CLINICIANS' SATISFACTION WITH CLINICAL INFORMATION SYSTEMS: A DISCONFIRMATION PARADIGM PERSPECTIVE

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CONTENTS

SUMMARY

Clinical information systems (CIS) have been widely regarded as efficient means of achieving healthcare quality, patient safety, and reduced healthcare costs. However, the realization of these potential benefits of CIS depends on clinicians' satisfaction with and continuous use of CIS. Prior IS satisfaction research in general and CIS satisfaction studies in specific lack a strong theoretical background, and overemphasize on technical aspects of IS and CIS. In other words, they offer limited understanding of the psychological processes that convert the IS performance on various system characteristics into user reaction to the system.

In this study, a conceptual framework is developed to identify the cognitive determinants of clinicians' satisfaction formation based on two models from the disconfirmation paradigm namely the expectations congruency and needs congruency models. The extant IS literature on user satisfaction is integrated into the research model of the study. As such, various IS attributes including system quality, information quality and service quality from the Delone and McLean's (2003) IS success model are utilized as the aspects of a system which clinicians may have expectations about. McClelland's learned needs theory (McClelland, 1976) is also employed to identify clinicians' needs in their work settings regarding CIS. In addition, the impact of perceived CIS performance (measured at functionality level) is investigated as another determinant of clinicians' satisfaction.

Survey methodology is adopted in this study to empirically validate the proposed research model. The survey is conducted at a public hospital with more than 500 beds in Singapore. 200 surveys were distributed among doctors of different

clinical departments in the sample hospital by their clinical secretaries. Nurse officers of the 19 wards in the sample hospital handed out 207 surveys to the nurses in their wards. The response rate from doctors and nurses were 57% and 100% respectively.

The partial least squares (PLS) method is used to analyze 112 valid responses from doctors and 203 valid responses from nurses. The results of the study show that perceived CIS performance is the most influential factor on clinician satisfaction. Contrary to the most previous studies findings, nurses' expectations and expectations congruency did not show a significant effect on their satisfaction. However, doctors' expectations congruency was the next significant determinant of their satisfaction. For nurses, the needs congruency found to be significantly affecting their satisfaction.

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CHAPTER 1

INTRODUCTION

1.1 Thesis Motivation

Information systems (IS) are widely regarded as means of achieving competitive advantage by organizations. As such, many organizations across various industries have invested large amounts in IS expenditures (Menon et al., 2000). Nevertheless, they have serious concerns about employees' (users) reaction to the implemented systems. The reason is that user resistance to IS or underutilization of them not only can hinder achieving competitive advantage, but also can lead to increased inefficiencies, turnover, and reduced productivity.

Healthcare delivery systems are attributed with undesirable characteristics such as unsafe practice (due to medical errors occurrence), treatment variability (in different healthcare environments), and less than desirable quality of care (Mayfield, 2008). They hence are facing great pressure to increase healthcare quality and patient safety and at the same time reduce healthcare costs. Health information technologies (HIT), especially clinical information systems (CIS), have been frequently suggested as efficient means to succeed in improving healthcare quality and patient safety, reducing medical errors, and decreasing costs (Berner et al., 2005, Bhattacherjee and Hikmet, 2007, Chiang et al., 2008). However, the same concern about users' interaction with information systems also exists in CIS implementations, because the realization of all these benefits is contingent upon clinicians' continuous use of these systems (Mazzoleni et al., 1996). Prior IS research have found that users' attitude and

continuance intention are associated with their satisfaction with information systems (Bhattacherjee, 2001, Bhattacherjee and Premkumar, 2004). Clinicians' satisfaction has also been found to explain intended future use of CIS (Sicotte et al., 2010). As such, understating clinicians' satisfaction with CIS is critical for successful CIS implementations.

From another point of view, assessing IS success has long been an important and challenging issue for IS researchers and practitioners. With the elevating amount of investments in IS implementations in general and CIS implementations at hospitals in specific, the importance of measuring the effectiveness of these investments has also been increasing. However, evaluating IS success has been identified as a difficult task and researchers have employed various methods to measure it. Some of these methods include cost-benefit analysis, system usage measurement, or user satisfaction evaluation, but most of them have their limitations.

The ideal measurement of IS success is believed to be evaluating the degree of IS use in decision making and the consequent productivity advantages (DeLone and McLean, 1992, Ives et al., 1983, Nolan and Seward, 1974). A system is then effective when its benefits exceed its costs. The fact is that while the identification of IS implementation and maintenance costs is potentially applicable (e.g., labor, software, hardware), the IS benefits are usually difficult to quantify. The reason is that IS benefits to organizations such as improved decision making or improved organizational effectiveness are mainly intangible, qualitative, and difficult to convert to monetary values (Zviran and Erlich, 2003).

System usage estimation is another measure of IS success which has been used frequently in practical and conceptual IS success studies (DeLone and McLean,

1992). DeLone and McLean (1992) have listed various operationalizations of this construct in prior research such as the number of computer inquiries, the amount of user connect time, and the number of computer functions or client records utilized. Recording this information usually requires installation of monitoring software which imposes further financial cost (Zviran and Erlich, 2003), and may decrease the system performance (Melone, 1990). Moreover, this measure has been criticized for ignoring the amount of users' actual utilization of the retrieved information from the system in their integrated work context (Melone, 1990). The association of system usage and IS success (e.g., the correlation between the number of queries issued by a decision support system and the quality of users' decision making) has also been questioned (Melone, 1990, Zviran and Erlich, 2003). In addition, users, informed of being observed, may change their usage behavior which biases the measurement results (Melone, 1990, Zviran and Erlich, 2003). Finally, system usage as an IS success indicator is more pertinent when the system use is voluntary (DeLone and McLean, 1992, Melone, 1990), because heavy system usage may be due to a mandate from management, political reasons or personal motivation rather than system effectiveness (Ives et al., 1983).

User satisfaction as a subjective or perceptual measure of IS success is probably the most widely employed IS success indicators in the relevant literature (DeLone and McLean, 1992). In their review of the literature on inpatient CIS evaluations, van der Meijden et al. (2003) found that user satisfaction was evaluated in 46% of the studies. This prevalence of user satisfaction as a surrogate of IS success has been attributed to its high degree of face validity, availability of reliable instruments to measure it, and difficulty of other measures obtainment or their weak conceptualization (DeLone and McLean, 1992). Furthermore, user satisfaction can be more than a simple substitute of

objective IS success measures, because it shows a system from its users' point of view. When a "good" information system is viewed by its users as a "poor" system, it is in fact a "poor" system (Ives et al., 1983). In other words, it is hard to deny the success of a system that is liked by its users (DeLone and McLean, 1992). This provides another incentive for this study to investigate user satisfaction in healthcare setting.

1.2 Gap in the Literature

There has been extensive research in IS literature on user satisfaction. This body of research (Bhattacherjee, 2001, DeLone and McLean, 1992) partly dealt with the role of user satisfaction in IS success (Nevo and Chan, 2007). Many other studies attempted to develop measurements for assessing user satisfaction (Bailey and Pearson, 1983, Baroudi and Orlikowski, 1988, Doll and Torkzadeh, 1988, Doll et al., 1994, Ives et al., 1983) or provide typologies of information system characteristics that seem to affect user perception of the system (DeLone and McLean, 1992, Delone and McLean, 2003, Seddon et al., 1999). They offered practitioners with helpful tools to improve their systems and chances of success (Briggs et al., 2008). Nevertheless, this body of research has been frequently criticized because of its overemphasis on IS technical soundness and specific system characteristics. It offers limited understanding of the psychological processes that convert the system performance on these characteristics into user reaction to the system (Khalifa and Liu, 2002, Spreng et al., 1996, Wirtz and Mattila, 2001). Besides, most of this research has an empirical findings basis rather than a theoretical background (Au et al., 2008).

In recent attempts to remedy these issues, a number of IS studies (Au et al., 2008, Chin and Lee, 2000, Khalifa and Liu, 2002, McKinney et al., 2002) the

disconfirmation paradigm from consumer satisfaction literature. This paradigm attempts to explain satisfaction in terms of the degree of congruency between the perceived performance of a product and a pre-consumption comparison standard. The IS studies adopting the disconfirmation paradigm mostly investigated user expectations as the comparison standard. However, the consumer satisfaction literature shows that other comparison standards (such as desires) can influence satisfaction over and above expectations (Spreng et al., 1996, Wirtz and Mattila, 2001). In IS literature, Khalifa and Liu's (2002) study used pre-adoption desires as an additional comparison standard for explaining IS user satisfaction and empirically investigated it in the context of Internet-based services. Desires (needs) may be conceptualized at different levels of abstraction. It is more common in marketing literature to follow the attribute-level conceptualization. Similarly, Khalifa and Liu's (2002) study elicited a list of desired attributes for an on-line knowledge community. However, prior IS research (Nevo and Chan, 2007) shows that the conversion of higher-level desires to concrete product attribute (especially in the case of complex IS such as CIS) is not easy and straightforward for different IS stakeholders.

Moreover, while several IS studies dealt with various aspects of IS usage within the specific context of healthcare such as clinicians' resistance towards (Bhattacherjee and Hikmet, 2007, Lapointe and Rivard, 2005) or acceptance of health information technologies (Walter and Lopez, 2008), the clinicians' satisfaction with clinical information systems is under-researched in the IS field. Although several studies in medical informatics literature investigated satisfaction with clinical information system, they are mainly based on the general IS satisfaction research and suffer from same shortcomings. In addition, the adopted relevant IS theories in several of these studies are not utilized properly (e.g., the use of the technology acceptance model

(TAM) to explain satisfaction rather than acceptance) or are operationalized poorly. The necessity of further investigation of clinicians' satisfaction is intensified with respect to the findings of previous health information technology acceptance studies indicating that clinicians differ from other types of IS users due to their specialized training, autonomous practice and professional work arrangements (Chau and Hu, 2002, Hu et al., 2002, Walter and Lopez, 2008).

1.3 Research Questions

With regard to the importance of clinicians' satisfaction in successful CIS implementations and the need for understanding the psychological processes of satisfaction formation, this study aims to develop a new conceptual framework to answer the following research questions:

- What are the cognitive determinants of clinicians' satisfaction formation with CIS?
- What are the clinicians' needs and expectations regarding CIS?

The framework will be built upon the large body of research on user satisfaction in IS literature, a wealthy body of knowledge from consumer satisfaction research in marketing literature (especially the disconfirmation paradigm), and informative studies in medical informatics research.

1.4 Research Objectives

"A psychological comparison of some sort is a central component in the conceptualization of the satisfaction process" (Wirtz and Mattila, 2001, p. 181). Not surprisingly, such comparison is the fundamental tenet of the major theory of consumer satisfaction, the disconfirmation paradigm, in marketing literature. The aim of this study is to investigate determinants of clinicians' satisfaction formation from

the perspective of this paradigm. Arguing that clinicians' needs (desires) and expectations regarding CIS are two separate satisfaction comparison standards, their effects will be examined jointly in the disconfirmation paradigm. Due to the difficulty of converting higher-level desires to concrete product attributes (especially in the case of complex IS) for different IS users (Nevo and Chan, 2007), the effect of clinicians' desires will be explored in terms of higher-level needs. Among the various needs theories, McClelland's learned needs theory (McClelland, 1976) will be employed to specify clinicians' needs with the use of CIS. The extant IS literature on user satisfaction will also be integrated into the research model of the study. As such, various IS attributes including system quality, information quality and service quality from the Delone and McLean's (2003) IS success model will be utilized as the aspects of a system which clinicians may have expectations about. Furthermore, the impact of perceived CIS performance (at functionality level) will be examined as another determinant of clinicians' satisfaction. The variety of information systems and the conflicting human interests may demand for different assessment of a system's impact and effectiveness to capture different stakeholders' point of view on the system (Seddon et al., 1999, Zviran and Erlich, 2003). Hence, the proposed model explaining/predicting clinicians' satisfaction will be tested among two different clinical user groups (i.e., nurses and doctors) to observe plausible differences practically.

1.5 Thesis organization

This chapter explained the motivation behind the thesis, the gaps it seeks to cover, the specific research questions to be answered, and the purpose of the thesis. The rest of the thesis is organized as follows:

In chapter 2, IS and CIS user satisfaction researches are reviewed. Discussions on their findings, strengths and shortcomings, and where this study will stand in relation to this literature are provided.

Chapter 3 is devoted to the theoretical background of the thesis. The disconfirmation paradigm and two of its models (i.e., the expectations congruency and needs congruency models) as the main theoretical basis of the study are explained. Other theories and literature augmenting these two models including McClelland learned needs theory (McClelland, 1976) are also discussed.

Chapter 4 presents the research model and hypotheses of the study. The main constructs of the conceptual model and their interrelationships are discussed here.

Chapter 5 explains the procedure for empirical validation of the research model including the details of the method used, the operationalization of the constructs, the system investigated and the sample environment and respondents.

In chapter 6, the data analysis and results of the thesis are presented. Finally, Chapter 7 concludes the thesis with a discussion on the findings of the study and their implications for theory and practice, and provides possible future research directions.

CHAPTER 2

LITERATURE REVIEW

Various researchers adopted different approaches to probe user satisfaction with information systems. In this chapter, the existing definitions of IS user satisfaction will be first reviewed. Then, it will be explained what CIS refer to in this thesis. Next, IS user satisfaction literature, IS user satisfaction studies adopting the disconfirmation paradigm, and medical informatics researches on user satisfaction will be reviewed. The findings and shortcomings of these studies will also be discussed.

2.1 IS User Satisfaction Definition

Briggs et al. (2008) identified three categories of user satisfaction definition in IS literature including satisfaction as judgment, satisfaction as affect, and a mixed definition including both judgment and affect elements. An examples of definitions framing satisfaction as a judgment or evaluation is

- "the extent to which users believe the information system available to them meets their information requirements" (Ives et al., 1983, p. 785).

Some examples of definitions considering satisfaction as an affective state include

- "the weighted sum of a user's positive or negative reaction to a set of 39 factors" (Bailey and Pearson, 1983, p. 538),
- "the affective attitude towards a specific computer application by someone who interacts with the application directly " (Doll and Torkzadeh, 1988, p. 261),

- "an affective state representing an emotional reaction to the entire Web site experience" (McKinney et al., 2002, p. 298).

An example of a definition considering both affective and evaluative components for satisfaction is

- "the IS end-user's overall affective and cognitive evaluation of the pleasurable level of consumption related fulfillment experienced with the IS" (Au et al., 2008, p. 453).

Following the second category of IS user satisfaction definitions, this study conceptualizes clinician satisfaction with CIS as an affective state representing an emotional reaction to a CIS which a clinician directly interacts with. The reason lies in the fact that a user with a positive evaluation of an IS might still not feel satisfied with it (Briggs et al., 2012). Besides, the evaluation component will be captured in two determinants (i.e., needs and expectations congruencies) of satisfaction which will be discussed in a later chapter of this thesis.

2.2 CIS Definition

Health information technology (HIT) spans various applications to serve different purposes in a healthcare setting. Bhattacherjee et al. (2007) developed a HIT classification based on the primary purposes of different HIT applications. Similar grouping has been extensively validated and utilized in prior relevant research. This categorization includes clinical HIT, administrative HIT and strategic HIT. In the present study, CIS refers to clinical cluster of this categorization representing applications designed to improve patient care, such as computerized physician order entry (CPOE) system, electronic medical record, and pharmacy information system.

2.3 IS User Satisfaction in Relation to Other Major IS Constructs

Information systems existence depends on whether they are used or not. Not surprisingly, system usage and related concepts including acceptance of, satisfaction with, and resistance to systems shape the core of different streams of research in the field of information systems. In this section, a conceptual illustration of IS user satisfaction in relation to these major IS constructs (i.e., user acceptance, user resistance, and system usage) and a review of important studies explaining their relationships are provided.

IS User Satisfaction

Wixom and Todd's (2005) study provides a theoretical framework integrating two stream of IS research including user satisfaction and technology acceptance. This integration aims to increase the user satisfaction predictive ability of use or acceptance and provide practical design recommendation for technology acceptance. The study explains the relationship between user satisfaction and user acceptance (see link 1 in Figure 2-1) by distinguishing between object-based and behavioral beliefs/attitudes using the attitude literature. User satisfaction then is stated to be an object-based attitude (feeling towards an information system) affecting behavioral beliefs regarding the use of the system. The results of the survey testing the proposed model of this study with a data warehousing software provide empirical support for this theoretical integration.

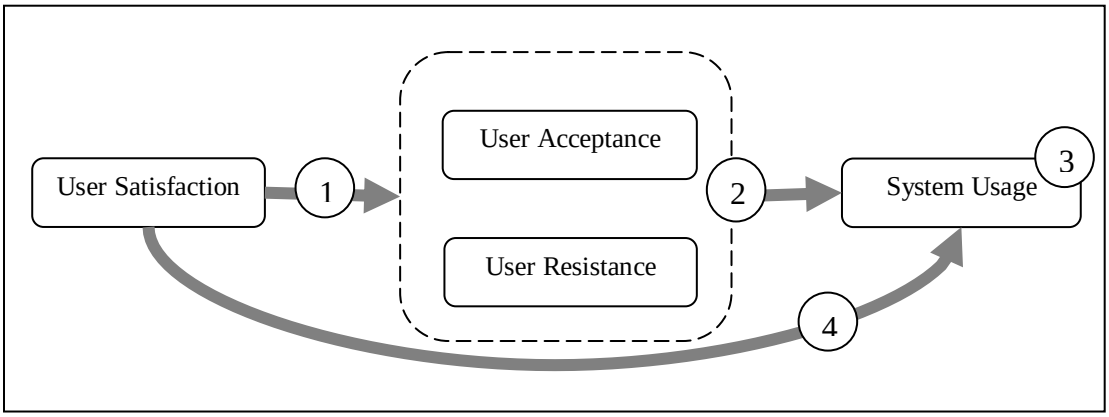


Figure 2-1: Conceptual Illustration of User Satisfaction in Relation to Other Major IS Constructs[1]

User Acceptance and Resistance

Kim and Kankanhalli's (2009) study of user resistance provides theoretical explanation for the users' decision making mechanism in resistance to a newly implemented information system and evaluating changes associated with it (e.g., threat or loss). They build their theoretical model based on technology acceptance literature (the theory of planned behavior (TPB)) and user resistance studies (the equity implementation model (EIM)) in conjunction with the status quo bias theory. The study explains the relevance of user acceptance and user resistance in term of the reaction that users decide to show to the system (Figure 2-1, part 2). The status quo bias theory is then utilized to provide explanation for people's tendency to stick with their current situation and the cost they consider for switching to a different situation. These explanations and the related costs include 1) rational decision making (transition and uncertainty costs), 2) cognitive misinterpretation (loss aversion), and 3) psychological commitment (sunk cost, social norms and efforts to feel in control). These costs and explanations are then mapped to the TPB and EIM with specific hypotheses in the context of prior IS implementation user resistance. The theoretical model is tested using a field survey of users of a new system in a major IT service

[1] The paths in this figure are not causal relationships. They depict a high level association. The exact causal hypotheses can be found in the related studies reviewed.

company with potential of resistance. The findings of the study indicate that switching costs affect user resistance directly and mediate the impacts of other factors on resistance including colleague opinion and self-efficacy for change. Perceived value and organizational support for change are also found to reduce user resistance.

System usage

Burton-Jones and Straub's (2006) study deals with the system usage construct in IS literature (Figure 2-12, part 3). Their investigation in different system usage related research areas (whether as a dependent or independent variable) including IS success, IS for decision making, IS acceptance and IS implementation shows a lack of theoretical conceptualization and systematic operationalization of this construct. Various system usage measurements and mixed results of its effects on other constructs are among the consequences of not conceptualizing it theoretically. Emphasizing that system usage can be conceptualized differently across various contexts, they provide a two staged approach for reconceptualizing and operationalizing system usage construct for any specific context. In the first stage (i.e., definition stage), the system usage and its characteristics needs to be defined and all the assumptions clarified. In the second stage (i.e., selection stage), the system usage is conceptualized in terms of structure and function. Three elements including user, system, and task shape the structure of the system usage. Choosing any of these elements (i.e., Structure) and measures for them (i.e., function) in a study is justified based on their relevance to the context, research model, and other constructs of that study. To examine the effectiveness of the approach, the association between system usage and short-run individual performance in the context of analysts' use of spreadsheets for financial analysis is tested. The results of the study in terms of the degree to which this association is explained using a very rich, rich and lean measure

of system usage measure (according to the proposed two-staged approach) supports the viability of this approach, and shows how an improper system usage measure selection can affect the empirical findings of studies.

Bhattacherjee's (2001) study differentiates between IS acceptance and continuance behaviors. The study then provides a theoretical model of IS continuance by incorporating user satisfaction and confirmation constructs with prior IS use research. The model considers satisfaction (Figure 2-1, path 4) and (ex post) expectations represented as (ex post) perceived usefulness as the salient motivation of IS continuance intentions. Confirmation and perceived usefulness are also posited to impact user satisfaction. The proposed model is tested in the context of online banking and empirically supported.

2.4 IS User Satisfaction Literature

In their "Behavioral Theory of the Firm", Cyert and March (1963) are the first to introduce the user satisfaction concept by proposing that the success of an information system in meeting the information needs of its users leads to either reinforcement or frustration of users' satisfaction (Bailey and Pearson, 1983, Ives et al., 1983).

After this study, a large body of IS research has been conducted to develop and validate instruments for evaluating user satisfaction, find the factors that support or constrain it, and measure IS success using this surrogate. In the following section, a sample of contributing studies in these areas will be reviewed.

The most influential works in the development of user satisfaction measurement instruments is possibly Bailey and Pearson's (1983) study (Conrath and Mignen, 1990, Zviran and Erlich, 2003). Using psychology literature, they defined satisfaction as a bi-dimensional attitude that is the sum of one's reactions (with intensities, and

positive/negative dimensions) to a set of factors. To identify the factors affecting computer user satisfaction, they reviewed 22 computer/user interface studies, asked three data processing professionals opinions, and interviewed 32 middle manager users. Their study resulted in a computer user satisfaction questionnaire of 39 factors evaluated by semantic deferential scales. 29 of the managers participated in the interview responded to this questionnaire. Despite this small size of the respondents, authors were able to show the reliability and validity of their instrument.

Ives et al. (1983) reexamined the reliability and validity of Bailey and Pearson's (1983) instrument with a sample of 200 production managers, and reported reasonable reliability and validity scores. In their factor analysis for evaluating the construct validity of the instrument, they found five dimensions among 22 scales at a cutoff value of 0.5. Bailey and Pearson (1983) reported eight factors as the result of their factor analysis, but their sample was small (29 responses for 39 scales). Three of the five factors revealed in Ives et al.'s (1983) factor analysis were related to the information system product, vendor support, and knowledge or involvement in the design of the information system. The other two dimensions were related to the information services function. The only scale pertaining to the vendor support dimension was later eliminated in the refined instrument. The authors then improved the instrument by omitting six scales with poor psychometric qualities. They had low or moderate importance ranking according to the Bailey and Pearson's (1983) respondents. To decrease the required answering time of the instrument, the number of items per scale was also reduced to two items per scale. The resultant instrument was then subjected to reliability and validity tests and showed adequate reliability and validity. Despite these improvements, the measurement was still long. The authors therefore tried to develop a "short form" instrument. They eliminated some other

factors (e.g., with undesirable psychometric qualities, or factor loading less than 0.5) and kept 13 scales with two items per scale. This short form instrument also found to be valid and reliable and less time consuming to answer. The authors suggested using the improved long form of the instrument for overall information system assessment, and evaluating various problematic aspect of the system using the individual scales. The short form was recommended for the situations where an overall measurement is needed and answering time is limited.

Later, Baroudi and Orlikowski (1988) further examined psychometric quality of the short form user information satisfaction measure developed by Ives et al. (1983). Their sample included 358 employees of organizations in various industries such as education, government and mainly financial services. In examining the reliability of the instrument, authors used reverse scores for the two items of some scales, because Ives et al. (1983) were concerned about the possibility of the inflation of reliability scores due to respondents' tendency to mark the same column for different items of a scale. The instrument showed satisfactory reliability. The factor analysis of the measurement tool also replicated the results of the original study indicating a three factor structure of the scales. The three factors include 1) "EDP staff and service" pertaining to users' evaluation of their relationship with EDT staff and the EDT staff's attitude and responsiveness, 2) "Information product" measuring users' perception of various attribute of the information system output such as reliability, relevancy, accuracy, precision, completeness, 3)" knowledge and involvement" related to the users' assessment of the provided system training, their understanding of the system, and their sense of participation.

Doll and Torkzadeh (1988) recognized the changes in information systems use environment in which more users are directly interacting with an information system

application rather than through operation staff or analysts/programmers. They stated that previous user satisfaction measurement tools such as Bailey and Pearson's (1983) instrument are more appropriate for traditional data processing environment than current end-user computing environment. Hence, they developed a 12-item instrument measuring end-user satisfaction with specific information system applications. The instrument was a combination of ease of use and information product items and covered five components of end-user satisfaction namely content, accuracy, format, ease of use, and timeliness.

Doll et al. (1994) also conducted a confirmatory factor analysis on this instrument to complete the research cycle of developing a standardized measurement tool. They identified four plausible models for the underlying structure of the factors and examined the model-data fits and existence of a higher-order factor. Their sample included 409 computer end users in 18 different organizations from various industries. Two of their four proposed models (one model with five first-order factors and one second-order factor, and the other one with five first-order factors correlating with each other) showed satisfactory model-data fit. However, the former had two advantages over the latter. First, it was in line with the relevant literature regarding the existence of a single user satisfaction construct. Second, the validity and reliability of second-order constructs can be assessed in this model. The result of confirmatory factor analysis on this model showed acceptable reliability and validity of the 12 items and the five user satisfaction components.

DeLone and McLean (1992) developed a taxonomy for IS success dimensions, and proposed a model for IS success according to this taxonomy. Based on the communication theory by Shannon and Weaver (1949), they stated that the IS success can be assessed at various levels including the technical level (the accuracy and

efficiency of the system), the semantic level (conveying the right meaning by the produced information), and the effectiveness or influence level (the effect of the information on the receiver). Along these levels, the authors distinguished six aspects of IS success including system quality, information quality, use, user satisfaction, individual impact, and organizational impact.

The system quality maps to the technical level, the information quality matches to the semantic level, and the rest fit in the influence level. Different IS researchers have chosen to focus their study on one or two of these aspects such as the desired characteristics of an information systems or the produced information, the quality of user interaction with the information system, and the impact of this interaction on individual and organizational performances.

In addition to this taxonomy, the authors proposed an IS success model that shows the interdependencies of these various aspects of the IS success. Moreover, the model emphasizes on the process nature of the success as well as the causal relationship and temporal order among the different dimensions. For instance, the interdependency of using the system and the resulting satisfaction is presented in the model.

Delone and McLean (2003) also provided an update of this model after a decade when the model was applied, validated, criticized and enhanced by various researchers. Main refinements to the model are inclusion of service quality and intention to use constructs, and substitution of individual and organizational impact constructs with net benefit construct. The service quality is added to model in response to the emergence of end user computing and the IS organizations role in providing both information and service to the end users. The intention to use as an

attitude construct is included to the model to be employed in relevant context when the use construct may not be appropriate or feasible to measure. The individual and organizational impacts are replaced by net benefit. The reason is that impacts may be both negative and positive, but net benefit emphasizes the right positive meaning. The nature of the study that adopts the model will identify what should be included as net benefit from whose perspective and at which level of analysis.

The Delone and McLean's (2003) IS success model suggested that system quality, information quality, service quality, usage, and net benefits are determinants of user satisfaction. As the study also provided guidance on how to measure these concepts, the model has been applied extensively to evaluate information systems from different aspects in various settings (Petter et al., 2008).

This body of research has provided important understanding of various aspects of information systems that can affect user satisfaction. The efforts in developing user satisfaction instruments have also been very influential in offering practitioners with measurement tools to assess IS success. However, this literature has been criticized for its overemphasis on technical aspect of information systems and lack of a theoretical underpinning (Au et al., 2008, Khalifa and Liu, 2002). It offers limited understanding of the psychological processes that convert the system performance on various system characteristics into user reaction to the system (Khalifa and Liu, 2002, Spreng et al., 1996, Wirtz and Mattila, 2001).

Some IS researchers thus have started to apply relevant theories from marketing literature (i.e., the disconfirmation Paradigm) to explain the IS user satisfaction formation. The disconfirmation paradigm is the dominant framework for explaining consumer satisfaction in marketing literature (Fournier and Mick, 1999, Wirtz and

Mattila, 2001, Yi, 1990). A meta-analysis of the empirical findings reported in consumer satisfaction research by Szymanski and Henard (2001) also found a strong association between disconfirmation and satisfaction. In the rest of this chapter, the IS studies adopting this paradigm will be first reviewed, and then the medical informatics literature on clinicians' satisfaction will be discussed.

2.5 IS User Satisfaction Research (Adopting the Disconfirmation Paradigm)

The following section is a review on IS studies that employed different models of the disconfirmation paradigm such as the expectations disconfirmation model from consumer satisfaction literature to explain IS user satisfaction in different contexts.

In their effort to develop an instrument for measuring Web-customer satisfaction, McKinney et al. (2002) incorporated the expectation disconfirmation paradigm from consumer satisfaction literature and user satisfaction antecedents from the Delone and McLean's (1992) IS success model. Based on these two models, they identified two sources for Web-customer satisfaction namely Web-information quality (IQ) satisfaction and Web-system quality (SQ) satisfaction. Web-IQ satisfaction and Web-SQ satisfaction are then argued to be affected by the perceived IQ and SQ performances respectively, as well as IQ and SQ expectations disconfirmations. Next, in a two-phase study they developed and tested a measurement for all these constructs of their Expectation-Disconfirmation Effects on Web-Customer Satisfaction (EDEWS) model and reported relatively high degree of validity and reliability. Although this study provides a valuable instrument for measuring Web-customer satisfaction, the model should be empirically tested in a variety of websites and on different products or services to provide empirical support for the proposed constructs and their effects.

Au et al. (2008) developed a model of end user information systems satisfaction formation (EUIS) based on three motivation theories including expectation theory, needs theory, and equity theory. In addition to IS performance and IS performance expectations that have been examined in previous studies as influential factors on EUIS, their model identified three new user satisfaction antecedents generally called as equitable needs fulfillment. The equitable needs fulfillment construct was defined as the ratio of the benefit an end user gains by using the IS and the input s/he incurs to achieve those benefits. Utilizing Alderfer's (1969) ERG needs theory, the authors determined three categories of users' needs that an IS can fulfill. These categories are work performance fulfillment, relatedness fulfillment, and self-development fulfillment and comprise the benefits of using the information system. Based on equity theory, they further argued that for an end user to be satisfied with an information system, the benefit s/he receives from using the information systems should worth the input they incur.

The model was tested using 922 survey responses from the hotel and airline sectors. Their results indicated that IS performance was the most significant influential factor on end user satisfaction. The next two factors showing significant direct effect on end user satisfaction were equitable work performance fulfillment and equitable relatedness fulfillment. Equitable self-development fulfillment and IS performance expectations did not show a significant impact on end user satisfaction.

The model of this study recognizes a wide range of users' benefits and inputs using an information system. In addition, the model takes into consideration the individual difference in having various levels of needs and incurring different levels of costs. It also makes the respondents to compare between what they obtain and what they spend rather than simple identification of these levels. However, while the

existing research on the expectations disconfirmation model in marketing literature provides more empirical support (Yi, 1990) for the impact of expectations disconfirmation on satisfaction (Oliver, 1980, Oliver and Bearden, 1983) than the influence of expectations (Bearden and Teel, 1983, Churchill and Surprenant, 1982), the model of this study only considers the effects of IS performance expectations. It is not surprising that the results of this study found no direct effect of expectations on end user satisfaction. Besides, the study only examines the users' expectations about the IS performance. However, users may also have expectations about their incurred inputs and received benefits of using the IS, and these expectations may affect their satisfaction with the IS as well. Moreover, most of the inputs considered in this study (e.g., amount of time required to learn to use the system, level of work pressure due to need for updating IT skills, level of intellectual skills required to learn to use the system) are related to the perceived ease of learning construct. Some of the studied benefits (especially the self-development fulfillment) also resemble perceived ease of use construct. Perceived ease of use and perceived ease of learning represent perceived IS performance. This suggest the possibility of a relationship between IS performance and the perceived inputs and benefits of the IS in the research model of this study. In other words, the IS performance may affect the perceived inputs and benefits of the system. The consideration of such a relationship is missing in this study which may affect its findings.

Szajna and Scamell (1993) study investigated the relationship between the realism of users' expectation from an information system and their perception (i.e., satisfaction) and performance with that information system (i.e., decision quality). The theoretical basis of the study was the cognitive dissonance theory which posits that when an individual holds two cognitive elements that are inconsistent with each

other, the individual will experience a psychological state of dissonance and will seek a consonance state by changing either or both of the cognitive elements. Adopting this theory the authors posited that when individuals experience positive disconfirmation (expectations exceeding performance of an information system), they will assimilate their perceptions of the information system performance to their expectations, and they will have higher perceptions than those with realistic expectations. In the case of negative disconfirmation (expectations falling short of performance), same assimilation of perceptions towards low expectations will occur. In addition to disconfirmation effect, the authors also investigated the effect of repeated disconfirmation over time. They predicted that over time expectations will be more realistic. As a result, the perceptions will decrease in the high expectation group, and it will increase in the low expectations group.

In this study, a number of pre-implementation factors believed to affect users' expectations were collected from prior research. These factors such as "user involvement, training, quality of IS staff, and organizational sophistications" were used to manipulate the realism of users' expectation to one of the three levels of high, moderate or low. 159 business undergraduate students participated in three decision making experiments. The second experiment was conducted one week after the first one. There was three days interval between the second and third experiments.

The results of the study showed that in the first two decision periods the satisfaction level was higher in the high expectations group than the moderate expectations group. The satisfaction level was also lower in each of the three periods in the low expectations group than the moderate expectation group. The satisfaction did not change significantly over time in the low and high expectations group but it remained significantly unchanged in the moderate expectations group. However,

expectations decreased between decision periods one and two in the high expectations group. A significant increase in expectations of the low expectations group was also observed between all decision periods.

The study therefore provides interesting understanding of the effects of the realism of users' expectations on their perceptions, and the changes of users' perceptions and expectations over time. However, the effect of expectations on satisfaction in this study is examined against a base line which is the satisfaction of users with moderate expectations. The results hence do not provide any information on the intensity and direction of the satisfaction (i.e., satisfied or dissatisfied, high or low dis/satisfaction).

Khalifa and Liu (2002) looked at the role of both expectations and desires in user satisfaction with Internet-based services. They also identified the specific desires and expectations that are influential on the end user satisfaction with the Internet-based services in the context of an online knowledge community. Fourteen specific expectations and desires were determined based on literature review and belief elicitation process from which five desires (i.e., information worthiness, membership perks, reliability of technical systems, user-friendliness, and membership services) and five expectations (i.e., information worthiness, user-friendliness, security, page loading speed, and membership perks) found to be significantly related to satisfaction formation. Two surveys were administrated. The First survey collected data about the pre-adoption desires and expectation of 356 new members of an online knowledge community for electronic business practitioners. The second survey evaluated the rest of the constructs after one week. 131 responses were received for the second survey from the same participants as the first survey. The findings of the study demonstrated that expectations, desires and perceived performance have significant impact on user

satisfaction.

While the authors considered overemphasis of the previous user satisfaction literature on specific system characteristics as a shortcoming, they operationalized desires and expectations based on these system characteristics. Nevertheless, the study provides valuable insights into the role of both desires and expectations in IS user satisfaction formation.

In summary, the disconfirmation paradigm as a promising framework for explaining IS user satisfaction has been employed in some IS studies. Most of these studies examined the expectations disconfirmation model of this paradigm. However, in marketing literature other comparison standards than expectations such as desires are also suggested to affect satisfaction. In the theoretical background chapter, this paradigm and its models will be discussed, and the approach of this study in utilizing this paradigm to explain clinicians' satisfaction will be elaborated.

2.6 Medical Informatics Literature

In this section a critical review of user satisfaction studies in medical informatics literature is provided. Table 2-1 shows a summary of these studies. These studies were identified through extensive search in the related data bases including Pubmed, Science Direct, ABI/ Inform, and JSTOR with specific keywords such as user/ clinical user/ medical user/ doctor / physician / nurse satisfaction or perception with HIT, CIS.

Tan et al.'s (2009) study examined physicians, pharmacists and pharmacy technicians' satisfaction with an Electronic Prescribing System (EPS) in the nine National Health Group Polyclinics in Singapore. The survey development was based on literature review. The survey measured participants' satisfaction with the functionality of the EPS, processing and system speed, user training and support, and

reduction of prescription errors and interventions. Respondents' computer literacy, experience in healthcare, experience with computers and the electronic prescribing system were also measured. 118 doctors and 61 pharmacy staff answered the survey.

Their results showed high degree of user satisfaction among both physicians and pharmacy staff. More than 70% of both groups indicated a high degree of agreement that they would recommend the system to other physicians/pharmacists and did not prefer to go back to the paper-based system. A high percentage of both groups also agreed that the electronic prescribing systems had a positive impact on patient care (reduced prescription errors and interventions). While physicians were generally satisfied with the functionality and speed of the system as well as the spent time on working with the system, pharmacy staffs' responses showed some degree of the systems' interference in their work flow. In addition, no significant association between prior computer knowledge and overall satisfaction was found. Satisfaction was also more related to systems' impact on productivity than patient care.

This study offers insights into the various user groups' (e.g., physicians and pharmacy staff) perceptions of an electronic prescribing system. However, the study does not explain how or why their proposed factors are possibly influential on users' satisfaction. There are also some concerns about the operationalization of some of their constructs. For instance, the wording of the items measuring computer literacy (e.g., poor) may have caused social desirability error and may explain the low percentage of poor computer literacy self-reports. Use of the words such as sophisticated user/ unsophisticated user could be a better choice.

Palm, et al.'s (2006) study adopted two well-known IS theories namely the technology acceptance model (TAM) (Davis, 1989) and the Delone and McLean's

(2003) IS success model to investigate determinants of overall CIS user satisfaction. The study examined five dimensions including user characteristics, user satisfaction, CIS use, CIS quality, perceived CIS usefulness, and service quality. The questionnaire was answered by 93 physicians, 174 nurses and 57 medical secretaries of the George Pompidou University hospital in Paris.

The findings of the study indicated that medical secretaries were more satisfied than physicians and nurses. The second higher satisfaction was observed within nurse groups. The results also showed significant association of overall satisfaction with CIS quality, CIS usefulness, and service quality.

In addition, some subjective norms (i.e., incentives from hierarchy, perceived use by other colleagues) significantly correlated with overall satisfaction in univariate correlation analysis, but they were not significantly associated with overall satisfaction in multivariate regression analysis.

Similar to Tan et al.'s (2009) research, this study provides useful information about the satisfaction of various user groups of CIS in hospitals. Satisfaction is also measured against daily routine functionalities of different CIS components used by each user group. Despite the utilization of the two IS theories as the theoretical foundation of the study, the basis of selecting the five dimensions among the other dimensions discussed in these theories is not clear. Moreover, in the operationalization of user characteristics construct, items related to social norms are included which may not pertain to user characteristics. Besides, the TAM tries to explain technology acceptance rather than satisfaction. Although the two constructs are related, they are not the same. While acceptance refers to a behavior (Bhattacherjee and Hikmet, 2007), satisfaction is an affective state. Besides, this

affective state can only shape after accepting and using the information system (Bhattacherjee, 2001). The two concepts hence address two different phenomena in the context of IS use.

Likourezos et al. (2004) surveyed physicians and nurses in an Emergency Department of a large urban teaching hospital about their perceptions regarding EMR use and its impact on their work and patient care. The survey also measured clinicians' computer background and experience. The study was conducted three months after the implementation of the EMR system. Both physicians and nurses first received training from some other physicians and nurses (called super users by the authors) and then from information technology training team of the hospital.

Although satisfaction is not directly measured in this study, ease of use, impact on work, and impact of patient care are implicitly considered as determinant of satisfaction with the EMR. The results of the study showed that physicians and nurses were generally satisfied with the EMR ease of use and impact on their work. While physicians were mostly (78.3%) disagree with the time efficiency of EMR, nurses reported that EMR is helpful for them to finish their tasks faster. Both user groups also reported confusion in following the sequence of screens and had concerns about the confidentiality of patient information. Both groups' responses also indicated that they perceive minimal impact of EMR on patient care. Authors stated that this result may be due to short period (less than one year) of experiencing the EMR. All the participants used a computer other than EMR at home or work and more than 80% of them used email and internet. Therefore, the authors could not examine the relationship between computer background and satisfaction with the EMR.

Table 2-1: Summary of Some Medical Informatics Studies

Study	*Study Basis*	*Studied Variables*	*Participants*	*Studied HIT*
(Tan et al., 2009)	Literature review	1. Satisfaction with the system's functionality 2. Impact on productivity 3. Impact on patient care 4. Computer literacy 5. User training and support	Physicians and pharmacy staff	An Electronic Prescribing System
(Palm et al., 2006)	The DeLone and McLean IS success and the TAM	1. User characteristics 2. User satisfaction 3. Perceived CIS use 4. Perceived CIS quality 5. Perceived CIS usefulness 6. Perceived service quality	Physicians, nurses, and medical secretaries	Four major components of a HIT: patient portal , CPOE, multimedia EPR, appointment and patient scheduling
(Likourezos et al., 2004)	Literature review	1. Perceptions of EMR use, 2. Impact on work 3. Impact on patient care 4. Clinician computer background and experience	Physicians and nurses	An Emergency Department EMR
(Zviran, 1992)	User information satisfaction questionnaire	1. IS staff and services 2. Information product 3. Knowledge and involvement	Ancillary, administrative, and physicians	A HIT serving various functional areas such as administration, pharmacy, laboratory
(Mazzoleni et al., 1996)	The TAM	1. Perceived ease of use 2. Perceived usefulness 3. Age 4. Familiarity with computers 5. Participation in the analysis phase of the system	Physicians and nurses	A HIT with different module for entry and retrieval of clinical data, management of laboratory data, etc.
(Lee et al., 1996)	Not stated	1. Impact productivity, 2. Impact on patient care, 3. Ease of use, speed, reliability, 4. Information quality, 5. Ability to find help, 6. Adequate training and attending training sessions 7. Experience with computers, 8. Frequency of feature use, 9. Perceived feature usefulness 10. Most & least liked features	Physicians and nurses	A physician order entry

Zviran (1992) conducted a user satisfaction study to identify both problematic and satisfactory aspect of a HIT from users' perspective in a hospital setting. The user information satisfaction (UIS) (Baroudi and Orlikowski, 1988) was used to measure these aspects of the system. The system, called the composite health care system (CHCS), served various functional areas in the sample hospital such as administration, appointment, pharmacy, laboratory, etc. The survey administration resulted in 101 responses (56% response rate) from three categories of users (i.e., ancillary, administrative, and physicians). Overall user satisfaction was found to be moderately positive (.87 in a -3 to +3 scale). Administrative group were significantly more satisfied than the other two groups (1.15), and physicians were the least satisfied users (.62). Among the 12 questions of the UIS, the two questions regarding processing of requests for changes in existing system and time required for new system development received negative scores. The authors stated that this low satisfaction might be due dissatisfaction with the contractor (the builder of the system) that is in charge of requests for system changes. The 12 question also correspond to three factors including IS staff and services, information product, and knowledge and involvement. IS staff and service was the factor with highest satisfaction, and knowledge and involvement was the least satisfactory factor.

This study is an example of how a user satisfaction investigation can be useful for collecting users' feedback of a CIS. The feedback can be helpful in determining the areas which users have problem or are satisfied with. Then appropriate improvement can be done in order to keep users satisfied and motivated to use the system efficiently and effectively.

In another study by Mazzoleni et al. (1996), physicians and nurse satisfaction with a hospital information system was measured using their perception of the system

usefulness and ease of use. Both physicians and nurses reported positive perceptions regarding system usefulness and ease of use. They did not find a strong relationship between age and these perceptions. In addition, familiarity with computers was not found to significantly impact ease of use perception. Authors however stated that users' knowledge of the underlying philosophy of the system can be influential on the perceived usefulness of the system. Thus, more collaboration, training, and ongoing support from technical staff suggested being worthy. In this study user satisfaction and acceptance has been employed interchangeably, but as discussed earlier the two concepts are not the same, and should be utilized properly.

Sicotte et al. (2010) measured users' perceptions of a picture archiving and communication system (PACS). The system was the first inter-hospital imaging network in Quebec, Canada, jointly deployed in eight remote sites. Three users group working with the system (radiologist, radiology technologist, and medical specialist) were asked to fill out a questionnaire on their perception of the intra-hospital and inter-hospital use of the system. Six dimension of the Delone and McLean's (2003) IS success model were assessed as various sets of the system benefits. Confirmation of expectations was also measured. 127 valid responses (66% response rate) were analyzed. The regression analysis on overall satisfaction showed that system quality, data quality, and confirmation of expectations were significantly associated with user satisfaction. In addition, intended future use was significantly related to overall satisfaction and perceived benefits.

While this study is one of the few studies examining the impact of expectations on clinical user satisfaction, no definition of expectations is provided. Inclusion of this construct in the research model is also not justified. Moreover, the scales for measuring confirmation of expectations ask respondents about their initial

expectations and hopes about the system use and benefits. As the survey was administrated three years after the implementation of the system, respondents might not be able to report their correct initial expectations of the system (i.e., recall bias).

Lee et al.'s (1996) study dealt with user satisfaction and usage of physician order entries (POE). This study investigated the effects of a range of factors on user satisfaction as shown in Table 1. They also measured self-reported usage patterns of clinicians. They carried out a survey at Brigham and Women's Hospital in Boston with 93 responses from nurses (47% response rate) and 112 responses from physicians (56% response rate).

Except for attending training sessions, computer background, and self-reported frequency of features use, all other factors were found to significantly affect overall satisfaction. The results of the study showed that overall user satisfaction was most strongly associated with factors pertaining to efficiency such as impact on productivity and ease of use. Among the responses for the open-ended question of the most liked thing about the CPOE, physicians indicated off-floor access more frequently and nurses reported clarity and ease of reading orders. The other open-ended question asked about the one thing physicians and nurses would like to change about the system. Physicians' most frequent answers were system's response time and too many screens for completing ordering task. Nurses indicated they should enter orders for physicians and there are too many steps for accomplishing ordering task.

Although no theoretical background is provided in this study, the examined factors can be classified according to relevant IS theories. For example, reliability matches system quality dimension in the IS success model, giving required information is related to information quality dimension, and adequacy of training

corresponds to service quality dimension. Usefulness and impact on productivity are also related to usefulness construct in the TAM.

Sittig et al. (1999) study evaluated user satisfaction with an EMR at Brigham and Woman's Physician Hospital Organization in Boston, MA. The short form of the Questionnaire for User Interaction Satisfaction (QUIS), a general evaluative measurement for interactive computer systems with proper construct validity and reliability , was used to measure 1) overall user reactions, 2) screen design and layout, 3) terminology and system messages, 4) learning, and 5) system capabilities of the Brigham & Women's Integrated Computing system (BICS). 50 out of 75 eligible primary care physicians rated the BICS on three of its applications namely clinical result review, ambulatory medical record, and list management.

"Screen design and layout" and "system capabilities" received the highest and lowest satisfaction score respectively. Authors attributed the high score of screen design and layout to the close interaction of system developers with skilled clinicians during screen design as well as continuous improvement of the layout based on users' feedback. The low satisfaction with the system capabilities was also attributed to the network problems at the time of survey. In addition, the system was serving almost two times simultaneous users than it was originally designed to handle. Furthermore, the items measuring physicians' ability in using the systems to perform their tasks showed the best correlation with overall satisfaction.

The results of this study provides empirical support for the importance of providing optimal workflow for clinicians and using their common terminology in designing clinical information systems (CIS) to obtain higher clinician satisfaction with CIS. The results also suggest user involvement in the development and

improvement of the system as a key means of achieving CIS alignment with clinicians' task needs.

In addition to the studies that investigated clinician satisfaction as their main variable of interest, several other studies examined clinician satisfaction in order to measure CIS success. van der Meijden et al. (2003) reviewed 33 papers from 1991 to 2001 evaluating inpatient care CIS success. They identified the attributes used in these studies to evaluate CIS success. They then matched the attributes to the six dimension of the Delone and McLean's (1992) IS success model. User satisfaction as one of these dimensions was measured in almost half of the studies. User satisfaction attributes included overall user satisfaction, user attitudes towards the CIS, user friendliness, expectations and competence. User satisfaction in these studies were associated to several factors including impact on patient care, improvement of clinical communications, improvement of medical record keeping, improvement of decision making, educational benefit, improvement of work efficiency and effectiveness, remote access, legibility of orders, response time, steps or screens to complete. They also determined a number of attributes that did not fit in any of the six IS success dimensions. They categorized these attributes to 1) system development (i.e., user involvement, redesigned work practice, reconstruction of work format, and technical limitations), 2) implementation attributes (i.e., communication, training, priorities chosen, technical support, and user involvement), 3) organizational aspect attributes (control and decision making, management support, professional value, collaboration/communication, support and maintenance, champions, and rewards). Some of these attributes such as training and user involvement found to be influential on user satisfaction (Mahmood et al., 2000).

The studies on CIS satisfaction in medical informatics literature although

provide useful understanding of clinicians' satisfaction with a variety of CIS functionalities and satisfaction differences among various user groups, lack a strong theoretical basis. In few cases of utilizing a theoretical framework (mainly the IS success model (Delone and McLean, 2003) or the TAM (Davis, 1989)), the theories are not utilized properly or are operationalized poorly. Similar to researches in IS literature on this topic, these studies also emphasize mainly on technical aspect of CIS. However, there are some efforts to include other factors such as impact on work productivity and efficiency, impact on patient care, and computer experience. Although no explanation is provided on why these factors are selected and how they affect satisfaction (except for reliance on literature review).

THEORETICAL BACKGROUND

This chapter discusses the theoretical background of the study. As such, the disconfirmation paradigm and its various models are reviewed. In addition, the approach for utilizing this paradigm and augmenting it with prior IS research and other theories are explained within the healthcare context. Figure 3-1 is an illustration of this theoretical framework. The disconfirmation paradigm serves as the core of the framework. The expectations and needs congruency models are the two models of this paradigm, and perceived performance is the basis of the comparisons in the models. Each of the needs and expectations dimensions associated with the selected models of disconfirmation paradigm is also specified.

3.1 Disconfirmation Paradigm

The disconfirmation paradigm is the dominant framework for explaining consumer satisfaction in marketing literature (Fournier and Mick, 1999, Wirtz and Mattila, 2001, Yi, 1990). This paradigm considers satisfaction as the result of an evaluative judgment between the perceived performance of a product and a pre-consumption comparison standard. Three different states can occur after this comparison process,

1. Positive disconfirmation: when the perceived performance is above the comparison standards,
2. Confirmation: when the perceived performance meets the comparison standard,

3. Negative disconfirmation: when the perceived performance is below the comparison standard.

Satisfaction is more likely when positive disconfirmation or confirmation occurs. Dissatisfaction is more expected in negative disconfirmation (Fournier and Mick, 1999, Yi, 1990).

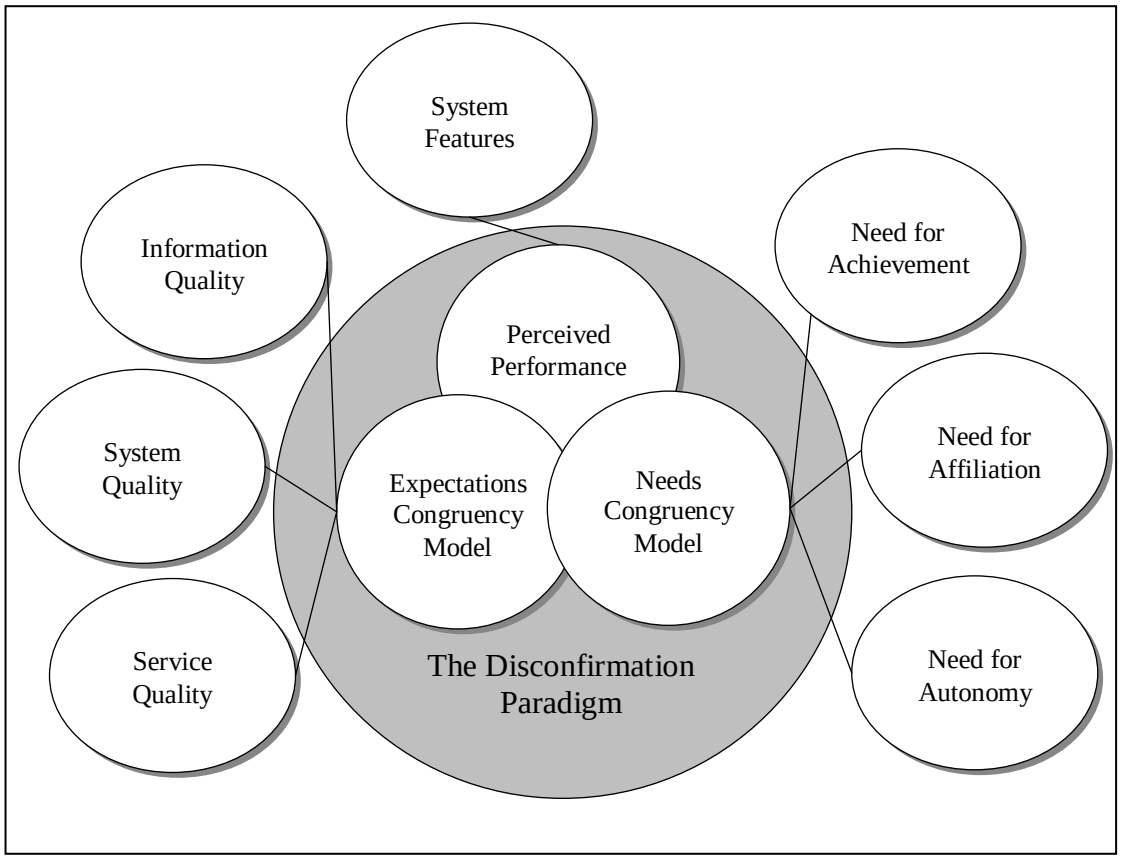


Figure 3-1: Theoretical Framework

3.2 Expectations and Expectation Congruency (Disconfirmation) Model

Different studies examined the effect of various comparison standards such as predictive expectations (Oliver, 1980, Tse and Wilton, 1988), desires and needs (Spreng et al., 1996, Westbrook and Reilly, 1983), and experience-based norms (Cadotte et al., 1987, Woodruff et al., 1983). However, the most common pre-experience comparison standard in the disconfirmation paradigm is expectations

(Cadotte et al., 1987, Fournier and Mick, 1999). Based on the expectations congruency (disconfirmation) model[2], satisfaction (or dissatisfaction) is the result of comparing the perceived performance of a product to the expectations about that product's performance. When the expectations exceed the perceived performance satisfaction arises, while the expectations falling behind the perceived performance results in dissatisfaction (Spreng et al., 1996, Yi, 1990).

There is substantial empirical support for the influence of expectations congruency on consumer satisfaction in marketing literature (Spreng et al., 1996). Yi (1990) provides a thorough review of these studies. Some instances are Oliver's (1980) study of flu shots that found positive association of expectations congruency with consumer satisfaction, and Bearden and Teel's (1983) investigation of consumer satisfaction with auto repair service that also supported this association. A number of IS studies also examined the expectations congruency model and/or the impact of expectations on end user satisfaction. A review on these researches has been provided in the previous chapter. On this basis, the expectations congruency model shapes one part of the theoretical framework of this study in explaining end user satisfaction (see Figure 3-1). The following is a discussion on various definitions of expectations.

3.2.1 Definition of Expectations

Despite widely inclusion of expectations in consumer satisfaction research, there is no consensus on the conceptual definition of this construct (Spreng et al., 1996). Spreng et al. (1996) identified two different conceptualizations for expectations. The first view (i.e., predictive expectations) defines expectations as "primarily perceptions of

[2] In the rest of this thesis, when a specific comparison standard is used in the disconfirmation paradigm, it will be referred to as the standard congruency (disconfirmation) model. This is a common practice in the relevant literature.

the likelihood (or probability of occurrence) of some event" (p. 16). The second view (i.e., evaluative expectations) adds another component to this likelihood estimation that is "an evaluation about the goodness or badness of the event" (p. 16). This judgment component can be misleading, and bias the effect of expectations on satisfaction. Following the predictive conceptualization, they defined expectations as "beliefs about a product's attributes or performance at some time in the future" (p.16).

Similarly, in IS literature, Szajna and Scamell (1993) in their review of expectations definitions in social psychology and organizational behavior recognized two components for expectations: "(1) a future time perspective and (2) a degree of uncertainty" (p. 494). They then defined user expectations of an information system as "a set of beliefs held by the targeted users of an information system associated with the eventual performance of the IS and with their performance using the system" (p. 494). McKinney et al. (2002) in their study of an instrument development for measuring Web-customer satisfaction also defined consumer expectations as "their pretrial beliefs about a product (a Web site in their study)" (p. 299) which is in line with both Szajna and Scamell's (1993) and Spreng et al.'s (1996) definitions. Likewise, this study defines expectations as an information system end user's set of pretrial beliefs about the eventual performance and attributes of the information system. To indentify these attribute, the study relies on prior IS user satisfaction literate, specifically the Delone and McLean's (2003) IS success model. This model provides three categories of IS attributes including information quality, system quality, and service quality. They will serve as the aspects of a system which clinicians may have expectations about.

3.3 Needs and Needs Congruency (Disconfirmation) Model

Although the expectations congruency model is widely employed in consumer behavior research and in some IS end user satisfaction studies, the model has its shortcomings. First, it fails to explain dissatisfaction when low expectations are confirmed (Spreng et al., 1996). Second, the disconfirmation effect can only account for the aspects of the product which consumers hold prior expectations, while they may also be dissatisfied with the unexpected aspects after consumption (Wirtz and Mattila, 2001). To address these shortcomings, one suggestion is to use perceived actual performance as an additional antecedents of satisfaction (Tse and Wilton, 1988), another approach is to utilize a different comparison standard namely one's values (or needs and wants) (Westbrook and Reilly, 1983).

In support of the effect of perceived actual performance on satisfaction, Tse and Wilton (1988) argued that when the perceived actual performance is low (although expected), the low performance may negatively affect satisfaction and override the effect of expectation confirmation. Their results showed perceived actual performance as the dominant determinant of satisfaction (Khalifa and Liu, 2002).

Based on Locke's (1967) work on job satisfaction, Westbrook and Reilly (1983) argued that the value-percept disparity model can be a more parsimonious and possibly more appropriate conceptual alternative for expectations congruency model. In value-percept disparity model, satisfaction is "an emotional response triggered by a cognitive-evaluative process in which the perceptions of (or belief about) an object, action, or condition are compared to one's values (or needs, wants, desires)" (Westbrook and Reilly, 1983, p. 258). The smaller the discrepancy between the perceptions and the values, the more favorable is the evaluation, and the greater the

positive affect related to goal attainment (i.e., satisfaction). Conversely, the greater the discrepancy between the perceptions and the values, the less favorable is the evaluation, and the less positive the affect related to goal frustration (i.e., dissatisfaction). Westbrook and Reilly (1983) also stated the values rather than expectations found to determine satisfaction, when they have been experimentally separated (Locke, 1967). On these grounds, the needs congruency model and perceived performance are included in the theoretical framework of this study. A discussion on needs definition adopted in the present study is provided below.

3.3.1 Definition of Needs

There is also no overall accepted definition for desires construct in marketing literature. Spreng et al. (1996) attributed this lack of consensus on the desires concept to the various possible levels of abstraction for conceptualizing desires. In a means-end framework they explain that desires ”can be defined abstractly in terms of the most basic and fundamental needs, life goals, or desired end-states or more concretely in terms of the means that a person believes will lead to the attainment of the desired end-states” (p. 16). They preferred to operationalize desires as “the levels of attribute and benefits that a consumer believes will lead to or are associated with higher-level values” (p. 17). However, in the context of information system end user satisfaction, it will be more useful to explore the influence of higher-level desires on end user satisfaction, because there is already extensive research on various attributes of an information system that can affect end user satisfaction. Besides, prior IS studies (Nevo and Chan, 2007) show that the conversion of higher-level desires to concrete product attributes (especially in the case of complex IS such as CIS) is not easy and straightforward for different IS stakeholders. To identify these higher-level needs, the needs theories in psychology literature were reviewed. Before proceeding to the needs

theories, it is worth clarifying the distinction between expectations and desires.

3.3.2 Expectations and Needs Distinction

Expectations and needs (desires) are conceptually different. The simple distinction among them declared in the information systems and marketing research is that "expectations state what the individual thinks *will* happen, while desires represent what the individual *would like* to happen" (Nevo and Chan, 2007, p. 300). Spreng et al. (1996) further elaborated that "expectations are belief about the likelihood that a product is associated with certain attribute, benefits, or outcomes, whereas desires are evaluations of the extent to which those attributes, benefits, or outcomes lead to the attainment of a person's value. Expectations are future-oriented and relatively malleable, whereas desires are present-oriented and relatively stable" (p. 17). Chin and Lee (2000) provide an example on the distinction of the two concepts and their effects on IS end user satisfaction: "an end-user may have low performance expectations form an IS developed in house (because in-house development team is known to be of a poor caliber), but he or she may actually desire a lot more from such an IS. A system that surpasses expectations, but not desired needs, may still lead to feelings of dissatisfaction. Conversely, an end-users' desire may be quite low (i.e., he or she really doesn't want the system). Yet, if the developed system failed to meet one's original expectations (e.g., based what the project team claims the system will do), the end-user might still feel some dissatisfaction with the in-house groups' inability to meet their stated objectives. In other words, independent of one's desires, we can still feel disappointment when expected performance is not met" (p. 554).

While most researchers agree that needs impact expectations, others went beyond this association. For instance, Oliver (1997) stated that needs and desires can

be incorporated into predictive standards (Wirtz and Mattila, 2001). Such an idea is evident in the "desired expectations" construct within the service quality literature (Zeithaml et al., 1993) and some consumer satisfaction research (Swan and Trawick, 1980). As Wirtz and Mattila (2001) highlighted this conceptualization of expectations would be quite similar to the needs (desires), but the latter might be less ambiguous. Similarly, Spreng et al. (1996) argued that "the only way to gain a clear understanding of the impact of expectations on satisfaction is to avoid confounding predictive expectations (what a person believes is likely to happen in the future) with judgments that implicitly require the use of several possible standards of comparison (e.g., desires, industry norms, equity, best brand)" (p.16). The theoretical framework of this study therefore recognizes expectations and desires (needs) as two distinct comparison standards in the disconfirmation paradigm.

3.3.3 Needs Theories

Major needs theories include Maslow's need hierarchy theory (Maslow, 1943, Maslow, 1954, Maslow, 1970), Alderfer's ERG theory (Alderfer, 1969, Alderfer, 1972), Herzberg's two-factor theory (Herzberg et al., 1959), Murray's manifest needs theory (Murray, 1938), and McClelland's learned needs theory (McClelland, 1976, McClelland et al., 1953). In management and organizational behavior fields they are also referred as theories of motivation. The following is a discussion and evaluation of these theories.

3.3.3.1 Maslow's Need Hierarchy Theory

Maslow (Maslow, 1943, Maslow, 1954, Maslow, 1970) proposed a theory of need hierarchy identifying five categories of needs including

1. *Physiological needs* consist of basic physiological requirements such as food,

water, air, sleep, constant body temperature, etc.

2. *Safety needs* are related to people's desire for safety, security, and protection from danger.
3. *Belongingness needs* pertain to social interaction needs such as friendship, acceptance, love, and affection.
4. *Esteem needs* include the need for self-respect and confidence, positive status and recognition, and appreciation by others.
5. *Self-actualization* needs are the individuals' desires for self-fulfillment, achieving their full and unique potential and being all they can be (George and Jones, 2005, Robbins et al., 2003, Rosenfeld et al., 1992).

In Maslow's hierarchy, physiological needs are at the lowest level and self-actualization needs are at the highest level. According to Maslow's need hierarchy theory, individuals are motivated to satisfy their needs in order from the lowest level to the highest level trough a dynamic cycle of deprivation, domination, gratification, and activation (Porter et al., 2003). While an individual's lower order needs (e.g., safety) have not been satisfied yet (i.e., deprivation), s/he would not pay attention (i.e., domination) to any of higher order needs (e.g., friendship). Only when the lower level needs (e.g., physiological needs) are met (i.e., gratification), the next level of needs (e.g., safety needs) will emerge (i.e., activation) and motivate individuals to engage in behaviors to fulfill them. This is also called a satisfaction-progression principle in Maslow's theory (Carson et al., 1995). This cycle repeats at each level until one reaches the self-actualization needs which its satisfaction increases its importance than decreasing it (Rosenfeld et al., 1992, Wahba and Bridwell, 1976).

Despite the common acceptance and popularity of Maslow's need hierarchy theory especially in management and organizational behavior research, there has been

little empirical support for this theory's predictions (Wahba and Bridwell, 1976). Pinder (1984) also notes that "in spite of its widespread popularity, it is a theory which to date enjoys very little scientific support… Maslow's theory remains very popular among managers and students of organizational behavior, although there are still very few studies that can legitimately confirm it" (Rosenfeld et al., 1992, pp. 47, 52).

3.3.3.2 Alderfer's ERG theory

Another theory positing a hierarchy of needs is Alderfer's ERG theory (Alderfer, 1969, Alderfer, 1972), but this theory proposed that there are three categories of needs including

1. *Existence needs* include different forms of a human's material and physiological desires such as food, air, shelter, pay or physical working condition. They consist of both physiological and safety needs of Maslow's theory.
2. *Relatedness needs* involve both relatedness and part of esteem needs in Maslow's theory and pertain to relationships with significant others such as family, friends, coworkers, and enemies.
3. *Growth needs* include people's desire for having creative or productive effects, utilizing and (developing) their (new) capacities and becoming what they can. They correspond to Maslow's self-actualization and part of esteem needs (Alderfer, 1969, Rosenfeld et al., 1992).

While Alderfer's ERG theory may sound as a condensed form of Maslow's theory, they have key differences (Rosenfeld et al., 1992). These differences can be seen in the seven major propositions of the ERG theory: "P1) the less existence needs

are satisfied, the more they will be desired, P2) the less relatedness needs are satisfied, the more existence need will be desired, P3) the more existence needs are satisfied, the more relatedness will be desired, P4) the less relatedness are satisfied, the more they will be desired, P5) the less growth needs are satisfied, the more relatedness needs will be desired, P6) the more relatedness are satisfied, the more growth needs will be desired, P7) the more growth needs are satisfied, the more they will be desired" (Alderfer, 1969, p. 148).

In summary, similar to Maslow's theory, ERG theory posits that people tend to move from existence needs to relatedness needs, and then to growth needs when needs in each level are fulfilled. However, unlike Maslow's theory, higher order needs activation does not require the satisfaction of lower order needs. For instance, the emergence of growth needs is not contingent upon the satisfaction of existence and relatedness needs. In other words, ERG theory allows different needs categories to be simultaneously motivating. Moreover, in addition to the satisfaction-progression principle in Maslow's theory (e.g., propositions three and six), ERG theory also posits a frustration-regression process (e.g., propositions two and five). That is when a higher order need cannot be satisfied, a regression to the lower order needs (that previously has been successfully satisfied) may occur to compensate the inability of fulfilling the higher level need (Porter et al., 2003, Rosenfeld et al., 1992).

Currently, only a few studies have examined the ERG theory. The empirical verification of the theory hence has not been established yet (Porter et al., 2003). In addition, although these studies reported more empirical support for the ERG theory than Maslow's need hierarchy theory, the research support has not been good enough to consider ERG theory as a universal theory of human needs (Landy and Becker, 1987, Rosenfeld et al., 1992).

3.3.3.3 Herzberg's Two-factor Theory

Unlike traditional views considering satisfaction and dissatisfaction as two ends of a continuum, Herzberg et al. (1959) proposed that satisfaction and dissatisfaction are two separate dimensions, each of them with a high and low end. Using critical incident technique, they asked several hundred engineers and accountants to identify the cases which they were exceptionally happy or unhappy about their jobs (Porter et al., 2003). Analysis of the responses resulted in two sets of factors (or needs) which are called variously as 1) motivators, satisfiers, or intrinsic factors, and 2) hygienes, dissatisfiers, or extrinsic factors (Rosenfeld et al., 1992). Examples of the motivators include achievement, growth, recognition, and responsibility which are more related to the content of jobs. Salary, relationships with peers and supervisors, company policies are instances of the second factor. They are mainly related to the context of jobs. In Herzberg's view, the presence of the motivators leads to satisfaction, while their absence does not lead to high level of dissatisfaction. The presence of the hygiene factors also avoids dissatisfaction and their absence just results in neutral states (Porter et al., 2003, Rosenfeld et al., 1992).

This theory has been widely applied in the area of job satisfaction and provided managers with systematic, empirical, easily understandable recommendation to motivate employees (Porter et al., 2003, Rosenfeld et al., 1992). It has also stimulated much thought and research on work motivation and job enrichment (Robbins et al., 2003). Nevertheless, there has been extensive criticism against this theory, such that it has been considered a too simplistic portrayal of job satisfaction (Robbins et al., 2003, Rosenfeld et al., 1992). Some researchers also criticized Herzberg's procedure and methodology (Robbins et al., 2003). In addition, the generalizability of his findings to various other occupations and vast diversity of individuals has been questioned,

because they were based on a sample of accountants and engineers (Rosenfeld et al., 1992).

3.3.3.4 Murray's Manifest Needs Theory

The next needs theory to be discussed here is the manifest needs theory also known as the need-press model (Steers and Braunstein, 1976). It is one of the oldest needs theories developed by (Murray, 1938). In his "explorations in personality" (1938), Murray argued that a series of needs are influential in shaping human personality and people can be classified according to them. His proposed system of needs included 27 needs (e.g., needs for achievement, power, affiliation, etc.) that any of them could exist in every individual at any one time (Rosenfeld et al., 1992). According to this theory, needs are mainly learned rather than inherited. They get activated (manifested) by cues from the external environment (called press). Otherwise, they will remain latent (inactivated) (Steers and Braunstein, 1976).

Unlike Maslow, in Murray's view people can have various needs at the same time. These needs often come into conflict. For example, someone might hesitate to fulfill his/her desire for flying an airplane (need for Achievement) because of fear (need for Harm-avoidance). However, not all needs are in conflict, some of them can be complementary and be satisfied by the same course of action (called fusion of needs). Some needs may also be subsidiary of a determinant need (called subsidiation of needs). In this case, the determinant need motivates the actions and it may not be fulfilled unless the subsidiary needs are met (Murray, 1938).

This theory has been further developed and enhanced by David McClelland and colleagues (McClelland et al., 1953). Their work is discussed in the following section.

3.3.3.5 McClelland's Learned Needs Theory

Building on Murray's theory, McClelland (1976) proposed the learned needs theory. According to this theory, individuals acquire certain needs through their life experiences in their culture. Four major learned needs in work setting include need for achievement, need for affiliation, need for power, and need for autonomy. Once these needs are acquired, they may be considered as personal predispositions that influence individuals' perception of work situations and goal setting behavior (Porter et al., 2003).

Despite popularity of content theories of motivation (e.g., Maslow's need hierarchy theory, Herzberg's two-factor theory), they are criticized for not addressing individual differences and considering same needs and motivation processes for all people. In contrast, the process theories of motivation (e.g., the expectancy theory (Vroom, 1964)) emphasize that every individual has a different set of needs and will be motivated differently from others. However, their flexibility and mathematical complexity makes them difficult to operationalize. McClelland's learned needs theory (McClelland, 1976, McClelland et al., 1953) as one of the most popularly accepted theories of motivation places between these two ends of a motivational theories spectrum. This theory recognizes individual differences and has specified content (specific needs categories). Hence, it offers considerable promise of explanatory power (Stahl, 1986). For this reason, this study utilizes it as the theoretical guide for identifying clinicians' higher-level needs (desires) in exploring their satisfaction with CIS.

3.3.4 Healthcare Context

This section elaborates each of the needs categories from McClelland's (1976)

learned needs theory and their application for users' satisfaction in healthcare contexts.

3.3.4.1 Need for Achievement

Need for achievement has been defined as "behavior towards competition with a standard of excellence" (McClelland et al., 1953). It is "the drive to excel, to achieve in relation to a set of standards and to strive to succeed" (Robbins et al., 2003, p. 349). The following are four characteristics of individuals with high need for achievement as identified by McClelland, "1) a strong desire to assume personal responsibility for finding solutions to problems or performing a task, 2) a tendency to set moderately difficult achievement goals and to take calculated risks, 3) a strong desire for concrete performance feedback on tasks, and 4) a single minded preoccupation with task accomplishment" (Porter et al., 2003, p. 11).

"The sample hospital of this study has certain values and standards. These values as described by the hospital include "1) *Integrity*: we are committed to the highest standards of ethical conduct, 2) *Compassion*: we empathize with those who are ill and suffering. We will do our best to alleviate their pain and discomfort, and treat them and their family with care and compassion, 3) *Professionalism*: we are committed to being the best in what we do and to achieve the best possible outcome for our patients. 4) *Respect*: we treat everyone with honesty, decency and fairness. 5) *Teamwork*: we nurture success by promoting collaboration, participation and trust across the organization within an environment of sharing and mutual respect. 6) *Social Responsibility*: we contribute positively back to our community, both as an organization and as individuals. "

Among the values this hospital holds, the third one pertains to the need for

achievement concept in this study. The standard this hospital has set for the organization and its clinicians is achieving the best possible patient outcome. CIS are health information technologies designed for the purpose of improving patient care (Bhattacherjee et al., 2007). Further, previous belief elicitation research on physicians about using EMR and CPOE shows that they believe these CIS influence (positively or negatively) their performance, productivity and efficiency, and patient outcomes. As the target hospital of this study values achieving the best possible patient outcomes, the study's research model investigates the congruency of the CIS with clinicians' need for achievement in terms of patient outcomes. These patient outcomes include 1) patient satisfaction, 2) healthcare quality, and 3) medical error occurrence (patient safety). Examples from health informatics literature (Holden, 2010) on clinicians' believes regarding the positive impact of the use of EMR and CPOE on patient outcome includes: 1) improved quality of care due to access to more up-to-date information more quickly, provision of reminders (e.g., overdue investigations), reduction of duplicate procedures (previously might have occurred due to difficulty of knowing about already ordered or conducted procedures like X-rays), 2) several patient safety benefits such as mandatory checks for ensuring safe conduct of practice (e.g., medication reconciliation, automatic checks for patient allergies and drug-drug interaction), easier checking of medication history, and more legible and clear orders due to improved data entry, 3) other patients benefits such as time and cost efficiency (e.g., less duplicate orders, reduced length of stay due to faster ordering and order processing). Threat on patient safety (e.g., as a result of physicians' over-reliance on potentially erroneous information, nurses' more focus on the EMR use protocol than checking order accuracy), and decreased quality of care (e.g., due to perceived delayed and poorer care from less familiar nurses with EMR and COPE and not

attending the orders, longer outpatient wait time and less time spent with patients as physicians need to spend more time on documentation) are among the negative clinicians' belief regarding the use of EMR and CPOE (Holden, 2010). The clinician needs congruency construct will measure the confirmation or disconfirmation (fulfillment or not fulfillment) of the best possible patient outcome attainment using CIS from clinicians' perspective.

According to the first characteristics listed earlier for individuals with high need for achievement, the success that satisfies their need for achievement must be attributed to the individuals' effort not other factors. As clinicians' endeavor in learning and utilizing the CIS is necessary, achieving the patient outcome goals by using CIS is still creditable to clinicians. The second characteristic states that the goals should be challenging but not impossible. These patient outcome goals are not easy but still achievable. Besides, high achievers tend to do something better than it has been done before (Robbins et al., 2003), and receive feedback on their performance. CIS also helps gathering information and providing feedback on clinicians working performance in terms of patient outcome (Chiang et al., 2008). Hence, this study will examine clinicians' need for achievement and the CIS congruency in meeting this need.

3.3.4.2 Need for Affiliation

According to McClelland (1976), need for affiliation refers to a concern for "establishing, maintaining, or restoring a positive affective relationship with another person" (p. 160). Birch and Veroff (1966) also defined need for affiliation as an "attraction to another organism in order to feel reassured from the other that the self is acceptable" (p.53). In the handbook of social psychology (Leary, 2010), affiliation is

defined as "the act of associating or interacting with one or more other people. The concept of affiliation carries no indication of the quality, affective tone, or length of the social encounter or the nature of the relationship between the people." (p. 465).

Every well-adjusted individual has a desire to interact with others (at various degrees due to individual differences) even if the interaction has no benefit except experiencing the interaction itself. Theorists suggested that affiliation motivation might have evolutionary roots such that prehistoric human ancestors sought group living and affiliation to improve their chances of adaption and survival (Leary, 2010). As determined by McClelland, individuals with high need for affiliation can be characterized by "1) a strong desire for approval and assurance from others, 2) a tendency to confirm to the wishes and norms of others when pressured by people whose friendship they value, and 3) a sincere interest in the feelings of others" (Porter et al., 2003, p. 11). Similarly, the multidimensional model of affiliation (Hill, 1987) proposes four primary reasons (or social rewards) for people's desire to affiliate: "1) positive affect or stimulation associated with interpersonal closeness and communication, 2) attention or praise, 3) reduction of negative affect through social contact, and 4) social comparison" (p. 1008).

The notion of positive stimulation is derived from Murray's description of need for affiliation that people desire to affiliate and interact with others because association and communication is usually enjoyable (Hill, 1987, Leary, 2010). This dimension also corresponds to other concepts in the relative social reward literature such as affect (Buss, 1986), love (Foa and Foa, 1974), belongingness and intimacy (Veroff and Veroff, 1980).

Subsequent research on Murray's need for affiliation identified another

affiliation dimension namely attention or praise. This dimension is related to individuals' fear of rejection and desire for approval and having others to hold high regards about them (Hill, 1987, Leary, 2010). Similar concepts considered as social rewards or relatedness incentives by other social reward theorists include status (Foa and Foa, 1974), praise and respect (Buss, 1983, Buss, 1986) and approval (Veroff and Veroff, 1980).

Another reason for affiliation is suggested to be mitigating the negative emotions in stressful or fearful situations. In these situations, people can receive emotional support and sympathy from others. Even the mere presence of others can be reliving in such circumstances (Hill, 1987, Leary, 2010). Sympathy that has been considered as a social reward by Buss (1986) and Veroff and Veroff (1980) is comparable to this dimension. Murray also included need for nurturance in the same group with affiliation as affective motives.

The last reason for affiliation motivation is called social comparison that "involves the seeking of information about a self-relevant issue from others when objective criteria for evaluation are not readily available, particularly with respect to opinions, beliefs, and other socially relevant attributes" (Hill, 1987, p. 1009). Receiving this information can be helpful for reducing ambiguity, uncertainty, confusion and better action in response to relevant situations (Hill, 1987, Leary, 2010).

In IS literature, affiliation motivation has been mainly defined as people's desire for interaction with others. The primary reason for interaction in these studies has been implied as positive stimulation according to the multidimensional model of affiliation. This can also be observed in the selection of items for measuring this need

from the instruments developed by Hill (1987) (e.g., see (Li et al., 2004)). These studies mainly investigated how people's enjoyment of interaction affects their use and acceptance of IT applications that support their interactions such as groupware or instant messaging.

For instance, Li et al. (2004) included affiliation motivation in the TAM to investigate its impact on groupware use. They defined affiliation motivation as "an individual's innate need to collaborate" (p. 1) or "a personality attribute that reflects an individual's desire for social interaction". In a voluntary use context, their empirical results showed that affiliation motivation was significantly associated with perceived ease of use and intention to use groupware.

Premkumar et al. (2008) also examined the impact of affiliation motivation as a control belief in a model based on the theory of planned behavior explaining intention to use instant messaging in organizations. They defined need for affiliation as "a sense of need to belong" (p. 452) and "an individual characteristic that reflects his or her desire to interact" (p. 453). Individuals with high need for affiliation have been found to be comfortable in social interaction and look for information and help in social situations. Accordingly in this study, people with strong desire for interaction were hypothesized to be more likely to use IM than those with lower need for affiliation. The empirical findings of this research indicated a positive but not significant impact of affiliation motivation on intention to use IM.

However, the most relevant dimension of affiliation motivation to CIS use in the healthcare context is social comparison, because individuals are increasingly depending on exchange of information at their work setting to carry out their job-related tasks (Carson et al., 1995). For instance, communication takes 80 percent of

healthcare manager's time (Carson et al., 1995). Moreover, patient-clinician and clinician-clinician communication shapes an essential component of clinicians' job. In addition, prior research (Ng and Kankanhalli, 2009, Sicotte et al., 2010) has shown that CIS affects the interaction and communication among these social actors at healthcare setting. In the context of EMR and CPOE, better documentation is believed by physicians to improve the communication between colleagues and nurses (Holden, 2010). Examples mentioned in the interviews with the nurses in this study depict this impact. In a paper based system, nurses will need to verbally transfer the details (not captured in patients' case note) of conducted/ need to be conducted procedures and orders to the nurse in the next shift. With the help of the hospital's CIS, these details are documented in the system with improved accuracy (e.g., forgetting an order). In case of any ambiguity on investigation orders, they will also need to call doctors to confirm the orders in a paper-based system. Due to more legible orders with the use of CIS, nurses no longer need to call physicians to confirm the right order. Physicians also benefit from the more clear and legible orders and past history of patients from other colleagues. In addition, the CIS investigated in this study has a separate SMS system, which is linked to the hospital's laboratory. When the laboratory finds a highly abnormal result, a SMS is sent to the ordering doctor to acknowledge. The CIS also facilitate patient management discussions via telephone among the care team by providing easy access to patient information anywhere within the hospital. The care team therefore can all see the same data and talk remotely, even from home. The CIS is also used to create and store patient transfer summaries which act as a form of communication. When a patient is transferred from ICU to the general ward, besides verbal handover, this transfer of care document is also handed over from the ICU team to the ward team to support the continuity of care.

Therefore, the social comparison dimension of need for affiliation among clinicians and the CIS congruency in facilitating the fulfillment of this need will be investigated in the present study.

3.3.4.3 Need for Power and Need for Autonomy

In his "explorations in personality" book, Murray (1938) states that five set of needs including need for dominance (power), need for autonomy, need for aggression, need for deference, and need for abasement can be taken together. Among these needs, need for power and need for autonomy are included in McClelland's learned needs theory (1976). The common concept among these needs is the control element. However, the object of control differs among them. While need for power is concerned with the controlling of other people, need for autonomy is about controlling one's way of working. More specifically, McClelland (1976) defined need for power as "a concern with the control of the means of influencing a person" (p. 167). According to McClelland, two characteristics of individuals with high need for power are "1) a desire to direct and control someone else, 2) a concern for maintaining leader-follower relations" (Porter et al., 2003, p. 11). Similarly, prior research on power perceptions in healthcare organizations influenced by power studies in business practices, mainly conceptualized and measured power as superior/subordinate and leader/follower relationships (Bartos et al., 2008). The system investigating in this study (description provided in chapter 5) did not impose any changes in the power distribution in the study's sample hospital either for nurses or doctors. The need for power hence is not included in this study.

Need for autonomy refers to "a desire for independence" (Porter et al., 2003, p. 12). People with high need for autonomy prefer to work alone and control their

workplace. They also do not want rules and procedures to impede them (Porter et al., 2003). Autonomy has also been proposed as one of the five essential job dimensions in the job characteristics model. The job characteristic model (Hackman and Oldham, 1975, Hackman and Oldham, 1976) is one of the most popular job design frameworks (George and Jones, 2005, Ng and Kankanhalli, 2009). This model identifies five primary job features including skill variety, task identity, task significance, autonomy, and feedback. The model then explains how these characteristics influence employees' three critical psychological states (i.e., experienced meaningfulness of the work, experienced responsibility for outcomes of the work, knowledge of the actual results of work activities) and consequently their reaction to their job. The framework finally elaborates the impact of these psychological states on individual and organizational outcomes such as intrinsic motivation, job satisfaction, job performance, and absenteeism and turnover (George and Jones, 2005). In this model, autonomy is defined as "the degree to which a job provides substantial freedom, independence, and discretion to the individual in scheduling the work and determining the procedure to be used in carrying it out" (Robbins et al., 2003, p. 356). This model has been employed in Ng and Kankanhalli's (2009) study to investigate the impact of healthcare IS on individuals' job performance. Autonomy was excluded from their research model, because they expected that not only their investigated CIS cannot increase users' autonomy, but it may actually decrease it.

Similarly, IS studies on HIT adoption and resistance investigated the impact of perceived threat to autonomy as a result of HIT implementation. For instance, Bhattacherjee and Hikmet (2007) developed a research model based on dual-factor model of technology usage to explain physician resistance to HIT. The model integrated both the technology acceptance and resistance to change literatures to

identify enablers and inhibitors of HIT usage. Perceived usefulness and perceived ease of use were proposed as enablers of usage while resistance to change was considered as an inhibitor of usage. The impact of inhibitor is stated to be asymmetric and independent from enablers such that their absence does not necessarily favor usage but their presence discourages usage. Then, perceived threat is proposed as a determinant of resistance to change. Perceived threat in their study referred to "physicians' loss of control over their work." The empirical validation of the study showed that perceived threat had a significant positive impact on resistance to change. In another study, Walter and Lopez (2008) proposed perceived threat to professional autonomy as a determinant of physicians' perception of usefulness and intention to use HIT. Professional autonomy in their study is generally defined as "professionals' having control over the conditions, processes, procedures, or content of their work according to their own collective and, ultimately, individual judgment in the application of their profession's body of knowledge and expertise" (p. 207). Their empirical findings indicated a significant negative impact of perceived threat to professional autonomy on both perceived usefulness and intention to use.

The system investigated in this study (see chapter 5) did change how doctors deal with laboratory or radiology investigations ordering and consequent tasks. That is it tampered with their autonomy. For nurses, the system brought them more convenience in carrying out the investigation orders, but no work control restriction was inflicted. In addition, nursing autonomy has been a recurring concept in the nursing literature for many years (Ballou, 1998, Varjus et al., 2003). The research on nursing autonomy mainly concerns the nursing discipline desire for professional status, the effect of socialization on women and nurses, and the impact of autonomy on nurses' job satisfaction. The nurses' desire for autonomy and having difficulties in

achieving it is evident in these areas (Ballou, 1998) .The nursing history shows that nursing worked with independence before industrialization due to the context of practice and the simple healthcare delivery. In the 1930's, the development of hospitals and the consequent bureaucracy and patriarchy modified the nurses' state of autonomy adversely that continues until now (Ballou, 1998, Church, 1990). In spite of various favorable changes to nursing autonomy such as increased nursing professionalism and accountability, perception of limited autonomy still remains common among many nurses (Finn, 2001). In the present thesis, the need for autonomy hence is examined only for doctors.

CHAPTER 4

RESEARCH MODEL AND HYPOTHESES

A research model based on the theoretical framework discussed in the previous chapter is presented here. The research constructs (see Table 4-1), hypotheses and their justifications are also explained. Figure 4-1 depicts these constructs and their interrelationships.

4.1 Expectations and Expectations Congruency

Expectations have long been the dominant comparison standard in the disconfirmation paradigm in marketing literature (Cadotte et al., 1987), and satisfaction has been considered to be resulted from the low discrepancy between the pretrial expectations and the post hoc perceptions (Yi, 1990). Similar to Spreng et al. (1996), clinician expectations congruency in this study is defined as a clinician's subjective assessment of the comparison between his or her expectations from a CIS and the CIS performance received. Clinician expectations in turn are conceptualized as a clinician's set of pretrial beliefs about the eventual performance and attributes of the CIS. The positive association of expectations congruency and satisfaction has received considerable empirical support in marketing literature (Spreng et al., 1996). Such an association has also been hypothesized in some IS satisfaction researches (Chin and Lee, 2000, Nevo and Chan, 2007). The studies that empirically tested the relationship have found significant effect of expectations congruency on IS satisfaction (Khalifa and Liu, 2002). Hence, similar positive effect of clinicians'

expectations congruency on their satisfaction with CIS is hypothesized.

H1. Clinician expectations congruency is positively related to clinician satisfaction with CIS.

The extant marketing literature also proposes a negative relationship between expectations and expectations congruency, because high expectations are more likely to be negatively disconfirmed and low expectations are more likely to be positively disconfirmed (Churchill and Surprenant, 1982, Spreng et al., 1996, Yi, 1990). This association has been included in a number of IS researches in different contexts such as satisfaction with knowledge management systems (Nevo and Chan, 2007), end user computing satisfaction (Chin and Lee, 2000), and measurement of Web-customer satisfaction (McKinney et al., 2002). Similarly, in this study, it is hypothesized that

H2. Clinician expectations are negatively related to clinician expectations congruency.

In addition to the indirect effect of expectations on satisfaction through expectations congruency, a direct positive impact of expectations on satisfaction has also been postulated in prior marketing research (Tse and Wilton, 1988). The results of a number of IS studies also provided empirical support for the effect of IS users' expectations on their overall satisfaction with the IS (Rushinek and Rushinek, 1986, Yoon and Guimaraes, 1995). A longitudinal experiment by Szajna and Scamell (1993) has shown an association between the realism of IS users' expectations and their satisfaction with the IS. The meta-analysis study by Mahmood et al. (2000) has also found a strong correlation between the two constructs. The rationale for this positive relationship comes from the cognitive dissonance theory. The underlying assumption of this theory is the individual's desire for cognitive consistency (Festinger, 1957). Therefore, the theory posits that when individuals hold two in-

consistent cognitive elements, they will try to attain the state of cognitive consistency by modifying one of the cognitive elements (Festinger, 1957, Szajna and Scamell, 1993). Considering clinician expectations and satisfaction as two cognitive elements, the next hypothesis states

H3. Clinician expectations are positively related to clinician satisfaction with CIS.

Table 4-1: Definition of Constructs

Construct	*Definition*
Clinician expectations	A clinician's set of pretrial beliefs about the eventual performance and attributes of a CIS
Clinician expectations congruency	A clinician's subjective assessment of the comparison between his or her expectations from a CIS and the CIS performance received
Clinician needs	Three categories of needs (i.e., need for achievement, need for affiliation, and need for autonomy) from McClelland's learned needs theory
Clinician needs congruency	A clinician's subjective assessment of the comparison between his or her needs and the CIS performance received
Perceived CIS performance	A clinician's beliefs regarding the performance of various functionalities of a CIS
Clinician Satisfaction with CIS	An affective state representing an emotional reaction to the CIS which a clinician directly interacts with

4.2 Needs and Needs Congruency

Some marketing researchers suggested the use of another frame of reference called needs (desires, values, or wants) in conjunction with expectations to address the shortcomings of the expectations congruency model (Spreng et al., 1996, Westbrook and Reilly, 1983). In this study, clinician needs is defined at an abstract level rather than at an attribute level, and refer to three categories of needs (need for achievement, need for affiliation, and need for autonomy) from McClelland's learned needs theory (1976). Clinician needs congruency also represents a clinician's subjective assessment of the comparison between his or her needs and the CIS performance received. Several consumer satisfaction researches (Spreng et al., 1996, Westbrook and Reilly, 1983, Wirtz and Mattila, 2001) have provided empirical support for the needs congruency model. A few IS studies have also employed the needs congruency model

to explain IS satisfaction (Chin and Lee, 2000, Khalifa and Liu, 2002, Nevo and Chan, 2007). This study similarly argues that higher clinician needs congruency leads to their higher satisfaction with CIS. Therefore, the next hypothesis is

H4. Clinician needs congruency is positively related to clinician satisfaction with CIS.

Similar association between expectations and expectations congruency has also been proposed for needs (desires or wants) and needs congruency (Spreng et al., 1996, Westbrook and Reilly, 1983, Wirtz and Mattila, 2001). That is, in CIS satisfaction context, when clinicians hold high (low) levels of needs (desires) towards an IS, the actual performance of the CIS will be less (more) likely to reach these levels, resulting in negative (positive) disconfirmations. This relationship has been considered in a few IS satisfaction research models such as Chin and Lee (2000), Khalifa and Liu (2002), and Nevo and Chan (2007). The result of Khalifa and Liu's (2002) empirical research of user satisfaction with Internet-based service showed significant negative effect of desires on desire congruency. Hence, the fifth hypothesis is

H5. Clinician needs are negatively related to clinician needs congruency.

Service quality literature, similar to the consumer satisfaction research, recognizes costumer expectations as an essential concept which service experiences are compared with. In their study of the nature and determinants of customer expectations of service, Zeithaml et al. (1993) suggest personal needs as one of the factors affecting expected service quality. Comparatively, in IS service quality literature, personal needs are also considered as determinants of expectations (Pitt et al., 1995). Therefore, the next hypothesis is

H6. Clinician needs are positively related to clinician expectations.

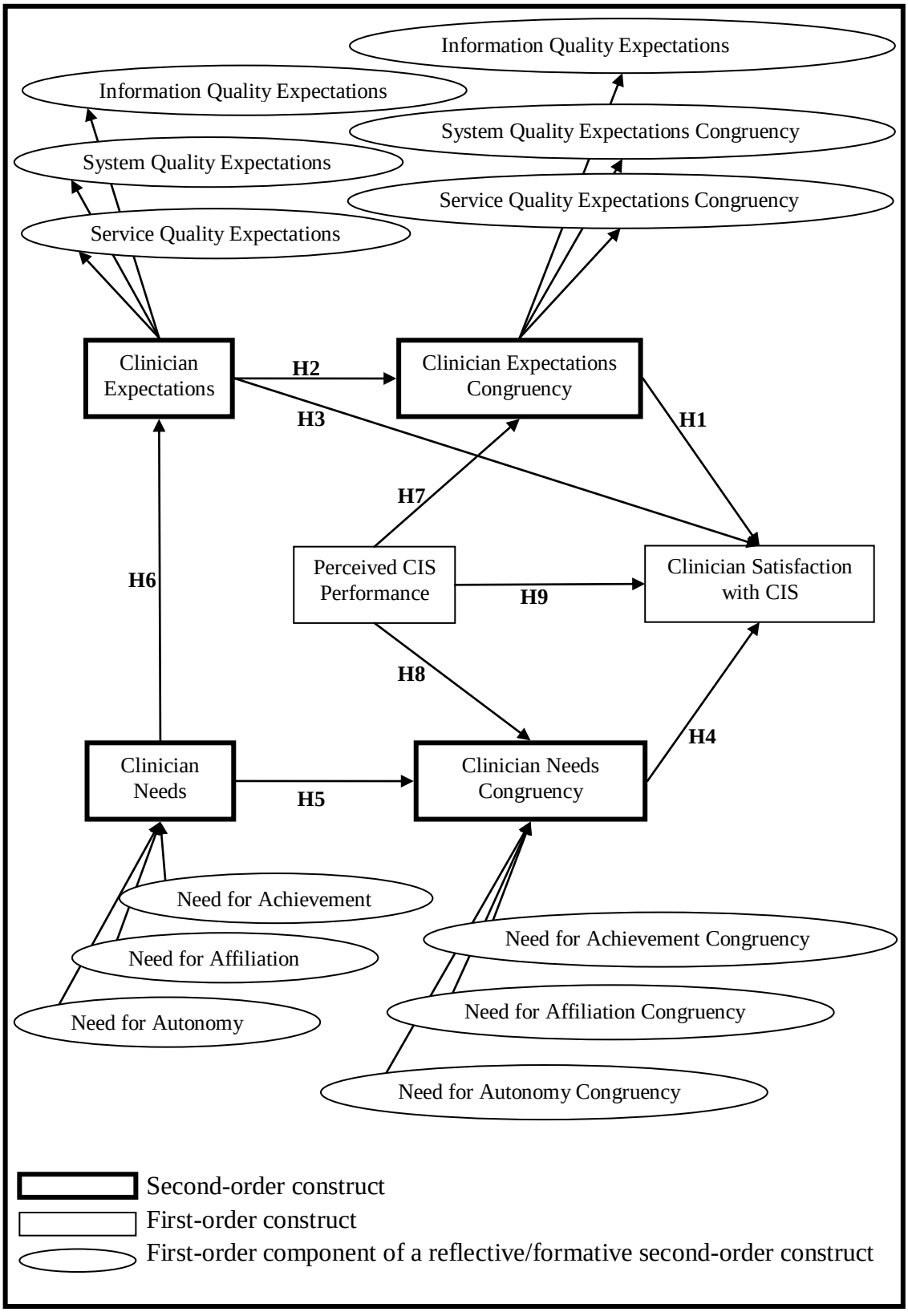


Figure 4-1: Research Model

4.3 Perceived CIS Performance

According to the expectations congruency and needs congruency models, perceived performance (which both expectations and needs are compared against it) has a positive impact on both congruencies, because high performance is more likely to meet or exceed high needs and expectations (Spreng et al., 1996). Here, perceived CIS performance is defined as beliefs regarding the performance of various functionalities of a CIS. The association between perceived performance and both congruencies has been found significant in both consumer satisfaction research (Churchill and Surprenant, 1982, Tse and Wilton, 1988) and IS satisfaction literature (Khalifa and Liu, 2002). Based on these models and findings, the next hypotheses are

H7. Perceived CIS performance is positively related to clinician expectations congruency.

H8. Perceived CIS performance is positively related to clinician needs congruency.

Several marketing studies have found a strong positive relationship between perceived performance and satisfaction (Churchill and Surprenant, 1982, Tse and Wilton, 1988) indicating that the effect of perceived performance on satisfaction is not completely mediated by the disconfirmation effect. The comparative study of Tse and Wilton (1988) also showed the relative better performance of a combined disconfirmation model including perceived performance over other disconfirmation models without perceived performance. A number of previous IS studies (Au et al., 2008, Khalifa and Liu, 2002) have also found positive association between IS performance and satisfaction. Au et al. (2008) have found that IS performance was the most significant determinant of end user satisfaction in a model comprising of IS performance expectations and equitable need fulfillment. Similar empirical supports for the positive impact of perceived performance or functionality of different CIS and

clinician satisfaction have been reported in various medical informatics researches (Lee et al., 1996, Palm et al., 2006). Thus, it is hypothesized that

H9. Perceived CIS performance is positively related to clinician satisfaction with CIS.

4.4 Control Variables

To verify alternative explanations of final results, a number of control variables were identified based on relevant literature. Prior research suggests that age, gender (Palm et al., 2006), work experience (Palm et al., 2006), duration of the system use (Murff and Kannry, 2001), computer background (Likourezos et al., 2004, Tan et al., 2009), and user training (Likourezos et al., 2004, Mahmood et al., 2000, Tan et al., 2009) might be influential on clinician satisfaction with CIS. The effects of these variables will be controlled in this study.

RESEARCH METHODOLOGY

Survey methodology is adopted in this study to empirically validate the proposed research model. This methodology is selected because of its appropriateness for research questions asking about respondents' beliefs or behaviors, generalizability power, and inherent statistical nature of its information (Neuman, 2006).

5.1 Measurement Model

5.1.1 Clinician Expectations

Different operationalizations of expectations construct exist in IS studies. Some measured expectations about the overall performance of information systems using semantic differential scales with ranges such as extremely adequate to extremely inadequate, or extremely good to extremely bad (Khalifa and Liu, 2003). Some others (Szajna and Scamell, 1993) used items asking respondents to rate the likelihood of their good decision making performance using information systems (ranging from highly likely to highly unlikely). However, other studies employed items measuring expectations about various attributes of information systems rather than their overall performance (Au et al., 2008, McKinney et al., 2002). These attributes are related to information quality, system quality, and service quality aspects of information systems as identified in the Delone and McLean's (2003) IS success model. In this study, "clinician expectations" construct is considered as a reflective second-order construct with three dimensions including information quality, system quality, and

service quality expectations. Each of these dimensions are measured using reflective items adopted from prior IS success studies such as Doll and Torkzadeh (1988) and Baroudi and Orlikowski (1988). The items were adjusted to the healthcare context based on the interviews with the nurses and doctors at the sample hospital prior to the survey data collection. For instance, in "service quality expectations" dimension, prompt IT support services for the system was considered very essential by the nurses (especially in emergency situations). The doctors and nurses questionnaire are provided in Appendixes 1 and 2. The respondents were asked to recall what they expected from the CIS before starting to use it. The expectations might have formed based on the information provided to them about the system during the training sessions, what they have heard from their colleagues, or prior experience with using similar systems.

5.1.2 Clinician Needs

"Clinician needs" construct is operationalized as a formative second-order construct. Among different categories of needs suggested in McClelland's learned needs theory (McClelland, 1976), "need for achievement" and "need for affiliation" are considered as the two dimensions of "clinician needs" construct for the nurse population in the present study. "Need for autonomy" is the third dimension investigated for the doctor population of the study. "Need for achievement", "need for affiliation", and "need for autonomy" are defined as first-order reflective dimensions. A discussion on the application of these needs categories to IS user satisfaction in the healthcare context is provided in an earlier chapter (i.e., chapter 3). As such, the items measuring the "need for achievement" in terms of patient outcome and the "need for affiliation" pertaining to the social comparison dimension of affiliation motivation are developed for the purpose of this study based on the relevant literature including (Holden, 2010,

McClelland, 1976, Murray, 1938) and (Hill, 1987, Leary, 2010, McClelland, 1976) respectively. The items of the "needs for autonomy" construct are adopted with some wording modifications from (Bhattacherjee and Hikmet, 2007, Walter and Lopez, 2008).

5.1.3 Clinician Expectations and Needs Congruencies

Expectations (needs) congruency can be measured with at least two approaches. The first one includes items asking respondents to directly compare the perceived performance of a product with their expectations (needs). The second one uses the calculated difference between the perceived performance scores and expectations (needs) scores as the measure of expectations (needs) congruency. Empirical research comparing the two approaches shows that the former is superior to the latter (Dabholkar et al., 2000). In addition, it has been validated in prior IS and consumer satisfaction research (Khalifa and Liu, 2002, Khalifa and Liu, 2003, McKinney et al., 2002, Wirtz and Mattila, 2001). Some researchers (Chin and Lee, 2000, Spreng et al., 1996) also suggest weighing this measure with the individuals' evaluation of the congruency (i.e., its relative goodness or badness) in an expectancy theoretic way (Bhattacherjee, 2001). However, Bhattacherjee (2001) argues that "the high correlation observed between belief (ΣB_i) and belief-evaluation ($\Sigma B_i e_i$) operationalizations (Swan and Trawick, 1981) suggests that the belief representation is not substantially different from (though conceptually simpler) than the belief-evaluation representations" (p. 355). Therefore, this study follows the subjective direct measurement of expectations (needs) congruency.

Similar to "clinician needs" construct, "clinician needs congruency" is defined as a formative second-order construct with two first-order reflective constructs (for the

nurses' user groups) including "need for achievement congruency" and "need for affiliation congruency". "Need for autonomy congruency" is the third dimension of this construct for the doctors' user group. Comparatively, "clinician expectations congruency" is considered as a reflective second-order construct with three first-order reflective constructs namely "information quality expectations congruency", "system quality expectations congruency", and "service quality expectations congruency". The items for these constructs are presented in Appendixes 1 and 2.

5.1.4 Performance

Perceived CIS performance can be measured at attribute level or functionality level. This study adopted the latter as it is more common in medical informatics literature. Besides, "clinician expectations" and "clinician expectations congruency" constructs are operationalized at attribute level in the present study. Hence, measuring perceived performance at functionality level can provide insights into the CIS performance from another point of view. It also allows detecting any problem with the different CIS functionalities utilized in daily practices of clinicians. The items asked about the performance of six different features of the CIS which nurses and doctors used most frequently in the sample hospital. Details of these features are provided in Appendixes 1 and 2.

5.1.5 Satisfaction

As this study defined satisfaction as an affective state, a suitable measurement to adopt is the one used by (Au et al., 2008, Chin and Lee, 2000, Spreng et al., 1996). As shown in Appendixes 1 and 2 these items ask respondents about their feelings regarding the use of CIS.

5.2 Conceptual Validity

To ensure conceptual validity, several clinicians at the sample hospital were consulted multiple times to test the survey questions. As a result, four items pertaining to information quality expectations (regarding information accuracy, preciseness, completeness, being provided on time), four items of system quality expectations (regarding the system effectively integrating data from different functional areas, maintaining high degree of data confidentiality, being easy to learn and user friendly), two items from service quality expectations (adequate technical competence, positive attitude towards users) and their corresponding items from the expectations congruency construct were omitted from the questionnaire. These items were dropped as the consulted clinicians (doctors and nurses) perceived that the rest of the items already captured the same content or were more important to their use of the CIS. Two rounds of labeled and unlabeled sorting were also conducted. In each round, three different IS postgraduate students were asked to go through the sorting process (Moore and Benbasat, 1991). The result of the unlabeled sorting is presented in Table 5-1. More than 89 percent of the items were correctly placed in the intended constructs with appropriate label. One item from the need for achievement construct (i.e., desire to receive detailed feedback on job performance) and its matching item from the need for achievement congruency construct were omitted as the sorting judges did not find them compatible with the rest of the items of these constructs. The results of the labeled sorting matched the intended construct well (100 percent hit rate). Before conducting the survey two items from the service quality expectations and service quality expectations congruency constructs (regarding the IT support's willingness to help users) were also removed based on the final revision by the hospital. Upon further consideration, another item (i.e., desire to save time at work)

from the need for achievement construct and its corresponding item from the need for achievement congruency construct were dropped from further analysis, as they seemed more related to clinician personal outcome than patient outcome.

Table 5-1: Results of unlabeled Sorting

Target Category	Actual Category														Total Qs	Hit Rate (%)
	InfQ	SysQ	ServQ	InfqC	SysqC	ServqC	Nach	Naff	Naut	NachC	NaffC	NautC	Perf	Sat	other	
InfQ	9	1													2	12	75
SysQ		11													4	15	73.33
ServQ			9													9	100
InfqC				9	1										2	12	75
SysqC					11										4	15	73.33
ServqC						9										9	100
Nach		1					13	1								15	86.67
Naff								12								12	100
Naut									12							12	100
NachC					1					13	1					15	86.67
NaffC											12					12	100
NautC												12				12	100
Perf													24		3	27	88.89
Sat														12		12	100
Average																	89.92

5.3 Survey Administration

The survey is conducted at a public hospital with more than 500 beds in Singapore. Singapore government considering healthcare information technologies as means of achieving high quality and cost effective clinical care has allocated up to $200 million for developing an electronic health records system at hospitals and polyclinics within 2 years from 2009 (Tan et al., 2009). Hence, its healthcare environment is suitable for conducting CIS satisfaction studies.

The doctors' population of this hospital was approximately 400 at the time the study was conducted. All the hospital's doctors (either senior or junior) use the system

with mostly similar functions. However, senior doctors use the CIS mainly in the clinics, while junior doctors' use of the CIS is in the wards most of the time. In addition, the perceived actual performance assessment in the survey of this study pertained to the common functions of the CIS. According to the sample size requirements suggested by Chin and Newsted (1999) for PLS analysis, this study with nine incoming paths to its dependent variable (i.e., four paths from the independent variables and five paths from the control variables) required at least a sample size of 90. Further, the survey distribution to doctors was carried out by the clinical secretaries of the hospital's different clinical departments. As such 200 surveys (half of the doctors' population) were distributed among the doctors of different clinical departments. The number of distributed surveys therefore was selected with the consideration of having sufficient responses for data analysis and imposing less extra work for the clinical secretaries. 114 surveys were collected back that indicates a 57% response rate. 112 valid responses were included for data analysis. The nurse officers of the 19 wards in the sample hospital handed out 207 surveys to the nurses in their wards (10 surveys per small ward and 12 surveys for larger wards as suggested by the nursing director of the hospital). All the surveys were collected back by the nurse officers resulting in a 100% response rate. Four incomplete responses were excluded and 203 valid responses were used for data analysis. An incentive of 10 Singapore dollars was given to each respondent. The survey was anonymous and approved by NUS institutional review board (NUS-IRB) (see Appendix 3).

Tables 5-2 and 5-3 show the demographic information of the respondents. The majority of the nurses were female (94.09%). Most of them (61.5%) were 20-29 years old and another nearly 30 percent reported 30-39 years old age. More than half of the nurses had 1-9 years of working experience. Almost 93 percent of the nurses indicated

the daily use of internet. Most of them (95.07%) attended the training session and nearly all of them (95.57%) used the system for more than 3 months.

Table 5-2: Demographic Data (Nurses)

	Response Category	***No. of Responses***	***% of Responses***
Age	20-29	123	61.5
	30-39	55	27.5
	40-49	15	7.5
	50-59	6	3
	>60	1	0.5
Gender	Male	12	5.91
	Female	191	94.09
Job Description	Staff Nurse SN/SSN	196	97.03
	Nursing Officers	6	2.97
Education	Diploma	102	50.25
	Bachelors degree (local)	17	8.37
	Bachelors degree (overseas)	72	35.47
	Postgraduate degree	6	2.96
	Others	6	2.96
Primary Language	English	172	84.73
	Chinese	23	11.33
	Malay	4	1.97
	Tamil	2	0.99
	Others	2	0.99
Work Experience	<1 (year)	30	15.23
	1—9	128	64.97
	10—19	28	14.21
	20—29	7	3.55
	30>	4	2.03
Computer Use Frequency	Daily	182	89.66
	Once a week	16	7.88
	Once a month	5	2.46
Internet Use Frequency	Daily	187	92.57
	Once a week	10	4.95
	Once a month	4	1.98
	Never use it	1	0.50
Attendance at the Training Session	Yes	193	95.07
	No	10	4.93
Duration of the System Use	0-3 (months)	9	4.43
	4-6	73	35.96
	>6	121	59.61

Table 5-3: Demographic Data (Doctors)

	Response Category	*No. of Responses*	*% of Responses*
Age	20-29	44	40.37
	30-39	42	38.53
	40-49	18	16.51
	50-59	3	2.75
	>60	2	1.83
Gender	Male	78	69.64
	Female	34	30.36
Job Description	HO	10	8.93
	MO	47	41.96
	Resident	7	6.25
	Registrar	18	16.07
	Associate Consultant	10	8.93
	Consultant/Senior Consultant	19	16.96
	Others	1	0.89
Education	Bachelors degree	49	44.55
	Postgraduate degree	56	50.91
	Others	5	4.55
Primary Language	English	107	96
	Chinese	5	4
Work Experience	<1 (year)	9	8
	1—9	67	60
	10—19	25	23
	20—29	8	7
	30>	2	2
Computer Use Frequency	Daily	110	98
	Once a week	2	2
Internet Use Frequency	Daily	112	100
Attendance at the Training Session	Yes	79	70.54
	No	33	29.46
Duration of the System Use	0-3 (months)	8	7
	4-6	29	26
	>6	75	67

Almost 70 percent of the doctors were male. Around 80 percent of them were between 20-29 or 30-39 years old (nearly half of them in each range). 60 percent of the doctors stated 1-9 years of working experience and all of them reported they use internet daily. Around two-thirds of the doctors participated in the training session,

and only seven percent of them had less than 4 months experience with using the system.

5.4 Investigated CIS

The CIS investigated in this thesis is an electronic medical record system called SCM. SCM has a computerized physician order entry (CPOE) to handle laboratory or radiology investigation orders. It also has documentation functions for doctors to complete patient discharge summary and printing of medical certificates or reports. SCM also serves as a launch pad (via interfaces) to other related clinical systems like:

- RIS-PACS: radiology information system, and picture archival and communication system – to view all X-Rays, CT, MRI scans and reports,
- iPharm: for outpatient medication orders,
- CPRS: cluster patient record system – which allows sharing of patient data across restructured hospitals in Singapore,
- ICIP: ICU record system – used for ICU patient documentation, and
- OTSys: Operating Theatre system – used for surgical operation documentation.

This system is used by doctors, nurses, and allied health staff to manage patients' medical data, orders, and documentation. The survey targeted the first two user groups (i.e., doctors and nurses) as main groups of clinical users that their large population also provided enough sample size for the data analysis. Differences in SCM for nurses versus doctors are more in terms of user rights. Both groups can see almost the same pages for example patient data, investigation orders, and documents. However, only a doctor can order investigations or write a document, while a nurse can only complete the order (order completion screens) and view certain documents. The description of the doctors and nurses workflow before and after the

implementation of the system is explained below (also see Figures 5-1 and 5-2). The workflow mainly focuses on the steps regarding the lab investigation orders (involving both doctors and nurses) and the documentation functions (involving doctors), as the implementation of the system components for carrying these steps was completed in all the wards and clinical departments of the target hospital at the time this study was conducted.

5.4.1 Previous Workflow

Doctors

Doctors visit a patient inside a ward and order lab investigations when needed in the patient's case note. They have to be inside the ward the patient is staying in order to be able to order any investigation. After the investigation is carried out by the nurse in charge (e.g., the specimen is collected and sent to the lab), they will wait for the results to arrive from the lab in hard copies via a human porter system, fax or remote printing. For urgent investigations, they might need to call the laboratory to trace the results.

Nurses

Nurses have to check the patient's case note to find out about new or pending investigation orders. Sometimes they will need to call the doctor to double check on an ordered investigation (e.g., due to illegible handwritings). They need to know which lab investigation request form/s (several types) to complete, and which specimen tubes to use (several types depending on investigations). After specimen collection, they will label the tubes and investigation request form/s with the patient's identification sticker and send it to the laboratory. They then wait for the hard copy results from the laboratory and call them for tracing the results if needed.

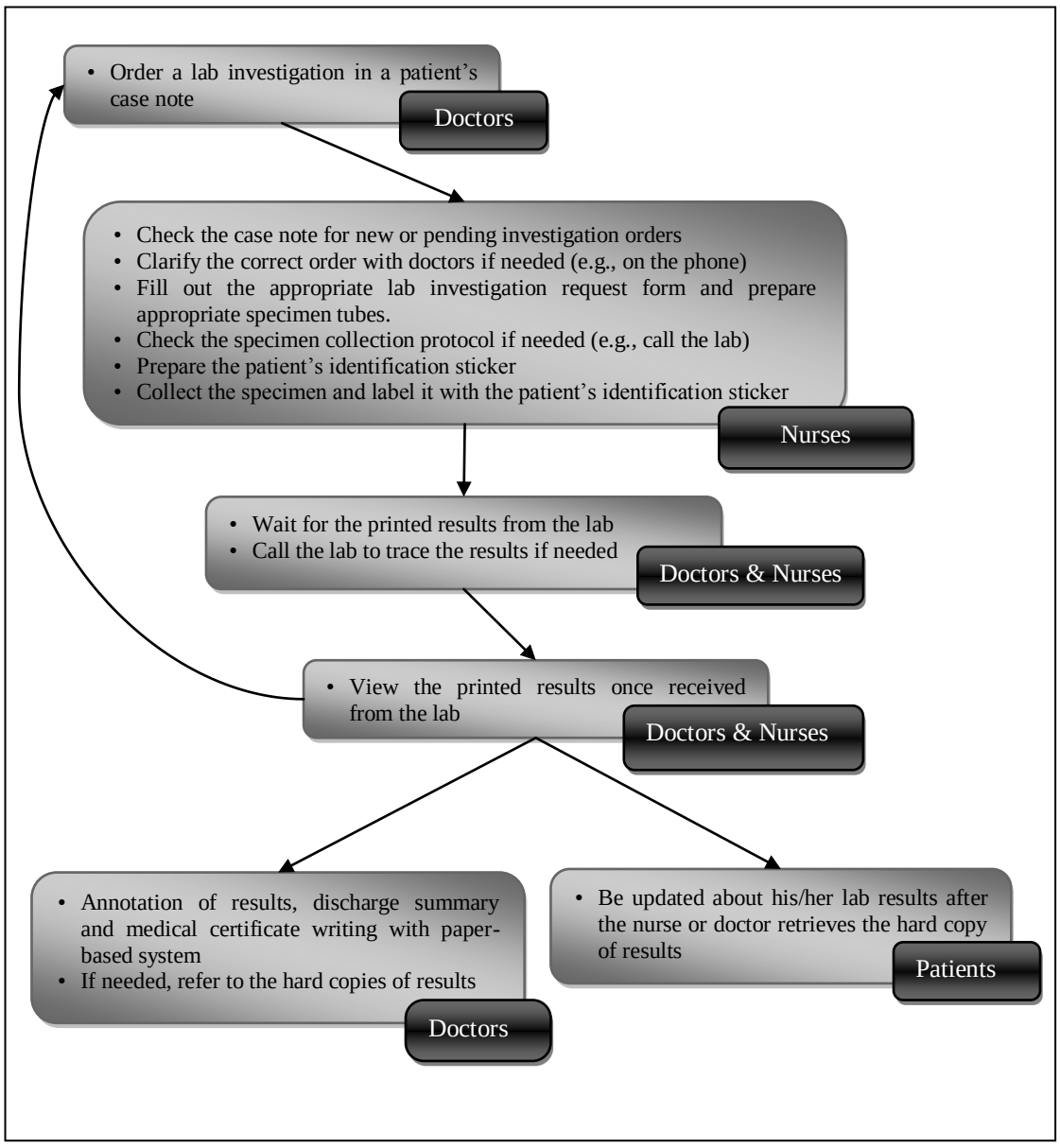


Figure 5-1: Work Flow before the Use of SCM

5.4.2 Current Workflow

Doctors

Doctors can order lab investigations through SCM as long as they are in the hospital and near any station. They can check the status of the investigation through the system to see if the nurses attended the investigation, or the lab is running the test. Once the lab uploads the results, doctors can see them immediately in the system.

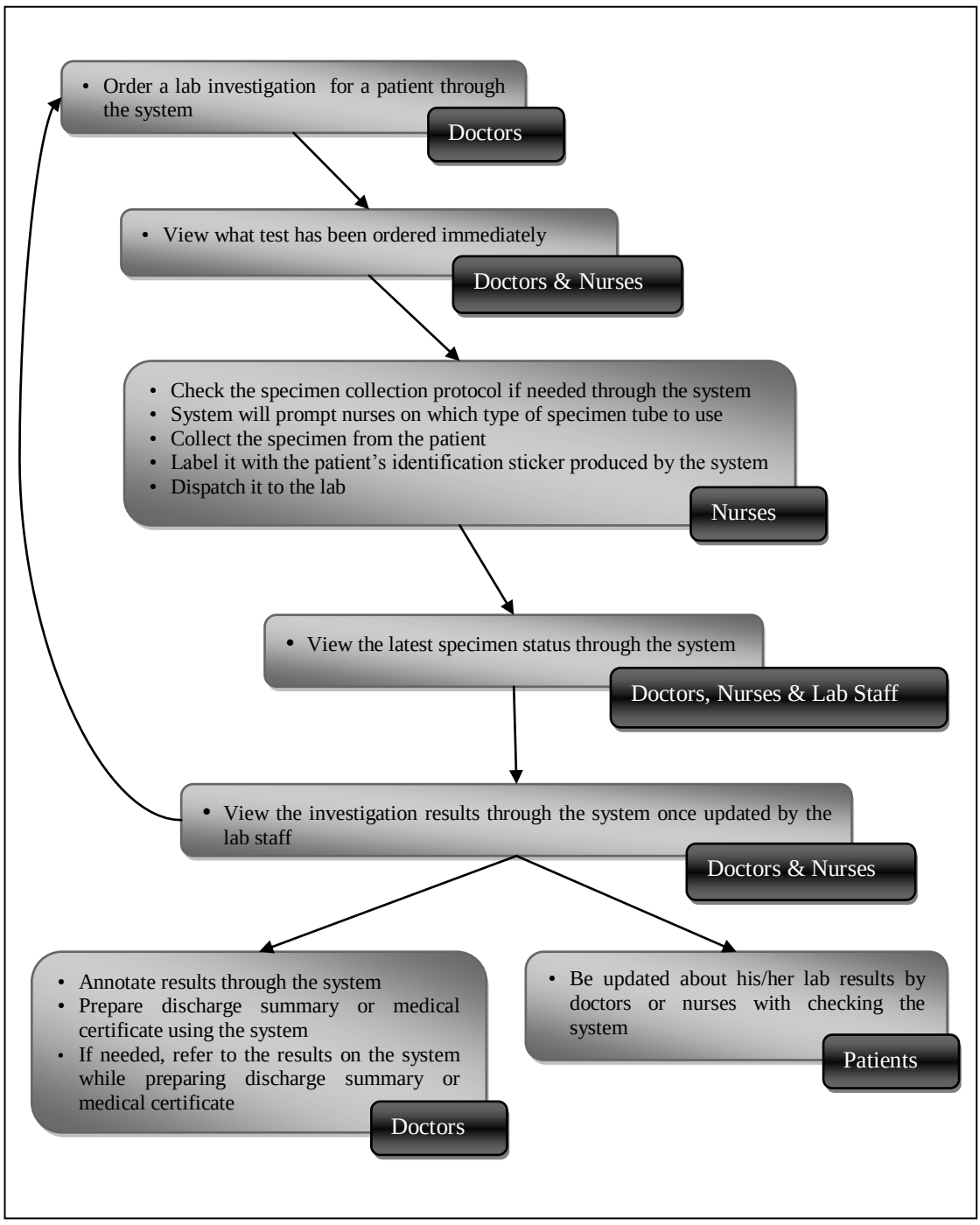


Figure 5-2: Work Flow with the Use of SCM

Nurses

Nurses can immediately view new orders and check the pending ones. They no longer need to fill any form for the investigations. The system will generate the appropriate identification sticker, and inform them which type of specimen tubes to use. After knowing what has been ordered, they 1) collect the required specimen from the

patient, 2) label it with the identification sticker produced by the system, 3) dispatch the specimen, and 4) update the investigation status in the system.

CHAPTER 6

DATA ANALYSIS AND RESULTS

Data analysis was carried out using partial least squares (PLS) technique of structural equation modeling with SmartPLS software (version 2.0 (beta)) (Ringle et al., 2005). PLS is an appropriate analysis technique for assessing complex research models that have formative constructs and need flexibility in addressing their higher order constructs. In addition, model specification and interpretation are more convenient in PLS (Chin, 2010).

In this study, "clinician expectations" and "clinician expectations congruency" are second-order reflective constructs. "Clinician needs" and "clinician needs congruency" are second-order formative constructs. The rest of the constructs as discussed in the measurement model section are first-order and reflective.

This research follows the two-step approach suggested by Anderson and Gerbing (1988) to conduct the structural equation modeling. In the first step, the measurement model is verified for construct reliability and validity. In the next step, the structural model and hypotheses are evaluated (Chin, 2010, Wilson, 2010).

6.1 Measurement Model Assessment

The measurement model is assessed for construct reliability and validity by conducting a confirmatory factor analysis (CFA). Two measures of reliability include Cronbach's alpha and composite reliability. They are required to be greater than 0.70

(Hair et al., 1998, Nunnally and Bernstein, 1994) to show adequate reliability. All the Cronbach's alpha and composite reliability values of the first-order constructs for the nurses' data are above 0.90. These values for the doctors' data are all greater than 0.80 (see Tables 6-1, and 6-2).

Table 6-1: Descriptive Statistics, and Reliability Measures (First-order Constructs) (Nurses)

Constructs	*No. of Items*	*Mean*	*Std. Dev.*	*Cronbach Alpha*	*Composite Reliability*
1. Information quality expectations	4	5.75	1.18	0.966	0.975
2. System quality expectations	5	5.82	1.13	0.963	0.971
3. Service quality expectations	2	5.61	1.07	0.933	0.967
4. Information quality expectations congruency	4	5.25	0.90	0.917	0.941
5. System quality expectations congruency	5	5.16	0.96	0.948	0.960
6. Service quality expectations congruency	2	5.22	1.07	0.952	0.976
7. Need for achievement	3	6.24	0.79	0.913	0.945
8. Need for affiliation	4	6.04	0.91	0.966	0.975
9. Need for achievement congruency	3	5.28	1.01	0.935	0.958
10. Need for affiliation congruency	4	5.28	1.00	0.969	0.977
11. Perceived CIS performance	6	5.54	0.92	0.924	0.941
12. Clinician satisfaction	4	5.44	0.96	0.969	0.977

Table 6-2: Descriptive Statistics, and Reliability Measures (First-order Constructs) (Doctors)

Constructs	*No. of Items*	*Mean*	*Std. Dev.*	*Cronbach Alpha*	*Composite Reliability*
1. Information quality expectations	4	6.00	1.02	0.954	0.967
2. System quality expectations	5	5.89	1.06	0.956	0.966
3. Service quality expectations	2	5.76	1.00	0.840	0.926
4. Information quality expectations congruency	4	4.93	0.98	0.904	0.933
5. System quality expectations congruency	5	4.67	1.06	0.914	0.936
6. Service quality expectations congruency	2	4.78	1.11	0.872	0.940
7. Need for achievement	3	6.30	0.96	0.933	0.957
8. Need for affiliation	4	6.27	0.91	0.972	0.979
9. Need for autonomy	4	6.18	0.90	0.921	0.944
10. Need for achievement congruency	3	4.92	0.95	0.887	0.930
11. Need for affiliation congruency	4	4.70	1.03	0.949	0.963
12. Need for autonomy congruency	4	4.94	1.00	0.928	0.949
13. Perceived CIS performance	6	4.89	1.04	0.860	0.896
14. Clinician satisfaction	4	4.58	1.18	0.967	0.976

Determining convergent validity requires all items to load highly on their hypothesized constructs with significant t-values (Gefen and Straub, 2005). All the item loadings of the first-order constructs fulfill this requirement in both of the user groups' data (Tables 6-3 and 6-4). In addition, the average variance extracted (AVE) of each construct should be greater than 0.50 (Fornell and Larcker, 1981). As shown in Tables 6-3 and 6-4, all the AVEs for the first-order constructs exceed this threshold.

Discriminant validity is assessed through items cross loadings pattern and AVE analysis. Discriminant validity is shown when items load more highly on their theoretically intended constructs rather than other constructs. In addition, the square root of AVE for each construct should be larger than the correlation among that construct and any other construct in the model (Gefen and Straub, 2005). Tables 6-5 and 6-6 show the items cross loadings for both of the user groups' data of this study. In the nurses' data, some of the item loadings from "information quality expectations", "system quality expectations", and "information quality expectation congruency" constructs seem to be close to their cross loadings. In the doctors' data, similar closeness in the value of item loadings and cross loadings can be observed in "information quality expectations" and "system quality expectations" constructs. Chin (2010) suggests that in such situations comparing squared item loadings and cross loadings provides a more intuitive interpretation, because these squared values show the percentage of an item overlap with each of the constructs. Squared item loadings and cross loadings are shown in Tables 6-7, and 6-8. Three items (INFQ 4, SYSQ 1, and INF-C4) in the nurses' data and three items in the doctors' data (INFQ 4, SYSQ 1, and SYSQ 5) show close overlap percentage with a construct other than their intended construct. Therefore, they are excluded from the rest of the data

analysis. Tables 6-9 to 6-12 illustrate the results of item loadings and cross loadings, and their squared values after omitting these items. All the items now load more highly on their own constructs. As shown in Tables 6-13 and 6-14, the AVE analyses are also satisfactory for both user groups.

Table 6-3: Convergent Validity Measures (Nurses)

Item	*Item Loading*	*T-Statistics*	*AVE*
INFQ1	0.955	115.651*	0.908
INFQ2	0.970	154.905*	
INFQ3	0.963	101.671*	
INFQ4	0.922	50.544*	
SYSQ1	0.930	64.894*	0.870
SYSQ2	0.935	70.384*	
SYSQ3	0.919	27.924*	
SYSQ4	0.928	48.092*	
SYSQ5	0.953	82.924*	
SERVQ1	0.972	162.685*	0.937
SERVQ2	0.963	93.218*	
INF-C1	0.901	69.144*	0.801
INF-C2	0.903	41.614*	
INF-C3	0.902	46.174*	
INF-C4	0.872	41.129*	
SYS-C1	0.912	68.080*	0.829
SYS-C2	0.930	82.843*	
SYS-C3	0.836	14.189*	
SYS-C4	0.942	105.051*	
SYS-C5	0.928	74.864*	
SERV-C1	0.977	211.561*	0.954
SERV-C2	0.977	211.845*	
NACH1	0.920	70.815*	0.852
NACH2	0.901	27.348*	
NACH3	0.948	98.736*	
NAFF1	0.917	41.027*	0.909
NAFF2	0.960	110.677*	
NAFF3	0.970	151.568*	
NAFF4	0.964	123.903*	
NACH-C1	0.938	96.033*	0.885
NACH-C2	0.933	74.713*	
NACH-C3	0.950	90.486*	
NAFF-C1	0.954	128.131*	0.914
NAFF-C2	0.964	156.088*	
NAFF-C3	0.946	111.648*	
NAFF-C4	0.960	117.177*	
PRF1	0.841	29.791*	0.726
PRF2	0.863	36.641*	
PRF3	0.761	21.713*	
PRF4	0.886	31.997*	
PRF5	0.889	28.537*	
PRF6	0.868	37.248*	
SAT1	0.951	109.528*	0.915
SAT2	0.960	136.343*	
SAT3	0.963	170.625*	
SAT4	0.952	106.849*	

*Significant at the 0.001 level

Table 6-4: Convergent Validity Measures (Doctors)

Item	*Item Loading*	*T-Statistics*	*AVE*
INFQ1	0.947	62.855*	0.880
INFQ2	0.957	75.792*	
INFQ3	0.918	31.222*	
INFQ4	0.928	51.997*	
SYSQ1	0.899	38.686*	0.851
SYSQ2	0.896	34.158*	
SYSQ3	0.925	47.368*	
SYSQ4	0.960	87.060*	
SYSQ5	0.931	36.252*	
SERVQ1	0.932	47.484*	0.862
SERVQ2	0.924	34.396*	
INF-C1	0.921	42.655*	0.778
INF-C2	0.866	26.895*	
INF-C3	0.914	44.692*	
INF-C4	0.824	24.918*	
SYS-C1	0.883	49.368*	0.744
SYS-C2	0.828	22.193*	
SYS-C3	0.884	33.641*	
SYS-C4	0.838	20.816*	
SYS-C5	0.878	32.553*	
SERV-C1	0.938	39.706*	0.886
SERV-C2	0.945	43.221*	
NACH1	0.928	52.194*	0.882
NACH2	0.932	45.114*	
NACH3	0.957	74.459*	
NAFF1	0.938	49.308*	0.922
NAFF2	0.967	85.167*	
NAFF3	0.966	78.973*	
NAFF4	0.969	82.883*	
NAUT1	0.892	29.471*	0.808
NAUT2	0.901	25.834*	
NAUT3	0.887	20.517*	
NAUT4	0.915	34.207*	
NACH-C1	0.880	32.753*	0.816
NACH-C2	0.911	44.596*	
NACH-C3	0.919	47.761*	
NAFF-C1	0.909	32.055*	0.867
NAFF-C2	0.939	50.190*	
NAFF-C3	0.931	45.082*	
NAFF-C4	0.944	57.914*	
NAUT-C1	0.923	57.329*	0.823
NAUT-C2	0.922	53.753*	
NAUT-C3	0.845	19.748*	
NAUT-C4	0.935	59.010*	
PRF1	0.715	13.191*	0.593
PRF2	0.875	40.028*	
PRF3	0.851	31.817*	
PRF4	0.758	17.924*	
PRF5	0.772	18.676*	
PRF6	0.623	6.907*	
SAT1	0.961	106.715*	0.909
SAT2	0.957	100.967*	
SAT3	0.929	62.429*	
SAT4	0.966	128.184*	

*Significant at the 0.001 level

Table 6-5: Item Loadings and Cross Loadings for the Measurement Model (1st) (Nurses)

	Inf-e	*Sys-e*	*Srv-e*	*Inf-c*	*Sys-c*	*Srv-c*	*Nach*	*Naff*	*Nac-c*	*Naf-c*	*Prf*	*Sat*
INFQ1	0.96	0.84	0.51	0.21	0.17	0.22	0.32	0.29	0.20	0.22	0.22	0.25
INFQ2	0.97	0.85	0.50	0.21	0.15	0.25	0.34	0.29	0.22	0.23	0.23	0.25
INFQ3	0.96	0.89	0.52	0.22	0.16	0.24	0.35	0.33	0.21	0.23	0.21	0.24
INFQ4	**0.92**	**0.87**	0.50	0.14	0.08	0.22	0.31	0.27	0.19	0.18	0.12	0.20
SYSQ1	**0.91**	**0.93**	0.54	0.21	0.15	0.26	0.32	0.31	0.21	0.19	0.18	0.22
SYSQ2	0.84	0.93	0.54	0.26	0.20	0.30	0.31	0.30	0.24	0.24	0.21	0.28
SYSQ3	0.82	0.92	0.53	0.22	0.18	0.26	0.32	0.30	0.24	0.21	0.20	0.25
SYSQ4	0.80	0.93	0.49	0.16	0.08	0.21	0.28	0.25	0.18	0.16	0.09	0.18
SYSQ5	0.86	0.95	0.51	0.23	0.18	0.25	0.31	0.31	0.20	0.20	0.16	0.24
SRVQ1	0.57	0.59	0.97	0.25	0.31	0.49	0.46	0.38	0.30	0.30	0.32	0.36
SRVQ2	0.46	0.49	0.96	0.30	0.36	0.52	0.40	0.34	0.32	0.32	0.36	0.37
INF-C1	0.13	0.14	0.25	0.90	0.72	0.52	0.28	0.30	0.58	0.59	0.52	0.56
INF-C2	0.19	0.22	0.23	0.90	0.73	0.49	0.23	0.25	0.58	0.60	0.52	0.56
INF-C3	0.25	0.27	0.28	0.90	0.76	0.60	0.27	0.38	0.57	0.59	0.53	0.51
INF-C4	0.17	0.20	0.26	**0.87**	**0.80**	0.56	0.30	0.34	0.59	0.64	0.57	0.56
SYS-C1	0.19	0.21	0.32	0.80	0.91	0.55	0.27	0.36	0.64	0.66	0.63	0.63
SYS-C2	0.11	0.15	0.29	0.80	0.93	0.58	0.25	0.35	0.63	0.69	0.61	0.61
SYS-C3	0.13	0.14	0.33	0.70	0.84	0.52	0.22	0.21	0.55	0.62	0.55	0.63
SYS-C4	0.11	0.13	0.31	0.77	0.94	0.56	0.24	0.34	0.60	0.64	0.64	0.63
SYS-C5	0.14	0.14	0.31	0.76	0.93	0.56	0.28	0.36	0.58	0.63	0.60	0.58
SRV-C1	0.23	0.28	0.53	0.59	0.60	0.98	0.32	0.35	0.56	0.55	0.56	0.51
SRV-C2	0.25	0.26	0.49	0.59	0.59	0.98	0.28	0.33	0.56	0.56	0.57	0.53
NACH1	0.31	0.29	0.45	0.31	0.29	0.37	0.92	0.73	0.41	0.41	0.46	0.39
NACH2	0.31	0.29	0.38	0.21	0.19	0.20	0.90	0.64	0.25	0.26	0.34	0.25
NACH3	0.34	0.35	0.40	0.32	0.28	0.27	0.95	0.74	0.34	0.36	0.42	0.36
NAFF1	0.33	0.35	0.34	0.32	0.32	0.34	0.69	0.92	0.37	0.36	0.43	0.31
NAFF2	0.26	0.26	0.33	0.35	0.34	0.32	0.74	0.96	0.37	0.41	0.45	0.33
NAFF3	0.30	0.29	0.39	0.36	0.36	0.35	0.73	0.97	0.39	0.40	0.44	0.33
NAFF4	0.30	0.30	0.36	0.34	0.35	0.33	0.76	0.96	0.41	0.41	0.45	0.33
NAC-C1	0.17	0.18	0.26	0.63	0.65	0.53	0.35	0.40	0.94	0.82	0.64	0.62
NAC-C2	0.24	0.26	0.33	0.57	0.58	0.54	0.30	0.32	0.93	0.79	0.62	0.61
NAC-C3	0.20	0.21	0.32	0.63	0.64	0.54	0.37	0.42	0.95	0.85	0.67	0.68
NAF-C1	0.23	0.23	0.34	0.65	0.70	0.57	0.38	0.40	0.85	0.95	0.67	0.70
NAF-C2	0.21	0.21	0.33	0.63	0.66	0.56	0.36	0.41	0.83	0.96	0.66	0.68
NAF-C3	0.18	0.16	0.25	0.64	0.69	0.52	0.32	0.38	0.82	0.95	0.68	0.71
NAF-C4	0.24	0.22	0.30	0.66	0.67	0.53	0.38	0.40	0.84	0.96	0.68	0.71
PRF1	0.29	0.28	0.34	0.54	0.58	0.48	0.48	0.52	0.58	0.61	0.84	0.65
PRF2	0.17	0.17	0.28	0.49	0.54	0.46	0.39	0.41	0.54	0.56	0.86	0.62
PRF3	0.12	0.09	0.20	0.45	0.58	0.45	0.23	0.24	0.59	0.57	0.76	0.66
PRF4	0.13	0.11	0.28	0.50	0.57	0.50	0.34	0.35	0.56	0.61	0.89	0.64
PRF5	0.14	0.12	0.35	0.53	0.56	0.57	0.39	0.43	0.58	0.60	0.89	0.62
PRF6	0.18	0.16	0.31	0.55	0.57	0.50	0.43	0.43	0.65	0.65	0.87	0.65
SAT1	0.21	0.22	0.33	0.57	0.61	0.48	0.37	0.31	0.63	0.69	0.71	0.95
SAT2	0.27	0.27	0.37	0.59	0.64	0.52	0.35	0.32	0.65	0.70	0.71	0.96
SAT3	0.24	0.25	0.38	0.57	0.65	0.52	0.33	0.31	0.68	0.72	0.71	0.96
SAT4	0.23	0.23	0.34	0.61	0.68	0.51	0.35	0.36	0.63	0.69	0.75	0.95

Table 6-6: Item Loadings and Cross Loadings for the Measurement Model (1st) (Doctors)

	Inf-e	Sys-e	Srv-e	Inf-c	Sys-c	Srv-c	Nach	Naff	Naut	Nac-c	Naf-c	Nat-c	Prf	Sat
INFQ1	0.95	0.86	0.61	0.23	0.12	0.06	0.65	0.55	0.48	0.01	-0.08	0.00	-0.02	0.06
INFQ2	0.96	0.87	0.70	0.24	0.09	0.08	0.59	0.55	0.54	0.04	-0.06	0.04	-0.01	0.00
INFQ3	0.92	0.82	0.64	0.21	0.03	0.18	0.57	0.55	0.51	0.06	-0.03	0.06	-0.01	-0.02
INFQ4	**0.93**	**0.89**	0.60	0.16	0.07	0.08	0.58	0.52	0.49	0.03	-0.13	-0.01	-0.04	-0.01
SYSQ1	**0.92**	**0.90**	0.67	0.25	0.13	0.13	0.53	0.51	0.51	0.07	-0.04	0.05	0.03	0.09
SYSQ2	0.77	0.90	0.57	0.18	0.17	0.05	0.45	0.45	0.38	0.10	-0.06	0.12	0.12	0.14
SYSQ3	0.79	0.93	0.58	0.13	0.16	-0.01	0.50	0.48	0.43	0.02	-0.07	0.05	0.02	0.01
SYSQ4	0.85	0.96	0.62	0.18	0.10	0.06	0.52	0.53	0.47	0.05	-0.03	0.09	0.02	0.07
SYSQ5	**0.88**	**0.93**	0.67	0.17	0.12	0.14	0.56	0.56	0.51	0.04	0.00	0.06	0.00	0.05
SRVQ1	0.65	0.65	0.93	0.08	0.02	0.10	0.45	0.51	0.52	-0.02	-0.04	0.07	0.07	-0.04
SRVQ2	0.61	0.61	0.92	0.15	0.08	0.07	0.39	0.42	0.52	0.03	0.00	0.10	0.11	0.07
INF-C1	0.29	0.24	0.19	0.92	0.70	0.40	0.35	0.29	0.32	0.48	0.43	0.45	0.48	0.53
INF-C2	0.24	0.24	0.23	0.87	0.62	0.31	0.27	0.22	0.33	0.45	0.50	0.48	0.48	0.51
INF-C3	0.25	0.21	0.07	0.91	0.66	0.34	0.34	0.30	0.35	0.51	0.48	0.47	0.42	0.50
INF-C4	0.01	0.00	-0.06	0.82	0.72	0.27	0.15	0.10	0.12	0.53	0.50	0.55	0.54	0.58
SYS-C1	0.19	0.22	0.09	0.70	0.88	0.27	0.37	0.24	0.25	0.46	0.43	0.45	0.54	0.61
SYS-C2	-0.07	0.00	-0.01	0.64	0.83	0.29	0.07	0.09	0.12	0.45	0.49	0.48	0.66	0.65
SYS-C3	0.10	0.18	-0.01	0.66	0.88	0.29	0.23	0.16	0.20	0.49	0.50	0.47	0.52	0.64
SYS-C4	0.04	0.07	0.09	0.67	0.84	0.26	0.11	0.05	0.27	0.54	0.61	0.50	0.55	0.68
SYS-C5	0.09	0.14	0.07	0.62	0.88	0.33	0.21	0.16	0.16	0.54	0.61	0.56	0.42	0.57
SRV-C1	0.12	0.09	0.10	0.32	0.32	0.94	0.15	0.16	0.16	0.38	0.36	0.31	0.36	0.29
SRV-C2	0.08	0.06	0.07	0.38	0.31	0.94	0.03	0.09	0.15	0.36	0.35	0.34	0.38	0.28
NACH1	0.59	0.51	0.42	0.24	0.23	0.08	0.93	0.77	0.66	0.14	0.08	0.14	0.04	0.13
NACH2	0.63	0.52	0.46	0.32	0.16	0.14	0.93	0.80	0.67	0.14	0.04	0.15	0.11	0.07
NACH3	0.58	0.54	0.39	0.34	0.27	0.05	0.96	0.80	0.68	0.18	0.08	0.18	0.10	0.14
NAFF1	0.56	0.52	0.48	0.22	0.10	0.14	0.79	0.94	0.78	0.10	0.04	0.11	0.03	-0.02
NAFF2	0.50	0.50	0.47	0.28	0.19	0.14	0.81	0.97	0.72	0.18	0.09	0.15	0.13	0.08
NAFF3	0.56	0.54	0.48	0.26	0.19	0.13	0.80	0.97	0.69	0.18	0.10	0.19	0.12	0.09
NAFF4	0.59	0.55	0.50	0.23	0.15	0.10	0.83	0.97	0.72	0.16	0.05	0.15	0.11	0.05
NAUT1	0.50	0.44	0.43	0.22	0.18	0.10	0.70	0.72	0.89	0.13	0.09	0.14	0.04	0.02
NAUT2	0.43	0.40	0.53	0.27	0.20	0.18	0.57	0.61	0.90	0.10	0.16	0.18	0.11	0.14
NAUT3	0.54	0.52	0.53	0.34	0.20	0.16	0.59	0.62	0.89	0.15	0.10	0.14	0.16	0.19
NAUT4	0.46	0.44	0.53	0.31	0.24	0.15	0.70	0.75	0.91	0.22	0.16	0.23	0.17	0.13
NAC-C1	0.05	0.10	0.01	0.50	0.51	0.33	0.19	0.16	0.18	0.88	0.67	0.69	0.50	0.51
NAC-C2	0.04	0.06	0.01	0.45	0.47	0.40	0.10	0.17	0.15	0.91	0.72	0.73	0.45	0.50
NAC-C3	0.02	0.01	0.00	0.56	0.57	0.33	0.16	0.12	0.13	0.92	0.75	0.77	0.52	0.57
NAF-C1	-0.04	0.00	-0.06	0.48	0.55	0.33	0.06	0.06	0.10	0.73	0.91	0.74	0.44	0.49
NAF-C2	0.01	0.03	0.02	0.54	0.62	0.35	0.18	0.14	0.17	0.72	0.94	0.74	0.48	0.59
NAF-C3	-0.09	-0.05	-0.01	0.50	0.53	0.37	0.00	0.02	0.13	0.73	0.93	0.76	0.48	0.57
NAF-C4	-0.16	-0.14	-0.05	0.50	0.57	0.35	0.04	0.05	0.14	0.76	0.94	0.79	0.47	0.57
NAT-C1	0.07	0.10	0.08	0.49	0.49	0.31	0.22	0.22	0.20	0.78	0.75	0.92	0.54	0.49
NAT-C2	0.03	0.10	0.09	0.45	0.49	0.30	0.16	0.14	0.15	0.74	0.69	0.92	0.52	0.51
NAT-C3	0.00	0.05	0.10	0.46	0.50	0.32	0.12	0.13	0.22	0.65	0.70	0.84	0.44	0.48
NAT-C4	-0.01	0.05	0.06	0.59	0.60	0.32	0.10	0.08	0.13	0.76	0.80	0.94	0.59	0.57
PRF1	-0.04	-0.02	0.01	0.32	0.41	0.18	0.05	0.02	0.02	0.48	0.38	0.41	0.71	0.53
PRF2	-0.03	0.02	0.05	0.46	0.56	0.33	0.07	0.04	0.06	0.42	0.41	0.51	0.87	0.59
PRF3	-0.06	0.00	0.04	0.49	0.58	0.33	0.09	0.09	0.09	0.40	0.41	0.47	0.85	0.61
PRF4	-0.07	0.02	0.08	0.37	0.51	0.38	0.02	0.11	0.11	0.43	0.46	0.47	0.76	0.55
PRF5	0.04	0.07	0.09	0.49	0.50	0.28	0.10	0.12	0.16	0.44	0.36	0.45	0.77	0.61
PRF6	0.08	0.10	0.20	0.33	0.24	0.32	0.09	0.08	0.19	0.35	0.27	0.35	0.62	0.45
SAT1	0.03	0.09	0.05	0.57	0.69	0.27	0.13	0.07	0.12	0.54	0.56	0.54	0.70	0.96
SAT2	0.04	0.10	0.05	0.61	0.71	0.28	0.17	0.09	0.18	0.56	0.59	0.57	0.66	0.96
SAT3	-0.05	0.02	-0.06	0.51	0.63	0.32	0.06	0.00	0.07	0.53	0.53	0.50	0.68	0.93
SAT4	0.01	0.07	0.03	0.61	0.75	0.29	0.11	0.04	0.12	0.58	0.59	0.54	0.73	0.97

Table 6-7: Squared Item and Cross Loadings for the Measurement Model (1st) (Nurses)

	Inf-e	*Sys-e*	*Srv-e*	*Inf-c*	*Sys-c*	*Srv-c*	*Nach*	*Naff*	*Nac-c*	*Naf-c*	*Prf*	*Sat*
INFQ1	0.91	0.71	0.26	0.04	0.03	0.05	0.10	0.09	0.04	0.05	0.05	0.06
INFQ2	0.94	0.73	0.25	0.05	0.02	0.06	0.12	0.09	0.05	0.05	0.05	0.06
INFQ3	0.93	0.79	0.27	0.05	0.03	0.06	0.13	0.11	0.04	0.05	0.04	0.06
INFQ4	**0.85**	**0.76**	0.25	0.02	0.01	0.05	0.10	0.08	0.04	0.03	0.02	0.04
SYSQ1	**0.82**	**0.86**	0.29	0.04	0.02	0.07	0.10	0.09	0.04	0.04	0.03	0.05
SYSQ2	0.71	0.87	0.29	0.07	0.04	0.09	0.10	0.09	0.06	0.06	0.05	0.08
SYSQ3	0.67	0.84	0.28	0.05	0.03	0.07	0.10	0.09	0.06	0.04	0.04	0.06
SYSQ4	0.65	0.86	0.24	0.03	0.01	0.05	0.08	0.06	0.03	0.03	0.01	0.03
SYSQ5	0.73	0.91	0.26	0.05	0.03	0.06	0.10	0.10	0.04	0.04	0.03	0.06
SRVQ1	0.32	0.35	0.95	0.06	0.09	0.24	0.21	0.14	0.09	0.09	0.10	0.13
SRVQ2	0.21	0.24	0.93	0.09	0.13	0.27	0.16	0.12	0.10	0.10	0.13	0.13
INF-C1	0.02	0.02	0.06	0.81	0.52	0.27	0.08	0.09	0.34	0.34	0.28	0.31
INF-C2	0.04	0.05	0.05	0.82	0.53	0.24	0.06	0.06	0.34	0.36	0.27	0.31
INF-C3	0.06	0.07	0.08	0.81	0.58	0.36	0.07	0.14	0.33	0.35	0.28	0.26
INF-C4	0.03	0.04	0.07	**0.76**	**0.64**	0.31	0.09	0.11	0.34	0.40	0.33	0.32
SYS-C1	0.03	0.05	0.10	0.64	0.83	0.30	0.07	0.13	0.41	0.44	0.40	0.40
SYS-C2	0.01	0.02	0.08	0.63	0.87	0.33	0.06	0.12	0.40	0.47	0.38	0.37
SYS-C3	0.02	0.02	0.11	0.49	0.70	0.27	0.05	0.05	0.30	0.38	0.30	0.39
SYS-C4	0.01	0.02	0.10	0.59	0.89	0.32	0.06	0.12	0.37	0.41	0.41	0.40
SYS-C5	0.02	0.02	0.10	0.58	0.86	0.32	0.08	0.13	0.34	0.40	0.36	0.33
SRV-C1	0.05	0.08	0.28	0.35	0.36	0.95	0.10	0.12	0.31	0.31	0.31	0.26
SRV-C2	0.06	0.07	0.24	0.35	0.35	0.95	0.08	0.11	0.31	0.31	0.33	0.28
NACH1	0.10	0.08	0.20	0.10	0.08	0.14	0.85	0.53	0.17	0.17	0.21	0.15
NACH2	0.10	0.08	0.15	0.04	0.04	0.04	0.81	0.41	0.06	0.07	0.12	0.06
NACH3	0.12	0.12	0.16	0.10	0.08	0.07	0.90	0.55	0.12	0.13	0.18	0.13
NAFF1	0.11	0.12	0.12	0.10	0.10	0.12	0.47	0.84	0.14	0.13	0.18	0.09
NAFF2	0.07	0.07	0.11	0.12	0.11	0.10	0.55	0.92	0.14	0.17	0.20	0.11
NAFF3	0.09	0.09	0.15	0.13	0.13	0.12	0.53	0.94	0.15	0.16	0.20	0.11
NAFF4	0.09	0.09	0.13	0.11	0.12	0.11	0.58	0.93	0.17	0.17	0.21	0.11
NAC-C1	0.03	0.03	0.07	0.39	0.42	0.28	0.13	0.16	0.88	0.67	0.41	0.39
NAC-C2	0.06	0.07	0.11	0.33	0.34	0.29	0.09	0.10	0.87	0.62	0.39	0.37
NAC-C3	0.04	0.05	0.10	0.40	0.40	0.29	0.14	0.17	0.90	0.72	0.45	0.46
NAF-C1	0.05	0.05	0.12	0.42	0.49	0.32	0.14	0.16	0.72	0.91	0.45	0.48
NAF-C2	0.04	0.05	0.11	0.40	0.44	0.31	0.13	0.17	0.69	0.93	0.44	0.46
NAF-C3	0.03	0.03	0.06	0.41	0.48	0.27	0.10	0.14	0.67	0.90	0.46	0.51
NAF-C4	0.06	0.05	0.09	0.43	0.45	0.28	0.14	0.16	0.70	0.92	0.47	0.50
PRF1	0.09	0.08	0.12	0.29	0.33	0.23	0.23	0.27	0.34	0.37	0.71	0.42
PRF2	0.03	0.03	0.08	0.24	0.29	0.21	0.15	0.17	0.29	0.32	0.74	0.39
PRF3	0.01	0.01	0.04	0.21	0.34	0.20	0.05	0.06	0.34	0.32	0.58	0.44
PRF4	0.02	0.01	0.08	0.25	0.33	0.25	0.11	0.12	0.32	0.37	0.78	0.41
PRF5	0.02	0.02	0.12	0.28	0.31	0.32	0.15	0.18	0.34	0.36	0.79	0.38
PRF6	0.03	0.02	0.10	0.30	0.33	0.25	0.18	0.19	0.43	0.42	0.75	0.42
SAT1	0.05	0.05	0.11	0.33	0.38	0.23	0.14	0.10	0.40	0.47	0.50	0.90
SAT2	0.07	0.07	0.14	0.35	0.41	0.27	0.12	0.10	0.42	0.49	0.50	0.92
SAT3	0.06	0.06	0.15	0.33	0.42	0.27	0.11	0.10	0.46	0.52	0.51	0.93
SAT4	0.05	0.05	0.12	0.37	0.47	0.26	0.12	0.13	0.40	0.48	0.56	0.91

Table 6-8: Squared Item and Cross Loadings for the Measurement Model (1st) (Doctors)

	Inf-e	Sys-e	Srv-e	Inf-c	Sys-c	Srv-c	Nach	Naff	Naut	Nac-c	Naff-c	Nat-c	Prf	Sat
INFQ1	0.90	0.74	0.37	0.05	0.01	0.00	0.43	0.30	0.23	0.00	0.01	0.00	0.00	0.00
INFQ2	0.92	0.75	0.49	0.06	0.01	0.01	0.34	0.30	0.29	0.00	0.00	0.00	0.00	0.00
INFQ3	0.84	0.67	0.41	0.04	0.00	0.03	0.33	0.30	0.26	0.00	0.00	0.00	0.00	0.00
INFQ4	0.86	0.79	0.36	0.03	0.01	0.01	0.34	0.27	0.24	0.00	0.02	0.00	0.00	0.00
SYSQ1	0.85	0.81	0.46	0.06	0.02	0.02	0.28	0.26	0.26	0.00	0.00	0.00	0.00	0.01
SYSQ2	0.60	0.80	0.32	0.03	0.03	0.00	0.20	0.20	0.14	0.01	0.00	0.02	0.01	0.02
SYSQ3	0.63	0.86	0.33	0.02	0.02	0.00	0.25	0.23	0.18	0.00	0.01	0.00	0.00	0.00
SYSQ4	0.72	0.92	0.38	0.03	0.01	0.00	0.27	0.28	0.22	0.00	0.00	0.01	0.00	0.00
SYSQ5	0.77	0.87	0.45	0.03	0.01	0.02	0.31	0.31	0.26	0.00	0.00	0.00	0.00	0.00
SRVQ1	0.42	0.42	0.87	0.01	0.00	0.01	0.20	0.26	0.27	0.00	0.00	0.00	0.00	0.00
SRVQ2	0.37	0.37	0.85	0.02	0.01	0.00	0.15	0.18	0.27	0.00	0.00	0.01	0.01	0.01
INF-C1	0.08	0.06	0.04	0.85	0.49	0.16	0.13	0.08	0.10	0.23	0.19	0.21	0.23	0.28
INF-C2	0.06	0.06	0.05	0.75	0.38	0.10	0.07	0.05	0.11	0.20	0.25	0.23	0.23	0.26
INF-C3	0.06	0.05	0.00	0.84	0.44	0.11	0.11	0.09	0.12	0.26	0.23	0.22	0.17	0.25
INF-C4	0.00	0.00	0.00	0.68	0.51	0.07	0.02	0.01	0.01	0.28	0.25	0.31	0.29	0.34
SYS-C1	0.03	0.05	0.01	0.49	0.78	0.07	0.14	0.06	0.06	0.21	0.19	0.21	0.29	0.37
SYS-C2	0.00	0.00	0.00	0.41	0.69	0.08	0.01	0.01	0.01	0.21	0.24	0.23	0.44	0.43
SYS-C3	0.01	0.03	0.00	0.43	0.78	0.08	0.05	0.02	0.04	0.24	0.25	0.22	0.27	0.41
SYS-C4	0.00	0.01	0.01	0.45	0.70	0.07	0.01	0.00	0.07	0.29	0.37	0.25	0.30	0.46
SYS-C5	0.01	0.02	0.01	0.39	0.77	0.11	0.05	0.03	0.03	0.29	0.37	0.32	0.17	0.33
SRV-C1	0.01	0.01	0.01	0.10	0.10	0.88	0.02	0.03	0.03	0.15	0.13	0.10	0.13	0.08
SRV-C2	0.01	0.00	0.00	0.15	0.10	0.89	0.00	0.01	0.02	0.13	0.12	0.11	0.15	0.08
NACH1	0.34	0.26	0.18	0.06	0.05	0.01	0.86	0.59	0.44	0.02	0.01	0.02	0.00	0.02
NACH2	0.40	0.27	0.21	0.10	0.03	0.02	0.87	0.64	0.45	0.02	0.00	0.02	0.01	0.01
NACH3	0.34	0.29	0.15	0.11	0.07	0.00	0.92	0.64	0.47	0.03	0.01	0.03	0.01	0.02
NAFF1	0.31	0.27	0.23	0.05	0.01	0.02	0.63	0.88	0.60	0.01	0.00	0.01	0.00	0.00
NAFF2	0.25	0.25	0.22	0.08	0.04	0.02	0.66	0.94	0.52	0.03	0.01	0.02	0.02	0.01
NAFF3	0.32	0.29	0.23	0.07	0.04	0.02	0.63	0.93	0.48	0.03	0.01	0.04	0.01	0.01
NAFF4	0.35	0.30	0.25	0.05	0.02	0.01	0.69	0.94	0.52	0.02	0.00	0.02	0.01	0.00
NAUT1	0.25	0.19	0.18	0.05	0.03	0.01	0.49	0.52	0.80	0.02	0.01	0.02	0.00	0.00
NAUT2	0.18	0.16	0.28	0.07	0.04	0.03	0.33	0.38	0.81	0.01	0.03	0.03	0.01	0.02
NAUT3	0.29	0.27	0.28	0.11	0.04	0.03	0.35	0.39	0.79	0.02	0.01	0.02	0.03	0.04
NAUT4	0.21	0.19	0.28	0.09	0.06	0.02	0.49	0.56	0.84	0.05	0.02	0.05	0.03	0.02
NAC-C1	0.00	0.01	0.00	0.25	0.27	0.11	0.04	0.02	0.03	0.77	0.45	0.47	0.25	0.26
NAC-C2	0.00	0.00	0.00	0.20	0.22	0.16	0.01	0.03	0.02	0.83	0.52	0.53	0.20	0.25
NAC-C3	0.00	0.00	0.00	0.31	0.32	0.11	0.03	0.01	0.02	0.85	0.56	0.59	0.27	0.33
NAF-C1	0.00	0.00	0.00	0.23	0.30	0.11	0.00	0.00	0.01	0.53	0.83	0.55	0.19	0.24
NAF-C2	0.00	0.00	0.00	0.29	0.38	0.12	0.03	0.02	0.03	0.52	0.88	0.55	0.23	0.34
NAF-C3	0.01	0.00	0.00	0.25	0.29	0.13	0.00	0.00	0.02	0.53	0.87	0.58	0.23	0.32
NAF-C4	0.03	0.02	0.00	0.25	0.32	0.12	0.00	0.00	0.02	0.58	0.89	0.63	0.22	0.32
NAT-C1	0.00	0.01	0.01	0.24	0.24	0.10	0.05	0.05	0.04	0.60	0.56	0.85	0.29	0.24
NAT-C2	0.00	0.01	0.01	0.21	0.24	0.09	0.03	0.02	0.02	0.54	0.48	0.85	0.27	0.26
NAT-C3	0.00	0.00	0.01	0.21	0.25	0.11	0.01	0.02	0.05	0.42	0.50	0.71	0.20	0.23
NAT-C4	0.00	0.00	0.00	0.35	0.36	0.10	0.01	0.01	0.02	0.57	0.65	0.87	0.35	0.32
PRF1	0.00	0.00	0.00	0.11	0.17	0.03	0.00	0.00	0.00	0.23	0.14	0.17	0.51	0.28
PRF2	0.00	0.00	0.00	0.22	0.31	0.11	0.00	0.00	0.00	0.17	0.17	0.26	0.77	0.35
PRF3	0.00	0.00	0.00	0.24	0.34	0.11	0.01	0.01	0.01	0.16	0.17	0.22	0.72	0.37
PRF4	0.00	0.00	0.01	0.14	0.26	0.15	0.00	0.01	0.01	0.18	0.22	0.22	0.57	0.30
PRF5	0.00	0.00	0.01	0.24	0.25	0.08	0.01	0.02	0.03	0.20	0.13	0.20	0.60	0.37
PRF6	0.01	0.01	0.04	0.11	0.06	0.10	0.01	0.01	0.04	0.12	0.07	0.12	0.39	0.21
SAT1	0.00	0.01	0.00	0.32	0.48	0.07	0.02	0.00	0.01	0.29	0.32	0.29	0.49	0.92
SAT2	0.00	0.01	0.00	0.38	0.51	0.08	0.03	0.01	0.03	0.32	0.35	0.33	0.44	0.92
SAT3	0.00	0.00	0.00	0.26	0.40	0.10	0.00	0.00	0.01	0.28	0.28	0.25	0.46	0.86
SAT4	0.00	0.01	0.00	0.37	0.56	0.08	0.01	0.00	0.02	0.34	0.35	0.30	0.53	0.93

Table 6-9: Item Loadings and Cross Loadings for the Measurement Model (2nd) (Nurses)

	Inf-e	*Sys-e*	*Srv-e*	*Inf-c*	*Sys-c*	*Srv-c*	*Nach*	*Naff*	*Nac-c*	*Naf-c*	*Prf*	*Sat*
INFQ1	0.97	0.81	0.51	0.21	0.17	0.22	0.32	0.29	0.20	0.22	0.22	0.25
INFQ2	0.98	0.83	0.50	0.22	0.15	0.25	0.34	0.29	0.22	0.23	0.23	0.25
INFQ3	0.97	0.87	0.52	0.22	0.16	0.24	0.35	0.33	0.21	0.23	0.21	0.24
SYSQ2	0.82	0.93	0.54	0.26	0.20	0.30	0.31	0.30	0.24	0.24	0.21	0.28
SYSQ3	0.80	0.93	0.53	0.22	0.18	0.26	0.32	0.30	0.24	0.21	0.20	0.25
SYSQ4	0.77	0.94	0.49	0.15	0.08	0.21	0.28	0.25	0.18	0.16	0.09	0.18
SYSQ5	0.84	0.95	0.51	0.22	0.18	0.25	0.31	0.31	0.20	0.20	0.16	0.24
SRVQ1	0.56	0.58	0.97	0.25	0.31	0.49	0.46	0.38	0.30	0.30	0.32	0.36
SRVQ2	0.45	0.49	0.96	0.28	0.36	0.52	0.40	0.34	0.32	0.32	0.36	0.37
INF-C1	0.15	0.14	0.25	0.92	0.72	0.52	0.28	0.30	0.58	0.59	0.52	0.56
INF-C2	0.21	0.22	0.23	0.93	0.73	0.49	0.23	0.25	0.58	0.60	0.52	0.56
INF-C3	0.25	0.27	0.28	0.90	0.76	0.60	0.27	0.38	0.57	0.59	0.53	0.51
SYS-C1	0.21	0.22	0.32	0.78	0.91	0.55	0.27	0.36	0.64	0.66	0.63	0.63
SYS-C2	0.12	0.16	0.29	0.75	0.93	0.58	0.25	0.35	0.63	0.69	0.61	0.61
SYS-C3	0.15	0.14	0.33	0.68	0.84	0.52	0.22	0.21	0.55	0.62	0.55	0.63
SYS-C4	0.12	0.13	0.31	0.72	0.94	0.56	0.24	0.34	0.60	0.64	0.64	0.63
SYS-C5	0.15	0.14	0.31	0.72	0.93	0.56	0.28	0.36	0.58	0.63	0.60	0.58
SRV-C1	0.23	0.28	0.53	0.57	0.60	0.98	0.32	0.35	0.56	0.55	0.56	0.51
SRV-C2	0.25	0.25	0.49	0.57	0.59	0.98	0.28	0.33	0.56	0.56	0.57	0.53
NACH1	0.31	0.29	0.45	0.29	0.29	0.37	0.92	0.73	0.41	0.41	0.46	0.39
NACH2	0.32	0.27	0.38	0.19	0.19	0.20	0.90	0.64	0.25	0.26	0.34	0.25
NACH3	0.34	0.35	0.40	0.30	0.28	0.27	0.95	0.74	0.34	0.36	0.42	0.36
NAFF1	0.33	0.35	0.34	0.31	0.32	0.34	0.69	0.92	0.37	0.36	0.43	0.31
NAFF2	0.27	0.26	0.33	0.33	0.34	0.32	0.74	0.96	0.37	0.41	0.45	0.33
NAFF3	0.30	0.29	0.39	0.34	0.36	0.35	0.73	0.97	0.39	0.40	0.44	0.33
NAFF4	0.30	0.30	0.36	0.32	0.35	0.33	0.76	0.96	0.41	0.41	0.45	0.33
NAC-C1	0.17	0.18	0.26	0.61	0.65	0.53	0.35	0.40	0.94	0.82	0.64	0.62
NAC-C2	0.24	0.26	0.33	0.55	0.59	0.54	0.30	0.32	0.93	0.79	0.62	0.61
NAC-C3	0.20	0.21	0.32	0.62	0.64	0.54	0.37	0.42	0.95	0.85	0.67	0.68
NAF-C1	0.24	0.23	0.34	0.62	0.70	0.57	0.38	0.40	0.85	0.95	0.67	0.70
NAF-C2	0.22	0.22	0.33	0.61	0.66	0.56	0.36	0.41	0.83	0.96	0.66	0.68
NAF-C3	0.19	0.16	0.25	0.61	0.69	0.52	0.32	0.38	0.82	0.95	0.68	0.71
NAF-C4	0.24	0.22	0.30	0.63	0.67	0.53	0.38	0.40	0.84	0.96	0.68	0.71
PRF1	0.31	0.28	0.34	0.51	0.58	0.48	0.48	0.52	0.58	0.61	0.84	0.65
PRF2	0.18	0.17	0.28	0.46	0.54	0.46	0.39	0.41	0.54	0.56	0.86	0.62
PRF3	0.14	0.08	0.20	0.44	0.58	0.45	0.23	0.24	0.59	0.57	0.76	0.66
PRF4	0.15	0.10	0.28	0.47	0.57	0.50	0.34	0.35	0.56	0.61	0.89	0.64
PRF5	0.16	0.12	0.35	0.51	0.56	0.57	0.39	0.43	0.58	0.60	0.89	0.62
PRF6	0.19	0.15	0.31	0.51	0.57	0.50	0.43	0.43	0.65	0.65	0.87	0.65
SAT1	0.22	0.22	0.33	0.55	0.61	0.48	0.37	0.31	0.63	0.69	0.71	0.95
SAT2	0.27	0.27	0.37	0.57	0.64	0.52	0.35	0.32	0.65	0.70	0.71	0.96
SAT3	0.25	0.25	0.38	0.55	0.65	0.52	0.33	0.31	0.68	0.72	0.71	0.96
SAT4	0.23	0.24	0.34	0.58	0.68	0.51	0.35	0.36	0.63	0.69	0.75	0.95

Table 6-10: Squared Item and Cross Loadings for the Measurement Model (2nd) (Nurses)

	Inf-e	*Sys-e*	*Srv-e*	*Inf-c*	*Sys-c*	*Srv-c*	*Nach*	*Naff*	*Nac-c*	*Naf-c*	*Prf*	*Sat*
INFQ1	0.94	0.66	0.26	0.04	0.03	0.05	0.10	0.09	0.04	0.05	0.05	0.06
INFQ2	0.96	0.68	0.25	0.05	0.02	0.06	0.12	0.09	0.05	0.05	0.05	0.06
INFQ3	0.94	0.76	0.27	0.05	0.03	0.06	0.13	0.11	0.04	0.05	0.04	0.06
SYSQ2	0.67	0.87	0.29	0.07	0.04	0.09	0.10	0.09	0.06	0.06	0.05	0.08
SYSQ3	0.64	0.87	0.28	0.05	0.03	0.07	0.10	0.09	0.06	0.04	0.04	0.06
SYSQ4	0.59	0.88	0.24	0.02	0.01	0.05	0.08	0.06	0.03	0.03	0.01	0.03
SYSQ5	0.71	0.91	0.26	0.05	0.03	0.06	0.10	0.10	0.04	0.04	0.03	0.06
SRVQ1	0.32	0.33	0.94	0.06	0.09	0.24	0.21	0.14	0.09	0.09	0.10	0.13
SRVQ2	0.20	0.24	0.93	0.08	0.13	0.27	0.16	0.12	0.10	0.10	0.13	0.13
INF-C1	0.02	0.02	0.06	0.85	0.52	0.27	0.08	0.09	0.34	0.34	0.28	0.31
INF-C2	0.04	0.05	0.05	0.86	0.53	0.24	0.06	0.06	0.34	0.36	0.27	0.31
INF-C3	0.06	0.07	0.08	0.82	0.58	0.36	0.07	0.14	0.33	0.35	0.28	0.26
SYS-C1	0.04	0.05	0.10	0.61	0.83	0.30	0.07	0.13	0.41	0.44	0.40	0.40
SYS-C2	0.01	0.02	0.08	0.57	0.87	0.33	0.06	0.12	0.40	0.47	0.38	0.37
SYS-C3	0.02	0.02	0.11	0.46	0.70	0.27	0.05	0.05	0.30	0.38	0.30	0.39
SYS-C4	0.02	0.02	0.10	0.52	0.89	0.32	0.06	0.12	0.37	0.41	0.41	0.40
SYS-C5	0.02	0.02	0.10	0.52	0.86	0.32	0.08	0.13	0.34	0.40	0.36	0.33
SRV-C1	0.05	0.08	0.28	0.33	0.36	0.95	0.10	0.12	0.31	0.31	0.31	0.26
SRV-C2	0.06	0.06	0.24	0.33	0.35	0.95	0.08	0.11	0.31	0.31	0.33	0.28
NACH1	0.09	0.08	0.20	0.08	0.08	0.14	0.85	0.53	0.17	0.17	0.21	0.15
NACH2	0.10	0.07	0.15	0.04	0.04	0.04	0.81	0.41	0.06	0.07	0.12	0.06
NACH3	0.12	0.12	0.16	0.09	0.08	0.07	0.90	0.55	0.12	0.13	0.18	0.13
NAFF1	0.11	0.12	0.12	0.09	0.10	0.12	0.47	0.84	0.14	0.13	0.18	0.09
NAFF2	0.07	0.07	0.11	0.11	0.11	0.10	0.55	0.92	0.14	0.17	0.20	0.11
NAFF3	0.09	0.08	0.15	0.11	0.13	0.12	0.53	0.94	0.15	0.16	0.20	0.11
NAFF4	0.09	0.09	0.13	0.10	0.12	0.11	0.58	0.93	0.17	0.17	0.21	0.11
NAC-C1	0.03	0.03	0.07	0.37	0.42	0.28	0.13	0.16	0.88	0.67	0.41	0.39
NAC-C2	0.06	0.07	0.11	0.30	0.34	0.29	0.09	0.10	0.87	0.62	0.39	0.37
NAC-C3	0.04	0.04	0.10	0.38	0.40	0.29	0.14	0.17	0.90	0.72	0.45	0.46
NAF-C1	0.06	0.05	0.12	0.38	0.49	0.32	0.14	0.16	0.72	0.91	0.45	0.48
NAF-C2	0.05	0.05	0.11	0.37	0.44	0.31	0.13	0.17	0.69	0.93	0.44	0.46
NAF-C3	0.04	0.03	0.06	0.37	0.48	0.27	0.10	0.14	0.67	0.90	0.47	0.51
NAF-C4	0.06	0.05	0.09	0.40	0.45	0.28	0.14	0.16	0.70	0.92	0.47	0.50
PRF1	0.10	0.08	0.12	0.26	0.33	0.23	0.23	0.27	0.34	0.37	0.71	0.42
PRF2	0.03	0.03	0.08	0.21	0.29	0.21	0.15	0.17	0.29	0.32	0.74	0.39
PRF3	0.02	0.01	0.04	0.20	0.34	0.20	0.05	0.06	0.34	0.32	0.58	0.44
PRF4	0.02	0.01	0.08	0.22	0.33	0.25	0.11	0.12	0.32	0.37	0.78	0.41
PRF5	0.03	0.01	0.12	0.26	0.31	0.32	0.15	0.18	0.34	0.36	0.79	0.38
PRF6	0.04	0.02	0.10	0.26	0.33	0.25	0.18	0.19	0.43	0.42	0.75	0.42
SAT1	0.05	0.05	0.11	0.30	0.38	0.23	0.14	0.10	0.40	0.47	0.50	0.90
SAT2	0.07	0.07	0.14	0.33	0.41	0.27	0.12	0.10	0.42	0.49	0.50	0.92
SAT3	0.06	0.06	0.15	0.31	0.42	0.27	0.11	0.10	0.46	0.52	0.51	0.93
SAT4	0.05	0.06	0.12	0.34	0.47	0.26	0.12	0.13	0.40	0.48	0.56	0.91

Table 6-11: Item Loadings and Cross Loadings for the Measurement Model (2nd) (Doctors)

	Inf-e	Sys-e	Srv-e	Inf-c	Sys-c	Srv-c	Nach	Naff	Naut	Nac-c	Naf-c	Nat-c	Prf	Sat
INFQ1	0.95	0.81	0.61	0.23	0.12	0.06	0.65	0.55	0.48	0.01	-0.08	0.00	-0.02	0.06
INFQ2	0.96	0.80	0.70	0.24	0.09	0.08	0.59	0.55	0.54	0.04	-0.06	0.04	-0.01	0.00
INFQ3	0.93	0.73	0.64	0.21	0.03	0.18	0.57	0.55	0.51	0.06	-0.03	0.06	-0.01	-0.02
SYSQ2	0.75	0.94	0.57	0.18	0.17	0.05	0.45	0.45	0.38	0.10	-0.06	0.12	0.12	0.14
SYSQ3	0.77	0.96	0.58	0.13	0.16	-0.01	0.50	0.48	0.43	0.02	-0.07	0.05	0.02	0.01
SYSQ4	0.82	0.95	0.62	0.18	0.10	0.06	0.52	0.53	0.47	0.05	-0.03	0.09	0.02	0.07
SRVQ1	0.66	0.59	0.93	0.08	0.02	0.10	0.45	0.51	0.52	-0.02	-0.04	0.07	0.07	-0.04
SRVQ2	0.61	0.56	0.92	0.15	0.08	0.07	0.39	0.42	0.52	0.03	0.00	0.10	0.11	0.07
INF-C1	0.30	0.20	0.19	0.92	0.70	0.40	0.35	0.29	0.32	0.48	0.43	0.45	0.48	0.53
INF-C2	0.26	0.21	0.23	0.87	0.62	0.31	0.27	0.22	0.33	0.45	0.50	0.48	0.48	0.51
INF-C3	0.26	0.18	0.07	0.91	0.66	0.34	0.34	0.30	0.35	0.51	0.48	0.47	0.42	0.50
INF-C4	0.02	0.01	-0.06	0.82	0.72	0.27	0.15	0.10	0.12	0.53	0.50	0.55	0.54	0.58
SYS-C1	0.18	0.22	0.09	0.70	0.88	0.27	0.37	0.24	0.25	0.46	0.43	0.45	0.54	0.61
SYS-C2	-0.06	0.03	-0.01	0.64	0.83	0.29	0.07	0.09	0.12	0.45	0.49	0.48	0.66	0.65
SYS-C3	0.10	0.20	-0.01	0.66	0.88	0.29	0.23	0.16	0.20	0.49	0.50	0.47	0.52	0.64
SYS-C4	0.05	0.06	0.09	0.67	0.84	0.26	0.11	0.05	0.27	0.54	0.61	0.50	0.55	0.68
SYS-C5	0.09	0.13	0.07	0.62	0.88	0.33	0.21	0.16	0.16	0.54	0.61	0.56	0.42	0.57
SRV-C1	0.13	0.04	0.10	0.32	0.32	0.94	0.15	0.16	0.16	0.38	0.36	0.31	0.36	0.29
SRV-C2	0.08	0.02	0.07	0.38	0.31	0.94	0.03	0.09	0.15	0.36	0.35	0.34	0.38	0.28
NACH1	0.58	0.46	0.42	0.24	0.23	0.08	0.93	0.77	0.66	0.14	0.08	0.14	0.04	0.13
NACH2	0.64	0.47	0.46	0.32	0.16	0.14	0.93	0.80	0.67	0.14	0.04	0.15	0.11	0.07
NACH3	0.57	0.51	0.39	0.34	0.27	0.05	0.96	0.80	0.68	0.18	0.08	0.18	0.10	0.14
NAFF1	0.56	0.47	0.48	0.22	0.10	0.14	0.79	0.94	0.78	0.10	0.04	0.11	0.03	-0.02
NAFF2	0.50	0.48	0.47	0.28	0.19	0.14	0.81	0.97	0.72	0.18	0.09	0.15	0.13	0.08
NAFF3	0.57	0.51	0.48	0.26	0.19	0.13	0.80	0.97	0.69	0.18	0.10	0.19	0.12	0.09
NAFF4	0.59	0.51	0.50	0.23	0.15	0.10	0.83	0.97	0.72	0.16	0.05	0.15	0.11	0.05
NAUT1	0.50	0.39	0.43	0.22	0.18	0.10	0.70	0.72	0.89	0.13	0.09	0.14	0.04	0.02
NAUT2	0.43	0.35	0.53	0.27	0.20	0.18	0.57	0.61	0.90	0.10	0.16	0.18	0.11	0.14
NAUT3	0.54	0.47	0.53	0.34	0.20	0.16	0.59	0.62	0.89	0.15	0.10	0.14	0.16	0.19
NAUT4	0.45	0.40	0.53	0.31	0.24	0.15	0.70	0.75	0.91	0.22	0.16	0.23	0.17	0.13
NAC-C1	0.05	0.13	0.01	0.50	0.51	0.33	0.19	0.16	0.18	0.88	0.67	0.69	0.50	0.51
NAC-C2	0.05	0.05	0.01	0.45	0.47	0.40	0.10	0.17	0.15	0.91	0.72	0.73	0.45	0.50
NAC-C3	0.02	0.00	0.00	0.56	0.57	0.33	0.16	0.12	0.13	0.92	0.75	0.77	0.52	0.57
NAF-C1	-0.03	0.00	-0.06	0.48	0.55	0.33	0.06	0.06	0.10	0.73	0.91	0.74	0.44	0.49
NAF-C2	0.03	0.03	0.02	0.54	0.62	0.35	0.18	0.14	0.17	0.72	0.94	0.74	0.48	0.59
NAF-C3	-0.07	-0.09	-0.01	0.50	0.53	0.37	0.00	0.02	0.13	0.73	0.93	0.76	0.48	0.57
NAF-C4	-0.14	-0.14	-0.05	0.50	0.57	0.35	0.04	0.05	0.14	0.76	0.94	0.79	0.47	0.57
NAT-C1	0.08	0.12	0.08	0.49	0.49	0.31	0.22	0.22	0.20	0.78	0.75	0.92	0.54	0.49
NAT-C2	0.03	0.12	0.09	0.45	0.49	0.30	0.16	0.14	0.15	0.74	0.69	0.92	0.52	0.51
NAT-C3	0.02	0.03	0.10	0.46	0.50	0.32	0.12	0.13	0.22	0.65	0.70	0.84	0.44	0.48
NAT-C4	0.00	0.06	0.06	0.59	0.60	0.32	0.10	0.08	0.13	0.76	0.80	0.94	0.59	0.57
PRF1	-0.04	-0.01	0.01	0.32	0.41	0.18	0.05	0.02	0.02	0.48	0.38	0.41	0.71	0.53
PRF2	-0.02	0.05	0.05	0.46	0.56	0.33	0.07	0.04	0.06	0.42	0.41	0.51	0.87	0.59
PRF3	-0.05	0.01	0.04	0.49	0.58	0.33	0.09	0.09	0.09	0.40	0.41	0.47	0.85	0.61
PRF4	-0.06	0.03	0.08	0.37	0.51	0.38	0.02	0.11	0.11	0.43	0.46	0.47	0.76	0.55
PRF5	0.04	0.09	0.09	0.49	0.50	0.28	0.10	0.12	0.16	0.44	0.36	0.45	0.77	0.61
PRF6	0.09	0.09	0.20	0.33	0.24	0.32	0.09	0.08	0.19	0.35	0.27	0.35	0.62	0.45
SAT1	0.04	0.09	0.05	0.57	0.69	0.27	0.13	0.07	0.12	0.54	0.56	0.54	0.70	0.96
SAT2	0.05	0.09	0.05	0.61	0.71	0.28	0.17	0.09	0.18	0.56	0.59	0.57	0.66	0.96
SAT3	-0.05	0.02	-0.06	0.51	0.63	0.32	0.06	0.00	0.07	0.53	0.53	0.50	0.68	0.93
SAT4	0.01	0.08	0.03	0.61	0.75	0.29	0.11	0.04	0.12	0.58	0.59	0.54	0.73	0.97

Table 6-12: Squared Item and Cross Loadings for the Measurement Model (2nd) (Doctors)

	Inf-e	Sys-e	Srv-e	Inf-c	Sys-c	Srv-c	Nach	Naff	Naut	Nac-c	Naff-c	Nat-c	Prf	Sat
INFQ1	0.90	0.65	0.37	0.05	0.01	0.00	0.43	0.30	0.23	0.00	0.01	0.00	0.00	0.00
INFQ2	0.93	0.63	0.49	0.06	0.01	0.01	0.34	0.30	0.29	0.00	0.00	0.00	0.00	0.00
INFQ3	0.87	0.53	0.41	0.04	0.00	0.03	0.33	0.30	0.26	0.00	0.00	0.00	0.00	0.00
SYSQ2	0.56	0.88	0.32	0.03	0.03	0.00	0.20	0.20	0.14	0.01	0.00	0.02	0.01	0.02
SYSQ3	0.59	0.91	0.33	0.02	0.02	0.00	0.25	0.23	0.18	0.00	0.01	0.00	0.00	0.00
SYSQ4	0.67	0.91	0.38	0.03	0.01	0.00	0.27	0.28	0.22	0.00	0.00	0.01	0.00	0.00
SRVQ1	0.44	0.35	0.87	0.01	0.00	0.01	0.20	0.26	0.27	0.00	0.00	0.00	0.00	0.00
SRVQ2	0.37	0.31	0.85	0.02	0.01	0.00	0.15	0.18	0.27	0.00	0.00	0.01	0.01	0.01
INF-C1	0.09	0.04	0.04	0.85	0.49	0.16	0.13	0.08	0.10	0.23	0.19	0.21	0.23	0.28
INF-C2	0.07	0.04	0.05	0.75	0.38	0.10	0.07	0.05	0.11	0.20	0.25	0.23	0.23	0.26
INF-C3	0.07	0.03	0.00	0.84	0.44	0.11	0.11	0.09	0.12	0.26	0.23	0.22	0.17	0.25
INF-C4	0.00	0.00	0.00	0.68	0.51	0.07	0.02	0.01	0.01	0.28	0.25	0.31	0.29	0.34
SYS-C1	0.03	0.05	0.01	0.49	0.78	0.07	0.14	0.06	0.06	0.21	0.19	0.21	0.29	0.37
SYS-C2	0.00	0.00	0.00	0.41	0.69	0.08	0.01	0.01	0.01	0.21	0.24	0.23	0.44	0.43
SYS-C3	0.01	0.04	0.00	0.43	0.78	0.08	0.05	0.02	0.04	0.24	0.25	0.22	0.27	0.41
SYS-C4	0.00	0.00	0.01	0.45	0.70	0.07	0.01	0.00	0.07	0.29	0.37	0.25	0.30	0.46
SYS-C5	0.01	0.02	0.01	0.39	0.77	0.11	0.05	0.03	0.03	0.29	0.37	0.32	0.17	0.33
SRV-C1	0.02	0.00	0.01	0.10	0.10	0.88	0.02	0.03	0.03	0.15	0.13	0.10	0.13	0.08
SRV-C2	0.01	0.00	0.00	0.15	0.10	0.89	0.00	0.01	0.02	0.13	0.12	0.11	0.15	0.08
NACH1	0.34	0.22	0.18	0.06	0.05	0.01	0.86	0.59	0.44	0.02	0.01	0.02	0.00	0.02
NACH2	0.41	0.22	0.21	0.10	0.03	0.02	0.87	0.64	0.45	0.02	0.00	0.02	0.01	0.01
NACH3	0.33	0.26	0.15	0.11	0.07	0.00	0.92	0.64	0.47	0.03	0.01	0.03	0.01	0.02
NAFF1	0.31	0.22	0.23	0.05	0.01	0.02	0.63	0.88	0.60	0.01	0.00	0.01	0.00	0.00
NAFF2	0.25	0.23	0.22	0.08	0.04	0.02	0.66	0.94	0.52	0.03	0.01	0.02	0.02	0.01
NAFF3	0.32	0.26	0.23	0.07	0.04	0.02	0.63	0.93	0.48	0.03	0.01	0.04	0.01	0.01
NAFF4	0.34	0.26	0.25	0.05	0.02	0.01	0.69	0.94	0.52	0.02	0.00	0.02	0.01	0.00
NAUT1	0.25	0.15	0.18	0.05	0.03	0.01	0.49	0.52	0.80	0.02	0.01	0.02	0.00	0.00
NAUT2	0.19	0.12	0.28	0.07	0.04	0.03	0.33	0.38	0.81	0.01	0.03	0.03	0.01	0.02
NAUT3	0.29	0.22	0.28	0.11	0.04	0.03	0.35	0.39	0.79	0.02	0.01	0.02	0.03	0.04
NAUT4	0.21	0.16	0.28	0.09	0.06	0.02	0.49	0.56	0.84	0.05	0.02	0.05	0.03	0.02
NAC-C1	0.00	0.02	0.00	0.25	0.27	0.11	0.04	0.02	0.03	0.77	0.45	0.47	0.25	0.26
NAC-C2	0.00	0.00	0.00	0.20	0.22	0.16	0.01	0.03	0.02	0.83	0.52	0.53	0.20	0.25
NAC-C3	0.00	0.00	0.00	0.31	0.32	0.11	0.03	0.01	0.02	0.85	0.56	0.59	0.27	0.33
NAF-C1	0.00	0.00	0.00	0.23	0.30	0.11	0.00	0.00	0.01	0.53	0.83	0.55	0.19	0.24
NAF-C2	0.00	0.00	0.00	0.29	0.38	0.12	0.03	0.02	0.03	0.52	0.88	0.55	0.23	0.34
NAF-C3	0.00	0.01	0.00	0.25	0.29	0.13	0.00	0.00	0.02	0.53	0.87	0.58	0.23	0.32
NAF-C4	0.02	0.02	0.00	0.25	0.32	0.12	0.00	0.00	0.02	0.58	0.89	0.63	0.22	0.32
NAT-C1	0.01	0.01	0.01	0.24	0.24	0.10	0.05	0.05	0.04	0.60	0.56	0.85	0.29	0.24
NAT-C2	0.00	0.01	0.01	0.21	0.24	0.09	0.03	0.02	0.02	0.54	0.48	0.85	0.27	0.26
NAT-C3	0.00	0.00	0.01	0.21	0.25	0.11	0.01	0.02	0.05	0.42	0.50	0.71	0.20	0.23
NAT-C4	0.00	0.00	0.00	0.35	0.36	0.10	0.01	0.01	0.02	0.57	0.65	0.87	0.35	0.32
PRF1	0.00	0.00	0.00	0.11	0.17	0.03	0.00	0.00	0.00	0.23	0.14	0.17	0.51	0.28
PRF2	0.00	0.00	0.00	0.22	0.31	0.11	0.00	0.00	0.00	0.17	0.17	0.26	0.77	0.35
PRF3	0.00	0.00	0.00	0.24	0.34	0.11	0.01	0.01	0.01	0.16	0.17	0.22	0.72	0.37
PRF4	0.00	0.00	0.01	0.14	0.26	0.15	0.00	0.01	0.01	0.18	0.22	0.22	0.57	0.30
PRF5	0.00	0.01	0.01	0.24	0.25	0.08	0.01	0.02	0.03	0.20	0.13	0.20	0.60	0.37
PRF6	0.01	0.01	0.04	0.11	0.06	0.10	0.01	0.01	0.04	0.12	0.07	0.12	0.39	0.21
SAT1	0.00	0.01	0.00	0.32	0.48	0.07	0.02	0.00	0.01	0.29	0.32	0.29	0.49	0.92
SAT2	0.00	0.01	0.00	0.38	0.51	0.08	0.03	0.01	0.03	0.32	0.35	0.33	0.44	0.92
SAT3	0.00	0.00	0.00	0.26	0.40	0.10	0.00	0.00	0.01	0.28	0.28	0.25	0.46	0.86
SAT4	0.00	0.01	0.00	0.37	0.56	0.08	0.01	0.00	0.02	0.34	0.35	0.30	0.53	0.93

Table 6-13: Inter-construct Correlations and AVE Scores (First-order Constructs) (Nurses)

	AVE	1	2	3	4	5	6	7	8	9	10	11	12
1 [a]	0.943	**0.97** [b]											
2	0.881	0.86	**0.94**										
3	0.937	0.53	0.55	**0.97**									
4	0.843	0.22	0.23	0.27	**0.92**								
5	0.829	0.17	0.17	0.34	0.80	**0.91**							
6	0.954	0.24	0.27	0.52	0.59	0.61	**0.98**						
7	0.852	0.35	0.33	0.44	0.28	0.28	0.30	**0.92**					
8	0.909	0.31	0.31	0.37	0.34	0.36	0.35	0.77	**0.95**				
9	0.885	0.21	0.23	0.32	0.63	0.66	0.57	0.37	0.40	**0.94**			
10	0.914	0.23	0.22	0.32	0.65	0.71	0.57	0.38	0.42	0.87	**0.96**		
11	0.726	0.22	0.18	0.35	0.57	0.67	0.58	0.44	0.47	0.69	0.71	**0.85**	
12	0.915	0.25	0.26	0.37	0.59	0.67	0.53	0.36	0.34	0.68	0.73	0.75	**0.96**

[a] Constructs are in the same order as in Table 6-1, [b] The numbers on the diagonal cells are the square root of AVEs

Table 6-14: Inter-construct Correlations and AVE Scores (First-order Constructs) (Doctors)

	AVE	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1[a]	0.901	**0.95**[b]													
2	0.901	0.82	**0.95**												
3	0.862	0.68	0.62	**0.93**											
4	0.778	0.24	0.17	0.12	**0.88**										
5	0.744	0.08	0.15	0.05	0.76	**0.86**									
6	0.886	0.11	0.04	0.09	0.37	0.33	**0.94**								
7	0.882	0.64	0.51	0.45	0.32	0.24	0.09	**0.94**							
8	0.922	0.58	0.51	0.50	0.26	0.16	0.13	0.84	**0.96**						
9	0.808	0.53	0.45	0.56	0.32	0.23	0.17	0.72	0.76	**0.90**					
10	0.816	0.04	0.06	0.01	0.56	0.57	0.39	0.16	0.16	0.17	**0.90**				
11	0.867	-0.06	-0.06	-0.02	0.54	0.61	0.37	0.07	0.07	0.14	0.79	**0.93**			
12	0.823	0.04	0.09	0.09	0.55	0.57	0.34	0.17	0.16	0.19	0.81	0.81	**0.91**		
13	0.593	-0.01	0.05	0.09	0.54	0.62	0.39	0.09	0.10	0.13	0.54	0.50	0.58	**0.77**	
14	0.909	0.01	0.07	0.02	0.60	0.73	0.30	0.12	0.05	0.13	0.58	0.60	0.57	0.73	**0.95**

[a] Constructs are in the same order as in Table 6-2, [b] The numbers on the diagonal cells are the square root of AVEs

Each of the second-order constructs are approximated separately using the repeated indicators approach (aka the hierarchical component model) suggested by (Wold, 1980) (Chin, 2010, Lohmöller, 1989, Wilson, 2010). "In essence, a second order factor is directly measured by observed variables of all the first order factors. While this approach repeats the number of manifest variables used, the model can be

estimated by the standard PLS algorithm" (Chin, 2010, p. 665). Latent variable scores (representing the first-order constructs) calculated by PLS at this stage serve as manifest variables for the second-order constructs in subsequent analyses (Wilson, 2010). "Test of validity for a second order factor model should, by analogy, follow the same process that is used to examine the validity of first order factors" (Chin, 2010, p. 667).

Figures 6-1 and 6-2 show two examples of how the second-order constructs of the study are modeled. In PLS, higher order constructs can be modeled in two forms called molar and molecular (the component based structural equation modeling is only applicable to the molecular form) (Chin, 1998 , Chin, 2010, Chin and Gopal, 1995). "Needs" and "needs congruency" match the molar model (with arrows from the first-order constructs to the second-order construct). "Expectations" and "expectations congruencies" fit the molecular model (with arrows from the second-order construct to the first-order constructs).

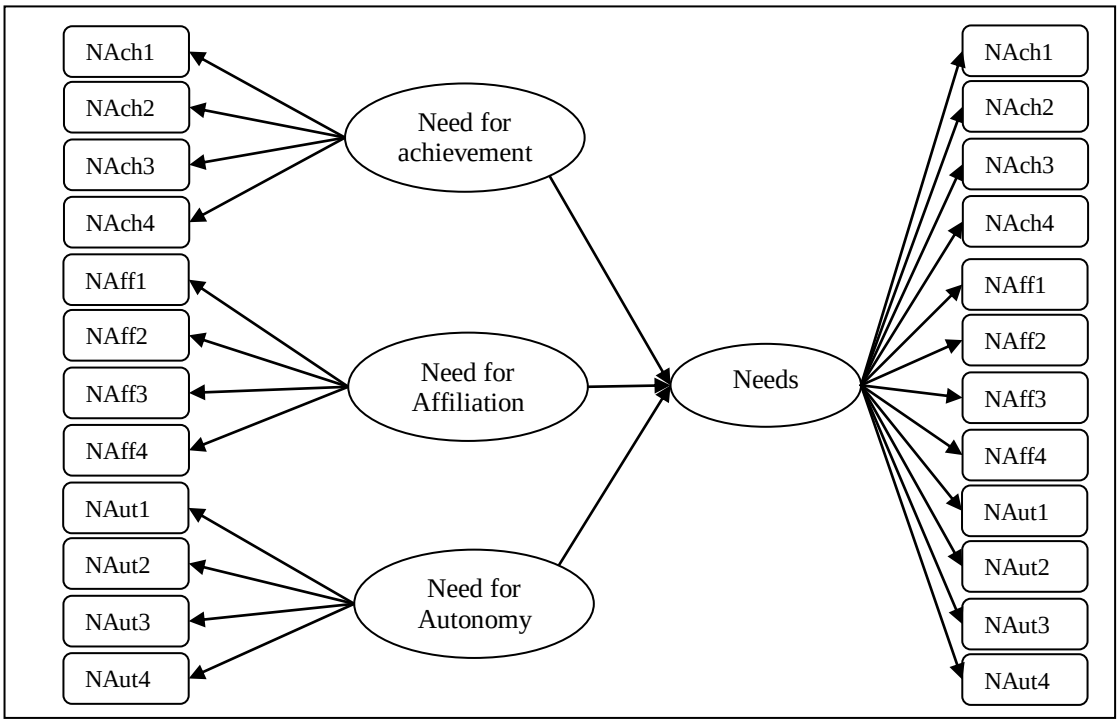


Figure 6-1: Second-order Molar Model

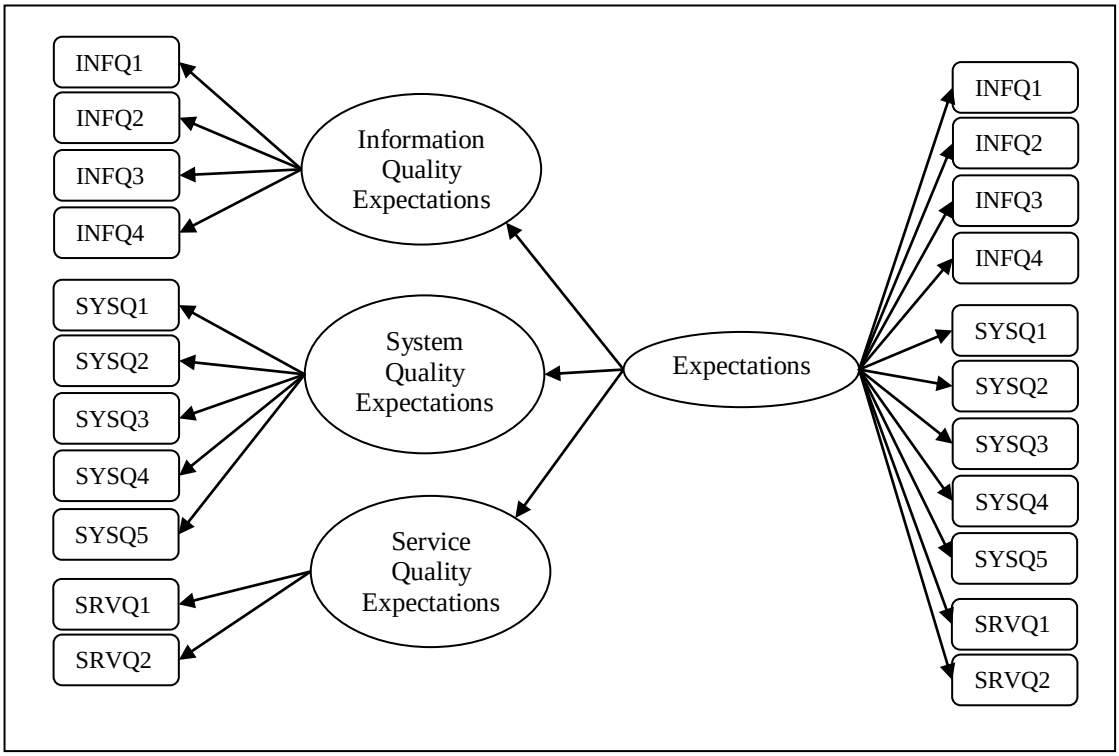


Figure 6-2: Second-order Molecular Model

Table 6-15 shows the correlations of the second-order constructs, and Table 6-16 reports the component loadings, Cronbach's alpha, composite reliability and AVE for the two second-order reflective constructs of this study for the nurses' data. The values meet all the requirements as discussed for the first-order constructs. This study has two second-order formative constructs (i.e., "clinician needs" and "clinician needs congruency"). For formative constructs, item weights are examined rather than item loadings (Chin, 2010). In addition, the formative measures should be assessed for multicollinearity. High multicollinearity is not desirable for formative constructs as it may be an indication of measures capturing the same aspect of the construct. Variance inflation factor (VIF) and tolerance can be used to identify the presence of multicollinearity (Petter et al., 2007). VIF < 3.3 and tolerance > 0.20 are the recommended cut-off criteria in the literature (Hair et al., 2011, Petter et al., 2007). In the nurses' data, all the component weights for the "clinician needs" and "clinician needs congruency" constructs are significant. The components of the "clinician

needs" construct have satisfactory VIF. However, the VIF of the components of the "clinician needs congruency" construct are greater than 3.3 (see Table 6-17). All these components are kept to ensure content validity (Bollen and Lennox, 1991, Petter et al., 2007).

Table 6-15: Inter-construct Correlations and AVE Scores (Second-order Constructs) (Nurses)

Constructs	*Clinician expectations*	*Clinician expectations congruency*	*Clinician needs*
Clinician expectations	**0.87** [a]		
Clinician expectations congruency	0.37	**0.88**	
Clinician needs	0.44	0.38	---
Clinician needs congruency	0.31	0.74	0.43

[a]The numbers on the diagonal cells are the square root of AVEs

Table 6-16: Measurement Model Results (Second-order Reflective Constructs) (Nurses)

Constructs	*Components*	*Loading*	*Sig.* [a]
Clinician expectations Cronbach's alpha=0.847 Composite reliability=0.904 AVE=0.759	Information quality expectations	0.878	***
	System quality expectations	0.891	***
	Service quality expectations	0.845	***
Clinician expectations congruency Cronbach's alpha=0.857 Composite reliability=0.913 AVE=0.779	Information quality expectations congruency	0.903	***
	System quality expectations congruency	0.921	***
	Service quality expectations congruency	0.821	***

[a] Bootstrapping results (n=1000) , *** $p < 0.001$

Table 6-17: Measurement Model Results (Second-order Formative Constructs) (Nurses)

Constructs	*Components*	*Weight*	*Sig.* [a]	*VIF*	*Tolerance*
Clinician needs	Need for achievement	0.559	**	2.414	0.414
	Need for affiliation	0.505	**	2.414	0.414
Clinician needs congruency	Need for achievement congruency	0.311	**	4.164	0.240
	Need for affiliation congruency	0.717	***	4.164	0.240

[a] Bootstrapping results (n=1000) , *** $p < 0.001$, ** $p < 0.01$

Tables 6-18 and 6-20 present the values of the same criteria for the doctors' data. All the requirements for the two reflective constructs are satisfactory. For the two formative constructs, VIF greater than 3.3 is observed in most of the components. In addition, only two of the component weights are significant. Diamantopoulos and Siguaw (2006) suggest that it may be appropriate to remove any item with non significant weight from a formative constructs (one at a time) with reserving the content validity of the construct. The need for affiliation and need for affiliation congruency components were omitted from the two second-order formative constructs of the doctors' data as they had the lowest weight among the other components. After this omission, all the VIF are below the recommended threshold of 3.3, and all the weights are significant (Table 6-21). The omission is less likely to affect the content validity of these construct considerably. This is so because the effect of the need for affiliation in terms of improved interaction and communication with colleagues in order to obtain necessary information to carry out daily tasks with the use of the system might be more salient for nurses (e.g., less phone call needs for confirming the right order, abnormal results notification, patient information transfer to the nurses in the next shift).

Table 6-18: Inter-construct Correlations and AVE Scores (Second-order Constructs) (Doctors)

Constructs	***Clinician expectations***	***Clinician expectations congruency***	***Clinician needs***
Clinician expectations	**0.90** [a]		
Clinician expectations congruency	0.16	**0.82**	
Clinician needs	0.64	0.30	---
Clinician needs congruency	0.04	0.67	0.18

[a] The numbers on the diagonal cells are the square root of AVEs

Table 6-19: Measurement Model Results (Second-order Reflective Constructs) (Doctors)

Constructs	*Components*	*Loading*	*Sig.* [a]
Clinician expectations Cronbach's alpha=0.879 Composite reliability=0.926 AVE=0.806	Information quality expectations	0.939	***
	System quality expectations	0.904	***
	Service quality expectations	0.848	***
Clinician expectations congruency Cronbach's alpha=0.743 Composite reliability=0.854 AVE=0.669	Information quality expectations congruency	0.910	***
	System quality expectations congruency	0.915	***
	Service quality expectations congruency	0.585	***

[a] Bootstrapping results (n=1000) , *** $p < 0.001$

Table 6-20: Measurement Model Results (Second-order Formative Constructs) (1st) (Doctors)

Constructs	*Components*	*Weight*	*Sig.* [a]	*VIF*	*Tolerance*
Clinician needs	Need for achievement	0.437	*	3.598	0.278
	Need for affiliation	0.242	n.s	4.128	0.242
	Need for autonomy	0.408	*	2.474	0.404
Clinician needs congruency	Need for achievement congruency	0.399	n.s	3.360	0.298
	Need for affiliation congruency	0.223	n.s	3.504	0.285
	Need for autonomy congruency	0.448	+	3.754	0.266

[a] Bootstrapping results (n=1000) , * $p < 0.05$, † $p < 0.1$ n.s = not significant

Table 6-21: Measurement Model Results (Second-order Formative Constructs) (2nd) (Doctors)

Constructs	*Components*	*Weight*	*Sig.* [a]	*VIF*	*Tolerance*
Clinician needs	Need for achievement	0.590	**	2.051	0.488
	Need for autonomy	0.489	**	2.051	0.488
Clinician needs congruency	Need for achievement congruency	0.484	*	2.851	0.351
	Need for autonomy congruency	0.568	*	2.851	0.351

[a] Bootstrapping results (n=1000) , * $p < 0.05$, ** $p < 0.01$

6.2 Structural Model and Hypotheses Testing

After ensuring proper measurement model, the next step is to test the structural model. This includes assessing the variance explained (using R^2) and the significance of the path coefficients. The f^2 and q^2 effect sizes, and the global criterion for goodness of fit (i.e., the GoF index) are other measures evaluating the structural

model.

Tables 6-22 and 6-23 present the results of the structural model assessments. In the nurses' data, the results indicate the proposed model explained 66% of variance for clinician satisfaction, 53% of variance for clinician needs congruency, 50% of variance for clinician expectations congruency, and 20% of variance for clinician expectations (see Table 6-22).

Table 6-22: Structural Model Results (Nurses)

Structural relation (hypothesis)	***Path Coef.***	***Sig.[a]***	***R^2***
Clinician Expectations Congruency → Clinician Satisfaction (H1)	0.14	n.s	0.66
Clinician Expectations → Clinician Satisfaction (H3)	0.07	n.s	
Clinician Needs Congruency →Clinician Satisfaction (H4)	0.31	***	
Perceived CIS Performance →Clinician Satisfaction (H9)	0.39	***	
Clinician Expectations → Clinician Expectations Congruency (H2)	0.18	**	0.50
Perceived CIS Performance → Clinician Expectations Congruency (H7)	0.63	***	
Clinician Needs → Clinician Expectations (H6)	0.44	***	0.20
Clinician Needs → Clinician Needs Congruency (H5)	0.11	*	0.53
Perceived CIS Performance→ Clinician Needs Congruency (H8)	0.67	***	
Control Variables:			
Age	0.08	n.s	
Gender	0.01	n.s	
Work Experience	-0.06	n.s	
Duration of system use	0.03	n.s	

[a] Bootstrapping results (n=1000) , *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, n.s = not significant

The paths from clinician needs congruency and perceived CIS performance to clinician satisfaction were seen to be significant , offering support for hypotheses 4 and 9. Contrary to expectations, clinician expectations and clinician expectations congruency paths to clinician satisfaction were not significant. Hence, hypotheses 1 and 3 are not supported. Perceived CIS performance was found to have a significant impact on both clinician expectations congruency and clinician needs congruency, providing evidence for hypotheses 7 and 8. Clinician needs was found to have a significant effect on clinician expectations. Hypothesis 6 is then supported. The links

from clinician expectations and clinician needs to clinician expectations congruency and clinician needs congruency respectively were observed to be significant but positive. Hypotheses 2 and 5 are not supported.

Table 6-23 presents the results of the structural model testing for the doctors' data. According to this empirical data, the proposed model accounts for 66% of variance for clinician satisfaction, 43% of variance for clinician expectations congruency, 37% of variance for clinician needs congruency, and 40% of variance for clinician expectations.

Table 6-23: Structural Model Results (Doctors)

Structural relation (hypothesis)	***Path Coef.***	***Sig.[a]***	***R^2***
Clinician Expectations Congruency → Clinician Satisfaction (H1)	0.36	***	0.66
Clinician Expectations → Clinician Satisfaction (H3)	-0.08	n.s	
Clinician Needs Congruency →Clinician Satisfaction (H4)	0.12	n.s	
Perceived CIS Performance →Clinician Satisfaction (H9)	0.43	***	
Clinician Expectations → Clinician Expectations Congruency (H2)	0.13	†	0.43
Perceived CIS Performance → Clinician Expectations Congruency (H7)	0.64	***	
Clinician Needs → Clinician Expectations (H6)	0.63	***	0.40
Clinician Needs → Clinician Needs Congruency (H5)	0.13	†	0.37
Perceived CIS Performance→ Clinician Needs Congruency (H8)	0.60	***	
Control Variables:			
Age	-0.10	n.s	
Gender	0.07	n.s	
Attendance at training session	0.02	n.s	
Work Experience	0.23	†	
Duration of system use	0.02	n.s	

[a] Bootstrapping results (n=1000) , *** $p < 0.001$, † $P < 0.1$, n.s = not significant

The paths from clinician expectations congruency and perceived CIS performance to clinician satisfaction were seen to be significant, offering support for hypotheses 1 and 9. Contrary to the expectations, clinician expectations and clinician needs congruency paths to clinician satisfaction were not significant. Hence, hypotheses 3 and 4 are not supported. Among the two proposed determinants of clinician expectations congruency, perceived CIS performance was found to have a

significant impact on this construct, providing evidence for hypothesis 7. The path from clinician expectations to this construct was positive and significant only at the 0.1 level. Hypothesis 2 is not supported. Clinician needs was also found to have a significant effect on clinician expectations. Hypothesis 6 is therefore supported. While the link from perceived CIS performance to clinician needs congruency was observed to be significant, the link from clinician needs to clinician needs congruency was not significant. Hypothesis 5 is not supported, but hypothesis 8 is supported.

Age, gender, work experience, attendance at training session, and duration of system use were included in the model as control variables. None of them were found to have a significant impact on clinician satisfaction except for work experience. Work experience was significant only at the 0.1 level in the doctors' data. Computer literacy was not included in the model as a control variable, because the respondents were mainly computer literate (a high percentage of both doctors (more 90%) and nurses (almost 90%) indicated daily use of internet and computers). Attendance at the training session was also included only in the doctors' model, because almost all of the nurses participated at the training session.

In addition to the above assessments, the changes in the R^2 when excluding a particular independent variable from a structural model can be used to evaluate its relative impact on the pertinent dependent variable in that model (Chin, 2010, Hair et al., 2011). This effect size (f^2) is calculated as:

$$f^2 = \frac{R^2_{included} - R^2_{excluded}}{1 - R^2_{included}}$$

The effect sizes of 0.02, 0.15, and 0.35 are considered as small, medium, and large effects at the structural level respectively (Cohen, 1988). Table 6-24 shows the

effect sizes of the four proposed determinants of clinician satisfaction among the nurses and doctors. The effect sizes of the perceived performance in the nurses' and doctors' model are 0.20 and 0.25 respectively. The perceived performance hence has approximately large impact on clinician satisfaction (above and beyond the impact of other proposed predictors of satisfaction). The effect sizes of clinician expectations in both user groups' model was almost zero, which is not surprising given that its link to satisfaction was not significant either. The impact of clinician expectations congruency was moderate in the doctors' model (f^2 = 0.16) and small (f^2 = 0.02) in the nurses' model. However, clinician needs congruency showed to have approximately moderate impact among nurses (f^2 = 0.10) and small effect (f^2 = 0.02) among doctors.

Table 6-24: f^2 Effect Sizes

	f^2 *(Nurses)*	f^2 *(Doctors)*
Perceived performance	0.20	0.25
Clinician expectations	0.01	0.01
Clinician expectations congruency	0.02	0.16
Clinician needs congruency	0.10	0.02

* In the calculation of the f^2, the control variables are excluded from the model.

The predictive sample reuse technique proposed by Stone (1974) and Geisser (1974) provides another measure (called the cross-validated redundancy Q^2) to explore the predictive relevance of a model. "The PLS adaptation of this approach follows a blindfolding procedure that omits a part of the data for a particular block of indicators during parameter estimates and then attempts to estimate the omitted part using the estimated parameters" (Chin, 2010, p. 680). For a model to have predictive validity the Q^2 should be greater than zero, and a Q^2 above 0.5 indicates a predictive model. In this study, the Q^2 for the nurses' and doctors' models were 0.60 and 0.57. Both models thus have predictive validity for clinician satisfaction.

Similar to the f^2 and R^2, the q^2 measure captures the changes in the Q^2 when certain variable and relationships are excluded from the model. This measure can be applied to assess the predictive relevance of that variable in the structural model (Chin, 2010, Hair et al., 2011).

As shown in Table 6-25, the q^2 of the perceived performance was 0.16 for the nurses and 0.18 for the doctors, which indicates moderate predictive relevance. The clinician expectations had no predictive relevance in the model. However, the clinician expectations congruency showed nearly moderate predictive impact among the doctors, but its impact among the nurses was small. Conversely, the predictive impact of the clinician needs congruency was found to be small among the doctors, but approximately moderate among the nurses.

Table 6-25: q^2 Effect Sizes

	q^2 (Nurses)	***q^2 (Doctors)***
Perceived performance	0.16	0.18
Clinician expectations	0.01	0.00
Clinician expectations congruency	0.02	0.12
Clinician needs congruency	0.08	0.02

* In the calculation of the q^2, the control variables are excluded from the model. An omission distance of 5 is used in the blindfolding approach.

The last measure to discuss is the Gof index. The GoF index proposed by (Tenenhaus et al., 2004) intends to account for the PLS model performance. The index is calculated as the geometric mean of the average communality and the average R^2 of the model (Chin, 2010). Since the index is based on the communalities of reflective indicators in the measurement model, it is considered conceptually inappropriate for models with formative constructs (Hair et al., 2011). The GoF therefore is not obtained in this study, because the model has two formative constructs.

6.3 Post-hoc Analyses

This section presents the results of some post-hoc analyses on the interaction and mediation (indirect) effects of certain constructs in the research model of this study. The approaches for mediation and interaction effects analysis in PLS are also explained.

6.3.1 Interaction Effects

In order to get better understanding of the effects of "clinician expectations" on "clinician expectations congruency" and "clinician satisfaction", the possible moderating effect of "clinician expectations" on the "clinician expectations congruency" and "clinician satisfaction" association was examined. Similarly, the moderating effect of "clinician needs" on "clinician needs congruency" and "clinician satisfaction" relationship was tested. Before proceeding to present the results of these further investigations, first the approach of this study for treating moderating effects within the structural model using PLS is explained.

Henseler and Fassott (2010) present two common approaches of moderating effect estimation in PLS including 1) the product term approach, and 2) the group comparison approach. While the former mostly suits continuous variables, the latter is more appropriate for categorical variables. This study utilized the first approach since the independent and moderator variables of the study are continuous. In addition, the techniques discussed in Henseler and Fassott's (2010) study to implement this approach in PLS can be generalized to higher order measurement models (e.g., see (Wilson, 2010)).

To implement the first approach in PLS, two models should be tested: 1) the main effects model that includes the direct paths from both the independent and

moderator variables to the dependent variable, and 2) the interaction model that features an additional variable called the interaction term and its direct path to the dependent variable. The indictors representing the interaction term are created by multiplying each indicator of the independent variable with every indicator of the moderator variable. If at least one of the variables is formative, then the products of the latent variable scores of the moderator variable and independent variable (produced in PLS while testing the main effects model) will serve as the interaction term indicator. When testing the interaction model in this case, it is recommended to replace the indicators of the moderator and independent variables with their latent variable scores (derived from testing the main effect model). The reason is to avoid the problems associated with estimating them again in the presence of the interaction term (Henseler and Fassott, 2010).

Accordingly, the moderating effect of "clinician expectations" on the direct link from "clinician expectations congruency" to "clinician satisfaction" is estimated. All the variables of interest in this interaction effect testing are reflective constructs. Therefore, the products of the indicators of moderator and independent variables served as the indicators of their interaction term. Since these two variables are second-order constructs, their indicators are the latent variable scores of their first-order constructs. These derived scores from PLS are standardized which lowers the multicollinearity of interaction term with its components. The results of both user groups are presented in Tables 6-26 and 6-27. The interaction term was not significant in any of the user groups and the changes in R^2 were very small (0.002 in the nurses' data and 0.014 in the doctors' data). Hence, the moderating effect of "clinician expectations" on the relationship between "clinician expectations congruency" and "clinician satisfaction" is not supported.

Table 6-26: Clinician Expectations Moderating Effect (Nurses)

Structural relation	***Main effects model***		***Interaction model***	
	Path Coeff	Sig.	Path Coeff	Sig.
Clinician expectations → Clinician satisfaction	0.12	n.s	0.10	n.s
Clinician expectations congruency → Clinician satisfaction	0.64	***	0.65	***
Interaction term			-0.05	n.s
R^2	0.479		0.481	

Path Coeff = Path coefficient, Sig. = Significance, n.s = not significant, *** $p < 0.001$

Table 6-27: Clinician Expectations Moderating Effect (Doctors)

Structural relation	***Main effects model***		***Interaction model***	
	Path Coeff	Sig.	Path Coeff	Sig.
Clinician expectations → Clinician satisfaction	-0.05	n.s	-0.12	n.s
Clinician expectations congruency → Clinician satisfaction	0.72	***	0.71	***
Interaction term			-0.14	n.s
R^2	0.507		0.521	

Path Coeff = Path coefficient, Sig. = Significance, n.s = not significant, *** $p < 0.001$

The moderating effect of "clinician needs" on the direct link from "clinician needs congruency" to "clinician satisfaction" is also estimated. Given that the independent and moderator variables are both formative constructs, the product of their derived latent variable scores (from testing of the main effect model) served as the indicator of their interaction term. These derived scores from PLS are also standardized. The results for both user groups are presented in Tables 6-28 and 6-29. Similar to the results of "clinician expectations" moderating effect, the interaction effect of "clinician needs" on the "clinician needs congruency" and "clinician satisfaction" association was not significant among doctors or nurses, and there were no noticeable changes in R^2.

Table 6-28: Clinician Needs Moderating Effect (Nurses)

Structural relation	*Main effects model*		*Interaction model*	
	Path Coeff	Sig.	Path Coeff	Sig.
Clinician needs → Clinician satisfaction	0.08	n.s	0.08	n.s
Clinician needs congruency → Clinician satisfaction	0.70	***	0.70	***
Interaction term			0.00	n.s
R^2	0.547		0.547	

Path Coeff = Path coefficient, Sig. = Significance, n.s = not significant, *** p < 0.001

Table 6-29: Clinician Needs Moderating Effect (Doctors)

Structural relation	*Main effects model*		*Interaction model*	
	Path Coeff	Sig.	Path Coeff	Sig.
Clinician needs → Clinician satisfaction	0.02	n.s	0.05	n.s
Clinician needs congruency → Clinician satisfaction	0.60	***	059	***
Interaction term			0.05	n.s
R^2	0.365		0.367	

Path Coeff = Path coefficient, Sig. = Significance, n.s = not significant, *** p < 0.001

6.3.2 Mediation Effects

In addition to the direct effect of expectations on satisfaction, its indirect effect on satisfaction through expectations congruency is also examined. Similarly, the indirect effect of needs on satisfaction through needs congruency is tested. The rest of this section provides the details of the approach for mediation effects analysis in PLS. The results of the analysis are then presented.

The most common approach for mediation effects analysis is probably the Baron and Kenney's (1986) causal steps approach. However, this approach received several criticisms mainly due to having low power in detecting indirect effects compared to most other approaches, and not directly estimating indirect effects (Hayes, 2009). A substitute to this approach which addresses these criticisms is the bootstrapping approach. The bootstrapping technique has been shown to have highest power to detect nonzero effects and the best Type I error control (Chin, 2010, Hayes,

2009, Williams and MacKinnon, 2008)[3].

To assess the significance of an indirect effect using the bootstrapping approach in PLS, the structural model under investigation needs to include both direct and indirect paths. The path coefficient of the indirect effect will be the product of the path coefficients from paths directing in and out of the mediator. After conducting a conventional bootstrapping procedure of path analysis, the percentile bootstrap or bias corrected bootstrap methods can be used to estimate the significance of the indirect path (chin 2010). This study uses the percentile method to construct confidence interval from bootstrapping. According to this method, the (1- α) confidence intervals are defined as $(\theta_{\alpha/2}, \theta_{1-\alpha/2})$ where $\theta_{\alpha/2}$ is the $\alpha/2^{th}$ percentile of the bootstrap sampling distribution of the indirect effect (Cheung and Lau, 2008).

The results of mediation analysis (see Tables 6-30 and 6-31) indicate no significant indirect effect of expectations on satisfaction among doctors and nurses. The results of the nurses' data however show a significant indirect effect of needs on nurses' satisfaction through the needs congruency construct.

Table 6-30: Indirect Effect of Expectations on Satisfaction through Expectations Congruency

	Indirect effect	***Mean***	***S. E***	***LL 95 CI***	***UL 95 CI***
Nurses	0.025	0.027	0.019	-0.004	0.072
Doctors	0.047	0.047	0.029	-0.001	0.112

Values are calculated through a bootstrapping approach with 203 cases for nurse, 112 cases for doctors and 1000 samples.

Table 6-31: Indirect Effect of Needs on Satisfaction through Needs Congruency

	Indirect effect	***Mean***	***S. E***	***LL 95 CI***	***UL 95 CI***
Nurses	.033	.034	0.018	0.002	0.074
Doctors	0.016	0.014	0.016	-0.017	0.049

Values are calculated through a bootstrapping approach with 203 cases for nurse, 112 cases for doctors and 1000 samples.

[3] The Sobel test is another popular approach, however it requires the sampling distribution of the indirect effect to be normal. The bootstrapping approach does not have this restriction.

6.4 Further Analysis

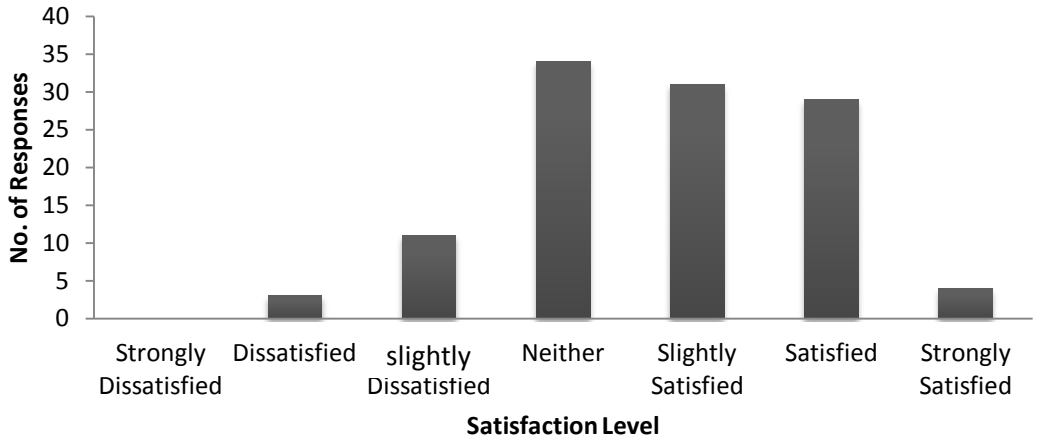
6.4.1 Overall Satisfaction Analysis

In this section, nurses' and doctors' overall satisfaction with the system are discussed. As Figure 6-3 shows, nurses are generally satisfied with the system. More than 86 percent of them indicated they are (slightly to strongly) satisfied with the system, while less than 13 percent of the nurses showed neither satisfaction nor dissatisfaction. Only one percent of the nurses reported slightly dissatisfaction with the system.

Satisfaction Level	Strongly Dissatisfied	Dissatisfied	Slightly Dissatisfied	Neither	Slightly Satisfied	Satisfied	Strongly Satisfied
% of Respondents	0.00	0.00	0.99	12.32	27.59	43.35	15.76

Figure 6-3: Nurses' Overall Satisfaction Level

Figure 6-4 shows the trend of doctors' satisfaction with the system. Less than 60 percent of the doctors reported they are satisfied with the system, almost 30 percent of the respondents selected the neither satisfied nor dissatisfied choice, and slightly more than 10 percent of the doctors indicated dissatisfaction with the system.



Satisfaction Level	Strongly Dissatisfied	Dissatisfied	Slightly Dissatisfied	Neither	Slightly Satisfied	Satisfied	Strongly Satisfied
% of Respondents	0.00	2.68	9.82	30.36	27.68	25.89	3.57

Figure 6-4: Doctors' Overall Satisfaction Level

Figure 6-5 shows both user groups' satisfaction with the system together. While the majority of nurses' replies fall in the second half of the diagram (the satisfaction half), the doctors' responses expand to both satisfaction and dissatisfaction halves. The average of satisfaction scores for nurses is almost 5.5 in the seven point scale. This score for doctors is more than 4.5, slightly above the middle point of the measurement scale. A two-sample t-test is conducted to see if the difference between the two users' groups overall satisfaction is significant. This test assumes that the two samples have equal variances. The result of the Levene's test for equality of variance ($F = 6.75$, $p = 0.010$) shows that the two users' group variances are not equal. Cohen (2001) states that when the two samples sizes are equal or large, using pooled variance need not to be a concern. The nurses' and doctors sample size are 203 and 112 respectively. Therefore, the two-sample t-test result can be relied on. The result is $t(313) = 7.05$, $P < 0.001$ which indicates that nurses are significantly more satisfied with the system than doctors. Nevertheless, another test called Welch's t-test is conducted because it uses a different formula and includes separate variances. The

Welch's t-test statistic for nurses' and doctors' overall satisfaction is t (193) = 6.65, p < 0.001. This result is also similar to the two-sample t-test and shows nurses are more pleased with the system than doctors.

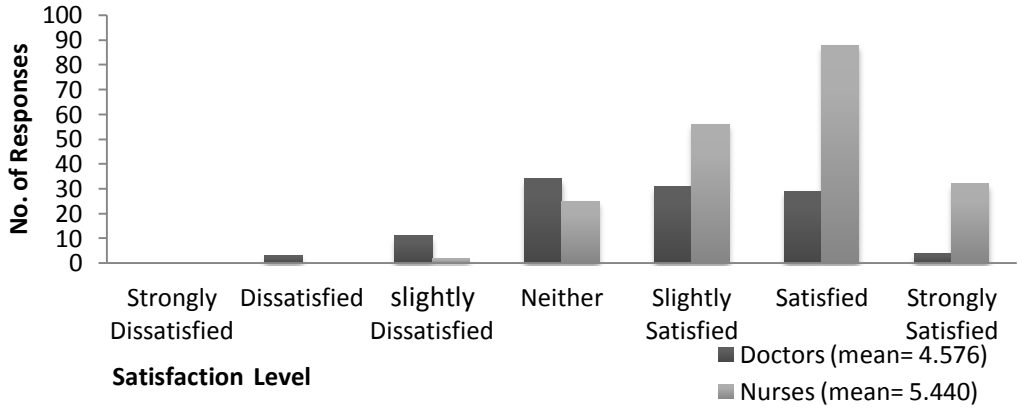


Figure 6-5: Overall User Satisfaction

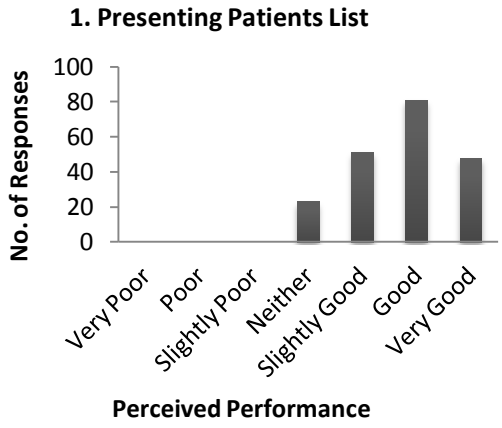
6.4.2 Features Performance Analysis

In addition to testing the research model and overall satisfaction levels, a closer look is taken at both user groups' perception of the system features performance. For each user group, six frequently used features have been investigated. For nurses, these features include: 1) presenting patients list, 2) presenting lab investigation orders, 3) printing labels for specimens, 4) tracking the status of specimens, 5) tracking the status of lab orders, and 6) presenting the results of lab orders. The features considered for doctors are: 1) presenting patients list, 2) ordering lab investigations, 3) ordering radiology investigations, 4) presenting the results of investigations, 5) printing discharge summary, and 6) printing medical certificate.

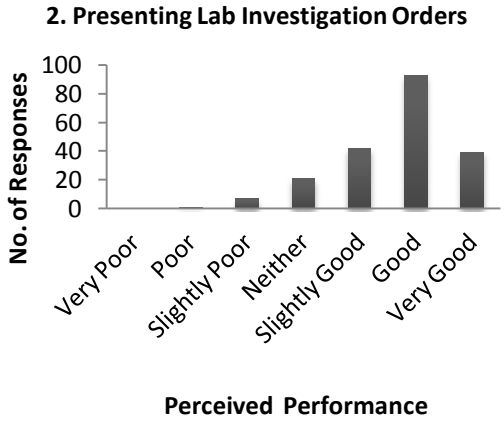
Figure 6-6 shows nurses' evaluation of each of the six features performances. While 11 percent of the nurses evaluated the "presentation of patients list" as neither good nor bad, the rest of the respondents perceived it as good. It is the only feature

with no poor performance rating. The "presentation of lab investigation orders" received less than five percent of poor performance rating, and more than 85 percents of the nurses indicated its good performance. The same trend is observed in the evaluations of all other features except for the "printing labels for specimens" feature. This feature has the highest rate (14.29 %) of perceived poor performance among the six features.

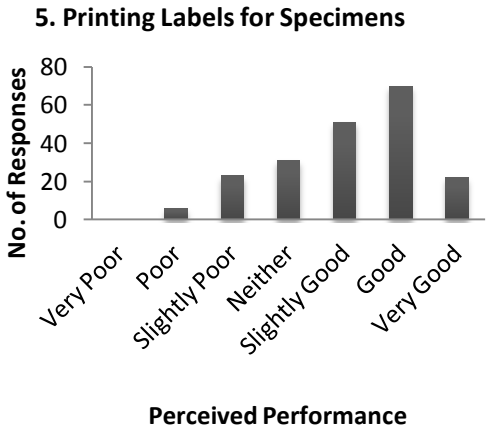
Figure 6-7 presents the doctors' evaluations of the system performance in the six features. "Presenting patients list", "presenting the results of investigations", and "printing discharge summary" share quite comparable performance evaluation results. 12 to 13 percent of the doctors perceived their performance poor, while 62 to 68 percent of them indicated good performance of these features. "Ordering lab investigations" and "printing medical certificate" received higher percentage (15-16) of poor performance rating, but they still got 65 to 67 percent good performance rating. However, "ordering radiology investigations" performance was perceived poor by almost 20 percent of the doctors (highest poor performance rating among all the features). It also has the lowest percentage (58.9) of good performance evaluation.



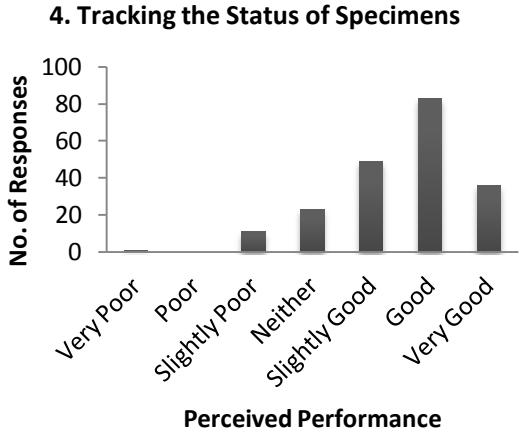
Min = 4, Max = 7, Mean =5.76



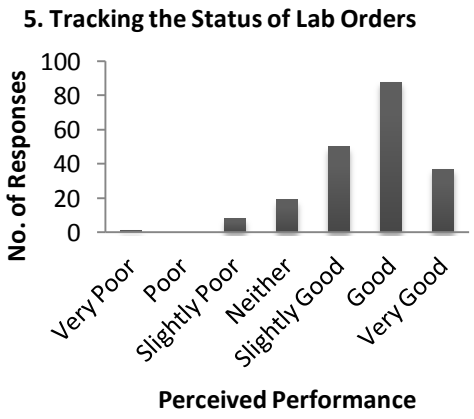
Min = 2, Max = 7, Mean =5.66



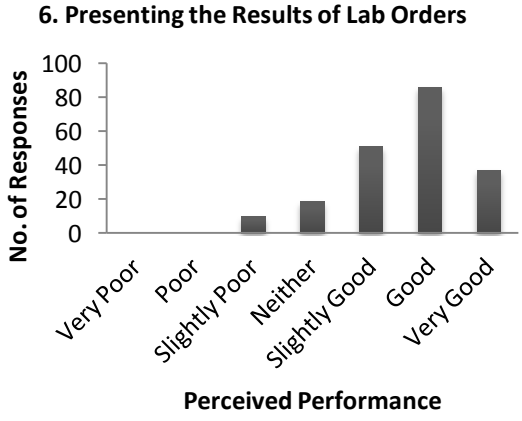
Min = 2, Max = 7, Mean =5.09



Min = 1, Max = 7, Mean =5.52

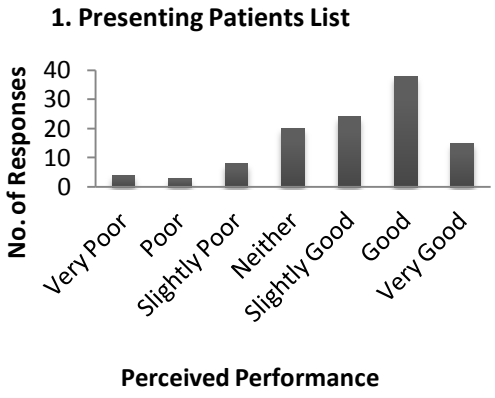


Min = 1, Max = 7, Mean =5.61

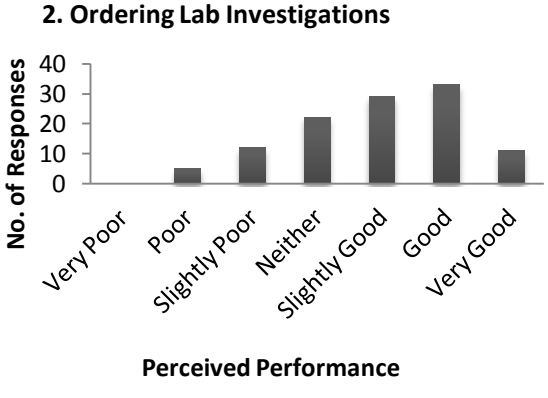


Min = 3, Max = 7, Mean =5.60

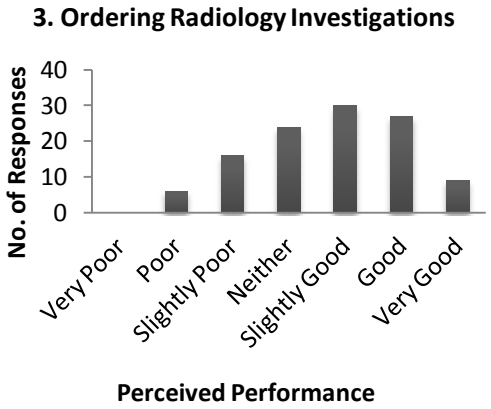
Figure 6-6: Features Performance Analysis (Nurses)



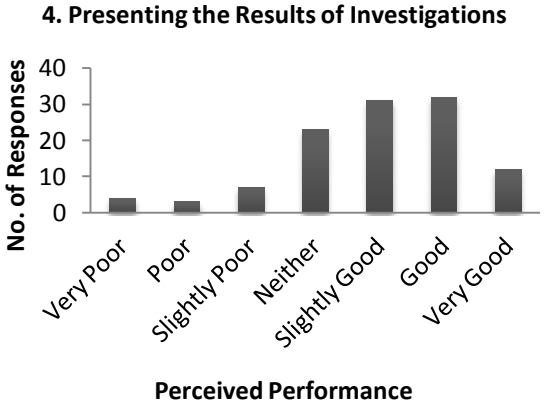
Min = 1, Max = 7, Mean = 5.06



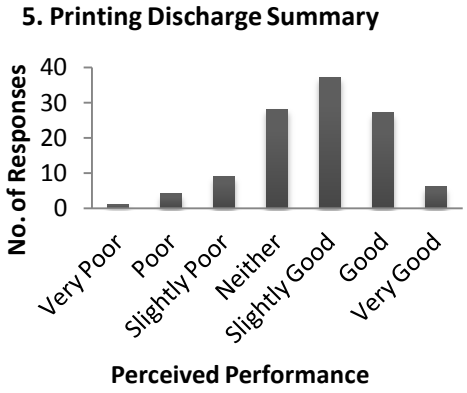
Min = 2, Max = 7, Mean = 4.95



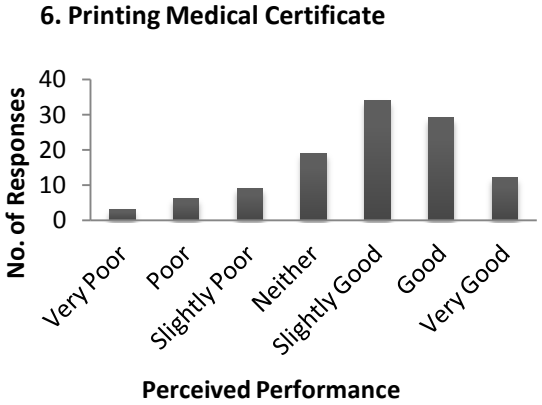
Min = 2, Max = 7, Mean = 4.74



Min = 1, Max = 7, Mean = 4.95



Min = 0, Max = 7, Mean = 4.79



Min = 1, Max = 7, Mean = 4.88

Figure 6-7: Features Performance Analysis (Doctors)

6.4.3 Open-ended Questions

At the end of the survey, the respondents were asked two open-ended questions about the CIS. The questions are: 1) what is the one thing you like most about SCM?, and 2) if there is one thing that you could change about SCM to make it better, what would it be? (Lee et al., 1996).

Table 6-32 shows all the answers by the nurses to the first question regarding what they like most about the system. The responses are classified according to their common theme into 10 groups. These groups and their respective comments are discussed below.

Investigation Orders

Investigation orders made through the system by doctors are clear and easy to understand. The nurses hence are no longer struggling with the illegible handwritten orders, calling doctors for clarification, or clarifying the orders to laboratory.

Results

The results of different investigation orders can be viewed by nurses at all times, which equips them with the information they need for better patient care management and productive communication with the doctors. Availability of results right after they are obtained in the lab (no waiting for lab print outs as before) is another positive aspect of the system for nurses.

Tracking

The nurses also find the system useful in informing them of new or pending investigations. They therefore do not need to check each patient's chart to find out about their investigation orders. The status of the specimens and results can also be check through the system which eliminates the need for follow-up calls to the

laboratory to trace the results.

Improved Work Load, Process, Time, Outcome

The system erased the need for paper work (filling investigation order forms) done by nurses for various investigations and consequently reduced the nurses' work load and save them some time at work. Furthermore, with the help of automatic labels produced for patients and specimens, the possibility of any errors such as wrong specimen from wrong patient is reduced.

Guidelines

Nurses found the guidelines and protocols regarding specimen collection quite useful, for example they can easily refer to the system and check the type of the tube to use for a specific investigation or the amount of specimen required. Previously they had to call and ask the laboratory for such information which was more time and effort consuming.

Presentation

Several nurses stated their positive opinion of the clear results display and trend view.

Ease of Access

The nurses' responses in this category indicate that all the information they need for patient management is available through this single system. The accessibility of the system from different locations in the hospital at any time, and hence convenient referring to this information is another plus point to the system.

Improved Interaction with Patients

With the availability of the patient information (e.g., investigation orders and results) through the system, nurses are able to better update the patients and their relatives at

anytime. Hence, the communication and interaction between nurses and patients or patients' relatives is improved.

Ease of Use

System ease of use is reflected in multiple responses from nurses.

General Remarks

Nurses also complemented the detailed information provided by the system, its speed, simplicity, reliability, and transparency, and paper consumption reduction.

Table 6-32: What Nurses Like Most about the System

Category	*Comments*	
Investigation Orders (18 items)	• It is clear and appropriate for us to note the orders • Check orders easily • You can see all the order • No more illegible hand writing • Ability to order radiological test through this system • Dr place order in SCM instead of using forms • Case note not messy because of all lab order • Able to view patient's ordered investigations at one time (more clear than hand written) • It is more easier for nurse to call Dr to order blood investigating and x-ray • We can see Dr's order • Straight forward, direct and readable handwriting	• Friendly user and I am assured whatever I dispatched is the correct order by the doctor and I don't have difficulty in asking the doctor of what test he/she wanted as like before that hand-written order sometimes you can't understand what they really want to order as sometimes that test is not clearly written, or that the lab also will ask you what test the doctor really wanted (e.g.,[…]) thanks to SCM! • Can clearly understand the bloods order • Easy to understand patient's order and type of bottles required • Clear, easy to understand • Able to take note of correct order and correct lab specimen tube to be use • Everything is ordered in SCM • Easy to understand what is needed at one glance
Results (58 items)	• And can discuss the results with my colleagues • I can access patient's laboratory and x-ray results/findings • Nurses can view the patient result on time • Laboratory results are available • X-rays report can be seen • I can see the radiology report online • Can see all the result inside the system • Results can be viewed easily • Immediately can see the result • Easy to access patient result especially lab result • Can see the lab results easily • Easy access to see results • Easy to use all lab results that are previously done • [You can see] all the result of patient either lab result, x-rays, scans, and […] • We nurses also can see the results properly • Updated patient list and lab results • Results readily accessible • At the same time can receive lab results easily, and can treat patient easily as soon as possible • Able to see the blood result and compare the result, which is very good system	• I could easily browse results of lab orders. Through this, I could easily picture out patient's condition even without asking the doctor. Can easily compare previous and current results which easily lead to a conclusion whether patient's condition improving or not. And through this, nurses affectively make a nursing care plan for patient • Nurses are able to trace some of the results instead of waiting for the hard copy (like in the past) • Nurses are able to review the impression of x-ray or scan patient done • The result is prompt • It helps to give the best possible healthcare quality to patients • Provide necessary information wanted • Easy to access blood result • Nurses are able to view lab results • Allows us to access DDS • Able to check the lab result without doctor, so we can call the doctor and communicate effectively with them • Lab results can be viewed right away • Able to view patient X-ray, U/S, CT scan result • User friendly as you can trace blood results of the patients on the spot, without waiting for the lab to print out lab results • Can check results [earlier]

	• I can access easily the results of my patient • Able to view discharge patients documentation and print lab results when requested • Easy access for results • One stop for lab, x-ray results to be seen/viewed • Clear results and accessible to results • Easy access of patient's lab results and other data • Can view and access easily, immediately results and orders • I can view my patient's results clearly • X-ray reports are available readily for nurses' viewing needs • And nurses are promptly to view blood results • Laboratory results – easily seen • Easy and fast access of patient's laboratory results • Easy access of lab results • It makes it easy to view the results after dispatch specimen, no need to call lab	• I can immediately see blood test results. If there is a need of all lab test to be printed I can do it on my own. • Results of blood tests available immediately, therefore enable team Dr to carry out necessary plan. • I can access to the patient's blood results promptly unlike last time need to wait for the hard copy • Can access CT scan, X-ray report in SCM • It's easy to check out the lab results and latest order of the patient, also the CT scan and […] results • Can easily check the blood investigations ordered in each patient • I would be able to view patient's results and its scans • Makes it easy for me to access […] patients information, e.g., results and doctors new order (laboratory/radiology) • That we able to view blood test result immediately • Clearly updated the result for investigation • Able to obtain the lab results fast
Tracking (41 items)	• Able to trace results/report • Ease of checking results • That I can have a clear view of specimen order status • Able to track results in the system • Able to track and differentiate lab results • Flags as it tells me what orders I have missed out or have not been […] • No need to call every now and to follow up • Once order has been made colleague of healthcare provider will do it as soon as possible • SCM is able to track the status of specimen • There is not a need to keep checking for new orders and investigation. Once marked I'll be able to see what is need to be done or ordered • Can trace back results quickly • Can easily access the specimen order and result and progressing of procedures • Tracking the status of the lab orders and tracking the results of the orders • Able to trace lab results without calling the lab • I can check promptly whose got lab test to be done • Able to check whether bloods taken • To easy track the orders and results • Easy to follow up the orders – we can check all one together at one time	• Colleagues able to follow up the blood tests if it is not done in the morning (clear communication) • If there is a new order from the doctor I can see if from the flag to note that I have a new order • Save time to call laboratory to trace results • Flagging- easily prompt you of new alerts and orders • Will no missed out order • Able to notify and taken action immediately • The timing and the status of specimens collection is stated clearly • Easy tracing of results • Can trace results easily • Flagging on so that any new order (investigation) will be flagged for easy reference at one shot for all patients we are taking care of • By logging into SCM account, I can find out if bloods ordered has already taken or not • It provides greater advantage to the nurses' part not to flip on individual charts just to see which patient has a new order • That we are able to trace results fast • Ability to show the outstanding tasks, and the results of the procedures done • It will update when there is changes to order

	• Easy to track patient laboratory results • Can easily trace down lab requests • Able to trace result effectively • One thing I like most is that it gives me direct overview of all lab investigation (including radiological investigations) at one glance	• Tracking status of lab order and presenting the result of lab order • Flag on when have new orders or new results • It helps/reminds me pending investigations that patient needs • Accessibility to doctors laboratory orders and results
Improved Work Load, Outcome, Time (59 items)	• Hassle free[:] Don't need to fill up form • Paperless, hassle free • Electric, no forms needed • It lessen paper works • It makes our work hassle free and faster • Less error in terms of patient's sticker • It prevented the nurses to dispatch wrong specimen • Less paper work (4 instances) • Save paper work • No need to label lab form • Paperless in terms of request forms, less time required • Orders that are e-order, less paper work • Paper less job • Save time • Less paper/no lab result to file in • More time to save compare to manual lab form labelling • No more paper work • Less error on wrong patient with wrong blood • Save time to fill up forms • Less medical error • Saves time for staff in terms of lab orders; • Paperless with laboratory results which lessen nurses errors on wrong filling on the case notes, hassle free • Better and more effective in preventing error of […]label as patient sticker and ordering sheet came together • No more manual labelling of blood label form • Easy to do ordering, paper less • Hassle free: less paper works (manually) for SN'c in carrying out doctors' order • No lab forms • Doctors hold more responsibility in ordering blood specimens, i.e., nurses need not spend time labelling blood forms	• It allows me to save more time at work • Very less chances to put the wrong sticky label • X-ray forms no longer goes missing • No more paper forms • It saves more time, energy and helps to prevent medical errors (always right patient and right specimen) • X-ray form will not lost • Do not need to label […] form • X-ray forms don't need to be tube off, less tendency of form lost • No need to fill up forms (waste of time) • Will not be wrong specimen/ label • No need to fill up lab order manually • Paperless operation – with date automatically recorded and fed to SCM. There is no need to fill out form for ordering, reduced error rate, human mistake can be virtually eliminated • No need for manual filling up of laboratory forms anymore! • Save a lot of paper work • It's a paperless system • It's paperless • Less paper work and time efficient • Now all investigations can be ordered in the SCM. No need [record] copy. It is very convenient for us • It eases the process of dispatching specimens to lab • Less paper work • No need to label lab forms manually • Save a lot of time of labelling lab order and specimen, reduce the errors of sending wrong specimen • Hassle free – can same time – no paper work – mean faster • Paperless • Reduced medical error • Saved more time • Less stress for working colleague

	• Less of filling and labelling the lab forms, minimizing the errors	
Guideline (16 items)	• It is easy to understand and even the blood tubes is stated clearly • It saves time as know the correct blood specimen tube, as it is indicated on the order, no need to waste time calling lab to verify the tube colour or look into the manual book • Standards to all blood/procedures needed for patient • Able to deliver the patient correct procedure and which can prevent from misunderstanding • Tubing used was instructed/indicated • List down the colour of blood tubes necessary for different test (reduce memory work) • Knowing the tubes of blood to be taken before attempting […] • When blood test(s) are ordered, I don't need to refer to any guides to know what blood tubes to use. Time saving • Know what tube to be collected • Know which blood tube to use to obtain specimen	• […] can […] effectively […] work and manage care with minimal phone call and manual information gathering. For example when collecting specimen for laboratory we are not sure what colour of blood tube also what form we need to use in this situation we used to call laboratory to ask, this is extra work time for us but because of SCM our workload was lesser because it was indicated already in SCM what specimen, colour of tube and no need to label form, for me SCM is very friendly • Easy to understand patient's order and type of bottles required • It indicates type of tubes or containers needed for specific laboratory examination • Instructions are given for what colour tube to be use(d) for different kind of blood specimens • It also gives me details regarding what specimen to collect, the amount and what tubes to use→ this really help us a lot • Able to take note of correct order and correct lab specimen tube to be use
Presentation (17 items)	• Presentation/orderliness/ arrangement of information and data • Compare lab results: trend summary • Highlighted the critical results • Trend view- easy review of patient's result • Trend view is useful • Trending view helps us to see results clearly • Laboratory test are presented in trends • Document view • Trending of results • Presentation of lab results	• Easy to view the trend view • Trend review on overall results since length of stay • Chronological order • The trending view allow us to monitor patient progress and update patient accordingly • Results for the blood investigations and radiological reports are displayed clearly in SCM • Trend view of results care clear • The display of lab investigation order, very clearly displayed
Ease of Access (20 Items)	• SCM is easy to access (3 instances) • Easy access(3 instances) • Easily access • Accessible • Easier access • It can be check anytime, anywhere in the ward • Easily accessible at most location/patient areas • Results can be viewed anywhere	• Easy access to the information needed • It's a one stop station for updated, detailed information for trending and evaluation of patient management • Once you're inside the SCM order the […] you can access to everything you need • All-in-a-glance concept • All the information you need is in the system • Easy to refer when in need
Improved Interaction	• Can easily update patient's relatives for a short period of time only • As it is very useful to update patients and relatives	• Easy to access investigation' results of patients (can update patient's family more effectively)

with Patients (8 items)	• Easy for us to update patient's family if they ask what are the results of the procedure done to their relative/patient. • It enable[s] the nurses to print out patient discharge summary to patient's […] • Able to update patients relatives in the absence of team doctors	• The trending view allow us to monitor patient progress and update patient accordingly • It tells you the result of the tests done, including radiology test thus making it easy and hassle free for nurses and doctors to update patients promptly
Ease of use (16 items)	• Easy to use (4 instances) • Convenient • User friendly (8 instances)	• Easy • It is easy to use • Friendly user
General Remarks (12 items)	• Fast (3 instances) • Transparent • Reliable (2 instances) • Simple • It is very detailed. E.g., the time that the specimen was printed	• Flexibility • Seldom has got […] Problems/ system breakdown • Can save paper, reduce wastage • Reduce the use of paper for lab forms

Table 6-33 displays all the comments from doctors on what the like most about the system. Their responses and their related categories are discussed below.

Trend View of Lab Results

The trend view option and the ability to chart the results is the most favorite feature of the system among doctors.

Integration with and Link to Other Systems

Several doctors expressed their contentment with the system in terms of its integration with several other systems like PACS, iPharm, CPRS, hence covering various clinical procedures and medical information all within one single portal.

Patients List

Another feature that received positive feedback from doctors is patient list and its customization capability for each doctor, ward, and discipline. It makes tracking of patients and follow-ups easier for them.

Improved Wok Process and Time

The system improved doctors work from different aspects such as readily available information (e.g., while consulting with patients or as soon as the lab is done with the orders), less time spent on tracking the status of investigations or retrieving patient past or current medical record.

Presentation

Seven compliments were also received on the display of patient information and results of blood and other investigations.

Ease of use

Several doctors indicated the ease of use and user friendliness of the system, log in,

ordering, annotation of results, creating lists, and viewing images.

Ease of Access

The other aspect of the system that doctors liked is its ease of access from different locations in the hospital and hence reaching to patients' different investigation results when they need it.

Speed

Finally, nine comments complemented the fast speed and loading of the system and its lack of frequent lagging or down-time.

General Remarks

Simplicity, accuracy, similarity with other systems (advantage of familiarity), more end user interaction, well maintenance, investigation panel, time chits, and medical certificates, and some other features are among the general comments from doctors on what they like most about the system.

Table 6-33: What Doctors Like Most about the System

Category	*Comments*	
Trend View (21 items)	• The investigations results can be visualized as a trend view. That is one thing I find very helpful • Able to trend investigation results and show investigation results in a summarized way • Trend view of results • Ability to chart results • Results displayed trending well • Trend view (3 instances) • Reviewing lab investigations, trend view, parameter display • Trend view of investigation results along with graphs	• Trending of lab results (2instances) • I personally like the flagging up of new results and the result trend table • Trending of results (2 instances) • Able to show a trend view instantaneously • Able to see trends and compare results • Results charting/ trend good • Can trend lab results so it is easy to see them: Numerical, Graphical form • Results can be in trends • The graph of results
Integration with and Link to Other Systems (17 items)	• Links to other programs • One stop access for most other programs • Incorporation of most aspect of clinical work e.g., admission/discharge summaries, lab results, radiology results, lab and radiology orders, parameters • Centralized data base • Universal access • Access to multiple portals • All of the information needed is available through one portal • Able to access labs, radiology images, CPRS, documents into one program	• Link to other programs e.g., PACS • Integrated system including all needed applications • User friendly→all in one • Most of the other portals to access information e.g., CPRS, iPharm are linked to SCM • link with CPRS, CDMR, imaging • Context switch. It launches the patient's iPharm/CPRS → minimize errors • Integrate all related system into one platform • Many functions integrated into one system • Can access CPRS
Patients List (17items)	• It creates good patient list • Customized list • Storage of pre created list like "my ward patients" • Create own table: personal account/ patient lists • Helps me create my own list • Patient list (2 instances) • Can create customized list of patients • Patient list can search by ward, discipline etc. • Can make my own patients list	• Patient list very good, easily trackable • Customizable list • Allowing me to keep track of my patients and easier follow-up from remote location • Able to maintain patient list according to services or location • Can have your own patient list • Can manage my list • Being able to construct own patient list • Can customize own list and trace patients results and follow ups
Improved Work Process and Time	• Reduced turnaround time • Electronic ordering system: able to view what has been ordered and whether the investigations have been done or are still pending/ received by performing department.	• Patient's past history of lab: results and medication • I personally like the flagging up of new results and the result trend table • Less paper work

(13 items)	• Tracking new results very easy • Faster retrieval of patient's results • Results are online • Ready availability of patients' investigations and records	• No need to ask for case sheet, call lab to trace results • Access to my patients' medical records and information while the patients are in consult with me • No long waiting to retrieve patients' physical records/case notes • Results are displayed as soon as they are ready from lab or radiology
Presentation (7 items)	• Fairly straight-forward display of patient information • Display of blood results • Better presentation • Layout	• It is better than the system used in the old AH (In terms of result presentation(ordering)) • Results are presented systematically and clearly • I personally like the flagging up of new results and the result trend table
Ease of Use (17 items)	• Quite easy to use • Ease of use (6 instances) • Relatively easy to use • Easy to manipulate • Fairly easy to use • User friendly	• Very easy to order radiology, lab investigations • Easy to view images • Easy friendly radiological • Easy annotation of results • Easy to launch/log in • Easy to create list
Ease of Access (5 items)	• Easy access everywhere • Access to patients' investigation • Provides ease of access to results	• Allowing me to keep track of my patients and easier follow-up from remote location • Easy access
Speed (9 items)	• System loads up quickly • Fast uploading • Fast (2 instances) • It's fast	• Good speed of access • No lagging • Program does not freeze often • Shut down-time and does not lag
General Remarks (13 items)	• Simple and effective • Accurate • Efficient • Better than CPRS • Familiarity: similar system in KKH, CGH and SGH • Well done • Well maintained	• More end user interaction, No just teaching • Time chit, MC • Investigation panel • Able to type in what time investigations to be done • Added cardiac enzyme and ECG set x1/ x2/ x3 is a plus point! • Option to comment of results, i.e., annotation of results

Table 6-34 shows nurses' comments on what they would like to change about the system. Comments addressing same issues are grouped together. They are discussed in the following.

Printer

The printer category has the largest number of comments. Nurses need to print shipping lists, specimen order forms, specimen labels, and name tags for patients. Majority of the comments complained about the printers frequently being out of order and how it disrupts their work. They also indicated the need for more printers in the wards.

Access

Access category received the second largest number of comments from nurses. The nurses requested granting them access to 1) view all tests, reports and results such as x-ray, CT scan, MRI, 2d echo, etc., 2) cancel repeated order entries by doctors, 3) order some tests like blood test, culture swab, wound C/S, 4) view discharged patients' results, 5) reorder what has been ordered in case of rejected specimen.

The other feedbacks included 1) granting new nurses and students access to view test results such as blood test, 2) HIV test ordering access to nurses who are trained for HIV test given the patient has consented, 3) granting access to nurse assistant as they are trained in taking blood, 4) allowing doctors to amend the timing of specimen collection after ordering.

Information

Various responses pertained to the information provided by the system. They mainly asked for 1) up-to-date information on lab requirements and protocols, 2) indication of tube color for different blood test, 3) reflecting time and date of certain procedures

like x-ray and CT, 4) having an extra column for nurses' personal note under their own patient list, 5) showing number of sticker labels to be printed in the blood investigation list.

Presentation

In the presentation category, different suggestions are given to improve the layout and interface of the system. Two of the responses indicated some information in the system would be clearer if it is presented with less word for examples the location of the patients or different laboratory tests to be carried out. Bolding patient location, flagging out abnormal results, having trend view for x-ray reports, different font colors for different laboratory test to highlight them from each other are instances of other suggestions.

Double Entry (Repeated Order) by Doctors

According to the nine comments categorized into "double entry" group, doctors sometimes place same order repeatedly in the system. Nurses find these repeated orders confusing and time consuming to contact the doctors and verify them. Nurses' suggestions to rectify this problem include providing proper training for doctors to avoid repeated order and properly canceling them if they occur, having notification pop-ups alerting the doctors on repeated orders, or granting the nurses the permission to cancel these orders.

Notification

Nurses proposed the use of notification pop ups for, 1) critical results, 2) printer out of order, and 3) double order entries. They also suggested alerting nurses through their hand phones when there is new order. In addition, alert function was requested for critical results and medication timing.

Speed

Four answers requested faster speed, login, and click on screen.

System

Some nurses commented on the system hardware including: 1) the difficulty of pushing some of the COWs (Computer On Wheel), 2) need for bigger screen, 3) long downtime, and 4) need for a backup system.

Consistent Updating of the System

According to the four feedbacks in this category, sometimes doctors place urgent orders in the system, but they are not reflected in nurses' view of the system. Similarly, nurses dispatch specimens to the lab, but the lab orders are still in the system list of lab requests. Therefore, nurses requested for faster and consistent update of the system.

Integrated System

The four comments related to "integrated system", mainly asked for inclusion of more treatment orders and notes (e.g., intake and output chart, notes (nurses and doctors), medication (IMR), and frequency of parameters) into the system. In addition, they are looking for a through integrated and paperless system such that they do not need to check both the system and patients' case note to know what needs to be done for the patients.

Security and Passwords

Three comments were grouped under the "security and password" theme. One suggests automatic logout of the system after a certain period of idle time. It can be a helpful feature added to the system to increase its security. The other two feedbacks are not directly related to this theme, but they can raise some concern about the

nurses' awareness of the importance of avoiding unauthorized access to the system. Although only two comments may not be representative of the whole nurse population of the hospital, but it is worth noting due to sensitivity of patient information.

Navigation

Two feedbacks asked for less clicks in order to reach the ab/normal results.

Search

One of the responses suggested the use of wildcard characters in database queries to facilitate searching in the system.

IT Support

One feedback was received on the need for improvement of IT support to resolve technical problems any time encountered.

Table 6-34: What Nurses Would Like to Change about the System

Category	*Comments*	
Printer (36 items)	• It would be better if can achieve hassle-free when printing lab order, because sometimes printing machine not able to print out the specimen order form or label due to poor wire connection, we as healthcare providers don't know about the trouble-shooting of the SCM system • To print out sticky label and shipping list properly every time • The printer, when printing sometimes nothing is print out, due to cable • To make the machine print out labels more quickly • Improving the printer, because sometimes it is a problem • To have more SCM printing machine in the ward • Make patient's sticking label (ID) printable in all COW's instead of just [main] counter • When printing- shipping list and name label, sometimes the machine doesn't print out straight away. Need to do troubleshoots. If that can be improved • Sometimes during printing of lab specimens, only the patients' stickers are printed out but not the shipping list. These is no indication telling that the printer is out of paper, […] doctor has to re-order specimen. • Printer function has to be improve, it get jam easily • Printer of both shipping list and stickers • Printers should function well all times • Sometimes printer unable to print, can improve that […] • Label printing machine are always down/ faulty. Affect us in not able to print labels and stickers • Auto print of lab test shipping list and patients' label at specific time stated for the test • Cable printer need to improve to function better • Can have printer? • Sometimes shipping /name label cannot be printed out if machine goes wrong • Sometimes not printing labels due [loose] USB connection	• In terms of printing labels, after investigation dispatched, it would be useful if we can return back to the investigation and able to choose number of labels required without the need to print the shipping list. • The printing labels got stuck or it cannot be produced at times, then we have to call the IT helpdesk to assist us (waste time!) • Take away the shipping list printer and sticky label printer because the blood tubes can use ward sticky label, the printers for both always have problems-unable to print, etc. • Printers of label, shipping list; at times it will print in 2 copy • To ensure that is no more hiccups when printing labels • The printer label and the sticker label machine should place in an area where it won't be jam sometimes can't print out despite there's paper in it. • To improve connection of printer, sometimes shipping list and sticker is not printing • If the SCM printer spoiled, need more time to dispatch the result • Printing of specimen sticker, downtime too often • Shipping list printing machine, always spoiled • About the machine of shipping list, every time can't print out • Hassle to print sticky label for wrist tag with only one printer and from only one pc • I can print SCM patients' wrist tag at both counters, the [phlembo] COW will not get stuck oftenly • It is okay, so far. Nothing against the system, but the printer irritates me a lot. (once paper finished and we refilled the paper, still un able to print) • Printer and [add on] test label • USB cables, too many sometimes have connection problem, need to unplug and reconnect • Printing sometimes takes time. The wiring is loose and we had to hold on to the wiring or plug and unplug the wiring multiple times before we get
Access (31 items)	• As staff nurse I hope we could also access reports/findings of x-rays, CT scan, MRI, etc • If doctor ordered double, we can't cancel and doctor also forget to cancel	• Able to order certain blood investigation, Drs may write in the […] sheet but at time did not order in the SCM- lead up to delay • SCM will be available to prompt the […] For repeated order as there were

	our […] is there any […] • If nurses can possibly order in the SCM, much better, so that any time we can take blood. Some times […] doctors to order is time consuming • That we are able to more tests, rather than calling doctor all the times, e.g., culture swab, etc. • To have common password for new nurses or student nurses, thus they able to check status of bloods taken from patient • Staff are allow to view discharged patients' results • Nurses should be allowed to order the tests • Nurses able to view all test, c-rays, scans, and reports • It should be easier if nurses are able to cancel repeated blood investigations • The lab test order could be activated automatically, once the specimen was rejected. • For nurses to have the authority to cancel double-order by doctors (saves time on asking colleagues whether done or not) • The ability reorder what has been ordered, as due to some mistakes, we need to resend orders again but we cannot, need to contact doctors to do it • Cancellation of double orders by doctors; should be extended to SNs; team doctor are reminded to cancel repeatedly but always forgotten. • Allow nurses to cancel double orders done by doctors • Allow nurses to order [wound c/s] • Double order by doctor can sometimes confusing as nurses do not have the authority to cancel • Allow specialized nurses, e.g., HIV nurse to order in the system , HIV blood test rather than the staff nurse in charge still need to inform Dr when patient gave his/her consent	multiple repeated order I encounter and were not cancelled (only doctors are able to do the cancelling) and made the staff getting […] • Allow access for assistant nurse as they are train in taking blood • Nurse can order some […] test e.g., wound C/S • Maybe when we try to print forms and suddenly when the laboratory call that the specimen is rejected, we need to call doctor to order again, very hassle for us nurses to ask doctor again especially during night time. Can we just reprint in the SCM? • Nursing access included • Allow to view x-ray report and x-ray pictures • If we could have x-ray images available • For the case of repeat orders by doctors in the system, we nurses are unable to cancel the repeated blood order • Staff nurses can also view all the results in […] SCM • For the HIV screening is it possible for the staff (the one who also do the […]) for them to order in the SCM, and no need to ask from team doctor to order as long as the patient consented for it. Waste of time for the nurse and team doctor to inform and order • Scan, x-ray, 2d echo results can be viewed by we nurse through SCM in order to know his patient well • The timing of specimen can be amended after ordering. As got experiences that Dr wanted to change the time of specimen collection but cannot change, and we need to write in the report to remind the next shift colleague it is no need to be taken during the time actually stated in the SCM • Can be amended timing after ordering
Information (14 items)	• Under the personal patient list, it will be helpful if we can manually enter into a remark column, for example [reason] for follow up or shat captured patient background for follow up, the information can only be accessed by user and not seen by others • With all the bloods investigations listed, it would be nice if number of stickers labels to be printer are shown • For blood tests, can show color codes for different tests to show what tube color can be used • Update lab requirement for some blood tests, keep information up to date • X-ray appointment/pre-schedule timings are available in the SCM when checking outstanding order	• Reflect time and date as well as protocol on line on certain procedure e.g., CT guided biopsy • More patient information • X-ray – porter comes anytime, but patient might be for procedure • Faster and more reliable results • Maybe its better the tube needed to be use be highlighted. As for DMP (diabetes monitory […]) needs both gray and purple tubes, some may oversee the purple tube needed and if did not take the purple tube, we may need to "poke" the patient again or patient need to repeat the whole procedure again the next day as it requires patient to fast the night before • For x-ray orders, for CT and U/S, to indicate if NBM is needed as new

	• Just continue maintaining integrity and reliability of system information • We can […] diet from SCM	nurses may not remember which procedure needs to be or NBM or which procedure require consent
Presentation (14 items)	• To bold patient's bed number • To be more presentable in terms of graphics • [Suggestion] laboratory results should be flag out for doctor to note, to take action • When adding specimen (to print out shipping list), to have the entire different category (hematology, biochemistry, etc) to be displayed in 1 page. • Viewing of results when scrolling down • Result should be categorize by patient admission stay in long run, as not to mess up the lab result and for easier referencing in the future, according to which […] admission • Display of results • Different font colour for microbiology, so as to highlight it from other lab orders	• Maybe it will be better if can flag out abnormal results • Less words, too wordy! e.g., UFE with Dipstix 7: - collect: Urine (10ml in sterile container) [now], - UFeme – mouse roll over then the rest of the details can be seen, OR -UFe with Dipstix7 → in Bold! • Under current location → can just have the department and bed number e.g., A52-03… no need for KTPH ward A52. It would be clearer and quite clear cut A52, B96, etc… • Differentiation using colours, for x-rays/scans and lab tests • Maybe its better the tube needed to be use be highlighted. As for DMP (diabetes monitory […]) needs both gray and purple tubes, some may oversee the purple tube needed and if did not take the purple tube, we may need to "poke" the patient again or patient need to repeat the whole procedure again the next day as it requires patient to fast the night before • Being able to trend the x-ray reports/reporting
Double entry (Repeated Orders) by Doctors (9 items)	• Doctor to order clearly for the investigation that requires, avoid to order double entry • If doctor ordered double, we can't cancel and doctor also forget to cancel our […] is there any […] • Regarding double orders • Honestly, it is not the SCM which I wanted to become better. I would like to appeal that doctors must be trained well on using it. Always encounter double entry (same order on same day). Time consuming for nurses to call them and verify. Most of them admit that it's double entry. Please teach them how to delete double orders. If their reason is because the "rush" it's not an excuse. It's not cost-effective for everyone (effort wasted) • Double order by doctor can sometimes confusing as nurses do not have the authority to cancel	• Sometimes repeat orders make confuse • Actually there is nothing wrong with SCM itself. To improve and make it better is I think to give more training and information to the doctors who are entering orders in the system. Because whenever they make double entry of orders or forget to cancel wrong orders, it gives confusion and would lead to mistakes or errors. • SCM will be available to prompt the […] For repeated order as there were multiple repeated order I encounter and were not cancelled (only doctors are able to do the cancelling) and made the staff getting […] • If doctors order same test (repeat), please […] them to prop up a window "to confirm or check". Most of the time some test are order double by different doctors/same doctors (something like double entry)
Notification (9 items)	• Sometimes during printing of lab specimens, only the patients' stickers are printed out but not the shipping list. These is no indication telling that the printer is out of paper, […] doctor has to re-order specimen • Detecting double orders and prompting the user • As nurses do not have time to check on the SCM regularly, we may miss on critical results. It will be good if on top of visual flagging, an alert tone can be used to alert nurses of critical results so that we can inform doctors promptly. In this case, we can also leave our SCM account logged on	• Notification pop up for critical results. If there is double entry, for pop up • Alert nurses when these is new orders without viewing SCM, e.g., HP alert, that there is a new order being ordered • Add alert function for medication that need to be given at different timing [• SCM will be available to prompt the […] For repeated order as there were multiple repeated order I encounter and were not cancelled (only doctors are able to do the cancelling) and made the staff getting […] • If doctors order same test (repeat), please […] them to prop up a window

	throughout the shift for easy viewing in one fixed computer • May there be prompt in the computer if these is error in SCM, e.g, unable to print investigation ordering sheet or patient sticker	"to confirm or check". Most of the time some test are order double by different doctors/same doctors (something like double entry)
Speed (4 items)	• The speed (2 instances) • Faster log in time	• The speed to be faster when logging in and clicking on the screen
System (4 items)	• The cow (computer on wheel): some of the cow is very hard to push • The down time was too long	• Bigger screen • Back up during downtime
Consistent Updating of the System (4 items)	• Even if the specimen has been taken lab request still on the SCM list […] • Update the system faster, as sometimes specimen sent however system is not updated • Other two cases were blood orders that was not reflected in nurses' access	• Ever a case when my doctor ordered for urgent MRI brain, but it's not reflected in the system under the nurses' access and x-ray access. But it is seen in the doctor's SCM access
Integrated System (4 items)	• Include other treatment orders e.g., intake and output chart, frequency of parameters, etc. • Currently, still have to check Dr's order in case note and SCM. If all orders can be ordered in SCM, nurses need not check 2 sides for order	• Parameters, medication (IMR) and notes (nurses and doctors) should be in SCM (for total paperless) • IMR incorporated into SCM?
Security and Password (3 itemz)	• To have common password for new nurses or student nurses, thus they able to check status of bloods taken from patient. • Sometimes, we forgot close/ logout the system. In the SCM under your account still opened until someone help you to close, also anyone can open the system and order, print labels for specimens without your permission. It would be automatically logout within time limit	• As nurses do not have time to check on the SCM regularly, we may miss on critical results. It will be good if on top of visual flagging, an alert tone can be used to alert nurses of critical results so that we can inform doctors promptly. In this case, we can also leave our SCM account logged on throughout the shift for easy viewing in one fixed computer
Navigation (2 items)	• It would be some of the normal values and its indications, be it abnormal, so as with another click it's easy to refer	• Lesser click to view the results
Search (1 item)	• The ability to use "wild card" in database queries. Such scenario would be searching the name of the physician when ordering tasks on behalf. E.g., Mark Teus. Could use "mark T*", results would be: Mark "Tan", "Teng", "Theng", etc	
IT Support (1item)	• It can improve the IT support – as after they come they still unable to find what the problem is	

All the responses on what doctors would like to change about the system can be seen in Table 6-35. The comments and their allocated categories are discussed below.

Presentation

This category received the largest number of comments. Examples of the respondents' suggestions regarding the presentation and lay out of the system include: having a separate category for patients with new test results, having help/search/index feature to find instructions easily, adding the ability to search patients by name, modifying the very small boxes in discharge summary, providing the option of hiding some of the columns in the results view, better design of patient list, better categorization of results in trend view, less screen and click to reach the desired functions.

Integration

Doctors' comments under this category emphasize on 1) incorporation of the findings and results of more investigations such as IMR, endoscopies, parameter charts (e.g., I/O chart, postural BP chart), and different report (e.g., OT, OAD) in the system, 2) integration with or addition of other systems such as ICIP, IMM, OISYS, iPharm, better clinical decision tools, and messaging system, and 3) standardization of the system in all the public hospitals and their interconnectivity.

Annotation, Acknowledgement of Results, Correspondents letter

This category contains doctors' suggestions on how these features should work and what they should include such as allowing multitasking while entering documents, adding memo writing capability, and improving annotation of results to be easier and less laborious. As reported in Table 6-22, doctors who have already worked with similar systems in other hospitals made comparison between their experience of using those systems and the system examined in this study. They then indicated what they

expect from the current system regarding annotation/acknowledgement of results.

Discharged Summaries

The respondents commenting on discharge summary feature asked for ease of processing them (e.g., less areas to click, better display, auto-inclusion of date range) and better availability of different investigations findings while writing discharge summaries.

Medical Certificate

In the feedbacks related to medical certificates, doctors asked for making the processing and printing them easy, intuitive, and time saving. Similar to the annotation category, the comments in medical certificate group include several comparisons of this feature with what doctors worked with in other hospitals.

Speed

Eight comments stated the need to increase the speed of the system, connection and loading time, availability of results, and opening and closing the windows while using different features.

System

Some respondents suggested having more computers and printers in the wards, adding hand writing (recognition) and drawing feature, and availability of the system on iPad. Two doctors also requested less system crash especially while using laptops.

Security and Password

The feedbacks in this category asked for less 1) system restriction, 2) complicated requirements for password, and 3) prompt change of passwords.

Ordering

Three comments indicated ordering of laboratory and radiological test is time consuming and laborious, and needs to be more intuitive.

User Friendly

Respondents also provided feedback on the need for increase in user friendliness of the system especially iPharm, MC, and radiological investigation.

Access

Two comments are placed in access category. One of them asked for being able to access to the system outside the hospital. The other one suggested providing access to nurses to place blood test orders in the system upon doctors' request. Therefore, doctors can have more time to focus on patient management and have better communication with nurses.

Printing

The two comments in this category stated the problems the respondents encountered during printing the order forms.

Table 6-35: What Doctors Would Like to Change about the System

Category	*Comments*	
Presentation (24 items)	• Better presentation of results of tests generated in the output setting i.e., can patients who have a result show up on an "outpatient new results" category rather than having to remember to look at all patients within X days • Make radiology access more [uni format] in one site • Some of the functions are not intuitive and if you do not know the steps, you can't get to where or what you want. Is there a help/search/index/topic function where I can get online instruction if I am lost? • Searching for patient by name • Shows current in-patient list for each consultant → all results in one screen including histology • Better arrangement of results and imaging studies • Make trend view the default • Remove the little boxes in summary gap-very small and difficult to select, very user-unfriendly • When viewing blood results, I hope I can hide some of the columns (in trend view format) (patients are on hourly glucose monitoring which causes many extra columns in between daily bloods and make it difficult to compare results) • In trend view format, it would be easier to see the trend result if selected row can be highlighted • Interface • Readily available list according to Dr's name/ward/specialty	• Typing of medicines to order prescription: if there is an error and you press backspace, have to key in entire thing again. To allow single letter changes without need to type entire drug name again • Less screens/ steps to get to the function • Patient list should be better designed [• Be able to select font size [font size] • Trend view of […] results: -Microbiological, -Radiology, -Histology • The display of trend results: perhaps it can be more categorized. I am still unclear the order of display. Is it alphabetical (probably not as hemotology appears first)? Is it by categories: -Biochemistry, -[…], -hematological • More intuitive, decrease the number of clicks • Comparison of x'le x'ray on one window (different x rays) • Minimize number of clicks/ toggle between different, page. E.g., divide screen into 4, so that visit summary, results, patient list, Qsott can be on the same page, rather than to toggle screen a/n screen • Results not displayed in a user-friendly manner, small boxes makes it difficult to select each box • Results displayed in difficult to read pattern • Lay out and overview of the presentation is not very clear or no clear enough
Integration (13 items)	• In some other institution where we have worked the SCM additionally incorporated the results of operation / endoscopies done at the same institution. I feel that if it had been the same here it would have been quite helpful • Just feel that all public hospitals should standardize the patient access system to ensure uniformity and reduce confusion • Incorporation with other systems, e.g., ICIP, IMM, OISYS to make it a all-in-one comprehensive • Can include online messaging system for doctors/ nurses/ clinicians to keep in contact • Include whole of the parameters chart (including I/O chart / postural BP	• Better clinical decision tools • Combine with iPharm so there is no need to open so many windows on the computer • Integrating All (radiological, blood [lx], histological) results as well as OT reports (as similar to SGH and KKH) • To put IMR electronically • The ability to see [histopath] reports, OAD reports, OT reports etc. • Patients' inpatient medical record, e.g., ECG, temperature chart to be in SCM • That we are connected to all other hospital regardless of system • That we can order drugs online and see prescription chart (like SGH),

	chart) and IMR on to the system	I/O chart online
Annotation, Acknowledgement of Results, Correspondents Letter (10 items)	• I would like it if I could note the CXR for no placement [acknowledge results] and just ask the staff nurse to start feeding patient without of physically going to the ward (specially on call) • Acknowledging results should be together with "Clear Flag" • Allow multiple windows for multitasking for "documents" entry • To be able to type memos in documents • Also, there is no application for memos unlike HIDS • Auto annotation of results	• Have a feature to have memo's which can be written and saved in the system similar to that of HIDS used by Singhealth • Annotation of results at times, I end up annotating few times and also when I annotate the screen blinks so fast, and then it scrolls down few names • Make annotating results easier, currently very laborious • Correspondence letter
Discharge summaries (7 items)	• Able to look through results at the same time during preparing discharge summary • While writing D/C summary: we often have to look up to the radiology/histology/ microbiology findings. It would be a lot more practical: if we can open up these windows, while we are typing the summary • Discharge summary display	• Discharge summary and medical certificate → ease of processing them • Choose the date range for auto-inclusion into the discharge summary • Discharge summary format[:] Toggle to lab results easily • Discharge summaries: Too many areas to click, it may not be very relevant in every patient profile
Medical Certificate (5 times)	• MC should be print out save→ printer→print [,] should print once we press the "save" • It takes some time to print a MC compared to Sighealth's HIDS system • Discharge summary and medical certificate → ease of processing them	• MC option should be made re-printable or amendable instead of cancelling MC and creating a new MC (in case of error entry) • The ordering and cancellation of medical certificates/ time chits is also not intuitive→ Singhealth have a better way of doing it
Speed (8 items)	• Faster speed • Fast, fast, and fast • To increase speed of operation • Increase speed • Speed	• Improve the accessibility and promptness in bringing the results. Connection speed is slow. Loading is taking longer • Would like to make SCM faster — opening and closing of windows while accessing tools or editing discharge summaries • It's becoming to[o] slow
System (6 items)	• Patient listing is not updated (compared with the SAP that nursing staff are using) • SCM hangs sometimes, especially when accessed via laptops • Less crash or hang	• Allow hand writing recognitions and drawing (free hard) • That we can have more computers in the ward with more computers with printing capabilities • Available on iPad
Security and Password (4 items)	• For 4 months, I was unable to access CPRS, I had to log in again with my User ID multiple times • Prompt change of password every 2-3 month	• Less system restriction • Uncomplicated password[requirement]
Ordering (3 items)	• Easier to order radiological investigation • Ordering of lab + radiological test not institutive enough, slows me down!	• Need to improve on the ordering of laboratory and radiological investigations →currently very laborious and time consuming
User Friendly (4 items)	• iPharm-prescribing is not user friendly • iPharm- not very good	• More user friendly, e.g., MCs, Radiological investigation (ordering), incomplete results, e.g., no histopath results

	• User friendly and computer idiot proof	
Access (2 items)	• Junior colleagues[’] interaction with nurses in terms of ordering lab investigations hampered → delay in ordering it via SCM as they have other commitments at same time. Might be useful if nurses have access, (i.e., allow nurses SCM access to order bloods) to carry out the lab orders as requested by doctors for us not to have a delay with respect to patient management	• Access to SCM outside of hospital
Printing (2 items)	• When printing the orders (TCU), sometimes it does not get printed together with the patient’s copy (discharge), and there is no ways to print out the order form	• Print out OA order forms more easily

CHAPTER 7

DISCUSSION AND CONCLUSION

7.1 Discussion

This thesis aims to devise a framework for determinants of IS user satisfaction (particularly clinicians) and explain how they shape satisfaction through the lens of the disconfirmation paradigm. The framework considers the perceived performance of the system and its congruency with the users' expectations and needs to form their satisfaction.

The results of the study show the clinicians were overall satisfied with the system. Among the two user profiles investigated, nurses showed more satisfaction with the system than doctors. The results also indicate the perceived CIS performance has the major impact on both nurses' and doctors' satisfaction. This finding corresponds to the findings of previous IS user satisfaction literature (Au et al., 2008, Suh et al., 1994) and consumer satisfaction research (Churchill and Surprenant, 1982, Swan and Trawick, 1980, Tse and Wilton, 1988). It suggests the impression that the actual performance of a system leaves on users is the essential factor in explaining their satisfaction. Perceived CIS performance not only affected satisfaction, it was also found to significantly impact doctors' and nurses' needs and expectations congruencies.

While the nurses' and doctors' results are consistent on the impact of perceived

CIS performance, the effect of the other factors on satisfaction differs among these two user groups. The results of the study show that the next influential factor on nurses' satisfaction is needs congruency. That is, among nurses, the system performance in fulfilling their needs at work setting has a significant impact on their positive perception of the system. Similar findings on the significant impact of needs congruency on user satisfaction were observed in prior IS research (Khalifa and Liu, 2002), consumer satisfaction literature (Barbeau, 1985, Locke, 1967, Spreng et al., 1996, Wirtz and Mattila, 2001). In addition, nurses' needs were found to have a positive impact on their expectations. In contrast, the other two factors (i.e., expectations and expectations congruency) were not observed to have a direct significant effect on nurses' satisfaction. This is consistent with the findings of previous studies such as (Au et al., 2008, Barbeau, 1985, Oliver and Bearden, 1983). The study was conducted more than six months after the implementation and use of the system by nurses. Therefore, there is a possibility that nurses were not able to recall their initial expectations after this period of time which consequently resulted in lack of a significant influence of expectations and expectations congruency in this research model.

For doctors, this is the system performance in meeting their expectations of the system which influences their satisfaction with the system rather than its relative performance with regard to their needs. Nevertheless, doctors' needs were found to significantly affect their expectations. Previous IS studies (Bhattacherjee, 2001, Khalifa and Liu, 2002, Szajna and Scamell, 1993) and especially consumer satisfaction research (Bearden and Teel, 1983, Yi, 1990) provides substantial empirical evidence for the impact expectations congruency on user satisfaction. This finding can be attributed to the importance of the patients' healthcare to doctors. Such

that it might lead them to put their patients' healthcare needs ahead of their own needs. Therefore, the performance of the system up to their expectations in delivering the best healthcare to their patients played the significant role on their positive perception of the system. In addition, the doctors in the sample hospital had experience with using similar CIS in other hospitals, while the nurse came from a paper-based system background. The doctors also expressed the comparison of these systems with the one used in the sample hospital several times (see the analysis of open-ended questions in chapter 6). Therefore, doctors' clearer expectations compared to nurses' expectations (limited to the information from the training session or colleagues) might explain the salient impact of expectations congruency on doctors.

The findings of the study on the relationships between "expectations and expectations congruency", and "needs and needs congruency" were quite similar among the two users groups. The results indicated neither direct negative relationships nor interaction effects among these constructs. Prior research on the association between expectations and expectations congruency consists of three views (since the relationship of clinician needs and clinician needs congruency was on the same basis as clinician expectations and clinician expectations congruency association, the following discussion also applies for their relationship). Some studies assert that there is no relationship between expectations and expectations congruency, and they consider their effects on satisfaction to be additive. This claim (originally made by (Oliver, 1977, Oliver, 1980)) received empirical support from several studies (for a review see (Yi, 1990)). Most other studies assert a direct negative link from expectations to expectations congruency (also hypothesized in this thesis). Finally, the third view states "although the results [of the previous two view] are inconclusive to date, the possibility of an interactive relationship seems worthy of further

investigation" (Yi, 1990, p. 32). This study examined the last two views, but the results did not correspond with them and showed direct positive relationships among these comparison standards and their congruencies. However, this finding should be acknowledged with respect to the high correlation observed between the first-order components of these constructs.

7.2 Implications for Theory

Elaborating the antecedents of CIS satisfaction (i.e., clinicians' perception of a CIS performance, evaluation of that performance in meeting clinicians' needs at their work setting, and fulfilling their CIS expectations) has valuable theoretical contributions for both clinician satisfaction and IS end user satisfaction literatures. It offer insights into the underlying cognitive-evaluative processes in which various attributes of CIS and IS such as information quality, system quality, and service quality, long being studied in IS research, translate into clinicians' satisfaction.

While perceived CIS performance showed to be the most significant determinant of satisfaction, needs and expectations congruencies were also found to be predictive of satisfaction for different user groups. Therefore, including other factors than mere technical capabilities of a system into satisfaction models seems more appropriate and informative. With the complex systems such as CIS, the results of this study reinforce the need for investigating the satisfaction of various user groups with different approaches and varying antecedents.

Compared to expectations congruency, needs congruency construct is a relatively less-investigated concept in IS and CIS satisfaction research. The results suggest that when users have limited expectations about the system (e.g., due to system novelty or lack of previous experience with similar systems), the system congruency with their needs might dominate their satisfaction. However, when they

have better expectations with the system (e.g., based on past experiences or knowledge from vendors) the system fulfillment of their expectations might influence their satisfaction rather than their needs. The results of the study hence shed light on the applications and relative effects of these concepts.

The empirical evidence of the needs congruency impact on clinicians' satisfaction (among nurses) shows the importance of considering users' needs fulfillment in utilization of the systems above and beyond their expectations (at least in the situations just discussed). In addition, the theatrical framework of this thesis identified and incorporated specific clinicians' needs regarding CIS based on McClelland's learned needs theory (1976), and adjusted them based on the unique characteristics of the healthcare context and CIS explored. McClelland's learned needs theory places between the content and process theories of motivation of motivation. That is, this theory recognizes individual difference (like process theories of motivation), and it also has content (certain needs categories) which gives it considerable explanatory power potential.

7.3 Implications for Practice

The empirical findings of the thesis have important implications for practice. According to the results of the study, the system performance plays the most important role in users' satisfaction. Hence, the technical capabilities of CIS still remain an important issue to address in CIS implementations. The CIS implementers could make sure that their systems perform well consistently, and there is fast and reliable service support in case of any problem with the system. This is especially important in healthcare environment which availability of the system is crucial for the wellbeing of patients in emergency situations.

Different user groups utilize different functions of the system. Regular assessment of the frequently used features of the system can be helpful in improving users' perception of the system. As in the case of this study, the system reduced the paper work of nurses to a considerable amount and saved them time in that respect. However, the printing problem with the system generated investigation order lists and identification stickers (which partly replaced nurses' paper work) caused a new difficulty in their workflow. In addition, when a CIS goes down, users have to go back to the old paper-based systems. This shift of the systems is frustrating for users. Given that this paper-based data will not be reflected to the system, it causes communication problems (e.g., forgetting to transfer conducted investigations during down time to the nurses in the next shift), increases the amount of duplicate investigations and costs, and may lead to patient dissatisfaction. Another example from this study of how feedback collection on system features can be helpful is identifying the issue of double order entry by doctors. It brought new difficulties to nurses for clarifying these orders. The nurses in their feedbacks suggested new system features such as alert functions (informing doctors in case of double order entry) to rectify the problem.

In addition, nowadays different CIS such as electronic medical records come with numerous functionalities. While many information technology managers and vendors often focus on selling more features and functionalities, the results of this study suggest that they should also emphasize on their "system performance" or how well those features operate.

Expectations congruency was found to affect users' satisfaction at least among one of the user groups of this study. Users usually gain insights and first impression of the system through training sessions. Therefore, it is critical not to oversell the

system, as this can increase user disappointment with the system if it cannot keep up with what they expected. The level of expectations should be kept reasonable. Another source of expectations is previous experience with similar systems. The managers and implementers can look for the systems utilized in other healthcare institutions (especially those their users might have previously used) and adjust their implementation to their best practices.

The empirical evidence of the study on the influence of needs congruency on nurses' satisfaction suggest that healthcare managers and CIS developers can enhance their clinical users' satisfaction by taking their needs into consideration when developing or planning for any system. Clinician needs also showed to be a significant determinant of clinician expectations. The training sessions for newly implemented CIS can provide information about how the CIS can be useful in fulfilling clinician desires at their work setting. This will help to guide clinician expectations in favor of the systems. Among these needs are clinician desire for efficient communication with their colleagues to obtain required information for carrying out their daily tasks, and improvement of their work performance in terms of patient safety, patient satisfaction, and quality of care.

7.4 Limitations and Future Work

The present thesis provides several contributions. Nonetheless, it comes with some limitations. First, expectations and needs (desires) were measured retrospectively. "Expectations are future-oriented and relatively malleable, whereas desires are present-oriented and relatively stable" (Spreng et al., 1996, p. 17). Expectations hence are more prone to the respondents' inability to recall their initial expectations of the system. This may explain the lack of empirical evidence in this study for the impact of

expectations on satisfaction. In order to better verify this impact, future studies can adopt a longitudinal approach measuring users' expectation before the deployment of the system. Second, while many studies examined the effects of expectations on consumer satisfaction in marketing research and also several IS studies, there is limited research on the antecedents of expectations in both literatures (Zeithaml et al., 1993). Identifying the antecedents of the expectations was not the primary objective of this study. The results of the study however provide insights on the positive influence of users' needs on their expectations. Besides, prior experience with similar systems showed to affect the formation of expectations which can possibly explain the differences observed in this study among the two users groups on the effect of expectations congruency. Therefore, an interesting avenue of future work is to look into the determinants of expectations and the process of expectations formation. Oliver and Winer's (1987) framework for the formation and structure of consumer expectations will provide a theoretical basis for such studies to identify the factors influencing clinicians' expectations. There are also few studies examining antecedents of consumer expectations of service (Zeithaml et al., 1993) in marketing literature. Furthermore, some IS researchers (Pitt et al., 1995) adopted these studies to explore IS service quality expectations. Although the emphasis in these studies is on service expectations, their theoretical findings could be useful to understand formation of clinicians' expectations from CIS.

The differences between nurses' and doctors' satisfaction with CIS and what influences them may also be investigated from an organizational culture perspective. In complex health care organizations such as hospitals various sub-cultures coexist. While these diverse sub-cultures may form based on occupation, department, social class, or gender, many times they shape along the professional groups (e.g., doctors,

nurses) (Callen et al., 2008, Scott et al., 2003). Prior medical informatics literature shows that doctors and nurses can have different perceptions of organizational cultures. Further, the perceived organizational sub-cultures, promoting different values, beliefs and behavioral norms, were found to influence clinicians' attitude to and satisfaction with clinical information system (Callen et al., 2008). Another future work direction is hence to incorporate the clinicians' perception of organizational culture into the proposed theoretical model of this study. More specifically, the moderating impact of cultural perception on the association between expectations and needs congruencies and satisfaction, and/or its direct influence on satisfaction can be examined. A possible approach to investigate the organizational culture is utilizing the organizational culture inventory (OCI) (Cook and Szumal, 2000) and its underlying framework as used in previous medical informatics studies (Callen et al., 2008). OCI provides an image of the clinicians' perception of their organizational culture in terms of three general organizational culture categories including: 1) constructive, 2) passive/defensive, and 3) aggressive/defensive cultures. A constructive culture with achievement, self-actualization, humanistic-encouraging, and affiliative norms values people's interaction with each other and pursuit of their tasks in a way that supports the fulfillment of their higher-order needs. In a passive/defensive culture with approval, conventional, dependent, and avoidance norms people are concerned with protecting their personal security in their task approach and interaction with others. The aggressive/defensive culture with oppositional, power, competitive, and perfectionist norms promotes forceful task approach and interaction with people to keep personal status and security safe (Cook and Szumal, 2000). Simple examples on how these types of cultures will relate to the research model of this study include the support of a constructive culture for fulfilling the need for achievement or affiliation,

or an aggressive/defensive culture being in favor of the need for power.

Next, the fact that the nurse officers and clinical secretaries of the studied hospital passed the devised number of surveys to part of the nurses and doctors of their wards and clinical departments suggest potential for sample selection bias. The service quality and service quality congruency constructs were measured using 2 items, while at least three items per construct is desired (Kim and Mueller, 1981). The VIF for the two components of the clinician needs congruency construct in the nurses' data was also higher than the recommended threshold. Due to high VIF among the components of the clinician needs and needs congruency constructs in the doctors' data, the need for affiliation and its corresponding congruency component were removed from these two constructs to reach the acceptable VIF.

Finally, the conceptual framework of the study included the need for power and the need for autonomy as important needs at job settings. Since the CIS investigated in this study did not alter the power distribution of the hospital, the need for power was not assessed in the empirical model. There was also no evidence on the restriction of autonomy for the nurses with the introduction of the system to their workflow. Therefore, the need for autonomy was only examined among the doctors. It will be interesting to examine the impact of the need for power and the need for autonomy in the proposed model of this study with the systems that bring changes to different users' state of power or autonomy with their deployment.

7.5 Conclusion

The study developed a conceptual framework for clinicians' satisfaction formation based on the expectations congruency and needs congruency models. Perceived CIS performance (measured at functionality level), expectations congruency, and needs

congruency showed to be the cognitive determinants of various clinical user groups' satisfaction with CIS. Prior IS and CIS satisfaction researches (the Delone and McLean's (2003) IS success model) identifying various attributes of a CIS were incorporated into the framework. These attributes categorized as information quality, system quality, and service quality detailed clinicians' expectations of CIS. Various needs categories from McClelland's learned needs theory (1976) were elaborated as the basis of clinicians' needs at their job setting considering CIS.

REFERENCES

ALDERFER, C. P. 1969. Empirical Test of a New Theory of Human Needs. *Organizational Behavior and Human Performance,* 4**,** 142-175.

ALDERFER, C. P. 1972. *Existence, relatedness, and growth: Human needs in organizational settings,* New York, Free Press.

ANDERSON, J. C. & GERBING, D. W. 1988. Structural Equation Modeling in Practice - a Review and Recommended 2-Step Approach. *Psychological Bulletin,* 103**,** 411-423.

AU, N., NGAI, E. W. T. & CHENG, T. C. E. 2008. Extending the understanding of end user information systems satisfaction formation: An equitable needs fulfillment model approach. *MIS Quarterly,* 32**,** 43-66.

BAILEY, J. E. & PEARSON, S. W. 1983. Development of a Tool for Measuring and Analyzing Computer User Satisfaction. *Management Science,* 29**,** 530-545.

BALLOU, K. A. 1998. A concept analysis of autonomy. *J Prof Nurs,* 14**,** 102-10.

BARBEAU, B. 1985. Predictive and Normative Expectations in Consumer Satisfaction: A Utilization of Adaptation and Comparison Levels in a Unified Framework. *In:* HUNT, H. K. & DAY, R. L. (eds.) *Conceptual and Empirical Contributions to Consumer Satisfaction and Complaining Behavior.* Bloomington: Indiana University, School of Business.

BARON, R. M. & KENNY, D. A. 1986. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51,* . 51**,** 1173-1182.

BAROUDI, J. J. & ORLIKOWSKI, W. J. 1988. A short-form measure of user information satisfaction: a psychometric evaluation and notes on use. *J. Manage. Inf. Syst.,* 4**,** 44-59.

BARTOS, C. E., FRIDSMA, D. B., BUTLER, B. S., PENROD, L. E., BECICH, M. J. & CROWLEY, R. S. 2008. Development of an instrument for measuring clinicians' power perceptions in the workplace. *J Biomed Inform,* 41**,** 1041-9.

BEARDEN, W. O. & TEEL, J. E. 1983. Selected Determinants of Consumer Satisfaction and Complaint Reports. *Journal of Marketing Research,* 20**,** 21-28.

BERNER, E. S., DETMER, D. E. & SIMBORG, D. 2005. Will the Wave Finally Break? A Brief View of the Adoption of Electronic Medical Records in the United States. *Journal of American Medical Informatics Association (12:1)* 3–7.

BHATTACHERJEE, A. 2001. Understanding Information Systems Continuance: An Expectation-Confirmation Model *MIS Quarterly (25:3)* 351-370

BHATTACHERJEE, A. & HIKMET, N. 2007. Physicians' Resistance Toward Healthcare Information Technology: a Theoretical Model and Empirical Test. *European Journal of Information Systems (16)***,** 725–737.

BHATTACHERJEE, A., HIKMET, N., MENACHEMI, N., KAYHAN, V. O. & BROOKS, R. G. 2007. The differential performance effects of healthcare information technology adoption. *Information Systems Management,* 24**,** 5-14.

BHATTACHERJEE, A. & PREMKUMAR, G. 2004. Understanding changes in belief and attitude toward information technology usage: A theoretical model and longitudinal test. *MIS Quarterly,* 28**,** 229-254.

BIRCH, D. & VEROFF, J. 1966. *Motivation: A study of action,* Monterey, Calif, Brooks/Cole.

BOLLEN, K. & LENNOX, R. 1991. Conventional Wisdom on Measurement - a Structural Equation Perspective. *Psychological Bulletin,* 110**,** 305-314.

BRIGGS, R. O., REINIG, B. A. & DE VREEDE, G.-J. 2008. The Yield Shift Theory of Satisfaction and Its Application to the IS/IT Domain. *Journal of the Association for Information Systems,* 9**,** 267-293.

BRIGGS, R. O., REINIG, B. A. & VREEDE, G.-J. 2012. The Yield Shift Theory of Satisfaction and Its Application to the IS/IT Domain

Information Systems Theory. *In:* DWIVEDI, Y. K., WADE, M. R. & SCHNEBERGER, S. L. (eds.). Springer New York.

BURTON-JONES, A. & STRAUB, D. W. 2006. Reconceptualizing system usage: An approach and empirical test. *Information Systems Research,* 17**,** 228-246.

BUSS, A. H. 1983. Social Rewards and Personality. *Search ResultsJournal of Personality and Social Psychology 44***,** 553-563.

BUSS, A. H. 1986. *Social Behavior and Personality,* Hillsdale, NJ, Lawrence Erlbaum.

CADOTTE, E. R., WOODRUFF, R. B. & JENKINS, R. L. 1987. Expectations and Norms in Models of Consumer Satisfaction. *Journal of Marketing Research,* 24**,** 305-314.

CALLEN, J., BRAITHWAITE, J. & WESTBROOK, J. 2008. Differences in doctors' and nurses' assessments of hospital culture and their views about computerised order entry systems. *Stud Health Technol Inform,* 136**,** 15-20.

CARSON, K. D., CARSON, P. P. & ROE, C. W. 1995. *Management of healthcare organizations,* South-Western College Pub.

CHAU, P. Y. K. & HU, P. J. 2002. Examining a Model of Information Technology Acceptance by Individual Professionals: An Exploratory Study. *J. Manage. Inf. Syst.,* 18**,** 191-229.

CHEUNG, G. W. & LAU, R. S. 2008. Testing Mediation and Suppression Effects of Latent Variables: Bootstrapping With Structural Equation Models. *Organizational Research Methods,* 11**,** 296-325.

CHIANG, M. F., BOLAND, M. V., MARGOLIS, J. W., LUM, F., ABRAMOFF, M. D. & HILDEBRAND, P. L. 2008. Adoption and perceptions of electronic health record systems by ophthalmologists: an American Academy of Ophthalmology survey. *Ophthalmology 115(9)***,** 1591-1597.

CHIN, W. W. 1998 Issues and opinion on structural equation modeling. *MIS Quarterly 22(1)***,** vii-xvi.

CHIN, W. W. 2010. How to Write Up and Report PLS Analyses

Handbook of Partial Least Squares. *In:* ESPOSITO VINZI, V., CHIN, W. W., HENSELER, J. & WANG, H. (eds.). Springer Berlin Heidelberg.

CHIN, W. W. & GOPAL, A. 1995. Adoption Intention in Gss - Relative Importance of Beliefs. *Data Base for Advances in Information Systems,* 26**,** 42-64.

CHIN, W. W. & LEE, M. K. O. 2000. A proposed model and measurement instrument for the formation of IS satisfaction: the case of end-user computing satisfaction. *Proceedings of the twenty first international conference on Information systems.* Brisbane, Queensland, Australia: Association for Information Systems.

CHIN, W. W. & NEWSTED, P. 1999. Structural equation modeling analysis with small samples using partial least squares. *In:* HOYLE, R. H. (ed.) *Statistical Strategies for Small Sample Research.* Thousand Oaks, CA: SAGE Publications.

CHURCH, O. M. 1990. Nursing's history: What it was and what it was not. *In:*

CHASKA, N. L. (ed.) *The nursing profession: Turning points* St. Louis: Mosby.

CHURCHILL, G. A. & SURPRENANT, C. 1982. An Investigation into the Determinants of Customer Satisfaction. *Journal of Marketing Research,* 19**,** 491-504.

COHEN, B. H. 2001. *Explaining psychological statistics,* New York, J. Wiley & sons.

COHEN, J. 1988. *Statistical power analysis for the behavioral sciences,* Hillsdale, New Jersey, Lawrence Erlbaum Associates.

CONRATH, D. W. & MIGNEN, O. P. 1990. What Is Being Done to Measure User Satisfaction with Edp/Mis. *Information & Management,* 19**,** 7-19.

COOK, R. A. & SZUMAL, J. L. 2000. Using the Organizational Culture Inventory to Understand the operating cultures of organizations. *In:* ASHKANASY, N. M., WILDEROM, C. & PETERSON, M. F. (eds.) *Handbook of Organizational Culture and Climate.* Thousand Oaks, CA: Sage.

CYERT, R. & MARCH, J. 1963. *A Behavioral Theory of the Firm,* Englewood Cliffs, NJ, Prentice-Hall, Inc. .

DABHOLKAR, P. A., SHEPHERD, C. D. & THORPE, D. I. 2000. A comprehensive framework for service quality: An investigation of critical conceptual and measurement issues through a longitudinal study. *Journal of Retailing,* 76**,** 139-173.

DAVIS, F. D. 1989. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly 13(3)***,** 319-340.

DELONE, W. H. & MCLEAN, E. R. 1992. Information systems success: The quest for the dependent variable. *Information Systems Research,* 3**,** 60-95.

DELONE, W. H. & MCLEAN, E. R. 2003. The DeLone and McLean Model of Information Systems Success: A Ten-Year Update. *J. Manage. Inf. Syst.,* 19**,** 9-30.

DIAMANTOPOULOS, A. & SIGUAW, J. A. 2006. Formative Versus Reflective Indicators in Organizational Measure Development: A Comparison and Empirical Illustration. *British Journal of Management,* 17**,** 263-282.

DOLL, W. J. & TORKZADEH, G. 1988. The Measurement of End-User Computing Satisfaction. *MIS Quarterly,* 12**,** 259-274.

DOLL, W. J., XIA, W. D. & TORKZADEH, G. 1994. A Confirmatory Factor-Analysis of the End-User Computing Satisfaction Instrument. *MIS Quarterly,* 18**,** 453-461.

FESTINGER, L. 1957. *A Theory of Cognitive Dissonance,* Stanford University Press.

FINN, C. P. 2001. Autonomy: an important component for nurses' job satisfaction. *Int J Nurs Stud,* 38**,** 349-57.

FOA, U. G. & FOA, E. B. 1974. *Societal Structures of the Mind,* Springfield, IL, Charles C. Thomas.

FORNELL, C. & LARCKER, D. F. 1981. Evaluating structural equation models with unobservable and measurement error. *Journal of Marketing Research 18***,** 39–50.

FOURNIER, S. & MICK, D. G. 1999. Rediscovering satisfaction. *Journal of Marketing,* 63**,** 5-23.

GEFEN, D. & STRAUB, D. 2005. A Practical Guide To Factorial Validity Using PLS-Graph: Tutorial And Annotated Example. *Communications of the Association for Information Systems 16* 91-109.

GEISSER, S. 1974. Predictive Approach to Random Effect Model. *Biometrika,* 61**,**

101-107.
GEORGE, J. M. & JONES, G. R. 2005. *Understanding and managing organizational behavior,* New Jersey, Pearson Education, Inc
HACKMAN, J. R. & OLDHAM, G. R. 1975. Development of the job diagnostic survey. *Journal of applied psychology,* 60**,** 159-170.
HACKMAN, J. R. & OLDHAM, G. R. 1976. Motivation through the design of work: test of a theory. *Organizational Behavior and Human Performance***,** 250-279.
HAIR, J., SARSTEDT, M., RINGLE, C. & MENA, J. 2011. An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science***,** 1-20.
HAIR, J. F. J., ANDERSON, R. E., TATHAM, R. L. & BLACK, W. C. 1998. *Multivariate Data Analysis with Readings, 5th Edition,* Englewood Cliffs, NJ, Prentice Hall.
HAYES, A. F. 2009. Beyond Baron and Kenny: Statistical Mediation Analysis in the New Millennium. *Communication Monographs,* 76**,** 408-420.
HENSELER, J. & FASSOTT, G. 2010. Testing Moderating Effects in PLS Path Models: An Illustration of Available Procedures
Handbook of Partial Least Squares. *In:* ESPOSITO VINZI, V., CHIN, W. W., HENSELER, J. & WANG, H. (eds.). Springer Berlin Heidelberg.
HERZBERG, F., MAUSNER, B. & SNYDERMAN, B. B. 1959. *The motivation to work,* New York, Wiley.
HILL, C. A. 1987. Affiliation Motivation: People Who Need People... But in Different Ways. *Journal of Personality and Social Psychology 52 (5)***,** 1008-1018.
HOLDEN, R. J. 2010. Physicians' beliefs about using EMR and CPOE: in pursuit of a contextualized understanding of health IT use behavior. *Int J Med Inform,* 79**,** 71-80.
HU, P. J. H., CHAU, P. Y. K. & SHENG, O. R. L. 2002. Adoption of telemedicine technology by health care organizations: An exploratory study. *Journal of Organizational Computing and Electronic Commerce,* 12 179-221.
IVES, B., OLSON, M. H. & BAROUDI, J. J. 1983. The Measurement of User Information Satisfaction. *Communication of the ACM 26(10)***,** 785-793.
KHALIFA, M. & LIU, V. 2002. Satisfaction with Internet-Based Services: The Role of Expectations and Desires. *Int. J. Electron. Commerce,* 7**,** 31-49.
KHALIFA, M. & LIU, V. 2003. Determinants of Satisfaction at Different Adoption Stages of Internet-Based Services. *Journal of the Association for Information Systems,* 4**,** 206-232.
KIM, H. W. & KANKANHALLI, A. 2009. Investigating User Resistance to Information Systems Implementation: A Status Quo Bias Perspective. *MIS Quarterly,* 33**,** 567-582.
KIM, J.-O. & MUELLER, C. W. 1981. *Factor Analysis: Statistical Methods and Practical Issues,* Newbury Park, CA, Sage publicatio.
LANDY, F. J. & BECKER, W. S. 1987. Motivation Theory Reconsidered. *Research in Organizational Behavior,* 9**,** 1-38.
LAPOINTE, L. & RIVARD, S. 2005. A multilevel model of resistance to information technology implementation. *MIS Quarterly,* 29**,** 461-491.
LEARY, M. R. 2010. Affiliation, Acceptance, and Belonging The Persuit of Interpersonal Connection. *Handbook of Social Psychology.* Hoboken, N.J.: John Wiley.
LEE, F., TEICH, J. M., SPURR, C. D. & BATES, D. W. 1996. Implementation of

physician order entry: user satisfaction and self-reported usage patterns. *J Am Med Inform Assoc,* 3**,** 42-55.

LI, D. H., DAY, J., LOU, H. & COOMBS, G. 2004. The effect of affiliation motivation on the intention to use groupware in an MBA program. *Journal of Computer Information Systems,* 44**,** 1-8.

LIKOUREZOS, A., CHALFIN, D. B., MURPHY, D. G., SOMMER, B., DARCY, K. & DAVIDSON, S. J. 2004. Physician and nurse satisfaction with an Electronic Medical Record system. *J Emerg Med,* 27**,** 419-24.

LOCKE, E. A. 1967. Relationship of Success and Expectation to Affect on Goal-Seeking Tasks. *Journal of Personality and Social Psychology,* 7**,** 125-&.

LOHMÖLLER, J.-B. 1989. *Latent variable path modeling with partial least squares,* Heidelberg, Physica-Verlag.

MAHMOOD, M. A., BURN, J. M., GEMOETS, L. A. & JACQUEZ, C. 2000. Variables affecting information technology end-user satisfaction: a meta-analysis of the empirical literature. *International Journal of Human-Computer Studies,* 52**,** 751-771.

MASLOW, A. H. 1943. A theory of human motivation. *Psychological review,* 50**,** 370-396.

MASLOW, A. H. 1954. *Motivation and personality,* New York, Harper & Row Publishers, Inc.

MASLOW, A. H. 1970. *Motivation and personality,* New York, Harper & Row Publishers, Inc.

MAYFIELD, S. R. 2008. *A Multivariate Analysis of the Effects of CPOE on Hospital Quality and Patient Safety.* Medical University of South Carolina - College of Health Professions.

MAZZOLENI, M. C., BAIARDI, P., GIORGI, I., FRANCHI, G., MARCONI, R. & CORTESI, M. 1996. Assessing users' satisfaction through perception of usefulness and ease of use in the daily interaction with a hospital information system. *Proceedings of the AMIA Annual Fall Symposium***,** 752-756.

MCCLELLAND, D. C. 1976. *The achieving society : with a new introduction,* New York, Irvington Publishers : Distributed by Halsted Press.

MCCLELLAND, D. C., ATKINSON, J. K., CLARK, R. A. & LOWELL, E. L. 1953. *The achievement motive* New York, Appleton-Century-Crofts.

MCKINNEY, V., YOON, K. & ZAHEDI, F. 2002. The measurement of web-customer satisfaction: An expectation and disconfirmation approach. *Information Systems Research,* 13**,** 296-315.

MELONE, N. P. 1990. A Theoretical Assessment of the User-Satisfaction Construct in Information-Systems Research. *Management Science,* 36**,** 76-91.

MENON, N. M., LEE, B. & ELDENBURG, L. 2000. Productivity of information systems in the healthcare industry. *Information Systems Research,* 11**,** 83-92.

MOORE, G. C. & BENBASAT, I. 1991. Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation. *nformation Systems Research,* 2**,** 192-222.

MURFF, H. J. & KANNRY, J. 2001. Physician satisfaction with two order entry systems. *J Am Med Inform Assoc,* 8**,** 499-509.

MURRAY, H. A. 1938. *Explorations in personality ; a clinical and experimental study of fifty men of college age,* New York , London etc., Oxford university press.

NEUMAN, W. L. 2006. *Social research methods : qualitative and quantitative approaches,* Boston, Allyn and Bacon.

NEVO, D. & CHAN, Y. E. 2007. A temporal approach to expectations and desires from knowledge management systems. *Decision Support Systems,* 44**,** 298-312.

NG, B.-Y. & KANKANHALLI, A. IT Impact on Individual Work: A Study in the Context of Healthcare Services. ICIS 2009 Proceedings, 2009 Phoenix, Arizona.

NOLAN, R. L. & SEWARD, H. H. 1974. Measuring user satisfaction to evaluate information systems. *In:* NOLAN, R. L. (ed.) *Managing the Data Resource Function.* Los Angeles: West Publishing Co.

NUNNALLY, J. C. & BERNSTEIN, I. H. 1994. *Psychometric Theory, Third Edition,* New York, McGraw-Hill.

OLIVER, R. L. 1977. Effect of Expectation and Disconfirmation on Postexposure Product Evaluations - Alternative Interpretation. *Journal of Applied Psychology,* 62**,** 480-486.

OLIVER, R. L. 1980. A Cognitive Model of the Antecedents and Consequences of Satisfaction Decisions. *Journal of Marketing Research,* 17**,** 460-469.

OLIVER, R. L. 1997. *Satisfaction: a behavioral perspective on the consumer,* New York, McGraw-Hill.

OLIVER, R. L. & BEARDEN, W. O. 1983. The Role of Involvement in Satisfaction Processes. *Advances in Consumer Research,* 10**,** 250-255.

OLIVER, R. L. & WINER, R. S. 1987. A Framework for the Formation and Structure of Consumer Expectations - Review and Propositions. *Journal of Economic Psychology,* 8**,** 469-499.

PALM, J. M., COLOMBET, I., SICOTTE, C. & DEGOULET, P. 2006. Determinants of user satisfaction with a Clinical Information System. *AMIA Annu Symp Proc***,** 614-8.

PETTER, S., DELONE, W. & MCLEAN, E. 2008. Measuring information systems success: models, dimensions, measures, and interrelationships. *European Journal of Information Systems* 17**,** 236-263.

PETTER, S., STRAUB, D. & RAI, A. 2007. Specifying formative constructs in information systems research. *MIS Quarterly,* 31**,** 623-656.

PINDER, C. C. 1984. *Work motivation : theory, issues, and applications / Craig C. Pinder,* Glenview, Ill. :, Scott, Foresman.

PITT, L. F., WATSON, R. T. & KAVAN, C. B. 1995. Service Quality: A Measure Of Information Systems Effectiveness. *MIS Quarterly 19(2)***,** 173-187.

PORTER, L. W., BIGLEY, G. A. & STEERS, R. M. 2003. *Motivation and work behavior,* McGraw-Hill/Irwin.

PREMKUMAR, G., RAMAMURTHY, K. & LIU, H. N. 2008. Internet messaging: An examination of the impact of attitudinal, normative, and control belief systems. *Information & Management,* 45**,** 451-457.

RINGLE, C. M., WENDE, S. & WILL, A. 2005. SmartPLS. 2.0 (beta) ed. Hamburg, Germany: SmartPLS.

ROBBINS, S. P., BERGMAN, R., STAGG, I. & COULTER, M. 2003. *Foundations of management,* Pearson Education Australia.

ROSENFELD, P., CULBERTSON, A. L. & MAGNUSSON, P. 1992. Human Needs: A Literature Review and Cognitive Life Span Model.

RUSHINEK, A. & RUSHINEK, S. F. 1986. What Makes Users Happy - the Results of a User Questionnaire Are Used to Determine the Effects of 17 Different Independent Variables on User Satisfaction. *Communications of the Acm,* 29**,** 594-598.

SCOTT, T., MANNION, R., DAVIES, H. T. & MARSHALL, M. N. 2003. Implementing culture change in health care: theory and practice. *Int J Qual Health Care,* 15**,** 111-8.

SEDDON, P. B., STAPLES, S., PATNAYAKUNI, R. & BOWTELL, M. 1999. Dimensions of information systems success. *Commun. AIS,* 2**,** 5.

SHANNON, C. E. & WEAVER, W. 1949. *The Mathematical Theory of Communication,* Urbana, IL, University of Illinois Press.

SICOTTE, C., PARE, G., BINI, K. K., MOREAULT, M. P. & LAVERDURE, G. 2010. Virtual organization of hospital medical imaging: a user satisfaction survey. *J Digit Imaging,* 23**,** 689-700.

SITTIG, D. F., KUPERMAN, G. J. & FISKIO, J. 1999. Evaluating physician satisfaction regarding user interactions with an electronic medical record system. *Proc AMIA Symp***,** 400-4.

SPRENG, R. A., MACKENZIE, S. B. & OLSHAVSKY, R. W. 1996. A reexamination of the determinants of consumer satisfaction. *Journal of Marketing,* 60**,** 15-32.

STAHL, M. J. 1986. *Managerial and technical motivation: Assessing needs for achievement, power and affiliation,* New York, Praeger

STEERS, R. M. & BRAUNSTEIN, D. N. 1976. Behaviorally-Based Measure of Manifest Needs in Work Settings. *Journal of Vocational Behavior,* 9**,** 251-266.

STONE, M. 1974. Cross-Validatory Choice and Assessment of Statistical Predictions. *Journal of the Royal Statistical Society Series B-Statistical Methodology,* 36**,** 111-147.

SUH, K., KIM, S. & LEE, J. 1994. End-User's Disconfirmed Expectations and the Success of Information Systems. *Information Resources Management Journal* 7**,** 31-39.

SWAN, J. E. & TRAWICK, I. F. 1980. Satisfaction related to predictive vs. desired expectations. *In:* HUNT, H. K. & DAY, R. L. (eds.) *Refining concepts and measures of consumer satisfaction and complaining behavior*. Bloomington: School of Business, Indiana University.

SWAN, J. E. & TRAWICK, I. F. 1981. Disconfirmation of Expectations and Satisfaction with a Retail Service. *Journal of Retailing,* 57**,** 49-67.

SZAJNA, B. & SCAMELL, R. W. 1993. The effects of information system user expectations on their performance and perceptions. *MIS Q.,* 17**,** 493-516.

SZYMANSKI, D. M. & HENARD, D. H. 2001. Customer satisfaction: A meta-analysis of the empirical evidence. *Journal of the Academy of Marketing Science,* 29**,** 16-35.

TAN, W. S., PHANG, J. S. & TAN, L. K. 2009. Evaluating user satisfaction with an electronic prescription system in a primary care group. *Ann Acad Med Singapore,* 38**,** 494-7.

TENENHAUS, M., AMATO, S. & ESPOSITO VINZI, V. A global goodness-of-fit index for PLS structural equation modelling. XLII SIS Scientific Meeting, 2004 Padova (Italy) CLEUP, 739-742.

TSE, D. K. & WILTON, P. C. 1988. Models of Consumer Satisfaction Formation - an Extension. *Journal of Marketing Research,* 25**,** 204-212.

VAN DER MEIJDEN, M. J., TANGE, H. J., TROOST, J. & HASMAN, A. 2003. Determinants of Success of Inpatient Clinical Information Systems: A Literature Review. *Journal of American Medical Informatics Association* 10**,** 235–243.

VARJUS, S. L., SUOMINEN, T. & LEINO-KILPI, H. 2003. Autonomy among

intensive care nurses in Finland. *Intensive Crit Care Nurs,* 19**,** 31-40.

VEROFF, J. & VEROFF, J. B. 1980. *SocialIincentives: A Life-span Developmental Approach,* New York, Academic Press.

VROOM, V. H. 1964. *Work and Motivation,* New York, Wiley.

WAHBA, M. A. & BRIDWELL, L. G. 1976. Maslow Reconsidered - Review of Research on Need Hierarchy Theory. *Organizational Behavior and Human Performance,* 15**,** 212-240.

WALTER, Z. & LOPEZ, M. S. 2008. Physician acceptance of information technologies: Role of perceived threat to professional autonomy. *Decision Support Systems,* 46**,** 206-215.

WESTBROOK, R. A. & REILLY, M. D. 1983. Value-Percept Disparity - an Alternative to the Disconfirmation of Expectations Theory of Consumer Satisfaction. *Advances in Consumer Research,* 10**,** 256-261.

WILLIAMS, J. & MACKINNON, D. P. 2008. Resampling and Distribution of the Product Methods for Testing Indirect Effects in Complex Models. *Structural Equation Modeling,* 15**,** 23-51.

WILSON, B. 2010. Using PLS to Investigate Interaction Effects Between Higher Order Branding Constructs. *Handbook of Partial Least Squares: Concepts, Methods and Applications.* New York: Springer.

WIRTZ, J. & MATTILA, A. 2001. Exploring the role of alternative perceived performance measures and needs-congruency in the consumer satisfaction process. *Journal of Consumer Psychology,* 11**,** 181-192.

WIXOM, B. H. & TODD, P. A. 2005. A theoretical integration of user satisfaction and technology acceptance. *Information Systems Research,* 16**,** 85-102.

WOLD, H. 1980. Model construction and evaluation when theoretical knowledge is scarce: Thoery and application of partial least squares. *Evaluation of econometric models.* New York: Academic Press.

WOODRUFF, R. B., CADOTTE, E. R. & JENKINS, R. L. 1983. Modeling Consumer Satisfaction Processes Using Experience-Based Norms. *Journal of Marketing Research,* 20**,** 286-304.

YI, Y. 1990. A Critical Review of Consumer Satisfaction. *Review of Marketing,* 4**,** 68-123.

YOON, Y. & GUIMARAES, T. 1995. Assessing expert systems impact on users' jobs. *J. Manage. Inf. Syst.,* 12**,** 225-249.

ZEITHAML, V. A., BERRY, L. L. & PARASURAMAN, A. 1993. The nature and determinants of customer expectations of service *Journal of the Academy of Marketing Science 21(1)***,** 1-12.

ZVIRAN, M. 1992. Evaluating user satisfaction in a hospital environment: an exploratory study. *Health Care Manage Rev,* 17**,** 51-62.

ZVIRAN, M. & ERLICH, Z. 2003. Measuring IS User Satisfaction: Review and Implications. *Communications of the Association for Information Systems,* 12**,** 81-103.

APPENDIX 1: NURSES' QUESTIONNAIRE

Please answer the following general questions.

General Questions							
1. Age: _____(years)							
2. Gender: ☐ Male ☐ Female							
3. Your department: Ward _____							
4. Job description: (tick one) ☐ Staff Nurse SN/SSN ☐ Nursing Officers ☐ Other (please specify):----------							
5. Highest educational level: (tick one) ☐ Diploma ☐ Bachelors degree (local) ☐ Bachelors degree (overseas) ☐ Postgraduate degree ☐ Others (please specify)_____							
6. Work experiences: in Years _____ OR Months _____							
7. Primary language: (tick one) ☐ English ☐ Chinese (Mandarin/Dialect) ☐ Malay ☐ Tamil ☐ Others (please specify) _____							
8. How much experience do you have with using personal computers? (tick one) ☐ Never use it ☐ Once a month ☐ Once a week ☐ Daily							
9. How much experience do you have with using Internet? (tick one) ☐ Never use it ☐ Once a month ☐ Once a week ☐ Daily							
10. Did you attend the training sessions for SCM? ☐ Yes ☐ No							
	(1)= insufficient			(4)= Neither			(7)= sufficient
11. If **yes**, how would you rate SCM trainings provided to you before its launch?	1	2	3	4	5	6	7
12. How long have you been using SCM? ☐0-3 months ☐4-6 months ☐more than 6 months							

The following questions are regarding your <u>expectations</u> about the <u>Information Quality</u> and <u>System Quality</u> of SCM. These expectations refer to what you have thought about SCM before starting to use the system (i.e., when we first moved from AH to KTPH). The expectations might have formed based on the information provided to you about SCM during the training sessions or what you have heard from your colleagues. Please recall what you expected from SCM in terms of the following aspects, and circle the number that best represents your expectations. The numbers indicate:

Strongly Disagree	Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

Information Quality (part 1)	(1)= strongly disagree						(7)= strongly agree
13. Before I use SCM, I expected the information provided by SCM to be *reliable*.	1	2	3	4	5	6	7
14. Before I use SCM, I expected the information provided by SCM to be *up-to-date*.	1	2	3	4	5	6	7
15. Before I use SCM, I expected the information provided by SCM to be *relevant*.	1	2	3	4	5	6	7
16. Before I use SCM, I expected the information provided by SCM to be *presented in a user friendly format*.	1	2	3	4	5	6	7

System Quality (part 1)	(1)= strongly disagree						(7)= strongly agree
17. Before I use SCM, I expected the system to *perform reliably*.	1	2	3	4	5	6	7
18. Before I use SCM, I expected the system to be *flexible in adjusting to new demands, conditions, or circumstances*.	1	2	3	4	5	6	7
19. Before I use SCM, I expected the system's *speed of operation to be fast*.	1	2	3	4	5	6	7
20. Before I use SCM, I expected the system to be *easy to use*.	1	2	3	4	5	6	7
21. Before I use SCM, I expected the system to be *easy to access* (e.g., access to work stations or log in to the system).	1	2	3	4	5	6	7

Based on your <u>experience</u> of using SCM, we are interested in knowing how SCM performed compared to your <u>initial expectations</u> in terms of the following <u>Information Quality</u> and <u>System Quality</u> aspects. Please circle the number that best represents your opinion. The numbers indicate:

Far below my expectations	Below my expectations	Slightly below my expectations	About what I expected	Slightly above my expectations	Above my expectations	Far above my expectations
1	2	3	4	5	6	7

Information Quality (part 2)	(1)=Far below my expectations						(7)= Far above my expectations
22. How well did the information provided by SCM meet your expectations in terms of *reliability*?	1	2	3	4	5	6	7
23. How well did the information provided by SCM meet your expectations in terms of *being up-to-date*?	1	2	3	4	5	6	7
24. How well did the information provided by SCM meet your expectations in terms of *relevancy*?	1	2	3	4	5	6	7
25. How well did the information provided by SCM meet your expectations in terms of *presentation in a user friendly format*?	1	2	3	4	5	6	7

System Quality (part 2)	(1)=Far below my expectations						(7)= Far above my expectations
26. How well did SCM meet your expectations in terms of *reliable performance*?	1	2	3	4	5	6	7
27. How well did SCM meet your expectations in terms of *flexibility in adjusting to new demands, conditions, or circumstances*?	1	2	3	4	5	6	7
28. How well did SCM meet your expectations in terms of *fast speed of operation*?	1	2	3	4	5	6	7
29. How well did SCM meet your expectations in terms of *ease of use*?	1	2	3	4	5	6	7
30. How well did SCM meet your expectations in terms of *ease of access*?	1	2	3	4	5	6	7

In the following questions, we are interested in knowing about your expectations of IT support services for SCM. These expectations refer to your thought (before using the system) about the support services for SCM that will be provided to you. Similarly, these expectations might have formed based on the information provided to you during the SCM training sessions, what you have heard from your colleagues, or previous IT support services for other information systems (if any). Please recall what you expected from IT support services in terms of the following aspects, and circle the number that best represents your expectations.

Service Quality (part 1)	(1)= strongly disagree						(7)= strongly agree
31. Before I use SCM, I expected the IT support services for SCM to be *prompt*.	1	2	3	4	5	6	7
32. Before I use SCM, I expected the IT support services for SCM to be *performed right the first time*.	1	2	3	4	5	6	7

Based on your experience of IT support services for SCM, we are interested in knowing how it was provided compared to your initial expectations. Please circle the number that best represents your opinion.

Service Quality (part 2)	(1)=Far below my expectations						(7)= Far above my expectations
33. How well did the IT support services meet your expectations in terms of *promptness*?	1	2	3	4	5	6	7
34. How well did the IT support services meet your expectations in terms of *being performed right the first time*?	1	2	3	4	5	6	7

The questions below are related to some of your desires (needs) at your work. Please circle the number that best represents your desires.

	(1)= strongly disagree						(7)= strongly agree
35. I desire to achieve the highest possible *patient satisfaction*.	1	2	3	4	5	6	7
36. I desire to make as few *medical errors* as possible.	1	2	3	4	5	6	7
37. I desire to provide the best possible *healthcare quality* to my patients.	1	2	3	4	5	6	7
38. I desire to *save time* at work as much as possible.	1	2	3	4	5	6	7

	(1)= strongly disagree						(7)= strongly agree
39. I desire to have *unambiguous communication* with my colleagues in order to get the necessary information for performing my tasks.	1	2	3	4	5	6	7
40. I desire to have *efficient interaction* with my colleagues in order to get the necessary information for performing my tasks (e.g., less time or effort consuming).	1	2	3	4	5	6	7
41. I desire to have *hassle-free communication* with my colleagues in order to get the necessary information for performing my tasks.	1	2	3	4	5	6	7
42. I desire to have *effective interaction* with my colleagues in order to get the necessary information for performing my tasks (e.g., no misunderstanding).	1	2	3	4	5	6	7

The following questions intend to assess the extent to which your <u>desires (needs)</u> have been fulfilled by using SCM. The <u>desires (needs)</u> are the same as the ones mentioned earlier. Please circle the number that best represents your opinion. The numbers indicate:

Far below my desires	Below my desires	Slightly below my desires	About what I desires	Slightly above my desires	Above my desires	Far above my desires
1	2	3	4	5	6	7

	(1)=Far below my desires						(7)= Far above my desires
43. By using SCM, how well are your desires (needs) met in terms *of improved patient satisfaction*?	1	2	3	4	5	6	7
44. By using SCM, how well are your desires (needs) met in terms of *reduced medical errors*?	1	2	3	4	5	6	7
45. By using SCM, how well are your desires (needs) met in terms of *increased healthcare quality to patients*?	1	2	3	4	5	6	7
46. By using SCM, how well are your desires (needs) met in terms of *saving more time at work*?	1	2	3	4	5	6	7

	(1)=Far below my desires						(7)= Far above my desires
47. By using SCM, how well are your desires (needs) met in terms of *unambiguous communication with your colleagues*?	1	2	3	4	5	6	7
48. By using SCM, how well are your desires (needs) met in terms of *efficient interaction with your colleagues*?	1	2	3	4	5	6	7
49. By using SCM, how well are your desires (needs) met in terms of *hassle-free communication with your colleagues*?	1	2	3	4	5	6	7
50. By using SCM, how well are your desires (needs) met in terms of *effective interaction with your colleagues*?	1	2	3	4	5	6	7

Based on your experience in using SCM, please evaluate its performance in the following functions:

	(1)=Very poor						(7)= Very good
51. SCM's performance in *presenting patients list* is	1	2	3	4	5	6	7
52. SCM's performance in *presenting lab investigation orders* is	1	2	3	4	5	6	7
53. SCM's performance in *printing labels for specimens* is	1	2	3	4	5	6	7
54. SCM's performance in *tracking the status of specimens* is	1	2	3	4	5	6	7
55. SCM's performance in *tracking the status of lab orders* is	1	2	3	4	5	6	7
56. SCM's performance in *presenting the results of lab orders* is	1	2	3	4	5	6	7

Please Circle the number that best represents your feelings about SCM.

	(1)= strongly disagree						(7)= strongly agree
57. I am very *pleased* with SCM	1	2	3	4	5	6	7
58. I am very *contented* with SCM	1	2	3	4	5	6	7
59. I feel *delighted* with SCM	1	2	3	4	5	6	7
60. Overall, I am very *satisfied* with SCM	1	2	3	4	5	6	7

Please answer the following questions regarding SCM.

61. What is the one thing you like most about SCM?
62. If there is one thing that you could change about SCM to make it better, what would it be?

Thank you very much for your participation!

APPENDIX 2: DOCTORS' QUESTIONNAIRE

Please answer the following general questions.

General Questions							
1. Age: _____(years)							
2. Gender: ☐ Male ☐ Female							
3. Your department (Please Specify): _____							
4. Job description: (tick one) ☐ HO ☐ MO ☐ Resident ☐ Registrar ☐ Associate Consultant ☐ Consultant / Senior Consultant ☐ Other (please specify):----------							
5. Highest educational level: (tick one) ☐ Bachelors degree ☐ Postgraduate degree ☐ Others (please specify)_____							
6. Work experiences: in Years _____ OR Months _____							
7. Primary language: (tick one) ☐ English ☐ Chinese (Mandarin/Dialect) ☐ Malay ☐ Tamil ☐ Others (please specify) _____							
8. How much experience do you have with using personal computers? (tick one) ☐ Never use it ☐ Once a month ☐ Once a week ☐ Daily							
9. How much experience do you have with using Internet? (tick one) ☐ Never use it ☐ Once a month ☐ Once a week ☐ Daily							
10. Did you attend the training sessions for SCM? ☐ Yes ☐ No							
	(1)= insufficient			(4)= Neither			(7)= sufficient
11. If **yes**, how would you rate SCM trainings provided to you before its launch?	1	2	3	4	5	6	7
12. How long have you been using SCM? ☐0-3 months ☐4-6 months ☐more than 6 months							

The following questions are regarding your <u>expectations</u> about the <u>Information Quality</u> and <u>System Quality</u> of Sunrise EMR system (SCM). These expectations refer to what you have thought about SCM <u>before</u> starting to use the system (i.e., when you first started work at KTPH). The expectations might have formed based on the information provided to you about SCM during the training sessions or what you have heard from your colleagues. Please recall what you expected from SCM in terms of the following aspects, and circle the number that best represents your expectations. The numbers indicate:

Strongly Disagree	Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

Information Quality (part 1)	(1)= strongly disagree						(7)= strongly agree
13. Before I use SCM, I expected the information provided by SCM to be *reliable*.	1	2	3	4	5	6	7
14. Before I use SCM, I expected the information provided by SCM to be *up-to-date*.	1	2	3	4	5	6	7
15. Before I use SCM, I expected the information provided by SCM to be *relevant*.	1	2	3	4	5	6	7
16. Before I use SCM, I expected the information provided by SCM to be *presented in a user friendly format*.	1	2	3	4	5	6	7

System Quality (part 1)	(1)= strongly disagree						(7)= strongly agree
17. Before I use SCM, I expected the system to *perform reliably*.	1	2	3	4	5	6	7
18. Before I use SCM, I expected the system to be *flexible in adjusting to new demands, conditions, or circumstances*.	1	2	3	4	5	6	7
19. Before I use SCM, I expected the system's *speed of operation to be fast*.	1	2	3	4	5	6	7
20. Before I use SCM, I expected the system to be *easy to use*.	1	2	3	4	5	6	7
21. Before I use SCM, I expected the system to be *easy to access* (e.g., access to work stations or log in to the system).	1	2	3	4	5	6	7

Based on your <u>experience</u> of using Sunrise EMR system (SCM), we are interested in knowing how SCM performed compared to your <u>initial expectations</u> in terms of the following <u>Information Quality</u> and <u>System Quality</u> aspects. Please circle the number that best represents your opinion. The numbers indicate:

Far below my expectations	Below my expectations	Slightly below my expectations	About what I expected	Slightly above my expectations	Above my expectations	Far above my expectations
1	2	3	4	5	6	7

Information Quality (part 2)	(1)=Far below my expectations						(7)= Far above my expectations
22. How well did the information provided by SCM meet your expectations in terms of *reliability*?	1	2	3	4	5	6	7
23. How well did the information provided by SCM meet your expectations in terms of *being up-to-date*?	1	2	3	4	5	6	7
24. How well did the information provided by SCM meet your expectations in terms of *relevancy*?	1	2	3	4	5	6	7
25. How well did the information provided by SCM meet your expectations in terms of *presentation in a user friendly format*?	1	2	3	4	5	6	7

System Quality (part 2)	(1)=Far below my expectations						(7)= Far above my expectations
26. How well did SCM meet your expectations in terms of *reliable performance*?	1	2	3	4	5	6	7
27. How well did SCM meet your expectations in terms of *flexibility in adjusting to new demands, conditions, or circumstances*?	1	2	3	4	5	6	7
28. How well did SCM meet your expectations in terms of *fast speed of operation*?	1	2	3	4	5	6	7
29. How well did SCM meet your expectations in terms of *ease of use*?	1	2	3	4	5	6	7
30. How well did SCM meet your expectations in terms of *ease of access*?	1	2	3	4	5	6	7

In the following questions, we are interested in knowing about your <u>expectations</u> of <u>IT support services</u> for Sunrise EMR system (SCM). These expectations refer to your thought (<u>before</u> using the system) about the support services for SCM that will be provided to you. Similarly, these expectations might have formed based on the information provided to you during the SCM training sessions, what you have heard from your colleagues, or previous IT support services for other information systems (if any). Please recall what you expected from IT support services in terms of the following aspects, and circle the number that best represents your expectations.

Service Quality (part 1)	(1)= strongly disagree						(7)= strongly agree
31. Before I use SCM, I expected the IT support services for SCM to be *prompt*.	1	2	3	4	5	6	7
32. Before I use SCM, I expected the IT support services for SCM to be *performed right the first time*.	1	2	3	4	5	6	7

Based on your <u>experience</u> of <u>IT support services</u> for SCM, we are interested in knowing how it was provided compared to your <u>initial expectations</u>. Please circle the number that best represents your opinion.

Service Quality (part 2)	(1)=Far below my expectations						(7)= Far above my expectations
33. How well did the IT support services meet your expectations in terms of *promptness*?	1	2	3	4	5	6	7
34. How well did the IT support services meet your expectations in terms of *being performed right the first time*?	1	2	3	4	5	6	7

The questions below are related to some of your <u>desires (needs)</u> at your work. Please circle the number that best represents your desires.

	(1)= strongly disagree						(7)= strongly agree
35. I desire to achieve the highest possible *patient satisfaction*.	1	2	3	4	5	6	7
36. I desire to make as few *medical errors* as possible.	1	2	3	4	5	6	7
37. I desire to provide the best possible *healthcare quality* to my patients.	1	2	3	4	5	6	7
38. I desire to *save time* at work as much as possible.	1	2	3	4	5	6	7

	(1)= strongly disagree						(7)= strongly agree
39. I desire to have *unambiguous communication* with my colleagues in order to get the necessary information for performing my tasks.	1	2	3	4	5	6	7
40. I desire to have *efficient interaction* with my colleagues in order to get the necessary information for performing my tasks (e.g., less time or effort consuming).	1	2	3	4	5	6	7
41. I desire to have *hassle-free communication* with my colleagues in order to get the necessary information for performing my tasks.	1	2	3	4	5	6	7
42. I desire to have *effective interaction* with my colleagues in order to get the necessary information for performing my tasks (e.g., no misunderstanding).	1	2	3	4	5	6	7

	(1)= strongly disagree						(7)= strongly agree
43. I desire to have *control over the way I make clinical decisions*.	1	2	3	4	5	6	7
44. I desire to have *control over the way I order patients' investigations*.	1	2	3	4	5	6	7
45. I desire to have *control over the way I access patients' lab results*.	1	2	3	4	5	6	7
46. I desire to have *control over the way I work*.	1	2	3	4	5	6	7

The following questions intend to assess the extent to which your <u>desires (needs)</u> have been fulfilled by using Sunrise EMR system (SCM). The <u>desires (needs)</u> are the same as the ones mentioned earlier. Please circle the number that best represents your opinion. The numbers indicate:

Far below my desires	Below my desires	Slightly below my desires	About what I desires	Slightly above my desires	Above my desires	Far above my desires
1	2	3	4	5	6	7

	(1)=Far below my desires						(7)= Far above my desires
47. By using SCM, how well are your desires (needs) met in terms *of improved patient satisfaction*?	1	2	3	4	5	6	7
48. By using SCM, how well are your desires (needs) met in terms of *reduced medical errors*?	1	2	3	4	5	6	7
49. By using SCM, how well are your desires (needs) met in terms of *increased healthcare quality to patients*?	1	2	3	4	5	6	7
50. By using SCM, how well are your desires (needs) met in terms of *saving more time at work*?	1	2	3	4	5	6	7

	(1)=Far below my desires						(7)= Far above my desires
51. By using SCM, how well are your desires (needs) met in terms of *unambiguous communication with your colleagues*?	1	2	3	4	5	6	7
52. By using SCM, how well are your desires (needs) met in terms of *efficient interaction with your colleagues*?	1	2	3	4	5	6	7
53. By using SCM, how well are your desires (needs) met in terms of *hassle-free communication with your colleagues*?	1	2	3	4	5	6	7
54. By using SCM, how well are your desires (needs) met in terms of *effective interaction with your colleagues*?	1	2	3	4	5	6	7

	(1)=Far below my desires						(7)= Far above my desires
55. By using SCM, how well are your desires (needs) met in terms of *control over clinical decision making*?	1	2	3	4	5	6	7
56. By using SCM, how well are your desires (needs) met in terms of *control over patients' investigation orders*?	1	2	3	4	5	6	7
57. By using SCM, how well are your desires (needs) met in terms of *control over accessing patients' lab results*?	1	2	3	4	5	6	7
58. By using SCM, how well are your desires (needs) met in terms of *control over the way you work*?	1	2	3	4	5	6	7

Based on your experience in using Sunrise EMR system (SCM), please evaluate its general performance in the following functions:

	(1)=Very poor						(7)= Very good
59. SCM's performance in *presenting patient list* is	1	2	3	4	5	6	7
60. SCM's performance in *ordering lab investigations* is	1	2	3	4	5	6	7
61. SCM's performance in *ordering radiology investigations* is	1	2	3	4	5	6	7
62. SCM's performance in *presenting the results of investigations* is	1	2	3	4	5	6	7
63. SCM's performance in *printing discharge summary* is	1	2	3	4	5	6	7
64. SCM's performance in *printing medical certificate* is	1	2	3	4	5	6	7

Please Circle the number that best represents your feelings about Sunrise EMR system (SCM).

	(1)= strongly disagree						(7)= strongly agree
65. I am very *pleased* with SCM	1	2	3	4	5	6	7
66. I am very *contented* with SCM	1	2	3	4	5	6	7
67. I feel *delighted* with SCM	1	2	3	4	5	6	7
68. Overall, I am very *satisfied* with SCM	1	2	3	4	5	6	7

Please answer the following questions regarding Sunrise EMR system (SCM).

69. What is the one thing you like most about SCM?
70. If there is one thing that you could change about SCM to make it better, what would it be?

Thank you very much for your participation!

APPENDIX 3: NUS-IRB APPROVAL

Office of Deputy President (Research and Technology)
Institutional Review Board

NUS National University of Singapore

NUS-IRB REFERENCE CODE: 10-289

23 September 2010

A/Prof Poo Chiang Choon, Danny
Dept of Information Systems
School of Computing
National University of Singapore

Dear A/Prof Poo,

APPROVAL TO CONDUCT RESEARCH AT NUS

Protocol Title: Clinical Satisfaction with Clinical Information Systems: A Disconfirmation Paradigm Perspective

Principal Investigator: A/Prof Poo Chiang Choon, Danny

Source of Funding: NUS ARF

We refer to your application for ethics review.

We are pleased to inform you that the NUS Institutional Review Board has approved the above-mentioned research to be carried out in the Department of Information Systems, School of Computing, National University of Singapore and [redacted] Hospital.

The following documents have been reviewed and approved by the NUS-IRB:

Documents	Document Date
1. NUS-IRB Application Form	Version 2, 17 Sep 2010
2. Research Protocol	Version 2, 17 Sep 2010
3. Participant Information Sheet	Version 3, 17 Sep 2010
4. Clinician's Satisfaction Survey	Version 2, 31 Aug 2010
5. Investigators' Curricula Vitae	--

We have enclosed the Approval Certificate NUS 1140 for this research.

Please let the Board have reports on the annual progress of the research. The first continuing review report will be due on 30 June 2011.

Thank you.

Yours sincerely

Professor Lee Hin Peng
Chairman, Institutional Review Board
National University of Singapore

Cc: Head, Dept of Information Systems, School of Computing, NUS) - without certificate
Director, Division of Research Administration, ODPRT, NUS) - without certificate
Vice Dean (Research), School of Computing, NUS) - without certificate

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