENT TO ADOPT CPOE

10. At what stage of CPOE system implementation is your department currently engaged? (Select one)

- Not Currently Implementing a CPOE System
- Planning
- Pilot Testing

11. Does your department intend to adopt CPOE? (Circle one)

Rating: 1='Not intent to adopt CPOE'
to 7='Definite intent to adopt CPOE'

No Intent to Adopt CPOE			Moderate Intent to Adopt CPOE			Definite Intent to Adopt CPOE	Don't Know
1	2	3	4	5	6	7	<input type="checkbox"/>

12. If your department is implementing or intending to adopt CPOE, how soon do you anticipate that the organization will have an operational system? (Select one)

- Less than 6 months
- 6 to 12 months
- 12 to 18 months
- 18 to 24 months
- More than 24 months
- No plan to implement CPOE

VITA

So-ra Jung was born in Pohang, Republic of Korea, on April, 07, 1980. She received the degree of Bachelor of Science in computer science from Dankook University, Korea, in February, 2003. She enrolled the master's program in the Department of Information Systems & Decision Sciences at Louisiana State University, Baton Rouge, in August, 2004. She is currently a candidate for the degree of Master of Science in the Department of Information Systems & Decision Sciences in December, 2006.