AN EMPIRICAL ASSESSMENT OF PATIENT HEALTHCARE QUALITY:

A LEAN HOSPITAL SUPPLY CHAIN PERSPECTIVE

A Dissertation

by

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ABSTRACT

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Improving the quality of healthcare services available to patients and increasing the efficiency of treatment processes are two pressing needs of the U.S. healthcare system. Aside from extensive research on medicine and disease-specific cures, extant literature does not offer a comprehensive framework that considers all determinants of patient care quality. The objective of this research is to offer an empirically tested framework that may be used by full-service U.S. hospitals to improve the quality of care available to their admitted patients. This framework draws in variables from both external as well as internal hospital supply chains, as recommended by many healthcare experts, and uses lean principles as the basic underlying philosophy thereby filling the aforementioned gap in the literature. To test the hypotheses a cross-sectional online survey was conducted resulting in responses from 294 senior hospital executives located all over the U.S. Structural equation modeling using LISREL 8.53 software was used to analyze the data. The results of the study demonstrate empirical support for all the suggested hypotheses.

This research contributes to operations and healthcare literature. First, a unified supply chain framework is offered that integrated several constructs which have been mentioned in a piecemeal manner across several studies in healthcare, operations and medical fields. Second, the results of this study highlight the need for academicians to comprehensively measure patient care quality (PCQ). Typically, three dimensions of PCQ–interpersonal, environmental and administrative quality–are overlooked in the operations and healthcare literature. Third, hospitals need to effectively manage relationships with their suppliers because lean practices cannot be implemented without active supplier and cooperation. Finally, this research provides empirically tested measures for PCQ which are more comprehensive than those available in extant literature.

The framework has implications for healthcare practice as well. Patients in hospitals would benefit from an integration of the entities of the hospital supply chains because the healthcare system would then focus on the effectiveness and efficiency of all elements and their individual processes. Full-service hospitals across the U.S. may find the framework useful in their efforts to improve the quality of admitted patient care.

DEDICATION

To my beloved mother Mrs. Pranati Chakraborty and the loving memory of my father Late Surya Pratap Chakraborty who wanted the best education for their sons.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

CHAPTER I

INTRODUCTION

Although The Malcolm Baldrige National Quality Award (MBNQA) for healthcare was established in 1999 and research in healthcare quality has accelerated in the last decade, research findings still indicate that the quality of U.S. healthcare has been less than desirable. For example, a study by Health Grades reveals a very grim situation:

> *". . . if all Medicare patients, who were admitted to U.S. hospitals between 2004 and 2006 with any of the 27 conditions studied, were treated at hospitals that performed at the level of Distinguished Hospitals for Clinical Excellence, 171,424 lives may have been saved and 9,671 patients may have avoided one or more in hospital major complications"* (HealthGrades, 2008, p. 2).

An earlier report by the Institute of Medicine (IOM)–*To Err is Human* (Kohn, Corrigan, & Donaldson, 1999)–estimated that within the U.S. as many as one million people were injured and 98,000 died in one year as a result of medical errors. The high number of avoidable injuries and deaths due to medical errors has forced both academicians and practitioners to study the quality of healthcare available in the U.S. in order to find methods to improve it (Boyer, Gardner, & Schweikhart, 2012; McFadden, Henagan, & Gowen, 2009; Pronovost, Miller, & Wachter, 2006; Wachter, 2010).

The nature of healthcare is complex; it is dependent on the medical treatment processes followed to cure a patient's ailment. Every patient may need some customized treatment, depending upon the severity of his/her condition. Further, the knowledge of the physicians depends to a large degree on the philosophy of their medical school education, and the specific objectives of the hospitals (Bohmer, 2009) (i.e., whether the hospitals focus on profit as compared to preventing equipment- and human-related errors). These factors pose additional challenges for hospitals to deliver high quality patient care (Bohmer, 2009).

It is often argued in literature that many of the problems with U.S. healthcare today are common supply chain integration issues that have already been resolved in other service industries (A. B. Cohen et al., 2008; Handfield, 2010). Specifically, the major issues with healthcare supply chain (e.g., too much emphasis being given by hospitals and their suppliers on price and hospitals being held to the whims of the major buyer–the Group Purchasing Organization (GPO[1]), are all related to supply chain management (Handfield, 2010). While some progress has been made in improving the quality of healthcare, many gaps still remain (Boyer & Pronovost, 2010; Pronovost et al., 2006). The recent reports of the Centers for Medicare and Medicaid Services (CMS) have highlighted that the degree of patient safety in U.S. healthcare, an important attribute of patient care quality, is low in many parameters but it is improving slowly (Boyer et al., 2012).

Although not all people are covered, the U.S. has the third highest public healthcare expenditure per capita in the world because of its high cost of medical care (NationMaster, 2003; OECD, 2010). In the late 1990s, the U.S. healthcare system was declared "broken"(A. Garson,

[1] Group Purchasing Organization (GPO) was created to leverage the purchasing power of hospitals in obtaining discounts from vendors. A 2005 study for the Health Industry Group Purchasing Association (HIGPA) reported that 72–80% of every acute healthcare dollar is acquired through GPOs (Hu & Schwarz, 2011). Examples of GPO are: Amerinet, Consorta, Novation, Premier and MedAssets.

Jr, 2000). A 2001 study in five states of the U.S. found that medical debt contributed to 46.2% of all personal bankruptcies, and 62.1% of those who filed for bankruptcies in 2007 claimed high medical expenses (CBSNews, 2009). Accordingly, improving the quality of healthcare services available to patients and increasing the efficiency of medical service delivery processes, keeping their costs under control are considered two important needs of U.S. healthcare (Toussaint & Berry, 2013).

Many healthcare experts and other stakeholders now agree that hospital supply chain management is crucial to improve the performance of U.S. healthcare (Schneller & Smeltzer, 2006). Although the cost of facilities, clinical support and their administration still form the major component of total healthcare costs (37 %), the cost of supplies and purchased services is close behind (31 %) and constitutes the second major component of today's high healthcare costs (Schneller & Smeltzer, 2006). Therefore, frameworks proposing solutions for resolving U.S. healthcare problems, such as the one being tested in this research, must take into consideration U.S. hospitals' internal as well as external supply chains. In order to be effective, a healthcare solution framework must address issues such as reducing hospital waste, preventing medical errors, improving the quality of care, and increasing operational performance of hospitals (Byrnes, 2004; Kowalski, 2009; Shih, Rivers, & Soya Hsu, 2009).

Overview of the Healthcare Supply Chain

The Council of Supply Chain Management Professionals (CSCMP), a well-known practitioner organization, has defined supply chain management (SCM), as the "*planning and management of all activities involved in sourcing, procurement, conversion, and logistics management. It also includes the crucial components of coordination and collaboration with channel partners which can be suppliers, intermediaries, third-party service providers, and* *customers*" (CSCMP, 2011). SCM includes both the internal chain (e.g., patient care unit, hospital storage, patient) and the external chain (e.g., vendors, manufacturers, distributors) (Rivard-Royer, Landry, & Beaulieu, 2002) of a focal firm.

A conceptual representation of the current U.S. healthcare supply chain is presented in Figure 1, wherein elements have been arranged in different layers depending upon their degree of close association with patient care. Each organization shown may have multiple layers of their own suppliers but they have been omitted for brevity. Explanatory notes for each organization shown in Figure 1 are given in Table 1. The core layer consists of a hospital where the patient is admitted for medical treatment. It also comprises the following elements that most hospitals have in-house: (1) healthcare team[2]; (2) hospital administration that includes billing and general management; (3) pharmacy; (4) emergency room; (5) intensive care units; and (6) auxiliary services such as diagnostic testing laboratory, medical counseling, blood and other organ banks, and transportation services such as ambulances. In this research, all core layer entities represent a hospital's internal supply chain.

As shown in Figure 1, hospital external supply chains have three layers. The inner layer comprises healthcare-related firms such as health insurance providers and therapy and specialty care provider firms. Both the core and the inner layer entities may interact directly with the patient. The middle layer entities consist of firms that provide typically outsourced services such as information technology support firms, medical record transcribing firms, equipment and other

[2] Healthcare team refers to the group of doctors, nurses, social workers, physical therapists, dietitians and discharge planners who work together as a team to care for admitted patients in most U.S. hospitals. In this research the two primary participants –doctors and nurses are in focus; therefore healthcare team refers to these two participants together.

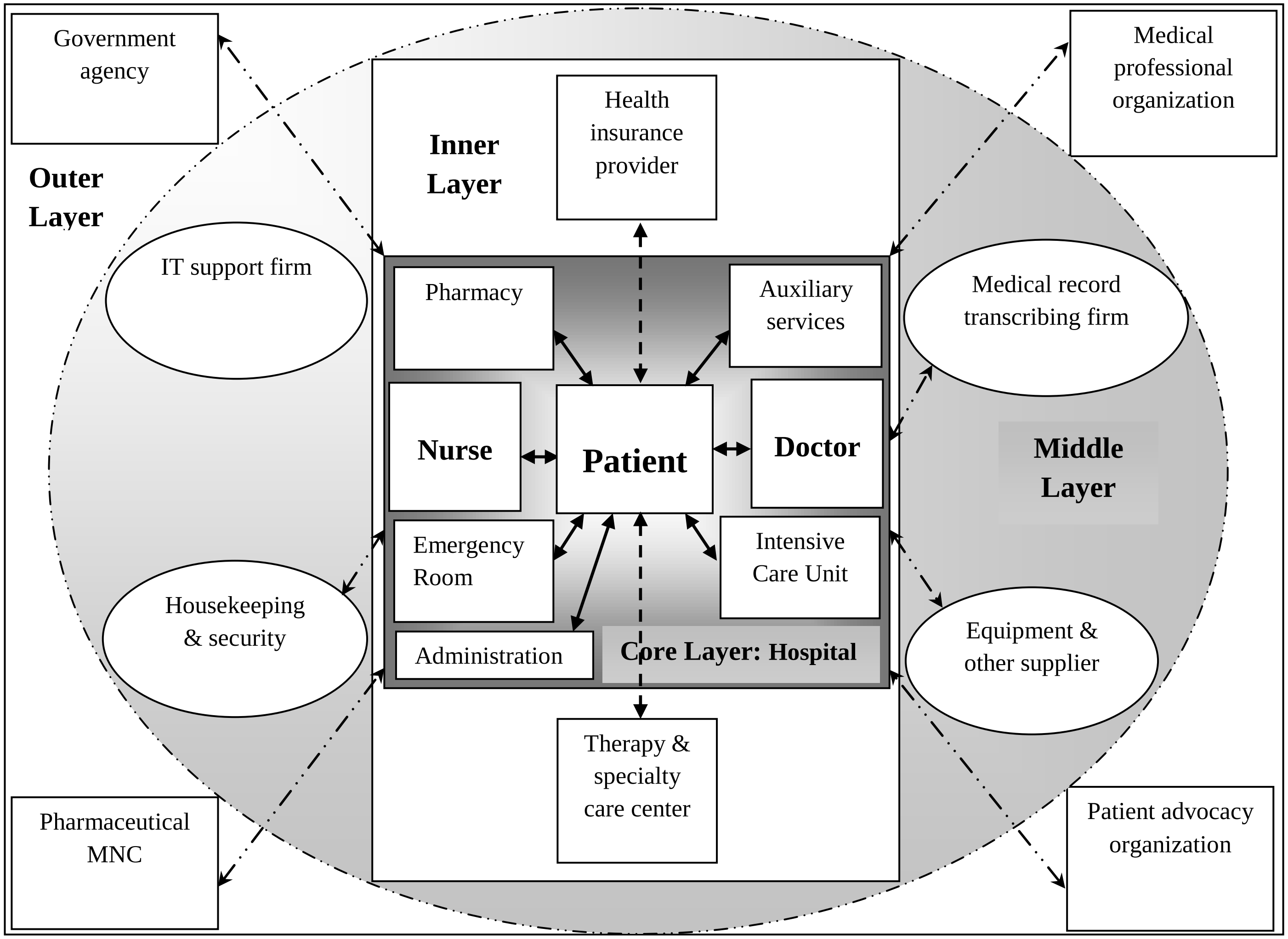

Figure 1: U.S. Healthcare Tier 1 Supply Chain

Notes: Entities associated with patient care in U.S. hospitals are shown here. The core layer represents the internal hospital supply chain. The remaining three layers represent the external hospital supply chain. Each organization shown may have multiple supporting organizations in their supply chain but only Tier-1 organizations in contact with the hospital have been shown for brevity. Arrows indicate material, information and patient flow. Solid arrows indicate flows between the hospital's internal supply chain elements and the admitted patient while broken arrows indicate flows between the external supply chain elements and the hospital.

Table 1. U.S. Healthcare Supply Chain Elements

Layer	Entity [a]	Definition & Details
		Internal hospital supply chain
Core layer	Hospital	The admitted patient in the hospital is shown at the center. The hospital comprises: (1) the doctor(s); (2) the nurse(s), who together are usually involved with the patient's medical treatment; and (3) other elements such as: (a) administration, including billing and general management, (b) pharmacy, (c) emergency room, (d) intensive care unit (ICU), and (e) all auxiliary services, like diagnostic testing laboratory, medical counseling, blood and other organ bank, transportation such as ambulances that are commonly provided in hospitals.
		External hospital supply chain
Inner layer	Health insurance provider	Health insurance protects a patient from the high cost of medical care by providing coverage for specific healthcare services. Three umbrella types of health insurance are common–consumer-directed, fee-for-service (often known as "indemnity" plans), and managed care. These plans cover medical, surgical and hospital expenses and some may cover prescription drugs, dental and behavioral/mental health coverage. Health insurance provider refers to a firm providing health insurance services.
	Therapy and specialty care center	Specialty Care Centers provide high-quality medical services such as radiation treatment, stem cell transplantation and cellular therapy. Therapy Centers provide developmental and rehabilitation services such as speech-language therapy, pediatric occupational therapy and pediatric physical therapy services.
Middle layer	IT support firm	An information technology (IT) firm that typically provides some or all IT services from computer support, IT consulting, IT outsourcing, helpdesk services, data backup, disaster recovery, application hosting, and email hosting to CIO level consulting, managed services, call centers.
	Medical record transcribing firm	Medical transcription deals with the process of converting voice-recorded reports as dictated by physicians and/or other healthcare professionals into text format. A firm that provides such transcription service for its clients.
	Equipment and other supplier	A firm that provides medical and other related types of equipment (e.g., beds) required by the hospital, doctors and nurses for treating patients. Also included are firms that provide other furnishings and supporting materials for patients such as curtains, bed sheets.
	Housekeeping and security	A firm that that provides security services to the hospital and also performs housekeeping services such as cleaning of rooms, medical equipment, laundry and stocking and keeping track of basic hospital amenities in all hospital rooms especially in the emergency rooms, intensive care units.

Table 1 Continued

Layer	Entity	Definition & Details
Outer layer	Government agency (for monitoring/ testing)	Agencies involved in monitoring product safety include the Food and Drug Administration (FDA), Centers for Disease Control (CDC) and the Office of the Surgeon General of the Department of Defense. Agencies that monitor the operation of the healthcare programs such as Medicare and Medicaid are authorized to conduct audits, investigations, and inspections of any facility.
	Medical professional organization/ fraternity	A professional association such as the American Medical Association (AMA) that helps physicians in their work by uniting physicians nationwide and medical students to work on the most important professional and public health issues. Professional fraternities are organizations whose primary purpose is to promote the interests of a particular profession and whose membership is restricted to students in that particular field of professional education or study. Common medical fraternities are: Phi Beta Pi-Theta Kappa Psi, Phi Delta Epsilon, Phi Rho Sigma and Phi Chi.
	Patient advocacy organization	A non-profit organization providing the patient voice in improving access to and reimbursement for high-quality healthcare through regulatory and legislative reform at the state and federal levels. Examples are National Patient Advocate Foundation, HealthHIV, and the National Association for Hearing and Speech Action.
	Pharmaceutical firm/ drug manufacturer	A Pharmaceutical firm could be involved in developing, producing, and marketing drugs licensed for use as medications. Pharmaceutical companies are allowed to deal in generic and/or brand medications and medical devices. Dosage forms include tablets and capsules, injectables, creams, ointments, inhalants, and solutions.

Notes. [a] Entities are drawn from an extensive review of healthcare and operations literature (e.g., Irvine et al., 1998; Alexander et al.,1996; Blomqvist,1991; Bloom, Standing, & Lloyd, 2008; Cook & Rasmussen, 2005; Currim, Gurbaxani, LaBelle, & Lim, 2006; Harper, 2002; Hay, 2003; and Langabeer, 2005) and National Health Council (NHC, 2015) suppliers and housekeeping and security related firms. The middle layer entities may interact indirectly with an admitted patient; i.e., there may always be an inner layer entity between the entity that refers the patient (and/or his/her family) and these middle layer entities. The outer layer entities are external supporting organizations like government agencies (for monitoring and testing drugs), medical professional organizations/fraternities, patient advocacy organizations, and pharmaceutical firms/drug manufacturers. The entities of the outer layer may not interact with the patient at all but support the healthcare system and its various processes. To manage the complexity of the study, this research includes hospital internal supply chain entities and only one entity from the middle layer of external supply chain–equipment and other suppliers (Tier-1 only).

Hospitals are the primary facility for most healthcare services that any person receives–diagnostic services to surgery to continuous nursing care and advanced disease/ medical treatments. Hospitals are of various types–small, free-standing rural facilities–or part of a vast, multi-facility, geographically dispersed but integrated system. Some hospitals specialize into cures for particular diseases such as HIV/AIDS, cancer or for particular types of procedures such as cardiology and heart surgery centers. Others are full-service hospitals[3] that prioritize medical treatment for most ailments (W. J. Flynn, Mathis, Jackson, & Langan, 2004). In order to make the study truly representative of the U.S. healthcare system as a whole, this research is limited to only full-service hospitals (depicted as the core layer in Figure 1) and their relationships with first tier equipment and other suppliers. The focus of this study is thus to find ways to improve the quality of health services received by admitted-patients in full-service U.S. hospitals across

[3] Of the 4,806 hospitals ranked by U.S. News in their latest 2013-14 rankings at both national and regional levels, only 738 (15.35%) were specialty hospitals (Comarow, 2013). The vast majority of U.S. hospitals are thus full-service hospitals. Therefore, this study includes only full-service U.S. hospitals, leaving out the specialty ones.

the country. Both consumers or patients and physicians would benefit from an improvement in hospitals' critical medical processes such as laboratory tests and operating room surgeries. Adopting a lean perspective is a step that hospitals could undertake to improve their processes.

Statement of the Research Problem and Theoretical Foundation

Lean is a customer-centered philosophy in operations management (OM) that focuses on continuously identifying improvement opportunities in the process by eliminating non-value added (or wasteful) activities (B. B. Flynn, Sakakibara, & Schroeder, 1995; Kaynak, 1997, 2002; Schonberger, 1982; Shah & Ward, 2003; Sugimori, Kusunoki, Cho, & Uchikawa, 1977). Value is defined as any activity within a process that is essential to delivering the required outcome.

Hospitals can adopt internal lean practices to improve their individual processes in order to improve the quality of the care that they offer to patients. To become internally lean, hospitals need to apply the following six principles throughout their supply chain (Toussaint & Berry, 2013). First, an attitude of continuous improvement must prevail throughout the chain. Second, value must be created at each step of the medical treatment processes followed. Third, complete unity of purpose must exist between all healthcare team members. Fourth, all hospital administrators must respect the front-line workers. Fifth, visual tracking of progress and improvements must be done on a daily basis. Last but not least, hospitals must follow flexible routines using standardized processes (to the extent possible) for medically treating different patient problems even though their ailments are unique (Toussaint & Berry, 2013).

Several studies have investigated different issues in the U.S. healthcare system using various perspectives. As an example, patient safety is a key aspect of healthcare quality (Kohn et al., 1999; Pronovost et al., 2006) and several studies have already investigated this important quality attribute and its implications in various fields such as nursing (see Powers, 1993; Rogers, Hwang, Scott, Aiken, & Dinges, 2004; Laschinger & Leiter, 2006), healthcare (see Cook & Rasmussen, 2005; Horak, Pauig, Keidan, & Kerns, 2004; Odwazny, Hasler, Abrams, & McNutt, 2005; Pronovost et al., 2006; Singer et al., 2007; Sirio et al., 2003), OM (see Chandrasekaran, Senot, & Boyer, 2012; McFadden, Henagan, & Gowen Iii, 2009; McFadden, Stock, & Gowen, 2006) and strategic management (SM) (see Douglas & Ryman, 2003; Edmondson, 2003; Huckman & Zinner, 2008). Patient safety is a component of one of the dimensions of patient care quality which has been named *technical quality* (Dagger, Sweeney, & Johnson, 2007). Recent studies on quality of patient care imply that there are more aspects of patient care quality such as *interpersonal, environmental* and *administrative quality* (e.g., Chang, Ma, Chiu, Lin, & Lee, 2009; Dagger et al., 1997; Ma, Yang, Lee, & Chang, 2009).

Aside from extensive research on medicine and disease-specific cures, systemic research on healthcare is scant and can be broadly categorized into the following groups: (1) improving hospital operations (e.g., Blomqvist, 1991; Irvine et al., 1998); (2) using optimal routing algorithms and scheduling operations (e.g., Alexander et al., 1996 ; Butler & Leong, 2000; Cook & Rasmussen, 2005; Goldstein et al., 2002; Harper,2002; Hay, 2003); (3) using technology to improve hospital admission rates (e.g., Coye & Kell, 2006; Langabeer, 2005); (4) examining the antecedents and consequences of organizational innovation in hospitals (e.g., Leidner, Preston, & Chen, 2010); (5) improving medication delivery (e.g., Mazur & Chen, 2009); (6) using e-learning adoption to build knowledge assets (e.g., Shin-Yuan, Chen, & Wan-Ju, 2009; Wickramasinghe & Davison, 2004); and (7) studying patient satisfaction with their hospital experience (e.g., Nelson & Niederberger, 1990, Ware et al., 1983). In sum, scholars have not offered a comprehensive framework that considers all determinants of patient care quality.

As already noted, improving the quality of healthcare and increasing the efficiency of medical service delivery processes are the major issues to be resolved in U.S. healthcare (Toussaint & Berry, 2013). Adopting a lean perspective could help hospitals make the best use of their limited resources to provide better quality care for their admitted patients and improve their medical care processes. While lean philosophy has been proven successful in reducing healthcare waste and increasing health provider profitability (Toussaint & Berry, 2013), surveys of hospital leaders continue to find that full deployment of lean in U.S. healthcare is very low. A 2009 survey by the American Society for Quality (ASQ) found that only 4 percent of U.S. hospitals reported a full deployment of lean, while 53% of the 77 hospitals responding reported some use of lean principles in their organization (Weintraub, 2011). According to ASQ respondents, the key reasons for the low deployment of lean principles in U.S. healthcare are lack of resources such as beds, equipment and pharmaceutical/surgical supplies, appropriate information and buy-in from leadership. Thus, there are many important challenges that hospitals face in their goal of implementing lean practices to improve the quality of patient care.

The lack of a clear framework in healthcare literature compounds the dilemma that hospital administrators and medical experts face while deciding how to resolve several interconnected issues to provide better quality of patient care. There is no established supply chain framework in the literature that suggests methods to improve the quality of care received by admitted patients in hospitals. The objective of this study is therefore to advocate using an inclusive approach towards improving the quality of patient care and contribute to research positioned at the cross section of operations and healthcare literature. By empirically testing a framework that considers variables from both the external as well as the internal hospital supply chains and using lean principles as its basic underlying philosophy, this study attempts to offer a set of guidelines thereby filling the void in the literature. Full-service U.S. hospitals could use the framework to improve the quality of care available to their admitted patients.

A theory is defined as "a system of constructs and variables in which the constructs are related to each other by propositions and variables are related to each other by hypotheses" (Cf. Kaynak, 1997; Bacharach, 1989, p 498). It is important to explain the four building blocks of theory development: (1) the *what* occurs in the phenomena being studied; (2) *how* it occurs; (3) *why* it occurs; and (4) *who* are all the parties involved, *where* and *when* the phenomena being studied occurs (Cf. Kaynak, 1997; Whetten, 1989) in order to have a clear understanding of the interrelationships among variables. Integration of findings supported by theory helps increase understanding of the phenomena being studied (Cf. Kaynak, 1997; Jemison, 1981). The framework being tested in this research draws from three different theoretical perspectives in interdisciplinary fields to explain the rationale for the hypothesized relationships among the variables.

Following an extensive review of literature in several interdisciplinary fields of healthcare management (HCM), human resources management (HRM), marketing, medicine, nursing, organizational behavior (OB), OM, and SM, the following three theoretical perspectives are used in this study. Quality management (Feigenbaum, 1961; Kaynak & Hartley, 2008) and lean systems theory (B. B. Flynn et al., 1995; Kaynak, 1997, 2002; Monden, 1981; Ōno, 1988; Shah & Ward, 2003; Sugimori et al., 1977) from OM and information processing theory (Davenport, 1998; Galbraith, 1973; Tushman & Nadler, 1978) from SM are the three theories.

Using lean as the basic underlying philosophy in this research, a supply chain view of the problems with U.S. healthcare is used in an attempt to provide a framework to improve the quality of care received by admitted patients at full-service U.S. hospitals. Specifically, in the context of U.S. full-service hospitals and their Tier-1 supply chains this research investigates the following research questions:

1. Which internal supply chain factors are related to the quality of patient care?
2. Which external supply chain factors are related to the quality of patient care?
3. How are these factors related to the quality of patient care?

A cross-sectional online survey research method was used to investigate the above research questions. Based on an exhaustive review of interdisciplinary literature, an online survey instrument was developed and was pilot tested by emailing the questionnaire to a random sample of hospital executives in the U.S. The target population is a list of all full-service hospitals in the U.S. because the study examines the relationships among variables related to internal and external supply chains of full-service U.S. hospitals. The subjects of the study are mostly department heads or managers in full-service hospitals who are responsible for quality implementation and have titles such as Chief Quality Officer and Director of Quality Improvement. The hospitals and the subjects were identified from a paid hospital senior executive database purchased from a reputed firm.

A statistical test such as Cronbach's alpha was performed on the data from the pilot study to establish the reliability of the instrument. Structural equation modeling (SEM) was used as the statistical tool for simultaneously analyzing the relationship among the research variables of the study.

Significance of the Research

This research fills a gap in the literature by testing a framework that suggests methods to improve the quality of patient care. The contribution to research is described first, followed by the contribution to practice.

Contribution to Research

The current U.S. healthcare supply chain view offered early in the research clearly suggests that a supply chain perspective is essential to improving the quality of care available to admitted patients in hospitals, a view not too often highlighted in operations or healthcare literature. This research contributes to the growing literature positioned at the cross-section of OM and HCM fields in the following ways.

First, this research offers an integrative approach to resolving the major issues in U.S. healthcare by drawing in variables from both the internal as well as external supply chain of a typical U.S. full-service hospital. Using a lean supply chain perspective, this research empirically tests a framework to suggest how the quality of care received by admitted patients can be improved. It is thus an attempt to offer an integrated approach to resolving healthcare issues. The results of this study highlight relationships between the different constructs that have been overlooked in the operations and healthcare literature (such as the role of supplier relationship management on internal lean practices in healthcare or the role of healthcare team effectiveness on quality of patient care) (Bohmer, 2009; Schneller & Smeltzer, 2006; Toussaint & Berry, 2013).

Second, as discussed in SCM literature (see Caniëls & Gelderman, 2007; Das, Narasimhan, & Talluri, 2006; Goodman & Jones, 2013; Mettler & Rohner, 2009; Noordewier, John, & Nevin, 1990; Olsen & Ellram, 1997; Rivard-Royer et al., 2002; Spekman, 1988; Stuart, 1997), the framework highlights that effective supplier management is very important for hospitals, like for other service firms (Handfield, 2010). Hospitals may need to pay attention to all the six different aspects of supplier relationship suggested in this study–supplier flexibility, supplier assistance, supplier information exchange, supplier monitoring, continuity expectation, and quality of supplies–to ensure that they have the best cooperation from their suppliers.

Third, the framework being tested integrates several constructs that have been mentioned in an isolated manner across several studies in the fields of HCM and medicine (see Bohmer, 2009; Schneller & Smeltzer, 2006; Toussaint & Berry, 2013; Weintraub, 2011). Many HCM studies do not consider all the aspects such as patient and material flow, continuous quality improvement and waste management while discussing lean implementation in hospitals. From an HCM perspective, the framework highlights that hospitals may need to consider all three characteristics of lean implementation. This study attempts to measure different aspects of patient care quality in a more comprehensive manner and future HCM studies may find it beneficial to use such a measure.

Finally, from a management research standpoint, the framework being tested in this research uses more comprehensive measures to capture all the different attributes of the phenomena. First, a second order construct (PCQ) is used to take into account all four dimensions of the quality of care received by patients in hospitals, some of which are often ignored in the literature. The framework also uses items to measure all the different aspects of supplier relationship management (Noordewier et al., 1990). Similarly, the measure for internal lean practices incorporates all different attributes that hospitals should give attention to while implementing lean practices. These constructs have hitherto not been measured in this manner in OM and SCM literature and this research aims to provide empirically tested valid and reliable measures for these constructs.

Contribution to Practice

The framework has several useful implications for patients and medical practitioners as well. First, patients in hospitals could greatly benefit from an integration of the various entities of the healthcare supply chain because it could bring the focus of the healthcare system on the effectiveness and efficiency of all entities and their individual processes which would ultimately improve the quality of healthcare services that they receive in the hospital.

Second, the framework highlights the importance of hospital leadership and lean operations and is aligned closely with the MBNQA award criteria for healthcare (NIST, 2013). The framework also directly addresses the most strategic issue raised by The American Medical Association (AMA, 2011)–quality of care. Medical practitioners involved in all hospital supply chain entities would gain from an integrated supply chain perspective because of the importance given to continuously improve quality at hospitals, steps taken to reduce hospital inventories and further, reduce and eliminate all wastes or non value-adding activities. The framework could thus show hospitals how to use their resources better.

Better quality of patient care could be provided by hospitals if they allocate the resources to support their processes that reduce medical errors and focus on overall quality of care (Byrnes, 2004; Shih et al., 2009; Singh, Rice, & Riquier, 2006). Better quality of patient care is a win-win for all stakeholders because it could improve hospitals' financial performance, benefit all intermediaries and suppliers in the chain, as well as benefit patients through better, quicker care (Lee, Lee, & Schniederjans, 2011).

Definition of Key Terms

In healthcare and operations literature the following key terms have been used in connection with the quality of patient care delivered in hospitals and improvement of the healthcare system-wide performance. Therefore, in this dissertation the following terms are defined as follows:

- Management leadership: This term indicates a firm's leadership in general terms and signifies the acceptance of quality responsibility by a hospital's senior management. It does not indicate any particular leadership style. It refers to the participation in quality improvement efforts and direction to workers and managers by top management of hospitals (e.g., Nelson et al., 2011).
- Technology integration: Refers to the interconnectedness of the different technological systems (both software and hardware) implemented in hospitals that enables frequent and up-to-date information exchange such as hospital patient medical information, inventory data about medicine/other supplies and personnel information in electronic form between different entities within the hospital, the healthcare team and hospital management (e.g., Leidner, Preston, & Chen, 2010; Li & Lin, 2006).
- Supplier relationship management: Indicates a relationship building approach that uses hospitals' social ties and interpersonal contacts with their suppliers to monitor, control and encourage desirable supplier behavior (e.g., Das et al., 2006; Lumineau & Henderson, 2012; Noordewier et al., 1990; Rivard-Royer, Landry, & Beaulieu, 2002).
- Healthcare team effectiveness: Indicates whether the team is able to function as a whole to survive, adapt, maintain itself and grow (P. S. Goodman, 1986). In the healthcare context, it indicates if the healthcare team is able to achieve its organizational goals (e.g., Poulton & West, 1993; 1999).
- Internal lean practices: This term refers to aligned internal operations that help hospitals perform effective medical procedures on patients in a timely manner at a reasonable cost

(e.g., Alexander, Halpern, & Lee, 1996; Butler & Leong, 2000; Cook & Rasmussen, 2005; Goldstein, Ward, Leong, & Butler, 2002; Harper, 2002; Hay, 2003).

- Patient care quality: Refers to the excellence of medical care received by admitted patients in U.S. hospitals (e.g., Nelson & Niederberger, 1990; Van Ess Coeling & Cukr, 2000; Ware et al., 1983).

Organization of the Dissertation

The rest of the dissertation is organized as follows. In the next chapter, the interdisciplinary literature on healthcare and hospital operations is reviewed first. An integrative framework for improving the quality of patient care available to admitted patients in hospitals is then offered along with a detailed introduction to each construct. The research hypotheses, which are all based on theory and literature, are discussed next. In the third chapter, research methodology is elaborated. All details of the pilot study, the procedures followed for the main study, and the data analysis techniques used to test the hypotheses, are enumerated. In the fourth chapter, all the results of the study are presented. Finally, in the last chapter, the results are discussed and, the limitations of the study are acknowledged. The dissertation concludes with future research directions.

CHAPTER II

LITERATURE REVIEW AND RESEARCH FRAMEWORK

This chapter comprises four sections. First, the recent state of U.S. healthcare is described. The many problems being faced due to the lack of effective hospital supply chain integration are highlighted. Second, three theories from different interdisciplinary fields are drawn upon to build the theoretical foundation for the constructs under study. In the third section, each construct is defined. The major studies using the construct in healthcare context are then listed and their findings are discussed. In the fourth section, based on theories discussed before and extant literature support, specific hypotheses among the research variables are offered. Tables and figures are used to highlight existing research and to depict the research model.

Quality Improvement in Healthcare

Even though healthcare quality improvement has been the focus of research in various disciplines for almost two decades or more, many quality related issues have not yet been resolved (Boyer & Pronovost, 2010; Pronovost et al., 2006). Therefore, extant literature was carefully reviewed to identify the major issues. All studies that had a focus on healthcare quality and used either conceptual, empirical or modeling methodologies were covered. The major studies on healthcare quality improvement in U.S. hospitals are listed in Table 2.

Table 2. Major Studies on Quality Improvement in Healthcare

Study	Purpose	Research Type	Main Findings
Shortell et al. (1995)	Relationships among organizational culture, quality improvement processes and outcomes	Empirical	The authors found that a participative, flexible and risk-taking organizational culture was significantly related to continuous quality improvement (CQI). CQI was positively associated with greater perceived patient outcomes and human resource development. Larger-size hospitals experience lower clinical efficiency due to higher charges and higher length of patient stay as they had more bureaucratic and hierarchical culture that served as a barrier to CQI implementation.
Li (1997)	Relationship between hospital quality management and service quality performance	Empirical	Results indicate that medical technology investment alone does not contribute to a significant improvement in hospital service quality. Their study also shows that organizational cooperation, workforce development, medical technology investment, and process analysis mediate the relationship between top management leadership and health service quality.
Raju and Lonial (2002)	Impact of service quality on financial performance in healthcare	Empirical	A framework is offered linking four constructs–quality context, quality outcomes, market orientation, and market/product development outcomes to a hospital's financial performance. They found that a sequential chain of relationships exists among the constructs where market orientation mediates the effect of quality context on quality outcomes, and market/product development outcomes mediate the effect of quality outcomes on financial performance.

Table 2 Continued

Study	Purpose	Research Type	Main Findings
Kanji and Sa (2003)	Total Quality Management (TQM) initiatives in healthcare	Conceptual	According to the authors, TQM has emerged as a potential solution to improve the efficiency and effectiveness of healthcare. The reasons for failure of TQM implementation are found to be insufficient support of health professionals, lack of leadership commitment and the tendency to look at TQM in isolation.
Coffey et al. (2005)	Critical paths in patient care	Conceptual	Critical paths are defined as the optimal sequencing and timing of interventions and collaborative efforts by physicians, nurses and other staff for a particular diagnosis or procedure. The authors note that these paths are developed to minimize delays and resource utilization and to maximize quality of care. These paths also reduce variation in the care provided, facilitate expected outcomes, reduce delays, reduce length of patient stay, and improve hospital cost effectiveness. The approach and goals of critical paths are an important part of an organization's TQM process.
Guth and Kleiner (2005)	Factors influencing delivery of high quality patient care	Empirical	Highly effective hospital managers exhibit roles and behaviors that correlate with the institutional commitment to quality and improved patient care outcomes. By reinforcing their involvement in quality improvement efforts, hospital managers are able to effectively promote and sustain quality care in hospitals.

Table 2 Continued

Study	Purpose	Research Type	Main Findings
Lucas et al. (2005)	Environmental and organizational factors supporting CQI adoption in nursing homes	Empirical	New requirements, environmental competition, organizational time and manager training differentiate the CQI adopters vs. non-adopters. The authors summarize that CQI adoption is facilitated by effective use of information systems, flexible use of personnel and team support, as well as CQI training for managers. The authors create a profile of CQI adopters that can guide administrators and policy-makers and can help nursing homes focus internal resources on key facilitators.
Shojania and Grimshaw (2005)	Review of quality improvement (QI) implementation literature	Conceptual	The authors review QI research problems and note that routine medical practice often failed to incorporate research evidence in a timely and reliable manner. They suggest that QI efforts should be based on evidence as well as the practices that the hospital seeks to implement.
Alexander, Weiner and Griffith (2006)	Association between the scope and intensity of hospitals' QI implementation and their performance	Empirical	Results suggest that QI has a measurable impact on global measures of organizational performance. Hospitals that implement QI effectively can expect to improve their financial and cost performance.
Gowen, McFadden, Hoobler and Tallon (2006)	Relationships among healthcare quality program practices, employee commitment initiatives and perceived results	Empirical	Perceived quality program results are related to employee commitment and control more than quality practices.

Table 2 Continued

Study	Purpose	Research Type	Main Findings
Pellicone and Martocci (2006)	Demonstration of how adoption of six sigma quality system reduces delays in hospital bed assignment turnaround time	Empirical	The hospital under study decided to focus on patient flow when it noticed an increase in patient volume. Delays in some areas in the hospital affected other departments causing a dip in patient services and physician satisfaction. The authors noted that in the following six months the six sigma team decreased its mean turnaround time.
Martin (2007)	Comparison of three different quality models	Conceptual	The authors examine some well-known quality improvement programs such as six sigma, lean and the Institute for Healthcare Improvement's model for healthcare and suggest that each of these models could work alone as well as together.
Gowen, Stock and McFadden (2008)	Usefulness of knowledge management for six sigma implementation in hospitals	Empirical	Knowledge management improves the success of six sigma initiatives, specifically for knowledge dissemination and responsiveness.
Dobson, Hasija and Pinker (2011)	Effect of reserving slots for urgent patients in a primary healthcare practice on service quality	Modeling	The authors found that encouraging routine patients to call for same-day appointments is a key ingredient of the success of advanced-access in clinical settings.
Goldstein and Iossifova (2012)	Long-term relationship between an organization's quality management practices and process-level performance	Empirical	The authors investigated the quality practices of U.S. general acute care hospitals. They found differing effects that are dependent on hospital slack. In hospitals with high slack, quality practices predicts three of four studied process performance measures, but in hospitals with low slack, quality practices predicts only one of the four process performance measures while other factors outweigh the effects of quality practices. This study supports management taking a long-term perspective related to implementation of quality management systems and highlighted the relevance of slack.

A review of studies in Table 2 indicates that most studies have chosen to focus only on specific issues determining U.S. healthcare, perhaps due to the serious challenges of operationalization and data collection from hospitals. For example, the ten studies reviewed under the empirical category that spread over a span of 17 years have mainly focused on establishing relationships among quality improvement efforts and the outcomes (S. M. Shortell et al., 1995) such as service quality (L. X. Li, 1997) and financial performance (Raju & Lonial, 2002). Lucas and colleagues (2005) enumerate the organizational factors (e.g., information systems, flexible use of personnel as and when required, and management support to team, quality training for managers) that support quality improvement in hospitals but have mostly restricted their research to factors within the hospital. Similarly, Gowen and colleagues (2006; 2008) have demonstrated the usefulness of knowledge management for six sigma implementation in hospitals and Goldstein and Iossifova (2012) have established a positive relationship between an organization's quality management practices and its process-level performance but both of these studies did not consider factors outside the immediate control of the hospital (e.g., related issues of supplier cooperation, flexibility, information exchange) and their impact on six-sigma processes and quality management practices. The modeling related study (Dobson et al., 2011), investigates a very important but narrowly focused issue-patient scheduling in clinical settings and its effect on service quality. Even the four conceptual studies reviewed reveal that scholars have chosen to focus on literature reviews (Shojania & Grimshaw, 2005) and specific measurable issues-comparison of three different quality models (Martin, 2007) and critical paths (Coffey et al., 2005).

It is thus clear that a inclusive supply chain perspective, which considers a hospital's external and internal supply chains, is missing. It is important to adopt a supply chain perspective because patient care quality related variables are also influenced by issues that are outside the control of the hospitals.

U.S. Healthcare: A Hospital Supply Chain Perspective

A few scholars suggest that many problems faced by U.S. healthcare today are common supply chain issues that previously affected other sectors of the economy and have already been resolved in several industries such as in manufacturing of consumer goods and other heavy industries and even in service firms (A. B. Cohen et al., 2008; Handfield, 2010). However, a few other scholars disagree that problems in healthcare are similar to those in other service industries. They highlight that there are major differences unique to the nature of healthcare and suggest that healthcare processes have the following five complex attributes that do not apply to other service organizations (Vogus, Sutcliffe, & Weick, 2010). First, defining and monitoring patient safety is a challenge because it is a “dynamic non-event” that is difficult to specify and visualize (Weick, 1987, p. 118). Second, human diseases are complex and may affect patients differently; therefore, the treatment for a similar medical problem will vary to some extent between patients. Third, the design of effective monitoring efforts could threaten patient safety because the high degree of specialization in healthcare makes it difficult for practitioners to agree on what constitutes an error and what should be an appropriate response for preventing errors (Khatri, Baveja, Boren, & Mammo, 2006). Fourth, as compared to other sectors such as manufacturing or services in general, healthcare has too many cases of routine “operational failures” (e.g., missing equipment and supplies) that disrupt caregivers’ work and operational failures divert caregivers’ attention from focused medical treatment to temporary workarounds (Tucker, 2007; Tucker, Nembhard, & Edmondson, 2007; Tucker, Singer, Hayes, & Falwell, 2008; Tucker & Spear, 2006). Finally, the professional culture of medicine also poses unique challenges for building and sustaining a safety culture in a hospital because a strong emphasis on individual accountability for error often results in "blaming and shaming" individuals for the errors that have occurred under their supervision (Carroll & Quijada, 2004). Thus, many times doctors, nurses and hospital administrators remain silent due to the fear of losing their individual and collective hospital reputations, even when they recognize unsafe conditions (Sutcliffe, Lewton, & Rosenthal, 2004).

Additionally, there are some issues in U.S. healthcare which makes it extremely challenging. It is difficult for many healthcare administrators to work with the challenges of the current organizational structures that are characterized by a lot of professional autonomy to all entities (Boyer & Pronovost, 2010). Most healthcare incentives to different supply chain entities are not perfectly aligned (Boyer & Pronovost, 2010); so performance is not uniform across the chain. Further, there is an ongoing substantial debate and disagreement over what would be the appropriate standard of care for patients (Boyer & Pronovost, 2010). Medicine has largely evolved as a series of distinct specialties with some parts driving the whole; hence, there are major system-wide challenges in coordinating large networks of individual providers, some of whom do not want to give up their traditional control on outcomes (Boyer & Pronovost, 2010). Further, there are major differences in hospital objectives based on their size, location and teaching or research orientation. Smaller hospitals deploy internal practices having specific outcome goals while larger hospitals deploy internal practices catering to a general outcome oriented climate (Boyer et al., 2012).

To further complicate matters, there are many separate legal entities and most healthcare facilities are owned by the private sector which cannot be forced to act by the government or any other single stakeholder[4]. A recent medical report commenting on the roadmap to transform U.S. healthcare argues for appropriate regulations and more proactive decision making (Heskett, 2007) by U.S. Federal government.

In sum, the U.S. healthcare supply chain is a large unorganized network of products and entities loosely held together by manual and people-intensive processes (Langabeer, 2005). As supplies move downstream towards hospitals, the quality and robustness of accompanying information used to manage these products deteriorate significantly. Technology that provides advanced planning, synchronization, and collaboration upstream to the large suppliers and distributors is used only at the larger and more sophisticated U.S. hospitals (Langabeer, 2005). This trend is changing very slowly though, with more hospitals beginning to use technology in their daily operations (Allen & Fenwick, 2007; Silow-Carroll, 2012). A supply chain perspective could help hospitals address some of the pressing quality issues in U.S. healthcare such as reducing wastes, preventing medical errors and increasing their operational performance (Byrnes, 2004; Kowalski, 2009; Shih et al., 2009) because many external entities also influence the quality of patient care available to admitted patients.

Next, three theories from interdisciplinary fields are selected because they provide broad theoretical support to the SCM constructs in this research and the relationships hypothesized among them: quality management (QM) (Ahire, Golhar, & Waller, 1996; Feigenbaum, 1961; Jayaram, Ahire, & Dreyfus, 2010; Kaynak & Hartley, 2008), lean systems theory (B. B. Flynn et al., 1995; Kaynak, 1997, 2002; Monden, 1981; Ōno, 1988; Shah & Ward, 2003; Sugimori et al.,

[4] According to the 2013 annual survey of the American Hospital Association (AHA) published in the AHA Hospital Statistics 2013 edition (AHA_Hospital_Statistics, 2013), out of a total 5,724 registered hospitals across the U.S. the number of Federal government hospitals was only 208 (approx. 4 %), the number of state and local government community hospitals was 1,045 (approx. 18 %), while a total of 3,928 hospitals (approx. 68%) were either privately owned for profit or not-for-profit.

1977) and information processing theory (IPT) (Davenport, 1998; Galbraith, 1973; Tushman & Nadler, 1978). A summary of the theoretical tenets is presented in Table 3. Over the next few sections each construct is introduced and the major healthcare findings related to the construct are highlighted. Next, the research model tying in all the hypothesized relationships among the variables is presented. Finally, the theoretically supported rationale for each hypothesized relationships among the variables is discussed in detail.

Key Constructs in the Theoretical Framework

Management Leadership

Management leadership is defined as the acceptance of quality responsibility by hospital senior management. It refers to the participation and direction given by senior management in quality improvement related efforts (e.g., Kaynak & Hartley, 2008; S. Nelson et al., 2011). Management provides all resources that are necessary for training employees in the use of new principles and tools and creates a work environment that is conducive to employee involvement in change and for supporting changes in work culture (Cf. Kaynak, 2003; Ahire & O'Shaughnessy, 1998; Anderson et al., 1995; Bell and Burnham, 1989; Burack et al., 1994; Flynn et al., 1995; Hamlin et al., 1997; Handfield et al., 1998; Schroeder et al., 1989; Wilson and Collier, 2000). Hospital management's leadership role is thus essential to implement quality.

Senior management needs to be aware of all the risks associated with improper patient care procedures and provide an environment in which patient safety initiatives can flourish (McFadden, Henagan, & Gowen Iii, 2009; Odwazny et al., 2005). Hospital management needs to spread the awareness about cleanliness throughout the hospital and ensure that all necessary precautions are taken to prevent healthcare related infections (HAI) (Saint et al., 2010). The major studies on the role of management leadership in healthcare are listed in Table 4.

Table 3. Theories Used in Support of Research Constructs and Relationships

Theory	**Application in Healthcare and Other Studies**	**Theoretical Tenets**
Quality management	Deming (1986); Feigenbaum (1961); Kaynak and Hartley (2008); McFadden, Henagan and Gowen Iii (2009); McLaughlin, McLaughlin and Kaluzny (2004)	QM is an integrative philosophy of management for continuously improving the quality of products and processes (Feigenbaum, 1961). The basic premise is that the quality of products/services and processes of their manufacture/generation is the responsibility of everyone who is involved with the creation or consumption of the products/services (Feigenbaum, 1961). QM highlights the involvement of management, workforce, suppliers, and even customers in order to meet or exceed customer expectations (Ahire, 1997; Deming, 1986; Kaynak & Hartley, 2008).
Lean systems theory	Dahlgaard, Pettersen and Dahlgaard-Park (2011); Flynn et al. (1995); Monden (1981); Ono (1988); Kaynak (1997, 2002); Shah and Ward (2003); Sugimori, Kusunoki, Cho and Uchikawa (1977)	Lean or JIT is a strategy that strives to improve a firm's return on investment by reducing in-process inventory and associated carrying costs. In services, lean concepts can be used in a variety of ways such as to organize problem-solving groups, upgrade housekeeping, level the facility load by reorganizing their physical configuration, eliminate unnecessary activities, introduce demand-pull scheduling and develop supplier networks (Chase, Jacobs, & Aquilano, 2006).
Information processing theory (IPT)	Galbraith (1973); Gittell (2008); Tushman and Nadler (1978)	IPT suggests that uncertainty drives the need for a firm's information technology (IT) capabilities which facilitate and enhance organizational structures (Galbraith, 1973; Tushman & Nadler, 1978).

Table 4. Major Studies on Role of Leadership in Healthcare

Study	Purpose	Research Type	Main Findings
Judge and Ryman (2001)	Shared model of leadership among the top healthcare executives	Conceptual	Senior hospital executives need to demonstrate their leadership by giving attention to joint collaborative abilities, creating customer value and experimenting and implementing innovative ways.
West et al. (2003)	Leadership clarity and team innovation	Empirical	The authors examined relationships among leadership clarity, team processes and innovation in healthcare. They found that leadership clarity is associated with team objectives, high levels of participation, commitment to excellence, and support for innovation. Their findings suggest that the healthcare team leadership needs to be clear when innovation is a desirable team performance outcome.
Odwazny, Hasler, Abrams and McNutt (2005)	Role of leadership in fostering a culture of patient safety	Empirical	If senior management supports a culture of learning and prevention and propagates an organizational structure that promotes collaboration, it would provide an environment in which patient safety initiatives can be implemented thereby having not only a safer and higher quality patient care, but also positive financial returns.
Khatri et al. (2006)	Framework linking management philosophy to medical errors and quality of care	Conceptual	A hospital's management approach is related to its clinical outcomes and managerial assumptions determine human resource management (HRM) practices. The clinical outcomes and HRM practices determine the medical errors and the quality of care via their impact on employee behaviors.
McFadden, Henagan and Gowen Iii (2009)	Role of leadership in improving patient safety	Empirical	Improving patient safety begins at the highest level of the organization with a transformational leadership style. Transformational leadership has an important relationship with creating a culture of safety which in turn is associated with the adoption of patient safety initiatives, and ultimately with positive improvements in patient safety outcomes. The authors found empirical support for the effectiveness of their patient safety chain model.
Saint (2010)	Importance of leadership in preventing healthcare associated infections (HAI)	Empirical	The authors' objective was to understand why some hospitals were engaged in HAI prevention activities while others were not. They found that successful leaders encouraged clinical excellence and effectively communicated the culture of excellence to staff. The authors concluded that hospital leadership plays an important role in infection prevention activities.

From a review of the studies listed in Table 4, it is clear that the authors have focused on investigating the role of healthcare leaders on specific aspects of patient care quality such as preventing HAI (Saint et al., 2010), encouraging team innovation (West et al., 2003) and improving patient safety (McFadden, Henagan, & Gowen, 2009) but an integrative research model focusing on the role of hospital leadership on patient care quality is missing. On a similar note, the conceptual papers have offered a shared model of leadership (Judge & Ryman, 2001) linking management philosophy to medical errors (Khatri et al., 2006). While medical errors are an important part of the quality of patient care (PCQ), there are several other components of PCQ, as will be discussed subsequently.

Because hospital management takes all financial decisions that affect the hospital's quality profile, direction and support from top leadership are crucial for any patient care quality improvement effort to be effective in hospitals. Hospital management needs to ensure that quality of patient care is given the maximum importance by all healthcare teams (S. Nelson et al., 2011). Management leadership is therefore proposed as an important antecedent to all other supply chain related variables in the research framework.

Technology Integration

Technology integration is defined as interconnectedness of the different technological systems (both software and hardware) implemented in hospitals that enables frequent and up-to-date information exchange such as hospital patient medical information, inventory data about medicine/other supplies and personnel information in electronic form between different entities within the hospital, the healthcare team and hospital management (e.g., Leidner, Preston, & Chen, 2010; Li & Lin, 2006). The tight integration present in software systems that some hospitals use reduce operational uncertainty by providing coordination, visibility, and easy information sharing across transactions (Hendricks, Singhal, & Stratman, 2007; Leidner et al., 2010). Easy access to integrated data about the latest in-house hospital stock levels may make it easier for hospital administrators to transact business with other entities, both within and outside the hospital (Huber & McDaniel, 1986; Saeed, Malhotra, & Grover, 2005). The major studies on technology integration in healthcare supply chain are presented in Table 5.

An examination of the research summaries in Table 5 shows that scholars offering conceptual models have focused mostly on healthcare in clinical settings. The cross-functional process framework (D. W. Young & Barrett, 1997) offers an integrated delivery system model but some of the organizational processes such as client management and cultural maintenance may not apply to U.S. hospital settings. Similarly, the Pittsburg Regional healthcare initiative (Sirio et al., 2003) offers a shared learning model but some of its care processes could be local to the state of Pennsylvania. In addition, as already noted, the research model was drawn up in clinical settings and some of the variables may not apply to the hospital settings across the country.

The empirical studies on the other hand, discuss several specific issues related to technology adoption and integration in hospitals, such as effect of business process reengineering (BPR) on performance (Devaraj & Kohli, 2000), technology accessibility and hospital readiness its effect on electronic medical records (EMR) (Korst, Aydin, Signer, & Fink, 2011) and the extent of using computerized physician order entry (CPOE) and its effect of patient satisfaction (Queenan, Angst, & Devaraj, 2011). In other words, many of the articles have chosen to investigate very specific and detailed issues that are influenced by factors within a hospital thereby ignoring the external supply chain related factors that are also influenced by the extent of technology integration.

Table 5. Major Studies on Technology Integration across Healthcare Supply Chains

Study	Purpose	Research Type	Main Findings
Young and Barrett (1997)	Cross-functional-process (CFP) framework for implementing an integrated delivery system (IDS) in healthcare	Conceptual	There are ten CFPs that could be put into three categories: planning processes (strategy formulation, program adaptation, budget formulation), organizational processes (authority and influence, client management, conflict resolution, motivation, and cultural maintenance), and measurement and reporting processes (financial and programmatic). The authors suggested that senior management must consider how to improve both the functioning of each CFP and the overall fit of all of them in order to achieve clinical integration, cost management and coordinated care.
Devaraj and Kohli (2000)	Effect of technology and business process reengineering (BPR) on performance	Empirical	Findings support the IT-performance relationship. The authors found a positive impact of technology on performance, though the degree of impact depends on the BPR practiced by hospitals.
Sirio et al. (2003)	Pittsburgh Regional Healthcare Initiative (PRHI)'s design for change using a shared learning model	Conceptual	By linking patient outcomes data with processes of care and sharing this information widely, PRHI supported measurable improvements in region wide clinical practice and patient safety.
Ilie, Van Slyke, Parikh and Courtney (2009)	Effect of IT accessibility on adoption of electronic medical records (EMR)	Empirical	Physical accessibility is defined as the availability of computers that can be used to access EMR and logical accessibility is defined as the ease or difficulty of logging into the system. The authors found that when deciding between the paper chart and EMR, accessibility is an important consideration in a physician's decision. They concluded that accessibility limits the acceptance of IT technologies.

Table 5 Continued

Study	Purpose	Research Type	Main Findings
Korst, Aydin, Signer and Fink (2011)	Hospital readiness for health information exchange	Empirical	A tool was developed to measure hospitals' readiness for data-sharing. They found that hospital leadership is important in collaborative efforts that aim to share data for quality implementation or safety purposes.
Queenan, Angst and Devaraj (2011)	Relationship between extent of computerized physician order entry (CPOE) use and patient satisfaction	Empirical	Contrary to extant research, the authors' positive findings suggest that the relationship between the CPOE use and patient satisfaction is stronger in non-academic hospitals. They also found evidence that a hospital's IT infrastructure substitutes for CPOE use in its effect on patient satisfaction.

There are several benefits of using modern technology in an integrated manner in hospitals. Technology can be used for keeping electronic patient medical records and giving e-prescriptions and other laboratory orders for patient tests directly to pharmacies or laboratories, which would ensure that medical errors due to intervention of the patient/kin are reduced (Ilie et al., 2009). Hospital information systems could provide alerts to the doctors and nurses monitoring the patient whenever any drug related complications occur (Ilie et al., 2009). Patient information systems could provide service statistics on patient occupancy rates and diagnostic tests performed in hospitals laboratories. Further, technology can support sharing the medication and other inventory information with external entities such as suppliers. Important medicinal stocks from the hospital could be automatically ordered in electronic form so as to be accurate and timely (Beier, 1995).

Accurate and useful patient information needs to flow to the healthcare team whenever needed. Similarly, hospital management needs to have access to summarized patient, hospital support systems like labs and pharmacies, accounting and financial and all other types of information when they need it to be able to make the best decisions. Therefore, it is crucial that all different software and hardware systems implemented in various departments in the hospital are able to "talk" to each other and exchange information on frequent basis (Angst, Devaraj, Queenan, & Greenwood, 2011; Devaraj & Kohli, 2000; Korst et al., 2011; Leidner et al., 2010; Queenan et al., 2011; Shin-Yuan et al., 2009; Sirio et al., 2003; Teplensky, Pauly, Kimberly, Hillman, & Schwartz, 1995; D. W. Young & Barrett, 1997). In other words, the advantages of technology are realized only if all the different IT systems in the hospital are well integrated with each other (Albani & Lee, 2007).

Supplier Relationship Management

Supplier relationship management is defined as an approach that uses social ties and interpersonal contact between a firm and its suppliers to monitor, control and encourage desirable supplier behavior (e.g., Das et al., 2006; Noordewier et al., 1990; Rivard-Royer, Landry, & Beaulieu, 2002). Using the same technology such as applications software packages and relational capital development efforts such as cross-functional involvement and joint problem solving could help both firms and their suppliers communicate inventory demand and supply position quickly (Das et al., 2006; Talluri & Sarkis, 2002).

In buyer-supplier relationship literature there are two major types of classifications. The first considers the relationship as a continuous process (e.g., transformation from awareness, exploration, expansion, and commitment to dissolution) (Dwyer, Schurr, & Oh, 1987). The second classification is based on the relationships at a point in time such as relationship governance that can range from a transaction-based relationship to a strategic alliance (Cooper & Gardner, 1993; Webster, 1992), or be in the continuum between competitive and cooperative orientation (Ellram & Hendrick, 1995). A detailed review of the buyer-supplier relationship literature yielded Table 6, which also enumerates the variables studied in the research and the aspects of the supplier relationship management construct that were identified.

Table 6. Supplier Relationship Management Characteristics Identified in Literature

Study	Noordewier et al. (1990)	Han, Wilson and Dant (1993)	Larson (1994)	Carr and Pearson (1999)	Kim (2000)	Prahinski and Benton (2004)	Ferguson, Paulin and Bergeron (2005)	Wang and Wei (2007)
Variable studied	Supplier relational governance	Buyer-supplier relationship	Supplier product quality	Buyer-supplier relationship	Dyadic relationship continuity	Buyer-supplier relationship	Relational governance	Relational governance
Characteristics identified	Supplier flexibility	Mutual trust	Degree to which product supplies meet specifications	Special agreements with few key suppliers	Continuity expectation	Buying firm’s commitment	Disagreement resolution	Trust
	Supplier assistance	Satisfactory exchange	Degree to which product supplies perform as intended	Loyalty to key suppliers		Cooperation	Mutual benefit and trust	Commitment
	Supplier information exchange		Lifespan of product supplies	Frequent face to face communication		Supplier’s commitment	Negotiated agreements	Coordination
	Supplier monitoring		Degree to which product supplies arrive as scheduled	Direct links with key suppliers			Timely and accurate information exchange	Joint problem solving
	Continuity expectation		Degree to which product supplies are protected by packaging				Reliance in times of adversity	

Table 6 Continued

Study	Tangpong, Michalisin and Melcher(2008)	Liu, Luo and Liu (2009)	Ambrose, Marshall and Lynch (2010)	Nyaga, Whipple and Lynch (2010)	Tangpong, Hung and Ro (2010)	Lumineau and Henderson (2012)
Variable studied	Buyer- supplier relationship	Buyer-supplier relationship governance	Buyer-supplier relationship	Buyer-supplier relationship	Buyer-supplier relationship	Supply chain governance
Characteristics identified	Relational mechanisms	Relational mechanisms (relational norms and trust)	Suppliers' ability of supplier to meet accuracy expectations	Collaboration	No opportunistic behavior	Relational governance
	Power dependence	Transactional mechanisms (jointly stipulated contractual clauses)	Suppliers' ability to meet on-time delivery standards			Contractual governance
			Suppliers' ability to meet productivity standards			
			Ability of firm to provide timely order status to supplier			

Based on a critical review of the research summaries in Table 6, it may be noted that among the 14 studies, five have chosen to explicitly study different aspects of governance of the supplier relationship from a buyer's perspective, while seven of them have focused on the buyer-relationship, in broad general terms. Further, a study investigated the continuity of supplier relationships using a dyadic lens while another chose to focus on quality of supplies. A detailed review of the characteristics of each of the variables studied suggest that supplier relationship management is a broad construct that comprises the following six characteristics (Chung, 2012; Lumineau & Henderson, 2012; Noordewier et al., 1990): *supplier flexibility, supplier assistance, supplier information exchange, supplier monitoring, continuity expectation,* and *quality of supplies*. Unforeseen requests for adjustments in price, stock levels and emergency deliveries are opportunities for a supplier to be *flexible* to quickly change its production/delivery schedules to meet the firm's requests (Chan, Bhagwat, & Wadhwa, 2008; Noordewier et al., 1990). The extent to which suppliers are willing to help firms by going beyond the contractually bound level of conduct is defined as *supplier assistance* (Dyer, Cho, & Chu, 1998; Janda, Murray, & Burton, 2002; Noordewier et al., 1990). *Supplier information exchange* refers to the frequency and type of information provided by suppliers to the firms (Noordewier et al., 1990; Trapero, Kourentzes, & Fildes, 2012). Key information such as suppliers' long-term forecasting and future component design information could help the firms plan their own product roll-out better. The supervisory actions that firms need to take to ensure supplier performance is referred to as *supplier monitoring* (Gavronski, Klassen, Vachon, & Nascimento, 2011; Noordewier et al., 1990). *Continuity expectation* describes long term expectations of a lasting relationship between firms and their suppliers (Noordewier et al., 1990; Villena, Revilla, & Choi, 2013). *Quality of supplies* delivered by the supplier to the firm (Gunasekaran, Patel, & McGaughey, 2004; Han et al., 1993;

Larson, 1994; SherwoodValve, 2011) is also important for a long term relationship because poor quality products/services could lead to rework for the supplier and loss of reputation and image.

Next, the major studies on supplier relationship management in healthcare literature are listed in Table 7. The characteristics of supplier relationship management used in this study are then compared with those of the major healthcare studies in Table 8.

A careful examination of the research summaries in Table 7 suggests that the studies employing modeling methodologies have chosen to investigate specific characteristics of the external hospital supply chain-the role of and problems related to GPOs (Hu & Schwarz, 2011; Hu, Schwarz, & Uhan, 2012). Empirical papers, on the other hand, have chosen to investigate different aspects of supplier relationships from an internal hospital supply chain viewpoint-factors that determine hospital operating efficiency and supply chain performance (D. Q. Chen, Preston, & Xia, 2013), effect of institutional pressures on the supply chain (Bhakoo & Choi, 2013) and hospital storage area rearrangement and related cost savings (Rivard-Royer et al., 2002). The current study is different from the major existing studies because it uses a more comprehensive construct that comprises the following six aspects–supplier assistance, supplier flexibility, supplier information exchange, supplier monitoring, continuity expectation and quality of supplies. These six characteristics are conceptually inter-related with each other and depict some aspect of supplier behavior and the focal firm’s response.

Table 7. Major Studies on Supplier Relationships in Healthcare

Study	Purpose	Research Type	Main Findings
Rivard-Royer et al. (2002)	Rearrangement of storage areas for supplies can generate savings for hospitals	Empirical	There are benefits for both the hospital and the supplier under a stockless replenishment method. In this method, the distributor packs and delivers hospital supplies according to needs of each hospital unit. The study also revealed that the packing format of supplies is important for distributor.
Langabeer (2005)	Current state of healthcare supply chain management technologies	Conceptual	The author opined that hospital supply chain orientation, from suppliers through the delivery of patient care is a relatively new concept in hospitals. He also suggested that in the future, predictive modeling, data mining and business intelligence will be used in healthcare like in other service industries.
Fredendall, Craig, Fowler and Damali (2009)	Internal service supply chain of the surgical services department of a non-academic community hospital	Empirical	Using the theory of swift and even flow (TSEF) for their analysis the authors' findings suggested the need to incorporate supply chain coordination into the theory.
Sinha and Kohnke (2009)	3A-framework founded on affordability, access, and awareness	Conceptual	The authors present a framework, which is applicable for implantable device-based care for cardiovascular diseases in developing countries. Their framework identifies integrated continuous improvement and innovation initiatives to bridge the gap between the demand and supply for high-quality, cost-effective and timely care.
Hu and Schwarz (2011)	Controversial role of GPOs in healthcare supply chain	Modeling	GPOs reduce manufacturers' incentives to innovate. They also examined the consequences of removing the contract administration fees (CAF) that GPOs charge manufacturers and concluded that it would not influence any stakeholder profits or costs.

Table 7 Continued

Study	Purpose	Research Type	Main Findings
Hu, Schwarz and Uhan (2012)	Impact of GPOs on healthcare product supply chains	Modeling	Although CAFs influence the distribution of profits between manufacturers and GPOs, they do not affect the providers' total purchasing costs.
Bhakoo and Choi (2013)	How institutional pressures and heterogeneity affect different elements of the healthcare supply chain	Empirical	The authors examine how organizations in different tiers of a healthcare supply chain respond to institutional pressures when implementing inter-organizational systems for coordination. The study shows how different institutional pressures such as coercive, mimetic, and normative act across the tiers. It also demonstrates how a mix of endogenous and institutional pressures leads to organizational responses.
Chen, Preston and Xia (2013)	Improving hospital operating efficiency to reduce costs	Empirical	The following factors affect hospital supply chain performance: trust, knowledge exchange, IT integration between the hospital and its suppliers, and hospital-supplier integration. Their results show that trust and IT integration affect knowledge exchange, knowledge exchange and IT integration affect the hospital-supplier integration, and hospital-supplier integration affects hospital supply chain performance.

Table 8. Supplier Relationship Management Characteristics in Healthcare Studies

This Study	Doyle (1989)	Rivard-Royer et al. (2002)	Langabeer (2005)	Fredendall, Craig, Fowler and Damali (2009)	Mettler and Rohner (2009)	Sinha and Kohnke (2009)	Hertz (2010)	Hu and Schwarz (2011)	Hu, Schwarz and Uhan (2012)	Bhakoo and Choi (2013)	Chen, Preston and Xia (2013)
Supplier flexibility					X						X
Supplier assistance					X		X				
Supplier information exchange			X		X					X	X
Supplier monitoring					X						
Continuity expectation	X										
Quality of supplies		X	X	X		X		X	X	X	X

In healthcare, the degree that the supplier is able to adapt to meet hospitals' needs and changes in quantities of supplies ordered represents the *supplier flexibility*. Suppliers need to respond quickly to all hospital requests. Further, suppliers should be able to make changes in quantity delivered and schedule well on time as required by the hospitals. Suppliers must be able to adjust their inventories to meet unforeseen needs that hospitals may have; they should be able to provide emergency deliveries to the hospitals (D. Q. Chen et al., 2013; S. Goodman & Jones, 2013; Noordewier et al., 1990).

Supplier assistance refers to the help that the supplier is willing to provide hospitals in all matters related to the quality and quantity of their delivered goods or supplies. Hospitals may want to involve their key suppliers in the redesign of existing products such as replacing existing equipment with better and more efficient ones and using more effective medication but suppliers would need to cooperate. Further, suppliers have to be willing to provide their detailed financial information to hospitals for their item-wise cost-value analysis (S. Goodman & Jones, 2013; Noordewier et al., 1990).

Supplier information exchange refers to the dyadic exchange of daily information that takes place between the supplier and the hospital is the third dimension. Hospitals need to provide suppliers with long-range forecasts of their requirements. They need to inform suppliers in advance of impending changes in products used along with the specifications and provide specific and detailed information about the quantity of supplies that they will need in the future so that the suppliers can plan their production schedules (S. Goodman & Jones, 2013; Langabeer, 2005; Noordewier et al., 1990).

Supplier monitoring refers to the degree of overseeing and supervision that is required by the hospital to ensure that the supplier is responsive and is able and willing to supply the required quality and quantity of supplies. Hospitals should assess suppliers' performance through a formal vendor evaluation program and have procedures to inspect materials from suppliers. Further, hospitals should conduct quality training for supplier personnel and advise each supplier of their performance (S. Goodman & Jones, 2013; Noordewier et al., 1990).

Continuity expectation refers to both parties' long term inclination to maintain ties. Hospitals should have a mutually beneficial professional relationship with their suppliers and expect suppliers to proactively resolve issues, expecting suppliers to improve their relationship with them over time. Hospitals need to have long term supplier relationships because of the advantages of trust with long term suppliers and the high costs associated with selecting new suppliers (S. Goodman & Jones, 2013; Noordewier et al., 1990).

The *quality of supplies* refers to whether the products and services provided by the suppliers to hospitals meet the prescribed medical standards (Gunasekaran et al., 2004; Han et al., 1993; Larson, 1994; SherwoodValve, 2011). For suppliers, a way to ensure that they are able to deliver high quality supplies is by implementing quality management in their goods production/service generation units. Supplier quality management refers to a firm's quality practices such as relying on suppliers' process control as an indication of its high quality standards and ensuring that each time only high quality products are purchased (Kaynak & Hartley, 2008). Supplier quality certification may be used by suppliers to add value to hospitals. Certified suppliers could help hospitals assure everyone about the high quality of medical supplies used. Further, in order to ensure defect free quality in all of its product supplies, suppliers need to have a manual describing their quality system that must be followed by all its employees. Suppliers need to calibrate their equipment against the product and equipment standards set by the National Institute for Standards and Technology (S. Goodman & Jones, 2013; SherwoodValve, 2011).

Due to the nature of many healthcare service delivery process in which suppliers may contribute directly to service delivery (e.g., outsourced ambulatory services) failures in supplier services can create life-threatening risks for patients (Baltacioglu, Ada, Kaplan, Yurt, & Kaplan, 2007). Therefore, to effectively manage their supplier relationships, hospitals need to pay attention to all the above six aspects of the relationship discussed above.

Healthcare Team Effectiveness

A team is defined as "a collection of individuals who are interdependent in their tasks, who share responsibility for outcomes, who see themselves and who are seen by others as an intact social entity embedded in one or more larger social systems (for example, business unit or corporation), and who manage their relationships across organizational boundaries" (S.G. Cohen & Bailey, p. 241). In this dissertation, the healthcare team refers to the doctors, nurses and supporting staff who work together as a group to care for admitted patients in most hospitals.

In an organizational decision making context, effectiveness of an action refers to whether the action taken is right or correct (Sundstrom, De Meuse, & Futrell, 1990). Team effectiveness refers to how well the team is able to perform to survive, adapt, maintain itself and grow (P. S. Goodman, 1986). Team effectiveness literature (Katzenbach & Smith, 2013; McGregor, 1987) suggests that effective teams have a clear unity of purpose. Team members criticize each other frequently but collectively agree on group activity. A team's performance on three important attributes determines the degree of its effectiveness. First, the ability of the team to exploit its environment to acquire scarce resources influences the team's ability to deliver (Shipper & White, 1983). Second, effective teams have a high degree of internal team efficiency, team spirit, confidence, trust, communication and support (Sundstrom et al., 1990). Third, effective teams are able to identify output goals and assess how well they can be attained (Hall, 1980).

Environmental factors such as industry characteristics influence task design which in turn, is related to internal and external group processes and group psychosocial traits such as the norms, all of which finally determine team effectiveness (S. G. Cohen & Bailey, 1997). Team cohesiveness, leadership and the team's internal activities also influence team effectiveness in a work context (P. S. Goodman, 1986). Although teamwork is one of the QM practices (Kaynak, 2003; Kaynak & Hartley, 2008) and also a key part of the lean implementation (B. B. Flynn et al., 1995; Kaynak, 1997, 2002; Monden, 1981; Ōno, 1988; Shah & Ward, 2003; Sugimori et al., 1977), not all teams are effective. Members of an effective team are able to deliver and achieve the team's goals (Shipper & White, 1983). Therefore, team effectiveness, instead of teamwork, was included in the research model. In patient care settings, a few studies have investigated different antecedents and consequences of effective teamwork. The major studies on healthcare team effectiveness are listed in Table 9.

A review of the research summaries listed in Table 9 indicate that conceptual papers including the literature reviews (Buljac-Samardzic, Dekker-van Doorn, van Wijngaarden, & van Wijk, 2010; Lemieux-Charles & McGuire, 2006; Schofield & Amodeo, 1999) discussed challenges that most healthcare teams face when they try to work effectively but the authors have not identified the determinants of team effectiveness. The empirical papers, on the other hand, focus on establishing the importance of team effectiveness for quality of patient care but the study was conducted with chronic illness care centers (Stephen M. Shortell et al., 2004), which makes the generalization to all U.S. hospitals difficult because of the difference in research context. The qualitative study (Delva, Jamieson, & Lemieux, 2008) highlights some of the

Table 9. Major Studies on Healthcare Team Effectiveness

Study	Purpose	Research Type	Main Findings
Dreachslin, Hunt and Sprainer (1999)	Effect of diversity on team communication in patient care settings	Empirical	The authors note that healthcare executives may need to involve the team in process improvement, emphasize team and diversity training for all members, provide task-focused training for non-licensed care givers and leadership training for registered nurses (RN), and implement team-based rewards to improve the performance of healthcare teams.
Schofield and Amodeo (1999)	Establishing the effectiveness of interdisciplinary teams	Conceptual, literature review	The authors' findings indicate that most scholars have used too many different research terminologies in the interdisciplinary research on team efficacy in health and human services that mostly do not cumulatively add up to advance the field.
Grumbach and Bodenheimer (2004)	How healthcare team members are able to work together	Conceptual	A number of barriers such as the challenges of human relationships and personalities affect effectiveness of team work. The authors recommend that team members should be carefully chosen in order to maintain a good work environment in primary care practices.
Shortell et al. (2004)	The importance of teams for improving quality of care	Empirical	A few factors such as patient satisfaction, presence of a team champion and physician involvement were positively associated with perceived team effectiveness. Maintaining a balance among cultural values, achievement, openness to innovation and adherence to rules and accountability were also important. Perceived team effectiveness was associated with the changes made to improve chronic illness care.

Table 9 Continued

Study	Purpose	Research Type	Main Findings
Lemieux-Charles and McGuire (2006)	Literature review on healthcare team effectiveness	Conceptual, literature review	The type and diversity of clinical expertise involved in team decision making is related to improvements in patient care and organizational effectiveness. Collaboration, conflict resolution, participation and cohesion influence staff satisfaction and perceived team effectiveness. The context in which teams are embedded also needs to be considered
Delva, Jamieson and Lemieux (2008)	Understanding how teams function effectively in primary care	Qualitative	The study highlights some of the challenges of developing effective primary care teams in an academic department of family medicine. It shows that setting clear goals and giving attention to teamwork is needed.
Buljac-Samardzic, Dekker-van Doorn, van Wijngaarden and van Wijk (2010)	Literature review on interventions to improve team effectiveness	Conceptual, literature review	A positive association was found between the intervention and non-technical team skills. The authors note that team training can improve the effectiveness of multidisciplinary teams in acute hospital care settings.

challenges that teams face but the research context is limited to academic departments of family medicine. In sum, the above literature on team effectiveness in healthcare has identified some of the determinants of team effectiveness in healthcare but they employ very narrow research contexts. Therefore, these findings may not be generalized to all U.S. full-service hospitals.

Internal Lean Practices

Lean/JIT (B. B. Flynn et al., 1995; Kaynak, 1997, 2002; Monden, 1981; Ōno, 1988; Shah & Ward, 2003; Sugimori et al., 1977) is a strategy that strives to improve firms' operating performance (Azadegan, Patel, Zangoueinezhad, & Linderman, 2013) by reducing the in-process inventory and associated carrying costs. In services, lean practices can be applied to improve the quality system being followed by a firm, clarify all process flows, revise process technologies to ensure that the latest techniques are being implemented correctly, level facility load, eliminate unnecessary activities, reorganize physical configuration, introduce demand-pull scheduling and develop supplier networks (Chase et al., 2006). These activities help a firm streamline its operations by ensuring supplier cooperation, reduced waste in terms of safety stocks and smooth process flow.

Internal lean practices are defined as aligned internal operations that help hospitals to achieve the outcome of performing effective medical procedures on patients in a timely manner at a reasonable cost (e.g., Alexander, Halpern, & Lee, 1996; Butler & Leong, 2000; Cook & Rasmussen, 2005; Goldstein, Ward, Leong, & Butler, 2002; Harper, 2002; Hay, 2003; Li, Rao, Ragu-Nathan, & Ragu-Nathan, 2005; Shah & Ward, 2003). An extensive review of lean literature resulted in Table 10.

Table 10. Characteristics of Lean Operations Identified in Literature

Study	Mehra and Inman (1992)	Sakakibara et al. (1993)	Flynn et al. (1995)	Lawrence and Hottenstein (1995)	Spencer and Guide (1995)	Dean and Snell (1996)
Characteristics [a]	Setup time reduction	Setup time reduction	*Kanban*	JIT deliveries from suppliers	Set-up reductions	Change in the number of suppliers in the past five years
	In-house lot sizes	Small lot sizes	Lot size reduction practices	Inventory reduction	Lot size reductions	Change in the size of their deliveries in the past five years
	Group technology	JIT deliveries from suppliers	Daily schedule adherence	Manufacturing strategy	Preventive maintenance	Change in the length of product runs in the past five years
	Cross-training	Supplier quality level	Setup time reduction practices	Employee involvement	Physical layout management	Change in the number of total parts in the past five years
	Preventative maintenance	Small-group problem solving		Employee responsibility	Plant-wide program adoption of JIT methods	Change in the amount of buffer stock in the past five years
		Training		Supplier involvement	In-house quality	
		Daily schedule adherence		Process modification		
		Preventive maintenance				
		Equipment layout				
		Product design simplicity				
		Kanban				
		Pull system support				

Table 10 Continued

Study	Forza (1996)	Jayaram and Vickery (1998)	Claycomb, Droge and Germain (1999)	Sim and Curtola (1999)	Callen, Fader and Krinsky (2000)	Fullerton and McWatters (2001)	McKone et al. (2001)
Characteristics	JIT deliveries from suppliers	Reduced setup times	JIT with customers	Pull system	Inventory performance	Focused factory	JIT delivery by suppliers
	JIT link with customers	Small lot sizes		Setup time reduction	Integrated product design	Group technology	Just-in-time link with customers
		Pull system		Preventative maintenance	Integrated supplier network	Reduced setup times	Pull system support
				Repetitive nature of master schedule	Preventive maintenance programs	Productive maintenance	Repetitive nature of master schedule
					Education about JIT	Multifunction employees	Setup time reduction
					Stable cycle rates	Uniform workload	
					Market paced final assembly		
					Group technology		
					Quality improvement programs for products and processes		
					Flexibility of workers' skills		

Table 10 Continued

Study	Brox and Fader (2002)	He and Hayya (2002)	Das and Jayaram (2003)	Shah and Ward (2003)	Ketokivi and Schroeder (2004)	Nahm, Vonderembse and Koufteros (2004)	Challis, Samson and Lawson (2005)	Li et al. (2005)
Characteristics	Minimum inventory in supply chain	Setup time reduction	Setup time reduction	Reduced lot sizes	JIT deliveries from suppliers	Reengineering setups	Preventative maintenance	Reduced set-up times
	Production and materials control pull system	Training	Kanban	Continuous flow production	Setup time reduction	Cellular manufacturing	Setup time reduction	Small lot sizes
	Employee participation and involvement	Daily schedule adherence	Group technology	Pull system	Pull system support	Quality improvement efforts	Close relationship with suppliers	Pull-production
	Reduction of wastes	Preventative maintenance	Preventative maintenance	Cellular manufacturing	Manufacturing cost performance	Preventative maintenance	Manufacturing cycle time	
			JIT supply	Reduced cycle time		Pull production	On-time delivery	
				Focused production				
				Agile manufacturing				
				Quick changeover techniques				
				Bottlenecks removed				
				Reengineered production processes				

Table 10 Continued

Study	Swink, Narasimhan and Kim (2005)	Cagliano Caniato and Spina (2006)	Narasimhan, Swink and Kim (2006)	Ward and Zhou (2006)	Avittathur and Swamidass (2007)	Matsui (2007)	Dal Pont, Furlan and Vinelli (2008)
Characteristics	Pull system in production	TQM, six sigma quality programs	Cellular manufacturing	Lead time performance JIT has a significant and positive relationship	JIT deliveries from supplier	Daily schedule adherence	Daily schedule adherence
	Produce in small lot sizes	Pull production	Pull system	Cycle time reduction with lead time performance.		Equipment layout	Equipment layout
	JIT flow production methods	Cellular layout	Small lot sizes	Agile manufacturing strategies		JIT delivery by suppliers	JIT deliveries from suppliers
	Production flow utilizes manufacturing cells		JIT link with customers	Quick changeover techniques		JIT link with customers	JIT link with customers
			JIT deliveries from suppliers	Focused factory production systems		Kanban	Kanban
			Daily shipments from suppliers	JIT/Continuous flow production		MRP adaptation to JIT	Setup time reduction
			Product flexibility	Cellular manufacturing		Repetitive nature of master schedule	Small lot sizes
				Lot size reduction		Setup time reduction	
				Pull system/Kanban		Small lot size	
				Bottleneck removal		Product capability	

Table 10 Continued

Study	Browning and Heath (2009)	Demeter and Matyusz (2011)	Olhager and Prajogo (2012)	Azadegan et al. (2013)
Characteristics	Visual replenishment systems	JIT		Product/process improvement efforts by shop-floor employees
	Non-value-adding task elimination	TQM	Processes and machines in close proximity	Daily planned equipment maintenance
	Balanced distribution of work	Total productive maintenance (TPM)	Lower set-up times	Process variance reduction
	New technologies and tools for fabrication and assembly	Human resource management (HRM)	Use *kanban* pull system	Low equipment set up times
	Standard work methods			Pull production system
	Flow shop layout			Customer feedback on quality and delivery performance
	Concurrent engineering			Supplier feedback on quality and delivery performance
	Design for manufacturing and assembly (DFMA)			Grouped equipment to produce continuous flow
	6S (sort, straighten, shine, standardize, safety, and sustain)			Process variance reduction
	Discontinuous improvements			
	Ergonomic work stations			
	Dissemination of lean through supplier network			
	Work sequencing			

Notes. [a] Based on Azadegan et al. (2013) and Mackelprang and Nair (2010)

An extensive review of the 32 studies presented in Table 10 reveals that lean/JIT is being investigated in operations and strategy literature for more than two decades now. A total of 89 characteristics of lean systems have been identified, which may be broadly grouped into the following three categories–*material flow management, continuous quality improvement* and *waste management* (Azadegan et al., 2013; S. Li et al., 2005; Mackelprang & Nair, 2010; Shah & Ward, 2003).

Material flow management refers to the continuous flow of production work in process without hindrance through the production factory or service generation unit (Benton et al., 2010; Chongwatpol & Sharda, 2013; Petersen & Wohlin, 2011). *Continuous quality improvement* refers to incremental improvement in quality standards of a firm on a regular periodic basis and is one of the key pillars of lean implementation (Aravindan & Devadasan, 1995; McFadden, Jung Young, Gowen Iii, & Sharp, 2014; Moran, 1992). Wastes refer to processes that add no value to the product/service or customer. *Waste management* refers to identifying, controlling and eliminating waste (Womack & Jones, 2010). Waste can occur in areas such as transportation, inventory, motion, waiting, overproduction, over processing and defects (Waring & Bishop, 2010).

Next, the major studies on lean hospital operations are identified first in Table 11. The attributes of internal lean practices used in this study are then compared with those of the major healthcare studies in Table 12.

Table 11. Major Studies on Lean Healthcare Operations

Study	Purpose	Research Type	Main Findings
Pocha (2010)	The implementation challenges of lean six sigma in healthcare	Conceptual	The author highlights the important lessons that were learned from lean six sigma implementation at a tertiary care medical center. These included guidelines to follow a team approach, have the "buy in" of all the stakeholders and to have the willingness of team members to change daily practice in order to adapt new and innovative ways of delivering better quality healthcare.
Graban (2011)	Improving quality, patient safety and employee satisfaction in hospitals using lean principles	Empirical	In this book, beginning with a historical perspective of lean, the author builds a case of why hospitals need a lean outlook and how lean implementation can help hospitals achieve their goals. Among the many directly measurable advantages, reduced turnaround time for clinical laboratory results, reduced instrument decontamination time, reduced patient deaths, reduced patient waiting times, increased surgical revenue and reduced patient length of stay, are some of the common ones that some of the U.S. hospitals have experienced after becoming lean.
LaGanga (2011)	Lean service operations	Empirical	Using action research methodology this outpatient clinical field research examines appointment data. The author analyzes a lean process improvement project that was conducted to increase capacity to admit new patients. The author's findings bring several insights about effective alignment of clinical resources, how clinics develop new strategies for responding to no-shows and highlights time-related variables that have been overlooked in appointment scheduling research.

Table 11 Continued

Study	Purpose	Research Type	Main Findings
Mazur, McCreery and Rothenberg (2012)	Facilitating learning during early stage of lean implementation in hospitals	Empirical	According to the author, some healthcare organizations have successfully used lean to help solve their quality and cost related problems. Most organizations accept that the challenge to sustain the lean philosophy is in continuing to learn the behaviors that are associated with lean improvement efforts. This article examines the lean implementation process in three rural hospitals, using involved healthcare professionals as lean participants and recommendations for facilitating lean thinking and behaviors during the initial years of lean program implementation.
Toussaint and Berry (2013)	Path to becoming lean in healthcare	Empirical	The authors suggest six principles that hospitals would need to consider in their quest to become lean: an attitude of continuous improvement, value creation, unity of purpose, respect for front-line workers, visual tracking, and flexible rules. The authors provide case studies in support of these principles. Their paper aims to provide a template for healthcare leaders to use in lean implementation.

Table 12. Internal Lean Practices in Healthcare Studies

This Study	Pocha (2010)	LaGanga (2011)	Mazur, McCreery and Rothenberg (2012)	Graban (2011)	Toussaint and Berry (2013)
Patient and material flow		X (Patient flow)			
Continuous quality improvement	X	X	X	X	X
Waste management	X	X	X	X	X

An examination of the research summaries in Table 11 highlights some of the challenges of lean implementation in healthcare such as having all stakeholder approval and having the willingness of team members to change daily practices in order to adapt new and innovative ways (Pocha, 2010). Research has also focused on identifying steps that hospitals take to facilitate learning during their early stage of lean implementation such as using involved healthcare professionals as lean participants (Mazur et al., 2012). Based on his lean consulting experience, Graban (2011) has suggested some best practices for hospitals to follow in order to improve quality, patient safety and employee satisfaction while implementing lean practices. Research has also identified some of the paths that healthcare providers may need to follow to become lean such as inculcating an attitude of continuous improvement, value creation, unity of purpose, respect for front-line workers, visual tracking and flexible rules throughout the hospital/healthcare organization (Toussaint & Berry, 2013). The studies presented in Table 11 also reveal that while lean has been related to patient care quality, only case studies and action research methods have been used and no statistical test has been demonstrated yet in the U.S. hospitals. Table 12 reveals that unlike this study, extant lean research in healthcare has not considered all attributes of lean implementation. Most healthcare studies have concentrated on two characteristics–continuous quality improvement and waste management–ignoring patient and material flow in hospitals.

To finalize the entire range of lean practices that hospitals may implement, they should consider the concept of service packages[5]. In the healthcare context, the hospital check-up

[5] A service package generally includes the following four items: (1) supporting facilities that may be used to provide the service; (2) facilitating goods which are common tools that may be used to help the service personnel; (3) few explicit services that are expected of the service provider; and (4) implicit services which the customer may not directly expect of the service provider but which is an ethical and moral obligation of the service provider to provide these additional services (Krajewski, Ritzman, & Malhotra, 2002).

rooms are the supporting facilities. The medical equipment like a physician's stethoscope and sphygmomanometer, a surgeon's knife and other medical technology-related items like robots are the facilitating goods. Treating the illness that the patient is suffering from by giving appropriate medicines and/or performing the required medical procedure constitute the explicit services. Implicit services comprise procedures such as checking the patient for related and even unrelated complications like allergies that the patient may already have, and/or those that may arise from the medicines/procedures, counseling and trauma therapy/services in cases of life-threatening illnesses like cancer, or in procedures like amputation of limbs. All four components of healthcare service package are taken into consideration in the subsequent discussion on how hospitals can streamline their internal operations.

Patient and material flow management imply that the hospital follows efficient patient admission and discharge procedures. It also implies that appropriate hospital facilities like ICU are available to patients when required so that their procedures are not delayed and housekeeping ensures that equipment such as drip stands are available when required (Alexander et al., 1996; Butler & Leong, 2000; R. Cook & Rasmussen, 2005; Devaraj, Ow, & Kohli, 2013; Goldstein et al., 2002; Harper, 2002; Hay, 2003). Hospitals could employ scheduling software that factor in the patients' medical conditions and needs along with the hospital room and equipment availability information together so that both patient and material flow within the hospital could be streamlined.

Continuous quality improvement considers whether healthcare teams internalize the lessons learnt from past mistakes on patient safety so as not to repeat them. Hospitals could use operational data from electronic clinical information systems to plan its staffing of doctors, nurses and other employees and up-to-date advanced medical equipment and technologies while performing all medical procedures. Healthcare teams in hospitals must strive to perform the correct medical procedures the very first time that they treat a patient (Albani & Lee, 2007; Axon & Williams, 2011; Butler & Leong, 2000; Goldstein et al., 2002). Hospitals need to keep abreast of the latest technological breakthroughs in the field (Hay, 2003). Upgraded physical infrastructure of labs, operation theatres and intensive care units (ICU) and other more basic elements like hospital beds are also necessary (Butler & Leong, 2000; Goldstein et al., 2002). Hospitals need to inculcate the best equipment and medical technology and share the best practices among their employees which is consistent with one of Deming's (1993) 14 point recommendations–to encourage cooperation among all employees to improve quality and productivity. Continuous quality improvement is thus a key element of lean implementation in hospitals.

In healthcare, *waste management* refers to whether hospitals use a ''pull'' production system wherein all supplies are inventoried as and when required, and whether hospitals push suppliers to achieve shorter lead-times. It incorporates whether hospitals streamline their own ordering, receiving and other paperwork from suppliers, and whether healthcare teams optimally uses all medical consumables to eliminate wastes (Hirano, 1995; Labarere, Francois, Auquier, Robert, & Fourny, 2001; Wakefield, Uden-Holman, & Wakefield, 2005; Wearmouth, 2001). Physical environment is an important attribute of lean operations. It includes the features of surroundings in which healthcare is delivered (i.e., whether the facilities and equipment used are orderly, the degree of pleasantness of hospital room atmosphere, the clarity of signs and directions to different facilities within hospitals). Effective housekeeping is an essential method of maintaining cleanliness and removing/minimizing wastes in hospital departments and helps streamline the entry and discharge procedures in a hospital (Labarere et al., 2001; Wakefield et al., 2005; Wearmouth, 2001). A clean and organized workplace is a key component of the 5-S philosophy, an overall approach to lean production systems (Hirano, 1995).

Patient Care Quality

Patient care quality (PCQ) is defined as the excellence of the medical care received by admitted patients in hospitals (e.g., Chang, Ma, Chiu, Lin, & Lee, 2009; Ma, Yang, Lee, & Chang, 2009; Nelson & Niederberger, 1990; Van Ess Coeling & Cukr, 2000; Ware et al., 1983). In extant literature, quite a few studies have focused on the identifying the determinants of patient care quality, both in hospital and clinical settings. The major studies on patient care quality are listed in Table 13.

A careful review of the studies cited in Table 13 reveal that a total of 25 different characteristics related to patient care quality such as cooperation between patients and physicians, cleanliness and quietness of hospital, and coordination with social welfare work have been identified. Based on a synthesis of the multi-dimensional nature of patient care quality discussed in extant literature (Dagger et al., 2007; Gill & White, 2009) it is suggested that PCQ has the following four primary dimensions: *interpersonal, technical, environmental* and *administrative* quality. *Interpersonal quality* reflects the relationship developed and the dyadic interplay that occurs between the healthcare team and the patient (Dagger et al., 2007; Gill & White, 2009). It takes into consideration issues such as whether healthcare teams treat their patients with respect, healthcare team members listen to what patients have to say, members give personalized attention to patients and whether team members are willing to answer questions that the patient or their kin may have (Dagger et al., 2007).

Table 13. Patient Care Quality Dimensions Identified in Literature

Study	Donabedian (1968)	McFadden, Stock and Gowen (2006)	Dagger et al. (2007)	Isaac, Zaslavsky, Cleary and Landon (2010)	Boyer et al. (2012)	Chandrasekaran et al. (2012)	Nair, Nicolae and Narasimhan (2013)
Characteristics	Application of modem scientific medicine	Patient safety	Interpersonal quality	Communication with nurses	Patient satisfaction data collection	Clinical quality	Clinical quality
	Emphasizes prevention		Technical quality	Communication with doctors	Quality teams of employees	Experiential quality	Experiential quality
	Requires cooperation between patients and physicians		Environmental quality	Responsiveness of hospital staff	Statistical quality (process control using control charts)		
	Considers the individual as a whole		Administrative quality	Pain management	Competitive benchmarking of best-in-class processes		
	Maintains close and continuing personal relation between physicians and patients			Communication about medicines			
	Coordinated with social welfare work			Discharge information			
	Includes all types of medical services			Cleanliness and quietness of hospital			

Technical quality reflects the expertise, professionalism, and competency of the healthcare team in delivering the cure (Dagger et al., 2007; Gill & White, 2009). It is concerned with whether patients are administered the correct medical care that is required to cure their ailment, tests (e.g., X-rays and lab tests) are ordered on patients only when required, healthcare team members are qualified, and whether they carry out their tasks competently (Dagger et al., 2007).

Environmental quality comprises hospital atmosphere such as cleanliness and order and tangibles like hospital bed and required equipment for patient health needs (Dagger et al., 2007; Gill & White, 2009). It takes into account whether the design of the hospital is patient friendly, the lighting at the hospital is appropriate, the temperature at the hospital is pleasant and whether the furniture at the hospital is comfortable (Dagger et al., 2007).

Administrative quality facilitates the production of the core medical cure while adding value to the patient (Dagger et al., 2007; Gill & White, 2009). Considerations such as whether the internal hospital services (e.g., pathology) work well, waiting time at the hospital is minimum, the hospital provides patients with a range of patient support services and whether the hospital records and documentation (e.g., billing) are error free (Dagger et al., 2007) are in the domain of this dimension of quality.

Next, the dimensions of PCQ used in this study are compared with those of the major healthcare studies in Table 14. A review of Table 14 indicates that most studies in operations and healthcare have used only one dimension (technical quality), one study used three dimensions (Donabedian, 1968) and only two of them used all the four dimensions (Dagger et al., 2007; Gill & White, 2009).

Table 14. Patient Care Quality in Healthcare Studies

This Study	Donabedian (1968)	McFadden, Stock and Gowen (2006)	Dagger et al. (2007)	Gill and White (2009)	Isaac et al.(2010)	Boyer et al. (2012)	Chandrasekaran et al. (2012)	Nair, Nicolae and Narasimhan (2013)
Interpersonal quality			X	X				
Technical quality	X	X	X	X	X	X	X	X
Environmental quality	X		X	X				
Administrative quality	X		X	X				

Hospitals could provide high quality of admitted patient care if they give importance to all the variables and the interrelationships described in the research model which would reduce medical errors and help them operate at the highest level of efficiency (Byrnes, 2004; Shih et al., 2009; Singh et al., 2006). Hospitals delivering high quality of admitted patient care is very crucial for all stakeholders because it could improve hospitals' financials, benefit all entities in the supply chain, and help the admitted patients directly through better and more responsive medical care that cures them of their ailments quicker and at lower cost (Lee et al., 2011).

In the next few sections, first, a summary of all research constructs is presented in Table 15. Next, the framework proposed in this research is depicted in Figure 2, and then the structural model empirically tested is given in Figure 3. Finally, the specific relationships hypothesized among the constructs are discussed with the rationale for each relationship drawn from the aforementioned three interdisciplinary theories.

Table 15. Definitions of the Constructs

Constructs	Definition
Management leadership	Acceptance of quality responsibility by a firm's senior management. It refers to the participation in quality improvement efforts and direction to workers and managers by top management (e.g., Kaynak, 2003; Nelson et al., 2011).
Technology integration	The interconnectedness of the different technological systems (both software and hardware) implemented in hospitals that enables frequent and up-to-date information exchange such as hospital patient medical information, inventory data about medicine/other supplies and personnel information in electronic form between different entities within the hospital, the healthcare team and hospital management (e.g., Leidner, Preston, & Chen, 2010; Li & Lin, 2006).
Supplier relationship management	A relationship building approach adopted by firms that uses their social ties and interpersonal contact with their suppliers to monitor, control and encourage desirable supplier behavior (e.g., Das et al., 2006; Lumineau & Henderson, 2012; Noordewier et al., 1990; Rivard-Royer, Landry, & Beaulieu, 2002). Based on a review of the literature, it is suggested that supplier relationship management has six different aspects: (1) *flexibility* of the supplier in quickly meeting hospital needs and changes in quantities of supplies ordered; (2) *assistance* that the supplier is willing to provide the hospitals in all matters related to the quality and quantity of supplies; (3) degree and intensity of *information exchange* between the supplier and the hospitals; (4) degree of *monitoring* required by hospitals to ensure that the supplier is responsive and is able and willing to supply the required quality and quantity of supplies; (5) *continuity expectation* referring to the hospitals' long term interest and orientation to maintain ties; and (6) *quality of supplies* that the supplier provides.
Internal lean practices	Aligned internal operations that help firms to perform effective medical procedures on patients in a timely manner at a reasonable cost (e.g., Alexander, Halpern, & Lee, 1996; Butler & Leong, 2000; Cook & Rasmussen, 2005; Goldstein, Ward, Leong, & Butler, 2002; Harper, 2002; Hay, 2003). Based on literature, it is suggested that internal lean practices have three characteristics: (1) p*atient and material flow management*; (2) *continuous quality improvement*; and (3) *waste management*.
Healthcare team effectiveness	Indicates whether a team is able to function as a whole to survive, adapt, maintain itself and grow (P. S. Goodman, 1986). In the hospital context, it indicates if the healthcare team is able to perform its work effectively and achieve its organizational goals (e.g., Poulton & West, 1993; 1999).
Patient care quality	Excellence of the medical care received by admitted patients in U.S. hospitals (e.g., Nelson & Niederberger, 1990; Van Ess Coeling & Cukr, 2000; Ware et al., 1983). Based on a review of the literature, it is suggested that patient care quality includes four primary dimensions: (1) *interpersonal quality* that reflects the relationship developed and the dyadic interplay that occurs between the healthcare team and patient; (2) *technical quality* that reflects the expertise, professionalism, and competency of the healthcare team in delivering the cure; (3) *environmental quality* that comprises hospital atmosphere related to cleanliness and tangibles, such as hospital bed and necessary equipment like drip stands and other required equipment for patient health needs; and (4) *administrative quality* that facilitates the production of the medical cure while adding value to the patient.

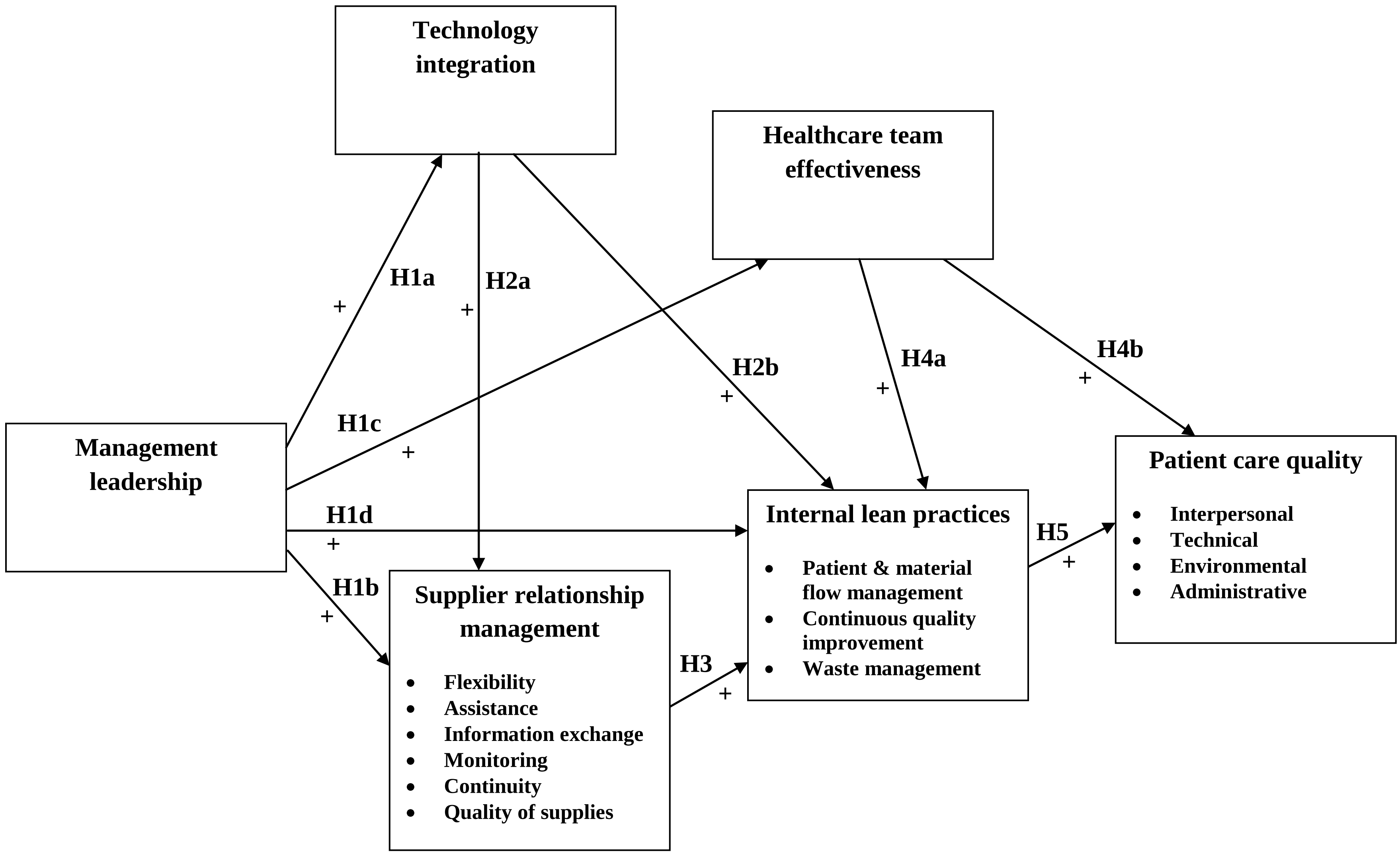

Figure 2. Framework for Improving Quality of Hospital-Admitted Patient Care

Notes. Bulleted items indicate different aspects of the phenomenon.

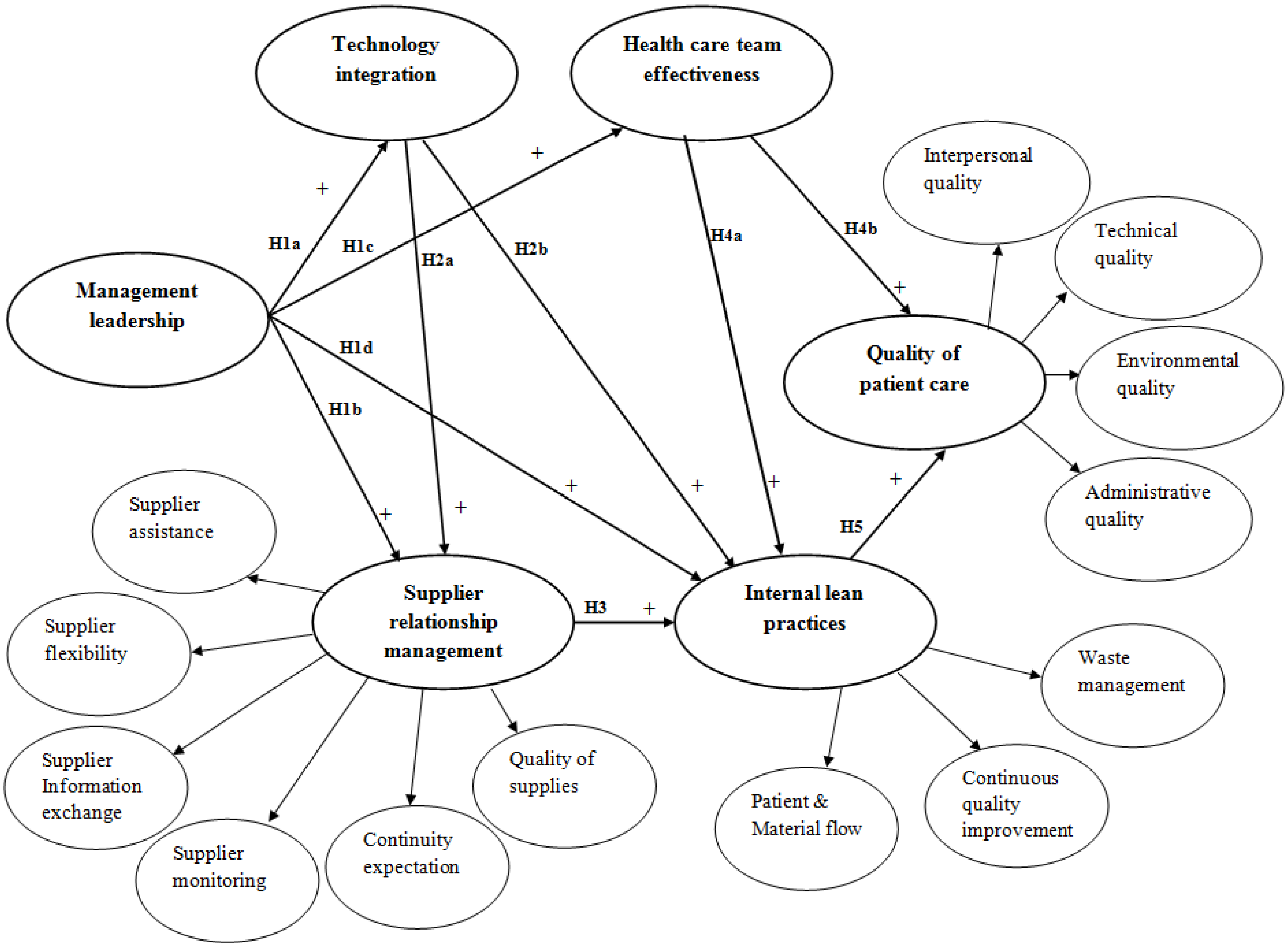

Figure 3. Structural Model of Relationships among Research Variables

Framework of Key Relationships and Hypotheses

Management Leadership and Technology Integration

A firm's top management provides the resources that are required to train employees to use new principles and tools (Cf. Kaynak, 2003; Ahire and O'Shaughnessy, 1998; Anderson et al., 1995; Bell and Burnham, 1989; Burack et al., 1994; Daft, 1998; Flynn et al., 1995; Hamlin et al., 1997; Handfield et al., 1998; Ho et al., 1999; Schroeder et al., 1989; Wilson and Collier, 2000). Top management needs to ensure that firms have a learning oriented environment for adoption of QM practices by allocating adequate finances for training and monitoring the outcomes (D. Y. Kim, Kumar, & Kumar, 2012).

In the healthcare context, hospital Chief Information Officer's (CIO) strategic leadership and Top Management Team's (TMT) attitude toward IT are key factors that influence IT innovation (Leidner et al., 2010). Innovative hospitals have exemplary CIOs who have strategic vision with a positive attitude which helps them utilize IT to solve common hospital problems. Coupled with positive hospital climate, innovative hospitals are able to generate greater impact from implementing IT solutions, which in turn results in their better performance than most other comparable hospitals (Leidner et al., 2010). Senior hospital management takes strategic decisions such as which information systems and medical equipment-related technologies are to be implemented at their hospitals and the need for integrating all different technological systems in the hospital (Coye & Kell, 2006; Teplensky et al., 1995). Leadership influences daily tactical activities by encouraging extensive use of technology among all staff to enhance medical practice at hospitals and make it safer for the patient (L. X. Li, 1997). Therefore, it is essential that all different software and hardware technological systems in the hospital are integrated between each other. Positive correlations exist among hospital leaders' taking a keen interest in implementing key medical technologies, encouraging staff in implementation and integration and operational excellence at hospitals (Coye & Kell, 2006; Teplensky et al., 1995). Based on the above discussions that highlight the crucial role of senior management in strategic organizational tasks including technology implementation and integration (Prajogo & Sohal, 2006), it is hypothesized:

H1a: *Management leadership is positively related to technology integration.*

Management Leadership and Supplier Relationship Management

A firm's leadership is expected to secure adequate supplies by leveraging better value deals from suppliers through negotiations and emphasize continuous improvement with suppliers by encouraging innovation in the processes followed (Goldstein & Naor, 2005). QM theory (Ahire et al., 1996; Feigenbaum, 1961; Jayaram et al., 2010; Kaynak & Hartley, 2008) notes the importance of management leadership in all supplier quality management activities (Kaynak & Hartley, 2008) and supplier relationship efforts (B. B. Flynn et al., 1995; Shin, Collier, & Wilson, 2000). Hospital leaders, like their counterparts in other firms, need to periodically oversee supplier compliance with all contracts and regulations that they have signed with the hospitals (Lumineau & Henderson, 2012).

Suppliers' flexibility in complying with a firm's requested changes in schedules and quantities ordered is an important aspect of the supplier relationship (Noordewier et al., 1990). A firm's committed top management leadership needs to train the lower level managers so that they give importance to both supplier flexibility and efficiency (Adler, Goldoftas, & Levine, 1999). Without senior management emphasizing these qualities lower-level managers could become more autocratic in their relations with subordinates and suppliers which would, in turn, undermine the trust between the firm and its suppliers (Adler et al., 1999). Management has a crucial role in encouraging hospital-supplier partnership (Doyle & Boudreau, 1989).

Led by their senior management, hospitals are now adopting a supplier management orientation and some hospitals are considering the six aspects of supplier relationships. A few hospitals are insisting upon supplier assistance while choosing their strategic suppliers (McKone-Sweet, Hamilton, & Willis, 2005). Similarly, management has to push their departments towards sharing the hospital's inventory requirements electronically with its key suppliers (Leidner et al., 2010). Further, hospital leadership needs to encourage sharing their product/service issues and metrics with the strategic suppliers so that suppliers can improve (L. X. Li, 1997). The degree of supplier monitoring required indicates the level of trust in firms' relationships with their suppliers (Carr & Pearson, 1999). Hospitals must have the necessary infrastructure to facilitate the close interaction with their suppliers so as to be able to monitor their activities (Xu, 2011). The continuity expectation that both the firms and their suppliers have from their relationship has an impact on the tenure (Noordewier et al., 1990). A continuity orientation or long-term cooperation between both firms and their suppliers helps increase the efficiency and effectiveness of relationships (Johnston, McCutcheon, Stuart, & Kerwood, 2004). By taking effective decisions to select key suppliers, senior management can help their hospitals develop partnerships with suppliers that have the potential to last long (Chao, Yu, Cheng, & Chuang, 2013). Finally, the quality of the supplies need to meet the high regulatory medical standards that are mandated by law in this industry (Standards, 2011). Hospitals need to insist on purchasing from only certified suppliers in order to ensure high quality patient care (Davis, 2004). Hospital management can hold their suppliers accountable for the quality of supplies and hospitals would want to collaborate and encourage long term relationships with those suppliers who help the hospital keep costs low (S. Goodman & Jones, 2013).

In sum, the above discussions support the important role of hospitals' management leadership in overseeing relationships with their key suppliers. Further, empirical evidence supports a positive role of a firm's leadership in managing its suppliers (Das et al., 2006; Goldstein & Naor, 2005; Talluri & Sarkis, 2002). Therefore, based on the above discussions, the following hypothesis is offered:

H1b: *Management leadership is positively related to supplier relationship management.*

Management Leadership and Healthcare Team Effectiveness

QM theory (Ahire et al., 1996; Feigenbaum, 1961; Jayaram et al., 2010; Kaynak & Hartley, 2008) suggests that senior management needs to provide resources like machines and trained personnel to make the work environment conducive for teams to work. Hospital leaders who encourage teams to focus on quality and innovation and do not micro manage healthcare teams' day-to-day work help team members concentrate on their immediate tasks (Force, 2005; West et al., 2003). This leadership is positively related to group cohesion and, in turn, to team effectiveness and performance because such leaders provide direction to the teams, help increase the team members' motivation to work toward common goals, and encourage team bonding by enhancing employee self-efficacy (Jung & Sosik, 2002; Pillai & Williams, 2004; Schaubroeck, Lam, & Cha, 2007; G. Wang, In-Sue, Courtright, & Colbert, 2011).

Hospital leadership has an important role in helping teams. The instrumental aspects of senior management leadership such as establishing common goals for all healthcare teams in the hospital are positively related to healthcare team effectiveness because teams consider it fair. Similarly, the psychosocial aspects such as establishing a climate of patient safety and active participation also increase healthcare team effectiveness because teams know what should be their important goals (Lemieux-Charles & McGuire, 2006). By emphasizing the hospital priorities, sending consistent and unambiguous communication to all team members and setting realistic and achievable team goals, top management can enhance healthcare team cohesiveness and ultimately their effectiveness (Nielsen, Yarker, Randall, & Munir, 2009; Tumerman & Carlson, 2012). Therefore, based on the above discussions, the next hypothesis is advanced:

H1c: *Management leadership is positively related to healthcare team effectiveness.*

Management Leadership and Internal Lean Practices

A firm's leaders must understand that any quality improvement initiative is not a quick fix and must support the employees and the quality champions in their change efforts (Graban, 2011). Deming's quality management framework highlights the interconnectedness of the different departments of organizations, the importance of management leadership and the need to have consistent organizational processes (Anderson, Rungtusanatham, & Schroeder, 1994). Lean systems theory (B. B. Flynn et al., 1995; Kaynak, 1997, 2002; Monden, 1981; Ōno, 1988; Shah & Ward, 2003; Sugimori et al., 1977) emphasizes that senior management has a crucial role in championing lean principles throughout an organization in order to optimize and efficiently use the available resources.

In healthcare, top management leadership involvement in CQI efforts, encouraging employee quality initiatives and addressing concerns as and when they arise helps increase the chances of successful implementation (Weiner, Shortell, & Alexander, 1997). In medical literature, patient safety climate addresses the important role of management leadership (Singer et al., 2007). These authors define senior management engagement as whether management has a clear understanding of current safety issues in their hospital, takes supportive action when necessary, and appreciates the frontline care providers who are often best qualified to solve patient safety issues (Singer et al., 2007). They also discuss leadership on patient safety as the senior executives' ability to articulate values consistent with patient safety and reducing healthcare associated infections (HAI) (e.g., how clearly does the senior executives articulate the hospital values relevant to patient safety and HAI) (Singer et al., 2007).

A hospital's executive leadership has to communicate to all employees that patient and material flow improvement is among the hospital's primary goals (Pate & Puffe, 2007). Hospital leadership has an important role in each of the following activities in a lean implementation– forming a patient flow team, measuring the hospital performance, identifying the processes to modify, prepare to launch the lean implementation, facilitate change, anticipate and address implementation challenges, and sharing results with all employees (McHugh, Van Dyke, McClelland, & Moss, 2011).

Like in other service firms, hospital leadership has to encourage employees to adopt a lean approach and be ready to eliminate waste (Jimmerson, Weber, & Sobek, 2005). Further, hospital leadership must ensure that lean implementation efforts are sustained in the organization, and finding and eliminating wastes do not end up in fault finding missions but result in continuous improvement in processes (Waring & Bishop, 2010). Based on the above discussions that highlight the important role of management leadership in the implementation of lean practices (Singer et al., 2007), it is hypothesized:

H1d: *Management leadership is positively related to internal lean practices.*

Technology Integration and Supplier Relationship Management

Integrating the different departments and internal hospital entities would help the hospital know its stock positions and inventory requirements accurately thereby allowing the hospital to strategically source their inventory items in a planned manner from a few trusted suppliers, manage the procurement processes and govern the existing supplier relationships (Loh & Koh, 2004; Mettler & Rohner, 2009). Receiving up-to-date information on the hospital's inventory items would help the supplier increase its assistance to the hospital, which in turn would help improve its own flexibility to meet changing hospital needs for products (Coye & Kell, 2006; E. T. G. Wang, Tai, & Wei, 2006). It would improve the type and amount of information that the supplier could provide the hospital when requested (Pouloudi, 1999).

On the other hand, a technologically integrated hospital, like any other service firm, could become aware of the cost of purchasing items from each supplier (Das et al., 2006; Talluri & Sarkis, 2002) instantly, helping it choose its strategic suppliers for each of its products/services that are required by various departments. Collaboration between hospitals and their suppliers would increase the continuity expectations that both parties have of the relationship (Mettler & Rohner, 2009; Walshe & Smith, 2006).

In sum, a technologically integrated hospital that knows the latest information from all its internal elements would be able to manage its supplier relationships effectively (Das et al., 2006; Talluri & Sarkis, 2002) because suppliers would feel encouraged to perform better with a hospital that informs them about the required supplies quite in advance. Therefore, based on the above discussions on advantages of a technologically integrated hospital for supplier relationships, it is suggested:

H2a: *Technology integration is positively related to supplier relationship management.*

Technology Integration and Internal Lean Practices

As noted earlier, technology integration in a hospital internal supply chain could focus primarily on the electronic form of data exchange adopted for all daily communication between the different entities within a hospital (S. Li & Lin, 2006). A technologically integrated hospital could spur effective inventory monitoring and control by all entities in-house in order so as to ensure that they have adequate supplies (e.g., blood units, counseling professionals, therapy professionals, medicines) at all times. In-house inventory monitoring at different supply chain entities could help reduce the hospitals' emergency buffer stocks and help them implement a lean system (Leidner et al., 2010) based on frequent but smaller delivery lots from suppliers.

Technology can help hospitals strategically plan the usage of their critical resources such as operating suites, intensive care units (ICU) and labs, various sophisticated medical equipment like magnetic resonance imaging (MRI), computed tomography (CT) scan and X-rays, considering the maximum and mean patient volumes and flow rates for each medical treatment process (Vissers & Beech, 2005). Thus technology could be used to maintain smooth patient and material flow rates in the hospital. A fundamental redesign of healthcare processes that is based on the use and integration of electronic communication across different technology platforms is now being implemented in some hospitals (Demiris et al., 2008).

Continuous quality improvement (CQI) adoption is facilitated by information systems, flexible use of personnel, and team support as well as training for managers (Lucas et al., 2005). Investing in medical technology does not automatically result in a significant improvement in patient care quality but organizational cooperation, workforce development and process analysis help improve the quality of health services (L. X. Li, 1997). Information technology such as using electronic patient record system and bar coding medicinal administration (Abrahamsen, 2005) can support all logistics and quality improvements in healthcare (Ammenwerth et al., 2002). Information technology can provide timely and accurate patient data and medical knowledge to the doctors and nurses who need it (Ammenwerth et al., 2002).

Lean philosophy strives to balance the demand for patient care with the capacity of the hospitals in order to eliminate wastes such as over-capacity or waiting times (Kollberg, Dahlgaard, & Brehmer, 2007). Healthcare requires innovation to remain competitive and cost efficient and lean implementation is a way to introduce incremental innovation in hospitals (de Koning, Verver, van den Heuvel, Bisgaard, & Does, 2006). Lean principles need to be applied to all processes to reduce all operational inefficiencies and reduce all types of wastes. Organizational information systems help in the distribution of the required information to different departments for lean implementation (de Koning et al., 2006).

Based on successful technology integration in hospitals (Stratman, 2008) and supported by IPT (Davenport, 1998; Galbraith, 1973; Tushman & Nadler, 1978), it is suggested that better information exchange would ultimately result in hospitals become lean. This is possible because better information exchange would benefit hospitals in optimizing their purchases as they can compare the product price and quality information available from each supplier and each department can buy the necessary quality products at lowest prices. In turn, it would provide the most appropriate medicines and other required supplies to the patient, keeping both the overall cost and time taken for delivery under control, helping hospitals become lean in the process. Therefore, based on the above discussions, the next hypothesis is offered:

H2b: *Technology integration is positively related to internal lean practices.*

Supplier Relationship Management and Internal Lean Practices

Both the supply and demand for hospital services need to be balanced for any hospital to function well. The preparation of the initial diagnostic and consultation report by the physician, taking the patient to the emergency room (ER) department (if it is an urgent case) and transferring the patient to specialized medical suites such as the operating room (if the patient needs surgery) are some of the internal supply chain related activities. The demand related activities incorporates processes for managing the flow of patients (Heineke, 1995) with the aim of having no more than the maximum number of patients that the hospital can handle. Failures in patient and material flow in the hospital such as excessive patient wait for admission and medical procedures may have a direct negative impact on the quality and overall effectiveness of service performance (Baltacioglu et al., 2007). The strength of its supplier relationships is positively related to the patient and material flow in a hospital and its ability to serve patients.

Similarly, supplier relationship management also impacts the continuous quality improvement efforts at the hospital (McLaughlin et al., 2004). Having structured relationships with hospital suppliers is one of the characteristics of a successful CQI implementation (LeBrasseur, Whissell, & Ojha, 2002). In addition to strong leadership support and commitment, successful and sustained CQI initiatives require hospitals to develop long term and mutually beneficial partnerships with key suppliers (LeBrasseur et al., 2002). Relationships with suppliers are necessary for hospitals to reduce their inventory and yet meet their patient care service quality standards (Dahlgaard et al., 2011).

Lean waste management can be successful only if hospitals are able to implement a "pull" system for managing their entire inventory (Womack & Jones, 2010; Zidel, 2006) which, in turn, depends upon supplier cooperation (Dahlgaard et al., 2011). Hospitals need to implement effective material restocking processes that involve more frequent but smaller batch deliveries or to rotate their supplies more quickly to reduce the amount of space used up in internal warehouses and the cash related to their tied-up in inventory (Graban, 2011), both of which could involve major supply chain improvements.

As noted earlier, lean systems theory (B. B. Flynn et al., 1995; Kaynak, 1997, 2002; Monden, 1981; Ōno, 1988; Shah & Ward, 2003; Sugimori et al., 1977) emphasizes that firms must have reduced inventory available just in time when they need it, and it requires supplier collaboration to implement such a "pull" system. Healthcare literature also supports this assertion (Dranove & White, 1987, 1989; Schneider & Mathios, 2006). Based on the above discussions, the next hypothesis suggests:

H3: *Supplier relationship management is positively related to internal lean practices.*

Healthcare Team Effectiveness and Internal Lean Practices

In reality, not all teams are effective (Belbin, 2011; Moxon, 1993). Therefore, it is important that organizational teams are able to work effectively and perform (Lemieux-Charles & McGuire, 2006; Temkin-Greener, Gross, Kunitz, & Mukamel, 2004). In healthcare, motivated doctors and nurses along with other hospital staff working together give their topmost attention to patient care (Price & Mueller, 1986; Temkin-Greener et al., 2004; Yukelson, Weinberg, & Jackson, 1984). Effective healthcare teams share the hospitals' objectives to make it a part of their unanimous team goals (Baker, Day, & Salas, 2006).

Uninterrupted patient flow within a hospital ward and among different wards is essential for lean implementation. Transferring patients from emergency to other hospital departments after their immediate medical procedures can go wrong because of improper communication, unbalanced workload, unavailability of appropriate information due to the inadequate IT system, and unassigned responsibility to individuals (Horwitz et al., 2009). Hospitals could implement unit or ward-specific strategies such as having teams deliver services with a professional attitude to patients and their kin (Smits, Falconer, Herrin, Bowen, & Strasser, 2003), which would help reduce errors and improve the team effectiveness (DiMeglio et al., 2005). To have a smooth patient flow in the hospital, an effective healthcare team can implement policies such as moving admitted patients from the emergency rooms to their respective rooms at the earliest, timely admission and discharge from the hospital without any procedural delays, and move patients in and out of the operating suites at soon as the room is available (Hostetter & Klein, 2013). Optimal patient flows helps hospitals achieve better outcomes (Lemieux-Charles & McGuire, 2006).

CQI is positively associated with greater perceived patient outcomes such as faster cure and early release of admitted patients (Lucas et al., 2005; S. M. Shortell, Bennett, & Byck, 1998; S. M. Shortell et al., 1995). Because effective healthcare teams discuss their patients' health related issues within themselves and jointly take decisions, the team morale remains high. Therefore, effective teams have a participative, flexible and risk-taking organizational culture that helps CQI efforts (S. M. Shortell et al., 1995). An effective healthcare team would be positively related to hospital-wide CQI efforts.

In lean philosophy, processes that do not add value to the product/service or customer are considered waste and can occur in seven broad areas that are accessed daily by healthcare teams in hospitals (Waring & Bishop, 2010). Increasing physician involvement (Goldstein & Ward, 2004; Reynolds & Goodroe, 2005) and nurses' support (Kane, Shamliyan, Mueller, Duval, & Wilt, 2007; Kuokkanen, Leino-Kilpi, & Katajisto, 2003; Laschinger & Wong, 1999) helps healthcare team members identify wastes to be eliminated. Because team work is an important lean practice (Drotz & Poksinska, 2014) and all lean practices must be simultaneously considered for implementation across the various departments of the hospital, team members must have mutual understanding of each other's tasks and must help each other whenever possible. Mutual respect, group pride and a clear unity of purpose of team members can ensure that the institutional effort spent in finding and eliminating wastes results in continuous improvement of existing processes (Waring & Bishop, 2010).

In sum, effective healthcare teams can communicate clearly with management, patients and other stakeholders and help achieve better patient flow, help in continuous quality implementation efforts, and waste identification and reduction throughout the hospital. Based on the above discussions, the following hypothesis is offered:

H4a: *Healthcare team effectiveness is positively related to internal lean practices.*

Healthcare Team Effectiveness and Patient Care Quality

Firms need to have cohesive cross-functional teams in order to implement quality practices across the organization because cohesive groups have a high degree of group identity and commitment to the group's tasks (Govers, 2001; E. Wang, Chou, & Jiang, 2005; E. T. G. Wang, Ying, Jiang, & Klein, 2006). This premise is based upon QM theory (Ahire et al., 1996; Feigenbaum, 1961; Jayaram et al., 2010; Kaynak & Hartley, 2008) which emphasizes team work as a required characteristic to achieve good employee relations, which in turn is required to implement quality practices. Effective healthcare teams perform their routine tasks little differently than other teams and learn quickly from each other. Small surgical team members are able to quickly learn from each other due to workload sharing and team helping, especially when the task complexity is very high (Vashdi, Bamberger, & Erez, 2013).

Extant literature highlights that in order to be effective teams could use physician empathy (S. S. Kim, Kaplowitz, & Johnston, 2004) and nurse emotional involvement (McQueen, 2000) to positively influence the interpersonal relationships that the healthcare teams are able to establish with their patients. Effective healthcare teams can take an active interest in their patients' medical condition, empathize with their suffering (Roark & Sharah, 1989), communicate clearly to the patient and his/her kin about their medical condition and unanimously work toward their quicker cure, which would result in better interpersonal quality of patient care (Deeter-Schmelz & Kennedy, 2003).

Adequate and timely access to and use of up-to-date patient health information can enhance the technical quality of patient care by providing physicians and nurses the correct up-to-date information on the patient's health (C. Chen, Garrido, Chock, Okawa, & Liang, 2009; Jha et al., 2009). Effective healthcare teams can use EHR and other hospital medical information systems to have all patient information readily available to the physicians for decision-making and nurses for support (Graetz et al., 2014).

All physical elements of a patient's environment such as the hospital bed, clothes and equipment must be clean and disinfected (Aiken, Clarke, & Sloane, 2008). Hand hygiene prevents infection among patients and others (Pittet et al., 2000). Effective healthcare teams can meticulously follow all hospital procedures, take all necessary precautions related to hygiene, ensure that all physical elements of the hospital including the beds and other medical and surgical equipment are thoroughly cleaned and disinfected before use on any patient (Carling, Parry, & Von Beheren, 2008). Further, effective healthcare teams can interact with housekeeping to ensure that the hospital wards are organized, clean and aesthetically pleasing (Mathur, 2014; Wearmouth, 2001). All these steps would result in better environmental quality.

Hospital administration departments like billing and reception typically tend to work with a silo mentality in isolation (Bokar & Perry, 2007; Conway, 1997) oblivious to the fact that all departments need to support the healthcare teams in their effort to provide quality patient care. Effective healthcare teams can interact closely with the hospital's administrative units (White & Whitman, 2006) to ensure that information is provided timely to the patients or their next of kin.

Because administrative quality is a key element of patient care (Grumbach & Bodenheimer, 2004), effective healthcare teams can frame a few preliminary procedures of their own to educate patients on simple administrative steps such as scheduling hospital visit appointments, providing food and dietary information related to the sickness to the patient or to their kin, explaining healthcare decision making processes to patients, and when required, interacting with the hospital's administrative departments on behalf of patients (Grumbach & Bodenheimer, 2004).

Based on the above discussions it is suggested that having effective healthcare teams in the hospital would avoid unnecessary delays and reduce variability in healthcare processes. In order to be effective, members of a healthcare team can avoid medical errors, check schedules and room/equipment availability in advance of patients' medical procedures, take steps to prevent infections in hospitals and keep the patients' care at the forefront of their decision making (Grumbach & Bodenheimer, 2004). These activities would make patient care safer and more accurate, improving its overall quality. Thus, the next hypothesis notes:

H4b: *Healthcare team effectiveness is positively related to patient care quality.*

Internal Lean Practices and Patient Care Quality

One of the objectives of lean implementation in a firm is to have high product or service quality (Dean Jr & Snell, 1996; Fullerton & McWatters, 2001) that meets or exceeds the required standards of the industry. Lean systems theory (B. B. Flynn et al., 1995; Kaynak, 1997, 2002; Monden, 1981; Ōno, 1988; Shah & Ward, 2003; Sugimori et al., 1977) highlights that reducing wastes would help firms identify and eliminate scrap and rework from their goods production or service generation processes. Lean systems theory helps explain the relationship between internally implementing lean practices at hospitals and the positive effect on patient care quality.

To deliver high PCQ the practitioners, i.e., both physicians and nurses need to master two aspects of medical care. First, practitioners need to become experts in the technical quality of patient care (i.e., the medical diagnosis and cure procedures and treatments need to be accurate and most effective). Second, the healthcare team members need to learn the attributes of interpersonal quality of patient care, i.e., keeping the patient well informed about the required medical treatment and its side-effects, empathizing with patients so that they are not overly worried (Hudelson, Cleopas, Kolly, Chopard, & Perneger, 2008; Marley, Collier, & Meyer Goldstein, 2004).

Hospitals should treat only the number of patients that they can handle so that patients flow though the hospital is effectively managed (Heineke, 1995). Smooth material and patient flow in the hospital help decrease the average wait times for patients before their surgery or other medical procedures (Baltacioglu et al., 2007) by ensuring that appropriate medical equipment and supplies and suites like intensive care units (ICU)s are available when needed. Longer wait times add additional stress to patients (Paterson et al., 2006), complicate patients' ailments, cause additional medical procedures to be performed on patients, and sometimes may result in preventable outcomes like death (Derlet & Richards, 2000). Patient and material flow are related to both the interpersonal and technical aspects of PCQ.

As noted earlier, physical elements of a patient's environment such as the hospital bed, clothes and equipments must be fully clean and disinfected (Aiken et al., 2008) in order to prevent infections (Pittet et al., 2000). Support from the administrative departments of a hospital such as billing and reception are also crucial to improving PCQ (Bokar & Perry, 2007; Conway, 1997). Implementing lean principles in a hospital encourages all practitioners to continuously develop expertise in their own areas of work, and to collaborate and share their knowledge with others in the healthcare teams (Sui-PPheng & Khoo, 2001), because value addition (Joosten, Bongers, & Janssen, 2009) and waste reduction (Toussaint & Berry, 2013) are two important concerns in a lean implementation. Thus, CQI and waste reduction, which form two pillars of a lean philosophy, are positively related to the technical, environmental and administrative dimensions of PCQ. Therefore, based on the above discussions, it is suggested that lean implementation in hospitals is positively related to all four dimensions of PCQ. Hence, the next hypothesize notes:

H5: *Internal lean practices are positively related to patient care quality.*

Chapter Summary

Based on several recent papers from interdisciplinary fields and status reports from the press on the state of the U.S. healthcare referenced in this research, it is evident that poor quality of patient care is the main issue troubling U.S. healthcare. As noted by Boyer and colleagues (2012), the IOM report (Kohn et al., 1999) has already prompted some corrective action in the healthcare community with many scholars working to improve various quality aspects of the system but several issues still remain unresolved. The findings of the extensive literature reviews are presented in 11 tables throughout the chapter. The framework presented in this chapter attempts to offer a more comprehensive perspective of the patient quality issues being faced at most full-service U.S. hospitals than found in the literature. Specific hypotheses, supported by extant literature and theory, are advanced for relationships among research variables. These hypotheses are empirically tested and their findings are presented and discussed in the subsequent chapters.

CHAPTER III

RESEARCH DESIGN AND METHODOLOGY

In this chapter the research design and methodology used for testing the hypothesized framework are described. This chapter addresses the following topics: (1) target population and sample; (2) operational definitions and measurements of the constructs; (3) data collection and analysis procedures employed for the pilot study; and (4) data collection and analysis procedures employed in the main study.

Target Population and Sample

To empirically test the research questions in this study a cross-sectional online survey methodology was used. There are two main reasons for using a survey rather than other types of research designs. First, the investigation of multiple variables in this study requires a large sample size to obtain reliable and valid results. A survey is a useful research tool to reach a large number of subjects (Kaynak, 1997). Second, full-service hospitals are scattered throughout the U.S.; hence limiting the study to a geographic region or one of the 50 U.S. states would not provide a sufficiently large sample size and would also restrict the generalizability of the results of this study.

Online cross-sectional surveys are accepted in academic literature as a valid and cost-effective way of reaching out to a scattered sample of respondents as they offer some advantages over the traditional forms (Barrios, Villarroya, Borrego, & Ollé, 2011; Callas, Solomon, Hughes, & Livingston, 2010; Evans & Mathur, 2005; Lonsdale, Hodge, & Rose, 2006; Meyerson & Tryon, 2003). The main advantage is that online surveys are relatively cheaper than the traditional paper and pencil ones (Gunn, 2002). Other advantages of web surveys over paper ones include the following: faster response rate, ease of sending reminders to participants, ease of processing data as responses can be easily downloaded to a spreadsheet, dynamic error checking capability, pop-up instruction inclusion for selected questions, and use of drop-down boxes (Gunn, 2002; Wright, 2005). Examining the results of previous research that compared mail and web surveys, Meyerson and Tryon (2003) concluded that online surveys are reliable, valid, representative, cost effective, as well as efficient. An online survey is therefore appropriate for this study and was used to reach the pool of hospital executives across the county.

Because in this study relationships among variables that are related to quality of care available to patients admitted into full-service U.S. hospitals are investigated, the target population is the list of full-service hospitals that exists in the 50 states of the U.S; no respondents from hospitals in other countries are being targeted. The respondents are hospital senior executives with titles such as Safety Director, Safety Coordinator, Quality Assurance Director, Quality Engineer, Director of Quality Improvement, Vice President of Operations, Chief Operations Officer, Chief Nursing Officer, Chief Operating Officer and Chairman, and Chief Executive Officer. These senior hospital executives are expected to be fully aware of the quality improvement initiatives being planned or implemented at their hospitals. The subjects of the study were chosen from a paid hospital executive database owned by Dun and Bradstreet (D&B). This company has the emails of the senior executives of most representative full-service hospitals in the 50 states of the U.S. and no region is excluded. The procedure used in this online survey is based on the Tailored Design Method by Dillman, Smyth and Christian (2008). Online surveys conducted using this method have traditionally achieved a high response rate.

Statistical power of this study is important because it involves a series of simultaneous regressions using Structural Equations Modeling (SEM). The statistical power of a test depends on the selected significance criterion, the reliability of the sample results and the effect size (J. Cohen, 1988). Cohen (1988) recommends three values of effect size: small = 0.02, medium = 0.15, and large = 0.35 (Kaynak, 1997). Since there is no available effect size from previous research, predicting effect size for this research is impossible. Following Kaynak (1997), a medium effect size of 0.15 was assumed for the study. This effect size was chosen in order to be conservative because effect sizes of 0.25 are infrequent in behavioral sciences (J. Cohen & Cohen, 1983).

As per the online calculator (Soper, 2006) with the following values for the study: a medium sized effect of 0.15, 16 latent and 96 observed variables in the model, required minimum power of 0.8 (80 %) and the assumed probability (α) of 0.05, the minimum sample size required for the study is 376. A screenshot of the online calculation is given in Appendix E. A 10% response rate could be expected for most healthcare practitioner surveys such as the one used in this study (Cummings, Savitz, & Konrad, 2001; Flanigan & McFarlane, 2008).

Keeping all the above factors in mind, it was decided to target 4000 subjects. The key criteria used for choosing a target respondent is his/her senior management rank and/or quality related designations held in full-service U.S. hospitals. Emails were sent to the identified respondents who were randomly selected from the paid executive database of senior hospital leaders. In some cases depending upon the data availability, multiple leaders in the same hospital were sent emails so as to have responses from more than one source with the aim of testing for presence of any biases. Multiple responses from the same hospital are counted only once in the sample size.

Each email contained a cover letter that explained the objective of the study and solicited the hospital leaders' help with the study. The cover letter was designed incorporating recommendations from literature such as to guarantee confidentiality of all responses and explained how the research results can be useful to the hospital, and to the researcher (Huber & Power, 1985). A copy of the cover letter and the questionnaire are presented in Appendix A and Appendix B respectively. In order to design an effective online survey, two broad categories of guidelines were followed to increase the benefits of participation for respondents and decrease the costs of participation for respondents (Andrews, Nonnecke, & Preece, 2003; Couper, 2008; Dillman et al., 2008). The first set of guidelines incorporates providing adequate information about the survey to respondents, who were asked in the cover letter to help with the survey. The questions were worded such that they would not be interpreted negatively. The cover letter also thanks the respondents up-front. Considerable effort was taken to make the questionnaire relevant to U.S. hospitals and interesting to administrators (Andrews et al., 2003; Couper, 2008; Dillman et al., 2008). Following the second category of guidelines, the questionnaire design incorporated convenience of the respondent to go on to the survey directly from the email by allowing them to click the link in the email, instead of having respondents type out the website in the browser (Huber & Power, 1985). The questionnaire avoided using any subordinating language, kept the sentences as short as possible and minimized requests to obtain any personal information (Andrews et al., 2003; Couper, 2008; Dillman et al., 2008). The study asks for respondents' name and the hospital that he/she belongs to with the address only once at the end of the survey. Response to this personal information was voluntary.

After two weeks of sending the original emails, a follow-up email containing the subsequent wave cover letter (presented in Appendix- D) and a link to the online survey were sent by email to all respondents (Dillman et al., 2008). Follow-up emails containing the cover letter and a link to the survey were sent to the target respondents once a week and later twice a week. In order to increase the response rate, telephone calls were made to the target respondents' office to impress upon their need for participation in the study and to ask for their input on the survey.

Validity Issues

This section focuses on six issues related to conducting online survey research: (1) errors related to coverage; (2) sampling; (3) measurement; (4) randomization of sample; (5) common method variance; and (6) non-response bias. The section discusses the issues that may arise in a study and how this research plans to minimize the effect of these issues.

Coverage Error

Coverage error results if all members of the population under study do not have a known nonzero chance of being included in the sample and if those excluded differ from those included (Andrews et al., 2003; Couper, 2008; Dillman et al., 2008; Singleton & Straits, 2010). In this study, since target respondents are randomly selected from a paid hospital executive database on full-service U.S. hospital executives, every member who is present in the company's hospital database has an equal chance of being selected for the sample. The well known company (D&B) had assured the researcher that neither any hospital type nor any geographic region is excluded from their database and thus coverage error is not a significant issue in this study.

Sampling Error

Sampling error occurs if only some, rather than all, members of the population under study are surveyed (Andrews et al., 2003; Couper, 2008; Dillman et al., 2008; Singleton & Straits, 2010). As noted earlier, in this study all executives of full-service U.S. hospitals whose information are present in the company database had an equal chance of being selected for the sample. Therefore, sampling error is not an issue.

Measurement Error

Measurement error occurs when respondents give inaccurate answers to questions (Nunnally & Bernstein, 1994) which could be due to the poor wording of the questions, survey mode effects, or any other aspects of respondent behavior (Andrews et al., 2003; Couper, 2008; Dillman et al., 2008). Careful attention has been given to make sure that the wording of the questions is clear, concise and unambiguous. In the pilot study, respondents were asked whether any question wording is ambiguous and necessary corrections were made.

Randomization

In this study the research questions target all full-service hospitals in the U.S. Lean is the underlying theory for the research model and the aim of the research is to find determinants of quality of patient care available to admitted patients. Although the study is not restricted to hospitals that have implemented or are considering lean implementation, a purposeful sampling is used to target hospital senior executives from the paid database of full-service hospital executives for sending the online survey. Purposive sampling (Singleton & Straits, 2010) is used in any study to select a target group of informed respondents (Jack et al., 2013). Randomization is not applicable in purposive sampling and in this study only senior level hospital executives were selected. This is clearly an advantage for the study since the senior executives could be expected to be fully aware of the constructs being studied and are thus likely to give meaningful responses.

Common Method Variance

Obtaining all data from a single source using self reports, also known as common method variance (CMV) (Campbell & Fiske, 1959), is a concern for the validity and reliability of the research results because if there are issues with the source it would affect more than one measure used in the study (Avolio, Yammarino, & Bass, 1991; Kaynak, 1997; Mitchell, 1985; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003; Podsakoff, MacKenzie, & Podsakoff, 2012; Podsakoff & Organ, 1986). In order to avoid this problem to the greatest extent possible, more than one respondent holding different ranks in the hospital hierarchy were selected from the same hospital in the hospital executive database, but they were counted only once in the sample. Having more than one respondent from the same hospital allows a comparison of the responses from the same hospital. The aim is to verify if there is any systematic bias or if the questionnaire is being interpreted in a particular undesirable manner by respondents belonging to a particular type of hospital (source).

In addition, positive affectivity, which is unrelated to the research variables, was introduced as a marker variable (Lindell & Whitney, 2001; Podsakoff et al., 2012; Richardson, Simmering, & Sturman, 2009). Four items were randomly introduced in the questionnaire to measure this variable. The average correlations of the marker variable with other latent variables were calculated. Further, a method-C/U model approach (Alge, Ballinger, Tangirala, & Oakley, 2006; Lindell & Whitney, 2001; Richardson et al., 2009; Williams & Anderson, 1994; Williams, Edwards, & Vandenberg, 2003) was used to test if CMV affected the study.

In this method-C/U model test, four different models are investigated-a baseline model, method-C model, method-U model, and a method-R model. In the second model (baseline) the covariances between the latent marker construct and both the exogenous and endogenous latent constructs are set to zero and the item loadings of the latent marker construct are fixed to their unstandardized values that are obtained from the a confirmatory factor analysis (CFA) model of the substantive and marker constructs. The method-C model is identical to the baseline model but the unstandardized loadings of paths from the marker construct to each exogenous/ endogenous construct item are added and constrained to be equal (i.e., noncongeneric). The method-U model is identical to the method-C model, but the marker construct- exogenous/ endogenous item loadings are freely estimated (i.e., congeneric). The method-R model is identical to either the method-C/U model; however, the exogenous/endogenous construct covariances are constrained to their unstandardized value from the baseline model. Chi-square (χ^2) differences between the baseline and method-C models, method-C and method-U models, and the method-C or -U and method-R models are then compared for statistical significance. If method-C model fits significantly better than the baseline model, it is concluded that there is evidence of CMV in the data. If the method-U fits significantly better than method-C, it is noted that there is evidence of unequal (i.e., congeneric) method effects. If method-R fits significantly worse than either method-C or -U (depending on which fit better), it indicates that there is evidence of bias because of CMV (Richardson et al., 2009).

Finally, if the above tests show evidence of CMV, the next stage is to investigate the extent to which CMV may have affected the hypothesized relationships in the study. Therefore, using the marker variable as a latent control, the structural model needs to be re-estimated and the coefficient for each hypothesized path has to be rechecked for statistical significance. If the coefficients of the hypothesized paths are all statistically significant and do not change much from their previous values (i.e., after the addition of the control variable), the test demonstrates that although CMV may have affected the study, the significant paths among variables obtained in the study were not due to CMV (Alge et al., 2006; Lindell & Whitney, 2001; Williams & Anderson, 1994; Williams et al., 2003).

Non-response Bias

The main disadvantage of online surveys is their low response rate compared to equivalent mail surveys (Couper, Blair, & Triplett, 1999; Solomon, 2001). A non-response bias may distort the reliability of the data by under representing a few groups while over representing a few others (Alreck & Settle, 1985). The sample of respondents could be broadly put into one of three groups–first, in which the respondents are keen to improve the quality of patient care at their hospitals but are experiencing some success in their efforts; hence, they responded to the online survey the earliest. The second group of respondents would be those who responded not very late, maybe after one or more reminders, while the third group of respondents comprises those who are perhaps not very excited about the survey but still responded after several reminders. Another group of potential respondents will refuse to participate in the survey and may even refuse to answer any further follow-up questions. Therefore, to avoid reaching any faulty conclusions, non-response bias was investigated.

Construction of the Instrument and Measures

Based on an extensive review of interdisciplinary literature from healthcare management (HCM), human resources management (HRM), medicine, marketing, nursing, organizational behavior (OB), operations management (OM), and strategic management (SM), existing scales were identified and adapted to the U.S. hospital setting. Initially, each construct was measured by six items; in all 96 items were used to measure the 16 latent research variables. As discussed earlier, four items were randomly introduced in the questionnaire at different points to measure positive affectivity; this construct was introduced as a marker variable to test for CMV. Eleven items were placed at the end of the questionnaire for collecting demographic information. Existing scales from literature were adapted to the healthcare context keeping the relevancy to the context in mind to measure 91 items. Five scale items–one for technology integration, three for patient and material flow and one for waste management–were created by the researcher based on a thorough review of the literature in order to comprehensively represent the entire domain of the constructs. While drawing up the new adapted scales, in a few cases, items from original scales were omitted because they were not relevant to the healthcare context. Refer to Table 16 for sources of the scale items, Table 17 for summary of scale items and to Appendix B for the items of each scale.

Existing scales from literature were relied upon to form the *management leadership* scale. All five items from the senior management engagement scale of a recent healthcare article (S. Nelson et al., 2011) were selected. In addition, an item from the management leadership scale of a frequently cited OM paper (Kaynak, 2003) was added and together, these six items formed the *management leadership* scale. Similarly, two sources were used to form the *technology integration* scale. Five items from the integration sophistication scale in a healthcare article (Paré & Sicotte, 2001) that had ten items were selected. The five items that were not included would not be applicable to all U.S. hospitals, especially smaller hospitals in the rural areas that may not have separate applications for some of their departments. In addition, an item on the use of electronic orders in healthcare was created by the researcher based on literature review (Beier, 1995) to fully measure the domain of the construct.

Table 16. Construction of the Survey Instrument

Construct	Items	Sources
Management leadership	1-5	Adapted from Nelson et al. (2011)
	6	Adapted from Kaynak (2003)
Technology integration	7	Researcher created based on literature review (e.g., Beier, 1995)
	8-12	Adapted from Pare & Sicotte (2001)
Supplier relationship management		
Supplier flexibility	13-17	Adapted from Noordewier et al. (1990)
	18	Adapted from Boyle et al. (1992)
Supplier assistance	19-22	Adapted from Noordewier et al. (1990)
	23-24	Adapted from Gassenheimer & Calantone (1994)
Supplier Information exchange	25-28	Adapted from Noordewier et al. (1990)
	29	Adapted from Nyaga et al. (2010)
	30	Adapted from Lumineau & Henderson (2012)
Supplier monitoring	31-34	Adapted from Noordewier et al. (1990)
	35-36	Adapted from Stump & Heide (1996)
Continuity expectation	38	Adapted from Aulakh, Kotabe & Sahay (1996)
	39-40	Adapted from Noordewier et al. (1990)
	41-43	Adapted from Heide &John (1990)
Quality of supplies	44-47	Adapted from the quality manual of the firm Sherwood Valve (2011)
	48-49	Adapted from Larson (1994)
Healthcare team effectiveness	51-56	Adapted from Poulton & West (1993, 1999)

Table 16 Continued

Construct	Items	Sources
Internal lean practices		
Patient and material flow management	58-59	Researcher created based on literature review (e.g., Maloney, Wolfe, Gesteland, Hales, & Nkoy, 2007)
	60	Researcher created based on literature review (e.g., Young et al., 2004)
	61	Adapted from Shah & Ward (2007)
	62-63	Adapted from Shah & Ward (2003)
Continuous quality improvement	64-67	Adapted from Shortell et al.(1995)
	68-69	Adapted from Shah & Ward (2007)
Waste management	71-73	Adapted from S. Li et al. (2005)
	74-75	Adapted from Shah & Ward (2007)
	76	Researcher created based on literature review (e.g., Jimmerson et al., 2005)
Quality of patient care		
Interpersonal quality	77-82	Adapted from Dagger et al. (2007)
Technical quality	83-88	Adapted from Dagger et al. (2007)
Environmental quality	89-94	Adapted from Dagger et al. (2007)
Administrative quality	95-100	Adapted from Dagger et al. (2007)
Positive affectivity	37,57,70, 76	Adapted from Agho, Mueller, & Price (1993)
Respondent information Demographics	101-111	Adapted from Kaynak (1997)

Table 17. Summary of Constructs and their Measurements

Construct	Type	Measurement mode	Values
Management leadership	Independent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Technology integration	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Supplier relationship management			
Supplier flexibility	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Supplier assistance	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Supplier Information exchange	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Supplier monitoring	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Continuity expectation	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Quality of supplies	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Internal lean practices			
Patient and material flow management	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Continuous quality improvement	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Waste management	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Healthcare team effectiveness	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Quality of patient care			
Interpersonal quality	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Technical quality	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Environmental quality	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Administrative quality	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree

Scales in supply chain management in OM, relational governance and industrial marketing were tapped to form the scales for each of the six characteristics of the *supplier relationship management* construct. First, all five items from the supplier flexibility scale in industrial marketing (Noordewier et al., 1990) were selected and one item from the flexibility scale in marketing (Boyle et al., 1992) was added to better represent the complete domain of supplier flexibility. These six items formed the *supplier flexibility* scale. Second, four items from the supplier assistance scale (Noordewier et al., 1990) that had five items were used and two relevant items from the supplier assistance scale from marketing (Gassenheimer & Calantone, 1994) were added to form the *supplier flexibility* scale. The items not included would not be relevant to U.S. healthcare. Third, all four items from the supplier information exchange scale in industrial marketing (Noordewier et al., 1990) were selected. Two more items–one from each of two recent buyer-supplier papers in OM (Lumineau & Henderson, 2012; Nyaga et al., 2010) were added to form the *supplier information exchange* scale such that the complete domain was represented. Fourth, four items from the supplier monitoring scale in industrial marketing (Noordewier et al., 1990) that had six items, were selected and two items were added from the monitoring scale of an industrial marketing paper (Stump & Heide, 1996) to form the *supplier monitoring* scale. The items left out were not relevant to U.S. healthcare. Fifth, to form the *continuity expectation* scale, three different sources were used. One item was adapted from a four-item continuity expectations scale (Aulakh et al., 1996) in international business. Two more items, adapted from a continuity expectations scale in industrial marketing (Noordewier et al., 1990), were added to three items from the continuity expectation scale in an industrial marketing paper (Heide & John, 1990) that had four items thereby having six items for the *continuity expectation* scale. Again, the items left out from the sources were not relevant to U.S.

healthcare. Finally, four items from the quality manual of an industrial valve manufacturing firm (SherwoodValve, 2011) were added to two relevant items from an eight-item product quality scale in buyer-supplier literature (Larson, 1994) to form the *quality of supplies* scale. The excluded items were not relevant to the U.S. healthcare context.

The team related items in the team effectiveness scale from healthcare literature were used to form the *healthcare team effectiveness* scale. All six items were selected (Poulton & West, 1993, 1999).

Next, both researcher-created and existing scales in lean operations were used to form the scales for each of the three attributes under the internal lean practices construct. All original items were modified to the hospital supply chain context. First, three sources were used to create the six-item *patient and material flow* scale. Three items were created based on healthcare literature–two to incorporate patient flow (Maloney et al., 2007) and one item to incorporate material flow (T. Young et al., 2004). Three relevant items from well-cited lean literature–two items from the five-item flow scale (Shah & Ward, 2007) and two from an earlier paper by the same scholars (Shah & Ward, 2003)–were added to have the final six items. The items not included were those that did not apply to the U.S. healthcare context. Second, two sources were used to create the six-item scale for *continuous quality improvement*. Four relevant items were adapted from the five-item CQI/TQM scale in healthcare literature (S. M. Shortell et al., 1995) and two relevant items were selected from the four-item employee involvement scale in lean operations (Shah & Ward, 2007). The items excluded were irrelevant for U.S. healthcare. Finally, to form the *waste management* scale, three different sources were used. Three relevant items were chosen from the internal lean practices scale in lean operations (S. Li et al., 2005). In order to fully measure the domain of the construct, two items were adapted from the five-item supplier development scale in lean operations (Shah & Ward, 2007) and one item was created by the researcher based on healthcare literature review (Jimmerson et al., 2005). The three items not included were not applicable to the U.S. healthcare context.

Scales from extant literature (Dagger et al., 2007) were relied upon to measure each of the four first-order factors under patient care quality–*interpersonal quality*, *technical quality*, *environmental quality*, and *administrative quality*. Since the original scale items were meant for clinical settings in the Australian context, some minor changes were required to adapt them to the current research context– admitted patients in full-service U.S. hospitals.

Positive affectivity is not a research variable but it has been introduced as a marker variable to test for CMV. Four items were selected from a 11-item scale in literature (Agho et al., 1993) to form the *positive affectivity* scale. The seven items that were excluded were not applicable to the context of U.S. hospital administrators. These four items were randomly introduced in the questionnaire. Finally, 11 questions related to respondents' demographic information such as name, age, education qualifications and hospital name and address were adapted from existing OM literature (Kaynak, 1997).

Pilot Testing

A pilot study provides a way to have feedback about the research method and the questionnaire to be used in a study before the actual test. Scholars can verify the appropriateness of their variables, measures and the data collection methods by checking with pilot study users. Unclear concepts and questions can be identified and the instrument can be made more user-friendly in this manner (Cf. Kaynak, 1997; Flynn et al., 1990). Therefore, a pilot study was conducted to gauge the appropriateness of the scales used in the study.

Procedures for Pilot Test

The pilot test for this study was done by emailing a list of 100 hospital executives and other quality heads of hospitals in the U.S. randomly selected from the list of professional contacts purchased from D&B. In addition, a few executives having quality responsibilities at six local hospitals were contacted and their participation in the online study was solicited. Sending the target respondents a link to the online survey is appropriate because the sample of the pilot test should be similar to that of the actual sample (Kaynak, 1997). A cover letter, presented in Appendix-A which explains the objectives of the study, was included in the email. Apart from the cover letter, the email contained a link to the consent form and the questionnaire hosted online (presented in Appendix- B). Although the sample size was small, the data obtained in the pilot test was used to perform preliminary analyses like reliability measures using Cronbach's α value.

Even after sending several reminders via email and phone over two months, only four completely-filled and eight more partially-completed surveys were received. After analyzing the percentage completion of the survey data, it was concluded that the length of the survey was a major reason causing potential respondents to drop out before completing the survey.

Since some fully completed survey data was available from the pilot study, reliabilities using Cronbach's α were calculated with an aim of preserving the most reliable items and also shortening the survey. From each scale, several items were eliminated which resulted in improving the scale reliabilities. One new item was added to fully capture the entire domain of the *internal lean practices* construct, while three existing items–two in the *supplier management relationship* scale and one in the *internal lean practices* scales–were reworded to make their meaning clearer. The two second order constructs–*supplier relationship management and* *internal lean practices*–were compressed to first order and were measured with six items each, while each of the other constructs were measured with four items. The questionnaire was thus shortened to its minimum length without compromising the reliabilities or the content validity of any scale. All shortened scales had Cronbach's α values greater than 0.8 and were thus acceptable[6]. The four items to measure the "marker" construct– *positive affectivity*–were preserved. Using the shortened questionnaire, a second pilot study was conducted again using the online questionnaire. Emails were sent to the remaining respondents in the list of 100, who had not yet responded to the first pilot survey. In addition, a few executives having quality responsibilities in six local hospitals (different set of people than those involved in the first pilot study) were personally invited to participate in the online pilot study. Within two weeks, a total of 14 completed responses were received in the second pilot study.

The reliability analysis of the data from the second pilot study indicates that Cronbach's α was greater than 0.8 for each scale and was therefore acceptable (Lance et al., 2006; Nunnally & Bernstein, 1994). Refer to Table 18 for the alpha values of each scale. Since the number of responses obtained in the pilot study is too small (i.e., only 14 completed responses), it was not possible to compute any other data analyses at this stage. Nevertheless, because the reliabilities of the scales were acceptable, it was decided to go ahead and conduct the main study with the revised framework.

Figure 4 gives the modified framework and the revised structural model empirically tested in this dissertation is presented in Figure 5. Refer to Table 19 for sources of the revised scale items, Table 20 for the summary of the revised scale items, and Appendix C for the revised items of each scale.

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[6] Value of Cronbach's α equal to or higher than 0.8 are considered acceptable (Lance, Butts, & Michels, 2006; Nunnally & Bernstein, 1994).

Table 18. Construct Reliabilities based on Second Pilot Study

Variables	Questionnaire Items	Cronbach's alpha (α)
Management leadership	1-4	0.84
Technology integration	5-8	0.84
Supplier relationship management	10-15	0.89
Healthcare team effectiveness	17-20	0.95
Internal lean practices	22-28	0.93
Quality of patient care		
Interpersonal quality	29-32	0.97
Technical quality	33-36	0.92
Environmental quality	37-40	0.85
Administrative quality	41-44	0.90
Positive affectivity (marker variable)	9,16,21,26	0.91

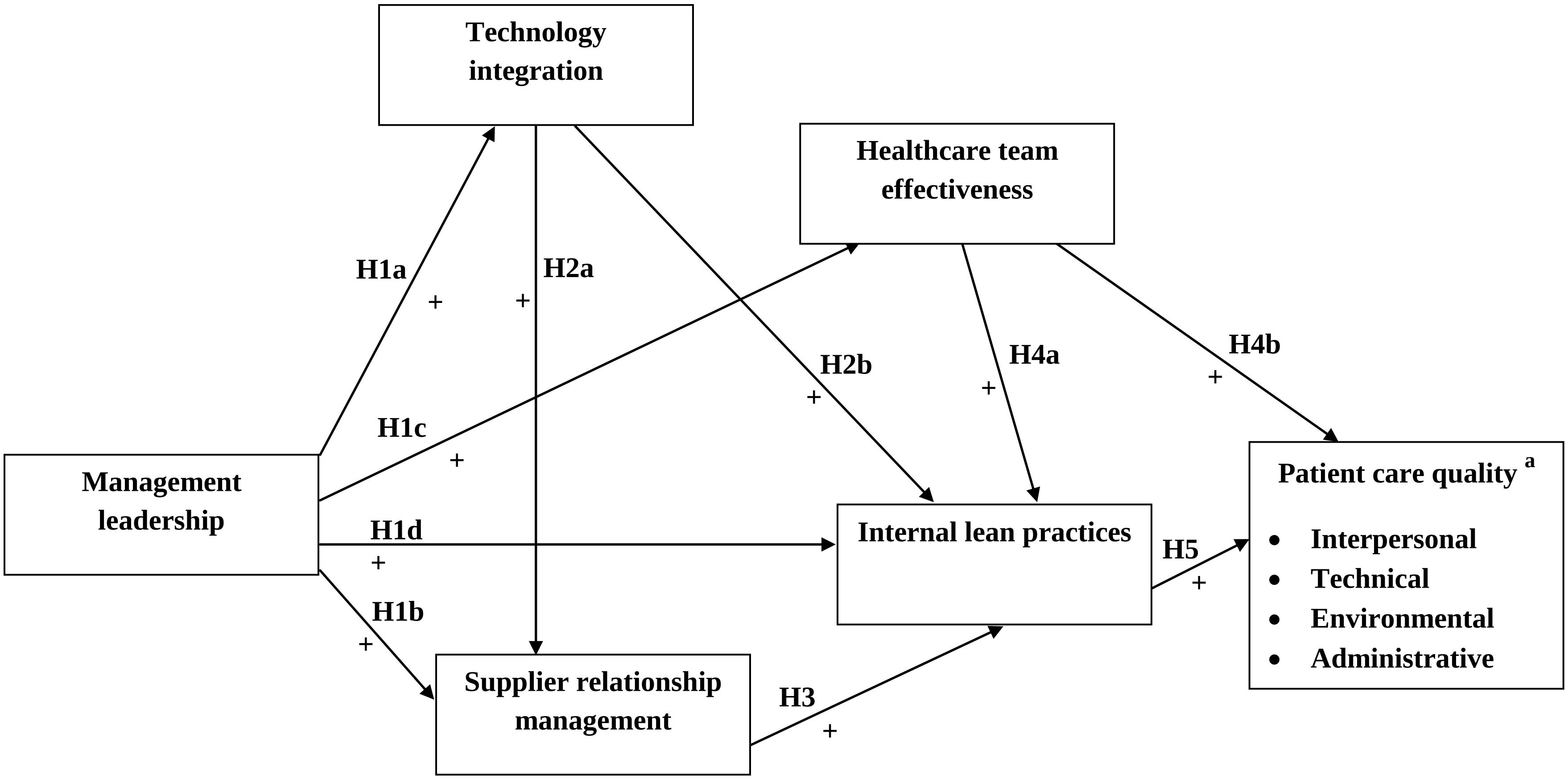

Figure 4. Revised Framework for Improving Quality of Hospital-Admitted Patient Care

Notes. [a] Bulleted items indicate the first order factors of the second-order construct.

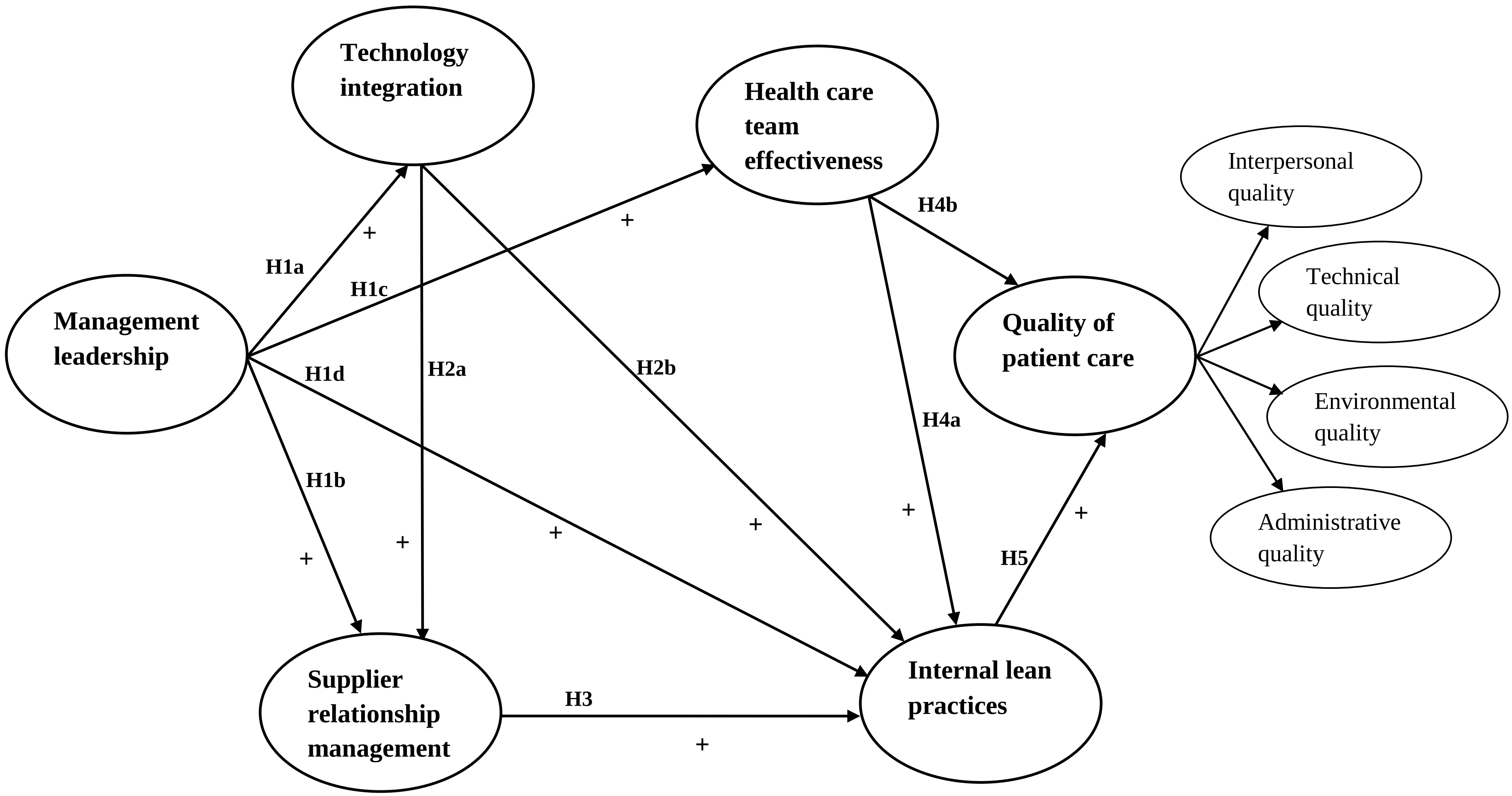

Figure 5. Revised Structural Model of Relationships among Research Variables

Table 19. Construction of the Revised Survey Instrument

Construct	Items	Sources
Management leadership	1-3	Adapted from Nelson et al. (2011)
	4	Adapted from Kaynak (2003)
Technology integration	5	Researcher created based on literature review (e.g., Beier, 1995)
	6-8	Adapted from Pare & Sicotte (2001)
Supplier relationship management		
Supplier flexibility	10	Adapted from Noordewier et al. (1990)
Supplier assistance	11	Adapted from Noordewier et al. (1990)
Supplier Information exchange	12	Adapted from Noordewier et al. (1990)
Supplier monitoring	13	Adapted from Stump & Heide (1996)
Continuity expectation	14	Adapted from Aulakh, Kotabe & Sahay (1996)
Quality of supplies	15	Adapted from Larson (1994)
Healthcare team effectiveness	17-20	Adapted from Poulton & West (1993, 1999)
Internal lean practices		
Patient and material flow	22	Researcher created based on literature review (e.g., Young et al., 2004)
management	23	Adapted from Shah & Ward (2007)
Continuous quality improvement	24	Adapted from Shortell et al.(1995)
	25	Researcher created based on literature review (e.g., Buetow & Roland, 1999; Shah & Ward, 2007)
Waste management	27	Adapted from Shah & Ward (2007)
	28	Researcher created based on literature review (e.g., Jimmerson et al., 2005)
Quality of patient care		
Interpersonal quality	29-32	Adapted from Dagger et al. (2007)
Technical quality	33-36	Adapted from Dagger et al. (2007)
Environmental quality	37-40	Adapted from Dagger et al. (2007)
Administrative quality	41-44	Adapted from Dagger et al. (2007)
Positive affectivity	9,16,21, 26	Adapted from Agho, Mueller, & Price (1993)
Respondent information	41-56	Adapted from Kaynak (1997)
Demographics		

Table 20. Revised Summary of Constructs and their Measurements

Construct	Type	Measurement mode	Values
Management leadership	Independent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Technology integration	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Supplier relationship management	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Internal lean practices	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Healthcare team effectiveness	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Quality of patient care			
Interpersonal quality	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Technical quality	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Environmental quality	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree
Administrative quality	Dependent Latent	Ordinal scale	1-7; 1=Strongly disagree; 7=Strongly agree

The notes given in Appendix-C indicate the three items that were modified from the earlier questionnaire to make their meaning clearer and the one item that was newly added in the revised scale to fully measure the domain of the construct. The first page introduced the potential respondent to the survey along with the consent form and a total of 10 pages displayed all 56 questions.

Based on the revised framework and questionnaire, the minimum sample size required for the study was recalculated. The same online calculator used before (Soper, 2006), was used again with the following values for the study: a medium sized effect of 0.15, nine latent and 40 observed variables in the research model, the required minimum power of 0.8, and the assumed probability (α) of 0.05. The minimum sample size required for the study was now reduced to 289. A screenshot of the online calculation is presented in Appendix F. A 10% response rate could be expected for most healthcare practitioner surveys (Cummings et al., 2001; Flanigan & McFarlane, 2008) such as that used in this study. Since the professional database had 4905 records of hospital executives (leaving out the 100 records that were randomly selected and used for the pilot study), all the remaining 4805 records of hospital executives were used for the main study.

A four-month long online survey campaign resulted in a total of 322 responses. Of the 4805 emails sent out in the campaign, 275 people informed the researcher that they did not fit the target population of the study. Furthermore, 1405 emails bounced back because people may have moved from their job and their earlier emails were disabled; hence, they never received the online questionnaire. Thus, the effective target population was 3125; thereby indicating a return rate was 10.3%, which is in line with recent survey results in extant OM literature (Handley &

Benton Jr, 2009; D.-Y. Kim, 2014) and healthcare literature (Cummings et al., 2001; Flanigan & McFarlane, 2008).

Seventeen responses had to be eliminated because they had one or more missing items among the 16 items that measured the outcome variable (patient care quality) in this study. Further, there were 11 cases of multiple respondents from the same hospital, including a response from the same respondent in a hospital who took the survey twice. As this study was being conducted at an organizational level (the hospital), all responses needed to represent unique hospitals. Therefore these 11 responses had to be dropped. Thus, a total of 294 usable responses remained and were used for all analyses.

Data Analysis Techniques

Once the data was collected, the sample demographics were examined using the software–SPSS Statistics v21. First, for all the variables in the research model frequency distributions were plotted and descriptive statistics were examined to test the assumptions of multivariate statistics. Box plots of the averages of each scale indicated that a few items were located outside the box and within the whiskers. Management leadership scale had five, technology integration had one, supplier relationship management had one, healthcare team effectiveness had two, internal lean practices had three, interpersonal quality had two, technical quality had two and environmental quality scale had five items, while administrative quality scale had no items in the whiskers. In addition to the box plots, extreme value analysis indicated the high and low values for each scale. From a statistical perspective, these data points could be considered as extreme values or outliers in the data. Upon cross-checking each of these respondents' answers to all questions, the extreme values were found to be reasonable. Further, the researcher did not want to lose any valid usable responses. Thus, no outliers were eliminated.

Second, Pearson correlations among research variables were checked along with the variance inflation factor (VIF) among each variable to check if multicollinearlity was an issue. VIF thresholds depend upon on the context of the study–in large samples, variances of estimates are generally small and a VIF of 10 may not present any significant problems, but in small samples, VIF of 2 may indicate multicollinearlity issues (Hair, Anderson, Tatham, & Black, 2009; O'brien, 2007).

Third, a missing item analysis revealed that 13 respondents (in the final usable 294 responses) had missed out indicating their choice for one out of the 40 items of the survey questionnaire. If the proportion of missing values is small, then single imputation methods based on multivariate normality are generally acceptable (Schafer, 1999). In this study, the percentage of missing items was miniscule (0.11 % because only 13 cases of missing values out of 40*294 final records). Hence using single imputation is acceptable. NORM, a commonly used software for single imputation (Darmawan & Gusti, 2002; Schafer & Graham, 2002) was used in the study for imputing the missing values. It uses the expectation-maximization (EM) algorithm (Dempster, Laird, & Rubin, 1977)–a technique that finds maximum likelihood estimates in parametric models for incomplete data. In NORM, the EM algorithm was first processed to estimate the parameters. Then the parameter based estimation was used to arrive at the final set of imputed values–one for each of the 13 missing values.

Fourth, in order to check for normality of the variable distributions, skewness and kurtosis and normality plots were checked for all 40 research variables. All variables were found to be negatively skewed and leptokurtic. Since none of the variables were normally distributed, normality correction was applied to each variable in the SEM software (LSIREL 8.53) before performing further SEM analyses.

Fifth, tests for reliability and unidimensionality were conducted by confirmatory factor analysis (CFA) (Anderson & Gerbing, 1988). As noted in Table 19, only four of the total 40 items used to measure the nine research constructs in the study have been created by the researcher based on supporting theory and extant literature and all the remaining 36 items have been adapted from existing scales in extant literature. If a conceptual underpinning to the items used to measure the constructs exists and a-priori hypotheses in the study are supported by theory, CFA instead of EFA may be considered as the logical step (Hurley, Scandura, Schriesheim, Brannick, Seers, Vandenberg, & Williams, 1997). Therefore, following Kaynak (2006), CFA was preferred over exploratory factor analysis (EFA) to establish the unidimensionality of all the scales because most of the scales have been developed/adapted based on literature and are supported by theory.

Cronbach's α estimate for each scale was calculated prior to establishing unidimensionality of the scales. Because Cronbach's α estimates are known to underestimate the true reliability when data are multidimensional (G. D. Garson, 2009; Osburn, 2000), two other indicators of reliability–Guttman's Lambda 2 (Guttman, 1945) and Raykov rho, also known as composite reliability (Raykov, 1998) were calculated for each scale. These indicators may give more accurate estimates of true reliability.

CFA was conducted using the measurement model, which allows all the factors in the model to covary. A number of indices were used to determine the fit of the model, including the χ^2/degrees of freedom ratio, parsimony goodness-of-fit indicator (PGFI), comparative fit index (CFI), parsimony normed fit index (PNFI), and root-mean squared error of approximation

(RMSEA). The value of GFI should be greater than 0.90, the values of PGFI and PNFI should be greater than 0.50 (Byrne, 1998; Mulaik et al., 1989) and RMSEA should be less than 0.08 to indicate a good fit of the model to the data. All indicator variables for each factor in the measurement model should have a *t*-statistic of 2.0 or greater and no standard error associated with the *t*-statistics should be close to zero (Carr, Kaynak, Hartley, & Ross, 2008). Also, the estimates for the composite reliability should be above 0.60 and the average variance extracted (AVE) should be above 0.50 (Carr et al., 2008).

Even though preliminary support for construct validity of scales used in the study already exists because many of the variables have been adapted from previously published research studies, convergent and discriminant validity were assessed to verify the fit of the model to the data collected in this study. Finally, structural equations modeling (SEM) was used in the study to simultaneously test the statistical significance of all the relationships among the variables. LISREL 8.53 was the SEM software used for the analysis. Although LISREL uses a more computing code approach than other user-friendly SEM software such as AMOS (Hair Jr., Gabriel, & Patel, 2014), many researchers prefer LISREL for larger more complex models and AMOS for smaller covariance-based SEM models. SEM provides an advantage over a series of separate hierarchical regressions in that it considers the effect of all variables together, some of which may decrease or weaken the strength of other relationships (Hair et al., 2009).

Chapter Summary

This chapter lists all the detailed procedures of the study including the pilot study that were performed to verify the questionnaire and the validity and reliability of the study. It also lists the target population, the sampling methodology and explains the sources of the scales that were used for the questionnaire. The revised framework that is empirically tested is also presented. The chapter ends with a discussion of the structural equations modeling (SEM) software tool that was used for analysis of the data and the approach followed in data analysis. The results of the study are presented in the subsequent chapter.

CHAPTER IV

RESULTS OF DATA ANALYSES

The results of the empirical study are presented in this chapter. First, the descriptive statistics for the variables in the research model are presented and the assumptions of multivariate tests are checked. Second, the results of the tests of the research model using structural equations modeling are highlighted. Finally, the different types of validity of the findings are discussed in detail.

Descriptive Statistics and Assumptions of Multivariate Tests

As already noted, the final usable sample contained 294 responses with only 13 missing values. In this section, descriptive statistics are presented first. The assumptions of multivariate tests, involving normality, linearity and homoscedasticity are then described.

Descriptive Statistics

As already mentioned, a box-plot and a descriptive extreme value analysis indicated that from a statistical perspective some values could be considered as potential outliers but the researcher did not want to eliminate any valid and reasonable data from the hospital executives. Hence, no outliers were eliminated. The descriptive statistics are presented in Table 21 and the correlation between all the 40 research variables is presented in Table 22. As expected, the correlations between the items of the same scale are high but between different items of different scales the correlations are low. All correlations are statistically significant.

Table 21. Descriptive Statistics for Research Variables

	Variable	Min	Max	Mean	SD
Management Leadership	Management supports a climate that promotes patient safety.	1	7	6.43	1.07
	Management has a clear picture of the risks associated with patient care.	1	7	6.11	1.25
	Management has a good idea of the mistakes that actually occur in the hospital.	1	7	5.87	1.25
	Management reviews patient care quality related issues in its meetings.	1	7	6.24	1.21
Technology Integration	The hospital follows an electronic ordering system for its supplies.	1	7	5.84	1.49
	Patient care software applications used in the hospital are integrated with each other.	1	7	4.95	1.68
	Different patient care software applications are integrated with other internal applications (e.g., pharmacy, radiology, laboratory, finance).	1	7	5.28	1.53
	Software applications used by different medical departments of the hospital (e.g., operating room, emergency room, laboratory, radiology and pharmacy) are integrated.	1	7	4.91	1.71
Supplier Relationship Management	Key suppliers are flexible to adjust to the changing demands of the hospital.	1	7	5.13	1.21
	Key suppliers make an effort to help the hospital during emergencies.	3	7	5.71	0.96
	Key suppliers provide information about changes to their existing products to the hospital.	1	7	5.52	1.10
	The hospital monitors the timeliness of delivery from its suppliers.	1	7	5.57	1.28
	The hospital and its key suppliers are committed to each other.	2	7	5.33	1.12
	The products and services provided by the suppliers meet required specifications.	1	7	5.86	0.96
Healthcare Team Effectiveness	Healthcare team members collaborate with each other.	1	7	5.89	1.05
	Healthcare team members value each other's roles.	1	7	5.69	1.12
	Healthcare team members share objectives of the team.	1	7	5.67	1.14
	Healthcare team members share learning with the team.	1	7	5.64	1.13

Table 21 Continued

	Variable	Min	Max	Mean	SD
Internal Lean Practices	Hospital equipment is arranged to help in the seamless flow of patients.	1	7	4.97	1.30
	Materials required for patients' medical treatments (e.g., medicines) are available to the healthcare team as and when needed.	1	7	5.65	1.17
	The hospital uses data-driven problem-solving approaches.	1	7	5.65	1.17
	The hospital considers quality improvement as a continuous process.	1	7	6.24	1.13
	The hospital orders supplies as and when required.	1	7	5.81	1.02
	The hospital departments improve processes so as to reduce wastes (e.g., by decreasing the turnaround time for transcription reports in the laboratory).	1	7	5.68	1.05
Patient care quality (PCQ)-Interpersonal Quality	Healthcare team members treat patients as individuals and not just numbers.	3	7	6.15	0.90
	Healthcare team members actively listen to what patients have to say.	3	7	5.89	0.94
	Healthcare team members give personalized attention to the patients.	2	7	5.99	0.96
	Healthcare team members are willing to answer questions that the patient or their kin may have.	3	7	6.09	0.87
PCQ-Technical Quality	Patients are administered the best medical care that is required to cure their ailment.	1	7	6.07	1.00
	Healthcare team members are well trained and qualified.	2	7	6.1	0.92
	Healthcare team members are highly skilled at their jobs.	2	7	6.12	0.90
	Healthcare team members carry out their tasks competently.	2	7	6.03	0.89
PCQ-Environmental Quality	The lighting at the hospital is appropriate.	2	7	5.98	0.98
	The temperature at the hospital is pleasant.	1	7	5.77	1.12
	The furniture at the hospital is comfortable.	1	7	5.48	1.22
	The interior design of the hospital is aesthetically pleasing.	1	7	5.44	1.30
PCQ-Administrative Quality	Internal hospital services (e.g., pathology) work well.	2	7	5.89	0.92
	The hospital records and documentation (e.g., billing) are error free	1	7	4.47	1.52
	The hospital provides patients with a range of support services.	2	7	5.9	1.13
	The hospital is well managed.	1	7	5.85	1.17

Table 22. Correlations among Research Variables

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Management supports a climate that promotes patient safety														
2	Management has a clear picture of the risks associated with patient care.	.83**													
3	Management has a good idea of the mistakes that actually occur in the hospital.	.72**	.78**												
4	Management reviews patient care quality related issues in its meetings.	.73**	.74**	.73**											
5	The hospital follows an electronic ordering system for its supplies.	.33**	.32**	.33**	.27**										
6	Patient care software applications used in the hospital are integrated with each other.	.28**	.28**	.25**	.22**	.32**									
7	Different patient care software applications are integrated with other internal applications (e.g., pharmacy, radiology, laboratory, finance).	.28**	.26**	.24**	.23**	.30**	.72**								
8	Software applications used by different medical departments of the hospital (e.g., operating room, emergency room, laboratory, radiology and pharmacy) are integrated.	.20**	.20**	.16**	.21**	.27**	.75**	.70**							
9	Key suppliers are flexible to adjust to the changing demands of the hospital.	.29**	.30**	.29**	.24**	.31*	.24**	.26**	.21**						
10	Key suppliers make an effort to help the hospital during emergencies.	.42**	.44**	.41**	.41**	.29**	.23**	.27**	.21**	.64**					
11	Key suppliers provide information about changes to their existing products to the hospital.	.31**	.37**	.34**	.38**	.26**	.22**	.21**	.22**	.64**	.62**				
12	The hospital monitors the timeliness of delivery from its suppliers.	.34**	.41**	.37**	.45**	.40**	.36**	.35**	.32**	.42**	.48**	.50**			
13	The hospital and its key suppliers are committed to each other.	.36**	.43**	.38**	.44**	.33**	.32**	.32**	.27**	.63**	.60**	.63**	.63**		
14	The products and services provided by the suppliers meet required specifications.	.52**	.53**	.42**	.47**	.31**	.41**	.38**	.34**	.48**	.60**	.53**	.58**	.60**	
15	Healthcare team members collaborate with each other.	.50**	.57**	.51**	.45**	.22**	.34**	.31**	.24**	.31**	.50**	.32**	.40**	.40**	.46**

Table 22 Continued

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
16	Healthcare team members value each other's roles.	.48**	.54**	.50**	.43**	.27**	.36**	.33**	.28**	.33**	.38**	.33**	.38**	.41**	.46**
17	Healthcare team members share objectives of the team.	.48**	.50**	.46**	.44**	.30**	.36**	.31**	.285**	.38**	.38**	.36**	.39**	.46**	.48**
18	Healthcare team members share learning with the team.	.53**	.54**	.52**	.43**	.29**	.32**	.32**	.27**	.42**	.45**	.35**	.39**	.48**	.49**
19	Hospital equipment is arranged to help in the seamless flow of patients.	.37**	.40**	.41**	.34**	.29**	.46**	.40**	.36**	.42**	.43**	.43**	.54**	.47**	.50**
20	Materials required for patients' medical treatments (e.g., medicines) are available to the healthcare team as and when needed.	.39**	.45**	.44**	.41**	.22**	.38**	.29**	.32**	.35**	.40**	.42**	.50**	.43**	.49**
21	The hospital uses data-driven problem-solving approaches.	.40**	.47**	.45**	.41**	.33**	.33**	.31**	.25**	.36**	.44**	.37**	.43**	.43**	.48**
22	The hospital considers quality improvement as a continuous process.	.62**	.64**	.59**	.59**	.27**	.30**	.27**	.24**	.28**	.44**	.39**	.43**	.44**	.53**
23	The hospital orders supplies as and when required.	.34**	.40**	.37**	.36**	.20**	.17**	.19**	.14*	.47**	.48**	.53**	.44**	.43**	.48**
24	The hospital departments improve processes so as to reduce wastes (e.g., by decreasing the turnaround time for transcription reports in the laboratory).	.46**	.42**	.45**	.45**	.32**	.33**	.34**	.30**	.45**	.45**	.49**	.49**	.49**	.59**
25	Healthcare team members treat patients as individuals and not just numbers.	.49**	.57**	.46**	.34**	.24**	.39**	.37**	.30**	.37**	.40**	.39**	.38**	.44**	.49**
26	Healthcare team members actively listen to what patients have to say.	.38**	.50**	.41**	.35**	.18**	.34**	.34**	.22**	.33**	.42**	.34**	.34**	.39**	.41**
27	Healthcare team members give personalized attention to the patients.	.32**	.41**	.37**	.29**	.14*	.38**	.36**	.24**	.30**	.34**	.24**	.35**	.33**	.38**
28	Healthcare team members are willing to answer questions that the patient or their kin may have.	.37**	.40**	.34**	.31**	.17**	.34**	.31**	.22**	.29**	.38**	.30**	.34**	.33**	.46**
29	Patients are administered the best medical care that is required to cure their ailment.	.51**	.51**	.46**	.36**	.22**	.28**	.27**	.17**	.31**	.38**	.27**	.35**	.32**	.46**

Table 22 Continued

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
30	Healthcare team members are well trained and qualified.	.50**	.55**	.47**	.42**	.27**	.37**	.37**	.27**	.34**	.41**	.30**	.41**	.36**	.55**
31	Healthcare team members are highly skilled at their jobs.	.43**	.48**	.42**	.35**	.26**	.35**	.39**	.27**	.28**	.38**	.27**	.42**	.31**	.48**
32	Healthcare team members carry out their tasks competently.	.38**	.45**	.42**	.37**	.28**	.33**	.36**	.24**	.32**	.35**	.30**	.41**	.34**	.44**
33	The lighting at the hospital is appropriate.	.33**	.39**	.35**	.32**	.41**	.33**	.31**	.22**	.30**	.33**	.25**	.42**	.38**	.44**
34	The temperature at the hospital is pleasant.	.34**	.43**	.37**	.30**	.33**	.33**	.30**	.22**	.27**	.29**	.25**	.40**	.35**	.43**
35	The furniture at the hospital is comfortable.	.34**	.39**	.34**	.28**	.34**	.39**	.33**	.28**	.34**	.33**	.30**	.41**	.40**	.41**
36	The interior design of the hospital is aesthetically pleasing.	.32**	.33**	.32**	.26**	.37**	.37**	.31**	.27**	.37**	.36**	.33**	.39**	.44**	.39**
37	Internal hospital services (e.g., pathology) work well.	.41**	.48**	.37**	.36**	.36**	.39**	.35**	.32**	.31**	.39**	.39**	.51**	.42**	.46**
38	The hospital records and documentation (e.g., billing) are error free	.23**	.31**	.28**	.24**	.15**	.33**	.31**	.27**	.30**	.37**	.32**	.33**	.34**	.37**
39	The hospital provides patients with a range of support services.	.36**	.42**	.36**	.28**	.28**	.37**	.40**	.28**	.28**	.39**	.23**	.37**	.36**	.40**
40	The hospital is well managed.	.47**	.56**	.47**	.45**	.19**	.31**	.31**	.22**	.28**	.38**	.32**	.40**	.43**	.47**

Table 22 Continued

	Variables	15	16	17	18	19	20	21	22	23	24
15	Healthcare team members collaborate with each other.										
16	Healthcare team members value each other's roles.	.81**									
17	Healthcare team members share objectives of the team.	.76**	.83**								
18	Healthcare team members share learning with the team.	.75**	.81**	.85**							
19	Hospital equipment is arranged to help in the seamless flow of patients.	.48**	.47**	.50**	.54**						
20	Materials required for patients' medical treatments (e.g., medicines) are available to the healthcare team as and when needed.	.54**	.52**	.53**	.51**	.67**					
21	The hospital uses data-driven problem-solving approaches.	.64**	.59**	.59**	.58**	.59**	.59**				
22	The hospital considers quality improvement as a continuous process.	.60**	.59**	.59**	.60**	.58**	.57**	.69**			
23	The hospital orders supplies as and when required.	.39**	.36**	.36**	.36**	.46**	.56**	.45**	.49**		
24	The hospital departments improve processes so as to reduce wastes (e.g., by decreasing the turnaround time for transcription reports in the laboratory).	.50**	.52**	.53**	.55**	.59**	.56**	.66**	.64**	.53**	
25	Healthcare team members treat patients as individuals and not just numbers.	.58**	.56**	.53**	.51**	.48**	.48**	.48**	.55**	.37**	.49**
26	Healthcare team members actively listen to what patients have to say.	.58**	.55**	.52**	.51**	.51**	.50**	.57**	.54**	.36**	.50**
27	Healthcare team members give personalized attention to the patients.	.53**	.50**	.45**	.43**	.49**	.46**	.48**	.46**	.34**	.49**
28	Healthcare team members are willing to answer questions that the patient or their kin may have.	.52**	.51**	.47**	.44**	.52**	.53**	.50**	.53**	.39**	.52**
29	Patients are administered the best medical care that is required to cure their ailment.	.60**	.59**	.54**	.56**	.48**	.58**	.53**	.60**	.39**	.48**
30	Healthcare team members are well trained and qualified.	.60**	.59**	.56**	.55**	.52**	.53**	.53**	.60**	.42**	.58**
31	Healthcare team members are highly skilled at their jobs.	.57**	.55**	.48**	.47**	.53**	.54**	.51**	.55**	.41**	.52**

Table 22 Continued

	Variables	15	16	17	18	19	20	21	22	23	24
32	Healthcare team members carry out their tasks competently.	.58**	.55**	.49**	.46**	.49**	.53**	.51**	.50**	.39**	.50**
33	The lighting at the hospital is appropriate.	.43**	.41**	.40**	.39**	.46**	.42**	.36**	.39**	.33**	.41**
34	The temperature at the hospital is pleasant.	.36**	.43**	.37**	.40**	.43**	.43**	.34**	.38**	.31**	.39**
35	The furniture at the hospital is comfortable.	.37**	.41**	.34**	.34**	.49**	.45**	.34**	.38**	.34**	.41**
36	The interior design of the hospital is aesthetically pleasing.	.38**	.38**	.37**	.35**	.52**	.39**	.40**	.35**	.29**	.45**
37	Internal hospital services (e.g., pathology) work well.	.52**	.48**	.51**	.46**	.51**	.54**	.52**	.52**	.42**	.54**
38	The hospital records and documentation (e.g., billing) are error free	.41**	.38**	.37**	.38**	.46**	.46**	.50**	.39**	.39**	.44**
39	The hospital provides patients with a range of support services.	.53**	.47**	.44**	.43**	.39**	.46**	.44**	.50**	.31**	.42**
40	The hospital is well managed.	.58**	.57**	.54**	.53**	.44**	.50**	.57**	.62**	.37**	.51**

	Variables	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
25	Healthcare team members treat patients as individuals and not just numbers.															
26	Healthcare team members actively listen to what patients have to say.	.77**														
27	Healthcare team members give personalized attention to the patients.	.70**	.78**													
28	Healthcare team members are willing to answer questions that the patient or their kin may have.	.70**	.78**	.77**												
29	Patients are administered the best medical care that is required to cure their ailment.	.62**	.66**	.63**	.67**											
30	Healthcare team members are well trained and qualified.	.65**	.65**	.65**	.65**	.75**										
31	Healthcare team members are highly skilled at their jobs.	.65**	.66**	.69**	.68**	.74**	.90**									
32	Healthcare team members carry out their tasks competently.	.61**	.65**	.69**	.67**	.71**	.82**	.87**								

Table 22 Continued

	Variables	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
33	The lighting at the hospital is appropriate.	.47**	.41**	.43**	.43**	.45**	.53**	.56**	.55**							
34	The temperature at the hospital is pleasant.	.42**	.40**	.36**	.39**	.43**	.51**	.50**	.48**	.71**						
35	The furniture at the hospital is comfortable.	.47**	.43**	.42**	.45**	.44**	.55**	.57**	.53**	.64**	.75**					
36	The interior design of the hospital is aesthetically pleasing.	.43**	.43**	.39**	.38**	.38**	.46**	.45**	.43**	.53**	.59**	.73**				
37	Internal hospital services (e.g., pathology) work well.	.55**	.50**	.49**	.52**	.52**	.60**	.59**	.58**	.62**	.56**	.61**	.57**			
38	The hospital records and documentation (e.g., billing) are error free	.39**	.48**	.41**	.43**	.42**	.47**	.47**	.43**	.34**	.35**	.48**	.42**	.48**		
39	The hospital provides patients with a range of support services.	.53**	.55**	.52**	.54**	.62**	.61**	.65**	.60**	.51**	.44**	.48**	.39**	.54**	.43**	
40	The hospital is well managed.	.55**	.58**	.55**	.56**	.62**	.64**	.65**	.62**	.43**	.46**	.47**	.43**	.59**	.49**	.59**

Notes. Pearson correlations are reported. ** Correlation is significant at the 0.01 level (2-tailed). For variables 5, 7, 10, 17, 20, 22 and 24, N = 293, while for variables 8 and 18, N = 292; for all other 31 variables, N = 294.

Next, the variance inflation factors (VIF) among all 40 research variables were checked. Because the study used a large sample of 294, the upper VIF threshold of 10 can be used (Hair et al., 2009; O'brien, 2007). None of the VIFs were above 10, thereby indicating that multicollinearlity did not pose a major challenge to the study.

The demographic profile of the respondents can be drawn from the following tables: gender (Table 23), age (Table 24), work experience (Tables 25, 26 and 27) and educational qualifications (Table 28). Women outnumbered men in the sample more than two to one–approximately 29 % of the respondents were male, while 67 % were female. The oldest respondent was 70; the youngest was 29, but the median age of respondents was 56 years. The majority of respondents held a master's degree (55.8 %) or a bachelor's degree (21.8 %). Respondents held high titles/positions in their respective hospitals because the sample was purposively selected to include key informants having upper ranks. Most respondents were experienced professionals–the median work experience in healthcare was 31 years; the median work experience in the current hospital was 13 years; while the median work experience in the current position was six years. Thus, based on their upper ranks, age, qualifications and long work experience, all respondents are likely to be fully aware of quality related issues in their hospital.

Table 23. Gender of Respondents

Gender	Frequency	Percent	Cumulative Percent
Male	86	29.25%	
Female	195	66.33%	95.58%
Not indicated	13	4.42%	100.00%
Total	294		

Table 24. Ages of Respondents

Age (years)	Frequency	Valid Percent	Cumulative Percent
61-70	71	24.15%	
51-60	127	43.20%	67.35%
41-50	52	17.69%	85.03%
31-40	17	5.78%	90.82%
< = 30	5	1.70%	92.52%
Not indicated	22	7.48%	100.00%
Total	294		

Table 25. Work Experience of Respondents in Healthcare

Yrs	Frequency	Percentage	Cumulative Percentage
< = 10	15	5.10%	
11-20	39	13.27%	18.37%
21-30	89	30.27%	48.64%
31-40	113	38.44%	87.07%
41-50	30	10.20%	97.28%
Not indicated	8	2.72%	100.00%
Total	294		

Table 26. Work Experience of Respondents in the Hospital

Yrs	Frequency	%	Cumulative %
< = 10	132	44.90%	
11-20	66	22.45%	67.35%
21-30	39	13.27%	80.61%
31-40	35	11.90%	92.52%
41-50	13	4.42%	96.94%
Not indicated	9	3.06%	100.00%
Total	294		

Table 27. Work Experience of Respondents in the Present Position

Yrs	Frequency	%	Cumulative %
< = 10	221	75.17%	
11-20	48	16.33%	91.50%
21-30	13	4.42%	95.92%
31-40	4	1.36%	97.28%
Not indicated	8	2.72%	100.00%
Total	294		

Table 28. Educational Qualifications of Respondents

Educational Qualification	Frequency	Percent	Cumulative Percent
Bachelor's Degree	64	21.8%	
MD	7	2.4%	24.1%
Master's Degree	164	55.8%	79.9%
Ph.D.	13	4.4%	84.4%
Other	37	12.6%	96.9%
Not declared	9	3.1%	100.0%
Total	294		

Assumptions of Multivariate Tests

The assumptions of multivariate tests include normality, homoscedasticity and linearity (Hair et al., 2009). Since the percentage of females in the sample is more than double that of males, a *MANOVA* was performed with the 40 research variables as dependent variables and gender as the independent variable to check if there was any significant difference in the variables between genders. The multivariate *F* was non-significant (refer to Table 29), thereby indicating that there were no significant differences among how males and females perceived and responded to the survey questions. *Levene's* test for equality of error variance was also non-significant for the majority of the variables (only for three items it was significant; see Table 30), thereby indicating that all variables had homoscedasticity.

Next, to verify if research variables are linearly related, scatter plots were checked for each variable. The scatter plots indicated that most of the data points were scattered uniformly around the central reference line (diagonal) in the plots. Therefore, variable relationships were linear.

Finally, the normality analyses of all the research variables were performed. Two ratios were calculated for each variable–skewness to its standard error and kurtosis to its standard error. The results are given in Table 31. For each research variable, the above two indicators were much above the threshold acceptable limits of -1 to +1. Further, the *Kolmogorov-Smirnov* and the *Shapiro-Wilk's* tests are significant, thereby indicating that the research variables were not normally distributed. All variables were negatively skewed and leptokurtic.

Table 29. MANOVA for Gender Differences

Multivariate Tests [a]						
	Effect	**Value**	**F**	**Hypothesis df**	**Error df**	**Significance**
Q10	Wilks' Lambda	0.85	1.05[b]	40	229	0.40

Notes. [a] Design: Intercept + Q10. [b] Exact statistic. Q10: Your sex is: Male/Female. Gender is the grouping variable (IV) while 40 research variables are the DV.

Table 30. Test for Homoscedasticity

Levene's Test of Equality of Error Variances [a]		
Variable	**F**	**Sig.**
Management supports a climate that promotes patient safety	0.26	0.61
Management has a clear picture of the risks associated with patient care.	0.49	0.48
Management has a good idea of the mistakes that actually occur in the hospital.	0.23	0.64
Management reviews patient care quality related issues in its meetings.	0.851	0.34
The hospital follows an electronic ordering system for its supplies.	1.692	0.19
Patient care software applications used in the hospital are integrated with each other.	0.00	1.0
Different patient care software applications are integrated with other internal applications (e.g., pharmacy, radiology, laboratory, finance).	1.13	0.29
Software applications used by different medical departments of the hospital (e.g., operating room, emergency room, laboratory, radiology and pharmacy) are integrated.	2.78	0.10
Key suppliers are flexible to adjust to the changing demands of the hospital.	0.89	0.35
Key suppliers make an effort to help the hospital during emergencies.	0.99	0.32
Key suppliers provide information about changes to their existing products to the hospital.	0.19	0.66
The hospital monitors the timeliness of delivery from its suppliers.	0.50	0.48
The hospital and its key suppliers are committed to each other.	1.74	0.19
The products and services provided by the suppliers meet required specifications.	0.93	0.34

Table 30 Continued

Variable	F	Sig.
Healthcare team members collaborate with each other.	4.51	0.04*
Healthcare team members value each other's roles.	1.19	0.28
Healthcare team members share objectives of the team.	0.00	0.95
Healthcare team members share learning with the team.	0.02	0.89
Hospital equipment is arranged to help in the seamless flow of patients.	0.04	0.85
Materials required for patients' medical treatments (e.g., medicines) are available to the healthcare team as and when needed.	4.46	0.04*
The hospital uses data-driven problem-solving approaches.	2.68	0.10
The hospital considers quality improvement as a continuous process.	1.35	0.25
The hospital orders supplies as and when required.	0.95	0.33
The hospital departments improve processes so as to reduce wastes (e.g., by decreasing the turnaround time for transcription reports in the laboratory).	1.19	0.28
Healthcare team members treat patients as individuals and not just numbers.	0.16	0.69
Healthcare team members actively listen to what patients have to say.	0.53	0.47
Healthcare team members give personalized attention to the patients.	0.38	0.54
Healthcare team members are willing to answer questions that the patient or their kin may have.	0.32	0.57
Patients are administered the best medical care that is required to cure their ailment.	0.72	0.40

Table 30 Continued

Variable	F	Sig.
Healthcare team members are well trained and qualified.	0.07	0.79
Healthcare team members are highly skilled at their jobs.	0.00	0.99
Healthcare team members carry out their tasks competently.	0.52	0.47
The lighting at the hospital is appropriate.	0.38	0.54
The temperature at the hospital is pleasant.	0.00	0.97
The furniture at the hospital is comfortable.	0.23	0.63
The interior design of the hospital is aesthetically pleasing.	0.69	0.41
Internal hospital services (e.g., pathology) work well.	1.43	0.23
The hospital records and documentation (e.g., billing) are error free	0.44	0.51
The hospital provides patients with a range of support services.	3.98	0.05
The hospital is well managed.	4.20	0.04[*]

Notes. [a] Tests the null hypothesis that the error variance of the dependent variable is equal across groups. [a] Design: Intercept + Q10. Q10: Your sex is: Male/Female. [*] Only three items out of the total 40 are significant at $p < 0.05$.

Table 31. Normality Test for Research Variables

	Variables	Skewness Statistic	Skewness Std. Error	Skewness/ SE	Kurtosis Statistic	Kurtosis Std. Error	Kurtosis/ SE	Kolmogorov-Smirnov [a] Statistic	Kolmogorov-Smirnov [a] df	Kolmogorov-Smirnov [a] Sig.	Shapiro-Wilk Statistic	Shapiro-Wilk df	Shapiro-Wilk Sig.
1	Management supports a climate that promotes patient safety	-3.10	0.14	-21.79	11.67	0.28	41.18	0.34	283	.000	0.57	283	.000
2	Management has a clear picture of the risks associated with patient care.	-2.04	0.14	-14.33	4.64	0.28	16.39	0.27	283	.000	0.71	283	.000
3	Management has a good idea of the mistakes that actually occur in the hospital.	-1.62	0.14	-11.37	3.14	0.28	11.08	0.26	283	.000	0.79	283	.000
4	Management reviews patient care quality related issues in its meetings.	-2.38	0.14	-16.75	6.46	0.28	22.80	0.30	283	.000	0.66	283	.000
5	The hospital follows an electronic ordering system for its supplies.	-1.60	0.14	-11.23	1.94	0.28	6.85	0.29	283	.000	0.75	283	.000
6	Patient care software applications used in the hospital are integrated with each other.	-0.77	0.14	-5.44	-0.31	0.28	-1.11	0.24	283	.000	0.88	283	.000
7	Different patient care software applications are integrated with other internal applications (e.g., pharmacy, radiology, laboratory, finance).	-1.06	0.14	-7.44	0.67	0.28	2.37	0.24	283	.000	0.86	283	.000
8	Software applications used by different medical departments of the hospital (e.g., operating room, emergency room, laboratory, radiology and pharmacy) are integrated.	-0.75	0.14	-5.25	-0.40	0.28	-1.41	0.24	283	.000	0.88	283	.000

Table 31 Continued

	Variables	Skewness		Skewness/ SE	Kurtosis		Kurtosis/ SE	Kolmogorov-Smirnov [a]			Shapiro-Wilk		
		Statistic	Std. Error		Statistic	Std. Error		Statistic	df	Sig.	Statistic	df	Sig.
9	Key suppliers are flexible to adjust to the changing demands of the hospital.	-0.91	0.14	-6.43	0.74	0.28	2.62	0.23	283	.000	0.88	283	.000
10	Key suppliers make an effort to help the hospital during emergencies.	-0.64	0.14	-4.49	0.14	0.28	0.49	0.26	283	.000	0.87	283	.000
11	Key suppliers provide information about changes to their existing products to the hospital.	-1.22	0.14	-8.55	1.71	0.28	6.03	0.30	283	.000	0.83	283	.000
12	The hospital monitors the timeliness of delivery from its suppliers.	-1.14	0.14	-8.03	1.19	0.28	4.19	0.26	283	.000	0.85	283	.000
13	The hospital and its key suppliers are committed to each other.	-0.59	0.14	-4.15	0.18	0.28	0.63	0.22	283	.000	0.90	283	.000
14	The products and services provided by the suppliers meet required specifications.	-1.29	0.14	-9.04	3.01	0.28	10.61	0.30	283	.000	0.82	283	.000
15	Healthcare team members collaborate with each other.	-1.62	0.14	-11.42	3.98	0.28	14.06	0.29	283	.000	0.78	283	.000
16	Healthcare team members value each other's roles.	-1.16	0.14	-8.17	1.72	0.28	6.08	0.26	283	.000	0.85	283	.000
17	Healthcare team members share objectives of the team.	-1.30	0.14	-9.15	2.25	0.28	7.95	0.27	283	.000	0.84	283	.000
18	Healthcare team members share learning with the team.	-1.20	0.14	-8.46	2.12	0.28	7.49	0.23	283	.000	0.84	283	.000
19	Hospital equipment is arranged to help in the seamless flow of patients.	-0.94	0.14	-6.58	0.56	0.28	1.99	0.28	283	.000	0.87	283	.000

Table 31 Continued

	Variables	Skewness		Skewness/SE	Kurtosis		Kurtosis/ SE	Kolmogorov-Smirnov [a]		Shapiro-Wilk	
		Statistic	Std. Error		Statistic	Std. Error		Statistic	Sig.	Statistic	Sig.
20	Materials required for patients' medical treatments (e.g., medicines) are available to the healthcare team as and when needed.	-1.43	0.14	-10.05	2.40	0.28	8.46	0.29	.000	0.81	.000
21	The hospital uses data-driven problem-solving approaches.	-1.21	0.14	-8.53	2.05	0.28	7.25	0.24	.000	0.85	.000
22	The hospital considers quality improvement as a continuous process.	-2.16	0.14	-15.23	5.41	0.28	19.10	0.28	.000	0.68	.000
23	The hospital orders supplies as and when required.	-1.26	0.14	-8.88	2.42	0.28	8.55	0.29	.000	0.83	.000
24	The hospital departments improve processes so as to reduce wastes (e.g., by decreasing the turnaround time for transcription reports in the laboratory).	-1.17	0.14	-8.21	2.10	0.28	7.40	0.28	.000	0.84	.000
25	Healthcare team members treat patients as individuals and not just numbers.	-1.33	0.14	-9.38	2.30	0.28	8.11	0.26	.000	0.79	.000
26	Healthcare team members actively listen to what patients have to say.	-0.84	0.14	-5.89	0.82	0.28	2.89	0.25	.000	0.85	.000
27	Healthcare team members give personalized attention to the patients.	-1.16	0.14	-8.20	1.97	0.28	6.94	0.25	.000	0.81	.000
28	Healthcare team members are willing to answer questions that the patient or their kin may have.	-1.02	0.14	-7.16	1.39	0.28	4.91	0.25	.000	0.81	.000

Table 31 Continued

	Variables	Skewness		Skewness/SE	Kurtosis		Kurtosis/ SE	Kolmogorov-Smirnov [a]		Shapiro-Wilk	
		Statistic	Std. Error		Statistic	Std. Error		Statistic	Sig.	Statistic	Sig.
29	Patients are administered the best medical care that is required to cure their ailment.	-1.75	0.14	-12.30	4.45	0.28	15.71	0.29	.000	0.76	.000
30	Healthcare team members are well trained and qualified.	-1.55	0.14	-10.88	3.96	0.28	13.97	0.27	.000	0.78	.000
31	Healthcare team members are highly skilled at their jobs.	-1.28	0.14	-8.98	2.39	0.28	8.44	0.25	.000	0.80	.000
32	Healthcare team members carry out their tasks competently.	-1.14	0.14	-8.00	2.18	0.28	7.71	0.27	.000	0.81	.000
33	The lighting at the hospital is appropriate.	-1.40	0.14	-9.86	2.52	0.28	8.88	0.31	.000	0.79	.000
34	The temperature at the hospital is pleasant.	-1.54	0.14	-10.86	3.03	0.28	10.70	0.32	.000	0.79	.000
35	The furniture at the hospital is comfortable.	-1.10	0.14	-7.75	1.09	0.28	3.86	0.28	.000	0.85	.000
36	The interior design of the hospital is aesthetically pleasing.	-1.00	0.14	-7.01	0.66	0.28	2.33	0.25	.000	0.87	.000
37	Internal hospital services (e.g., pathology) work well.	-1.29	0.14	-9.05	2.77	0.28	9.79	0.31	.000	0.81	.000
38	The hospital records and documentation (e.g., billing) are error free	-0.53	0.14	-3.71	-0.44	0.28	-1.55	0.23	.000	0.92	.000
39	The hospital provides patients with a range of support services.	-1.37	0.14	-9.67	1.99	0.28	7.01	0.28	.000	0.80	.000
40	The hospital is well managed.	-1.66	0.14	-11.67	3.47	0.28	12.26	0.31	.000	0.78	.000

Notes. [a] Lilliefors Significance Correction

In sum, because the data did not fully meet the assumption of normality, it was decided to continue with SEM analyses after applying the in-built normality correction in the SEM software package (LISREL 8.53) used for the study.

Tests of the Research Model using Structural Equations Modeling

In this section, the three components of construct validity–unidimensionality, convergent validity and discriminant validity are discussed for the measurement models. First, two measurement models were tested: the outcome variable of the research model, which was patient care quality (PCQ); and all variables other than PCQ. Then the tests for PCQ as a second-order variable are presented. Finally, the structural model or path analyses results are elaborated. In each section, tables and figures are used to present the results of the data analyses.

Tests for Reliability and Unidimensionality

For each scale, reliability was estimated using Cronbach's α values (Cronbach, 1951), followed by Guttman's Lambda and then composite reliability was calculated. The Cronbach's α, Guttman Lambda 2 coefficients and composite reliabilities for each scale are presented in Table 32. Except one scale (administrative quality) that had Cronbach's α value of 0.79, all others had values greater than 0.80 (α values ranged from 0.79 to 0.94). The values for Guttman Lambda 2 coefficients and the composite reliabilities for each scale were slightly higher or equal to those of Cronbach's α, exceeding the threshold value (Cf. Kaynak & Hartley, 2006; Bagozzi & Yi, 1988; Guttman, 1945). Therefore, as indicated by the values of all the three indicators-Cronbach's α, Guttman Lambda 2 coefficient, and composite reliability, all scales used in the study were reliable. It was decided to retain all items of each scale to preserve the content validity of the scales.

Table 32. Final Measurement Items, Reliabilities and Convergent validity

Measurement items	Cronbach's α	Guttman's Lambda 2	Composite reliability	Standardized loadings	*t*-value
Management Leadership	0.92	0.92	0.90		
1. Management supports a climate that promotes patient safety.				0.81	n/a [a]
2. Management has a clear picture of the risks associated with patient care.				0.88	17.31
3. Management has a good idea of the mistakes that actually occur in the hospital.				0.80	15.16
4. Management reviews patient care quality related issues in its meetings.				0.81	15.61
Technology Integration	0.81	0.83	0.83		
1. The hospital follows an electronic ordering system for its supplies.				0.38	n/a
2. Patient care software applications used in the hospital are integrated with each other.				0.88	6.39
3. Different patient care software applications are integrated with other internal applications (e.g., pharmacy, radiology, laboratory, finance).				0.82	6.32
4. Software applications used by different medical departments of the hospital (e.g., operating room, emergency room, laboratory, radiology and pharmacy) are integrated.				0.82	6.32
Supplier Relationship Management	0.89	0.89	0.89		
1. Key suppliers are flexible to adjust to the changing demands of the hospital.				0.75	n/a
2. Key suppliers make an effort to help the hospital during emergencies.				0.79	13.58
3. Key suppliers provide information about changes to their existing products to the hospital.				0.78	13.54
4. The hospital monitors the timeliness of delivery from its suppliers.				0.69	11.74
5. The hospital and its key suppliers are committed to each other.				0.83	14.40
6. The products and services provided by the suppliers meet required specifications.				0.74	12.70

Table 32 Continued

Measurement items	Cronbach's α	Guttman's Lambda 2	Composite reliability	Standardized loadings	*t*-value
Healthcare Team Effectiveness	0.94	0.94	0.93		
1. Healthcare team members collaborate with each other.				0.88	n/a
2. Healthcare team members value each other's roles.				0.91	22.76
3. Healthcare team members share objectives of the team.				0.88	20.86
4. Healthcare team members share learning with the team.				0.86	20.19
Internal Lean Practices	0.89	0.89	0.88		
1. Hospital equipment is arranged to help in the seamless flow of patients.				0.72	n/a
2. Materials required for patients' medical treatments (e.g., medicines) are available to the healthcare team as and when needed.				0.71	13.92
3. The hospital uses data-driven problem-solving approaches.				0.79	13.04
4. The hospital considers quality improvement as a continuous process.				0.79	12.90
5. The hospital orders supplies as and when required.				0.63	10.32
6. The hospital departments improve processes so as to reduce wastes (e.g., by decreasing the turnaround time for transcription reports in the laboratory).				0.79	12.89
Interpersonal Quality	0.92	0.92	0.93		
1. Healthcare team members treat patients as individuals and not just numbers.				0.84	n/a
2. Healthcare team members actively listen to what patients have to say.				0.90	19.56
3. Healthcare team members give personalized attention to the patients.				0.87	18.78
4. Healthcare team members are willing to answer questions that the patient or their kin may have.				0.87	18.75

Table 32 Continued

Measurement items	Cronbach's α	Guttman's Lambda 2	Composite reliability	Standardized loadings	*t*-value
Technical Quality	0.94	0.94	0.94		
1. Patients are administered the best medical care that is required to cure their ailment.				0.79	n/a
2. Healthcare team members are well trained and qualified.				0.93	19.35
3. Healthcare team members are highly skilled at their jobs.				0.96	20.14
4. Healthcare team members carry out their tasks competently.				0.89	18.06
Environmental Quality	0.88	0.89	0.88		
1. The lighting at the hospital is appropriate.				0.80	n/a
2. The temperature at the hospital is pleasant.				0.87	16.31
3. The furniture at the hospital is comfortable.				0.85	15.38
4. The interior design of the hospital is aesthetically pleasing.				0.68	11.99
Administrative Quality	0.79	0.79	0.82		
1. Internal hospital services (e.g., pathology) work well.				0.77	n/a
2. The hospital records and documentation (e.g., billing) are error free				0.63	10.96
3. The hospital provides patients with a range of support services.				0.74	13.00
4. The hospital is well managed.				0.79	14.14

Notes. [a] The first item in each scale does not have an associated *t*-value because it had a fixed parameter in LISREL. All *t*-values are significant at $p < 0.00001$.

Unidimensionality refers to whether each item measures one and only one construct (Cf. Kaynak & Hartley, 2006; Bagozzi, 1980). As per recommendations, after reliability is established, unidimensionality needs to be assessed (Kaynak & Hartley, 2006). For further refinement of reliable scales, an exploratory factor analysis (EFA) is normally recommended and should be followed by confirmatory factor analysis (CFA) (Cf. Kaynak & Hartley, 2006; Gerbing & Anderson, 1988). As already noted, the EFA step was skipped in this study because there is already is a conceptual underpinning to the items used to measure the constructs and all a-priori hypotheses of the study are supported by theory (Hurley et al., 1997). Next, the reliable scales were evaluated using CFA.

For conducting CFA, it is recommended that the measurement model for each factor be estimated separately; then the factors need to be combined into pairs and each pair needs to be estimated; and finally the measurement model for all factors should be estimated together (Cf. Kaynak & Hartley, 2006; Jöreskog & Sörbom, 1993). At each step, it should be assessed whether the model fits the data. The two measurement models–the first, containing all variables other than the outcome variable (PCQ) and the second, containing the four PCQ factors–were separately tested using LISREL 8.53 software (Jöreskog & Sörbom, 2002).

In the first measurement model that excludes the outcome variable (PCQ), the modification indices indicated that the model fit could be improved if the error terms between the two items of each of the following three scales were correlated: (1) the fourth and sixth items of the *supplier relationship management* scale ("The hospital monitors the timeliness of delivery from its suppliers" and "The products and services provided by the suppliers meet required specifications"); (2) the third and the fourth items of the *healthcare team effectiveness* scale ("Healthcare team members share objectives of the team" and "Healthcare team members share learning with the team"); and (3) the first two items of the *internal lean practices* scales ("Hospital equipment is arranged to help in the seamless flow of patients" and "Materials required for patients' medical treatments (e.g., medicines) are available to the healthcare team as and when needed").

Correlating the error terms of the two items of the *supplier relationship management* scale is justified. They are interrelated to some degree because only if the products/services meet the hospitals' specifications, the supplier delivery would be accepted or else the supplies would be rejected. Therefore, it may be noted that for suppliers to provide their products/services on time, their products/services must be of acceptable standards that meet the hospital specifications. This argument is supported by lean systems theory (Dahlgaard et al., 2011; B. B. Flynn et al., 1995; Kaynak, 1997, 2002; Monden, 1981; Ōno, 1988; Shah & Ward, 2003; Sugimori et al., 1977) which notes that just-in-time supplies must be of acceptable quality standards.

Similarly, correlating the error terms between the given items of the *healthcare team effectiveness scale* is justified because the items are related to some extent. If healthcare teams share their objectives and goals among themselves on a daily basis; they are likely to share their learning as well. Since an effective team would be well-knit, they are likely to share their lessons learnt and mistakes among themselves so as not to repeat them in the future, which is in line with QM theory (Deming, 1986; Feigenbaum, 1961; Kaynak & Hartley, 2008; McFadden, Henagan, & Gowen Iii, 2009; McLaughlin et al., 2004).

Finally, correlating the error terms between the above mentioned items of the *internal lean practices* scale is justified because the items are intertwined. Only if the hospital equipment and materials are organized or arranged to smooth the patient flow, they could be easily available for use by the healthcare team as and when needed. The 5S philosophy of lean systems theory (Dahlgaard et al., 2011; Monden, 1981; Ōno, 1988; Sugimori et al., 1977) supports the above assertion that avoiding clutter would help make items readily available when needed.

In the second measurement model for PCQ, the modification indices indicated that the model fit could be improved if the third and the fourth items of the *environmental quality* scale ("The furniture at the hospital is comfortable" and "The interior design of the hospital is aesthetically pleasing") are correlated. Correlating the error terms between the items of the *environmental quality* scale is justified because the items are somewhat connected. Once the furniture in a hospital is comfortable and suitably arranged, the aesthetics of the interior design would be better and thereby environmental quality of care in the hospital could be improved. Aesthetics is one of the eight dimensions of quality (performance, features, reliability, conformance, durability, serviceability, aesthetics and perceived quality) and thus, the assertion is supported by QM theory (Garvin, 1987; Sousa & Voss, 2002).

Next, the ratio of χ^2 to degree of freedom, root mean square error of approximation (*RMSEA*), a consistent version of the *Akaike's Information Criterion (CAIC),* the *Parsimony Goodness-of-Fit Index (PGFI),* the *Parsimony Normed Fit Index (PNFI)* and the *Comparative Fit Index (CFI)* were selected as indices to estimate the model fit. These fit indices, except RMSEA, were chosen because they can adjust for model complexity and degrees of freedom (Kaynak & Hartley, 2006). Although RMSEA is very sensitive to model complexity, it is one of the most useful criteria to indicate an absolute fit (Cf. Kaynak & Hartley, 2006; Byrne, 1998). These indices for the two measurement models are presented in Table 33. A comparison of the goodness-of-fit statistics to the recommended threshold values of these indices reveal a good fit of both the measurement models to the data.

Table 33. Confirmatory Factor Analysis and Path Analysis

Goodness-of-fit statistics	Measurement model: All variables other than PCQ	Measurement model: PCQ	Measurement model: Second order PCQ	Structural model	Recommended values for satisfactory fit of a model to data[+]
χ^2/df	517.21/239 = 2.16	220.78/97 = 2.28	238.93/99 = 2.41	1617.39/727 = 2.22	< 3.0[a]
Root mean square error of approximation (RMSEA)	0.06	0.06	0.06	0.06	< 0.08[b]
90% confidence interval for RMSEA	(0.05-0.07)	(0.05-0.07)	(0.05-0.07)	(0.06-0.07)	Narrow confidence interval; lower and upper bounds <0.08[c]
Akaike's information criterion (CAIC)	913.00	462.66	465.66	2123.03	
CAIC for saturated model	2,005.07	908.97	908.97	5480.54	< Saturated model and Independent model [c]
CAIC for independent model	15,657.1	11,383.89	11,383.89	45,251.94	
Parsimony goodness-of fit index (PGFI)	0.70	0.66	0.67	0.70	> 0.50[d]
Parsimony Normed Fit Index (PNFI)	0.84	0.79	0.81	0.90	> 0.50[d]
Comparative Fit Index (CFI)	0.98	0.99	0.99	0.98	> 0.90[b]

Notes. df = degrees of freedom. [a] Bollen (1989), Carmines and McIver (1981), and Hair et al. (2009). [b] Byrne (1998), Jaccard and Wan (1996), and Jöreskog and Sörbom (1993). [c] Byrne (1998) and Jöreskog and Sörbom (1993). [d] Byrne (1998) and Mulaik et al. (1989). [+] The recommended threshold values are adapted from Kaynak & Hartley (2006).

Convergent Validity and Discriminant Validity

Convergent validity refers to the extent to which multiple attempts to measure the same constructs give similar results (Cf. Kaynak & Hartley, 2006; Bagozzi, Yi, & Phillips, 1991; Hoskisson, Hitt, Johnson, & Moesel, 1993). High convergent validity exists if the correlations between measures of the same construct using different methods are high (Cf. Kaynak, 1997; Crocker & Algina, 1986). All the standardized factor loadings and their respective *t*-values shown in Table 32 are statistically significant. Further, each item's coefficient was greater than twice its standard error, which implies that loadings of the items on their respective factors are significant, demonstrating high convergent validity (Anderson & Gerbing, 1988).

Discriminant validity refers to the extent to which measures of different constructs are separate (Cf. Kaynak & Hartley, 2006; Bagozzi et al., 1991; Hoskisson et al., 1993). It was assessed by three methods. In the first method, χ^2 difference tests between a constrained and an unconstrained model were performed (Anderson & Gerbing, 1988). In the constrained model, each pair of factor correlations was set to 1.0 and separate tests were performed for each pair. The revised significance level, α, was arrived at by dividing the original α (0.05) by the number of tests performed (10 for the measurement model and 6 for PCQ model) (Anderson & Gerbing, 1988). Thus, the revised significance level, α was 0.005 (0.05/10) for the measurement model and 0.008 (0.05/6) for the PCQ model, respectively. As shown in Table 34, significant χ^2 difference between each constrained model and the unconstrained model (lower χ^2 for the unconstrained model) demonstrates that factors have discriminant validity. The χ^2 differences between each constrained model and unconstrained model are statistically significant (a significantly lower χ^2 for the unconstrained model) at $p < 0.000001$.

Table 34. Discriminant and Criterion Validity

Variables	1	2	3	4	5	6	7	8	9
1 Management Leadership	**0.69**[a]								
2 Technology Integration	0.33[b] (0.00001)[c] (0.21-0.45)[d] 595.46[e]	**0.57**							
3 Supplier Relationship Management	0.59 (0.00001) (0.49-0.67) 410.61	0.44 (0.00001) (0.32-0.54) 363.65	**0.59**						
4 Healthcare Team Effectiveness	0.62 (0.00001) (0.55-0.71) 417.49	0.41 (0.00001) (0.31-0.53) 399.57	0.56 (0.00001) (0.47-0.65) 571.55	**0.78**					
5 Internal Lean Practices	0.68 (0.00001) (0.62-0.77) 276.64	0.49 (0.00001) (0.38-0.59) 342.04	0.76 (0.00001) (0.69-0.82) 197.97	0.75 (0.00001) (0.69-0.82) 282.42	**0.55**				
6 Interpersonal Quality	0.48 (0.000)	0.39 (0.000)	0.50 (0.000)	0.61 (0.000)	0.67 (0.000)	**0.76**			
7 Technical Quality	0.53 (0.000)	0.40 (0.000)	0.49 (0.000)	0.64 (0.000)	0.69 (0.000)	0.80 (0.00001) (0.75-0.85) 294.01	**0.79**		
8 Environmental Quality	0.43 (0.000)	0.46 (0.000)	0.52 (0.000)	0.48 (0.000)	0.57 (0.000)	0.59 (0.00001) (0.49-0.67) 403.02	0.67 (0.00001) (0.60-0.75) 349.49	**0.63**	
9 Administrative Quality	0.51 (0.000)	0.46 (0.000)	0.56 (0.000)	0.63 (0.000)	0.73 (0.000)	0.81 (0.00001) (0.75-0.87) 96.77	0.86 (0.00001) (0.81-0.91) 71.54	0.81 (0.00001) (0.73-0.86) 86.09	**0.54**

Notes. [a] Values on the diagonal (bolded) are the average variance extracted for each construct. [b] Values represent bivariate correlations among the pair of variables. Correlations between the PCQ factors are estimated in LISREL while correlations between PCQ factors and other variables are calculated in SPSS by taking average score of each factor. [c] Corresponding *p*-values of the bivariate correlations are indicated parentheses. [d] The confidence interval for each bivariate correlation is calculated as +_2 standard errors. [e] χ^2 differences between each constrained model and unconstrained model. Difference in degree of freedom = 1. All differences on pair wise comparisons of the scales were significant at $p < 0.000001$.

A second test for discriminant validity involves constructing confidence intervals (±2 standard errors) around the correlation estimate between two factors. If the confidence interval does not include 1.0, discriminant validity is achieved (Cf. Kaynak & Hartley, 2006; Anderson & Gerbing, 1988). From Table 34, it is clear that none of the confidence intervals for each bivariate correlation of factors includes 1.0.

A third test for discriminant validity requires comparison between the squared correlation of each pair of factors and the average variance extracted (AVE) for each factor. As shown in Table 34, discriminant validity is demonstrated since the squared correlation of two factors is less than the average variance extracted for each factor (Cf. Kaynak & Hartley, 2006; Fornell & Larcker, 1981). The results of all three tests taken together suggest that all constructs had discriminant validity.

Criterion Validity

Criterion-related validity refers to the degree to which predictions from a theoretical framework are supported (Cf. Kaynak, 1997; Venkatraman & Grant, 1986). Based on theory, a criterion variable is identified which should correlate highly with the predictor test scores (Cf. Kaynak, 1997; Crocker & Algina, 1986; Nunnally & Bernstein, 1994). Validity is indicated by the size of the correlation between the predictor test scores and the criterion variable (Nunnally & Bernstein, 1994). Based on extant literature, healthcare team effectiveness and internal lean practices should be correlated to each of the four dimensions of the outcome variable in the study-PCQ.

First, the rationale for correlations between healthcare team effectiveness and PCQ are highlighted. Interpersonal quality of patient care refers to the relationship developed and the dyadic interplay that occurs between the healthcare team and patient. An effective healthcare team uses physician empathy (S. S. Kim et al., 2004) and nurse emotional involvement (McQueen, 2000) to positively influence the interpersonal relationships that the healthcare teams are able to establish with patients. In order to be effective, healthcare teams take an active interest in each patient's medical condition, empathize with their suffering (Roark & Sharah, 1989), communicate clearly to the patient and his/her kin about their medical condition and unanimously work towards their quicker cure, resulting in better quality of patient care (Deeter-Schmelz & Kennedy, 2003).

Technical quality reflects the expertise, professionalism, and competency of the healthcare team in curing the patient of his/her ailment. In order to be effective, healthcare teams use EHR and other hospital medical information systems (Graetz et al., 2014) to have all patient information readily available to the physicians for decision making and nurses for support (C. Chen et al., 2009; Jha et al., 2009).

Environmental quality comprises hospital atmosphere related to cleanliness and tangibles, such as hospital bed and necessary equipment like drip stands and other required equipment for patient health needs. Effective healthcare teams follow hospital procedures, take all necessary precautions related to hygiene, ensure that all physical elements of the hospital including the beds and other medical and surgical equipment are thoroughly cleaned and disinfected before use on any patient (Carling et al., 2008). Further, effective healthcare teams interact with housekeeping to ensure that the hospital wards are organized, clean and aesthetically pleasing (Mathur, 2014; Wearmouth, 2001).

Administrative quality refers to those hospital activities that support the patient cure while adding value to patient (e.g., clarifying questions by the billing department, promptly fixing appointments with doctors by the reception). Effective healthcare teams interact closely with the hospital's administrative units (White & Whitman, 2006) to ensure that information is provided timely to the patients or their next of kin. Because administrative support is a key element of patient care (Grumbach & Bodenheimer, 2004), effective healthcare teams frame a few preliminary procedures of their own to educate patients on simple administrative steps such as making hospital visit appointments, and when required, interacting with the hospital's administrative departments on behalf of patients (Grumbach & Bodenheimer, 2004).

In sum, it is suggested that having effective healthcare teams in the hospital reduces the cost of the medical procedures/surgery, avoids unnecessary delays and reduces variability in healthcare processes (Vashdi, Bamberger, & Erez, 2013). Effective healthcare teams avoid medical errors, check schedules and room/equipment availability in advance of patients' medical procedures, take steps to prevent infections in hospitals and keep the patients' care at the forefront of their decision making (Grumbach & Bodenheimer, 2004). All these activities make patient care safer and more accurate, improving its overall quality.

Next, moving to internal lean practices, it may be noted that one of the objectives of lean implementation in a firm is to have high service quality (Dean Jr & Snell, 1996; Fullerton & McWatters, 2001). To deliver high quality of patient care both physicians and nurses need to master two aspects of medical care. First, practitioners need to develop expertise in the technical aspects of patient care, i.e., the medical diagnosis and cure procedures and treatments need to be. Second, they also need to learn the interpersonal attributes of patient care, i.e., keeping the patient well informed about the medical treatment that is required and its side-effects, empathizing with patients so that they are not overly worried (Hudelson et al., 2008; Marley et al., 2004).

Hospitals need to medically treat only the number of patients that they can handle; therefore the smooth flow of patients needs to be managed (Heineke, 1995). Smooth material flow in the hospital help decrease the average wait times for patients before their surgery or other medical procedures (Baltacioglu et al., 2007) by ensuring that appropriate medical equipment and supplies and suites like ICUs are available when needed. Longer wait times add additional stress to patients (Paterson et al., 2006), complicate patients' ailments, cause additional medical procedures to be performed on patients, and sometimes may result in preventable outcomes like death (Derlet & Richards, 2000). Patient and material flow are positively related to both the interpersonal and technical patient care quality.

As noted earlier, all physical elements of a patient's environment such as the hospital bed, clothes and equipments must be fully clean and disinfected (Aiken et al., 2008) in order to prevent HAI (Pittet et al., 2000). Support from the administrative departments of a hospital such as billing and reception are also crucial to improving patient care quality (Bokar & Perry, 2007; Conway, 1997). Implementing lean principles in a hospital encourages all practitioners to continuously develop expertise in their own areas of work, and to collaborate and share their knowledge with others in the healthcare teams (Sui-PPheng & Khoo, 2001), because value addition (Joosten et al., 2009) and waste reduction (Toussaint & Berry, 2013) are two important concerns in a lean implementation. Thus, CQI and waste reduction, which are very important in lean philosophy, are related to the technical, environmental and administrative patient care quality. Based on the above discussions, it is suggested that lean implementation in the hospitals positively impacts all the four dimensions of patient care quality

In this study, subjects rated the importance of healthcare team effectiveness and internal lean practices to patient care quality using the online questionnaire, keeping in mind the situation in their own hospital. A close look at Table 34 shows strong correlations among healthcare team effectiveness and the four dimensions of PCQ–*interpersonal, technical, environmental* and *administrative quality*, and among *internal lean practices* and the four PCQ dimensions. Except for one correlation between healthcare team effectiveness and environmental quality (which is close to 50%), all other correlations are higher than 50 % and even closer to 60 %. All correlations are also statistically significant. Therefore, the above results taken together indicate that the constructs had criterion-related validity.

Second-Order Factor model for PCQ

A second-order factor model can be tested if theory indicates that correlations among the first-order factors can be explained by a higher order factor (Cf. Kaynak & Hartley, 2006; Bollen, 1989; Byrne, 1998; Rindskopf & Rose, 1988). Theoretical relationships exist among the four PCQ factors–*interpersonal, technical, environmental* and *administrative quality* (Dagger et al., 2007; Gill & White, 2009). In this study, the four PCQ factors are considered as dependent variables and PCQ, an independent variable (Byrne, 1998). The second-order factor model for PCQ is presented in Figure 6.

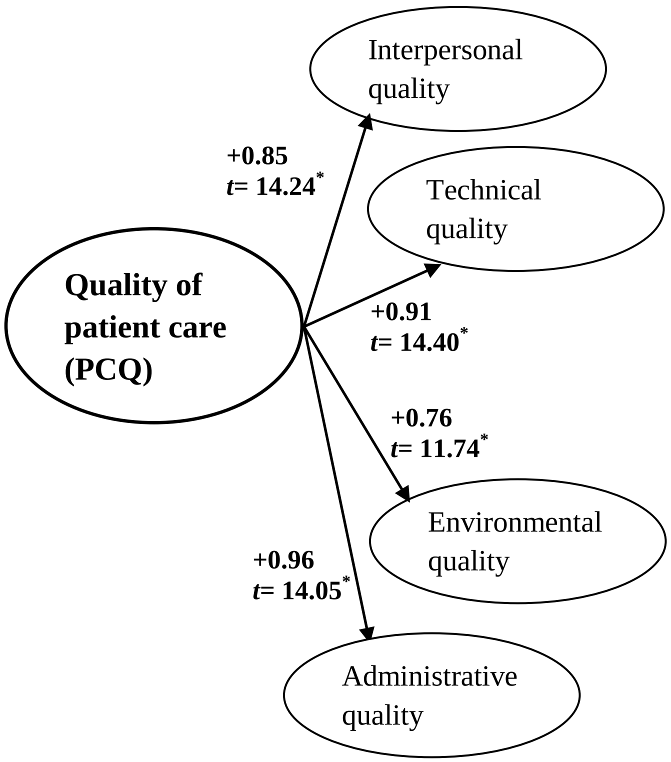

Figure 6. Second-order Factor Model for PCQ

Notes. The standardized estimated path coefficients and the associated *t*-values are shown. All *t*-values are significant at $p < 0.00001$.

The goodness-of-fit indices pertaining to the second-order model are presented in Table 33. Standardized loadings of the first-order factors on the second-order variable and their corresponding *t*-values are indicated in Figure 6. Factor loadings ranged from 0.63 to 0.96 and are significant at $p < 0.00001$. A comparison of the goodness-of-fit indices to their recommended values reveals that the second-order factor model is a good fit to the data. The target coefficient (T) index, the ratio of the χ^2 value of the first-order model to that of the second-order factor model (Kaynak & Hartley, 2006), was used to assess the fit of the second-order factor model relative to the first-order factor model. A target coefficient value of 1.0 would indicate that the second-order factor model completely explains the relations among the first-order factors (Cf. Kaynak & Hartley, 2006; Marsh & Hocevar, 1985). The target coefficient of 0.92 (220.782/238.928) indicates that 92% of the covariation among four PCQ factors can be accounted for by the PCQ construct (Kaynak & Hartley, 2006). Therefore, the data indicates a good fit of the second-order factor structure for PCQ.

Test of the Structural Model

The SEM results of the relationships among the research variables are depicted in Figure 7. Each path in the figure represents the associated hypotheses and the estimated path coefficients (standardardized) and *t*-values are shown on each path. The goodness-of-fit statistics used to assess the fit of the data to the hypothesized model are the same as those used to test the measurement models and are presented in Table 33. Compared to the recommended threshold values of the fit indices, the goodness-of-fit indices for the hypothesized model reveal a good fit of the model to the data. All coefficients of the 10 hypothesized paths in the model are significant and positive (i.e., the results are in the direction hypothesized); hence all hypotheses are supported. A summary of the results of all hypotheses is presented in Table 35.

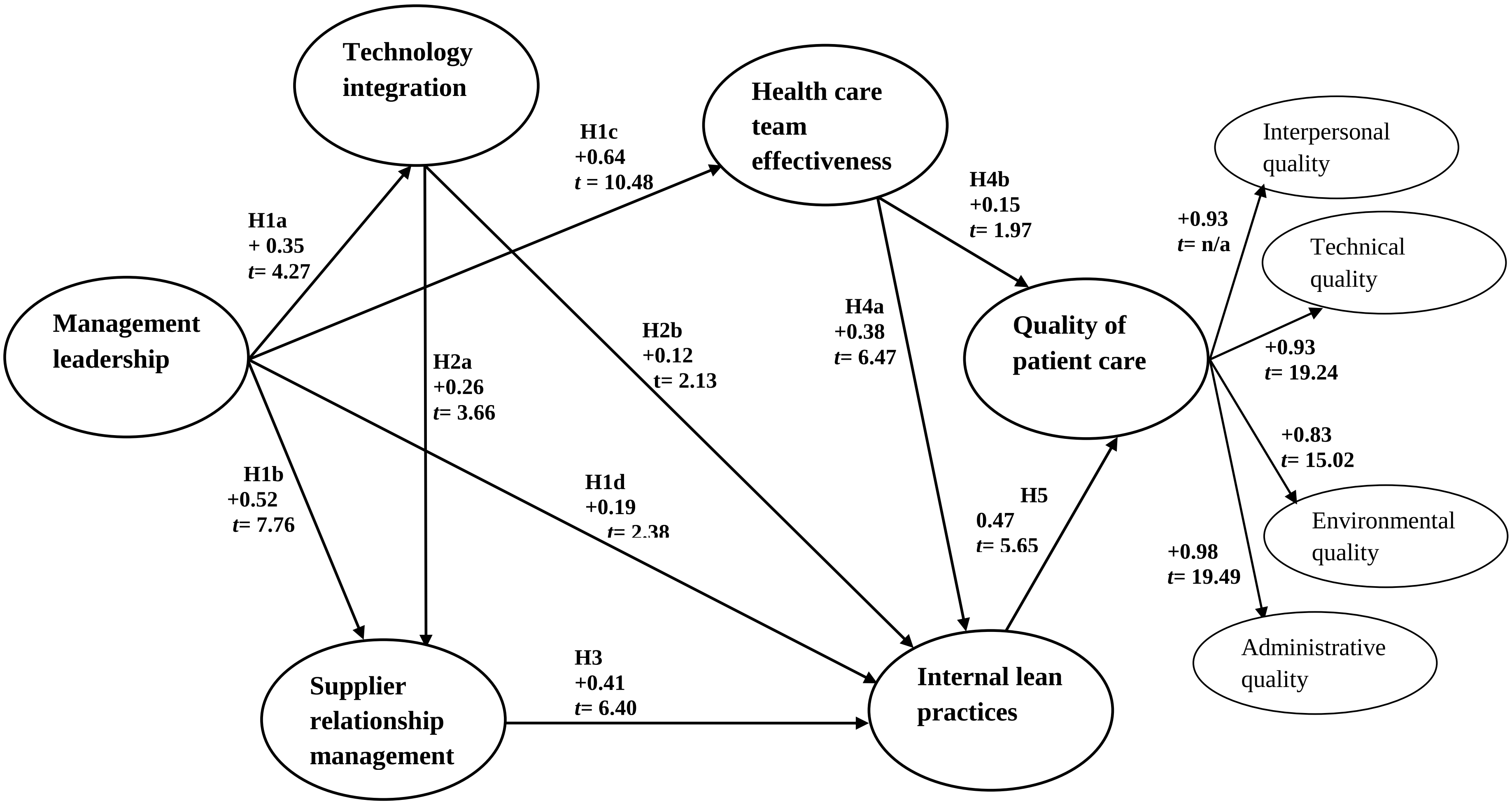

Figure 7. Structural Model Results

Notes. The standardized estimated path coefficients and the associated *t*-values are shown. All *t*-values are significant at $p < 0.05$. With degrees of freedom =727 for *t*-values > = 2.59, the corresponding *p*-value is < 0.01; for *t*-values > = 4.45, the corresponding *p*-value is < 0.00001(Stangroom, 2015). The path *PCQ-Interpersonal quality* does not have an associated *t*-value because it had a fixed parameter in LISREL.

Table 35. Results of Research Hypotheses

#	Hypotheses	Result
H1a	Management leadership is positively related to technology integration.	Supported
H1b	Management leadership is positively related to supplier relationship management.	Supported
H1c	Management leadership is positively related to healthcare team effectiveness.	Supported
H1d	Management leadership is positively related to internal lean practices.	Supported
H2a	Technology integration is positively related to supplier relationship management.	Supported
H2b	Technology integration is positively related to internal lean practices.	Supported
H3	Supplier relationship management is positively related to internal lean practices.	Supported
H4a	Healthcare team effectiveness is positively related to internal lean practices.	Supported
H4b	Healthcare team effectiveness is positively related to patient care quality.	Supported
H5	Internal lean practices are positively related to patient care quality.	Supported

Notes. All *t*-values are significant at $p < 0.05$. With degrees of freedom =727 for *t*-values > = 2.59, the corresponding *p*-value is < 0.01; for *t*-values > = 4.45, the corresponding *p*-value is < 0.00001 (Stangroom, 2015).

Validity of Findings

In this section several validity-related issues are discussed. They are grouped into four sub-sections: (1) statistical conclusion validity; (2) internal validity; (3) construct validity; and (4) external validity.

Statistical Conclusion Validity

In correlational research the major threats to this validity can come from low statistical power, violated assumptions of statistical tests, non-reliability of measures, non-response bias and Type I error (Kaynak, 1997). Table 36 gives a summary of the validity types and the potential threats to each. A power analysis performed before conducting the survey indicated that with an α (Type I error rate) of 0.05 (5 %), a minimum sample size of 289 would be required to have an overall power of 80 % for the study (Soper, 2006). The study had 294 usable responses; therefore, it may be concluded that the power of the study would be acceptable. Nevertheless, following guidelines from extant literature (Hoyle, 2014; MacCallum, Browne, & Cai, 2006; MacCallum, Browne, & Sugawara, 1996; MacCallum & Hong, 1997), a post-hoc power analysis was performed for SEM structural model using the root mean squared error of approximation (RMSEA) that was obtained. Results presented in Appendix-G indicate that the study had a power level of 1.0. Thus, low statistical power was not a concern for the study.

Assumptions of Statistical Tests. As noted earlier, all assumptions of multivariate tests were not satisfied. Although all the research variables were linear and homoscedastic, they were not normally distributed. It was therefore decided that data analyses would be conducted only after applying the in-built normality correction in the SEM software package (LISREL 8.53). Hence, assumptions of statistical tests did not pose any major issue to the study's findings.

Table 36. Different Types of Validity and Potential Threats

Type of Validity [a]	Definition	Threats
Statistical conclusion	Related to the factors that could affect the statistical analysis	• Low statistical power • Violated assumptions of statistical tests • Reliability of measures • Non-response bias • Type I error
Internal	Concerned with the threat from other variables, not considered in the research model, explaining the significant correlations between the research variables–both independent and dependent	Variables not accounted for in the research model
Construct		• Incomplete definition and explanation of constructs • Common method variance
• Content	• Content validity refers to whether each scale taps into the complete domain of the phenomenon it is trying to measure	
• Unidimensionality	• Unidimensionality refers to the concern whether the internal structures of the set of variables really measure a construct	
• Convergent	• Convergent validity is concerned with the extent to which multiple attempts to measure the same constructs agree with each other	
• Discriminant	• Discriminant validity refers to the extent to which measures of different constructs are truly separate	
• Criterion-related	• Criterion-related validity refers to the degree to which predictions from a theoretical framework are supported	
External		• Cost-restricted sampling • Self-selection and volunteer bias • Temporal effects • Regional differences
• Population	• Population validity refers to the extent to which the research sample could be generalized to the target population	
• Ecological	• Ecological validity is concerned with to extent to which the findings of the study could be generalized from one context to another, such as different places and times	

Notes. [a] Adapted from Kaynak (1997)

Reliability of Measures. As noted before, three indicators–Cronbach's α, Guttman's Lambda 2 and composite reliability–were used to measure the reliability of each scale. The results indicate that for each scale the values of the three indicators were higher than or close to 0.8, which were acceptable (Lance et al., 2006; Nunnally & Bernstein, 1994). Thus, reliability of measures was not an issue for the study.

Non-response Bias. A non-response bias is known to distort the reliability of the data by under-representing a few groups while over-representing a few others (Alreck & Settle, 1985). The respondents in the sample could be broadly divided into one of three groups–early, middle and late responders. According to extant literature (Lindner, Murphy, & Briers, 2001), those who generally respond to the survey within the first 30 days of the campaign should be considered early respondents . Those who respond to the last wave of contact should be considered late respondents. If the last wave does not generate 30 or more responses then the respondents in the last two waves should be considered late responders. If this process still does not yield 30 responses, the authors (Lindner et al., 2001) suggest using the latter 50% of responders as the late responder group. All remaining respondents could be grouped as middle respondents.

As already mentioned, the study took four months. Therefore, following the guidelines (Lindner et al., 2001), all respondents who completed the survey within the first four weeks (first month) were considered as early; all respondents who completed the survey in the middle eight weeks (two months) were considered middle respondents, while all respondents who completed the survey in the last four weeks (one month) were considered late. Of the total 294 usable responses, this approach resulted in 115 responses (39.1 %) being classified as early, 151 responses (51.4 %) as middle, while 28 responses (9.5 %) were classified as late. Even though the number of participants in the late respondent group was less than the suggested 30 (Lindner et al., 2001) (the number of respondents was 28, which is close to 30), the researcher did not want to lump more participants together as late participants. Therefore, the grouping of participants into early, middle and late respondents based on their survey responses received in the first, month, middle two and last month were preserved. A *MANOVA* was performed with all the 40 research variables as dependent and the wave of response as the independent variable. The multivariate *F* was not significant (see Table 37) thereby indicating that there were no significant differences between any of the three groups of respondents.

Table 37. MANOVA for Response Wave

Multivariate Tests [a]						
Effect		**Value**	**F**	**Hypothesis df**	**Error df**	**Sig.**
Wave	Wilks' Lambda	0.70	1.17[b]	80	482	0.17

Notes. [a] Design: Intercept + Wave. [b] Exact statistic. Wave 1: Early (First 4 weeks; 115); Wave 2: Middle (middle 8 weeks; 151); Wave 3: Late respondent (last 4 weeks; 28); Wave of respondent is the grouping factor (IV) while the 40 research variables form the DV. Df: degrees of freedom.

A few participants had left the online survey mid-way without completing it or leaving any comments. This data was excluded from all prior analyses. It was decided to statistically verify if there were any difference among those leaving the survey mid-way and the respondents who completed the survey. Upon careful examination of the incomplete data, it was found that 61 of the responses had completed at least all four items of the first scale (management leadership scale) and their average scores on this scale were calculated. An average of the ratings on the management leadership scale was calculated for the sample containing 294 responses. An *ANOVA* was then conducted between the two unequal sized groups (61 for those who quit the survey midway and 294 for the useful sample). The results presented in Table 38 indicate that the omnibus F was not significant. Therefore, it can be concluded there was no significant difference between the group of respondents who left the survey midway and the respondents in the sample using the data that was available.

A total of 111 people refused to participate in the online survey. Many of them were again contacted to understand the primary reason for their refusal but no responses could be obtained from these people. Thus, based on the statistical tests with the available data, there is no reason to believe that any biases existed between the three waves of respondents (early, middle and late respondents) or among those who left the survey midway. It may thus be concluded that non-response bias did not pose any challenge for the study.

Table 38. ANOVA for Incomplete Responses

ANOVA: Single Factor						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F critical**
Between Groups	1.11	1	1.11	1.00	0.32	3.87
Within Groups	392.63	353	1.11			
Total	393.75	354				

Notes. Difference between average score of the 4 items of management leadership scale between two unequal sized groups is being tested here; Group 1: 61 responses from the people who quit midway, Group 2: 294 responses in usable sample. df: degrees of freedom; SS: sum of squares, MS: mean square.

Type I error. If a large number of variables are present in a study, significant results may be found just by chance (Cf. Kaynak, 1997; T. D. Cook & Campbell, 1979; Mitchell, 1985). In this study, there are 40 observed variables that are grouped into nine latent variables which is not large for SEM analysis. Four of these first-order factors are grouped into a second-order factor. The final sample size is 294, which is quite a big-sized sample.

This study utilizes SEM for the simultaneous analysis of the effect of all hypothesized relationships. SEM provides an advantage over a series of separate hierarchical regressions in that it considers the effect of all variables together, some of which may decrease or weaken the strength of other relationships (Hair et al., 2009). All path coefficients in the structural model are significant at $p < 0.05$; five of them are significant at $p < 0.00001$. Overall, it can be concluded that Type-I error was not the reason and all the results of the study are not by mere chance.

Internal Validity

Internal validity is generally concerned with the threat from other variables, not considered in the research model, explaining the significant correlations between the research variables–both independent and dependent (Kaynak, 1997). A rigorous review of several interdisciplinary fields such as healthcare management, human resources management, marketing, medicine, nursing, organizational behavior, operations and strategic management helped the researcher identify the research variables. Further, all hypothesized relationships are all based on theory and empirical support as discussed in the previous chapters. Therefore, the threat from other variables not accounted in the research model explaining the significant correlations between the research variables is minimal, if not completely ruled out.

Construct Validity

Construct validity refers to the extent that selected measures or scales actually represent the construct they are supposed to measure (Cf. Kaynak, 1997; Mitchell, 1985). It has five different components– content validity, structural validity, convergent validity, discriminant validity, and criterion-related validity. These five components are addressed in the following sections.

Content Validity. Content validity refers to whether each scale taps into the complete domain of the phenomenon it is trying to measure (Cf. Kaynak, 1997; Hoskisson et al., 1993; Nunnally & Bernstein, 1994). In this study, all procedures recommended for developing scales with good content validity (Cf. Kaynak, 1997; Churchill, 1979) were meticulously followed. First, an exhaustive literature review was used to identify the entire domain of all the constructs in the study. Second, as already noted, most scales adapted items that were already present in the literature, and content validities of the scales were already established in those studies. The remaining items, for which measures were created by the researcher, were based on literature review. Third, a review of the research model and the measures were conducted by academicians in the research incubator for the OM division of the Academy of Management conference in 2013 and their feedback was incorporated. Finally, the pilot study conducted before the main study, or the main study did not bring out any adverse comments on the questionnaire. Thus, all together, content validity of scales was satisfactory.

Unidimensionality. Unidimensionality refers to the concern whether the internal structures of the set of variables really measure a construct (Cf. Kaynak, 1997; Nunnally & Bernstein, 1994). Further, the structures should have high reliability as well. As already noted in this study, the exploratory factor analysis was skipped as most items of the study have been adapted from literature. But the results of the confirmatory factor analysis (CFA) (Table 33, Chapter 4) indicate a very good model fit. In addition, the reliabilities of all the scales were high. Therefore it may be concluded that structural validity of the scales was good.

Convergent Validity. Convergent validity is concerned with the extent to which multiple attempts to measure the same constructs agree with each other (Cf. Kaynak, 1997; Bagozzi et al., 1991; Hoskisson et al., 1993). If the correlations between measures of the same construct using different methods are high, the measures are said to have high convergent validity (Cf. Kaynak, 1997; Crocker & Algina, 1986). In CFA, all standardized factor loadings and their respective t-values (Table 32, Chapter 4) are statistically significant. Also, each item's coefficient is greater than twice its standard error, which implies that loadings of the items on their respective factors are significant thereby demonstrating high convergent validity for all scales (Cf. Kaynak, 1997; Anderson & Gerbing, 1988).

Discriminant Validity. Discriminant validity refers to the extent to which measures of different constructs are truly separate (Cf. Kaynak, 1997; Bagozzi et al., 1991; Hoskisson et al., 1993). This was assessed by three methods as demonstrated in the previous chapter (Table 34, Chapter 4). In the first method, χ^2 difference tests between a constrained and the unconstrained model were performed (Cf. Kaynak, 1997; Anderson & Gerbing, 1988) and statistically significant differences were found between each constrained model and the unconstrained model (lower $\chi 2$ for the unconstrained model). A second test involved constructing confidence intervals (±2 standard errors) around the correlation estimate between two factors and this interval should not contain 1.0 (Cf. Kaynak, 1997; Anderson & Gerbing, 1988). None of the confidence intervals for each bivariate correlation of factors included 1.0. A third test required comparison between the squared correlation of each pair of factors and the average variance extracted (*AVE*) for each factor. Further, *AVE* for each factor should be above 0.50 (Carr et al., 2008). The squared correlation of two factors was less than the variance extracted for each factor (Cf. Kaynak, 1997; Fornell & Larcker, 1981). Thus, these results taken together suggest that all scales had discriminant validity.

Criterion-related Validity. Criterion-related validity refers to the degree to which predictions from a theoretical framework are supported (Cf. Kaynak, 1997; Venkatraman & Grant, 1986). Based on theory, a criterion variable is identified which should correlate highly with the predictor test scores (Crocker & Algina, 1986; Nunnally & Bernstein, 1994). Validity is indicated by the size of the correlation between the predictor test and scores on the criterion variable (Cf. Kaynak, 1997; Nunnally & Bernstein, 1994). As discussed earlier, all constructs had criterion-related validity.

Common Method Variance. Common method variance (CMV) is a threat to the validity of constructs in those studies where data are obtained by self-reports (Cf. Kaynak, 1997; Howard, 1994; Spector, 1994). The common sources of this problem could occur because of participants' social desirability, halo effect and selective memory thereby biasing their responses. In this study, CMV was tested by four methods. First, Harman's one-factor test (Podsakoff et al., 2012; Podsakoff & Organ, 1986) was conducted with the 40 research variables. First, an un-rotated factor analysis was performed (using principal components as the method of extraction) with all 40 research variables, which extracted six factors. Second, a similar factor analysis performed with 24 variables (leaving out the items of the outcome variable-PCQ) extracted four factors. Finally the same procedure was performed with only the 16 variables (of the outcome variable-PCQ) and two factors were extracted. If one single factor was causing a major bias, the results would have been consistently indicated that a single factor was explaining most of the variance in the outcome and independent variables.

Second, using key informants is another strategy to avoid CMV to a large extent because senior level executives are most likely to be aware of the quality related issues facing the hospital and senior level executives are more reliable than junior-level employees (Cf. Kaynak, 1997; Campbell, 1955; Huber & Power, 1985). Table 39 presents all titles held by respondents, which shows that most respondents held very high positions or titles in their respective hospitals.

Third, positive affectivity, which is unrelated to the research variables, was introduced as a marker variable (Lindell & Whitney, 2001; Podsakoff et al., 2012; Richardson et al., 2009). Four items were randomly introduced in the questionnaire to measure this variable. As indicated in Table 40, the average correlations of the marker variable with other research variables were not zero or near zero as expected.

Table 39. Positions/Titles Held by the Respondents

Positions/Titles	Frequency	Percent	Cumulative Percent
Chairman, Chief Executive Officer & Chief Operating Officer	1	0.3%	
Vice President & Chief Operating Officer	1	0.3%	0.7%
Vice President of Operations	14	4.8%	5.4%
Vice President, Chief Nursing Officer & Associate Dean for Practice	1	0.3%	5.8%
Chief Operating Officer, Information Technology	1	0.3%	6.1%
Chief Operating Officer	77	26.2%	32.3%
Chief Purchasing Officer	1	0.3%	32.7%
Chief Nursing Officer	45	15.3%	48.0%
Safety Director	26	8.8%	56.8%
Ambulatory Services Director & Director of Quality Improvement	1	0.3%	57.1%
Director of Quality Assurance	78	26.5%	83.7%
Director of Quality Improvement	34	11.6%	95.2%
Quality Assurance Coordinator	8	2.7%	98.0%
Quality Engineer	1	0.3%	98.3%
Safety Coordinator	2	0.7%	99.0%
Chief Nurse Executive	3	1.0%	100.0%
Total	294		

Notes. Order of arrangement of positions/titles does not reflect any organizational hierarchy.

Table 40. Correlations of the Marker Variable with Research Variables

	Variables	1	2	3	4	5	6	7	8	9
1	Management Leadership									
2	Technology Integration									
3	Supplier Relationship Management									
4	Healthcare Team Effectiveness									
5	Internal Lean Practices									
6	PCQ-Interpersonal Quality									
7	PCQ-Technical Quality									
8	PCQ-Environmental Quality									
9	PCQ-Administrative Quality									
10	Positive Affectivity (marker variable)	0.39**	0.34**	0.54**	0.51**	0.53**	0.39**	0.44**	0.40**	0.51**

Notes. **Pearson correlation is significant at the 0.01 level (2-tailed).

Next, to verify if CMV had affected the study, an elaborate four-model method-C/U approach (Lindell & Whitney, 2001; Podsakoff et al., 2012; Richardson et al., 2009; Williams & Anderson, 1994; Williams et al., 2003) was adopted. SEM (LISREL 8.53) was used to perform the detailed tests with four different models. Each model had a good model fit as is evident from the indices in Table 41 that were all above their threshold values. The CFA model containing all first-order latent variables with covariance links from the latent marker variable to all other latent variables was used as the basis for the CMV tests. First, in the baseline model, the coefficients of the four items of the latent marker variable and the error variances were fixed to their values obtained earlier in the CFA model. Further, the covariances of the different paths from the latent marker variable to the latent research variables were all set to zero. Second, the method-C model was similar to the baseline model. In addition to the baseline model, in the method-C model individual paths were drawn from the latent marker variable to each of the 40 items (observed variables in the study) and their coefficients were set to an equal value, so as to constrain them. Third, in the method-U model, over and above the method-C model, the coefficients of individual paths from the latent marker variable to 40 items were now allowed to vary freely. Finally, the method-R model was akin to the method-U model; except that the covariances of all paths among the latent research constructs were now fixed to their unstandardized values obtained from the baseline model.

For each model (method-C,-U, –R), the difference between model χ^2 and baseline χ^2 was calculated; similarly the difference between each model degrees of freedom and that of the baseline was computed. The ratio of the decrease in χ^2 to the corresponding decrease in degrees of freedom was tested for statistical significance. As indicated in Table 41, the χ^2 difference per degree of freedom between the method-C and the baseline model, was significant thereby

Table 41. CMV Tests using Method-C/U Models

Goodness-of-fit statistics	CFA model (first-order factors)	Method-C/U Models			
		Baseline Model	Method-C Model	Method-U model	Method-R model
Comparative Fit Index (CFI)	0.99	0.98	0.99	0.99	0.99
Parsimony goodness-of fit index (PGFI)	0.70	0.70	0.69	0.69	0.71
Parsimony Normed Fit Index (PNFI)	0.87	0.89	0.85	0.85	0.89
Root mean square error of approximation (RMSEA)	0.05	0.05	0.05	0.05	0.05
χ^2	1535.19	1677.15	1468.29	1468.29	1542.02
df	853	869	829	829	865
Difference in χ^2 /df between given model and baseline			5.22+	5.22+	33.78+

Notes. + χ^2 > 3.84 is significant for 1 df (degrees of freedom). Threshold values for PGFI and PNFI are > 0.50 (Byrne, 1998; Mulaik et al., 1989) and for RMSEA is < 0.08 (Byrne, 1998; Jaccard & Wan, 1996; Jöreskog & Sörbom, 1993). Method-C model and Method-U model fit better than the baseline; Method-R model fit significantly worse than the baseline.

demonstrating evidence of CMV in the study (Richardson et al., 2009). In addition, since the method-U model was a better fit than method-C model (significant decrease in χ^2 per degree of freedom in Table 41), there was evidence of unequal (i.e., congeneric) method effects (Richardson et al., 2009). Further, the method-R model had a significantly worse fit than the method-U model, indicating that there was some bias in the study because of CMV.

For each model (method-C,-U, –R), the difference between model χ^2 and baseline χ^2 was calculated; similarly the difference between each model degrees of freedom and that of the baseline was computed. The ratio of the decrease in χ^2 to the corresponding decrease in degrees of freedom was tested for statistical significance. As indicated in Table 41, the χ^2 difference per degree of freedom between the method-C and the baseline model, was significant, thereby demonstrating evidence of CMV in the study (Richardson et al., 2009). In addition, since the method-U model was a better fit than method-C model (significant decrease in χ^2 per degree of freedom in Table 41), there was evidence of unequal (i.e., congeneric) method effects (Richardson et al., 2009). Further, the method-R model had a significantly worse fit than the method-U model thereby highlighting that there was some bias in the study because of CMV.

To determine the extent to which CMV may have affected the hypothesized relationships, the structural model was re-tested with the latent marker variable as a control variable (Alge et al., 2006; Richardson et al., 2009). As indicated in Table 42, the resulting model had a good fit. Further, the results in Table 43 indicate that although some of the standardized path coefficients changed from their earlier values, they were all statistically significant. A post-hoc power analysis (Hoyle, 2014; MacCallum et al., 2006; MacCallum et al., 1996; MacCallum & Hong, 1997) conducted using the structural model with the marker variable as control using the value of

Table 42. Structural Model Fit with Marker as Control

Goodness-of-fit statistics	Structural model with Marker as Control	Recommended values for satisfactory fit of a model to data[+]
χ^2/df	= 1874.57/883 = 2.12	< 3.0 a
Root mean square error of approximation (RMSEA)	0.06	< 0.08 b
Parsimony goodness-of fit index (PGFI)	0.70	> 0.50 c
Parsimony Normed Fit Index (PNFI)	0.90	> 0.50 c
Comparative Fit Index (CFI)	0.98	> 0.90 b

Notes. df = degrees of freedom. a Bollen (1989), Carmines and McIver (1981), and Hair et al. (2009). b Byrne (1998), Jaccard and Wan (1996), and Jöreskog and Sörbom (1993). c Byrne (1998) and Mulaik et al. (1989). [+] The recommended threshold values are adapted from Kaynak & Hartley (2006).

Table 43. Structural Model Comparison between Hypothesized Model and Marker as Control

	Variables	Hypothesized Structural Model [+]						Structural Model with Marker as Control [#]					
		1	**2**	**3**	**4**	**5**	**10**	**1**	**2**	**3**	**4**	**5**	**10**
1	Management Leadership												
2	Technology Integration	0.35[a] (4.27)[b]						0.20 (2.48)					
3	Supplier Relationship Management	0.52 (7.76)	0.26 (3.66)					0.34 (5.37)	0.17 (2.69)				
4	Healthcare Team Effectiveness	0.64 (10.48)						0.46 (7.30)					
5	Internal Lean Practices	0.19 (2.87)	0.12 (2.38)	0.41 (6.40)	0.38 (6.47)			0.20 (3.57)	0.11 (2.18)	0.37 (5.40)	0.35 (5.69)		
6	Patient Care Quality-Interpersonal quality						0.93 (n/a)[c]						0.93 (n/a)a
7	Patient Care Quality-Technical quality						0.93 (19.24)						0.94 (19.36)
8	Patient Care Quality-Environmental quality						0.83 (15.02)						0.83 (15.12)
9	Patient Care Quality-Administrative quality						0.98 (19.49)						0.98 (19.64)
10	Patient Care Quality				0.15 (1.97)	0.47 (5.65)					0.14 (1.70)	0.45 (4.66)	

Notes. [a] Standardized path coefficients are indicated; [b] The corresponding t-values are given in braces. [c] The path PCQ-*Interpersonal quality* to does not have an associated *t*-value because it had a fixed parameter in LISREL. [+] *df* = 727; all paths are significant at $p < 0.05$ (for t-values > = 4.5, the corresponding *p*-value is < 0.00001). [#] *df* = 883; all paths are significant at $p < 0.1$ (for t-values > = 1.97, the corresponding *p*-value is < 0.05; for *t*-values > = 4.45, the corresponding *p*-value is < 0.00001).

RMSEA indicated a high power level of 1.0 (refer to Appendix-G). Therefore, although CMV affected the study, the significant relationships among research variables were not due to CMV. In any case, the researcher would also like to note a differing viewpoint in extant literature that the common belief that correlations between variables measured with the same method (such as self-report surveys) are automatically inflated due to the action of common method variance (CMV), may be overstated (Spector, 1987, 1994, 2006).

Finally, multiple responses were used to verify if there were any biases among a few hospitals (sources). Eleven multiple responses were available from people who were essentially the second respondent from their respective hospitals and one person responded to the survey twice; hence, their data had to be discarded from all other analyses. It was decided to statistically test if there was any significant differences among the responses of these 10 dropped multiple respondents and their counterparts from the same hospital (included in the study) in the manner they responded to the variables. Using average score for each of the nine latent variables as the dependent variables and the grouping variable as the independent variable, a *MANOVA* was performed. The multivariate F indicated in Table 44 was not significant, thereby indicating no significant difference among the omitted multiple respondents and the data from their counterparts in the same hospital.

In sum, because the study used a single source (online survey) to reach the respondents some bias was created due to CMV; but the extensive post-hoc statistical tests discussed above demonstrate that the significant relationships obtained in the study were not due to CMV. Further, given the need to reach hospital executives across the country in a reasonable timeframe, there was no other feasible alternative to using an online survey. The researcher called several of the hospital executives who had not responded but could only reach very few of them.

Table 44. MANOVA for Multiple Respondents

Multivariate Tests [a]						
Effect		Value	F	Hypothesis df	Error df	Significance
Grouping Variable: Multiple respondent dummy	Wilks' Lambda	0.74	0.39[b]	9	10	0.92

Notes. [a] Design: Intercept + Grouping variable. [b] Exact statistic. The 10 multiple responses (discarded from all analyses) were coded as 1 and their counterparts from the same hospital (included in the final sample of 294 respondents) were coded as 2. Dummy variable was used as the grouping factor (IV) while the average scores of the 20 respondents on each of the 9 scales formed the DVs.

External Validity

External validity is concerned with the degree to which the findings of the study can be generalized across different situations that use other measures, research settings and draws sample from different populations (Cf. Kaynak, 1997; Mitchell, 1985). Population and ecological validity are the two types of validity in this category (Cf. Kaynak, 1997; Neale & Liebert, 1986). Both these types of validity are addressed in the following sections.

Population Validity. Population validity refers to the extent to which the research sample could be generalized to the target population (Cf. Kaynak, 1997; Neale & Liebert, 1986) . The major threats to this validity are: cost-restricted sampling and self-selection and volunteer bias (Kaynak, 1997).

In this study, first, as mentioned before, a list of senior hospital executives was purchased from a reputed company-Dun & Bradstreet (D&B). Second, as mentioned before, a total of 4805 email requests were sent to the target respondents who were located across 50 states of the U.S. Third, repeated email reminders were sent to the potential respondents throughout the four-month long period of the study. In addition, several phone calls were made by the researcher, trying to reach the potential respondents. Thus, cost-restricted sampling is not an issue with the study.

Self-selection and volunteer bias are unlikely to have affected the sample. There are several reasons why the type of respondents used in this study would not volunteer to participate in any study. It is a well-known fact that medical practitioners and senior hospital executives generally do not subscribe to any non-medical/healthcare email lists. The final sample used in the study covers all types of full-service hospitals in 47 states of the country that are located in big cities as well as in remote rural areas. Emails of people holding quality-related positions, nursing, safety and other CEO/CFO positions in hospitals such as those used in this study are generally not listed in the public domain. Further senior hospital executive emails are not available except upon purchase from a handful of companies (like D&B) and only for academic research.

It may further be noted that no attempt is made to generalize the findings beyond the current sample. Therefore, population validity does not appear to be a major concern in this study.

Ecological Validity. Ecological validity is concerned with to extent to which the findings of the study could be generalized from one context to another, such as different places and times (Cf. Kaynak, 1997; Neale & Liebert, 1986). There are six common threats to ecological validity–regional differences, interaction of treatment by setting, temporal effects, interference effects, unique contexts, and experimenter effects (Cf. Kaynak, 1997; Neale & Liebert, 1986).

There are three reasons why none of the above commonly mentioned threats to ecological validity pose any serious concern in this study. First, this study was a one-time data collection effort that spread all over the 50 states of the U.S. and covered full-service hospitals that were geographically distributed in cities, small towns and even rural areas. Only three states–Hawaii, Rhode Island and Vermont had no representation in the final sample. Potential respondents from hospitals in these three states did not complete the survey within the four-month period that the study was conducted but it is not a cause for concern because these three are small states and the vast majority of the states (47 out of the 50) have been covered. Second, the study did not involve experimental settings but used an online survey; hence, the concerns related to interaction of treatment and interference, unique contexts or experimenter effects are not relevant. Third, there were no firm (hospital) performance related variables involved in the study that could be affected by industry cycles of recession and growth. The study is related to the determinants of quality of patient care and, therefore do not depend on time of the year or any year in particular. Thus, temporal effects are not relevant. All the above reasons indicate that ecological validity was satisfactory.

In sum, the above discussions on validity of the findings indicate that the measures used in the study were valid and reliable. The study provides evidence of correlational relationships among the research variables.

Chapter Summary

Results of the data analyses are elaborated in this chapter. First, the descriptive statistics and correlations among all research variables were presented. Second, the assumptions of multivariate tests were described. Third, the tests for reliability and unidimensionality were discussed. Fourth, convergent validity and discriminant validity of all scales were tested and their results presented. Fifth, criterion-related validity was tested and the results were given. Sixth, based on theory, a second-order factor model for the outcome variable in the study–patient care quality (PCQ) was presented and tested. Seventh, the tests of the structural model demonstrated that the estimated standardized coefficients for all the paths are statistically significant and the relationships are in the direction hypothesized (i.e., path coefficients are positive). Finally, the discussions on the different types of validity and reliability indicate that the measures used in the study were valid and reliable. Overall, the study provides evidence of correlational relationships among the variables.

CHAPTER V

DISCUSSION AND IMPLICATIONS

In this chapter, the results of all hypotheses tested in this study are first considered in order and the implications of the findings, for both researchers and practitioners are elaborated. Second, the limitations of the study are discussed and future research directions are offered.

Implications for Researchers and Practitioners

The main objective of this research was to empirically establish a framework that includes determinants of quality of patient care for admitted patients in full-service U.S. hospitals. The variables in the framework were drawn from both the external and internal supply chains of a hospital after an extensive review of extant literature and supporting theory. The implications of the results are discussed first from a theory building perspective and then for healthcare practice. Each hypothesis from Chapter 3 is considered in sequence and the findings are discussed in depth. A summary of all results of the hypotheses is available in the previous chapter (Table 35).

Hypothesis H1a

Hypothesis *H1a* posited a positive relationship between management leadership and technology integration. This relationship is based on quality management (QM) theory (Ahire et al., 1996; Feigenbaum, 1961; Jayaram et al., 2010; Kaynak & Hartley, 2008) which highlights the involvement of the management team in overseeing all daily activities of any firm. A firm's top management should ensure that a learning oriented environment prevails wherein teams are ready to adopt the best quality practices using the most accurate and up-to-date information from its various decision support systems. Top management needs to allocate adequate finances to encourage and support cross-systems training of healthcare practitioners and monitor the performance of different technologies used in the hospital (D. Y. Kim et al., 2012). The results support findings in extant literature that hospital leadership is expected to make strategic decisions to encourage effective integration between different software and hardware platforms in the hospital (Coye & Kell, 2006; L. X. Li, 1997; Prajogo & Sohal, 2006; Teplensky et al., 1995).

Because various technological systems hold specific knowledge in their repositories about the organizational functions that they encapsulate, integrating all the discrete knowledge into a common platform is necessary for the overall knowledge-level of the organization (hospital). In line with the knowledge-based theory of a firm (Grant, 1996), primary knowledge resides within the various individuals of the healthcare team and the hospital needs to synthesize the different knowledge and make it readily available for effective decision making both by hospital management and the healthcare team members.

From a healthcare practice standpoint, the study reiterates that hospital leaders should encourage the integration of all software and hardware technological systems used throughout their hospital. Integrating all systems in the hospital will allow complete information flows seamlessly throughout the network and will ensure that accurate and up-to-date information is available both to the healthcare teams for making patient-related decisions and to management.

Hypothesis H1b

Hypothesis *H1b* suggested a positive relationship between management leadership and supplier relationship management. Supplier relationship management covers six different aspects of a hospital's close relationship with its key suppliers–*supplier flexibility, supplier assistance, supplier information exchange, supplier monitoring, continuity expectation and quality of supplies*. QM theory (Ahire et al., 1996; Feigenbaum, 1961; Jayaram et al., 2010; Kaynak & Hartley, 2008) notes the importance of leadership in all supplier quality management activities (Kaynak & Hartley, 2008) and supplier relationship management efforts (B. B. Flynn et al., 1995; Shin et al., 2000). Further, supplier assistance is a key quality practice (Kaynak, 2003; Saraph, Benson, & Schroeder, 1989). Buyer-supplier relationships have been elaborately investigated in the context of service firms in general but in extant healthcare and medical literature, only a few studies have discussed the role of senior management on the six aspects of the relationship: supplier flexibility (Graban, 2011), supplier assistance (McKone-Sweet et al., 2005), supplier information exchange (Leidner et al., 2010; L. X. Li, 1997), supplier monitoring (Doyle & Boudreau, 1989) (Xu, 2011), continuity expectations (Chao et al., 2013; S. Goodman & Jones, 2013), and quality of supplies (Davis, 2004). The positive relationship between management leadership and supplier relationship management confirms prior research on hospital leadership's encouragement and support for long term relationships with key suppliers.

Extant buyer-supplier literature (Luo, Liu, Yang, Maksimov, & Hou, 2015; Wu, Sinkovics, Cavusgil, & Roath, 2007) has discussed the potential problems arising out of the agency problem (Eisenhardt, 1989). In the hospital context, top management support for strong and lasting supplier relationships will help achieve supplier cooperation.

The results reflect that hospital management needs to acknowledge that a lean perspective cannot be achieved in hospitals without active support and cooperation from their key suppliers. Hospital management needs to hold their suppliers accountable for the quality of the supplies. Hospital leaders must oversee the relationship with key suppliers.

Hypothesis H1c

Hypothesis *H1c* noted a positive relationship between management leadership and healthcare team effectiveness. The predicted relationship is supported by QM theory (Ahire et al., 1996; Feigenbaum, 1961; Jayaram et al., 2010; Kaynak & Hartley, 2008) which suggests that senior management needs to provide resources like equipment and trained personnel to make the work environment conducive for teams to work. Team work is one of the key QM practices (B. B. Flynn, Schroeder, & Sakakibara, 1994; Kaynak, 2003; Kaynak & Hartley, 2008; Sakakibara et al., 1993) and is also crucial lean practice (B. B. Flynn et al., 1995; Kaynak, 1997, 2002; Monden, 1981; Ōno, 1988; Shah & Ward, 2003; Sugimori et al., 1977). The current findings thus support the extant healthcare literature which has highlighted that by providing clear direction emphasizing the hospital priorities and setting realistic and achievable team goals, hospital top management can enhance the healthcare team cohesiveness and ultimately their effectiveness (Lemieux-Charles & McGuire, 2006; Nielsen et al., 2009; Tumerman & Carlson, 2012).

A firm's leadership that encourages teams to focus on quality and innovation in their day-to-day work helps all team members concentrate and feel enthused to work. Leadership is positively related to small group cohesion and, in turn, to team effectiveness because such leaders give team direction, helps increase the team members' motivation to work toward common goals, and encourage team bonding by enhancing employee self-efficacy.

Hospital leaders have to ensure that healthcare teams have the required internal freedom to be effective and can focus on the quality of patient care. The findings reiterate that hospital senior management needs to give adequate freedom to the healthcare teams so that they work effectively.

Hypothesis H1d

Hypothesis *H1d* suggested a positive relationship between management leadership and internal lean practices. Internal lean practices comprise three different aspects–*patient and material flow, continuous quality improvement* and *waste management*. The suggested relationship is based on lean systems theory (B. B. Flynn et al., 1995; Kaynak, 1997, 2002; Monden, 1981; Ōno, 1988; Shah & Ward, 2003; Sugimori et al., 1977) which emphasizes that hospitals must have reduced inventory available just in time when they need it, which in turn, requires supplier collaboration to implement such a "pull" system. As noted before, Deming's quality management framework highlights the integrated nature of organizations, the importance of management leadership and the need to have consistent organizational processes throughout all departments (Anderson et al., 1994). Quality philosophy suggests that senior management leadership and patience is critical for organizational success (Dean & Bowen, 1994; Deming, 1986; Juran, 1989). Leaders must understand that any quality improvement initiative is not a quick fix and must support the employees and the quality champions in their change efforts (Graban, 2011). The present findings provide support to the results in extant healthcare literature that touch all the three aspects of the relationship–patient and material flow in the hospital (Baltacioglu et al., 2007), continuous quality improvement efforts at the hospital (LeBrasseur et al., 2002; McLaughlin et al., 2004) and lean waste management (Dahlgaard et al., 2011; Graban, 2011; Womack & Jones, 2010; Zidel, 2006).

Leadership is about establishing governance arrangements that cross all the departmental boundaries, supporting a rigorous, long-term vision of the firm's value-producing processes and holding every employee accountable for meeting the firm’s lean commitments. In order to achieve a change in the mindset of the healthcare team, hospital senior management needs to personally become involved in overseeing lean implementation activities.

The current findings confirm that hospital management plays a crucial role in implementing lean principles. Top management leadership involvement in CQI efforts, encouraging employee quality initiatives and addressing concerns as and when they arise helps increase the chances of successful quality efforts. Thus, the study provides support for the important role of senior management leadership in quality improvement.

Hypothesis H2a

Hypothesis *H2a* predicted a positive relationship between technology integration and supplier relationship management. This relationship is based on support from the information processing theory (IPT) (Davenport, 1998; Galbraith, 1973; Tushman & Nadler, 1978) which notes that effective use of technologies to integrate all internal hospital supply chain entities would allow timelier and more accurate information flow throughout. Implementing software systems such as enterprise resource planning (ERP), customer relationship management (CRM), decision support system (DSS) and patient relationship management (PRM) is positively related to the information exchange across the internal hospital chain (Siau, 2003; Tan & Hanna, 1994). The current study’s findings are in sync with results discussed in extant healthcare literature that highlight strategic sourcing (Loh & Koh, 2004; Mettler & Rohner, 2009), long term supply partnership (Johnston et al., 2004), information used for supplier assistance (Coye & Kell, 2006;

E. T. G. Wang, Tai et al., 2006), and supplier flexibility (Pouloudi, 1999) as important aspects for hospitals.

Due to the information asymmetry between firms and their suppliers, suppliers may exhibit opportunistic behavior. A technologically hospital could share of up-to-date and accurate information electronically with its key suppliers thereby alleviating agency problems to some extent.

For many U.S. hospitals, the present findings highlight two major areas that need improvement-integration of various technology systems used in the hospital and supplier relationship management. Hospitals can strategically source their inventory items from a few trusted suppliers, manage the procurement processes and govern the existing supplier relationships. Receiving up-to-date information on the hospital's inventory items would help suppliers increase their assistance to the hospital thereby improving their own flexibility. It would improve the information that the supplier could provide the hospital when requested. A technologically integrated hospital could become aware of the suppliers capabilities and the cost of purchasing an item from each supplier instantly, helping it choose its strategic suppliers. Thus, frequent and real-time information exchange within the hospital could help build a hospital's trust in its suppliers, increase collaboration between the parties and reduce the hospital's need to monitor its supplier activities. Collaboration between hospitals and their suppliers could increase the continuity expectations that both parties have of the relationship. .

Hypothesis H2b

Hypothesis *H2b* posited a positive relationship between technology integration and internal lean practices. IPT (Davenport, 1998; Galbraith, 1973; Tushman & Nadler, 1978) provides the theoretical basis for this relationship. In order to implement lean practices, a firm needs to integrate all its information systems, have flexible personnel and team support and cross-trained managers who could work in different departments (Lucas et al., 2005). The results confirm the findings in healthcare studies that cover different aspects of this relationship– successful technological integration in hospitals (Stratman, 2008), hospital process improvement (Demiris et al., 2008; Vissers & Beech, 2005), continuous quality improvement (CQI) adoption (Lucas et al., 2005), workforce development (L. X. Li, 1997), and successful lean implementations in hospitals (de Koning et al., 2006; Kollberg et al., 2007).

From a lean implementation perspective, integrating different technology systems in the hospitals has several advantages. Technology integration can help hospitals strategically plan the usage of their critical resources such as operating suites, intensive care units (ICU) and labs, various sophisticated medical equipment like magnetic resonance imaging (MRI), considering the maximum and mean patient volumes and flow rates for each medical treatment process. Inter-connecting different information technology platforms such as the electronic patient record system and bar coding medicinal administration supports logistics and quality improvements in the hospital, which can help the CQI adoption in hospitals. Joining the different hospital systems can help in the distribution of the required information for lean implementation and can help the hospital balance the demand for patient care with the capacity in order to eliminate wastes such as over-capacity or waiting times.

Hypothesis H3

Hypothesis *H3* predicted a positive relationship between supplier relationship management and internal lean practices. This relationship is based on support from lean systems theory (B. B. Flynn et al., 1995; Kaynak, 1997, 2002; Monden, 1981; Ōno, 1988; Shah & Ward, 2003; Sugimori et al., 1977) which emphasizes that firms must have reduced inventory available just in time when they need it, and it requires supplier collaboration to implement such a "pull" system. The present study's findings are in line with extant literature (Dranove & White, 1987, 1989; Schneider & Mathios, 2006) which emphasizes the importance of supplier cooperation and flexibility in lean implementation (Graban, 2011).

The findings imply that academicians in healthcare may need to stop viewing the quality related problems of hospitals in isolation and adopt a supply chain view. Many healthcare academicians still do not consider the hospital and its integrated supply chains while offering solutions. Some of the issues related to hospitals, especially related to inventory, cannot be improved without better supplier coordination and cooperation. Therefore, an integrated supply chain perspective needs to be adopted by all academicians in healthcare while discussing quality related problems in the hospital.

For the healthcare practitioners, the results imply that lean implementation can be successful only if hospitals are able to implement a "pull" system for managing their entire inventory. It also hints that most hospital executives recognize that managing operations with just-in-time inventory levels in the hospital depends upon supplier cooperation. The findings of the study highlight that managing supplier relationships is essential. They reiterate that to implement lean in a hospital, like any other service firm, supplier cooperation is a must. In order to achieve just-in-time ordering of stocks to maintain optimal in-house inventory levels, hospitals need to have a few trusted key suppliers. Further, to eliminate wastes and to continuously improve patient care quality, hospitals must focus on performing all medical procedures correctly the first time and suppliers have an indirect role to play here. All supplies of medications, equipment and other materials must meet their specifications which can be achieved only with supplier cooperation and assistance. In sum, hospitals need to give their supplier relationships the importance that they deserve.

Hypothesis H4a

Hypothesis *H4a* noted a positive relationship between healthcare team effectiveness and internal lean practices. This relationship is based on support from QM theory (Ahire et al., 1996; Feigenbaum, 1961; Jayaram et al., 2010; Kaynak & Hartley, 2008) and lean systems theory (B. B. Flynn et al., 1995; Kaynak, 1997, 2002; Monden, 1981; Ōno, 1988; Shah & Ward, 2003; Sugimori et al., 1977) which emphasizes that functional team goals should be aligned with those of the organization to ensure that internal lean practices are followed throughout the firm. For firms to be successful in their quality improvement initiatives, employees must be able to work effectively in teams (Bell & Burnham, 1989; Ford, Fottler, Russ, & Millam, 1995; Sakakibara et al., 1993) to achieve their team goals. The findings are in line with extant literature. For example, implementing ward-specific strategies to improve team effectiveness (DiMeglio et al., 2005; Smits et al., 2003) improves patient flows (Lemieux-Charles & McGuire, 2006) which helps in continuous quality improvement (CQI) for faster cure and early release of admitted patients (Lucas et al., 2005; S. M. Shortell et al., 1998; S. M. Shortell et al., 1995). Increased physician involvement (Goldstein & Ward, 2004; Reynolds & Goodroe, 2005) and nurses' support (Kane et al., 2007; Kuokkanen et al., 2003; Laschinger & Wong, 1999) helps healthcare team members identify wastes for elimination.

The findings are a reminder to most hospitals that leaders need to focus on team effectiveness. In extant healthcare literature, especially in nursing, several suggestions have been discussed such as team members listening to and respecting each other's work, which could help achieve team effectiveness.

Hypothesis H4b

Hypothesis *H4b* suggested a positive relationship between healthcare team effectiveness and quality of patient care. To reiterate, quality of patient care (PCQ) refers to the excellence of the medical care received by admitted patients in hospitals (e.g., Chang, Ma, Chiu, Lin, & Lee, 2009; Dagger et al., 1997; Ma, Yang, Lee, & Chang, 2009; Nelson & Niederberger, 1990; Van Ess Coeling & Cukr, 2000; Ware et al., 1983). It has the following four primary dimensions or factors–*interpersonal, technical, environmental,* and *administrative quality*. *Interpersonal quality* reflects the relationship developed and the dyadic interplay that occurs between the healthcare team and patients (Dagger et al., 2007; Gill & White, 2009). *Technical quality* reflects the expertise, professionalism, and competency of the healthcare team in delivering a medical cure (Dagger et al., 2007; Gill & White, 2009). *Environmental quality* comprises hospital atmosphere such as cleanliness and order and tangibles like hospital bed and required equipment for patient health needs (Dagger et al., 2007; Gill & White, 2009). *Administrative quality* facilitates the production of the core medical cure while adding value to the patient (Dagger et al., 2007; Gill & White, 2009).

This relationship is based on support from QM theory (Ahire et al., 1996; Feigenbaum, 1961; Jayaram et al., 2010; Kaynak & Hartley, 2008) and lean systems theory (B. B. Flynn et al., 1995; Kaynak, 1997, 2002; Monden, 1981; Ōno, 1988; Shah & Ward, 2003; Sugimori et al., 1977) because teamwork is a key QM practice and firms need to have cohesive functional teams in order to achieve high service quality. Although there is a lot of extant literature on team effectiveness and its advantages in service firms (S. G. Cohen & Bailey, 1997; P. S. Goodman, 1986; Hall, 1980; Katzenbach & Smith, 2013; McGregor, 1987; Shipper & White, 1983; Sundstrom et al., 1990), there are not too many studies on healthcare team effectiveness and how it influences patient care quality in hospitals. The current findings support the findings in extant literature on healthcare, operations and medicine which has explored various aspects of the relationship. A few articles have explored *interpersonal quality* related issues (Deeter-Schmelz & Kennedy, 2003; S. S. Kim et al., 2004; McQueen, 2000; Roark & Sharah, 1989), *technical quality* related issues (C. Chen et al., 2009; Graetz et al., 2014; Jha et al., 2009), *environmental quality* related research (Aiken et al., 2008; Carling et al., 2008; Mathur, 2014; Pittet et al., 2000; Wearmouth, 2001), and *administrative quality* related problems (Bokar & Perry, 2007; Conway, 1997; Grumbach & Bodenheimer, 2004; White & Whitman, 2006).

From a healthcare practice viewpoint, many hospital patient care quality standards are evolving and currently, in many U.S. hospitals, healthcare teams are not yet fully effective in overcoming all patient care quality problems. Therefore, hospitals need to focus on achieving team effectiveness.

Hypothesis H5

Hypothesis *H5* predicted a positive relationship between internal lean practices and quality of patient care. This relationship is supported by the lean systems theory (B. B. Flynn et al., 1995; Kaynak, 1997, 2002; Monden, 1981; Ōno, 1988; Shah & Ward, 2003; Sugimori et al., 1977) that advocates firms to focus on reducing wastes which would help them identify and eliminate scrap and rework from their goods production or service generation processes. Lean systems theory thus helps explain the relationship between internally implementing lean practices at hospitals and the positive outcome on service quality which is patient care quality in the hospital context. The results of this study strongly affirm the positive relationship between internal lean practices and PCQ. Quite a few articles in the extant literature have discussed various aspects of this relationship related to the four PCQ factors such as interpersonal quality issues (Hudelson et al., 2008; Marley et al., 2004), patient and material flow throughout the hospital (Baltacioglu et al., 2007; Derlet & Richards, 2000; Heineke, 1995; Paterson et al., 2006), physical elements of hospital environment or environmental quality (Aiken et al., 2008; Pittet et al., 2000), administrative quality related to billing and reception (Bokar & Perry, 2007; Conway, 1997).

To deliver high quality of patient care in the hospital, healthcare team members need to master the interpersonal attributes of patient care. For hospitals to have their resources best utilized on patients who need the cure the most, smooth patient flow throughout the hospital is important. Implementing lean principles in a hospital would thus require all medical practitioners to continuously improve in their own areas of work.

The findings also imply that building a quality-related theory for healthcare is now essential that incorporates tenets of lean philosophy. Although healthcare is similar to other services and hospitals are somewhat similar to other service firms, there are many important differences that have been discussed in detail in the first chapter (Boyer & Pronovost, 2010; Carroll & Quijada, 2004; Chandrasekaran et al., 2012; Khatri et al., 2006; Sutcliffe et al., 2004; Tucker, 2007; Tucker et al., 2007; Tucker et al., 2008; Tucker & Spear, 2006; Vogus et al., 2010). It will be, therefore, essential to fine tune the quality theory of services to the context of healthcare, more specifically, hospitals. For this long-term and detailed effort, several empirical studies would be needed and collaboration between most hospitals and academia is of essence. The Agency for Healthcare Research and Quality (AHRQ) is a nodal organization that is uniquely positioned to lead the industry-academic collaboration and systematically build up a longitudinal panel database on all different variables that determine patient care quality in U.S. hospitals. Further, AHRQ can coordinate with many healthcare organizations, such as the

Centers for Medicare and Medicaid Services (CMS), which has already done great work in the field of healthcare by developing an extensive set of metrics to measure different aspects of technical quality. An extensive database could be used by future researchers to propose and test an integrated quality theory for healthcare.

In sum, the findings of the study are very important for quality of care available to patients in U.S. hospitals. As already noted, the objective of empirically testing the entire framework was to bring out the relevant variables from within a hospital and its external supply chains. Therefore, the empirical results obtained in the study demonstrate the importance of all five variables to PCQ. Moreover, the four-factor PCQ structure empirically tested in the study highlight that most hospitals and other healthcare agencies may need to enlarge their concept of quality in the hospital. Most hospitals, healthcare agencies and medical practitioners consider only the technical quality and to some degree interpersonal quality but leave out the other two factors- environmental and administrative quality. The empirical results of the study thus point to the need to rethink patient care quality from a holistic perspective, keeping the patient's cure at the centre of all activities (e.g., Chang, Ma, Chiu, Lin, & Lee, 2009; Dagger et al., 1997; Ma, Yang, Lee, & Chang, 2009).

Limitations and Future Directions

As in most studies, this study too had several limitations, which are highlighted below. Furthermore, based on the findings of the current study, the challenging unanswered questions that future research can address are discussed in detail.

The most important methodological issue for studies using a single method to collect the data is common method variance (CMV) (Cf. Kaynak, 1997; Howard, 1994; Spector, 1994). A major concern in the studies that use self-reported data collected through surveys is that participants may have social desirability bias, and as a result, indicate the responses that make them and their organizations look "good" (Cf. Kaynak, 1997; Howard, 1994; Spector, 1994). While the discussions in the previous chapter indicate that CMV appears to have affected the study, the extensive SEM tests also confirm that the significant results obtained in the study are not due to CMV. At this point the researcher would also like to mention a differing viewpoint in extant literature that the common belief that correlations between variables measured with the same method (such as self-report surveys) are automatically inflated due to the action of common method variance (CMV), may be overstated (Spector, 1987, 1994, 2006).

Among the major causes for CMV, the presence of social desirability is the most common. The study used a four-factor second-order construct for patient care quality (PCQ), in the process introducing two dimensions of PCQ (environmental and administrative quality) that are not commonly used by academicians or practitioners in many U.S. hospitals today. While social desirability cannot be ruled out completely, based on their high titles or positions and their long years of work experience, it is unlikely that the respondents were swayed by desirability bias. Second, although positive affectivity was introduced as a marker variable (Lindell & Whitney, 2001) and four items to measure it were randomly scattered in the questionnaire, high positive correlations were found among other research variables and the seemingly unrelated variable–positive affectivity (or mood). The above issues add to the ongoing debate on how a study could be designed to completely avoid CMV. Based upon suggestions in the literature, the best method to avoid CMV would be to use multiple methods or sources to collect the data which presents some implementation challenges. Extensive studies such as this one was conducted at the organizational (hospital) level and had to therefore rely on one person from each hospital for his/her opinions. The researcher collected responses from 10 people, who were essentially the second person to respond from the same hospital, but these had to be dropped from the study because of the need to uniquely map each response to an organization (hospital). Therefore, obtaining multiple survey responses from the same organization (hospital) was not a solution for the study. As already mentioned, it took the researcher four months to collect the sample of 294 usable responses using a cross-sectional online survey. No online website hosts this type of quality-related variable data. Thus, the possibility of supplementing the entire study, or even a part of it, from other secondary sources such as online or public records was ruled out. In the pilot stage, the researcher physically visited several hospitals in the vicinity and talked to quite a few of the potential respondents personally and even gathered their thoughts on these variables which were used to refine the questionnaire, but such an exhaustive procedure was not feasible to conduct for the main study.

Scores on the outcome variable of this study (PCQ), which were self-reported by senior hospital executives, could be compared with objective measures obtained from public domain. Each year the Center for Medicare and Medicaid Services (CMS) reports a set of several specific quality metrics for most hospitals in the country. Two common quality metrics available in the public domain are the 30-day risk-standardized mortality and readmission rates for ailments such as acute myocardial infarction (heart attack) and pneumonia. In addition, the Agency for Healthcare Research and Quality (AHRQ) reports Patient Safety Indicators (PSI) for death among surgical in-patients with serious treatable complications. Even though the objective measures are disease or ailment-specific, they reflect specific aspects of quality of medical care administered in the hospital. If the quality of care administered in the hospital is high, mortality rate (number of deaths within a 30-day period after the surgical procedure) should be low. Similarly, the number of patients readmitted to the hospital because of complications arising from the surgical procedure, should be low and the patient safety indicators should be high. Therefore, the aforementioned specific quality metrics are related to the comprehensive measure of PCQ obtained in the current study. These three hospital quality metrics could be collected for all or a subset of the 294 hospitals that responded in this study. A high correlation between the self-reported measures from the study and the aforementioned objective measures from public domain could help validate the outcome variable (PCQ) obtained in the study (Crandall, 1976).

To completely avoid the major issues associated with single source studies, future studies on healthcare quality in the hospital may need to budget more time and resources and use multiple sources such as surveys and interviews to gather their data. A practical solution could be to focus on a few states or regions and use surveys and interviews from hospital executives in that region, with data collected at different instances of time.

A second issue to consider relates to the two variables–supplier relationship management and internal lean practices–that were originally conceptualized as second order constructs having six and three first-order factors respectively. As this study had several other variables in the entire framework, four to six questions had to be included to measure each variable which made the survey questionnaire very long. It was noticed in the pilot study that the length of the study was linked to respondent dropouts. Therefore, the researcher was forced to compress these two second-order variables in order to shorten the survey questionnaire. Future healthcare studies on these variables could conceptualize these variables as second-order constructs and use more detailed measures to measure the entire domain of these constructs.

A third suggestion for future studies is about the conceptualization of patient care quality (PCQ) as a second order variable along with its four first-order factors. As already noted in the second chapter while reviewing the literature, only a handful of published studies (Dagger et al., 2007; Gill & White, 2009) have used the three dimensions of patient care quality (*interpersonal*, *environmental* and *administrative quality*), other than *technical quality*. As a result, many studies may have missed having the comprehensive picture of patient care quality in the hospital while focusing only on the technical quality (see Boyer et al., 2012; Chandrasekaran et al., 2012; Isaac et al., 2010; McFadden et al., 2006; Nair et al., 2013). Most academicians in the field of healthcare operations may have to acknowledge that there are a few dimensions of PCQ being left out, other than the elaborate metrics that Centers for Medicare & Medicaid Services (CMS) has developed to measure specific aspects of technical quality.

In marketing and healthcare literature, there are quite a few studies that have already considered patient satisfaction with a cure and patient safety and other quality related issues from a patient's perspective (Altman, Clancy, & Blendon, 2004; Chang et al., 2009; Dagger et al., 2007; Ma et al., 2009; C. W. Nelson & Niederberger, 1990; Van Ess Coeling & Cukr, 2000; Ware et al., 1983). In order to fill the void in literature, this study chose to investigate the patient related issues from hospital administrators' points of view. Future studies could link both perspectives together in a single study using dyads. In other words, future studies could collect data from patients released from hospitals after their admission stay and gather their views on quality related issues that they faced in the hospital and also data from the hospital's executive about the same issues in the hospital. Using a measurement instrument similar to SERVQUAL (Parasuraman, Zeithaml, & Berry, 1985, 1988, 1991) in healthcare, such a study would help clearly pin-point the gaps in the quality demanded by patients and those being administered in the hospital. Such micro level studies would help the hospital administrators realize the specific areas that they need to improve in their hospital.

Another avenue for future studies concerns healthcare team effectiveness, a variable which can be best studied at meso-level. Since this study was conducted at a macro level with the unit of analysis being the organization (hospital), all variables were studied at the same macro level to avoid issues of confounding with levels. Future studies could investigate hospitals much more closely and study how healthcare team effectiveness helps the hospital become lean and how team effectiveness helps the hospital improve the quality of the service delivered by the team (PCQ).

Lean implementation efforts at hospitals are also linked with a direct improvement in team effectiveness and further to improvement in quality of service or cure. Today, there are not many cases of hospitals that have successfully implemented lean principles or are even considering going down that path (de Koning et al., 2006; Graban, 2011; Kollberg et al., 2007) but future studies could empirically investigate hospitals' lean journey and success in improving PCQ due to the lean implementation using a sample of the hospitals that have implemented lean philosophy.

Future studies could link PCQ to financial performance of the hospitals. Many hospitals are not doing too well financially and their margins are under stress (A. Garson, Jr, 2000; Schneller & Smeltzer, 2006). Therefore, hospitals would like to know how each quality improvement effort could help them save cost and become lean in the process. Longitudinal studies will be needed to first measure hospital financial performance at different times of the year and then empirically link performance with the variables in the framework. In the end, while hospitals are all meant to serve the suffering public and cure them of their ailments, they too like other service firms, need to be concerned about financial performance. It would be thus a win-win for all parties if by using a lean approach the quality of patient care improves because all of the following three effects are inter-linked. First, patients can be cured faster and effectively and can leave the hospital sooner after their cure. Second, doctors and nurses can become more satisfied with faster and effective recovery of their patients who do not need to come back for the same ailment. Third, hospitals can enjoy superior financial performance due to the ability of patients to pay off their lower hospital bills, which would be possible due to the improved quality of care.

Although this research had limited its context to studying the determinants of quality of care for admitted patients in full-service U.S. hospitals, the recent happenings in the healthcare industry in the U.S. such as the upholding of Affordable Care Act (ACA) by the U.S. Supreme Court on June 25, 2015 may have implications for this research. For the most part, it seems that three major thrust areas of ACA– making it mandatory for health insurance companies to insure all patients with any pre-existing ailments; for employers to provide insurance for all their employees; and for all U.S. citizens to buy health insurance (HHS, 2010)–do not impact the determinants of patient care quality. The ACA is a policy for increasing the access of health care whereas the determinants of PCQ investigated in this study are related to managing hospital operations. The policy, however, may have a few implications for PCQ. Currently, most hospitals pre-check with the patients' insurance provider before proceeding with surgeries and other medical procedures. With the new ACA ruling that makes it mandatory for insurance companies to cover all patient illnesses, the administrative procedures can now be eliminated completely or simplified. There may be some challenges too. Because of the increased number of insured people, there may be more demand for health services. The increased demand could pose some difficulties for the patient flow aspect of hospitals' lean implementation. Therefore, hospitals should be prepared to allocate more resources to ensure that PCQ is not adversely affected.

Finally, extending the above discussions to other countries that have a more direct government intervention in healthcare like in Australia, Canada and the U.K is another avenue for future research. In these countries there are no separate health insurance providers, government provides all payment to hospitals, and healthcare is mandated by law and free to the patient. The researcher would like to highlight that the determinants of patient care quality studied in this dissertation are universal but as already mentioned earlier, no attempt is made to generalize the findings of this study beyond the current research context. Future studies could be conducted to compare and contrast the U.S. healthcare research model with all the variables studied and its applications could be investigated in such countries.

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APPENDIX A

APPENDIX A

COVER LETTER

Subject of email: Research project on health care quality

Dear <Dr./Mr./Ms. Last Name>,

We, researchers at The University of Texas-Pan American (UTPA), are studying how to improve the quality of care available to patients admitted to full-service U.S. hospitals. UTPA is currently being consolidated into a new emerging research university–The University of Texas Rio Grande Valley (UTRGV), which will include a new medical school.

The framework being empirically tested in this research directly addresses the strategic issue of quality of care raised by The American Medical Association (AMA). We invite you to share your inputs on patient care quality in a short survey that should take about 10-15 minutes of your time. We expect that the findings of our study will contribute to the improvement of patient care quality in hospitals in our region and nationally. Given the importance of healthcare in our community and the future medical school, this topic is very relevant and timely.

We cannot possibly complete this research without your help because the success of this study depends on the cooperation between hospitals, senior doctors and administrators like you and academia. Participation in this research is completely voluntary and you can withdraw from the study at any time. If there are any individual questions that you would prefer to skip, simply leave the answer blank.

Your prompt response is greatly appreciated. In appreciation of your time/effort we will send you a copy of the aggregated results. Please indicate on the last page of the survey if you would like to receive this report and give your hospital information.

If you have any questions please do not hesitate to call Subhajit Chakraborty. He is available via phone at (575) 621-0947 and by email at schakraborty1@utpa.edu . Thank you very much for your time and consideration.

Sincerely,

Subhajit Chakraborty
Doctoral Candidate
Principal Investigator

Hale Kaynak, Ph.D.
Ph.D. Committee Chair
Faculty Advisor

Click here to begin: https://utpa.qualtrics.com/SE/?SID=SV_elYLTDCnFOSHuK1

APPENDIX B

APPENDIX B

QUESTIONNAIRE

An Empirical Assessment of Patient Healthcare Quality: A Lean Hospital Supply Chain Perspective

This research is being conducted by Subhajit Chakraborty, Ph.D. candidate and Dr. Hale Kaynak, Professor of Operations Management from the University of Texas–Pan American. The objective of this research is to test a framework that may be used by full-service U.S. hospitals for improving the quality of care available to their admitted patients.

This survey should take about 15-20 minutes to complete. Participation in this research is completely voluntary. If there are any individual questions that you would prefer to skip, simply leave the answer blank.

You must be at least 18 years old to participate. If you are not 18 or older, please do not complete the survey.

All survey responses that we receive will be treated confidentially and stored on a secure server. However, given that the surveys can be completed from any computer (e.g., personal, work, school), we are unable to guarantee the security of the computer on which you choose to enter your responses. As a participant in our study, we want you to be aware that certain technologies exist that can be used to monitor or record data that you enter and/or websites that you visit. Any individually identifiable responses will be securely stored and will only be available to those directly involved in this study.

This research has been reviewed and approved by the Institutional Review Board for Human Subjects Protection (IRB). If you have any questions about your rights as a participant, or if you feel that your rights as a participant were not adequately met by the researcher, please contact the IRB at 956-665-2889 or irb@utpa.edu. You are also invited to provide anonymous feedback to the IRB by visiting www.utpa.edu/IRBfeedback.

For each question on the following pages please indicate the extent to which you agree with the following statements in the context of the hospital. A few unrelated questions are also included for research purposes.

Management Leadership

Management refers to senior hospital management. Please indicate the degree to which you agree or disagree with the following statements using the following scale:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
1. Management supports a climate that promotes patient safety.	❍	❍	❍	❍	❍	❍	❍
2. Management has a clear picture of the risks associated with patient care.	❍	❍	❍	❍	❍	❍	❍
3. Management has a good idea of the mistakes that actually occur in the hospital.	❍	❍	❍	❍	❍	❍	❍
4. Management considers patient care quality when changes are discussed.	❍	❍	❍	❍	❍	❍	❍
5. Management encourages clear communication flow up and down the chain of hospital command regarding patient issues.	❍	❍	❍	❍	❍	❍	❍
6. Management reviews patient care quality related issues in its meetings.	❍	❍	❍	❍	❍	❍	❍

Technology Integration

Technology refers to software applications and hardware used by the hospital. Please indicate the degree to which you agree or disagree with the following statements using the following scale:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
7. The hospital follows an electronic ordering system for its supplies.	❍	❍	❍	❍	❍	❍	❍
8. Patient care software applications used in the hospital are integrated with each other.	❍	❍	❍	❍	❍	❍	❍
9. Different patient care software applications are integrated with other internal applications (e.g., pharmacy, radiology, laboratory, finance).	❍	❍	❍	❍	❍	❍	❍
10. Patient care systems used in the hospital interface with the computerized systems of external entities (e.g., other hospitals and clinics).	❍	❍	❍	❍	❍	❍	❍
11. Software applications used by different medical departments of the hospital (e.g., operating room, emergency room, laboratory, radiology and pharmacy) are integrated.	❍	❍	❍	❍	❍	❍	❍
12. Integrated financial information from all medical units is available for decision making.	❍	❍	❍	❍	❍	❍	❍

Supplier Relationship Management (SRM)

Suppliers refer to the hospital's key suppliers for materials and hospital consumables (e.g., medicines, beds, equipment).

SRM-Supplier Flexibility

Please indicate the degree to which you agree or disagree with the following statements using the following scale:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
13. Key suppliers respond quickly to requests that the hospital makes.	❍	❍	❍	❍	❍	❍	❍
14. Key suppliers make changes in quantity supplied on time.	❍	❍	❍	❍	❍	❍	❍
15. Key suppliers can readily adjust their inventories to meet unforeseen needs that might occur in the hospital.	❍	❍	❍	❍	❍	❍	❍
16. Key suppliers can provide emergency deliveries.	❍	❍	❍	❍	❍	❍	❍
17. Key suppliers make adjustments to their production schedule to accommodate environmental changes.	❍	❍	❍	❍	❍	❍	❍
18. Key suppliers make adjustments to contracts with the hospital when problems arise.	❍	❍	❍	❍	❍	❍	❍

SRM-Supplier Assistance

Please indicate the degree to which you agree or disagree with the following statements using the following scale:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
19. Key suppliers let the hospital know about delivery problems in advance.	❍	❍	❍	❍	❍	❍	❍
20. Key suppliers make an effort to help the hospital during emergencies.	❍	❍	❍	❍	❍	❍	❍
21. Key suppliers recommend stock substitutes for products (e.g., medicines, other daily consumables and equipment) when delivery troubles develop.	❍	❍	❍	❍	❍	❍	❍
22. Key suppliers are willing to provide their detailed financial information to the hospital for value analysis.	❍	❍	❍	❍	❍	❍	❍
23. Key suppliers take action on complaints related to order servicing and shipping.	❍	❍	❍	❍	❍	❍	❍
24. Key suppliers are willing to help the hospital by expediting orders when requested.	❍	❍	❍	❍	❍	❍	❍

SRM-Supplier Information Exchange

Please indicate the degree to which you agree or disagree with the following statements using the following scale:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
25. The hospital provides suppliers with forecasts of their product and service requirements.	❍	❍	❍	❍	❍	❍	❍
26. The hospital gives its product usage information to suppliers to help them better plan their needs.	❍	❍	❍	❍	❍	❍	❍
27. The hospital informs suppliers in advance of impending changes in products used along with specifications.	❍	❍	❍	❍	❍	❍	❍
28. Key suppliers provide information about changes to their existing products to the hospital.	❍	❍	❍	❍	❍	❍	❍
29. The hospital expects key suppliers to inform them about events or supplier-related changes that may affect hospital operations.	❍	❍	❍	❍	❍	❍	❍
30. The hospital and its key suppliers share more information with each other more than contractually required.	❍	❍	❍	❍	❍	❍	❍

SRM-Supplier Monitoring

Please indicate the degree to which you agree or disagree with the following statements using the following scale:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
31. The hospital advises each supplier of their performance in relation to that of other suppliers.	❍	❍	❍	❍	❍	❍	❍
32. Suppliers provide the hospital summary usage reports on a quarterly or monthly basis.	❍	❍	❍	❍	❍	❍	❍
33. The hospital conducts quality training for supplier personnel.	❍	❍	❍	❍	❍	❍	❍
34. The hospital has procedures to inspect supplies from suppliers.	❍	❍	❍	❍	❍	❍	❍
35. The hospital keeps track of timeliness of delivery from its suppliers.	❍	❍	❍	❍	❍	❍	❍
36. The hospital keeps track of accuracy of orders fulfilled by its suppliers.	❍	❍	❍	❍	❍	❍	❍
37. On most days hospital administrators have moments of real fun or joy.	❍	❍	❍	❍	❍	❍	❍

SRM-Continuity Expectation

Please indicate the degree to which you agree or disagree with the following statements using the following scale:

	Strongly Disagree	**Disagree**	**Somewhat Disagree**	**Neither Agree nor Disagree**	**Somewhat Agree**	**Agree**	**Strongly Agree**
38. The hospital and its key suppliers are committed to each other.	❍	❍	❍	❍	❍	❍	❍
39. The hospital expects supplier relationships to last long.	❍	❍	❍	❍	❍	❍	❍
40. Renewal of the hospital's relationship with key suppliers is automatic.	❍	❍	❍	❍	❍	❍	❍
41. The hospital expects suppliers to be willing to work with them to resolve all issues.	❍	❍	❍	❍	❍	❍	❍
42. The hospital enjoys a mutually beneficial relationship with its suppliers.	❍	❍	❍	❍	❍	❍	❍
43. Both parties make plans not only for the terms of the individual purchase, but also for the continuance of the relationship.	❍	❍	❍	❍	❍	❍	❍

SRM-Quality of Supplies

Please indicate the degree to which you agree or disagree with the following statements using the following scale:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Agree	Strongly Agree
44. Suppliers have a document (manual) that describes their quality system.	❍	❍	❍	❍	❍	❍	❍
45. Suppliers have meetings to review their quality system.	❍	❍	❍	❍	❍	❍	❍
46. Suppliers periodically conduct internal audits of their quality system.	❍	❍	❍	❍	❍	❍	❍
47. Suppliers calibrate their equipment against standards.	❍	❍	❍	❍	❍	❍	❍
48. The products and services provided by the suppliers meet required specifications.	❍	❍	❍	❍	❍	❍	❍
49. The products and services provided by the suppliers perform as intended.	❍	❍	❍	❍	❍	❍	❍
50. Hospital administrators live a very interesting life.	❍	❍	❍	❍	❍	❍	❍

Healthcare Team Effectiveness

Healthcare team refers to the team of doctors and nurses, who are responsible for the medical care of admitted patients in the hospital. Please indicate the degree to which you agree or disagree with the following statements using the following scale:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
51. Healthcare team members collaborate with each other.	❍	❍	❍	❍	❍	❍	❍
52. Healthcare team members value each other's roles.	❍	❍	❍	❍	❍	❍	❍
53. Healthcare team members have a strategy for communication.	❍	❍	❍	❍	❍	❍	❍
54. Healthcare team members share objectives of the team.	❍	❍	❍	❍	❍	❍	❍
55. Healthcare team members share learning with the team.	❍	❍	❍	❍	❍	❍	❍
56. Healthcare team members collaborate with other social services.	❍	❍	❍	❍	❍	❍	❍
57. Hospital administrators always seem to have something pleasant to look forward to.	❍	❍	❍	❍	❍	❍	❍

Internal Lean Practices (ILP)

ILP-Patient and Material Flow

Please indicate the degree to which you agree or disagree with the following statements using the following scale:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
58. The admission procedure followed at the hospital is efficient.	❍	❍	❍	❍	❍	❍	❍
59. The discharge procedure followed at the hospital is efficient.	❍	❍	❍	❍	❍	❍	❍
60. Materials required for patients' medical treatments (e.g., medicines, equipment) are available to the healthcare team as and when needed.	❍	❍	❍	❍	❍	❍	❍
61. Hospital equipment is arranged to help in the continuous flow of patients.	❍	❍	❍	❍	❍	❍	❍
62. Quick changeover techniques are used in the critical hospital facilities (e.g., intensive care unit, operating room).	❍	❍	❍	❍	❍	❍	❍
63. The hospital administration analyzes and removes all bottlenecks that hinder continuous patient and material flow.	❍	❍	❍	❍	❍	❍	❍

ILP-Continuous Quality Improvement

Please indicate the degree to which you agree or disagree with the following statements using the following scale:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
64. The hospital uses data-driven problem-solving approaches.	❍	❍	❍	❍	❍	❍	❍
65. The hospital emphasizes the use of systems to improve processes.	❍	❍	❍	❍	❍	❍	❍
66. The hospital uses cross-functional healthcare teams in its patient care processes.	❍	❍	❍	❍	❍	❍	❍
67. The hospital has a clear customer (patient) focus.	❍	❍	❍	❍	❍	❍	❍
68. Healthcare team members lead product/process improvement efforts at the hospital.	❍	❍	❍	❍	❍	❍	❍
69. Healthcare team members undergo cross-functional training.	❍	❍	❍	❍	❍	❍	❍
70. For hospital administrators, life is a great adventure.	❍	❍	❍	❍	❍	❍	❍

ILP-Waste Management

Waste refers to any non-value adding activity. Please indicate the degree to which you agree or disagree with the following statements using the following scale:

	Strongly Disagree	**Disagree**	**Somewhat Disagree**	**Neither Agree nor Disagree**	**Somewhat Agree**	**Agree**	**Strongly Agree**
71. The hospital orders supplies as and when required.	❍	❍	❍	❍	❍	❍	❍
72. The hospital pushes suppliers for shorter lead-times.	❍	❍	❍	❍	❍	❍	❍
73. The hospital streamlines ordering, receiving and other paperwork from suppliers.	❍	❍	❍	❍	❍	❍	❍
74. The hospital evaluates suppliers on the basis of total cost and not per unit price.	❍	❍	❍	❍	❍	❍	❍
75. The hospital takes active steps to reduce the number of suppliers.	❍	❍	❍	❍	❍	❍	❍
76. The hospital departments identify and improve processes so as to reduce wastes (e.g., by decreasing the turnaround time for transcription reports in the laboratory).	❍	❍	❍	❍	❍	❍	❍

Patient Care Quality (PCQ)

PCQ-Interpersonal Quality

Interpersonal quality reflects the relationship developed and the dyadic interplay that occurs between the healthcare team and patient. Please indicate the degree to which you agree or disagree with the following statements using the following scale:

	Strongly Disagree	**Disagree**	**Somewhat Disagree**	**Neither Agree nor Disagree**	**Somewhat Agree**	**Agree**	**Strongly Agree**
77. Healthcare team members treat patients as individuals and not just numbers.	❍	❍	❍	❍	❍	❍	❍
78. Healthcare team members actively listen to what patients have to say.	❍	❍	❍	❍	❍	❍	❍
79. Healthcare team members give personalized attention to the patients.	❍	❍	❍	❍	❍	❍	❍
80. Healthcare team members are willing to answer questions that the patient or their kin may have.	❍	❍	❍	❍	❍	❍	❍
81. Healthcare team members explain the ailment to the patient or their kin in a way that they can understand.	❍	❍	❍	❍	❍	❍	❍
82. Healthcare team members sometimes kid around, laugh, or joke with patients like close friends.	❍	❍	❍	❍	❍	❍	❍

PCQ-Technical Quality

Technical quality reflects the expertise, professionalism, and competency of the healthcare team in delivering the cure. Please indicate the degree to which you agree or disagree with the following statements using the following scale:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
83. Patients are administered the best medical care that is required to cure their ailment.	❍	❍	❍	❍	❍	❍	❍
84. Tests (e.g., X-rays and lab tests) are ordered on patients only when required.	❍	❍	❍	❍	❍	❍	❍
85. Healthcare team members are well trained and qualified.	❍	❍	❍	❍	❍	❍	❍
86. Healthcare team members are highly skilled at their jobs.	❍	❍	❍	❍	❍	❍	❍
87. Healthcare team members carry out their tasks competently.	❍	❍	❍	❍	❍	❍	❍
88. Patients leave the hospital feeling encouraged about their medical treatment.	❍	❍	❍	❍	❍	❍	❍

PCQ-Environmental Quality

Environmental quality comprises hospital atmosphere related to cleanliness and tangibles, such as hospital bed and necessary equipment like drip stands and other required equipment for patient health needs. Please indicate the degree to which you agree or disagree with the following statements using the following scale:

	Strongly Disagree	**Disagree**	**Somewhat Disagree**	**Neither Agree nor Disagree**	**Somewhat Agree**	**Agree**	**Strongly Agree**
89. The design of the hospital is patient friendly.	❍	❍	❍	❍	❍	❍	❍
90. The lighting at the hospital is appropriate.	❍	❍	❍	❍	❍	❍	❍
91. The temperature at the hospital is pleasant.	❍	❍	❍	❍	❍	❍	❍
92. The furniture at the hospital is comfortable.	❍	❍	❍	❍	❍	❍	❍
93. The interior design of the hospital is aesthetically pleasing.	❍	❍	❍	❍	❍	❍	❍
94. The hospital has an appealing atmosphere.	❍	❍	❍	❍	❍	❍	❍

PCQ-Administrative Quality

Administrative quality facilitates the production of the medical cure while adding value to patient. Please indicate the degree to which you agree or disagree with the following statements using the following scale:

	Strongly Disagree	**Disagree**	**Somewhat Disagree**	**Neither Agree nor Disagree**	**Somewhat Agree**	**Agree**	**Strongly Agree**
95. Internal hospital services (e.g., pathology) work well.	❍	❍	❍	❍	❍	❍	❍
96. Waiting time at the hospital is kept at a minimum.	❍	❍	❍	❍	❍	❍	❍
97. Generally, appointments at the hospital run on time.	❍	❍	❍	❍	❍	❍	❍
98. The hospital records and documentation are error free (e.g., billing).	❍	❍	❍	❍	❍	❍	❍
99. The hospital provides patients with a range of support services.	❍	❍	❍	❍	❍	❍	❍
100. The hospital is well managed.	❍	❍	❍	❍	❍	❍	❍

Demographics

101. How long have you been working in healthcare?

____

102. How long have you been working for this hospital?

____

103. How long have you been at your present position?

____

104. Your present position is

____

105. The highest level of education that you have completed is

- ❍ Bachelor's Degree
- ❍ MD
- ❍ Master's Degree
- ❍ Ph.D.
- ❍ Other

106. Your sex is

- ❍ Male
- ❍ Female

107. Your age is ______________________________________

Thank you very much for your cooperation. If you could print the name of your hospital on the following page, our results of the research study will be enhanced greatly. Your individual answers are strictly confidential and will NOT be seen by anyone other than researchers nor will your responses be reported individually under any conditions.

Profile

108. Your name ____

109. Your hospital's name ____

110. Your hospital's address ____

111. I would like to receive a copy of the aggregated final study results

❍ Yes

❍ No

112. Comments ____

APPENDIX C

APPENDIX C

REVISED QUESTIONNAIRE

An Empirical Assessment of Patient Healthcare Quality: A Lean Hospital Supply Chain Perspective

This research is being conducted by Subhajit Chakraborty, Ph.D. candidate and Dr. Hale Kaynak, Professor of Operations Management from the University of Texas–Pan American (UTPA) which is currently being consolidated into a new emerging research university–The University of Texas Rio Grande Valley (UTRGV). The new university will include a new medical school.

The objective of this research is to test a framework that may be used by full-service U.S. hospitals for improving the quality of care available to their admitted patients. We expect that the findings of our study will contribute to the improvement of patient care quality in hospitals in our region and nationally. Given the importance of healthcare in our community and the future medical school, this topic is very relevant and timely.

This survey has seven pages and should take about 10-15 minutes to complete. Participation in this research is completely voluntary and you can withdraw from the study at any time. If there are any individual questions that you would prefer to skip, simply leave the answer blank. You must be at least 18 years old to participate. If you are not 18 or older, please do not complete the survey.

All survey responses that we receive will be treated confidentially and stored on a secure server. However, given that the surveys can be completed from any computer (e.g., personal, work, school), we are unable to guarantee the security of the computer on which you choose to enter your responses. As a participant in our study, we want you to be aware that certain technologies exist that can be used to monitor or record data that you enter and/or websites that you visit. Any individually identifiable responses will be securely stored and will only be available to those directly involved in this study.

This research has been reviewed and approved by the Institutional Review Board for Human Subjects Protection (IRB). If you have any questions about your rights as a participant, or if you feel that your rights as a participant were not adequately met by the researcher, please contact the IRB at 956-665-2889 or irb@utpa.edu. You are also invited to provide anonymous feedback to the IRB by visiting www.utpa.edu/IRBfeedback.

For each question on the following pages please indicate the extent to which you agree with the following statements in the context of the hospital. A few unrelated questions are also included for research purposes.

Management Leadership

Management refers to senior hospital management. Please indicate the degree to which you agree or disagree with the following statements using the following scale:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
1. Management supports a climate that promotes patient safety.	○	○	○	○	○	○	○
2. Management has a clear picture of the risks associated with patient care.	○	○	○	○	○	○	○
3. Management has a good idea of the mistakes that actually occur in the hospital.	○	○	○	○	○	○	○
4. Management reviews patient care quality related issues in its meetings.	○	○	○	○	○	○	○

Technology Integration

Technology refers to software applications and hardware used by the hospital. Please indicate the degree to which you agree or disagree with the following statements using the following scale:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
5. The hospital follows an electronic ordering system for its supplies.	○	○	○	○	○	○	○
6. Patient care software applications used in the hospital are integrated with each other.	○	○	○	○	○	○	○
7. Different patient care software applications are integrated with other internal applications (e.g., pharmacy, radiology, laboratory, finance).	○	○	○	○	○	○	○
8. Software applications used by different medical departments of the hospital (e.g., operating room, emergency room, laboratory, radiology and pharmacy) are integrated.	○	○	○	○	○	○	○
9. On most days hospital administrators have moments of real fun or joy.	○	○	○	○	○	○	○

Supplier Relationship Management

Suppliers refer to the hospital's key suppliers for materials and hospital consumables (e.g., medicines, beds, equipment).

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
10. Key suppliers are flexible to adjust to the changing demands of the hospital.	○	○	○	○	○	○	○
11. Key suppliers make an effort to help the hospital during emergencies.	○	○	○	○	○	○	○
12. Key suppliers provide information about changes to their existing products to the hospital.	○	○	○	○	○	○	○
13. The hospital monitors the timeliness of delivery from its suppliers.	○	○	○	○	○	○	○
14. The hospital and its key suppliers are committed to each other.	○	○	○	○	○	○	○
15. The products and services provided by the suppliers meet required specifications.	○	○	○	○	○	○	○
16. Hospital administrators live a very interesting life.	○	○	○	○	○	○	○

Healthcare Team Effectiveness

Healthcare team refers to the team of doctors and nurses, who are responsible for the medical care of admitted patients in the hospital. Please indicate the degree to which you agree or disagree with the following statements using the following scale:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
17. Healthcare team members collaborate with each other.							
18. Healthcare team members value each other's roles.							
19. Healthcare team members share objectives of the team.							
20. Healthcare team members share learning with the team.							
21. Hospital administrators always seem to have something pleasant to look forward to.							

Internal Lean Practices

Waste refers to any non-value adding activity. Please indicate the degree to which you agree or disagree with the following statements using the following scale:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
22. Hospital equipment is arranged to help in the seamless flow of patients.	○	○	○	○	○	○	○
23. Materials required for patients' medical treatments (e.g., medicines) are available to the healthcare team as and when needed.	○	○	○	○	○	○	○
24. The hospital uses data-driven problem-solving approaches.	○	○	○	○	○	○	○
25. The hospital considers quality improvement as a continuous process.	○	○	○	○	○	○	○
26. For hospital administrators, life is a great adventure.	○	○	○	○	○	○	○
27. The hospital orders supplies as and when required.	○	○	○	○	○	○	○
28. The hospital departments improve processes so as to reduce wastes (e.g., by decreasing the turnaround time for transcription reports in the laboratory).	○	○	○	○	○	○	○

Patient Care Quality

Please indicate the degree to which you agree or disagree with the following statements using the following scale:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
29. Healthcare team members treat patients as individuals and not just numbers.	○	○	○	○	○	○	○
30. Healthcare team members actively listen to what patients have to say.	○	○	○	○	○	○	○
31. Healthcare team members give personalized attention to the patients.	○	○	○	○	○	○	○
32. Healthcare team members are willing to answer questions that the patient or their kin may have.	○	○	○	○	○	○	○
33. Patients are administered the best medical care that is required to cure their ailment.	○	○	○	○	○	○	○
34. Healthcare team members are well trained and qualified.	○	○	○	○	○	○	○
35. Healthcare team members are highly skilled at their jobs.	○	○	○	○	○	○	○
36. Healthcare team members carry out their tasks competently.	○	○	○	○	○	○	○

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
37. The lighting at the hospital is appropriate.	○	○	○	○	○	○	○
38. The temperature at the hospital is pleasant.	○	○	○	○	○	○	○
39. The furniture at the hospital is comfortable.	○	○	○	○	○	○	○
40. The interior design of the hospital is aesthetically pleasing.	○	○	○	○	○	○	○
41. Internal hospital services (e.g., pathology) work well.	○	○	○	○	○	○	○
42. The hospital records and documentation (e.g., billing) are error free	○	○	○	○	○	○	○
43. The hospital provides patients with a range of support services.	○	○	○	○	○	○	○
44. The hospital is well managed.	○	○	○	○	○	○	○

Demographics

45. How long have you been working in healthcare?

46. How long have you been working for this hospital?

47. How long have you been at your present position?

48. Your age is

49. The highest level of education that you have completed is

- Bachelor's Degree
- MD
- Master's Degree
- Ph.D.
- Other

50. Your sex is

- Male
- Female

Thank you very much for your cooperation. If you could print the name of your hospital in the following section, our results of the research study will be enhanced greatly. Your individual answers are strictly confidential and will NOT be seen by anyone other than researchers nor will your responses be reported individually under any conditions.

Profile

51. Your hospital's name

52. Your hospital's address

53. I would like to receive a copy of the aggregated final study results

- Yes
- No

Personal Details

54. Your name

55. Your email

56. Comments

Notes. Three items have been modified from the earlier questionnaire (Appendix-B) to make their meaning clearer. These are: Two items in the *supplier relationship management* scale–item 10 from item 15, and item 13 from item 35 and one item in the *internal lean practices* scale–item 22 from item 61. Item 25 has been added new to the *internal lean practices* scale to fully capture the domain of the construct.

APPENDIX D

APPENDIX D

SUBSEQUENT WAVE COVER LETTER

Subject of email: Research project on health care quality

Dear <Dr./Mr./Ms. Last Name>,

Recently we, researchers at The University of Texas-Pan American (UTPA), wrote to you seeking your assistance for improving the quality of care for admitted patients at full-service U.S. hospitals. UTPA is currently being consolidated into a new emerging research university–The University of Texas Rio Grande Valley (UTRGV), which will include a new medical school.

The framework being empirically tested in this research directly addresses the strategic issue of quality of care raised by The American Medical Association (AMA). We invite you to share your inputs on patient care quality in a short survey that should take about 10-15 minutes of your time. We expect that the findings of our study will contribute to the improvement of patient care quality in hospitals in our region and nationally. Given the importance of healthcare in our community and the future medical school, this topic is very relevant and timely.

If you have recently completed the survey please accept our sincere thanks and disregard this email. If not, we urge you to complete the short survey today. In appreciation of your time/effort we will send you a copy of the aggregated results. Please indicate on the last page of the survey if you would like to receive this report and give your hospital information.

We cannot possibly complete this research without your help because the success of this study depends on the cooperation between hospitals, senior doctors and administrators like you and academia. Participation in this research is completely voluntary and you can withdraw from the study at any time. If there are any individual questions that you would prefer to skip, simply leave the answer blank. If you think you are unable to complete this questionnaire, please forward it to an individual in your hospital who you believe would be best qualified to do so.

If you have any questions please do not hesitate to call Subhajit Chakraborty, the principal investigator. He is available via phone at (575) 621-0947 and by email at schakraborty1@utpa.edu. Your cooperation is greatly appreciated.

Sincerely,

Subhajit Chakraborty
Doctoral Candidate
Principal Investigator

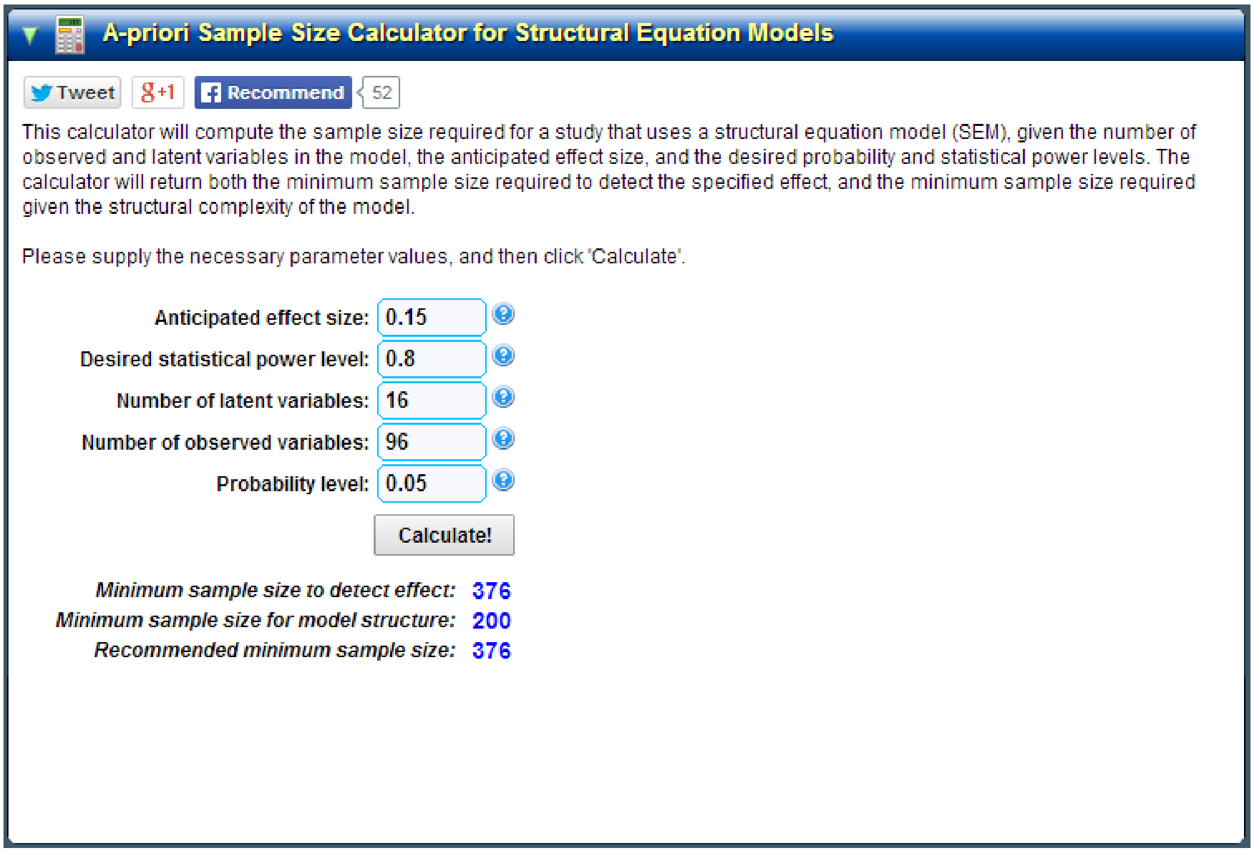
Hale Kaynak, Ph.D.
Ph.D. Committee Chair
Faculty Advisor

Click here to begin: https://utpa.qualtrics.com/SE/?SID=SV_elYLTDCnFOSHuK1

APPENDIX E

APPENDIX E

POWER ANALYSIS

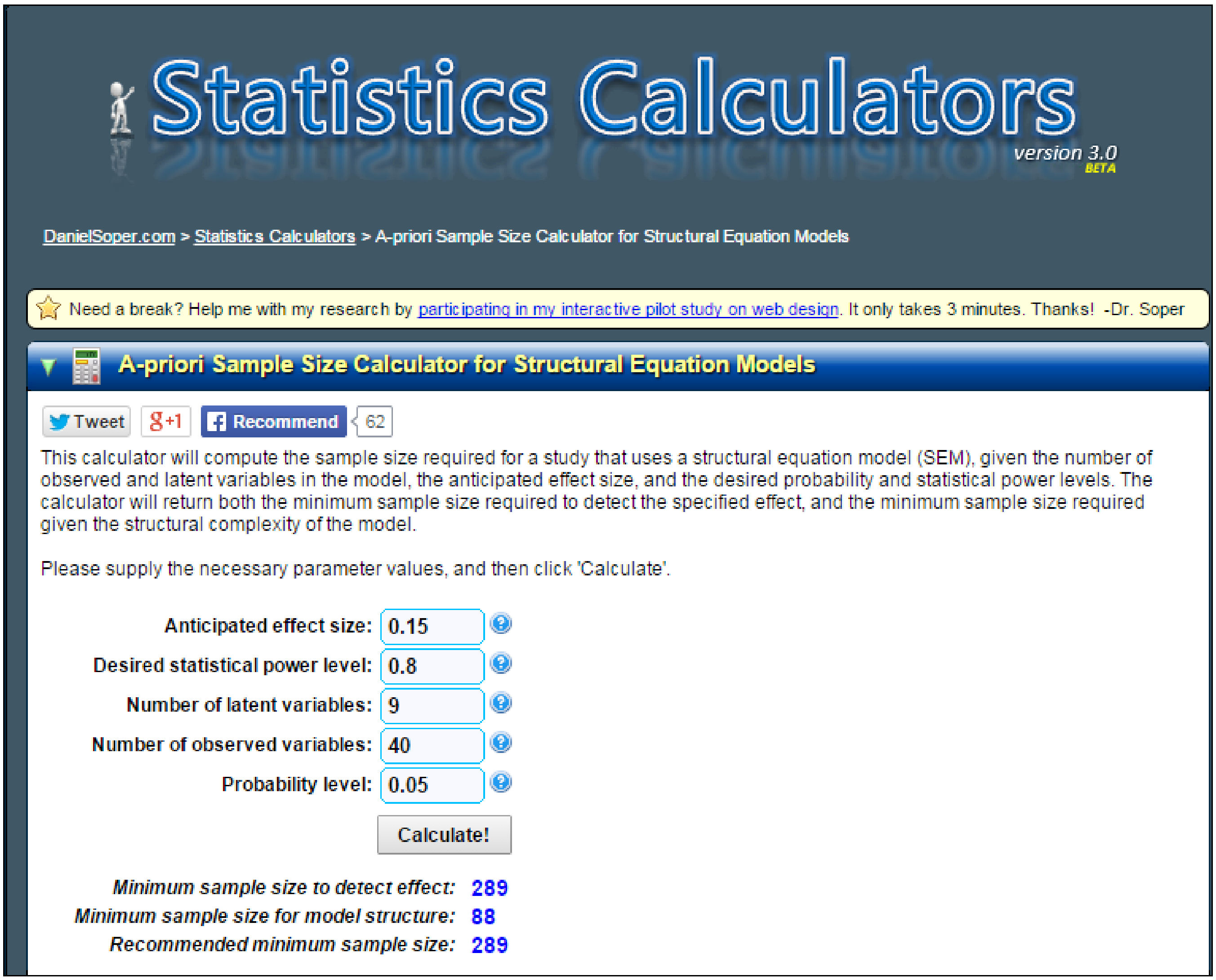


Notes. Values used for calculation: Anticipated effect size = 0.15, desired statistical power = 0.8, number of latent variables = 16; number of observed variables = 96; probability level or alpha = 0.05. Recommended minimum sample size = 376 (Soper, 2006).

APPENDIX F

APPENDIX F

REVISED POWER ANALYSIS



Notes. Anticipated effect size = 0.15, desired statistical power = 0.8, number of latent variables = 9; number of observed variables = 40; probability level or alpha = 0.05. Recommended minimum sample size = 289 (Soper, 2006).

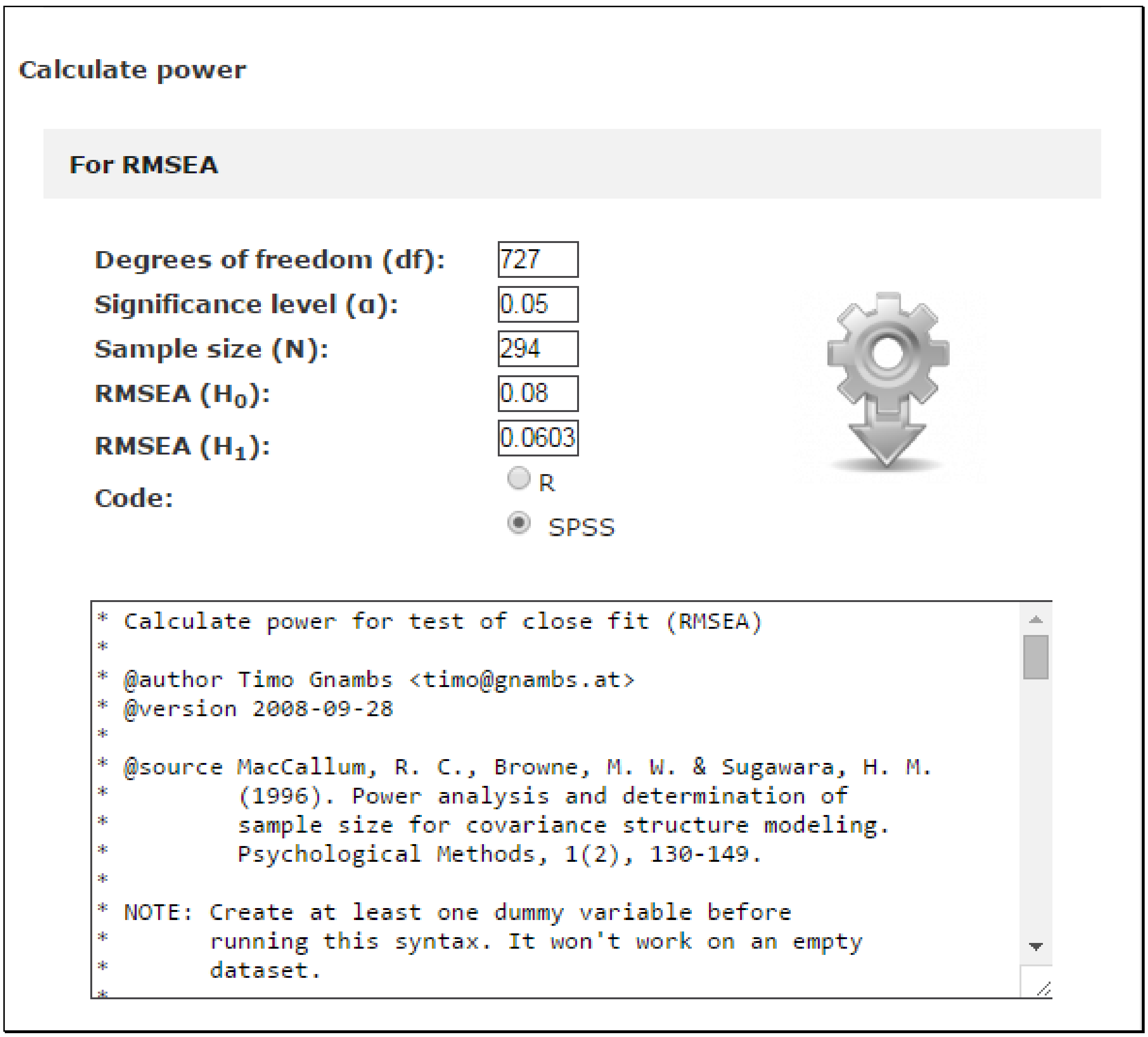
APPENDIX G

APPENDIX G

POST-HOC POWER ANALYSIS FOR SEM MODELS

Hypothesized Model

***SPSS Syntax generated from Gnambs* (2013)**



Calculate power

For RMSEA

Degrees of freedom (df): 727
Significance level (α): 0.05
Sample size (N): 294
RMSEA (H_0): 0.08
RMSEA (H_1): 0.0603
Code: R / SPSS (selected)

```
* Calculate power for test of close fit (RMSEA)
*
* @author Timo Gnambs <timo@gnambs.at>
* @version 2008-09-28
*
* @source MacCallum, R. C., Browne, M. W. & Sugawara, H. M.
*         (1996). Power analysis and determination of
*         sample size for covariance structure modeling.
*         Psychological Methods, 1(2), 130-149.
*
* NOTE: Create at least one dummy variable before
*       running this syntax. It won't work on an empty
*       dataset.
*
```

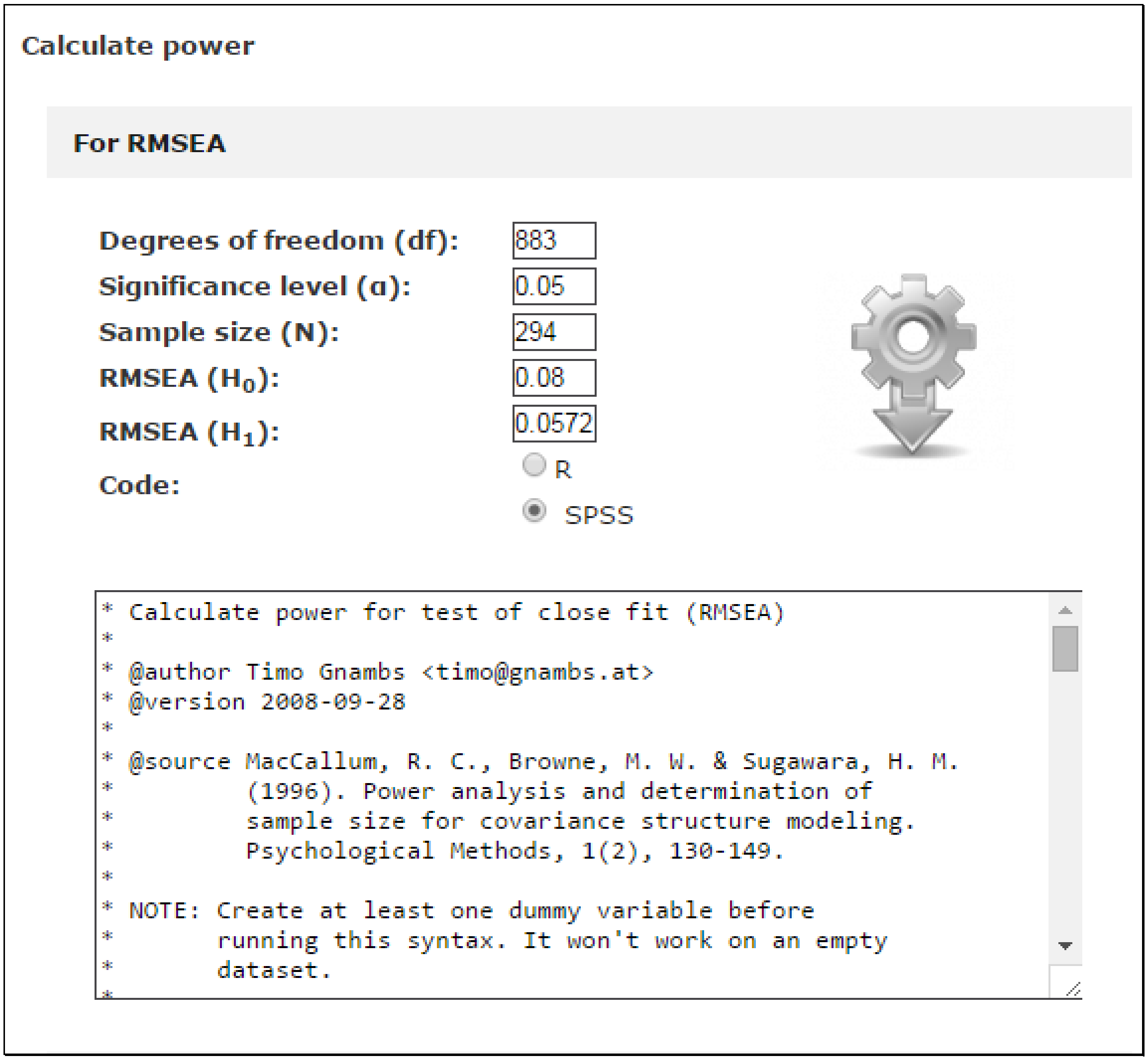
__SPSS Output for Power of the Study (Hypothesized Model)__

```
* Calculate power for test of close fit (RMSEA)
*
* @author Timo Gnambs
* @version 2008-09-28
*
* @source MacCallum, R. C., Browne, M. W. & Sugawara, H. M.
*        (1996). Power analysis and determination of
*        sample size for covariance structure modeling.
*        Psychological Methods, 1(2), 130-149.
*
* NOTE: Create at least one dummy variable before
*      running this syntax. It won't work on an empty
*      dataset.

********************** SETTINGS **********************.

compute #df = 727.        /* Degrees of freedom */
compute #alpha = 0.05.   /* Significance level */
compute #n = 294.        /* Sample size */
compute #rmsea0 = 0.08.  /* RMSEA under H0 */
compute #rmseaa = 0.0603.  /* RMSEA under H1 */

*****************************************************.

set mxloops = 1000.
* Noncentral inverse chi-square distribution function.
* (adapted from corresponding R function "nmath/qnchisq.c").
define !nidf.chisq(p=!TOKENS(1) /df=!TOKENS(1) /ncp=!TOKENS(1)).
*1. finding an upper and lower bound.
compute #b = (!ncp*!ncp) / (!df + 3*!ncp).
compute #c = (!df + 3*!ncp)/(!df + 2*!ncp).
compute #ff = (!df + 2 * !ncp)/(#c*#c).
compute #ux = #b + #c * idf.chisq(!p, #ff).
if(#ux  0) #ux = 1.
loop.
do if(!p > 1).
break.
end if.
compute #ux = #ux * 2.
compute #t = ncdf.chisq(#ux, !df, !ncp).
end loop if (#t > !p).
compute #lx = #ux*2.
loop.
compute #lx = #lx*0.5.
compute #t = ncdf.chisq(#lx, !df, !ncp).
```

```
end loop if (#t  !p).
* 2. interval (lx,ux)  halving.
compute #accu = 1e-13.
loop.
compute #nx = 0.5 * (#lx + #ux).
do if (ncdf.chisq(#nx, !df, !ncp) > !p).
compute #ux = #nx.
else.
compute #lx = #nx.
end if.
end loop if ((#ux - #lx) / #nx  #accu).
compute #nidf.chisq = 0.5 * (#ux + #lx).
!enddefine.

compute #ncp0 = (#n-1)*#df*#rmsea0**2.
compute #ncpa = (#n-1)*#df*#rmseaa**2.
do if(#rmsea0  #rmseaa).
compute #tmp = 1-#alpha.
!nidf.chisq p=#tmp df=#df ncp=#ncp0.
compute #cval = #nidf.chisq.
compute #powerrmsea = 1 - ncdf.chisq(#cval,#df,#ncpa).
else.
!nidf.chisq p=#alpha df=#df ncp=#ncp0.
compute #cval = #nidf.chisq.
compute #powerrmsea = ncdf.chisq(#cval,#df,#ncpa).
end if.
do if($casenum=1).
print records=5 /'Degrees of freedom (df): ' #df (F4.0)
                /'Sample size (n)): ' #n (F4.0)
                /'RMSEA (H0): ' #rmsea0 (F4.2)
                /'RMSEA (H1): ' #rmseaa (F4.2)
                /'Power for test of close fit (McCallum et al., 1996):' #powerrmsea.
end if.
exe.
Degrees of freedom (df):  727
Sample size (n)):  294
RMSEA (H0):  .08
RMSEA (H1):  .06
Power for test of close fit (McCallum et al., 1996):    1.00
```

Structural Model with Marker as Control

SPSS Syntax generated from Gnambs **(2013)**



SPSS Output for Power of the Study (Structural Model with Marker as Control)

```
GET
  FILE='C:\Users\schakraborty1\Desktop\Subhajit\Prof dev\Dissertation\Final data
analyses\Latest\NSuBCWM.sav'.
DATASET NAME DataSet2 WINDOW=FRONT.
DATASET CLOSE DataSet0.
* Calculate power for test of close fit (RMSEA)
*
* @author Timo Gnambs
* @version 2008-09-28
```

```
*
* @source MacCallum, R. C., Browne, M. W. & Sugawara, H. M.
*        (1996). Power analysis and determination of
*        sample size for covariance structure modeling.
*        Psychological Methods, 1(2), 130-149.
*
* NOTE: Create at least one dummy variable before
*      running this syntax. It won't work on an empty
*      dataset.

********************* SETTINGS *********************.

compute #df = 883.        /* Degrees of freedom */
compute #alpha = 0.05.   /* Significance level */
compute #n = 294.        /* Sample size */
compute #rmsea0 = 0.08.  /* RMSEA under H0 */
compute #rmseaa = 0.0572.  /* RMSEA under H1 */

****************************************************.

set mxloops = 1000.
* Noncentral inverse chi-square distribution function.
* (adapted from corresponding R function "nmath/qnchisq.c").
define !nidf.chisq(p=!TOKENS(1) /df=!TOKENS(1) /ncp=!TOKENS(1)).
*1. finding an upper and lower bound.
compute #b = (!ncp*!ncp) / (!df + 3*!ncp).
compute #c = (!df + 3*!ncp)/(!df + 2*!ncp).
compute #ff = (!df + 2 * !ncp)/(#c*#c).
compute #ux = #b + #c * idf.chisq(!p, #ff).
if(#ux  0) #ux = 1.
loop.
do if(!p > 1).
break.
end if.
compute #ux = #ux * 2.
compute #t = ncdf.chisq(#ux, !df, !ncp).
end loop if (#t > !p).
compute #lx = #ux*2.
loop.
compute #lx = #lx*0.5.
compute #t = ncdf.chisq(#lx, !df, !ncp).
end loop if (#t  !p).
* 2. interval (lx,ux)  halving.
compute #accu = 1e-13.
loop.
compute #nx = 0.5 * (#lx + #ux).
```

```
do if (ncdf.chisq(#nx, !df, !ncp) > !p).
compute #ux = #nx.
else.
compute #lx = #nx.
end if.
end loop if ((#ux - #lx) / #nx  #accu).
compute #nidf.chisq = 0.5 * (#ux + #lx).
!enddefine.

compute #ncp0 = (#n-1)*#df*#rmsea0**2.
compute #ncpa = (#n-1)*#df*#rmseaa**2.
do if(#rmsea0  #rmseaa).
compute #tmp = 1-#alpha.
!nidf.chisq p=#tmp df=#df ncp=#ncp0.
compute #cval = #nidf.chisq.
compute #powerrmsea = 1 - ncdf.chisq(#cval,#df,#ncpa).
else.
!nidf.chisq p=#alpha df=#df ncp=#ncp0.
compute #cval = #nidf.chisq.
compute #powerrmsea = ncdf.chisq(#cval,#df,#ncpa).
end if.
do if($casenum=1).
print records=5 /'Degrees of freedom (df): ' #df (F4.0)
                 /'Sample size (n)): ' #n (F4.0)
                 /'RMSEA (H0): ' #rmsea0 (F4.2)
                 /'RMSEA (H1): ' #rmseaa (F4.2)
                 /'Power for test of close fit (McCallum et al., 1996):' #powerrmsea.
end if.
exe.
```

```
Degrees of freedom (df):  883
Sample size (n)):  294
RMSEA (H0):  .08
RMSEA (H1):  .06
Power for test of close fit (McCallum et al., 1996):    1.00
```

BIOGRAPHICAL SKETCH

Subhajit Chakraborty, born in Rourkela, India holds a Bachelor of Engineering (BS) degree in chemical engineering from National Institute of Technology (NIT) Rourkela and a MBA with dual majors in marketing and systems from Xavier Institute of Management (XIM) Bhubaneswar, India. He received his Ph.D. in Business Administration (Operations Management) from The University of Texas-Pan American (UTPA) in 2015.

Subhajit is a practitioner turned academic with 11 years of industry experience having worked as a Project Manager with *Tata Consultancy Services Limited* (TCS). He has operations and supply chain management practitioner background, and experience as an expatriate. His research interests include service quality along firms' supply chain, services design, outsourcing and lean healthcare operations. He has presented several papers at premier academic conferences such as the annual meeting of the Academy of Management and the Decision Sciences Institute. He has also co-authored a few papers in academic peer-reviewed journals. Subhajit is now an Assistant Professor of Management in the E. Craig Wall Sr. College of Business at Coastal Carolina University, Conway, SC and can be reached at schakrabo@coastal.edu.