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The Impact of Combining Conformance and Experiential Quality on Hospitals' Readmissions and Cost Performance

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To investigate the opportunity for hospitals to achieve better care at lower cost, we examine two key process quality measures, conformance quality and experiential quality, and two measures of performance, readmission rate and cost per discharge. Conformance quality represents a hospital's level of adherence to evidence-based standards of care, whereas experiential quality represents the level of interaction between hospital's caregivers and patients. Analyzing six years of data from 3,474 U.S. acute care hospitals, we find that combining conformance and experiential quality results in lower readmission rates. However, conformance quality and experiential quality each independently increase cost per discharge, which suggests that a readmissions–costs trade-off is unavoidable. To investigate this further, we conduct post hoc analyses by distinguishing between the granular elements of experiential quality (EQ) based on task type: response-focused EQ and communication-focused EQ. Response-focused EQ measures caregivers' ability to respond to patient's explicit needs, whereas communication-focused EQ measures caregivers' ability to engage in meaningful conversations with the patient. We find that combining communication-focused EQ with conformance quality reduces readmission rates. Moreover, as conformance quality increases, the cost of improving communication-focused EQ decreases, indicating complementarity. Response-focused EQ in combination with conformance quality also results in reduced readmission rates. However, as conformance quality increases, the cost of improving response-focused EQ also increases, suggesting that these dimensions might compete for resources. Taken together, our results suggest that hospital administrators can mitigate the trade-off between reducing readmissions and controlling costs by prioritizing communication-focused EQ over response-focused EQ.

Keywords: healthcare delivery; conformance quality; experiential quality; readmissions, trade-off
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1. Introduction

In their latest report, the Institute of Medicine argues that delivering the "Best Care at Lower Cost" is the fundamental path to reviving America's healthcare system (Institute of Medicine 2012, p. 1). However, research suggests that this goal might entail a trade-off between care outcomes and cost during healthcare delivery (Pauly 2014). We investigate this issue in U.S. hospitals by looking at two key process quality measures, conformance quality and experiential quality, and two measures of performance, 30-day readmission rate and cost per discharge. Conformance quality represents hospital's level of adherence to evidence-based standards of care during healthcare delivery, as documented on patients' medical records (Senot et al. 2015). In particular, for specific medical conditions (e.g., heart attack, heart failure, and pneumonia), the U.S. government has published standards of care that have been shown to improve patient's health (Chassin et al. 2010). Experiential quality, on the other hand, represents the level of interaction between hospital's caregivers and patients during healthcare delivery, as experienced by the patient (Chandrasekaran et al. 2012).

To encourage hospitals to focus on both these process quality dimensions, the new healthcare reimbursement policy, implemented in October 2012 by the Centers for Medicare and Medicaid Services

(CMS), evaluates hospitals based on their scores on both conformance and experiential quality (U.S. Department of Health and Human Services 2011). Hospitals initially risk losing 1% of their reimbursements for Medicare patients if they do not demonstrate a focus on both conformance and experiential quality. By 2017, that penalty will increase to 2%. To reflect the hospital's emphasis on both these dimensions, we define combined quality as the extent to which the hospital jointly pursues conformance and experiential quality.

Combined quality can result in reduced readmission rates because patients not only receive evidence-based care, but also have that care tailored to their individual needs. However, achieving combined quality at a systemic level can also be challenging for hospitals. The healthcare industry has historically favored evidence-based practices (Levinson et al. 2010). Thus, creating a culture that emphasizes patient-centered care without compromising the existing focus on conformance quality could involve significant training costs. Operationalizing combined quality could also result in additional staffing costs. Indeed, because of the different requirements for conformance and experiential quality, hospitals may need to not only allow their caregivers to spend more time with each patient, but also hire additional peripheral staff to support these quality initiatives. These challenges make it difficult for hospitals, which are tasked with achieving combined quality, to evaluate the related benefits and costs. The purpose of this research is to investigate the following research question: How does a hospital's joint pursuit of conformance and experiential quality (i.e., combined quality) affect its readmissions and cost performance?

Prior research addresses certain elements of the process quality–performance relationship. For example, Boulding et al. (2011) investigate the link between experiential quality and readmission rates. Jha et al. (2009) study the cost consequences of conformance quality, whereas Bechel et al. (2000) investigate the cost consequences of experiential quality. However, these studies are limited by their small sample size or a mismatch of time frames between process quality and performance. They also fail to ask how process quality affects multiple aspects of performance. Finally, to our knowledge, no studies investigate the benefits and the costs associated with combined quality—a significant gap, particularly in light of the policy changes in hospital reimbursements.

Our research addresses these limitations and examines the relationships between combined quality and performance in terms of readmission rates and cost per discharge. To do this, we analyze six years of secondary data from the 3,474 U.S. acute care hospitals included in the CMS database as of June 2012. Our results indicate synergies between conformance and experiential quality as shown by the negative effect of combined quality on readmission rates, a key measure of hospital performance (Boulding et al. 2011). Thus, hospitals that seek to reduce their readmission rates benefit from pursuing both conformance and experiential quality. We also find that combined quality does not increase costs, suggesting that hospitals do not incur an additional financial burden for jointly pursuing conformance and experiential quality. However, we do find that improving the individual process quality dimensions independently (i.e., conformance and experiential quality) increases cost. Together, these results suggest that hospitals face a trade-off between readmissions and costs when improving their healthcare delivery.

To better delineate this trade-off, we conduct post hoc analyses, looking into the granular elements of experiential quality. Using insights from the task effectiveness literature (Stewart and Barrick 2000), we disaggregate experiential quality (EQ) into two distinct dimensions based on the type of tasks performed by caregivers: (i) response-focused EQ, which measures caregivers' ability to respond to patient's explicit needs and (ii) communication-focused EQ, which measures caregivers' ability to engage in meaningful conversations with the patient. We then look at the interactions between these dimensions and conformance quality with respect to readmission rate and cost per discharge. Our results indicate that combining either dimension of experiential quality with conformance quality reduces readmission rates. From a cost standpoint, our results suggest that as conformance quality increases, the cost of improving communication-focused EQ decreases, whereas the cost of improving response-focused EQ increases. This finding suggests a complementarity in resources between communication-focused EQ and conformance quality, but not between response-focused EQ and conformance quality. Taken together, these findings suggest that hospital administrators can mitigate the trade-off between readmissions and costs by initially favoring investments that can help develop communication-focused EQ in conjunction with conformance quality among their caregivers.

2. Prior Research and Hypotheses Development

2.1. Conformance Quality

Conformance quality represents the degree to which a product meets established standards (Garvin 1987). Generally, improving conformance quality has been shown to reduce internal and external failures (Deming 1982, Hendricks and Singhal 2001). In our context, conformance quality represents the level of adherence to disease-specific evidence-based standards of care (Donabedian 1988). One manifestation of conformance quality is the set of core process measures for common and serious conditions developed by the Joint Commission and CMS (Senot et al. 2015). Studies show that following these standards improves patient's health (Chassin et al. 2010). For instance, when a heart attack patient is admitted to a hospital, CMS specifies a set of six essential standard steps that must be followed, providing the patient is eligible (see Online Appendix C1[1] for more details). Following these six steps is likely to facilitate the patient's recovery and help maintain better health upon discharge (Joint Commission 2010).

We propose that improving conformance quality will incur substantial costs for hospitals. Processes must be restructured and employees trained on these new processes, which involves considerable expense (Ittner et al. 2001). In addition, medical experts point to the resource-intensive nature of documenting and monitoring conformance quality (Fonarow and Peterson 2009, Boulding et al. 2011). Despite these initial investments, studies in the manufacturing context suggest that the reduction in costs of internal and external failures will ultimately outweigh the increase in appraisal and prevention costs, once processes mature (Juran and Gryna 1988). In the healthcare environment, a patient's condition that worsens while in the hospital because the correct treatment was not administered on time would represent an internal failure. An unplanned readmission because a recommended vaccine was forgotten during the initial hospital stay, which led to the patient acquiring an infection, could be considered an external failure. However, the healthcare context is characterized by rapidly evolving underlying knowledge of what is considered best practice (Bohmer and Lee 2009), and many hospitals still have much room for improvement in developing and adhering to standardized processes (Jewell and McGiffert 2009). Thus, we expect most hospitals to incur significant initial and recurring costs when pursuing conformance quality.

2.2. Experiential Quality

Researchers acknowledge the consumer's perception of the level of interaction with service providers as a measure of experiential quality (Kellogg and Chase 1995, Parasuraman et al. 1988). Similarly, in healthcare, experiential quality relates to the level of interaction between caregivers and individual patients, as experienced by the patient, and is an important dimension of process quality. In 2006, CMS and the U.S. Agency for Healthcare Research and Quality jointly developed the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey to measure patients' perceptions of the level of interaction with their caregivers during their hospital stay. Online Appendix C2 contains the list of composites and their underlying survey items from the HCAHPS survey. Perception measures include elements such as communication with caregivers (COMP 1, COMP 2, COMP 5, and COMP 6) and caregivers' responsiveness to patients' requests (COMP 3 and COMP 4). Researchers find that experiential quality results in lower readmission rates (Boulding et al. 2011). Increasing the level of interaction between patients and caregivers during healthcare delivery can encourage patients to not only bring to light important information that enables caregivers to more efficiently diagnose and care for them (Groopman 2008), but also better adhere to discharge instructions (Blackwell 1973, Cameron 1996).

Despite these potential benefits, improving experiential quality can, on average, increase costs for hospitals for several reasons. Elements of experiential quality—such as being responsive to patients when they request assistance—may require hospitals to substantially invest in resources such as dedicated nurses per floor (Neighmond 2012) and advanced information technology systems (Myers and Reed 2008), all of which can increase operating costs. In addition, improving other elements of experiential quality—such as communication with physicians and nurses—may require hospitals to support initiatives that require significant added time and effort during delivery of care, such as including patients in the rounding discussions (Nair et al. 1998). Also, although medical schools have been required to include in their curriculum the teaching and assessment of interpersonal skills since 2002 (Swing 2007), this education, which relates to experiential quality, has been found to vary greatly across academic programs (Hojat et al. 2002) and is often neglected (Levinson et al. 2010). Thus, hospitals that seek to improve experiential quality are likely to incur heavy costs to train their caregivers (Merlino and Raman 2013).

2.3. Combined Quality

Research recognizes the multidimensional nature of process quality and the importance of combining these dimensions (Garvin 1987, Krishnan et al. 2000, Oliva and Sterman 2001, Voss et al. 2008). For example, quality systems such as lean management and Six Sigma deliver high performance by integrating conformance to standards (e.g., conformance quality) with a focus on interactions with the consumer (e.g., experiential quality) (Ittner and Larcker 1997, Kaynak 2003). In fact, organizational learning scholars offer insights on this complementarity.

[1] The online appendices are available as supplemental material at http://dx.doi.org/10.1287/mnsc.2014.2141.

For instance, Levinthal and Rerup (2006) argue for strong synergies between an organization's ability to follow routines and its ability to adapt interactions to consumers' unique needs—skills that map onto our concepts of conformance quality and experiential quality, respectively. Similarly, March (1994) describes how the enactment of rules that underlies conformance quality can free up resources needed for interacting with the consumer (i.e., experiential quality). However, empirical evaluation of the potential synergies offered by combined quality and the associated cost in the healthcare delivery context is still lacking, a gap that this study seeks to address.

2.3.1. Impact on Readmission Rate. Consistent with lessons from nonmedical domains, the new CMS payment program requires hospitals to simultaneously focus on both conformance and experiential quality when delivering care. Because it emphasizes explicit standards of care, conformance quality is based on a repository of existing medical knowledge (Swensen et al. 2010). Hospitals that have such stable knowledge can create a more targeted interaction between caregivers and patients, which facilitates effective care. Furthermore, experiential quality can result in better and faster identification of conditions to which conformance quality standards can be applied, information that helps hospitals to avoid potential complications and assist patient's full recovery. As an illustration of the importance of experiential quality in enhancing the effect of conformance quality, consider CMS' standards of care. These standards dictate that a pneumonia patient should receive an influenza vaccination to reduce the chances of reacquiring pneumonia as a complication of the flu (see PN7 in Online Appendix C1). However, in the absence of experiential quality, important information (e.g., allergies precluding the patient from receiving the vaccine) can be missed during the delivery of care, which can result in the patient's readmission to the hospital. Therefore, hospitals that improve patient interactions in the area of conformance quality standards can better identify the treatments for which the patient is truly eligible and avoid unnecessary or conflicting medications and procedures, reducing chances of readmission (Goold and Lipkin 1999). Thus, overall, we expect combined quality to result in a healthier patient upon discharge.

In addition, patients from hospitals that have achieved high combined quality are likely to have higher compliance rates with discharge instructions once they leave the hospital setting. This greater compliance results from a combination of practices: The hospital demonstrates the importance of these guidelines by setting an example through its own conformance quality, while at the same time it ensures that the delivery of these instructions varies according to patient needs and preferences (e.g., visual tools, teach-back methods), through its experiential quality. As a result of this higher compliance rate, the risk of readmission may decrease. Hence, we state the following hypothesis:

Hypothesis 1. *Combined quality will be associated with lower readmission rate.*

2.3.2. Impact on Cost per Discharge. Despite potential benefits of emphasizing both conformance and experiential quality, the healthcare industry has historically favored conformance quality over experiential quality (Levinson et al. 2010). Most clinicians still consider experiential quality to be a mere "bonus" for the patient or even a burden to clinicians (Groopman 2008). To create a culture that values patient experience without compromising evidence-based care will require caregivers to change their own mindsets and behaviors so as to use interactions with patients to shape a delivery of care that is both standardized and personalized. This task could be daunting for hospitals and may involve significant training costs.

Moreover, beyond these training expenses, hospitals may also need to make significant investments in staffing to make combined quality operationally feasible. Indeed, organizational learning theorists recognize the challenges for individuals to simultaneously undertake activities that draw on different learning mechanisms (Gavetti and Levinthal 2000, Gupta et al. 2006). In healthcare delivery, conformance and experiential quality represent such contrasting activities. As Donabedian (1988) emphasizes, conformance quality requires close adherence to standard guidelines, whereas experiential quality requires adaptation to countless variations in patient needs and preferences. Thus, hospitals that pursue combined quality may need to allow their caregivers to spend more time with each patient as well as to hire additional peripheral staff to perform certain specialized tasks.

These additional training and staffing costs are well documented. For instance, Merlino and Raman (2013) report that in 2009, all 42,000 employees at the Cleveland Clinic received training in the combined approach to quality, a process that incurred substantial costs. Related to staffing costs, Massachusetts hospitals increased their workforce by 11.4% (11,800 additional full-time equivalent (FTE) employees) between 2004 and 2008 to support combined quality initiatives (Massachusetts Hospital Association 2010). This additional workforce was hired to, among other tasks, collect and report measurement data, attend to patients' needs, and advance electronic medical reports, electronic health records, and physician order entry systems. Hospitals that implement quality initiatives are also likely to experience a shift to more qualified and certified workers, which can significantly increase wages (Massachusetts Hospital Association 2010). Thus, we state the following hypothesis:

Hypothesis 2. *Combined quality will be associated with higher cost per discharge.*

3. Research Design and Data

The unit of analysis in this study is the U.S. acute care hospital. We collected secondary data from multiple sources for six years from July 2006 to June 2012 for the 3,474 U.S. acute care hospitals included in the CMS database as of June 2012. Our study begins with fiscal year July 2006–June 2007 (year t), the first year for which the data on experiential quality are available.

Online Appendix A lists the following seven sources of secondary data used to investigate our research question: CMS process of care measures (conformance quality), CMS HCAHPS surveys filled out by patients (experiential quality), Medicare cost reports (cost per discharge), CMS outcomes files (30-day readmission rate), CMS Impact files (controls), and two websites that track state legislation and are maintained respectively by the Committee to Reduce Infection Deaths and by the National Association on State Health Policy (instruments for endogeneity checks for readmission rate analyses).

Online Appendix B shows the number of observations collected for the key variables for the six years considered. Based on data availability, the final sample contains 12,538 hospital years across 2,983 hospitals for *Cost per Discharge* analyses, and 5,858 three-year observations across 2,929 hospitals for *Readmission Rate* analyses. Hospitals in our sample are located in all 50 U.S. states and the District of Columbia.

3.1. Performance Outcomes

Readmission Rate is reported by CMS as a three-year rolling average (at the hospital level) for three conditions: heart attack (acute myocardial infarction (AMI)), heart failure (HF), and pneumonia (PN). It reflects the proportion of patients, within each condition, who were readmitted for the same diagnosis within 30 days of discharge. For each hospital, this percentage is adjusted by CMS for patients' age, gender, past medical history, and comorbidities using hierarchical logistic regression models based on Medicare claims data (Grady et al. 2013). Low readmission rates occur when hospitals deliver the most effective care when first admitting patients and provide helpful instructions about care plans to ensure that complications do not arise upon discharge (Boulding et al. 2011). Following CMS guidelines, only measures that are based on a sample of at least 25 patients for a given condition are included in the study. Relative to our study time frame, CMS reports hospital readmission rates for the July 2006–June 2009 and July 2009–June 2012 time periods. We thus compute, for each hospital, the weighted average of the three conditions' readmission rates for both of these time periods. Thus, the final *Readmission Rate*$_{it*}$ value for the three-year time period t^* for hospital i with respective readmission rates AMI_{it*}, HF_{it*}, and PN_{it*} and number of patients $nAMI_{it*}$, nHF_{it*}, and nPN_{it*} is given as follows:

$$Readmission\ Rate_{it*} = \frac{(AMI_{it*} \times nAMI_{it*} + HF_{it*} \times nHF_{it*} + PN_{it*} \times nPN_{it*})}{nAMI_{it*} + nHF_{it*} + nPN_{it*}}.$$

Cost per Discharge is estimated using the approach promoted by the Agency for Healthcare Research and Quality and adopted by many healthcare scholars (e.g., Every et al. 1996, Chen et al. 2010, Marks et al. 2014) and state agencies (e.g., Ohio Bureau of Workers Compensation, Wisconsin ForwardHealth); that is, we convert each hospital's total inpatient operating charges for their fiscal years beginning in time periods t to $t+5$ to 2012 U.S. dollars using the consumer price index for inpatient hospital services. We then divide these inflation-adjusted inpatient charges by the total number of inpatient discharges and exclude the top and bottom 1% to prevent outliers from unduly affecting the results (Every et al. 1996). Finally, we multiply these charges by the hospital-specific Medicare inpatient operating cost-to-charge ratio to estimate inpatient operating costs per discharge. Both inpatient operating charges and discharges are extracted from CMS cost reports. Medicare inpatient operating cost-to-charge ratio is derived from these cost reports and reported on CMS Impact Files with a three-year lag, which we accounted for when collecting the data. To satisfy normality and homoscedasticity requirements, we apply the natural logarithm transformation to the resulting ratio. The final *Cost per Discharge*$_{it}$ value for hospital i in year t with inflation-adjusted inpatient operating charges O_{it}, number of discharges D_{it}, and inpatient operating cost-to-charge ratio CCR_{it} is

$$Cost\ per\ Discharge_{it} = \ln\left(\frac{O_{it}}{D_{it}} \times CCR_{it}\right).$$

3.2. Process Quality

Conformance Quality corresponds to the level of systematic adherence to evidence-based standards achieved by hospitals when delivering healthcare to the patient. We evaluate this construct using CMS process of care measures that report the percentage of eligible hospitalized patients who received care in accordance with the evidence-based guidelines in time periods t to $t+5$. These measures were developed in 2003 by CMS and the Joint Commission; results are reported on the CMS Hospital Compare website (http://www.hospitalcompare.hhs.gov, accessed March 2014).

Specifically, consistent with our readmission measure, we consider process of care measures for three conditions: AMI, HF, and PN. Given the definition of *Conformance Quality*—level of systematic adherence to evidence-based standards—we focus our attention on the 11 measures that have been deemed to "accurately capture whether the evidence-based care has been delivered" (Chassin et al. 2010, p. 685). For each hospital, the measure reports the percentage of eligible patients who actually receive the treatment. A complete list of the conformance quality measures used in this study, along with sample averages and standard deviations over the six years considered, appears in Online Appendix C1.

Following CMS guidelines, only measures that are based on a sample of at least 25 eligible patients are included in the study. We compute hospitals' weighted average percentage across all selected measures, based on the number of patients eligible for each measure (Theokary and Ren 2011, Andritsos and Tang 2014). Then, in accordance with statistical theory (Collett 2003) and previous research (Chandrasekaran et al. 2012), we transform this percentage into its normally distributed logit form to satisfy the distributional assumptions such as normality and homoscedasticity required for regression.

Conformance Quality (CQ_{it}) for hospital i in year t given a weighted average percentage across process of care measures P_{it} is hence given by[2]

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

Experiential Quality measures the level of interaction between caregivers and patients, as experienced by the patient (Chandrasekaran et al. 2012). In the context of healthcare delivery, this construct is evaluated using patients' responses to the HCAHPS survey obtained in time periods t to $t+5$. These measures were developed by CMS and the U.S. Agency for Healthcare Research and Quality in 2006; the results are also reported, at a composite level (i.e., set of two to three questions related to a common topic), on the CMS Hospital Compare website. Our *Experiential Quality* construct incorporates the six composites from this survey that measure hospitals' emphasis on the interactions between caregivers and individual patients (Boulding et al. 2011). Questions included in these composites ask patients to rate the extent to which their individual care needs were considered during these interactions. These composites address general communication (COMP 1 and COMP 2) and targeted communication (COMP 5 and COMP 6) between caregivers and patients, as well as the level of responsiveness of caregivers to patients' more explicit needs (COMP 3 and COMP 4). Full text of items for each composite, along with sample averages and standard deviations for the six years considered, appear in Online Appendix C2. Cronbach's alpha for these items is 0.93, which indicates excellent internal consistency (Hair et al. 2010).

Based on CMS guidelines, only data from hospitals that received survey responses from at least 100 patients are included in the study. To address potential bias from the mode of survey administration (e.g., phone, letter) and patient characteristics that may differ across hospitals, CMS adjusts the score for each survey item for each hospital using patient-mix adjustments (i.e., education, self-rated health, non-English primary language, age, and service line) and survey mode adjustments. CMS also adjusts for impact of the time lag between discharge and completion of the survey (http://www.hcahpsonline.org). After making these patient-level adjustments, CMS aggregates the data to the hospital level for public reporting. Thus, although the data in our analysis are at the hospital level, they have ex ante been adjusted for patient-level characteristics. For each question COMP 1 through COMP 5, CMS reports the adjusted percentage of patients at the hospital who answered the question using the response categories "never/sometimes," "usually," or "always." We designate the percentage of patients who answered "always" as the measure for the items' individual scores. COMP 6's response categories are only "yes" or "no," so the percentage score for that item is the percentage of respondents who answered the question with "yes." Finally, an overall score for each hospital is calculated as the average of the percentage scores for the six items. Similar to the *Conformance Quality* measure, this percentage score is then transformed into its normally distributed logit form.

Experiential Quality (EQ_{it}) for hospital i in year t with composite percentage score is given by[3]

$$EQ_{it} = \ln\left(\frac{E_{it}}{1 - E_{it}}\right).$$

[2] We dropped 250 observations—1% of the total sample distributed among 198 hospitals, showing conformance quality score of 100%. However, these hospitals did not have measures for all of the process conformance items, and therefore had incomplete data, which produced artificially high scores. Moreover, dropping these observations reduced our overall sample size by only six hospitals, and including these hospitals using linear extrapolation for *Conformance Quality* scores did not change results. None of the hospitals in our sample had $P = 0\%$.

[3] None of the hospitals in the sample had $E = 0\%$ or $E = 100\%$.

Combined Quality reflects the extent to which a hospital is able to jointly pursue conformance and experiential quality. Consistent with other studies that measure the ability of organizations to focus on two distinct dimensions (Gibson and Birkinshaw 2004, Jansen et al. 2009), we measure *Combined Quality* as the product of *Conformance Quality* and *Experiential Quality* scores. This approach best reflects the potential synergies between the two dimensions. To ease interpretation of the results, we mean centered the quality measures before computing the interaction term (Aiken and West 1991). The *Combined Quality* (CBQ_{it}) score for hospital i in year t is given by

$$CBQ_{it} = CQ_{it} \times EQ_{it} \quad (\text{with } CQ_{it} \text{ and } EQ_{it} \text{ centered}).$$

3.3. Control Variables

Previous studies identify several variables as potential sources of heterogeneity in performance across acute care hospitals. Hence, we control for their effects in this study in order to minimize concerns related to differences in service offerings (e.g., hospital's ability to treat more severe cases). Our analysis includes six time-varying controls: *Teaching Intensity*, calculated from residents-to-bed ratio (Sloan et al. 2001); *Bed Size*, represented as ln(*number of beds*); *Case Mix Index* and *Wage Index* (Shwartz et al. 2011), both calculated after we control for the effect of teaching intensity, because teaching hospitals tend to treat a more complex case mix and pay higher wages than nonteaching hospitals (Nath and Sudharshan 2006, Koenig et al. 2003); *OPDSH Adjustment Factor*, or CMS operating disproportionate share hospital payment adjustment factor, which reflects the hospital's propensity to treat uninsured and Medicaid patients who often require more resources (Coughlin and Liska 1998); and *Outlier Adjustment Factor*, or CMS operating outlier adjustment factor, which reflects unusually costly cases treated by the focal hospital. Both *OPDSH* and *Outlier Adjustment Factors* are calculated and reported by CMS. We also include year dummies to control for unobserved factors causing overall population change in hospital performance. Finally, through panel-data modeling, we control for hospital-level fixed effects, which include all time-invariant hospital characteristics (e.g., corporate goals, ownership, and location).

4. Analyses and Results

The 3,474 acute care U.S. hospitals demonstrate sufficient variation in process quality (*Conformance Quality*, *Experiential Quality*), and performance (*Readmission Rate*, *Cost per Discharge*). Online Appendix A shows the summary statistics for all variables in this study. Table 1 presents the correlations among these variables, averaged for each hospital across all six time periods considered. The negative and significant correlation between *Conformance Quality* and *Experiential Quality* ($r = -0.06, p < 0.01$) underlines the inherent tension that exists between those two dimensions (Gupta et al. 2006).

4.1. Endogeneity Checks

Conformance quality and experiential quality are only proxies for a hospital's process quality initiatives and may raise endogeneity concerns with respect to cost; that is, a hospital's past cost performance cannot be linked only to its current cost performance, but can also influence its current levels of conformance and experiential quality by freeing or constraining available resources. To account for this endogeneity issue with respect to cost, we apply a system generalized method-of-moments (GMM) estimation approach that uses previous lags of endogenous variables as instruments. We discuss this approach in more detail in §4.3. A Durbin–Wu–Hausman test comparing results between the instrumented and the noninstrumented system GMM estimations offers support for our endogeneity concerns in the prediction of *Cost per Discharge* ($\chi^2(24) = 161.59$, $p < 0.01$; Davidson and MacKinnon 1993).

Table 1 **Pairwise Correlations**

Variable	1	2	3	4	5	6	7	8	9	10	11
1. *Cost per Discharge*	1.00										
2. *Readmission Rate*	−0.15	1.00									
3. *Conformance Quality*	0.29	−0.08	1.00								
4. *Experiential Quality*	−0.04	−0.27	−0.06	1.00							
5. *Combined Quality*	0.13	0.01	0.02	−0.27	1.00						
6. *Teaching Intensity*	0.27	0.26	0.07	−0.22	0.03	1.00					
7. *Case Mix Index*	0.58	−0.09	0.43	0.03	0.13	0.27	1.00				
8. *Wage Index*	0.49	0.03	0.17	−0.34	0.12	0.19	0.16	1.00			
9. *OPDSH Adj. Factor*	−0.06	0.28	−0.12	−0.37	0.14	0.35	−0.03	0.16	1.00		
10. *Outlier Adj. Factor*	0.40	−0.05	0.14	0.01	0.06	0.16	0.25	0.11	0.03	1.00	
11. *Bed Size*	0.21	0.17	0.37	−0.56	0.09	0.39	0.35	0.21	0.29	0.07	1.00

Note. Significance levels: $p \leq 0.01$ if $|r| > 0.02$.

Models predicting *Readmission Rate* may not suffer from the same endogeneity issues because, during the time period studied (July 2006–June 2012), hospitals were not penalized for excess readmissions (legislation on reimbursements changed after 2012). As a result, hospitals with lower readmission rates did not receive additional revenues, when compared to hospitals with higher readmission rates, to invest in improving process quality. Hence, compared to cost models, theoretical arguments for endogeneity of process quality measures in the analysis of readmissions are rather weak.

Nevertheless, we also empirically examine the endogeneity concerns for *Readmission Rate* models. To include a sufficient number of eligible admissions, CMS only provides hospitals' readmission rates as a three-year rolling average. We thus have *Readmission Rate* observations for only two three-year time periods per hospital (as opposed to six one-year time periods for *Cost per Discharge*). This arrangement prevents the use of the system GMM approach—which requires at least three observations per unit of analysis—to generate instruments based on lagged variables and test for endogeneity (Blundell and Bond 1998). Thus, we rely on prior literature to identify potential instruments for conformance quality and experiential quality. Specifically, we use number of years since the first state-level initiative was enacted for (1) healthcare-associated infections (HAI) and (2) patient-centered medical homes (PCMH) as instruments for conformance and experiential quality, respectively. Chandrasekaran et al. (2012) find that hospitals located in states with longer duration of HAI laws tend to do well on conformance quality. Similarly, legislation on PCMH emphasizes interactions between patients and caregivers in the care delivery process (http://www.pcmh.ahrq.gov) and hence can be used as an instrument for experiential quality. After centering both state legislative measures, we also compute the interaction term between them. We use this interaction as an instrument to predict combined quality. First-stage regressions, the Angrist and Pischke 2008 *F*-test for weak instruments, and Anderson's (1984) canonical correlation test all support the quality of these instruments. The Durbin–Wu–Hausman test (Durbin 1954, Wu 1973, Hausman 1978), which compares results between the instrumented regression and the regular ordinary least squares (OLS) regression ($\chi^2(10) = 9.19$, $p = 0.51$), supports the lack of endogeneity concerns with respect to *Readmission Rate* (Davidson and MacKinnon 1993). Because of the lack of theoretical and empirical reasons to be concerned about endogeneity with *Readmission Rate*, and to achieve more efficient estimation, we do not use instrumental variables to predict *Readmission Rate* in our main analyses (Wooldridge 2008).

4.2. Modeling Readmission Rate

To control for hospital-level effects, we model *Readmission Rate* using both fixed-effects and random-effects estimators. A Durbin–Wu–Hausman test result indicates that modeling hospital-level effects as fixed rather than random is most appropriate in our analyses ($\chi^2(9) = 318.38$, $p < 0.01$).[4] Hence, we report the results from the fixed-effects regressions which, given the two three-year time periods available, effectively corresponds to a first-differences model. Specifically, the following model represents the *Readmission Rate* for hospital i in the three-year time period t^*:

$$\textit{Readmission Rate}_{it^*} = \beta X_{it^*} + u_i + v_{it^*},$$

where X_{it*} is a vector of the independent and control variables averaged over the three years considered, u_i represents the fixed hospital-level effect, and v_{it^*} represent the idiosyncratic error term.

4.3. Modeling Cost per Discharge

We adopt the system GMM estimation approach (Arellano and Bover 1995, Blundell and Bond 1998, Angelini and Generale 2008, Kuhnen and Niessen 2012, Rego et al. 2013) to model *Cost per Discharge* using the xtabond2 command in STATA12. We opted for this approach based on the characteristics of our sample, namely, (1) a "small T (six time periods), large N (≈3,000 hospitals)" panel, (2) a linear functional relationship between our predictors and outcome variables, (3) dynamic outcome variables (e.g., cost) whose current values depend on past realizations, (4) predictors of interest (i.e., process quality variables) that are likely endogenous and instruments that are hard to find, (5) a need to control for fixed hospital-level effects, and (6) heteroscedasticity and autocorrelation within hospitals but not across them (Roodman 2009, Rego et al. 2013).

The system GMM estimator uses a system of two equations, one based on the first differences in regressors (Arellano and Bond 1991) and the other based on regressors' previous levels. Specifically, the two general equations estimated simultaneously for hospital i at time t are[5]

$$\Delta Cost_{it} = \alpha \Delta Cost_{it-1} + \beta 1 \Delta X_{it} + \beta 2 \Delta W_{it} + \Delta v_{it}$$
$$\text{(first-differences equation)},$$
$$Cost_{it} = \alpha Cost_{it-1} + \beta 1 X_{it} + \beta 2 W_{it} + u_i + v_{it}$$
$$\text{(levels equation)},$$

[4] We also repeated our analyses treating hospital-level effects as random, which provided very similar results.

[5] We also included first lagged regressors when predicting *Cost per Discharge* to account for longer-term effects (Anderson and Hsiao 1982, Arellano and Bond 1991). For clarity purposes, these are not shown in the equations because they are not the focus of this study.

where X_{it} is a vector of endogenous predictors (*Conformance Quality*, *Experiential Quality*, and *Combined Quality*), W_{it} is a vector of exogenous predictors (controls and time dummies), and the error term includes a hospital-specific fixed effect u_i (which disappears in the first-differences equation—thus controlling for fixed effects) and an observation-specific error v_{it}.

Instruments for the predetermined (i.e., $Cost_{it-1}$) and endogenous (i.e., X_{it}) variables are generated using their lags. Specifically, in the first-differences equation, past levels of these variables are used as instruments for their differences, whereas in the levels equation, past differences of these variables are used as instruments for their levels. The Arellano–Bond test allows researchers to determine valid lags to use as instruments, as the next section describes. See Arellano and Bover (1995) and Blundell and Bond (1998) for more details on this approach.

4.4. Estimation Results

For each dependent variable, we first run a regression with only the main effects of *Conformance Quality* and *Experiential Quality*, and then include *Combined Quality*. Models 1 and 2 in Table 2 summarize theresults for the *Readmission Rate* analyses, which use hospital-level fixed-effects regressions; Models 3 and 4 in Table 3 show results for the *Cost per Discharge* analyses, which use system GMM estimations. Multiple statistics support our *Cost per Discharge* models' specification. First, for all models, α (coefficient for lagged dependent variable) has an absolute value below unity (i.e., $|\alpha| < 1$), which ensures that the process converges (Blundell and Bond 1998).[6] Second, although first-order serial correlation is expected (significance of AR(1)), the Arellano–Bond test for AR(2) in first differences fails to reject the null hypothesis ($p > 0.10$) that there is no second-order serial correlation in residuals in differences (i.e., no first-order serial correlation in residuals in levels), thus supporting the validity of using lags 2 and longer for the differences equation and lags 1 and longer for the levels equation as GMM instruments (Arellano and Bond 1991). Third, the Hansen (Hansen 1982) test of overidentifying restrictions fails to reject ($p > 0.10$) the null hypothesis of joint validity of the instruments, thus offering further support for our model specification.

4.4.1. Effect of Combined Quality on Readmission Rate. Hypothesis 1 posits that combined quality reduces readmission rates. Model 2 shows a strong significant negative relationship between *Combined Quality* and *Readmission Rate* ($\beta_{CBQ} = -0.43$, $p < 0.01$), providing support for Hypothesis 1. It is worth noting that *Conformance Quality* and *Experiential Quality* appear to directly affect *Readmission Rate* in Model 1, but the model fit is improved when *Combined Quality* is entered into the model ($\Delta\chi(1) = 38$, $p < 0.01$). This result indicates that the effect of *Conformance Quality* on *Readmission Rate* depends on the level of *Experiential Quality* and vice versa. All these observations further support the importance of considering combined quality when studying hospitals' performance.

Table 2 **Effect of Process Quality on Readmission Rate: Hospital-Level Fixed-Effects Regressions**

	Readmission Rate	
	Model 1	Model 2
Conformance Quality	-0.48^{**}	-0.46^{**}
	(0.03)	(0.03)
Experiential Quality	-0.48^{**}	-0.73^{**}
	(0.20)	(0.20)
Combined Quality		-0.43^{**}
		(0.10)
Time-varying controls		
Teaching Intensity	-2.73^{**}	-2.92^{**}
	(0.78)	(0.79)
Bed Size	0.14	0.13
	(0.22)	(0.22)
OPDSH Adj. Factor	4.80^{**}	5.08^{**}
	(0.43)	(0.43)
Case Mix Index (after adjusting for teaching)	-3.45^{**}	-3.35^{**}
	(0.34)	(0.34)
Wage Index (after adjusting for teaching)	1.89^{**}	1.59^{*}
	(0.70)	(0.69)
Outlier Adj. Factor	-0.65	-0.78
	(0.98)	(0.97)
Observations	5,858	5,858
Hospitals	2,929	2,930
χ^2	$\chi^2(8) = 1{,}784^{**}$	$\chi^2(9) = 1{,}822^{**}$
R^2 (adjusted) (%)	67.74	67.97
ΔAIC (base: Model 1)	—	-43.81
ΔBIC (base: Model 1)	—	-37.12

Notes. Panel data over six years are shown: two three-year time period observations per hospital. Standard errors are clustered at the hospital level. AIC stands for Akaike Information Criterion; BIC stands for Bayesian Information Criterion.
$^{*}p \leq 0.05$; $^{**}p \leq 0.01$.

Figure 1 represents the interaction plot between *Conformance Quality* and *Experiential Quality* (i.e., *Combined Quality*) with regard to *Readmission Rate*. The total effect shown corresponds to both the interaction and the main conditional effects (Aiken and West 1991). The importance of combined quality in reducing readmission rates is reflected in this plot. Consider a hospital that is in the 75th percentile of *Conformance Quality*. In this case, a 1.00 percentage point increase in raw *Experiential Quality* score would correspond to a 4.95 percentage point decrease in *Readmission Rate*, which roughly means avoiding one readmission for every 20 patients discharged. In contrast, for hospitals with relatively low levels of *Conformance Quality* (25th percentile), a 1.00 percentage point increase

[6] Additional checks on the upper and lower bounds for this coefficient are described in the section Robustness Checks.

Table 3 Effect of Process Quality on Cost per Discharge: Hospital-Level System GMM Estimations

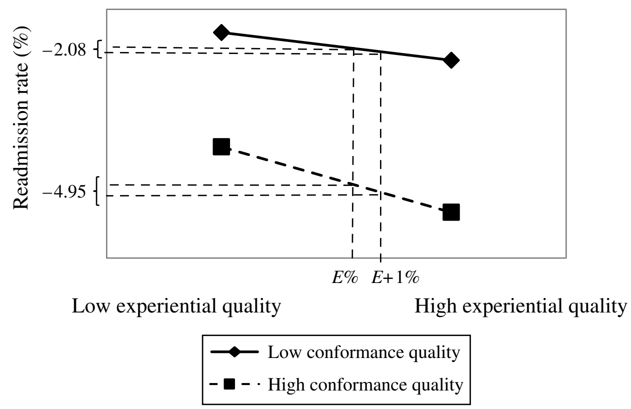
	Cost per Discharge	
	Model 3	Model 4
Conformance Quality	0.09**	0.09**
	(0.03)	(0.04)
Experiential Quality	0.32*	0.28**
	(0.16)	(0.12)
Combined Quality		0.01
		(0.06)
Time-varying controls		
Teaching Intensity	0.46**	0.43**
	(0.13)	(0.12)
Bed Size	−0.12**	−0.12**
	(0.03)	(0.03)
OPDSH Adj. Factor	−0.01	−0.02
	(0.05)	(0.04)
Case Mix Index	0.59**	0.54**
(after adjusting for teaching)	(0.18)	(0.18)
Wage Index	0.23**	0.23**
(after adjusting for teaching)	(0.04)	(0.04)
Outlier Adj. Factor	1.13**	1.16**
	(0.19)	(0.19)
Y_{t-1} (lagged dependent variable)	0.37**	0.37**
	(0.05)	(0.05)
Year dummies	Yes	Yes
Lagged regressors	Yes	Yes
Observations	12,538	12,538
Hospitals	2,983	2,983
χ^2	$\chi^2(9) = 369$**	$\chi^2(10) = 379$**
AR(1) test (p-value)	(0.00)	(0.00)
AR(2) test (p-value)	(0.36)	(0.41)
Hansen test of overidentification (p-value)	(0.55)	(0.56)

Notes. Panel data over six years are shown: six one-year time period observations per hospital. Standard errors are corrected for heteroscedasticity and clustered at the hospital level. AR(1) and AR(2) test for first- and second-order serial correlation in the first-differenced residuals, under the null of no serial correlation. Nonsignificance for AR(2) indicates that lags 2 and longer for the differences equation and lags 1 and longer for the levels equation are valid GMM instruments. Nonsignificance for the Hansen test of overidentifying restrictions supports joint validity of the instruments used.
*$p \leq 0.05$; **$p \leq 0.01$.

in *Experiential Quality* would result in a 2.08 percentage point decrease in *Readmission* or one readmission avoided for every 48 patients discharged.

4.4.2. Effect of Combined Quality on Cost per Discharge. Hypothesis 2 posits that combined quality increases cost per discharge. Model 4 shows no significant association between *Combined Quality* and *Cost per Discharge* ($\beta_{CBQ} = 0.01$, $p = 0.97$). This result indicates that hospitals that jointly pursue both conformance and experiential quality (i.e., combined quality) do not incur an additional cost. Thus, Hypothesis 2 is not supported. However, Models 3 and 4 show a significant positive main effect of both *Conformance Quality* ($\beta_{CQ} = 0.09$, $p < 0.01$ for both models) and *Experiential Quality* ($\beta_{EQ} = 0.32$, $p < 0.05$ for Model 3; $\beta_{EQ} = 0.28$, $p < 0.01$ for Model 4) on *Cost per Discharge*. This finding suggests that each process quality dimension independently increases cost.

Figure 1 Effect of Combined Quality on Readmission Rate



Notes. The 25th–75th percentile ranges are represented for *Conformance Quality* (89.9%–97.3%). *E* stands for a hospital's raw experiential quality score.

4.4.3. Summary of Results. Overall, our results indicate that hospitals face a trade-off between reducing readmissions and controlling their costs. Combined quality reduces readmission rates and thus makes improvement along both conformance quality and experiential quality an imperative for hospitals. However, costs increase independently with conformance quality and with experiential quality.

Surprisingly, no additional cost is incurred by jointly pursuing conformance and experiential quality. To unpack the reasons for this result, we conduct post hoc analyses to examine the granular elements of experiential quality. To split conformance quality would require us to divide it based on patient conditions (i.e., heart attack, heart failure, and pneumonia), which would prohibit analyses at the hospital level. Therefore, we do not pursue this option. We examine experiential quality in greater detail because it is common across all patients admitted to the hospital, and hence splitting it allows us to replicate the hospital-level analyses. Furthermore, conformance quality has been a longstanding priority for healthcare practitioners. As changes to reimbursements signal a new recognition and promotion of experiential quality, additional insights on how different elements of experiential quality interact with conformance quality become managerially relevant. For instance, some of the elements of experiential quality may be harder—and thus more costly—for hospitals to implement with conformance quality, whereas other elements may complement and therefore be less costly for hospitals to implement in conjunction with conformance quality. Thus, the two may cancel each other's effect when aggregated in the main cost analysis.

4.5. Post Hoc: Granular Investigation of Experiential Quality

4.5.1. Two Dimensions of Experiential Quality: Response-Focused EQ and Communication-Focused EQ. Online Appendix C2 presents the full text of items that constitute experiential quality (COMP 1 through COMP 6). A closer look at these items suggests that they map onto a variety of task routines among the caregivers during their interactions with patients. According to the task effectiveness literature, tasks can be subdivided into behavioral and conceptual tasks depending on the type of work performed by the individuals and the resources required to execute them. Behavioral tasks are more standardized with clear specifications of means and ends, whereas conceptual tasks are less standardized with no clear specifications of means and ends (Stewart and Barrick 2000). Researchers have shown that promoting both types of tasks among individuals requires different organizational resources. For instance, organizations invest in technologies and automation to facilitate behavioral tasks (Goodman 1986), but invest in training and educational systems to facilitate conceptual tasks (Herold 1978).

Based on these distinctions, consider the individual items that constitute experiential quality. Scoring high on items such as COMP 3 (staff responsiveness) and COMP 4 (pain management) means that caregivers immediately responded to patients' requests. We refer to this dimension as *response-focused EQ*. From a task effectiveness standpoint, this dimension reflects behavioral task routines (McGrath 1984) performed by the caregivers that primarily rely on motor skills, that is, a caregiver's ability to detect and respond to explicit patient requests. An example of this routine is the nurse's ability to detect a patient's request in the nurse call system (e.g., light turning on) and immediately travel to the patient room to assist with toileting or pain medication. In terms of hospital resources, response-focused EQ benefits from investments in technologies such as visual monitoring systems (Myers and Reed 2008), radio-frequency identification location systems (Yao et al. 2012), and advanced communication systems (Wu et al. 2012) that help caregivers quickly identify and respond to patients' requests.

In contrast, high scores on COMP 1, COMP 2, COMP 5, and COMP 6 means that caregivers were able to effectively communicate with patients on various topics such as general information (COMP 1 and COMP 2), new medications (COMP 5), and discharge instructions (COMP 6). We refer to this dimension as *communication-focused EQ*. From a task effectiveness standpoint, this dimension reflects conceptual task routines (McGrath 1984). These routines rely primarily on the caregiver's ability to assimilate a patient's request and alter his or her response according to the patient's implicit needs and preferences. An example of this routine is that the physician or the nurse carefully listens to a patient's question about medication, answers her question in a manner that she understands, and addresses any other questions or concerns clearly and respectfully. In terms of hospital resources, training programs that teach interpersonal skills to the caregivers can increase communication-focused EQ. An example would be the Cleveland Clinic's teaching of empathy and patient-centeredness to all its caregivers (Cosgrove 2014).

Given the differences in both the type of tasks and the hospital's investments for response-focused EQ versus communication-focused EQ, we replicate our main analyses to examine the impact on readmission rate and cost per discharge of combining each of these experiential quality dimensions with conformance quality.

4.5.2. Post Hoc Analyses and Results. We create the *Communication-Focused EQ* and *Response-Focused EQ* constructs in the following manner. We measure *Response-Focused EQ* for a given hospital using the average percentage score across COMP 3 and COMP 4. We computed the normally distributed logit of this average to obtain our final measure. Similarly, we started by computing the logit of a hospital's average percentage score across COMP 1, COMP 2, COMP 5, and COMP 6 to assess *Communication-Focused EQ*. However, given that both *Communication-Focused EQ* and *Response-Focused EQ* are subconstructs of experiential quality, the degree of multicollinearity between these variables is very high ($r = 0.89$, $p < 0.01$), which can be problematic if we include both variables in the same regression model. Under such conditions, scholars recommend differentiating these variables by creating orthogonal constructs through sequential regression (Ridker and Henning 1967, Sine et al. 2003, Nagar and Rajan 2005, Hastie et al. 2009). This approach requires selecting one variable to remain as is and regressing the other variable against it. The residuals of this regression are then used to represent the second construct. Sequential regression allows assigning the common variance between two variables to one construct only—the variable selected to remain as is—when performing multiple variable regression. For instance, Sine et al. (2003) use this approach to disentangle prestige (evaluated through rankings) and past licensing performance (which could also influence rankings) when investigating these variables' individual effects on university inventions' current licensing performance. Along these lines, we select *Response-Focused EQ* to remain

Table 4 Post Hoc: Granular Investigation of Dimensions of Experiential Quality

	Readmission Rate (fixed effects)		*Cost per Discharge* (system GMM)	
	Model 5	Model 6	Model 7	Model 8
Conformance Quality	−0.47**	−0.45**	0.12**	0.10**
	(0.03)	(0.03)	(0.03)	(0.03)
Experiential Quality				
Response-Focused EQ	−0.27	−0.47**	−0.03	0.09
	(0.18)	(0.18)	(0.10)	(0.09)
Communication-Focused EQ	−0.90**	−1.46**	0.84^	0.41^
	(0.34)	(0.33)	(0.45)	(0.24)
Combined Quality				
Response-Focused CBQ		−0.26**		0.16**
		(0.09)		(0.05)
Communication-Focused CBQ		−0.92**		−0.19*
		(0.20)		(0.10)
Time-varying controls				
Teaching Intensity	−2.71**	−2.93**	0.10	0.14
	(0.77)	(0.79)	(0.09)	(0.09)
Bed Size	0.14	0.13	−0.07**	−0.06**
	(0.22)	(0.02)	(0.02)	(0.01)
OPDSH Adj. Factor	4.77**	4.96**	−0.11*	−0.07^
	(0.43)	(0.43)	(0.05)	(0.04)
Case Mix Index	−3.40**	−3.22**	0.04	0.05^
	(0.34)	(0.34)	(0.03)	(0.03)
Wage Index	1.89**	1.50*	0.19**	0.23**
	(0.69)	(0.69)	(0.05)	(0.04)
Outlier Adj. Factor	−0.65	−0.83	1.51**	1.53**
	(0.98)	(0.98)	(0.17)	(0.16)
Y_{t-1} (lagged dependent variable)	—	—	0.40**	0.39**
			(0.05)	(0.05)
Year dummies	—	—	Yes	Yes
Lagged regressors	—	—	Yes	Yes
Observations	5,858	5,858	12,538	12,538
Hospitals	2,929	2,929	2,983	2,983
χ^2	$\chi^2(9) = 1{,}795$**	$\chi^2(11) = 1{,}868$**	$\chi^2(10) = 293$**	$\chi^2(12) = 343$**
R^2 (adjusted) (%)	67.78	68.18	—	—
ΔAIC (base: Model 1)	−8.50	−83.00	—	—
ΔBIC (base: Model 1)	−1.80	−62.91	—	—
AR(1) test (*p*-value)	—	—	(0.00)	(0.00)
AR(2) test (*p*-value)	—	—	(0.80)	(0.99)
Hansen test of overid. (*p*-value)	—	—	(0.13)	(0.32)

Note. For *Readmission Rate*, see notes for Table 2; for *Cost per Discharge*, see notes for Table 3.
^$p \le 0.10$; *$p \le 0.05$; **$p \le 0.01$.

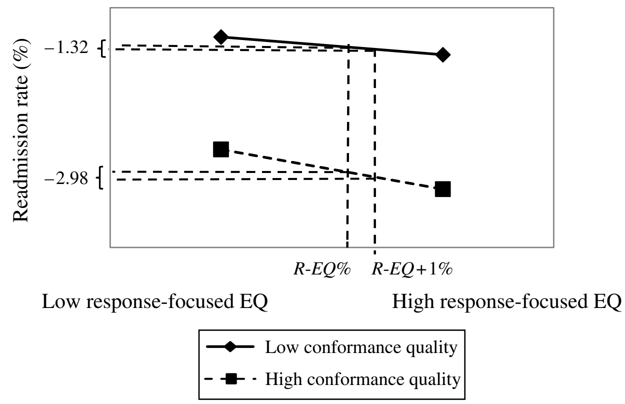
as is because this construct necessarily involves some communication, which is typically standardized, to respond to patients' explicit needs (e.g., caregivers' inquiring about patient's level of pain before delivering pain medication). Thus, although it primarily relies on the behavioral tasks identified in COMP 3 and COMP 4, *Response-Focused EQ* is also partly reflected in the other items of experiential quality, which measure all communication. On the other hand, *Communication-Focused EQ* does not involve any of the behavioral tasks measured in COMP 3 and COMP 4. We therefore regress *Communication-Focused EQ* (dependent variable) against *Response-Focused EQ* (independent variable) and use the residuals from this regression as our final measure of *Communication-Focused EQ*. This approach allows us to distinguish between communication directly related to the execution of behavioral tasks and the assignment of the related variance solely to *Response-Focused EQ*, and the strictly conceptual communication that uniquely defines *Communication-Focused EQ*. Similar to the *Combined Quality* construct, *Response-Focused CBQ* and *Communication-Focused CBQ* constructs were measured using the product term of *Conformance Quality* and the corresponding *Response-Focused EQ* and *Communication-Focused EQ* dimensions, respectively. Table 4 summarizes the results of our post hoc analyses that use analytical approaches consistent with the main analyses (i.e., hospital-level fixed-effects regressions for *Readmission Rate* and system GMM estimations for *Cost per Discharge*). Also mirroring the main analyses, for each dependent variable we first show results with only the main effects of *Conformance Quality, Response-Focused EQ*, and *Communication-Focused EQ* (Models 5 and 7). We then show results when *Response-Focused CBQ* and *Communication-Focused CBQ* are included as additional regressors (Models 6 and 8).

4.5.3. Readmission Rate. Model 6 reveals that both *Response-Focused CBQ* ($\beta_{R\text{-}CBQ} = -0.26$, $p < 0.01$) and *Communication-Focused CBQ* ($\beta_{C\text{-}CBQ} = -0.92$, $p < 0.01$) have a strong negative association with *Readmission Rate*. As for the main conditional effects (Aiken and West 1991) in Model 6, we find that both *Communication-Focused EQ* and *Response-Focused EQ* are negatively associated with *Readmission Rate* ($\beta_{R\text{-}EQ} = -0.47$, $p < 0.01$; $\beta_{C\text{-}EQ} = -1.46$, $p < 0.01$). These results suggest that both behavioral and conceptual dimensions of experiential quality have a strong direct and synergistic effect (with conformance quality) on readmission rate.

Figures 2 and 3 represent the interactions plots (Aiken and West 1991) between *Conformance Quality* and *Response-Focused EQ* (Figure 2) and *Conformance Quality* and *Communication-Focused EQ* (Figure 3) with regard to *Readmission Rate* based on Model 6. While we see that each experiential quality dimension reduces readmission rate, irrespective of *Conformance Quality*, we also observe the synergies at play through the difference in slopes. For instance, a 1.00 percentage point increase in *Response-Focused EQ* raw average score corresponds to a 1.32 percentage point average decrease in *Readmission Rate* under low *Conformance Quality* versus a 2.98 percentage point average decrease under high *Conformance Quality*. Similarly, a 1.00 percentage point increase in *Communication-Focused EQ* raw average score would decrease *Readmission Rate* by 2.00 percentage points under low *Conformance Quality*, versus 5.12 percentage points under high *Conformance Quality*.

4.5.4. Cost per Discharge. Model 8 shows the effect of *Response-Focused CBQ* and *Communication-Focused CBQ* on *Cost per Discharge*. Results reveal that *Response-Focused CBQ* has a significant positive effect on *Cost per Discharge* ($\beta_{R\text{-}CBQ} = 0.16$, $p < 0.01$), whereas *Communication-Focused CBQ* has a significant negative effect on *Cost per Discharge* ($\beta_{C\text{-}CBQ} = -0.19$, $p < 0.05$). This result can perhaps explain the lack of interaction between conformance quality and overall experiential quality (i.e., *Combined Quality*) on *Cost per Discharge* (Model 4), such that these effects cancel each other out. When looking at the main conditional effects in Model 8, we find that *Response-Focused EQ* is not associated with *Cost per Discharge* ($\beta_{R\text{-}EQ} = 0.09$, $p = 0.32$)

Figure 2 **Post Hoc: Effect of Response-Focused CBQ on Readmission Rate**



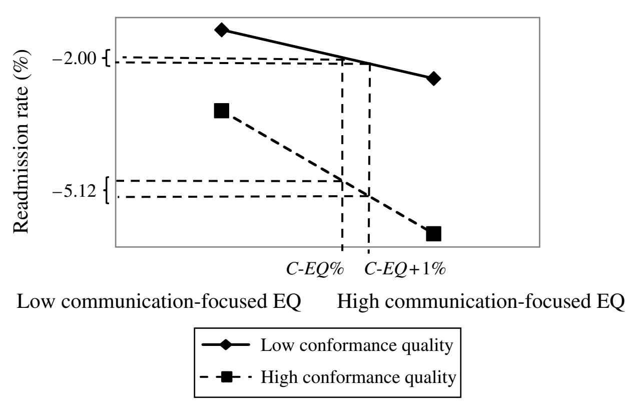
Note. The 25th–75th percentile ranges are represented for *Conformance Quality* (89.9%–97.3%).

while *Communication-Focused EQ* has a weak, positive association with *Cost per Discharge* ($\beta_{C\text{-}EQ} = 0.41$, $p < 0.10$).

Figures 4 and 5, which represent the interaction plots (Aiken and West 1991) based on Model 8, help interpret these results. Specifically, we see two observations of interest. First, under high levels of *Conformance Quality*, increasing either *Response-Focused EQ* or *Communication-Focused EQ* increases *Cost per Discharge*. Second, for each experiential quality dimension, the slopes between high and low levels of *Conformance Quality* add an important insight: As *Conformance Quality* increases, the impact of improving *Response-Focused EQ* on *Cost per Discharge* increases (−\$7 versus \$62), whereas the impact of improving *Communication-Focused EQ* on *Cost per Discharge* decreases (\$80 versus \$48).

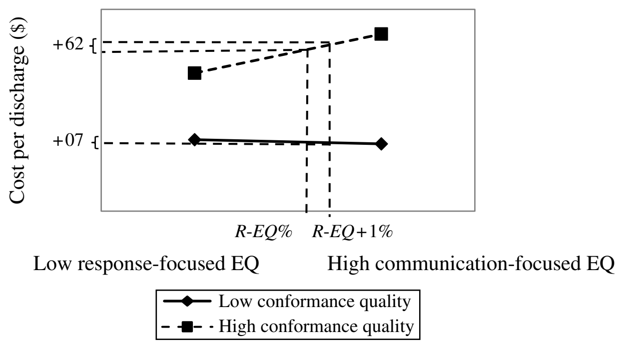
Overall, by distinguishing between the behavioral and conceptual dimensions of experiential quality, our

Figure 3 **Post Hoc: Effect of Communication-Focused CBQ on Readmission Rate**



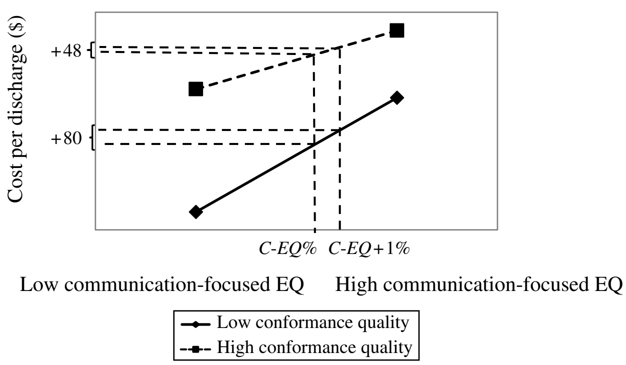
Note. The 25th–75th percentile ranges are represented for *Conformance Quality* (89.9%–97.3%).

Figure 4 **Post Hoc: Effect of Response-Focused CBQ on Cost per Discharge**



Note. The 25th–75th percentile ranges are represented for *Conformance Quality* (89.9%–97.3%).

Figure 5 **Post Hoc: Effect of Communication-Focused CBQ on Cost per Discharge**



Note. The 25th–75th percentile ranges are represented for *Conformance Quality* (89.9%–97.3%).

post hoc analyses provide additional insights on the readmissions–costs trade-off. Specifically, we find that a complementarity exists between communication-focused EQ and conformance quality with respect to both readmission rate and cost per discharge. In contrast, response-focused EQ complements conformance quality with respect to readmission rate, but not with respect to cost per discharge. These results offer some preliminary insights for hospital administrators on how to combine process quality dimensions.

4.6. Robustness Checks

We performed several additional sets of analyses to check the robustness of our results to alternative model specifications. First, to assess the validity of the system GMM results derived for costs in this study, Bond (2002) recommends using coefficients on the lagged dependent variable from both the simple OLS and the within-hospital fixed-effects regressions as bounds for the true parameter. Specifically, in the OLS regression, the lagged dependent variable would be positively correlated with the error, which would bias its coefficient estimate upward. On the other hand, in the fixed-effects regression, the lagged dependent variable would be negatively related with the error, biasing its coefficient downward (Roodman 2009). Thus, if our model's validity is supported, the coefficient on the lagged *Cost per Discharge* variable should be between the coefficient from the fixed-effects regression (lower bound) and the coefficient from the OLS regression (upper bound). Fixed-effects and OLS regressions consistently determine the credible range for the true parameter of the lagged variable as $[0.10 - 0.83]$. Thus, the coefficient found in our system GMM analyses (between 0.37 and 0.40) belongs to this credible range. This finding further supports the validity of our system GMM models.

Second, to ensure that our results are robust to patient-level variations, we collected patient-level data from the Ohio State University Wexner Medical Center. This hospital is a public hospital located in Columbus, Ohio, with close to 1,000 beds. It is nationally ranked in the 2013–2014 top 50 best hospitals by *U.S. News* for many adult specialties including cardiology and heart surgery. A total of 9,910 patients were admitted between September 2008 and June 2011 for the three conditions considered in this study: AMI, HF, and PN. From this population, data from 2,645 patients (26.69%) on core measures were reported to the CMS and made available to the research team. The sampling criterion was based on the Joint Commission report,[7] and the sampling was done by the University Healthcare Consortium—the core measure vendor for this hospital. For these 2,645 patients, process measure data were matched with their corresponding completed HCAHPS surveys to produce a reduced sample of 444 patients. Because all patients were treated by the same hospital, they all shared the same overall indirect costs (e.g., training of staff, hiring). Thus, we were unable to use these data to study the effect of process quality on cost per discharge. Instead, we focused on the relationships between process quality and readmission rates. Scores for conformance quality were 100% for all except nine patients. This low variation in conformance quality would have prevented us from deriving any meaningful results if this construct had been included as a predictor. Therefore, we limited patient-level analyses to those 435 patients with 100% conformance quality score. Despite this limitation, these patient-level analyses allow us to investigate the effect of *Experiential Quality*, *Response-Focused EQ*, and *Communication-Focused EQ* at high levels of *Conformance Quality* and thus align with our investigation of combined quality. Data availability for the other variables considered led

[7] For more details on the sampling process, refer to https://manual.jointcommission.org/releases/TJC2013A/SamplingChapterTJC.html#Sample_Size_Requirements (accessed November 2014).

Table 5 **Robustness Check: Condition-Level Fixed-Effects Logistic Models for Patient-Level Data**

	Readmission ($n = 374$)	
	Model A	Model B
Experiential Quality	−1.31** (0.49)	
Response-Focused EQ		−0.73 (0.46)
Communication-Focused EQ		−1.01** (0.41)
+ Patient-level controls included but not shown for brevity		
McFadden's pseudo-R^2 (%)	3.32	3.43

Notes. Conformance Quality is 100% for all patients included. Patient-level variables included when computing independent variables are as follows: education level, self-assessed health, age group, and non-English primary language. Additional patient-level variables used as controls in the analyses are as described in §4.6: illness severity index, gender, and intention to recommend. Bootstrap standard errors are shown.

$^{**}p \leq 0.01$.

to a final sample of 374 patients. In accordance with CMS procedure, we adjusted raw patients' answers to the HCAHPS survey before computing scores related to experiential quality according to the following patient-level factors: age group, self-assessed health, education, and non-English primary language (http://www.hcahpsonline.org). This adjustment was achieved through OLS regressions of each HCAHPS raw composite score (COMP 1 through COMP 6) on the patient-level predictors. Adjusted composite scores correspond to the residuals of these regressions and were used to compute *Experiential Quality*, *Response-Focused EQ,* and *Communication-Focused EQ* constructs. We adopt a condition-level fixed-effects logistic regression model to control for different intercepts across conditions when predicting readmission (binary outcome). We also added illness severity index and gender as controls in our analyses. Finally, to account for the possibility that a patient might elect to get readmitted to a different hospital and thus not be recorded by the focal hospital as a readmission (Gonzalez et al. 2013),[8] we controlled for patient's intention to recommend the hospital (source: HCAHPS survey). As demonstrated by the results shown in Table 5, using patient-level data, we were able to derive support for the strong negative association between *Experiential Quality* and *Readmission* under high levels of *Conformance Quality* (i.e., Model A shows that at high levels of *Conformance Quality*, *Experiential Quality* is associated with a strong decrease in readmissions) and for the importance of *Communication-Focused EQ* in reducing readmissions under high levels of *Conformance Quality* (i.e., Model B shows that at high levels of *Conformance Quality*, *Communication-Focused EQ* is associated with a strong decrease in readmissions). Interestingly enough, our patient-level analyses show that *Response-Focused EQ* is not associated with readmissions. This analysis at the patient level further supports our results regarding the effects of combined quality on readmission rate and highlights the importance of *Communication-Focused EQ*.

Third, in addition to readmission rates, we also collected mortality rates for hospitals. Similar to the readmission rate measure, each 30-day mortality rate is given as an average over a three-year period by CMS. We therefore collected two observations per hospital to match the time frame in our study (July 2006–June 2009 and July 2009–June 2012). We reran analyses with *Mortality Rate* as a dependent variable. Results show no effect of *Combined Quality* on *Mortality Rate* ($\beta_{CBQ} = 0.11$, $p = 0.17$) and a positive effect of *Conformance Quality* on *Mortality Rate* ($\beta_{CQ} = 0.16$, $p < 0.01$; see Online Appendix D). This would suggest not only that combined quality (as well as experiential quality) does not significantly affect mortality rates, but, even more surprisingly, that adherence to best technical practices significantly increases risk of dying for the patient. Further investigation revealed an important flaw in this *Mortality Rate* measure based on the data provided by CMS. In particular, *Mortality Rate* was positively and significantly correlated with hospital's raw *Case-Mix Index* measure for the first period considered (July 2006–June 2009: $r = 0.053$, $p < 0.01$). However, there was no longer a significant correlation between *Mortality Rate* and hospital's raw *Case-Mix Index* measure for the second period considered (July 2009–June 2012: $r = 0.022$, $p = 0.21$). The positive correlation in the first period suggests some statistical flaw in the initial risk adjustment done by CMS. We urge future researchers to assemble mortality data from other sources to conduct a more thorough investigation of this relationship.

5. Discussion and Conclusion

This study examines the relationship between a hospital's joint pursuit of conformance and experiential dimensions of quality, which we define as combined quality, and its impact on readmission rate and cost per discharge. These are important relationships to investigate because hospitals may face a tension between improving healthcare outcomes and maintaining their financial bottom line (Berwick et al. 2008). The changes made by CMS to its reimbursement policy, rewarding hospitals based on their performance on both conformance and experiential quality, can only increase this tension. However, little is known about the joint impact of these

[8] Hospital-level data used in our main analyses are provided by CMS and, as such, include readmissions to other hospitals.

quality dimensions on multiple aspects of hospital's performance. Our study offers insights into these relationships.

Results show that combined quality reduces readmission rates in hospitals. However, conformance and experiential quality each independently increases costs, even though no additional cost is associated with combining these dimensions. The absence of a significant effect of combined quality on cost per discharge called for a more granular investigation. We therefore conducted post hoc analyses, looking at the different elements of experiential quality and their interaction with conformance quality. We used insights from the task effectiveness literature and split experiential quality into response-focused EQ and communication-focused EQ, depending on the type of tasks.

From a hospital's accountability standpoint, we find that combining either response-focused EQ or communication-focused EQ with conformance quality reduces readmission rates. This finding indicates that either dimension of experiential quality decreases the likelihood of readmission for a patient. From a cost standpoint, post hoc analyses reveal two important insights. First, we find that, under high levels of conformance quality, improving either experiential quality dimension is costly for hospitals, which underlines a trade-off between reducing readmissions and controlling costs. However, we also find that as conformance quality increases, the cost of improving communication-focused EQ decreases, indicating complementarity between the two constructs. Conversely, the cost of improving response-focused EQ increases as conformance quality increases, suggesting tension between the two dimensions.

One possible explanation for these observations is that conformance quality and response-focused EQ require hospitals to invest in different resources. Whereas conformance quality may benefit from dedicated staff to gather and extract process compliance data, response-focused EQ requires hospitals to invest in nurse call management systems and patient monitoring systems, or in adding more peripheral staff to respond quickly to patients' explicit needs. Therefore, response-focused EQ might compete with conformance quality for scarce investment funds. However, hospitals' investments to promote communication-focused EQ, such as to educate caregivers on the importance of communication or on how to interpret and address individual patients' concerns, are also useful to promote conformance quality: They facilitate quick identification and adherence to best technical practices and help to avoid unnecessary procedures or tests (Wen and Kosowsky 2013). For example, chest pain might indicate a heart attack, but it is also a symptom of a variety of other conditions ranging from pneumonia to simple indigestion. Several tests exist to identify or exclude specific conditions, such as a blood test for markers that show damage to the heart in the case of a heart attack. However, these markers take time to form, thus delaying identification in the case of a heart attack. Also, running every possible test for every possible diagnosis would further delay care and increase cost. Simply talking with the patient can reveal whether the pain feels like tightness or like a knife, comes in spikes or lasts several minutes at a time, and so on. Such information is likely to allow a much faster, yet accurate, diagnosis (*Harvard Health Letter* 2010). Thus, where conformance quality and communication-focused EQ are concerned, investments in one domain benefit performance in the other.

Overall, these results suggest that the readmissions–costs trade-off can be partially mitigated through investments that enable meaningful communication between patients and caregivers—that is, promote communication-focused EQ. This underlying synergy may partially explain why leading healthcare organizations such as the Cleveland Clinic are spending millions of dollars and implementing mandatory training on communication skills for their staff (Merlino and Raman 2013, Cosgrove 2014). Given the penalties associated with readmission rates, this investment offers a potential quality improvement avenue for hospitals.

5.1. Contributions to Theory

Our research offers three important theoretical contributions. First, we empirically demonstrate synergies between the two process quality dimensions, conformance quality and experiential quality, with regard to readmission rates. Indeed, results indicate that combined quality reduces readmission rate. We also find that the pursuit of either conformance or experiential quality is associated with an increased cost per discharge. These findings emphasize the importance of including both conformance and experiential quality measures as well as their interaction in the study of hospital performance, and offer important insights for healthcare management scholars. For instance, Jha et al. (2009), who do not control for experiential quality, report a weak to nonexistent relationship between conformance quality and hospital costs. Thus, we recommend that healthcare researchers investigate both process quality dimensions.

Second, quality management researchers call for more empirical research that treats quality as a multidimensional rather than unidimensional construct (Sousa and Voss 2002), and for research that identifies industry-specific process quality dimensions (Roth and Menor 2003). We make such contributions to this literature by assessing two process quality dimensions, conformance and experiential quality, that are specific to the context of healthcare delivery. We also look at more granular elements of experiential quality based on the type of task—behavioral versus conceptual—performed by the caregivers. With regard to cost performance, the different nature of interplay between conformance quality and response-focused EQ versus communication-focused EQ suggests the need to adopt a more nuanced approach to the study of process quality's impact on hospital performance in the healthcare industry.

Finally, we find that research on healthcare delivery often reports mixed findings on the importance of process quality dimensions. These results can be attributed to limitations such as studying performance dimensions individually (e.g., Boulding et al. 2011), deriving inferences based on small samples (e.g., Bechel et al. 2000), or mismatching time frames between process quality dimensions and performance (e.g., Jha et al. 2009). Our study largely overcomes the above limitations and represents the first large-scale empirical test of the readmissions–costs trade-off in a healthcare setting. Specifically, our results show that, despite important synergies, both dimensions of experiential quality remain expensive to improve. Thus, it does appear difficult for hospitals to simultaneously reduce readmissions and control costs. These findings reaffirm the importance for healthcare scholars to adopt a more encompassing view of healthcare delivery by systematically considering multiple aspects of performance.

5.2. Contributions to Practice

Our study also offers important implications for hospital administrators and clinical care providers. First, our results provide evidence that a dual focus, represented by combined quality, does reduce readmission rates. This result underscores the importance not only of changing caregivers' mindsets so that they can deliver high levels of care, but also of creating organizational structures that can integrate both process quality dimensions. For example, in hospitals, conformance and experiential quality dimensions are typically handled by different departments. Even hospitals acknowledged as leaders in quality—such as the Cleveland Clinic—put distinct entities in charge of conformance quality (i.e., Office of Patient Safety) and experiential quality (i.e., Office of Patient Experience). The strong synergy with respect to readmission rates found in our study suggests that hospitals may benefit from organizational structures that facilitate management of the interdependencies between these two quality dimensions. One possible solution would be to integrate both departments within the same entity.

Second, from a financial standpoint, hospitals that aim to achieve high levels of both conformance and experiential quality should anticipate increased spending because of the independent costs associated with each dimension. However, there appear to be some synergies between communication-focused EQ and conformance quality with respect to cost. Therefore, given hospitals' financial constraints, initial investment in training and enriching communication with patients rather than in IT systems and the hiring of additional staff may be an ideal starting point for hospitals. Such a strategy would allow them to simultaneously support part of experiential quality and conformance quality, and, very possibly, to avoid a significant loss in revenues given the important and strong synergy between communication-focused EQ and conformance quality in the reduction of readmission rates. Indeed, as of October 2012, CMS will levy a significant penalty on hospitals that show excess readmissions. This result suggests that the Cleveland Clinic's investment in improving interpersonal skills among its caregivers is a better strategy, under financial constraints, when compared to the hospitals from Massachusetts that focused on increasing their staffing levels.

5.3. Policy Implications

This study also offers important implications for policy makers. The consideration of both conformance and experiential quality included in Medicare's Value-Based Purchasing program (beginning in October 2012) appears well targeted at reducing readmission rates. However, by weighing conformance quality and experiential quality separately, the current legislation appears to highlight the duality rather than the complementarity between these dimensions. Conversations with caregivers and administrators during our patient-level data collection revealed that this legislative view makes it challenging for hospitals to understand and promote such complementarity and can ultimately affect the delivery of care. Thus, policy makers may want to consider a reimbursement scheme for hospitals whereby scores on conformance and experiential quality would be combined, such as through an interaction term, before being linked to reimbursement decisions.

Furthermore, operationalizing this dual focus requires not just the implementation of control and feedback mechanisms, but a change in longstanding mindsets—including the willingness to spend more time with each patient—and caregivers' training. These investments can be costly for hospitals. The readmissions–costs trade-off we find implies that, for the policy to work, it is important that the benefits of achieving this dual focus outweigh its costs. Thus, this trade-off should be properly managed not only at the hospital level, but also at a policy level. Under the new payment program, hospitals that do not perform well along both conformance and experiential quality dimensions are financially penalized and can hence suffer millions of dollars in yearly revenue losses. Given the heavy cost of achieving combined quality, reducing hospitals' reimbursement for low-performing hospitals is likely to reduce their opportunity to improve their process quality in subsequent years. Hence, the current method adopted by CMS of using a "stick over a carrot" may increase the gap between high and low performers rather than lead to homogenously better care. Instead, our results suggest that CMS may want to consider providing assistance, such as free training, to low-performing hospitals at the beginning of the evaluation period instead of simply penalizing them at the end. Such assistance could be used initially to improve interpersonal skills, which our study shows strongly complement conformance quality in terms of both readmission rates and cost per discharge. If such assistance is successful, the cost incurred could subsequently be deducted from the end-of-period reimbursement for these hospitals.

5.4. Limitations and Conclusion

We acknowledge that our study has several limitations that suggest avenues for further research. First, our analyses are conducted at the hospital level. Thus, we do not control for physician-level or patient-level characteristics that have been shown to influence performance (Hannan et al. 1989, Jollis et al. 1997, Pisano et al. 2001, Gawande 2012). However, considering only hospital-level data also has several benefits. Most important, recent studies in the field of medicine find benefit from hospital-wide initiatives aimed at improving hospital performance, irrespective of patient-mix variations (Kansagara et al. 2011, Glass et al. 2012, Joynt and Jha 2013, Cosgrove 2014). We were also able to validate our results through patient-level data from the Ohio State University Wexner Medical Center. Nevertheless, we urge scholars to investigate multiple levels of analyses to deepen our understanding of these trade-offs.

Second, this study shows that combined quality is a worthy endeavor for hospitals in terms of readmission rates. However, we do not shed light on the approaches used by hospitals that have achieved combined quality. We encourage future research to investigate the specific organizational mechanisms that allow hospitals to achieve combined quality.

Third, we chose to study readmission rates because recent policy changes in the form of the Readmissions Reduction Program enacted in October 2012 highlight their importance not only to patients but also to hospitals, which face pressure to develop actionable plans to improve their readmission rates. However, readmission rate is just one indicator of hospital performance and, as such, is limited (Press et al. 2013). For instance, Press et al. (2013) found readmission rates to be weakly correlated with quality indicators, such as risk-adjusted mortality. They also found that hospitals' readmission rates suffer from a regression to the mean, with high performing hospitals getting slightly worse and low performing hospitals getting slightly better over time. We encourage future research to further investigate the robustness of our findings while controlling for these limitations.

Overall, this research demonstrates that the pursuit of combined quality, as promoted by the value-based purchasing program, carries a readmissions–costs performance trade-off for hospitals. However, given the strong synergies between conformance and experiential quality with regard to readmission rates, this trade-off must be faced and managed rather than avoided. We believe that identifying the approaches to combat this trade-off will be of continuing interest to researchers, administrators, and policy makers.

Supplemental Material

Supplemental material to this paper is available at http://dx.doi.org/10.1287/mnsc.2014.2141.

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