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Process Management Impact on Clinical and Experiential Quality: Managing Tensions Between Safe and Patient-Centered Healthcare

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This research investigates the effect of process management on clinical and experiential quality. Clinical quality measures hospitals' performance on patient safety, i.e., adherence to standards, whereas experiential quality relates to patient centeredness, i.e., responsiveness to the needs and preferences of the patient. Drawing from the organizational learning literature, we argue for a trade-off between clinical and experiential quality as hospitals emphasize process management. We also study how external and internal forces, i.e., state legislation and hospital leadership, influence this relationship. A combination of primary data and secondary data collected at various time intervals is employed to test our hypotheses. Four important implications emerge from this work. First, we find that hospitals' emphasis on process management is associated with an increase in clinical quality but a decrease in experiential quality. Second, we find that state legislation initially reinforces this trade-off but, overtime, facilitates a positive impact of process management on both quality outcomes. Third, a post hoc analysis suggests that a specific type of hospital leadership, namely, patient-centered leadership, helps mitigate the negative association between process management and experiential quality. Finally, our research provides preliminary evidence regarding the relationship between clinical quality and patient satisfaction contingent on experiential quality. Implications for theory and practice are discussed.

Key words: healthcare operations; process management; clinical and experiential quality; empirical research
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1. Introduction

In 1999, the Institute of Medicine (IOM) published an alarming report titled *To Err Is Human*, which documented that as many as 1,000,000 people a year are injured, and 98,000 people a year die as a result of preventable medical errors in U.S. hospitals (IOM 1999). This report had a groundbreaking impact on the medical community in alerting healthcare providers to substantial problems in the delivery of safe care. The report also started a groundswell of interest in the improvement of patient safety across the spectrum of healthcare environments. In particular, the IOM's (1999) recommendations included the development of standardized education and training on processes related to patient safety and a focus on continuous improvement using scientific methods. Since the IOM's (1999) report, several scientifically proven protocols have been identified for common procedures and conditions to reduce medical errors in hospitals (Pronovost et al. 2006a). For example, in 2003, the U.S. Centers for Medicare and Medicaid Services (CMS) developed a set of core process measures for common and serious health conditions that include acute myocardial infarction (AMI), heart failure (HF), pneumonia (PN), and the surgical care improvement project (SCIP). These conditions affect millions of patients every year and are among the leading causes of death and hospitalization. The development of protocols to measure whether patients received proper care for these conditions reflects the acceptance of human fallibility and a shift to view errors as the result of system flaws rather than people flaws (Kennedy 2004, Leape 1994). Standardization of procedures can reduce errors by "reinforcing the pattern recognition that humans do well" (Leape 1994, p. 1854) and therefore can minimize variation in healthcare providers' judgments.

Studies show that implementing process management techniques—a systemic approach to map, improve, and adhere to given sets of guidelines—can help organizations minimize variation in their processes (Flynn et al. 1994, Westphal et al. 1997). In this research we investigate the effect of one such process management technique focused on improving the delivery of core process measures in hospitals. We define *CMS Process Management* as a structured approach designed to facilitate the delivery of CMS process of care measures. It includes initiatives such as training of healthcare providers, use of electronic medical records, management by fact, documentation of CMS measures, and continuous improvement of

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care delivery processes to minimize medical errors and maximize patient safety (Lilford et al. 2007).

We investigate the effect of CMS process management on two distinct patient outcomes: clinical quality and experiential quality. Clinical quality refers to the performance on CMS process of care measures, which are a set of clinical protocols scientifically identified as best practices to achieve high levels of patient safety. To illustrate, one of the clinical quality measures developed by the CMS is whether patients are given influenza vaccination when treated for pneumonia. Although patients generally assume that such aspects of care, which have been shown to be medically appropriate, are universally provided, this is often not the case. Online Appendix B (available at http://dx.doi.org/10.1287/msom.1110.0374; see data for PN7) shows that only 90.24% of eligible patients in over 3,500 U.S. hospitals received the recommended vaccine between April 2009 and March 2010. This deviation from 100% delivery of accepted medical practices is unfortunately a fairly common occurrence. As shown in Online Appendix B, the CMS process of care measures (hereafter labeled *Clinical Quality*) involve a series of 0/1 variables for particular elements of care, with results reported on a per-hospital basis as a percentage of eligible patients that received that care. Evaluating a hospital's performance along the clinical quality dimension (i.e., "what" treatments are provided to the patient) mostly has an internal focus (Meyer and Collier 2001).

Experiential quality, on the other hand, relates to the external measure of quality of care from the patient's perspective (Donabedian 1980, Li and Benton 1996). It focuses on "how" treatments are provided to and perceived by the patient. In practice, recent emphasis on patient-centered care through models such as "medical homes" has led to a focus on the interpersonal quality of care as experienced by the patient (Epstein and Peters 2009, Weng 2008). Attention to a patient's unique characteristics has not only been shown to improve patient satisfaction (Rubin et al. 2001, Vuori 1991), but has also been linked to improvements in clinical outcomes (Bechel et al. 2000, Donabedian 1980). We employ the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey to measure experiential quality. The HCAHPS survey measures patients' perspectives on the quality of their interactions with healthcare providers. It includes questions regarding nonmedical elements such as the patient's perception of the quality of communication with their healthcare providers (i.e., physicians and nurses), explanations regarding procedures, and aftertreatment recovery instructions given to patients.

Tensions occur when hospitals try to balance clinical and experiential quality; that is, clinical quality focuses on technical standards of care and adherence to strict guidelines and involves eliminating variation from processes, whereas experiential quality, by its very nature, induces variation because it is contingent on patients who might require different methods of communication and treatment. Research on service operations attests to the fact that the direct presence of customers tends to increase variability (Campbell and Frei 2011, Hitt and Frei 2002). With growing importance given to designing a both safe and patient-centered healthcare delivery system, we investigate the following research question (RQ):

- RQ1. *What is the effect of CMS process management initiatives on both clinical and experiential quality of care in U.S. hospitals*?

Organizational learning theorists have extensively studied how to balance two types of learning activities: those that reduce variation (e.g., exploitation) and those that induce variation (e.g., exploration) (Benner and Tushman 2003, Chandrasekaran et al. 2012, March 1991). In the healthcare context, clinical quality is analogous to exploitation in that getting the right medical treatments delivered requires minimizing variation in the delivery process, whereas experiential quality is analogous to exploration, in that it involves a degree of customization and individual treatment for every patient, which can promote variation. According to this stream of research, a tension between these two forms of learning can occur when (i) they are mutually exclusive and cannot be combined (Levinthal and March 1993, Gupta et al. 2006) or (ii) they are not thoroughly understood yet are practiced (Guler et al. 2002, Gupta et al. 2006, O'Reilly and Tushman 2004).

This reasoning and pattern of results is interesting in our context because recent studies show that clinical and experiential quality are not mutually exclusive but rather are complementary (Pronovost and Vohr 2010, Toussaint 2009). In fact, anecdotal evidence suggests that regulatory pressures from the state or institutions force hospitals to adopt CMS process management to improve clinical quality (Westphal et al. 1997). When external institutional forces are strong, adoptions may occur without proper organizational buy-in in the form of hospital leadership commitment (Guler et al. 2002). This can in turn minimize the potential impact of process management on performance (Guler et al. 2002, Shortell and Singer 2008). Accordingly, we look at the following two research questions:

- RQ2. *How do regulatory forces influence the effect of CMS process management on clinical and experiential quality*?
- RQ3. *How does hospital leadership influence the relationship between CMS process management and clinical and experiential quality*?

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We investigate these research questions by combining three different sources of data collected at multiple time periods. We collect secondary data on state regulations related to healthcare delivery quality between January 2003 and December 2008. We use a primary survey data collected through a Web survey of 284 acute-care hospitals in September 2009 to obtain information on hospital leadership and on the extent of CMS process management. Finally, we collect performance data on clinical quality and on experiential quality for these hospitals through the CMS Hospital Compare database between April 2009 and March 2010 to study performance implications. Our final sample consists of 273 acute-care U.S. hospitals from 43 states.

Findings from this study are as follows. First, results show that CMS process management is positively associated with clinical quality but negatively associated with experiential quality, suggesting a tension between the two healthcare outcomes. Second, state legislation initially reinforces this trade-off but, overtime, allows process management to have a positive impact on both quality outcomes. Third, hospital leadership, when measured at the aggregate level, does not influence the relationship between CMS process management and clinical or experiential quality. However, a post hoc analysis suggests that a specific type of leadership, namely, a patient-centered hospital leadership, helps mitigate the negative association between CMS process management and experiential quality. This suggests the importance of encouraging hospital leaders to focus more on patient-centered quality practices and to clearly communicate these goals within their organization. Our post hoc results also provide preliminary evidence regarding the relationship between clinical quality and patient satisfaction contingent on experiential quality. All of these results offer important implications on designing safe and patient-centered healthcare process management initiatives.

The rest of this paper is organized as follows. In §2, we review the literature on process management in healthcare and identify key missing links. Section 3 discusses the conceptual framework and develops a set of testable hypotheses. Section 4 details the research design and data collection approach, whereas §5 provides details regarding the analysis and the results. Finally in §6, we conclude the study by spelling out the major contributions, limitations, and directions for future research.

2. Literature Review

2.1. Process Management in Healthcare

Process management involves "concentrated efforts to map, improve, and adhere to organizational processes" (Benner and Tushman 2003, p. 238). It focuses on minimizing variation in a system (i.e., increasing reliability) to allow for continuous improvement to take place through feedback loops (Hendricks and Singhal 2001). Given the complexity of the daily tasks performed by physicians and nurses, the healthcare environment requires a systematic approach to patient care (Gawande 2010). In fact, in its 1999 report, the IOM underlined the role of process management in improving patient safety (IOM 1999).

Although a focus on "customers" is usually an important part of process management programs (Anderson et al. 1994, Barsness et al. 1993), this is rarely the case in the healthcare context. The past decade has seen many calls for healthcare providers to focus on internal clinical quality with far less emphasis on external experiential quality (Laffel and Blumenthal 1989, Pronovost et al. 2006b, Tucker 2007). As a result, both in theory and in practice, there seems to be an inherent bias for process management in healthcare to focus primarily on internal efficiency. Even the few studies that have considered external measures such as patient satisfaction or physician–patient relationship when studying process management use data as measured by the hospitals rather than the patients themselves (Shortell and O'Brien 1995, Westphal et al. 1997). Measuring experiential quality directly from patients can capture the actual variability in treatment procedures provided by the healthcare providers, which is important yet rarely studied (Vuori 1991). Our research addresses these current limitations by employing data from the relevant respective population of interest; that is, we measure clinical quality as reported by the hospitals, whereas we examine experiential quality as reported by patients who were treated by these hospitals.

2.2. Clinical and Experiential Quality—Dual Objectives of Safe and Patient-Centered Care

Past research on healthcare has differentiated "what" healthcare services the patient receives from "how" those services are delivered to the patients (Collier 1994). For example, Donabedian's (1980) classification of the performance of practitioners as technical (i.e., clinical) and interpersonal (i.e., experiential) emphasizes the fact that although care providers should value clinical quality ("what"), customization of care to fit the unique needs and values of the patient, i.e., experiential quality ("how"), is also an essential dimension of healthcare quality.

Considering experiential quality is important for three main reasons. First, by communicating with patients and considering them as "expert witnesses to their care" (Bechel et al. 2000, p. 401), physicians and nurses can learn valuable insights for arriving at an accurate diagnostic and for selecting the most appropriate method of care depending on the individual

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patient's characteristics (Elwyn et al. 2000). Second, the importance of experiential quality is made clear through the concept of patient-centered care, which is defined as "care that is respectful of and responsive to individual patient preferences, needs and values" (IOM 2001, p. 6). Studies argue that patient-centered care should be considered as an end in itself, not merely a means to achieve other healthcare outcomes (Duggan et al. 2006, Epstein and Peters 2009, Porter and Teisberg 2007). Third, there has been a substantial stream of research that reveals that patients often do not follow discharge instructions from physicians and that higher experiential quality—i.e., the physician connecting with the patient—can facilitate better patient compliance with discharge instructions (Blackwell 1973, Butler et al. 2002, Cameron 1996).

In comparing the two types of quality, we find an inherent tension between clinical quality (focused on minimizing variation) and experiential quality (contingent on individual patients and therefore promotes variation). However, both these dimensions are important for patient well-being. As a brief example, consider the discharge instructions from the hospital for patients following a heart attack treatment. Clinical quality guidelines stated by the Joint Commission are unambivalent in stating that patients should get a prescription for beta blockers to significantly reduce risk of mortality and morbidity, yet offer no prescriptions for "how" to communicate with those patients. Clinical studies show that only 8% of patients without proper discharge instructions fill in their prescriptions within 30 days—an important posttreatment measure for heart attack (Butler et al. 2002). This is, in part, due to a lack of experiential quality—whereas some patients can simply be told once to take a drug, others might require detailed explanations or multiple reminders to adhere to the recommended treatment. Although our review of healthcare literature attests to the fact that both clinical quality and experiential quality are end outcomes to optimal healthcare delivery, there is limited understanding of how to achieve these dual objectives.

2.3. Impact of Institutional Pressure and Hospital Leadership on Healthcare Delivery

Since the publishing of the 1999 IOM report, numerous U.S. federal and state initiatives have been undertaken to promote process management practices aimed at improving quality of healthcare delivery. For example, since 2003, the CMS has provided financial incentives to hospitals that report process of care measures. In another initiative in July 2008, the U.S. Department of Health and Human Services (HHS) established a steering committee charged with developing a comprehensive strategy to reduce healthcare-associated infections (HAIs), which have been shown to be one of the leading causes of preventable death in the United States (HHS 2011). Between 2003 and 2008, many individual states acted at the local level, as reported by the Association for Professionals in Infection Control and Epidemiology (APIC 2009), with 29 U.S. states enacting HAI reporting laws that require hospitals to publicly report their healthcare-associated infection rates every year. This suggests that state legislation is increasingly promoting and regulating the adoption of healthcare quality initiatives.

The primary focus of healthcare quality regulations, however, has been on clinical quality, with substantially less emphasis on experiential quality. Multiple factors can explain this focus. First, regulating clinical quality (i.e., establishing right from wrong) has historically been the responsibility of legislative bodies, whereas experiential quality has been considered a more private matter. For example, in the report *To Err Is Human*, the IOM (1999, p. 20) states that "a strong regulatory component is critical to accomplishing [the patient-safety] goal," whereas regulations have a lesser role in "the customization of care to meet individual needs." Second, because its measurement is less discrete, experiential quality is often seen as a concept that is more subjective and difficult to operationalize (Kaiser Permanente 2009). As a result, although it is clearly viewed as a critical outcome of proper care, experiential quality appears to have been mostly left to the hospital's discretion.

As our understanding regarding the effect of government legislation continues to develop, the healthcare operations literature already provides some evidence on the relationship between hospital leadership and clinical quality (McFadden et al. 2009). For instance, Shortell and O'Brien (1995) find that hospital leaders can foster quality improvement implementation resulting in better clinical quality outcomes. Goodrick and Salancik (1996) consider hospital leadership's effect on clinical quality in the larger institutional context (i.e., while accounting for institutional forces such as legislation) and find that leadership's impact is in fact the greatest when institutional standards are uncertain. This underlines the role of internal forces, such as hospital leadership, not only in ensuring compliance with regulations but also in promoting progress in underlegislated areas. Although these studies provide ample evidence on the role of hospital leaders in creating a patient-safe clinical environment, our understanding of how hospital leaders help manage the seemingly contradicting outcomes of clinical and experiential quality is still emerging (Frampton et al. 2008).

In general, our review of the leadership literature suggests two major gaps. First, we find that both institutional forces and hospital leadership can have

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distinct impact on clinical and experiential quality. There has been little, if any, empirical examination of the relationships between institutional forces, hospital leadership, process management, and healthcare quality. Second, we find no evidence on how hospital leaders manage the dual goals of clinical and experiential quality, which are important for a both safe and patient-centered care. We examine these missing relationships in our research, which can inform both hospital leaders and policy makers on how to design an effective healthcare delivery system.

3. Conceptual Framework

3.1. CMS Process Management and Clinical Quality

Process management practices, in general, promote adherence to identified best practices to reduce process variation and foster incremental improvements (Benner and Tushman 2003, Hendricks and Singhal 2001). In hospitals, CMS process management emphasizes adherence to strict scientific protocols, data-based decision making, and the use of electronic tools to monitor and report changes to the clinical outcomes to encourage incremental changes in existing healthcare quality. It promotes an enabling structure that allows horizontal coordination among healthcare providers and drives them toward a common goal of minimizing variance as experienced by the patient (Flynn et al. 1994). For example, although providing antibiotics to a surgery patient for a few hours after surgery might be beneficial, one of the CMS guidelines for surgery is to stop administrating antibiotics to patients within at most 24 hours after their surgery to reduce the risk of complications (see SCIP3 in Online Appendix B). Because surgeries are often delayed, it is difficult for providers to quickly and easily determine the 24-hour cutoff point. Thus, having access to patient's charts through the use of electronic medical records can help provide both a reminder and documentation, whereas a postsurgery checklist/routine can make sure this important detail is not forgotten in the jumble of myriad activities and steps following a complex surgery (Benson et al. 1991). Such applications of process management can therefore increase stability and reliability when managing such complex interactions (Saraph et al. 1989). Clinical quality, which is evaluated based on widely recognized technical standards of care, necessitates adherence to strict guidelines and repetition to achieve continuous improvement. Thus, as hospitals increasingly emphasize CMS process management, it promotes a systemwide, coordinated course of action among healthcare providers toward minimizing variance and hence can positively influence clinical quality during healthcare delivery. This suggests the following hypothesis.

Hypothesis 1A. *CMS process management will be positively associated with clinical quality ceteris paribus*.

3.2. CMS Process Management and Experiential Quality

The exploitative benefit of higher levels of clinical quality associated with CMS process management can also prevent high levels of experiential quality (Tushman and Romanelli 1985). Experiential quality includes nonmedical elements such as the quality of communication between patients and healthcare providers (i.e., physicians and nurses) and explanations regarding procedures as well as aftertreatment recovery instructions given to patients. These activities require adapting to patients and are associated with increased variation because of patient involvement (Campbell and Frei 2011, Hitt and Frei 2002). For instance, Donabedian (1988, p. 1744) argues that "the management of the interpersonal process must adapt to so many variations in the preferences and expectations of individual patients that general guidelines do not serve us sufficiently well." This attests to the fact that experiential quality may be inconsistent when faced with a strong focus on adherence to established routines—i.e., CMS process management (Benner and Tushman 2003). Adopting higher levels of CMS process management can shift healthcare providers' attention to standardized aspects of healthcare delivery and away from activities that induce variability. For example, activities such as providing explanations to patients regarding their medication, giving personalized instructions regarding aftertreatment recovery, etc., tend to be ignored because completing all clinical and administrative tasks sometimes takes precedence over listening to the patients during care delivery. In short, the majority of healthcare providers have a tendency to view clinical versus experiential quality as somewhat of an either/or situation and hence the much needed efficiency gains of CMS process management on clinical quality can also hurt the experiential quality encountered by the patients. In the present context, we expect the trade-off model to dominate; thus we test the following hypothesis:

Hypothesis 1B. *CMS process management will be negatively associated with experiential quality ceteris paribus*.

3.3. Effect of State Legislation Timing

The previous two hypotheses suggest a trade-off between clinical and experiential quality as hospitals focus on CMS process management. This trade-off can be due to a sequencing strategy employed by the hospitals to first improve on clinical quality and then focus on experiential quality. Institutional theory offers an explanation why this might be the case.

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According to institutional theory, adoption of formal structures, such as process management practices, can occur partly because of regulatory/coercive pressure (DiMaggio and Powell 1983, Guler et al. 2002). With the report *To Err Is Human* (IOM 1999), preventable medical errors were brought to the forefront, and hospitals have been increasingly pressured through sanctions and penalties from states to increase standardization of care (Gawande 2010). Healthcare quality legislation mainly aims at rectifying the "great deal of variability in medical practice and, oftentimes, the lack of adherence to medical standards based on scientific evidence" (IOM 1999, p. 19). Therefore, legislation is primarily targeted at improving patient safety/clinical quality because "strong policy directives are difficult to implement [in the area of patient experience] because of the variety of individual needs and preferences" (IOM 1999, p. 19).

An example of state legislation regarding clinical quality involves U.S. state mandates for hospitals to publically report their HAI rates. HAI has been defined by the Agency for Healthcare Research and Quality (AHRQ) as the "most common complication of hospital care" and "one of the top 10 leading causes of death in the United States" (AHRQ 2011). Between 2003 and 2008, 29 U.S. states demonstrated active leadership by institutionalizing HAI reporting laws and issuing penalties to hospitals that failed to report their HAI rates. The impact of this growing public scrutiny, almost exclusively focused on clinical quality, is likely to drive hospitals to focus on closely adhering to standards to provide visible evidence of their dedication to improving clinical quality, i.e., seek legitimacy (Griffith et al. 1995, Westphal et al. 1997). In contrast, the more subjective experiential quality does not receive as much institutional attention, in part because it is difficult to measure and evaluate. Given the high levels of institutional attention to clinical quality and low levels of attention to experiential quality, it is likely that hospitals neglect the latter to focus their resources on the former.

A natural tension exists between variance-reducing clinical quality and variance-inducing experiential quality. Therefore, dedicating resources exclusively to one aspect of quality can negatively affect the other. From the time legislation on patient safety is introduced, hospitals are likely to develop a competency at improving clinical quality with an expressed preference for activities that facilitate this outcome (Levitt and March 1988). This preference will in turn reduce the likelihood for hospitals to "reevaluate the wisdom of engaging in particular activities" (Levinthal and March 1993, p. 100) and eventually might "trap the organization within its given competencies" (Smith and Tushman 2005, p. 524). In other words, there is a competency trap such that as hospitals improve clinical quality they continue to focus exclusively on this aspect that is being watched by government leaders, while ignoring the importance of the less watched experiential quality. Over time, hospitals tend to replicate behaviors and practices they are good at and avoid behaviors and practices that are outside their normal operations. Thus, when considering the effect of legislation alone, we argue that the timing of state legislation will be positively associated with clinical quality and negatively associated with experiential quality because hospitals in early legislation states will fall into a competency trap—once they become relatively good at clinical quality, they will continue to seek the rewards of improving where they are already good, all while neglecting the experiential quality dimension.

However, as shown by previous research on exploration/exploitation (Benner and Tushman 2003, March 1991), the relationship between clinical and experiential quality is unlikely to be simple and straightforward. For example, the efficiency of the tools and methods used by hospitals to comply with legislation and improve along the clinical quality dimension can also create resource slack that can then be invested toward improving experiential quality. This is Crosby's (1979) "Quality is Free" argument. As legislation is introduced, hospitals are likely to adopt CMS process management to improve their clinical quality, as argued in our Hypothesis 1A. Once those structured improvement approaches are in place and systematic improvement in clinical quality has been achieved, hospitals have more organizational slack that can then be applied to the more subtle, interpersonal aspect of quality of care, i.e., the experiential quality; that is, delivering the right clinical quality in a consistent manner (i.e., using process management practices to comply with legislation) reduces rework and can free up resources to then improve experiential quality. Hence, we argue that the negative association between CMS process management and experiential quality will be less pronounced in states with early legislation compared to states with late legislation. Similarly, the positive association between CMS process management and clinical quality will be more pronounced in states with early legislation compared to states with late legislation. These arguments can be summarized in the following hypotheses:

Hypothesis 2A. *State legislation timing* (*e.g., HAI regulation timing*) *positively influences the relationship between CMS process management and clinical quality—i.e., the positive effect of CMS process management on clinical quality becomes stronger as state legislation timing increases.*

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Hypothesis 2B. *State legislation timing* (*e.g., HAI regulation timing*) *positively influences the relationship between CMS process management and experiential quality—i.e., the negative effect of CMS process management on experiential quality becomes weaker as state legislation timing increases*.

3.4. Effect of Hospital Leadership

The previous hypotheses argue that, as a result of institutional pressures, for most hospitals the question is not whether to adopt CMS process management (Westphal et al. 1997) but rather how to avoid the negative consequences of CMS process management on experiential quality. Organizational leadership can be a critical factor for effective implementation of process management (Hambrick and Mason 1984, Sakakibara et al. 1997). Not only do senior leaders have the potential to enhance organizational characteristics, such as organizational learning, that are necessary to achieve expected outcomes of process management (Vera and Crossan 2004), but they are also able to mitigate its negative impact on outcomes that are not directly targeted. Indeed, senior leadership has been shown to greatly influence the determination and realization of organizational goals beyond commonly promoted outcomes (Goodrick and Salancik 1996). This influence, which translates into the control of organizational designs and resource allocation decisions, allows senior leaders to balance seemingly contradictory organizational goals (Smith and Tushman 2005). For example, in the innovation literature, senior leadership has been shown to allow coexistence of variance-reducing and variance-inducing activities (Brown and Eisenhardt 1997, Nemanich and Vera 2009). Similarly, when studying organizational learning, Vera and Crossan (2004) argued the need for strong senior leadership to both increase the effectiveness of existing practices and allow the pursuit of new goals.

Hospitals that have senior leaders focused on healthcare quality are more likely to observe expected outcomes from CMS process management. Senior leaders can design appropriate organizational structures and invest in improving technology usage, which can facilitate the use of CMS process management (Griffith et al. 1995). Hospital leaders can also create a patient-safety culture by communicating the importance of adhering to clinical guidelines across the entire organization. The presence of a strong hospital leader can therefore influence the relationship between CMS process management and clinical quality. The same leader can also mitigate the negative impact of CMS process management on experiential quality by promoting a patient-centered culture. For example, hospital leaders can design protocols that ask for patients' input when undergoing treatments, thereby accommodating individual patients' characteristics. They can also allocate resources toward the hiring or training of "hospitalists" who are responsible for patients rather than specific treatments, thereby creating a focus on the patient rather than on individual processes (Wachter and Goldman 1996), Hence, hospitals that have senior leaders focused on healthcare quality will increase the likelihood of observing expected outcomes of CMS process management practices, i.e., improvement along the clinical quality, while also mitigating its negative effect on the experiential quality. This translates into the following hypotheses:

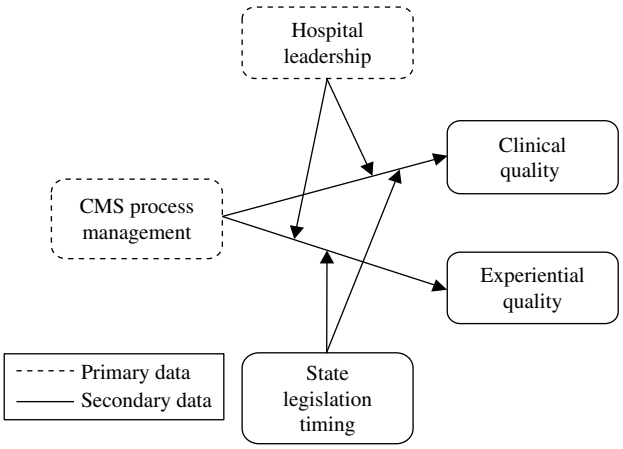
Hypothesis 3A. *Hospital leadership positively influences the relationship between CMS process management and clinical quality—i.e., the positive effect of CMS process management on clinical quality becomes stronger as hospital leadership increases*.

Hypothesis 3B. *Hospital leadership positively influences the relationship between CMS process management and experiential quality—i.e., the negative effect of CMS process management on experiential quality becomes weaker as hospital leadership increases*.

4. Data Collection and Measurement Model

Figure 1 represents the framework studied in this research. A combination of both primary and secondary data is used to test this framework. The appendix provides a brief description of the main variables included in our study. More details regarding variables, definitions, data sources, and the time frame of our data collection can be found in the online supplement (Online Appendices A and B). In accordance with CMS guidelines, all secondary sources of data based on a sample size of fewer than

Figure 1 Framework



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25 patients for *Clinical Quality* measures and fewer than 100 patients for *Experiential Quality* measures were excluded from this analysis to mitigate measurement errors. Only hospitals for which we had both primary and secondary data were included in this study, which resulted in a final sample comprising 273 acute-care U.S. hospitals across 43 states. This section describes our research design and measurement model.

4.1. Primary Data

4.1.1. Data Collection. The primary data used in this research were collected as part of a larger survey investigating quality management practices across U.S. hospitals. Five constructs used in our framework—namely, *Hospital Leadership*, *CMS Process Management*, *Training*, *CMS Full-Time Equivalent* (*FTE*), and *Perceived Relative Performance*—are measured through this survey. The items for these constructs are based on prior literature. The survey was pilot tested by the senior administrative director of clinical quality from the Ohio State University Medical Center (UMC) and five members of her staff. Our UMC was recently ranked among the top 20 hospitals in the United States by U.S. News and World Report (2011). The appendix contains more details on the survey items.

The survey data collection took place between September 2009 and November 2009 in two separate waves. In the first wave, we partnered with several hospital networks including the Florida Hospital Association, the Michigan Hospital Association, the Greater Cincinnati Health Council, the Greater Dayton Hospital Association, and the University Hospital Consortium to develop a list of contacts from 386 member hospitals. The survey was then sent to the director of quality, the chief nursing officer, or one with an equivalent title in these hospitals. This resulted in 81 responses. To collect data from a larger sample of U.S. hospitals, in our second wave we worked with a commercial organization that maintains and sells mailing lists. The list used contained contact information for directors of quality or chief nursing officers in approximately 5,500 hospitals across all regions within the United States. For confidentiality purposes, we had to rely on the organization to send an invitation email to complete our survey and a follow-up reminder one week later. Combining both contact groups, we received surveys from 284 U.S. acute-care hospitals across 43 different states. Eleven hospitals were dropped from the sample because of the absence of secondary data. Hospitals in the final study sample had an average size of 268 beds (sd = 257.8), which is consistent with the general acute-care U.S. hospital demographics. Online Appendix B shows the differences between the national average versus the sample average for our two dependent variables *(Clinical Quality* and *Experiential Quality)*. No significant differences are present, indicating no reason to be concerned about sample bias in our outcome variables. The number of participating hospitals within each state varied from 1 (Wyoming) to 40 (Florida). The following constructs are measured using the survey data.

4.1.2. Variable Measurement. *Hospital Leadership* is evaluated using a five-item scale that measures senior management's initiatives in creating a high-quality clinical environment. These items were originally developed by Meyer and Collier (2001). See the appendix for the measurement items.

CMS Process Management contains five items that measure the extent to which a structured data-driven approach is employed by healthcare providers in hospitals. Items include ongoing education and training, use of electronic tools to monitor and report CMS measures, use of past CMS data for decision making, extent of physicians documenting the CMS measures, and use of a specific set of guidelines for each of the four core process measures (AMI, HF, PN, and SCIP). The scale is based on the definition of process management by Anderson et al. (1994) and was developed based on several discussions with healthcare providers that work in areas assessed by the CMS process of care measures. The scale includes process management actions common in healthcare and understandable to recipients of our survey. The scale was pretested with several healthcare providers with small changes in wording and presentation. See the appendix for more details on the measurement items.

Several hospital-level controls collected through our survey were included in our analysis to account for and mitigate other unexplained effects. A hospital's emphasis on training can impact its implementation efforts; thus we employ two measures of training, both drawn from our survey of hospital executives—one a multi-item scale labeled *Training*, which includes five items originally developed by Meyer and Collier (2001), and one a discrete question regarding the number of full-time-equivalent employees assigned to collect and monitor CMS data (*CMS FTE*). Whereas *CMS FTE* is a direct measure of the technical skills devoted by the hospital to CMS reporting activities (i.e., improving clinical quality), *Training* reflects hospital's focus on improving staff's general competency in dealing with unexpected issues (i.e., improving experiential quality). We also controlled for *Perceived Relative Performance* along both the clinical and experiential quality dimensions as assessed by the quality directors. Including this subjective assessment of performance allows controlling for omitted variables, such as competitive pressure, that might impact reported performance

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but were not included in this study. For example, in the presence of strong competitors, patients might provide a relative rating of experiential quality while giving an absolute rating in more isolated areas (i.e., where competition is weak/nonexistent). Similarly, a hospital's performance on clinical quality can be partly due to increased pressure because of its presence in a highly competitive environment and may not be related to CMS process management.

4.2. Secondary Data

We obtained data on *State Legislation Timing*, *Clinical Quality*, and *Experiential Quality* using secondary sources at different time periods. A short description of these sources and of the time of data collection follows.

State Legislation Timing is evaluated based on the year in which states enacted laws that required hospitals to report their HAI rates. Our robustness tests examining the effect of other similar legislation show consistent results. Clinical research shows that HAIs are the most common infectious cause of death and 1 of the 10 leading causes of death overall in the United States (Zell and Goldmann 2007). According to the report from the APIC, 25 of the 43 states in our study enacted HAI reporting laws prior to January 1, 2009 (i.e., approximately one year prior to our survey). The year of enactment of those HAI reporting laws, as reported by the APIC, varies from 2003 (e.g., Illinois) to 2008 (e.g., Massachusetts, Maine, West Virginia). Hence *State Legislation Timing* is an integer variable ranging from 0 for nonadopting states (in 2009) to 6 (2003) based on when a state adopted its first HAI law. Thus, early adopting states have higher values on this measure.

Clinical Quality refers to the technical quality of the care provided and is evaluated using CMS process of care measures, which are based on patient medical records and reported on the CMS Hospital Compare website (http://www.hospitalcompare.hhs.gov). These measures, first implemented in 2003, were developed by CMS and the Joint Commission. Four measures of common and serious health ailments are considered in this study: AMI, HF, PN, and SCIP. Assessment for each condition consists of the percentage of each hospital's patients that are eligible for each treatment that actually receive that treatment. For example, across all hospitals, 89.36% of patients hospitalized for heart attack receive percutaneous coronary intervention (PCI) within 90 minutes of arrival (see AMI 8 in Online Appendix B). Online Appendix B provides details regarding the individual items for each condition. We matched data from the period April 2009–March 2010 from the CMS Hospital Compare website with data for all hospitals that completed our survey. Consistent with statistical theory and other medical research, we translate clinical outcomes (average percentage P of correct treatments, between 0 and 1) into their logit form (Carman et al. 2000, Collett 2003). This transformation is done to satisfy distributional assumptions required for the regression analysis (e.g., normality, heteroskedasticity). The clinical quality for a hospital j in state i with clinical outcome P_{ij} is given!by

$$CQ_{ij} = \ln\left(\frac{P_{ij}}{1-P_{ij}}\right).$$

Experiential Quality represents the interpersonal quality of the care provided and is measured using items asking patients about the extent of communication with healthcare providers (i.e., doctors and nurses), the control of pain, the speed of delivery of help, the explanation of procedures, and the post-treatment instructions for recovery. The data, collected through the HCAHPS survey, are reported on the CMS Hospital Compare website. This survey, first implemented in October 2006, was jointly developed by the CMS and the U.S. Agency for Healthcare Research and Quality and has been checked for reliability and validity in numerous published studies (Giordano et al. 2010). The *Experiential Quality* score is based on six items contained in the HCAHPS survey (see Online Appendix B). Patients can answer composites COMP1–COMP5 as "Never," "Sometimes" (reported at the aggregate level by the CMS), "Usually," or "Always," and COMP6 as "Yes" or "No." Prior to computing this score, answers are coded according to the following scheme: "Never/Sometimes" and "No" (coding variable, -1), "Usually" (coding variable, 0), and "Always" or "Yes" (coding variable, 1). A percentage Q representing average of these coded responses across all six items was then computed (percentage of "1" minus percentage of "-1"). Similar to *Clinical Quality*, the *Experiential Quality* score for each hospital was then calculated as the logit transformation of this percentage. The *Experiential Quality* for a hospital j in state i with experiential outcome Q_{ij} is given by

$$EQ_{ij} = \ln\left(\frac{Q_{ij}}{1-Q_{ij}}\right).$$

We also included several hospital-level control variables collected from public records. First, we controlled for *Hospital Size*—measured using the natural logarithm of the number of beds. This measure was collected through the American Hospital Directory website. We also controlled for hospital *Ownership Structure* (i.e., private or public) and *Corporate Goals* (i.e., profit or nonprofit) using two dummy variables. Both of these measures are available through

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the CMS Hospital Compare database. Finally, we controlled for the hospital teaching status by determining whether the hospital is a member of the Council of Teaching Hospitals (*COTH*). Previous studies have shown that COTH membership is a good approach to account for teaching status when compared to other measures such as number of residents or resident-to-bed ratio (Rivard et al. 2008).

4.3. Validity and Reliability: Confirmatory Factor Analysis

We assessed the constructs for reliability and validity using confirmatory factor analysis (CFA), with fit statistics presented in Online Appendix C. The measurement model for CFA included 19 items representing the four perceptual measures (*Hospital Leadership, CMS Process Management, Training*, and *Perceived Relative Performance*) described as our primary data. The fit indices indicated a good fit for the data ($\chi^2 = 259.5$, df $= 146$, Norm $\chi^2 = 1.78$, Root Mean Square Standard Error of Approximation $= 0.05$, Comparative Fit Index $= 0.96$). Convergent validity of the construct was assessed by examining the path coefficients from the constructs to their corresponding measurement items (Anderson and Gerbing 1982). All path coefficients were significant ($p < 0.01$), with values ranging from 0.40 to 0.92. Furthermore, the composite reliabilities for all constructs were in acceptable ranges with values between 0.80 and 0.93. Discriminant validity was assessed in two ways. First, we analyzed all possible pairs of constructs in a series of two-factor CFA models (Bagozzi and Phillips 1982). Each model was estimated twice—once constraining the Φ coefficient to unity and once freeing this parameter. A χ^2-test was used to assess whether the χ^2 was significantly lower for the unconstrained models compared to the constrained models. The critical value ($\Delta\chi^2_{(\Delta\,\mathrm{df}=1)} > 3.84$) was exceeded for all pairs of constructs, supporting their discriminant validity. Second, we examined the average variance extracted (AVE) for the constructs, which ranged from 0.45 to 0.72. The AVE for each construct was greater than its squared correlation with any other construct, further indicating their discriminant validity (Fornell and Larcker 1981). Overall, we found the constructs and their measurement items to be reliable and valid. We also note that our performance measures—*Clinical quality* and *Experiential quality*—use items that are developed by the CMS following a rigorous process recognized by the National Quality Forum.

5. Analysis

Our data consist of an unbalanced panel consisting of 273 hospitals from 43 states. Table 1 gives the pairwise correlations for the variables used in the analysis. The largest observed correlation between any two predictor variables in the study is 0.52 (between *Training* and *CMS Process Management*). Multicollinearity therefore does not appear to be a significant concern in our analysis. In addition, the variation inflation factors (VIFs) for all estimated models were below the acceptable limit of 3 (Hair et al. 1998).

5.1. Relationship Between CMS Process Management and Quality Outcomes

Our first two hypotheses examine the effect of *CMS Process Management* on *Clinical and Experiential Quality*. We employ a multilevel random effects regression approach that captures the nested structure of our data (i.e., hospitals within states) to test these hypotheses (Rabe-Hesketh and Skrondal 2005). A Hausman (1978) test result offers support to treat state-level effects as the random effects portion (Wooldridge 2002), with test results indicating a random effects estimator to be an efficient estimator in our analyses. A Huber–White sandwich estimator is used to correct for multicollinearity and provides robust standard errors in the clustered data sample (Rabe-Hesketh and Skrondal 2005). Table 2 presents the regression results for both dimensions of quality.

Model 1 illustrates the effects of control variables on *Clinical Quality*. Among the controls, we find that

Table 1 Correlations

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. *Teaching*	1.00											
2. *Size*	0.42**	1.00										
3. *Corporate Goals*	−0.11+	−0.12*	1.00									
4. *Ownership Structure*	−0.09	−0.07	−0.16**	1.00								
5. *Training*	−0.02	0.04	−0.02	−0.08	1.00							
6. *CMS FTE*	0.22**	0.37**	−0.07	−0.05	0.01	1.00						
7. *Perceived Relative Performance*	−0.01	0.09	0.04	−0.18**	0.34**	0.10+	1.00					
8. *CMS Process Management*	0.06	0.12*	0.05	−0.13*	0.52**	0.05	0.40**	1.00				
9. *Hospital Leadership*	0.07	−0.04	0.09	−0.11+	0.51**	−0.08	0.31**	0.49**	1.00			
10. *State Legislation Timing*	0.01	0.25**	0.10+	−0.06	0.13*	0.03	0.12*	0.15**	−0.07	1.00		
11. *Clinical Quality*	0.04	0.17**	0.18**	−0.28**	0.15**	0.15**	0.34**	0.36**	0.21**	0.18**	1.00	
12. *Experiential Quality*	−0.15**	−0.54**	−0.05	−0.06	0.13*	−0.11+	0.12*	0.01	0.17**	−0.31**	−0.01	1.00

+$p < 0.10$; *$p < 0.05$; **$p < 0.01$.

Table 2 Random Effect Regression Results Predicting Quality Outcomes

	Clinical Quality				*Experiential Quality*			
Predictor variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Constant	1.890**	1.962**	1.903**	1.883**	1.544**	1.532**	1.375**	1.392**
Teaching	−0.238+	−0.292*	−0.343**	−0.323*	0.118+	0.115+	0.065	0.077
Size	0.207**	0.188**	0.187**	0.186**	−0.076+	−0.222**	−0.184**	−0.189**
Corporate Goals (for profit)	0.380*	0.364*	0.462**	0.462**	−0.166*	−0.168*	−0.165*	−0.178**
Ownership Structure (public)	−0.317**	−0.276**	−0.219*	−0.216*	−0.076+	−0.078+	−0.084+	−0.086*
Training	0.024	−0.055	−0.033	−0.056	0.041+	0.069**	0.053*	0.038
CMS FTE	0.014	0.022	0.029	0.028	0.010	0.012	0.005	0.005
Perceived Relative Performance	0.155**	0.120**	0.112*	0.097*	0.042*	0.053*	0.063**	0.060**
CMS Process Management		0.231**	0.233**	0.225**		−0.066*	−0.031	−0.035
State Legislation Timing			0.017	0.020			−0.034*	−0.030*
CMS Process Management × *State Legislation Timing*			0.044+	0.043+			0.023*	0.024*
Hospital Leadership				0.069				0.039
CMS Process Management × *Hospital Leadership*				0.055				0.029
R^2	26.34	32.87	34.14	34.50	23.79	26.17	28.85	29.11
ΔR^2	—	6.53**	1.27*	0.36	—	2.38*	2.68*	0.26
χ^2	77.85**	103.03**	107.31**	107.68**	118.91**	125.87**	142.66**	150.11**

+$p < 0.10$; *$p < 0.05$; **$p < 0.01$.

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private, for profit, large, and nonteaching hospitals are associated with higher levels of *Clinical Quality* when compared to public, not for profit, small, and teaching hospitals. *Perceived Relative Performance* is also positively associated with *Clinical Quality*. Model 2 includes the additional effect of *CMS Process Management* on *Clinical Quality*, with results indicating that *CMS Process Management* is positively associated with *Clinical Quality* ($\beta = 0.231$, $\Delta R^2 = 6.53\%$, $p < 0.01$), providing support for Hypothesis 1A.

Models 5 and 6 in Table 2 provide the regression results for *Experiential Quality*. Among the controls (Model 5), for-profit hospitals tend to possess lower levels of *Experiential Quality* compared to nonprofit hospitals, whereas small, teaching and private hospitals demonstrate higher levels of *Experiential Quality* compared to their corresponding base groups. Finally, *Training* and *Perceived Relative Performance* are positively associated with *Experiential Quality*. Model 6 provides the incremental impact of *CMS Process Management* on *Experiential Quality*, with results indicating that *CMS Process Management* is negatively associated with *Experiential Quality* ($\beta = -0.066$, $\Delta R^2 = 2.38\%$, $p < 0.05$), providing support for Hypothesis 1B.

Taken together, these results suggest that as hospitals focus more on CMS process management, clinical quality improves, whereas experiential quality worsens—illustrating the tensions between these outcomes.

5.2. Effect of State Legislation Timing on the Relationship Between CMS Process Management and Quality Outcomes

The correlation between *State Legislation Timing* and *Clinical Quality* ($r = 0.18$, $p < 0.01$; see Table 1) is positive and significant, which suggests that hospitals located in states that adopted regulations relatively early tend to have better current clinical quality than hospitals in late adopting states. Similarly, the correlation between *State Legislation Timing* and *Experiential Quality* ($r = -0.31$, $p < 0.01$; see Table 1) is negative and significant, which suggests that hospitals in early adopting states have worse current experiential quality. These correlations support our arguments regarding the competency traps between *Clinical* and *Experiential Quality* (Levinthal and March 1993).

Hypothesis 2A suggests that the positive effect of *CMS Process Management* on *Clinical Quality* becomes stronger as *State Legislation Timing* increases. Similarly, Hypothesis 2B suggests that the negative effect of *CMS Process Management* on *Experiential Quality* becomes weaker as *State Legislation Timing increases*. To test these hypotheses, we created an interaction term between *State Legislation Timing* and *CMS Process Management*, with both variables centered to avoid multicollinearity issues (Aiken et al. 1991). Models 3 and 7 in Table 2 show these regression results for both *Clinical* and *Experiential Quality*. The earlier result regarding the relationship between *CMS Process Management* and *Clinical Quality* remains consistent ($\beta = 0.233$, $p < 0.01$) for *Clinical Quality* (Model 3), whereas the interaction between *State Legislation Timing* and *CMS Process Management* has a positive association ($\beta = 0.044$, $p < 0.10$) with *Clinical Quality*, providing support to Hypothesis 2A; that is, the effect of *CMS Process Management* on *Clinical Quality* is stronger in hospitals that reside in states with longer *State Legislation Timing*.

Focusing on *Experiential Quality*, Model 7 shows that the main effect of *CMS Process Management* on

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Figure 2 **Effect of State Legislation Timing on the Relationship Between CMS Process Management and Clinical Quality**

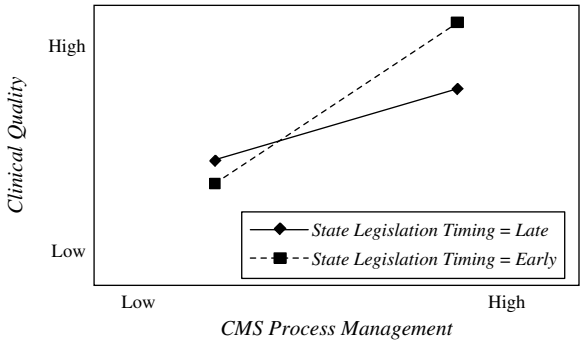
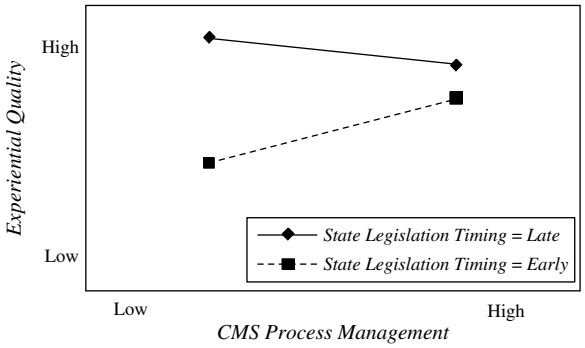


Figure 3 **Effect of State Legislation Timing on the Relationship Between CMS Process Management and Experiential Quality**



Experiential Quality is negative but not significant ($\beta = -0.031$, $p > 0.10$) when *State Legislation Timing* is added. However, *State Legislation Timing* has a significant negative association with *Experiential Quality* ($\beta = -0.034$, $p < 0.05$), whereas the interaction between *State Legislation Timing* and *CMS Process Management* is positively associated with *Experiential Quality* ($\beta = 0.023$, $p < 0.05$). This provides support for Hypothesis 2B; that is, although state legislation might lead hospitals to fall into a competency trap of focusing on clinical quality and trading off with experiential quality, combining long-term state legislation with high levels of CMS process management can free up resources as argued earlier and in turn have a positive impact on experiential quality.

To better understand the interaction effects of *State Legislation Timing* and *CMS Process Management* on the two quality outcomes, we created the corresponding conditional effect plots (Aiken et al. 1991). Figure 2 provides the conditional effect plot for the relationship between *CMS Process Management* and *Clinical Quality* for hospitals across different levels of *State Legislation Timing* (*State Legislation Timing = Early*, two standard deviations above the mean; *State Legislation Timing = Late*, two standard deviations below the mean). An increase in *CMS Process Management* corresponds to an increase in *Clinical Quality* for hospitals irrespective of the *State Legislation Timing*. However, hospitals in states with *Early State Legislation Timing* have a higher slope compared to hospitals in states with *Late State Legislation Timing*, providing evidence for the interaction effect—i.e., *CMS Process Management*'s positive relationship with *Clinical Quality* is stronger in states with early *State Legislation Timing*.

Similarly, Figure 3 represents the interaction plot for the relationship between *CMS Process Management* and *Experiential Quality* for hospitals across different levels of *State Legislation Timing* (*State Legislation Timing = Early*, two standard deviations above the mean; *State Legislation Timing = Late*, two standard deviations below the mean). In this case, an increase in *CMS Process Management* corresponds to an increase in *Experiential Quality* for hospitals in states with *Early State Legislation Timing*, whereas the opposite occurs for hospitals in states with *Late State Legislation Timing*; that is, an increase in *CMS Process Management* corresponds to a decrease in *Experiential Quality* for hospitals that are present in states with recently enacted patient-safety legislation. Taken together, these results provide intriguing evidence regarding how legislative forces combined with practices within organizations affect clinical and experiential quality in U.S. hospitals. We believe the results suggest some unintended consequences of legislative forces, which we will examine further in the discussion section.

5.3. Effect of Hospital Leadership on the Relationship Between CMS Process Management and Quality Outcomes

Hypotheses 3A and 3B posit that *Hospital Leadership* positively influences the relationship between *CMS Process Management* and quality outcomes. Models 4 and 8 (in Table 2) present results for *Clinical* and *Experiential Quality*. Results indicate that the interaction between *Hospital Leadership* and *CMS Process Management* is not significant for both *Clinical Quality* ($\beta = 0.055$, $p > 0.10$) and *Experiential Quality* ($\beta = 0.029$, $p > 0.20$), and hence offer no support for either hypothesis. All other relationships are consistent with respect to our earlier findings. Given the theoretical arguments in support of these relationships, we find the lack of support to be surprising; thus, we conduct a post hoc analysis to more fully examine this finding.

5.4. Post Hoc Analyses

5.4.1. Understanding Hospital Leadership. Bass (1985) and numerous leadership scholars (see Burns 2004, Jung and Avolio 1999) argue that senior leadership has multiple dimensions that can have distinct

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effects on organizational outcomes. Our scale for hospital leadership was adapted from earlier work by Meyer and Collier (2001) that measured leadership according to the Malcolm Baldrige Award for Quality in Healthcare. This scale possesses good reliability and has been shown to be associated with improved performance, yet is relatively broad and not focused on measuring distinct types of leadership within healthcare. Accordingly, we reexamined the items used to measure *Hospital Leadership* in our survey with a focus on how they might relate to clinical versus experiential quality. We differentiated two items (Items 2 and 3 in the appendix) that primarily measure the degree to which hospital leaders focus on understanding patient characteristics or experiential quality from the remaining three items (Items 1, 4, and 5), which focus more on the degree to which hospital leaders' focus on internal or clinical quality issues. Thus, we created two constructs, namely, *Patient-Focused Leadership* (Pearson correlation = 0.73; see Streiner and Norman 1995) and *Internal-Focused Leadership* (Cronbach alpha = 0.77). A χ^2-test was used to assess if the two constructs demonstrated discriminant validity. The χ^2 difference between the constrained and unconstrained models is 12.1 (i.e., $\Delta\chi^2_{(\Delta df=1)} > 3.84$), indicating that these items measure different traits of hospital leadership. We analyzed the data using these two traits of hospital leadership. We centered these variables before computing the interaction terms with *CMS Process Management*. Table 3 shows these regression results for *Clinical Quality* and *Experiential Quality*. As seen from Model 9, both *Patient-Focused Leadership* and *Internal-Focused Leadership* and their corresponding interactions with *CMS Process Management* are not associated with *Clinical Quality*. In contrast, Model 10 indicates that, although the two leadership traits do not directly impact *Experiential Quality*, the interaction effect between *Patient-Focused Leadership* and *CMS Process Management* ($\beta = 0.075$, $p < 0.05$) is positively associated with *Experiential Quality*.

These results suggest an interesting relationship between the nature of hospital leadership, CMS process management, and experiential quality; that is, when a hospital leader is patient focused, process management practices are implemented while accounting for the patient component and their service expectations. Such focused leadership can mitigate the inherent negative association between *CMS Process Management* and *Experiential Quality*. When the same hospital leader is focused primarily on internal quality, process management practices are designed without accounting for the patient component, and hence the hospital experiences a trade-off between *Clinical* and *Experiential Quality* with an increase in *CMS Process Management*.

Table 3 Effect of Patient-Focused and Internal-Focused Hospital Leadership

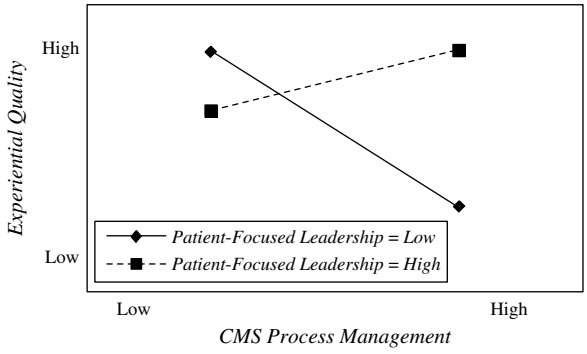
	Clinical Quality	*Experiential Quality*
Predictor variables	Model 9	Model 10
Constant	1.884**	1.396**
Teaching	−0.315*	0.081
Size	0.187**	−0.188**
Corporate Goals (for profit)	0.463**	−0.181**
Ownership Structure (public)	−0.216*	−0.077+
Training	−0.055	0.037
CMS FTE	0.027	0.002
Perceived Relative Performance	0.100*	0.056**
CMS Process Management	0.228**	−0.031
State Legislation Timing	0.020	−0.029*
CMS Process Management × *State Legislation Timing*	0.043+	0.026*
Patient-Focused Leadership	0.040	0.034
Internal-Focused Leadership	0.032	0.010
CMS Process Management × *Patient-Focused Leadership*	0.045	0.075*
CMS Process Management × *Internal-Focused Leadership*	0.019	−0.050
R^2	34.51	29.50
χ^2	114.92**	136.44**

+$p < 0.10$; *$p < 0.05$; **$p < 0.01$.

To illustrate, Figure 4 represents the interactions plot for the relationship between *CMS Process Management* and *Experiential Quality* across different levels of *Patient-Focused Leadership* (*High*, two standard deviations above the mean; *Low*, two standard deviations below the mean). As seen in Figure 4, under *High Patient-Focused Leadership*, an increase in *CMS Process Management* is associated with an increase in *Experiential Quality*, whereas hospitals with *Low Patient-Focused Leadership* experience the opposite—i.e., an increase in *CMS Process Management* is associated with a decrease in *Experiential Quality*. These results demonstrate the importance of purposely including a patient-centered aspect in the design of healthcare delivery systems.

5.4.2. Effect of Clinical and Experiential Quality on Patient Satisfaction. In some ways, experiential and clinical quality can be viewed as intermediate

Figure 4 Effect of Patient-Focused Leadership on the Relationship Between CMS Process Management and Experiential Quality



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outcomes with the ultimate goal of improving patient satisfaction. We conducted additional post hoc analyses to see the impact of these quality measures on patient satisfaction. *Patient Satisfaction* is based on the overall satisfaction as rated by patients in the HCAHPS survey (scale from 1 to 10) over a 12-month period (see the appendix). The CMS reports these data in an aggregate manner based on the following scheme: 6 or lower (coding variable, −1), 7 or 8 (coding variable, 0), and 9 or 10 (coding variable, 1). The total satisfaction score for each hospital is calculated as the average of these coded answers. This measure was not correlated with *Clinical Quality* ($r = 0.07$, $p > 0.10$) and was significantly correlated with *Experiential Quality* ($r = 0.80$, $p < 0.01$). It is not surprising that there is a very strong correlation between *Experiential Quality* and *Patient Satisfaction* because both measures are rated by patients and may be vulnerable to common method bias. We therefore conducted a subgroup regression analysis by splitting our sample into two groups based on the median scores of *Experiential Quality* (below the median, *Low Experiential Quality* group; above the median, *High Experiential Quality* group). This approach provides a more fine-grained means of examining the relationship between *Clinical Quality* and *Patient Satisfaction* (Becerra and Gupta 2003). Table 4 shows these results for the two groups. For the *Low Experiential Quality* group, there is no association between *Clinical Quality* and *Patient Satisfaction* ($\beta = -0.389$, $p > 0.10$). However, for the *High Experiential Quality* group, *Clinical Quality* is positively associated with *Patient Satisfaction* ($\beta = 2.86$, $p < 0.05$), which suggests an interaction between the two quality outcomes; that is, patients appreciate clinical quality at high levels of experiential quality. This result provides preliminary evidence on the relationships between clinical quality, experiential quality, and patient satisfaction, which to date is relatively unexplored in the medical literature.

Table 4 Effect of Clinical Quality on Patient Satisfaction

	Low Experiential Quality	*High Experiential Quality*
Predictor variables	Model 11	Model 12
Constant	49.705**	67.383**
Teaching	6.194*	11.334**
Size	−0.335	−0.188*
Corporate Goals (for profit)	−3.511	−2.814
Ownership Structure (public)	−3.622	−3.507+
Training	2.746*	1.112
CMS FTE	0.828*	−0.348
Perceived Relative Performance	2.030+	0.021
Clinical Quality	−0.389	2.860*
N (states)	29	37
n (hospitals)	111	114
R^2	19.36	18.37
χ^2	27.44**	25.81**

+$p < 0.10$; *$p < 0.05$; **$p < 0.01$.

5.5. Robustness Checks

Our results remain robust to several checks on regression model specification, omitted variable issues, and alternative definitions of predictor variables. First, we replicated all our analyses using a clustered regression approach (grouping hospitals at the state level) and obtained consistent results.

Second, the inclusion of several controls in our analyses mitigated concerns due to omitted variable bias (Davidson and MacKinnon 1993). Nevertheless, to test the exogenous nature of *CMS Process Management*, we ran a Durbin–Wu–Hausman test using *wave*—a binary variable to categorize the two waves of our survey—as an instrument. The absence of statistically significant effects of the residuals ($t = 1.38$, $p > 0.20$) minimizes endogeneity concerns regarding *CMS Process Management*.

Third, we used alternative definitions for *State Legislation Timing* and obtained consistent results. Specifically, we used two distinct measures collected from different data sources—state-level patient-safety initiatives reported on the Quality and Patient Safety website (QuPS.org) and Patient Safety States as recognized by the National Academy for State Health Policy. Both variables were strongly correlated with the *State Legislation Timing* measured through HAI regulations. These results demonstrate criterion validity to *State Legislation Timing* measured using HAI regulations.

Finally, we performed additional analyses to rule out the presence of higher order effects. Specifically, we included three-way interaction analyses among *CMS Process Management*, *Hospital Leadership*, and *State Legislation Timing*. The interaction term was not associated with *Clinical* and *Experiential Quality*, providing additional support to our framework.

6. Discussion and Conclusion

This study has provided empirical support for four related yet different findings regarding the design of a safe and patient-centered healthcare delivery system in U.S. hospitals. First, we find that a focus on CMS process management is associated with an increase in clinical quality as reported by hospitals, while being associated with a decrease in experiential quality as reported by patients. Second, we find that state legislation initially reinforces this trade-off but, overtime, allows process management to have a positive impact on both quality outcomes. Third, results from our post hoc analysis suggest that a specific type of hospital leadership, namely, a patient-focused leadership, can help mitigate the negative association between CMS process management and experiential quality,

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thereby enabling hospitals to excel on both dimensions of quality. Finally, our research provides preliminary evidence regarding the relationship between clinical quality and patient satisfaction contingent on experiential quality.

With regard to CMS process management, it may not be surprising to business professionals that careful attention to standardizing processes is associated with better clinical quality, yet it is revealing that many practices from other business sectors have not been widely adopted in healthcare. Furthermore, physicians and nurses often view themselves as highly educated professionals to whom standardization is anathema. Our data provide broader empirical support for what a leading patient safety expert and physician has described in anecdotal form. Pronovost and Vohr (2010) describe how a nurse practitioner is taught two different means of administering a central line (a common procedure in hospitals to deliver IV medications, yet one that has been frequently associated with deadly bloodstream infections). The variability associated with two different approaches to such a common medical procedure can be deadly. Pronovost's seminal insight was that medicine strongly needed greater process management practices. Thus, in 2001, he developed a five-step checklist for standardizing the insertion of central lines. In a statewide project in Michigan, this checklist and the attendant safety-based culture were applied in over 100 hospitals and have been estimated to save 2,000 lives and $200 million in related costs per year (Boyer and Pronovost 2010). Our results support this earlier finding in a broader context—namely, showing that careful CMS process management impacts a broad variety of outcomes associated with heart attacks, heart failure, pneumonia, and surgical care.

Whereas CMS process management is positively associated with clinical quality, our data suggest that it has a negative association with experiential quality, at least in the short run; that is, healthcare providers are likely to fall into a competency trap such that once focused on clinical quality and achieving improved results, their focus on experiential quality falters. This is likely because of the preoccupation of healthcare providers with the easily measurable aspects of healthcare delivery—namely clinical quality. After all, one of the primary personality characteristics of physicians is their ability to process large amounts of scientific data—most of which can be easily represented as an explicit number. Physicians, as a group, tend to be overachieving and more focused on scientific acumen than on bedside manners. Yet, experiential quality matters greatly. Beyond the moral obligation of considering the needs and preferences of each patient while delivering care, healthcare providers need to build a relationship with the patient (i.e., relate to him or her as a person) if they are to expect full disclosure and compliance with instructions. Our finding that clinical quality correlates with patient satisfaction only in situations where patients express high ratings regarding experiential quality provides broad empirical support for the importance of balancing the tension and improving both types of quality. As noted by Pronovost and Vohr (2010, p. 19):

> Yet, just as in business, there is much opportunity for customization. Patients vary substantially in their genetic makeup and response to therapies. Medical treatment is increasingly offering customizable treatments. Thus, there is an inherent challenge—too much standardization limits customized treatment. Too little standardization results in harm and waste.

This study also provides important insights regarding the relationship between the timing of state legislation and healthcare quality. The analyses offer support for the hypothesis that state legislation is positively associated with clinical quality, which is critically important. For too long, medicine has operated much like the American businesses excoriated by Philip Crosby in the seminal book *Quality is Free* in 1979—with a willingness to accept poor quality as a necessary outcome of working in a complex environment. Our results clearly indicate that basic clinical quality, as assessed by CMS process of care measures, can be substantively improved through the combination of legislative attention and thoughtful process management. Clinical quality measures have been definitively linked to reduced mortality—the rate of one-year mortality (following hospital admission for a heart attack) has been shown to differ by 1.2% between the top and bottom quartile of hospitals on the process of care measures for heart attack (Werner and Bradlow 2006). Given 1.2 million heart attacks per year in the United States, moving all hospitals to the current compliance level achieved by the top quartile of hospitals through better process management initiated by state legislation would result in 14,400 fewer deaths per year.

Although we find that state legislation has driven hospitals and healthcare providers in the intended direction (i.e., improvement in clinical quality), it has resulted in other unintended consequences (i.e., decrease in experiential quality). Additional results from our study show that as hospitals focus on CMS process management they are more likely to improve clinical quality, which in turn may free up resources to focus on experiential quality; that is, the negative association between CMS process management and experiential quality is lower in hospitals that are present in states with longer time since legislation. These relationships between state legislation timing and both clinical and experiential quality can provide policy makers with new insights. Specifically, we feel that it is helpful for government officials to

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be cognizant of the trade-off between the two types of quality and to design legislation that addresses both. One possible mechanism is to introduce legislation that has a dual emphasis on patient safety and patient-centered healthcare delivery. Although this might seem difficult to implement, it could provide a foundation for a better healthcare delivery system. The concept of "patient-centered medical homes" promoted in the healthcare reform and currently being concretized through state-level initiatives (see http://www.nashp.org/med-home-map) is a good example of such legislation.

When measured at the aggregate level, our analyses did not provide any support for the relationship among hospital leadership, CMS process management, and healthcare quality. However, our post hoc analysis involving a fine-grained approach to study leadership—i.e., patient-focused versus internal-focused—suggests ways of mitigating the negative association between CMS process management and experiential quality. We find that hospitals that have a patient-focused leader can effectively orient and guide healthcare providers to overcome the negative consequences of CMS process management. Similar to the findings in the field of organizational theory on balancing exploration and exploitation (Benner and Tushman 2003, Chandrasekaran et al. 2012), our results suggest that clinical and experiential quality can be simultaneously fostered in the presence of strong patient-focused leadership.

Our post hoc analysis provides preliminary results for a link between clinical quality and patient satisfaction. Although patients are often assumed to trust healthcare providers to make the right clinical choices (Rubin et al. 2001, Vuori 1991), our results indicate that patients are able to recognize and value clinical quality at high levels of experiential quality. This provides empirical evidence to the argument that poor levels of experiential quality might overshadow higher levels of clinical quality (Collier 1994).

In closing, we point out a few limitations of our research that offer future researchers a way to examine these issues and shed more light on the ways to simultaneously improve clinical and experiential quality. First, our measures of CMS process management were quite broad because of the relative newness of this concept and the absence of existing standard protocols to measure it at a granular level. Future research should seek to examine more refined and specific practices while comparing the efficacy of different process management approaches. This line of research is reminiscent of much of the work in strategy and operations management in the 1990s when the quality, six sigma, and lean philosophies first took hold. Second, our measure of hospital leadership was self-reported. Future research should aim at systematically evaluating this construct through multiple respondents across all hierarchical levels to avoid potential bias. Third, our data are sequenced in time, with the state legislation data coming before process management and outcome data, yet they are not truly longitudinal, thus cannot really be considered causal. Future research should examine longitudinal data for both process management and outcomes. The CMS measures are designed and collected in an ongoing, longitudinal manner and thus are particularly adapted to causal analysis. Regarding process management, there is an opportunity to observe, document, and analyze the impact of process management initiatives over a period of years. The operations management field has much to offer medicine in this regard. Overtime, process management with appropriate focused leadership has the potential to greatly improve both clinical and experiential quality.

Electronic Companion

An electronic companion to this paper is available as part of the online version at http://dx.doi.org/10.1287/msom.1110.0374.

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Appendix. Primary Data Scales/Items and Secondary Data Overview

Primary data	
Construct	Items
Hospital leadership (CR = 0.93; AVE = 0.72)	*To what extent do the following occur at your hospital*? (1 = *not at all*, 7 = *always*) 1 Our senior executives are involved in quality activities 2 Our senior executives focus on improving patient care 3 Our senior executives are accessible to patients 4 Our senior executives set strategic directions for our hospital, like deciding which new service to offer 5 Our department heads are responsible for leading quality improvement in their departments

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Appendix. (Continued)

Primary data	
Construct	**Items**
CMS process management (CR = 0.80; AVE = 0.45)	*To what extent do the following occur at your hospital*? (1 = *not at all*, 7 = *always*) 1 Ongoing CMS education and training 2 Use of electronic tools to monitor and report CMS measures 3 Analysis and use of past CMS data to make improvements in care 4 Physicians document the CMS measures 5 Use of unique processes for each different CORE measure
Training (CR = 0.92; AVE = 0.71)	*To what extent do the following occur at your hospital*? (1 = *not at all*, 7 = *always*) 1 We use training to build the capabilities of our staff 2 Frontline employees are trained on how to handle services failures ("recoveries" from patient property theft, long waiting times, etc.) 3 Employees are trained with problem-solving skills 4 We evaluate the benefits of staff training by measuring changes in skills or behavior 5 Employees are rewarded for learning new skills
CMS FTE	*How many full-time-equivalent employees do you estimate work on CMS reporting at your organization*?
Perceived relative performance (CR = 0.90; AVE = 0.70)	*Please indicate the position relative to other hospitals with respect to*: (1 = *significantly worse*, 7 = *significantly better*) 1 Clinical outcomes, measured externally 2 Compliance with standard care patterns 3 Functional status of the patients 4 Patient unplanned readmission

Secondary data		
Construct	**Measurement**	**Source**
Clinical quality	Logit of weighted average performance on core process measures across four conditions (AMI, HF, PN, and SCIP)	CMS database (April 2009–March 2010)
Experiential quality	Logit of weighted average performance on six interaction measures (COMP1–COMP6)	HCAHPS survey (April 2009–March 2010)
State legislation timing	Time in years since state enacted first HAI reporting law	APIC report (January 2009)
Patient satisfaction (post hoc)	Average performance on satisfaction measure	HCAHPS survey (April 2009–March 2010)

Notes. For additional information, refer to Online Appendices A and B. CR = composite reliability; AVE = average variance extracted.

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