The Role of Family Engagement in Influencing Patient Satisfaction

J. Bok, C. McDermott, and L. Sharma

Abstract

Family engagement (FE) is an ongoing partnership between health professionals and families working at various levels of the healthcare system to enhance the quality, safety, and delivery of healthcare. Increasingly, FE is considered to be an essential component of patient-centered care. In this paper, we study the impact of healthcare metrics such as length of stay (LOS) and patient cost (PC) as well as severity of illness (SOI) on patient satisfaction (PS) with FE as a moderator. We run ordinary least square regression with propensity score matching using 5,915 observations of patients in Korean acute care hospitals from 2011 through 2015. We find that FE relieves the negative relationships between PS and LOS as well as PS and SOI. However, contrary to our expectations, we discover that PC has a positive impact on PS, with FE further strengthening this relationship. In a post-hoc analysis, we learn that perception of recovery (REC) acts as a mediator between PC and PS with the presence of FE. As an additional post-hoc analysis, we investigate whether the benefits of FE are contingent on the type of family member involved in the care delivery process and discover that the effect of FE through family caregivers living together (FCLT) is stronger than through family caregiver living separately (FCLS). Overall, our study shows the importance of FE in influencing the relationship between difficult-to-change aspects of healthcare delivery—that is, LOS, PC, and SOI—and PS. We reveal that FE is a critical element of patient-centered care for enhancing PS.

Keywords: Family Engagement; Length of Stay; Patient Cost; Severity of Illness; Patient Satisfaction; Propensity Score Matching

1. Introduction

The healthcare industry makes up 10% of the world's GDP and close to 20% of the United States' GDP (Cotlear et al. 2015). Its relative value compared to other industries has firmly increased and will continue growing as populations get older. As research into healthcare operations has expanded, a quick look reveals that its primary focus is on improving care delivery centric measures such as length of stay, mortality rates, and patient cost, as they are often the most direct outcomes of the service provided. While hospital managers can and should do everything to improve healthcare metrics, it has become clear that patient-centric metrics like patient experience are also essential.

Patient experience (PE) represents a measure of the quality of care from the patient's viewpoint (Li and Benton 1996). It concentrates on "how" medical care is provided to and felt by the patient (Chandrasekaran, Senot, and Boyer 2012). Attention to a patient's opinion and feedback has been shown to promote healthcare performances (Bechel, Myers, and Smith 2000). It has also been linked to increases in patient satisfaction (Rubin, Pronovost, and Diette 2001). We employ patient satisfaction to measure PE.

Patient satisfaction (PS) is essential for a variety of reasons. First, it can be considered a measure of quality as it assesses patient (or "customer") perceptions in this service setting and can be used as a proxy in that sense. Second, it earns recognition not only because it is an inherently worthy aim but also because it is a possibly significant mediator for various traditional healthcare performances like mortality and readmissions (Boudreaux and O'Hea 2004). Satisfied patients may carefully follow their medical regimens, implying that satisfaction may be a critical component in reducing readmissions rate and increasing well-being (Senot et al. 2016; Wu et al. 2012). Third, PS may also directly influence the financial viability of a hospital by affecting patient choice, with unsatisfied patients choosing to purchase or attain healthcare services elsewhere and even sharing perceptions of their experience with friends and on social media (Boudreaux and O'Hea 2004). Perceived healthcare quality from the hospital significantly influences patient behaviors, such as loyalty and word of mouth (Andaleeb 2001). These factors, combined with an increasing emphasis on provider responsibility, competition for a limited number of healthcare dollars spent, and a desire to lessen professional liability claims, have resulted in a rapid increase in studies and critiques of PS over the last several decades (Boudreaux and O'Hea 2004).

PS is a perceptual construct that is important, and emerging research shows that it is influenced by many of these "hard" numbers, such as length of stay, patient cost, and severity of illness (Carmel 1985; Fisher, Newman, and Dhar 2018; Tokunaga and Imanaka 2002). If one assumes that a patient’s healthcare performances are “fixed” within an organization (or at least not quickly or easily changed), it would nonetheless be useful for hospitals to try to improve the experience from the perspective of PS. Costs and length of stay may not be easily changed, but given these constraints, administrators would still like to understand how costs and length of stay might best affect the patient’s perception of their experience. With this in mind, we next explore the extent to which a situational variable—family engagement—may play a moderating role between healthcare metrics and PS.

Family engagement (FE) has become an area of growing importance for hospitals (Carman et al. 2013). Not only is engaging families and providing family-centered care the appropriate thing to do but also the numerous specific benefits of FE work together to help improve hospital performance (Conway et al. 2006). Increasing FE is not a new or separate drive but rather a critical part of what hospitals are already doing to promote quality and safety (Rockville et al. 2012). In this study, we explore the extent to which the presence of FE influences the relationship between three healthcare metrics—length of stay (LOS), patient cost (PC), and severity of illness (SOI)—and PS during the hospital stay.

In previous research, FE itself has been shown to be a critical element of patient-centered care for enhancing patient recovery. By extension, we explore the extent to which it serves as a moderating element between healthcare metrics and satisfaction. As we later discuss, PS is an increasingly important performance metric for hospitals, and understanding the moderating effects FE has on the relationship between healthcare metrics and PS is a key first step to providing hospital administrators with insight into a tool that might improve PS even if clinical and financial healthcare elements themselves cannot be changed.

Using secondary data, we develop an integrated framework that helps to understand the interrelationships between healthcare metrics and their impacts on PS with the moderator, FE. To our knowledge, this study provides the first set of empirical findings that examine this relationship in a hospital setting. Using medical data from South Korea to investigate PS based on healthcare metrics, we examine the influence of FE on PS in inpatient care settings. We empirically substantiate the effect of FE on the relationship between healthcare metrics and PS using ordinary least square regression with propensity score matching. We find that FE relieves the negative relationships between PS and LOS as well as between PS and SOI. However, contrary to expectations, we find that PC has a positive impact on PS, with FE further strengthening this relationship. In a post-hoc analysis, using mediation analysis, we find that perception of recovery (REC) is the intervening mechanism to the relationship between PC and PS. As an additional post-hoc analysis, we investigate whether the benefits of FE are contingent on the type of family member involved in the care delivery process and discover that FE through family caregiver living together (FCLT) works stronger than through family caregiver living separately (FCLS). Our analysis helps understand the implications of healthcare metrics—LOS, PC, and SOI—on PS with the presence of FE in inpatient care settings. We reveal that FE is a critical element of patient-centered care for enhancing PS.

2. Theory Development and Research Model

2.1 Patient-Centered Healthcare

The core of patient-centered healthcare is PS (Grøndahl et al. 2013). PS is defined as a patient's evaluation of the comprehensive experience after receiving medical care (Jonsson et al. 2011; Marley, Collier, and Meyer Goldstein 2004). Ware Jr et al. (1983) suggest three key reasons to measure PS: (1) PS is the outcome of healthcare; (2) PS gives helpful information on the structure, process, and issue of healthcare; and (3) satisfied and dissatisfied patients act distinctively. Not surprisingly, it has increasingly become an essential part of healthcare providers' focus (Reidenbach and McClung 1999). PS is an increasingly important measure as patients take on a more active role in choosing amongst care delivery providers.

Moreover, PS is increasingly serving as an actual indicator of healthcare quality (Salzarulo et al. 2011). PS is not only a worthwhile aim of hospitals, but this variable also has a critical influence on patient retention and hospital profitability (Boudreaux and O'Hea 2004). Patients with a high level of satisfaction tend to follow physician guidance and refer the healthcare providers to acquaintances (Boudreaux and O'Hea 2004).

PE is perception-based and has close links to the level of interaction between providers and patients. The interpersonal relationships between a provider and patient represent an external capability that stresses customer satisfaction (Sousa 2003). For this reason, the terms PS and PE are often used exchangeably (Berkowitz 2016). With the growing importance of experiential quality in influencing healthcare operations performance, such as readmission rates and costs (Senot et al. 2016), many researchers have explored the relationship between healthcare metrics and PE to enhance patient-centered healthcare.

Among healthcare metrics, some researchers have investigated the relationship between PS and LOS. They find that longer LOS increases the possibility of complications such as medication errors and nosocomial infections (Freeman and McGowan Jr 1978; Hauck and Zhao 2011), which could, in turn, increase the likelihood of overtreatment and delay the recovery of patients, which can negatively impact PS. Furthermore, these complications can enhance the risk of in-hospital infections and mortality (Hauck and Zhao 2011), which can have a negative impact on PS. Given these mechanisms, it is not surprising that current research has consistently found longer stays to be associated with lower PS (Tokunaga and Imanaka 2002).

The relationship between PC and PE is one of the most debatable topics in healthcare. While there is growing literature on the relationship between PC and PE, the relationship between these two variables is complicated (Hussey, Wertheimer, and Mehrotra 2013). In general, patients do not see a majority of the cost because insurance pays for the care delivery episode. However, patient copays are increasing in cost, and high deductible plans are becoming increasingly popular, thus making this relationship increasingly essential and relevant. An increase in cost could result in an improvement in satisfaction. The contention is that hospitals could invest in further resources, including support staff, nurses, and specialists, to further enhance PS by using the profits from patients (Stukel et al. 2012). In comparison, the opposing view suggests that lower PC could be a result of selecting healthier patients, which, in turn, would result in improvements in PS (Huerta et al. 2008).

Concerning SOI, some researchers have found that illness severity affects PS (Erickson et al. 2009; Moons et al. 2005). Steca et al. (2013) study the impact of illness severity on depression and satisfaction in patients experiencing a cardiovascular rehabilitation program. They provide empirical results showing that illness severity is related to depression, which is in line with previous studies that have revealed significant relationships between patients' clinical fitness with their levels of depression (Doyle et al. 2010). Moons et al. (2005) show that SOI is negatively related to the quality of life and perceived well-being. We can conclude that patient severity hurts the quality of PE, ultimately leading to a lower PS.

As discussed above, some of the existing research provides clues and theoretical justification for further inquiry. The majority of papers have looked at healthcare metrics—LOS, PC, and SOI—which can be linked to PS and hence the likelihood of patients to recommend hospitals. While the findings, not surprisingly, point to a generally negative relationship between healthcare metrics (LOS, PC, and SOI) and PS, this is of frustratingly little use to many hospital managers who are limited in their ability to impact these items since they are not directly involved in patient care. Despite best efforts, some patients will have hospital stays that are long and/or expensive, and some patients will have complicated illnesses. For hospital administrators, the question becomes one of what they can do to improve patient-centered care, given that there will sometimes be extended stays, very sick patients, or large hospital bills. In the next section, we explore one avenue, FE, which holds promise as a potential method of impacting this relationship.

2.2 Family Engagement

Carman et al. (2013) define family engagement (FE) as families and health professionals engaging in collaborative partnerships at a variety of levels across the healthcare system to enhance the quality, safety, and delivery of healthcare for patients. FE, as a construct, is considered an essential component of patient-centered care. The literature on FE shows that it enhances various aspects of performance in terms of benefits for hospitals and patients. When a hospital's approach to care focuses on patients, including family caregivers, they become allies in the hospital's efforts to enhance quality and safety, thus benefitting the hospital. Family caregivers can provide informed options, assist with reliable medication use, offer infection control leads, understand care processes, and practice self-management (Coulter and Ellins 2007). These actions turn into measurable improvements in quality of care and patient safety (Johnson et al. 2008). When patients and families are disengaged, hospitals add wasteful activities such as larger call volume, continuous patient education efforts, expanded diagnostic tests, and a higher need for referrals (Oates, Weston, and Jordan 2000; Conway et al. 2006), thus leading to rising costs. Concerning patient benefits, engaging families through enhanced communication and other practices also have a positive impact on patient results —emotional health, symptom resolution, pain management, and physiologic criteria such as blood pressure and the level of sugar in the blood (Epstein and Street 2008; Roter 1989). In addition, policies that encourage FE can lessen hospitals’ rates of preventable readmissions (Steffens et al. 2009).

In this context, it is useful to highlight some of the key findings from the FE empirical literature stream. Kelly et al. (2013) identify strategies to improve FE and reveal important factors that affect FE, such as the style of communication, scheduling, and IT use. Wyskiel et al. (2015) evaluate family and provider openness to expanding the care team to incorporate family participation and reveal that engaging family members has the potential to improve nursing availability for other tasks, heighten relationship building, and begin early training for family, better preparing them for development of care and discharge. Furthermore, Locatelli et al. (2015) study attempts of Veterans Affairs medical centers to involve patients and families in patient-centered care. They identify that patients and families offer a unique perspective and critical comprehension of veterans' needs and enable hospital employees and providers to learn from unexpected outcomes.

Although FE is actively discussed in practice and other disciplines, as noted above, research into the role of FE is mostly non-existent in the healthcare operations management literature. While the impact of FE has been studied in different areas, its impact in influencing PS (either directly or as a moderator) has not been evident. Information exchange in healthcare has seen increased interest in recent years (Queenan et al., 2011; Dobrzykowski and Tarafdar, 2015), and much has focused on the role of new information technologies. Following these studies, we argue that FE may improve information exchange and hence influence PS directly and/or indirectly. As such, the core interest in the present study is to examine the extent to which FE impacts the relationship between healthcare metrics and PS. Using secondary data, we develop an integrated framework that helps to understand the interrelationships between healthcare metrics and their impacts on PS with the moderator, FE. We investigate the influences of LOS, PC, and SOI on PS with FE in inpatient care settings. The research model is presented in Figure 1.

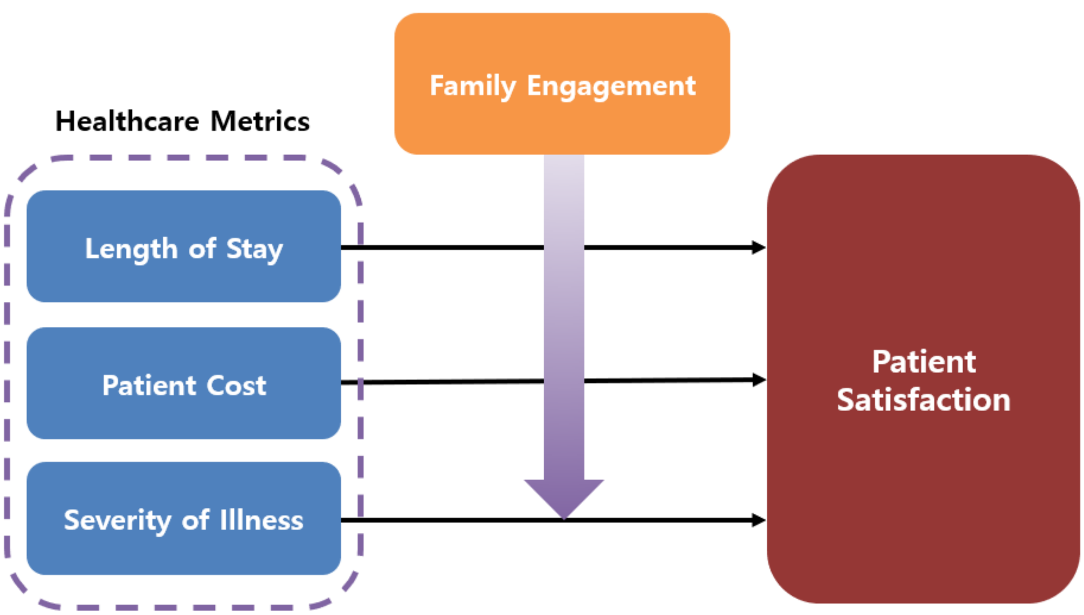

Figure 1: The Research Model

3. Research Hypotheses

3.1 Impact of FE on the Relationship between LOS and PS

Current research suggests that the relationship between LOS and PS is relatively consistent, with extended stays associated with lower PS (Tokunaga and Imanaka 2002). While this negative relationship between LOS and PS exists, we aim to study the effect of FE on mitigating this relationship. Although this has not been considered explicitly in the literature, there is some tangential support for this idea. Patients who have had lower family support before surgery have been more likely to have more depressive symptoms and distress than those who had more support from family (Okkonen and Vanhanen 2006). By extension, an engaged family member can protect health and promote recovery from severe conditions as patients could have a secure connection with psychological well-being resulting from staying with family.

Additionally, during a hospital stay, FE can reduce a patient's stress and anxiety caused by prolonged LOS, thus enhancing patients' satisfaction and experience with care (Al-Mutair et al. 2013). Patients with engaged family members might show decreased confusion, agitation, and anxiety that result from longer LOS than expected. Moreover, such engagement can increase feelings of security, which could be one of the crucial factors in PS. Assistance and support resulting from FE have been associated with enhancing patient adherence by increasing optimism and self-esteem, relieving the stresses of being ill and patient depression, improving sick-role behavior, and providing practical assistance during hospitalization (Shumaker and Hill 1991).

FE can also lead to outcomes that decrease malpractice claims, which may occur more often as hospital stays increase. When Georgia Health Sciences Medical Center enacted changes to its visitation policy to strengthen FE, the center found a 62 percent decrease in medication errors during hospital treatment (Conway 2008). FE can help hospitals realize quality and safety improvements, including improvements in the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey scores and reductions in preventable readmissions after discharge (Birkelien 2017). In addition, the opportunities for improvements in information exchange and communication afforded through increased family engagement might also help the patient to better understand the reasons behind lengthy stays. Taken together with the potential reductions in stress through FE noted above, we can conjecture that a negative relationship between LOS and PS could be relieved by FE during the hospital stay, and we hypothesize that.

H1. FE can attenuate the negative relationship between LOS and PS.

3.2 Impact of FE on the Relationship between PC and PS

There are two inconsistent views of the PC-PS relationship in current healthcare literature (Fu and Wang 2008; Hussey, Wertheimer, and Mehrotra 2013). An increase in costs has been linked to a rise in PS (Anderson and Chalkidou 2008). This makes sense, with better equipment and more service providers, among other positive changes, resulting in improved outcomes. However, research also finds that an increase in PC can be negative, as it adds to the financial burden on consumers, and consumers may begin to feel that over-treatment is occurring, leading to decreases in PS. Fisher et al. (2003) suggest that higher spending on Medicare beneficiaries often results in worse outcomes, especially satisfaction with care because some patients receive unnecessary medical services and a low level of value. On balance, the research seems to indicate that higher costs are associated with lower PS in healthcare settings.

The increase in medical expenses can be a burden on the patient owing to the higher out-of-pocket expenses resulting from increased PC. Although PS might be reduced due to growing PC, family members who stay with patients may be able to understand and explain the necessity of any additional tests, procedures, or other expense-driving activities that can otherwise serve to lower patient unhappiness. FE could contribute to improvements in quality and patient safety while meaningfully engaging families in a redesigned, supportive healthcare system (Charmel and Frampton 2008). Moreover, engagement initiatives often question the perceived needs, standards, and presumptions of healthcare providers as they make treatment recommendations among a variety of constraints, such as insufficient patient visits, heightened complexity of diagnoses, and reimbursement policies (Carman et al. 2013). In addition, the opportunities for improvements in information exchange and communication afforded through increased family engagement might also help the patient to better understand the reasons behind expensive visits. FE helps healthcare providers manage such a complex and costly healthcare system and generate scientifically convincing evidence for medical interventions, thus leading to increasing PS (Carmen et al. 2013). Therefore, we expect that FE can attenuate the negative relationship between PC and PS as benefits from FE can mitigate the stress or burden resulting from medical costs and help provide patients with better explanations for these costs. Therefore, we hypothesize that

H2. FE can attenuate the negative relationship between PC and PS.

3.3 Impact of FE on the Relationship between SOI and PS

The severity of patient illness hurts the quality of PE, ultimately leading to lowering PS. The sicker one is, the less satisfied he or she feels. However, FE may attenuate this negative relationship between SOI and PS. Engaging families of severely ill patients can provide the opportunity to improve information exchange and communication with doctors and nurses and hence have more possibility of a positive effect on patient outcomes than patients without FE (Epstein and Street 2008). Family caregivers can help patients obtain information from providers by guiding questions to ask, mostly related to particular procedures (e.g., before surgery and after diagnosis) or topics like pain management (Carman et al. 2006). Besides, involving family members may reduce preventable medical errors, resulting in more severe health consequences, such as severe pain or long-term disability.

When families take a more productive and shared role—partnering in patients' overall health and the healthcare system—patients can benefit, especially for both controlling pain management and increasing PS (Reinhard et al. 2008). Education and preparation through FE can develop how care is organized and delivered for relieving pain. FE would give families the skills, courage, and authority to partner in communications and decision-making at all levels and to give self-care and handle illness and chronic disease effectively (Kralik, Price, and Telford 2010). Because patients are diverse in their desires, FE is essential to consider how healthcare providers can tailor efforts to meet patients where they are and address specific needs and concerns regarding patients' discomfort and symptoms.

FE could affect several elements of healthcare performance, including health statuses, such as quality of life, symptom severity, and satisfaction with communication and systems of care (Halladay et al. 2017). In addition, FE in decision making has been linked in healthcare settings with lessened pain and discomfort, quicker recovery, and advances in emotional health (Oates, Weston, and Jordan 2000). Patients with engaged families have better pain control and symptom determination, better emotional health, significantly less preventable hospital readmissions, better control of chronic diseases, and overall enhanced functioning (Dunbar et al. 2008). As such, we believe that FE can moderate the relationship between patient severity of illness and PS. Therefore, we hypothesize that

H3. FE can attenuate the negative relationship between SOI and PS.

4. Methods and Measures

4.1 Study Data

This study utilizes annual data from the Korea Health Panel jointly gathered since 2008 by the Korea Institute for Health and Social Affairs and the Korea National Health Insurance Service. The Korea Health Panel is a longitudinal panel survey intended to give information on health service usage patterns, health expenditures, and overall analyses of factors that influence healthcare consumption behavior. The data is comprised of household- and individual-level data as well as healthcare usage data. This data is derived by collecting detailed receipts from each healthcare visit, thus allowing for panel time series analysis. Because the South Korean government provides mandatory insurance for all nationals and the major portion of health costs comes from deductibles, the Korea Health Panel provides for in-depth analysis of the cost data. We use patients who were hospitalized in Korean acute-care hospitals from 2011 to 2015 (a 5-year window). Outpatient and emergency visits are excluded from the dataset because we can explore the effect of FE better in inpatient settings rather than outpatient and emergency contexts, which are both healthcare episodes of relatively shorter durations compared to inpatient stays. After accounting for data reduction and missing observations, we arrive at a final sample size of 5,915 observations (no caregiver: 1,811 observations; family caregiver: 4,104 observations).

4.2 Variable Descriptions

The independent variables in the model are LOS, PC, and SOI. LOS captures the duration of a single episode of hospitalization and is measured as the time spent at the medical facility during a patient's admission. LOS is measured as the natural logarithm of the number of days spent at the medical facility during a patient’s hospitalization. PC is measured as the natural log of a patient's out-of-pocket expenses for admission and represents the portion of healthcare costs not covered by health insurance. The unit of PC is the South Korean won. A log transformation is applied to the LOS and PC variables in order to linearize the regression model (Kleinbaum, Kupper, and Muller 1988). We measure the SOI using the number of concomitant diseases afflicting the patient concurrently with a primary disease. FE is measured as a dummy variable (FE = 1 when a family caregiver is present during hospitalization, otherwise FE = 0). PS is a dependent variable and indicates how satisfied patients are with the overall inpatient care experience. PS is comprised of a 5-point Likert scale with 5 representing very satisfied, 4 representing satisfied, 3 representing moderately satisfied, 2 representing unsatisfied, and 1 representing very unsatisfied.

Consistent with Boudreaux and O'Hea (2004) and Fu and Wang (2008), several key social-economic factors examined in the healthcare industry are included as controls in our regression model: public hospital (pub), insurance type (insu), additional private insurance (priinsu), travel time (ltt), gender (gender), age (age), the level of household income (quint), the type of treatment (treat), the reason for hospitalization (reason), emergent situation (emer), marriage status (marr), the type of hospital (hosp). The research model also includes the year and region fixed effects. The full list of variables, including controls, is listed below in Table 1.

Table 1: Variable Descriptions

Variable	Description
LOS	• Length of stay • The duration of hospitalization. • The natural logarithm is used.
PC	• Patient cost • A portion of healthcare costs not covered by National Health Insurance • The natural logarithm is used.
SOI	• Severity of illness • The number of concomitant diseases with a primary disease
PS	• Patient satisfaction • 1: Very unsatisfied ~ 5: Very satisfied
FE	• 1. Family engagement, 0. Otherwise • Consists of family caregiver living together (FCLT) and family caregiver living separately (FCLS)
pub	• 1. Public hospital, 0. Private hospital
insu	• 1. Korean Medicaid, 0. National Health Insurance
priinsu	• 1. Additional private insurance, 0. Otherwise
ltt	• Travel time to the hospital (unit: minute) • The natural logarithm is used.
gender	• 1. Male, 0. Female
age	• Age
quint	• Household income quintile • 1. The poor ~ 5. The rich
treat	• 1. Surgery, 2. Non-surgical treatment, 3. Checkup only, 4. Other
reason	• 1. Accident or Poisoning, 2. Disease, 3. Delivery • 4. Readmission within one month after discharge, 7. Other
emer	• 1. Admitted right away through the emergency room or Transported shortly from another hospital • 0. Otherwise
marr	• 1. Marriage, 0. Otherwise
hosp	• 1. Advanced general hospital, 2. Regular general hospital • 3. Common hospital
address	• Region fixed effects (South Korea has 17 provinces)
year	• Year fixed effects (2011 – 2015)

5. Estimation

5.1 Descriptive Statistics

Table 2 presents descriptive statistics and correlations of major numerical variables.

Table 2: Correlations and Descriptive Statistics

	Mean	SD	1	2	3	4	5	6
1. LOS[a]	**1.74**	**.85**						
2. PC[a]	**13.19**	**1.23**	.35***					
3. SOI	**2.73**	**2.67**	.12***	.05***				
4. FE	**.69**	**.46**	.14***	.13***	-.00			
5. FCLT[b]	**.54**	**.50**	.05***	.03**	-.12***	.73***		
6. FCLS[b]	**.15**	**.36**	.11***	.12***	.17***	.28***	-.46***	
7. PS	**3.66**	**.64**	-.06***	.02	-.06***	-.00	-.01	.00

Notes: n = 5,915; *p < .10, ** p < .05, *** p < .01
[a] The natural logarithm is used for LOS and PC.
[b] FE consists of FCLT (Family Caregiver Living Together) and FCLS (Family Caregiver Living Separately).

5.2 Propensity Score Matching

We were concerned about possible sources of bias in the data set. Particularly, FE is not randomly assigned to each patient. Additionally, omitted variables could lead to endogeneity concerns. Thus, we take several measures to account for and correct sources of such unobserved heterogeneity. First, in order to reduce omitted variable biases, we control for the number of hospitals and patient-level characteristics in the main analysis. Second, we employ matching to reduce biases between the patient groups with and without family caregivers during the hospital stay, thus mitigating concerns with the non-random assignment of FE. Finally, as a robustness check, we use instrumental variables estimations to account for endogeneity concerns; the results remain consistent with our main analysis.

The propensity score matching (PSM) procedure is deployed to generate a quasi-control group (patients without FE) with comparable characteristics to a treatment group (patients with FE), thus reducing biases in our estimations (Heckman, Ichimura, and Todd 1998). Although the matching procedure does not directly control for omitted variable bias, it excludes patients in the control group that are “too different” from patients in the treatment group. We adopt a propensity score matching procedure where patients in the control group are matched with patients in the treatment group based on six patient-level covariates. We match patients on characteristics that have been shown to influence FE during a hospital stay using gender, surgery, chronic disease, marriage, perceived medical cost burden, and living metropolitan area.

Studies have documented superior performance with the propensity score matching technique when (i) the treatment and control groups are derived from the same data sources and (ii) they are matched on an extensive list of characteristics. To ensure these criteria, we use the same dataset for the treatment and control groups. We also include a comprehensive list of covariates for matching patients in the two groups using 1:1 nearest neighbor matching with replacement and a caliper restriction to limit matching only within a range of propensity scores. We set caliper using 1/4 of the standard deviation from the propensity score (Rosenbaum and Rubin 1985).

In addition, our matched datasets pass the criterion used to determine matching quality. Specifically, there were no significant differences in the matched characteristics between control and treatment groups, as seen in Table 3. Besides, Rubins' B (Rubin 2001) was 2.3—well below the threshold value of 25—and Rubin's R (Rubin 2001) was 1.02—well within the 0.5 to 2 threshold range. Figure 2 also supports the match.

Table 3: Match Statistics

Variable	Unmatched Matched	Mean - Treated	Mean - Control	%bias	% reduction in Bias	T-Test, * indicates significance
Gender	U	.50	.39	21.2	97.2	7.71***
	M	.50	.50	-0.6		-0.26
Chronic Disease	U	.74	.79	-9.8	86.6	-3.55***
	M	.74	.75	-1.3		-0.58
Metropolitan Area	U	.32	.33	-4.1	78.5	-1.51
	M	.32	.32	-0.9		-0.40
Marriage	U	.63	.67	-8.2	100.0	-2.98***
	M	.63	.63	0.0		0.00
Surgery	U	.45	.43	5.2	82.2	1.91*
	M	.45	.45	0.9		0.42
Perceived medical cost burden	U	3.88	3.83	4.1	70.4	1.49
	M	3.88	3.89	-1.2		-0.56

*p < .10, ** p < .05, *** p < .01

Sample	Ps R^2	LR chi^2	p > chi^2	Mean Bias	Med Bias	B	R	%Var
Unmatched	0.012	93.16	0.000	8.8	6.7	26.5	0.96	0
Matched	0.000	1.08	0.983	0.8	0.9	2.3	1.02	0

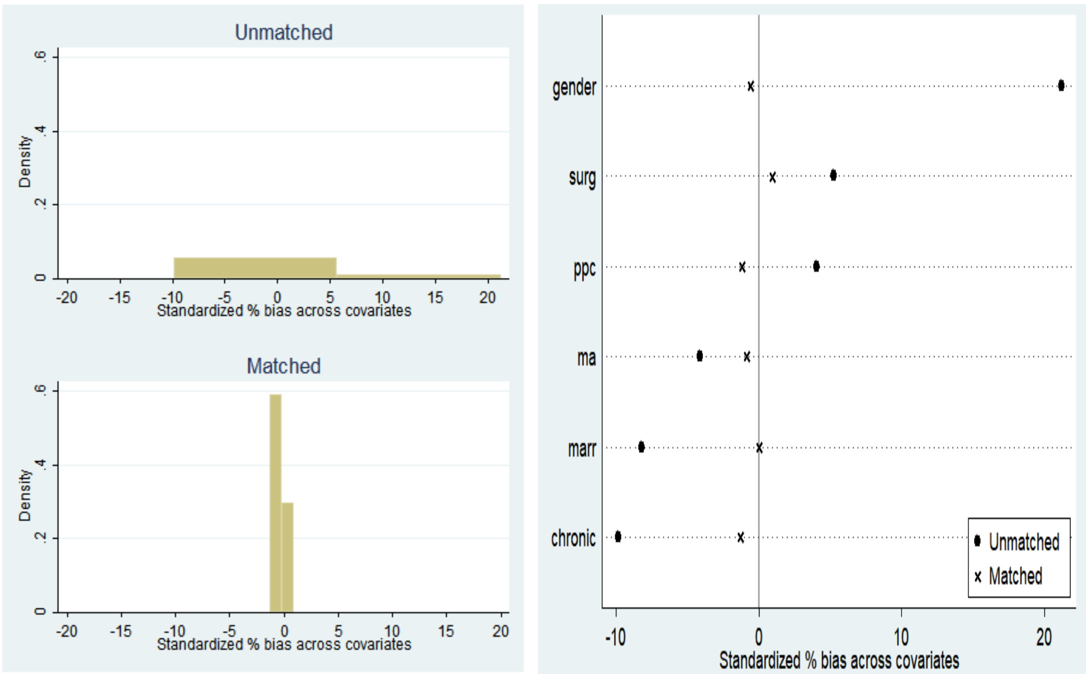

Figure 2: Comparison of Unmatched and Matched Data

5.3 Hypotheses Testing

We run ordinary least squares (OLS) regressions after balancing by PSM. All the independent variables except for the categorical variables in the regression analysis are mean-centered to reduce multicollinearity concerns. The results of the regression models are presented in Table 4. As seen from Table 4, the interaction between LOS and FE turns out to be significant ($\beta = .079$, $p < .01$), indicating differential impacts on PS for patients with no FE (6.6% PS reduction) compared to patients with FE (2.9% PS reduction) as their LOS changes from low (one standard deviation below the mean) to high (one standard deviation above the mean). This result provides support for H1. The interaction between SOI and FE is also significant ($\beta = .070$, $p < .01$), implying differential impacts on PS for patients with no FE (11.2% PS reduction) and FE (1.1% PS reduction) as SOI varies from low to high.

This result is supportive of H3. Finally, in contrast to H2, we find that PC has a *positive* impact on PS, with FE enhancing the strength of this relationship. Specifically, the interaction term between PC and FE is significant and positive ($\beta = .071$, $p < .01$), indicating differential impacts on PS for patients with no FE (0.2% PS increase) and patients with FE (5.2% PS increase) as PC rises from low to high. The interaction plots for FE and our independent variables of interest are shown in Figures 3-5.

Our results indicate that FE could relieve the negative relationships with PS and LOS as well as with PS and SOI. However, PC has a direct positive impact on PS, and FE helps PC further improve PS. Our analysis helps us to understand the effects of healthcare metrics—LOS, PC, and SOI—on PS with the presence of FE in inpatient care settings. We identify that FE is a crucial factor in patient-centered care for enhancing PS.

Table 4: Matched OLS with Replacement

	(1) Matched OLS (W/Re)[a] PS	(2) Matched OLS (W/Re)[a] PS	(3) Matched OLS (W/Re)[a] PS	(4) Matched OLS (W/Re)[a] PS	(5) Matched OLS (W/Re)[a] PS
LOS	-0.104***	-0.141***	-0.114***	-0.104***	-0.135***
	(0.010)	(0.013)	(0.011)	(0.010)	(0.013)
PC	0.036***	0.032***	0.003	0.032***	0.005
	(0.007)	(0.008)	(0.009)	(0.007)	(0.009)
SOI	-0.040***	-0.040***	-0.038***	-0.077***	-0.074***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
FE	0.111***	0.124***	0.133***	0.153***	0.177***
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
FE*LOS		0.079***			0.048***
		(0.018)			(0.018)
FE*PC			0.071***		0.055***
			(0.012)		(0.013)
FE*SOI				0.070***	0.067***
				(0.006)	(0.006)
Control	Yes	Yes	Yes	Yes	Yes
Year Fixed	Yes	Yes	Yes	Yes	Yes
Region Fixed	Yes	Yes	Yes	Yes	Yes
N	8,208	8,208	8,208	8,208	8,208
R^2	0.149	0.151	0.152	0.163	0.166
F	33.983	33.726	34.103	36.911	36.154

[a] With replacement
Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

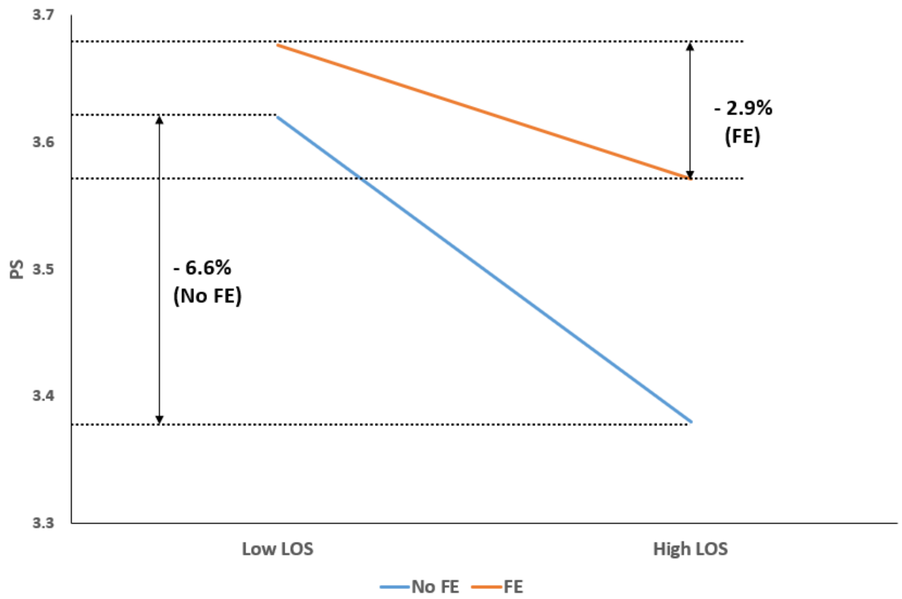

Figure 3: Interaction Plot of FE and LOS

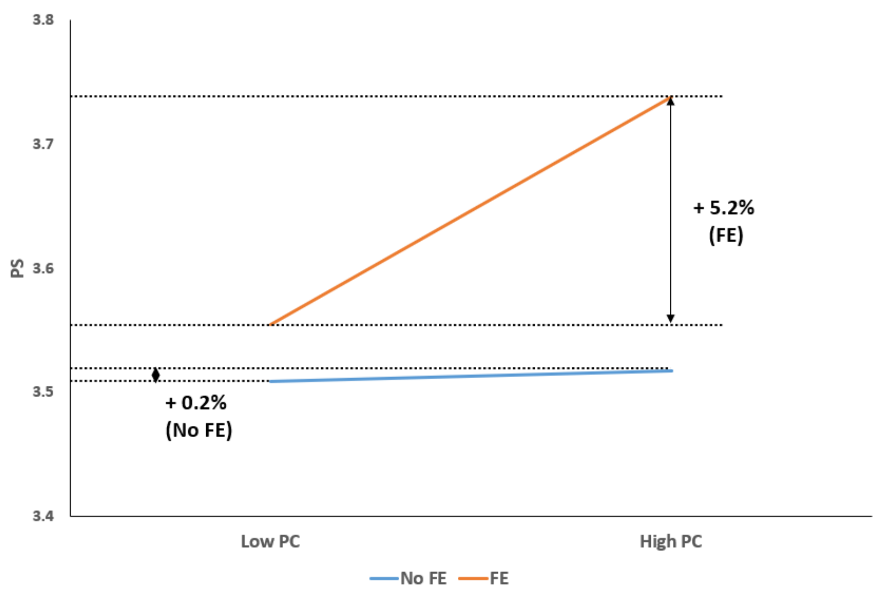

Figure 4: Interaction Plot of FE and PC

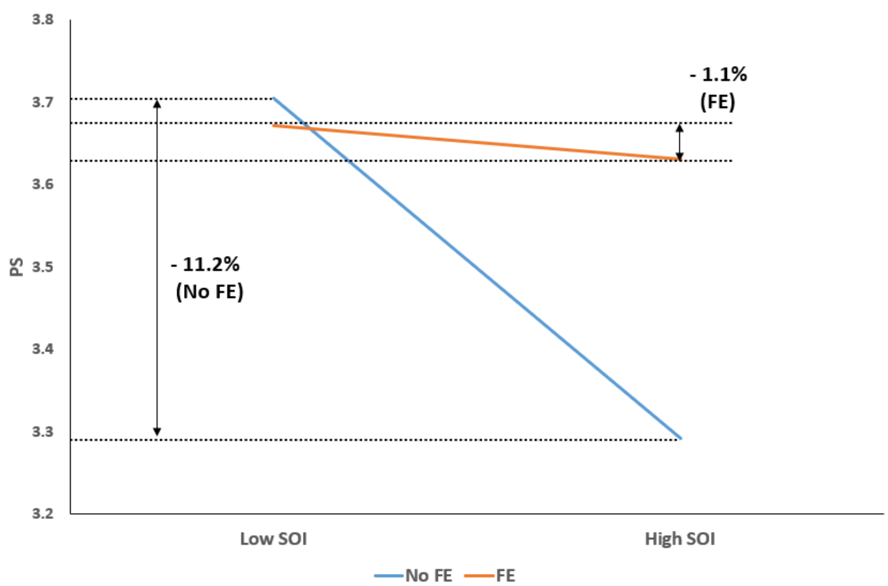

Figure 5: Interaction Plot of FE and SOI

5.4 Post-hoc Analyses

The significant and positive direction as well as moderated impact of PC on PS was initially puzzling to us and not supportive of H2. We thus explore this relationship further as a post-hoc analysis. One potential mechanism that may explain this relationship is the perception of recovery (REC) with the presence of FE. REC helps patients better understand the care delivered and their associated costs, which may explain the stronger association between PC and PS for patients with the presence of FE. In order to further explore this mechanism, we test REC as a mediator between PC and PS with FE as a moderator. REC is comprised of a 4-point Likert scale with 4 representing fully recovered, 3 representing largely recovered, 2 representing slightly unrecovered, 1 representing very unrecovered.

Based on a mediation analysis following methods from Baron and Kenny (1986) and Sobel (1982), we investigate the role of REC in the relationship between PC and PS. The results of this analysis are shown in Table 5. We observe that REC is valid as a mediator and meets Baron and Kenny's three steps for partial mediation and that the *p*-value of the Sobel test is less than 0.01. The interaction of FE and PC enhance REC, and an increase in REC could lead to improving PS. This result allows us to better understand the mechanism through which PC enhances PS.

As an additional post-hoc analysis, we investigate whether the benefits of FE are contingent on the type of family member involved in the care delivery process. In order to investigate this question, we divide family caregivers into two parts: family caregiver living together (FCLT) and family caregiver living separately (FCLS). This classification divides family caregivers based on their closeness to the patient receiving hospital care. We anticipate that the patient in the FCLT scenario is likely to be a spouse or young child, whereas the patient in the FCLS scenario is likely to be an older parent receiving help from adult children. As shown in Figure 6, the average ages of each patient group are statistically different (the average patient ages for FCLT and FCLS are 47.1 and 63.9, respectively; t-static = 21.8, p = 0.000, Satterthwaite's degrees of freedom[1] = 1974.3) and the distributions of patients' ages are also different, further confirming our speculation about the degree of closeness of family members in these two groups. This is also consistent with our intuition regarding the caregiver being a spouse (FCLT) rather than an adult child (FCLS). Furthermore, FCLT has a significant negative correlation with SOI. In contrast, FCLS has a significant positive correlation with SOI, indicating that (as expected), the older patient group associated with FCLS has a higher number of concomitant diseases. We choose to examine the different impacts of FCLT and FCLS on PS using matched OLS with replacement given these differences in family caregivers and patient profiles between these two groups.

[1] After the Levene test, we conclude that patient groups of FCLT and FCLS have unequal variances. Thus, we use the t-test for a two-sample mean-comparison test with Satterthwaite's approximation.

Table 5: Mediation Model of REC between PC and PS

	(1) Matched	(2) Matched	(3) Matched
	OLS (W/Re)[a]	OLS (W/Re)[a]	OLS (W/Re)[a]
	PS	REC	PS
LOS	-0.114***	-0.123***	-0.077***
	(0.011)	(0.012)	(0.010)
PC	-0.038***	-0.028***	-0.030***
	(0.004)	(0.004)	(0.004)
SOI	0.003	-0.088***	0.029***
	(0.009)	(0.011)	(0.009)
FE	0.133***	-0.041	0.145***
	(0.022)	(0.025)	(0.021)
FE*PC	0.071***	0.048***	0.057***
	(0.012)	(0.014)	(0.012)
REC			0.299***
			(0.009)
Control	Yes	Yes	Yes
Year Fixed	Yes	Yes	Yes
Region Fixed	Yes	Yes	Yes
N	8,208	8,208	8,208
R^2	0.152	0.213	0.252
F	34.103	51.337	62.499

[a] With replacement
Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Among a total of 5,915 patients, 4,104 patients stay with a family caregiver during a hospital stay. Among the 4,104 observations, 3,217 patients have FCLT, and 887 patients have FCLS. We run matched OLS with a replacement for FCLT and FCLS. We add both FCLT and FCLS as categorical variables in the regression models in order to compare these two options with No FE. As seen in Table 6, we find that all the interaction terms are statistically significant. To better understand these interaction effects, we created conditional plots that illustrate the relationships among FCLT, FCLS, and healthcare metrics, as shown in Figures 7-9.

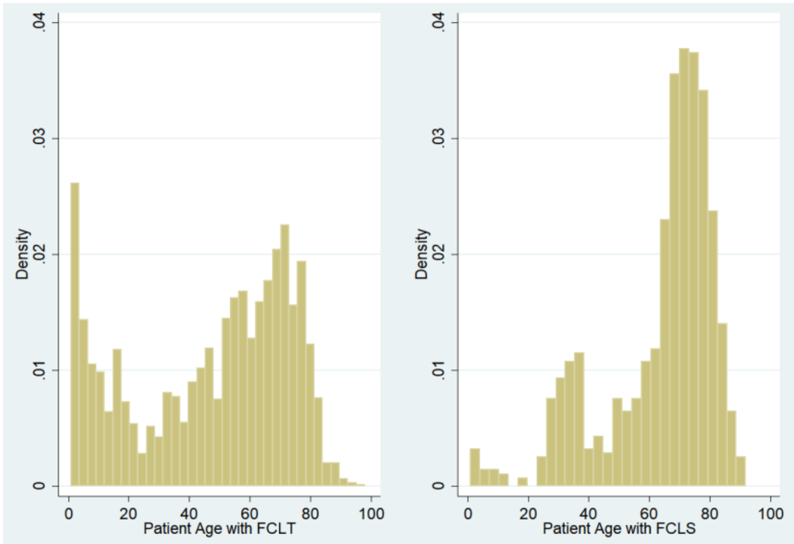

Figure 6: The distribution of Patient Age with FCLT and FCLS

The results indicate that as LOS increases from low to high, patients with FCLS witness a 0.4% increase in PS. Interestingly, FCLT results in a 4.0% PS reduction, which slightly mitigates the negative relationship with LOS and PS compared to No FE (5.9% PS reduction) but is not nearly as positive an impact on PS as FSLS. Unlike the LOS case, as PC increases from low to high, patients with both FCLS and FCLT witness 5.8% and 4.9% increases in PS, respectively, whereas patients without FE at all witness just a 0.2% increase in PS. Finally, as SOI increases from low to high, our findings suggest a 1.1% increase in PS for patients with FCLS, while FCLT shows a 2.0% PS reduction, which appears to mitigate the negative relationship between SOI and PS compared to No FE (11.1% PS reduction). The results show that FCLS helps healthcare metrics improve PS while FCLT helps the relationship between PC and PS and attenuates the negative relationships between LOS & SOI and PS compared to No FE. It might be inferred that if the caregiver is a grown-up child (FCLS) rather than a parent or spouse (FCLT), FCLS may be less emotionally attached to patients than FCLT. While it is natural for a patient to be supported by a parent or spouse during hospitalization, care provided by a child who has lived separately from parents (FCLS) might provide the hospitalized parent an opportunity to connect with a family member that they might otherwise not have had. Therefore, if a child helps elderly parents while in hospital, the unexpected FE effect of FCLS is relatively stronger than FCLT.

Table 6: FCLT and FCLS using Matched OLS with Replacement

	(1) Matched OLS (W/Re)[a] PS	(2) Matched OLS (W/Re)[a] PS	(3) Matched OLS (W/Re)[a] PS	(4) Matched OLS (W/Re)[a] PS	(5) Matched OLS (W/Re)[a] PS
LOS	-0.103***	-0.140***	-0.114***	-0.103***	-0.133***
	(0.010)	(0.013)	(0.011)	(0.010)	(0.013)
PC	0.035***	0.031***	0.003	0.032***	0.005
	(0.007)	(0.008)	(0.009)	(0.007)	(0.009)
SOI	-0.040***	-0.040***	-0.039***	-0.077***	-0.074***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
FCLT	0.098***	0.113***	0.122***	0.144***	0.169***
	(0.022)	(0.022)	(0.022)	(0.022)	(0.023)
FCLS	0.167***	0.164***	0.180***	0.164***	0.175***
	(0.031)	(0.031)	(0.032)	(0.032)	(0.032)
FCLT*LOS		0.057***			0.027
		(0.019)			(0.020)
FCLS*LOS		0.138***			0.110***
		(0.028)			(0.031)
FCLT*PC			0.067***		0.057***
			(0.013)		(0.013)
FCLS*PC			0.081***		0.044**
			(0.021)		(0.022)
FCLT*SOI				0.064***	0.062***
				(0.006)	(0.006)
FCLS*SOI				0.085***	0.080***
				(0.009)	(0.009)
N	8,208	8,208	8,208	8,208	8,208
***R*²**	0.149	0.152	0.153	0.163	0.168
F	33.366	32.565	32.724	35.444	33.501

[a] With replacement
We include controls, year fixed, and region fixed effects in the models.
Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

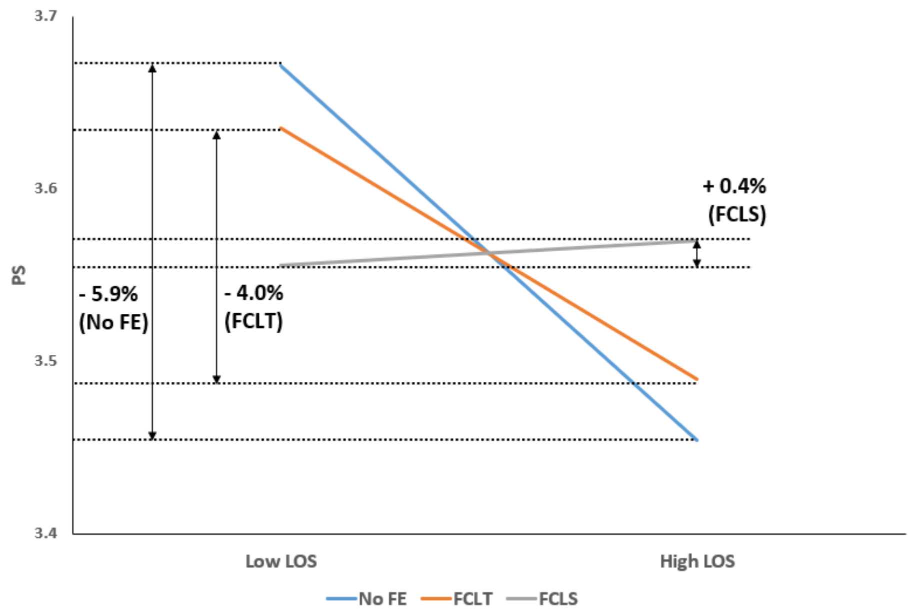

Figure 7: Interaction Plot of FCLT and FCLS for LOS

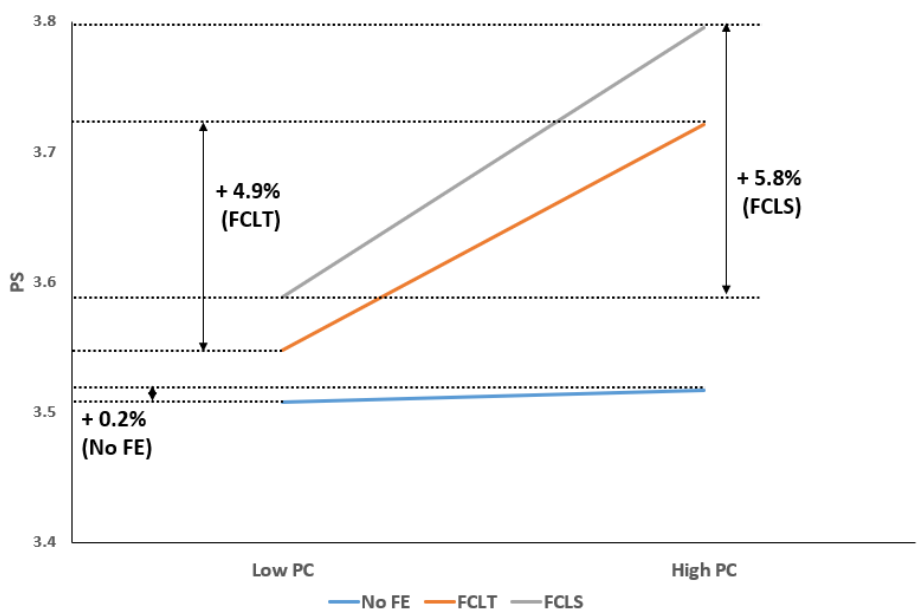

Figure 8: Interaction Plot of FCLT and FCLS for PC

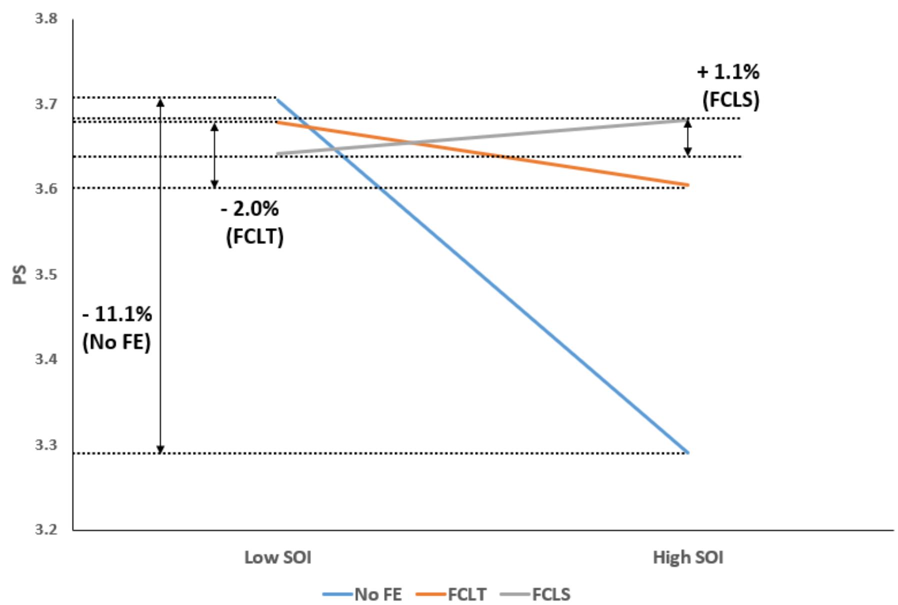

Figure 9: Interaction Plot of FCLT and FCLS for SOI

5.5 Robustness Check

We perform a number of additional analyses to show the robustness of the results. First, a common concern when evaluating the direct and moderated impacts of LOS, PC, and SOI on PS is endogeneity. To relieve these concerns, we also use instrumental variables estimations to test our hypothesis. Due to the de-identified nature of the dataset, finding strong instruments is challenging. In such settings, instruments can be generated using Lewbel's method (Baum et al. 2012; Lewbel 2012), which relies on the underlying data structure to create instruments. Specifically, Lewbel (2012) uses heteroscedastic covariance restrictions to construct internal instruments.

We run instrumental variables (IV) estimations after balancing by PSM using the same criterion as the main analysis. The empirical results for the IV estimations using Lewbel’s method to generate instruments are presented in Table 7. The empirical results are consistent with the main analysis. As a test of the validity of the instruments, we notice that all the first stage regression models have F-statistics that are higher than the threshold of 10 (Staiger and Stock 1994), implying that the Lewbel generated instruments are not weak.

Lastly, we run a matched OLS without replacement to compare its empirical results from the main analyses. Unlike the main matched OLS, the interaction term of FE and LOS is not positively significant and is shown in Table 8. However, the interaction terms for FE, PC, and SOI are also positively significant, as presented by the main analyses. The empirical findings from the matched OLS without replacement are similar to the results from the unmatched OLS.

Table 7: Matched IV Estimations with Replacement

	(1) Matched	**(2) Matched**	**(3) Matched**
	IV (W/Re)[a]	**IV (W/Re)[a]**	**IV (W/Re)[a]**
	PS	**PS**	**PS**
LOS	-0.130***	-0.134***	-0.104***
	(0.014)	(0.014)	(0.010)
PC	0.017	0.011	0.033***
	(0.011)	(0.010)	(0.007)
SOI	-0.040***	-0.038***	-0.078***
	(0.004)	(0.004)	(0.005)
FE	0.125***	0.139***	0.152***
	(0.022)	(0.022)	(0.022)
FE*LOS	0.143***		
	(0.037)		
FE*PC		0.109***	
		(0.021)	
FE*SOI			0.068***
			(0.007)
Control	Yes	Yes	Yes
Year Fixed	Yes	Yes	Yes
Region Fixed	Yes	Yes	Yes
N	8,208	8,208	8,208
R^2	0.148	0.150	0.163

[a] With replacement
Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table 8: Matched OLS without Replacement

	(1) Matched OLS (WO/Re)[a]	(2) Matched OLS (WO/Re)[a]	(3) Matched OLS (WO/Re)[a]	(4) Matched OLS (WO/Re)[a]	(5) Matched OLS (WO/Re)[a]
	PS	**PS**	**PS**	**PS**	**PS**
LOS	-0.030**	-0.030	-0.031**	-0.029**	-0.024
	(0.015)	(0.018)	(0.015)	(0.015)	(0.018)
PC	0.003	0.003	-0.012	0.002	-0.014
	(0.011)	(0.011)	(0.014)	(0.011)	(0.014)
SOI	-0.008	-0.008	-0.008	-0.016**	-0.017***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)
FE	0.013	0.013	0.019	0.015	0.020
	(0.022)	(0.023)	(0.023)	(0.022)	(0.023)
FE*LOS		0.001			-0.017
		(0.025)			(0.027)
FE*PC			0.029*		0.034*
			(0.017)		(0.018)
FE*SOI				0.018**	0.019**
				(0.008)	(0.008)
Control	Yes	Yes	Yes	Yes	Yes
Year Fixed	Yes	Yes	Yes	Yes	Yes
Region Fixed	Yes	Yes	Yes	Yes	Yes
N	3,616	3,616	3,616	3,616	3,616
R^2	0.041	0.041	0.042	0.043	0.044
F	3.673	3.586	3.655	3.703	3.617

[a] Without replacement
Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

6. Discussion

6.1 Implications for Theory

Although FE is actively discussed in other disciplines, research into the role of FE is mostly non-existent in the healthcare operations management literature. While the impact of FE has been studied in different areas, its influence on the relationship between healthcare metrics—LOS, PC, and SOI—and PS is unclear. This is a meaningful relationship to consider given that healthcare metrics are often difficult to change, and PS has become an increasingly important performance metric, with hospital administrators actively seeking ways to improve PS. Therefore, we investigate the impact of healthcare metrics on PS with the presence of FE in inpatient care settings. From a theoretical perspective, our results demonstrate a link between FE, healthcare metrics, and PS. This is an important finding because it provides a link in the literature that empirically demonstrates that FE is an important metric to be considered in healthcare management research. Our study expands our understanding by showing the role of FE in the relationship between healthcare metrics and PS.

As seen in Table 9, we substantiate the effect of FE on the relationship between healthcare metrics and PS by OLS and IV estimations with PSM. We show that FE relieves the negative relationships between LOS and PS as well as between SOI and PS. However, FE is associated with a sharp *increase* in the positive relationship between PC and PS, counter to our hypothesis. Thus, our analysis helps us to better understand the effects of these healthcare metrics—LOS, PC, and SOI—on PS with the presence of FE in inpatient care settings. We identify that FE is a crucial factor in patient-centered care for enhancing PS.

We also demonstrate that different *types* of family caregivers result in different outcomes. In our additional post-hoc analysis, we investigate whether the benefits of FE are contingent on the type of family member involved in the care delivery process. Given differences in family caregivers and patient profiles between FCLT and FCLS, we examine the different impacts of these two groups on the relationship between healthcare metrics and PS using matched OLS with replacement. We find that FCLS helps healthcare metrics improve PS while FCLT helps the relationship between PC and PS and attenuates the negative relationships between LOS & SOI and PS compared to patients without any family engagement. We inferred that the patient may take for granted the support from his or her parents or spouse during hospitalization but may consider special support from children who live separately from older parents. Therefore, we find that FE through FCLS has stronger effects than FE through FCLT.

Table 9: Empirical Results: Hypotheses Testing

Hypotheses		OLS after Matching		IV after Matching	
		Coefficient	Test Results	Coefficient	Test results
H1	LOS → PS	-.141***	**Supported**	-.130***	**Supported**
	FE*LOS → PS	.079***		.143***	
H2	PC → PS	.003	Rejected	.011	Rejected
	FE*PC → PS	.071***		.109***	
H3	SOI → PS	-.077***	**Supported**	-.078***	**Supported**
	FE*SOI → PS	.070***		.068***	

Notes: n = 8,208; * $p < .10$, ** $p < .05$, *** $p < .01$

Lastly, PC was found to have a positive impact on PS, contrary to our expectations. Hence, we explore why FE helps PC increase PS by testing the role of REC as a mediator in this relationship. Through the mediation test, we learned that perception of recovery (REC) acts as a mediator between PC and PS with the presence of FE. Although the relationship between healthcare costs and PE remains one of much debate in healthcare management research, our findings provide insight into the topic and help build theoretical linkages that can help us understand the complex drivers of PS better. Given the growing emphasis on PS as an essential measure for patient-centered care and the lack of knowledge about the relationship between PC and PS (Hussey, Wertheimer, and Mehrotra 2013), our findings suggest that the role of patient recovery could explain the PC-PS relationship from the consumers' perspective.

6.2 Implications for Practice

Our findings provide insights for healthcare managers and administrators aiming to improve the performance of hospitals on the increasingly important dimension of PS. It is often frustratingly not possible for managers to directly improve the common healthcare clinical metrics related to LOS, mortality, or SOI in order to influence PS because managers are not trained as healthcare providers. Our findings suggest that FE may be an area that can help improve PS even if these clinical metrics remain fixed. From a managerial perspective, our findings relating to the role of FE in PS suggest that FE is something that management should actively encourage, as FE positively influences the relationship between hard-to-change healthcare metrics and PS. As such, one could argue that FE is a critical element of patient-centered care for enhancing PS.

Taken together, our findings suggest that healthcare managers should consider actively managing FE efforts and behaviors as a mechanism to impact PS positively. To the best of our knowledge, this is the first-time empirical data have been used in such a way to establish this link, and as such, these findings open up several key pathways for future research.

7. Limitations and Conclusions

There are several limitations to this study. First, data that identified the hospital used by the patient were not available. Thus, the analysis cannot account for hospital fixed effects or cluster standard errors by hospitals. Although we use appropriate control variables and matching to remove any confounding effects, we urge future researchers to control for hospital fixed effect or use clustered standard errors to estimate the influence of predictors and moderators with more accuracy. Second, although we used IV estimations using Lewbel-generated instruments to account for endogeneity, we acknowledge that external instruments based on appropriate exclusion restrictions may be stronger than those created by data-generated instruments. Finally, our study is based on data from South Korea and may be influenced by cultural and regional biases. Future researchers should consider exploring the impact of FE using data from different countries. Even in light of these limitations, we are confident in the accuracy of the findings, given their strong theoretical grounds as well as the support we found through various robustness checks.

This study helps understand the impacts of healthcare metrics —LOS, PC, and SOI—on PS with the presence of FE in inpatient care settings. As discussed, we find that FE relieves the negative relationships between LOS & PS and SOI & PS. However, contrary to our expectations, we discover that PC has a positive impact on PS, with FE further strengthening this relationship. We show that FE is a critical element of patient-centered care for enhancing PS, and it is important to consider both theoretical and managerial perspectives.

References

Al-Mutair, Abbas Saleh, Virginia Plummer, Anthony O'Brien, and Rosemary Clerehan. 2013. 'Family needs and involvement in the intensive care unit: a literature review', *Journal of clinical nursing*, 22: 1805-17.

Andaleeb, Syed Saad. 2001. 'Service quality perceptions and patient satisfaction: a study of hospitals in a developing country', *Social science & medicine*, 52: 1359-70.

Anderson, Gerard F, and Kalipso Chalkidou. 2008. 'Spending on medical care: more is better?', *Jama*, 299: 2444-45.

Baron, Reuben M, and David A Kenny. 1986. 'The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations', *Journal of personality and social psychology*, 51: 1173.

Baum, Christopher F, Arthur Lewbel, Mark E Schaffer, and Oleksandr Talavera. 2012. "Instrumental variables estimation using heteroskedasticity-based instruments." In *United Kingdom Stata User's Group Meetings*.

Bechel, Diane L, Woodrow A Myers, and Dean G Smith. 2000. 'Does patient-centered care pay off?', *The Joint Commission journal on quality improvement*, 26: 400-09.

Berkowitz, Eric N. 2016. *Essentials of health care marketing* (Jones & Bartlett Learning).

Birkelien, Natalie L. 2017. 'A strategic framework for improving the patient experience in hospitals', *Journal of Healthcare Management*, 62: 250-59.

Boudreaux, Edwin D, and Erin L O'Hea. 2004. 'Patient satisfaction in the emergency department: a review of the literature and implications for practice', *The Journal of emergency medicine*, 26: 13-26.

Carman, K, K Devers, Jeanne McGee, Pamela Dardess, Judith Hibbard, and Richard Frankel. 2006. "Ensuring positive physician-patient communication about hospital quality information." In *134th Annual Meeting and Exposition of the American Public Health Association. Boston, MA*.

Carman, Kristin L, Pam Dardess, Maureen Maurer, Shoshanna Sofaer, Karen Adams, Christine Bechtel, and Jennifer Sweeney. 2013. 'Patient and family engagement: a framework for understanding the elements and developing interventions and policies', *Health Affairs*, 32: 223-31.

Carmel, Sara. 1985. 'Satisfaction with hospitalization: a comparative analysis of three types of services', *Social science & medicine*, 21: 1243-49.

Chandrasekaran, Aravind, Claire Senot, and Kenneth K Boyer. 2012. 'Process management impact on clinical and experiential quality: Managing tensions between safe and patient-centered healthcare', *Manufacturing & Service Operations Management*, 14: 548-66.

Charmel, Patrick A, and Susan B Frampton. 2008. 'Building the business case for patient-centered care', *Healthc Financ Manage*, 62: 80-5.

Conway, James. 2008. 'Getting boards on board: engaging governing boards in quality and safety', *The Joint Commission Journal on Quality and Patient Safety*, 34: 214-20.

Conway, Jim, Bev Johnson, Susan Edgman-Levitan, Juliette Schlucter, Dan Ford, Pat Sodomka, and Laurel Simmons. 2006. 'Partnering with patients and families to design a patient-and family-centered health care system: a roadmap for the future: a work in progress', *Bethesda, MD: Institute for Family-Centered Care*.

Cotlear, Daniel, Somil Nagpal, Owen Smith, Ajay Tandon, and Rafael Cortez. 2015. *Going universal: how 24 developing countries are implementing universal health coverage from the bottom up* (The World Bank).

Coulter, Angela, and Jo Ellins. 2007. 'Effectiveness of strategies for informing, educating, and involving patients', *Bmj*, 335: 24-27.

Doyle, Frank, Ronán Conroy, Hannah McGee, and Mary Delaney. 2010. 'Depressive symptoms in persons with acute coronary syndrome: specific symptom scales and prognosis', *Journal of psychosomatic research*, 68: 121-30.

Dunbar, Sandra B, Patricia C Clark, Christina Quinn, Rebecca A Gary, and Nadine J Kaslow. 2008. 'Family influences on heart failure self-care and outcomes', *The Journal of cardiovascular nursing*, 23: 258.

Epstein, RM, and RL Street. 2008. 'Patient-centered care for the 21st century: Physicians' roles, health systems and patients' preferences', *Philadelphia, PA: American Board of Internal Medicine Foundation*.

Erickson, Steven R, Jeffrey J Ellis, Suzan N Kucukarslan, Eva Kline-Rogers, Dean E Smith, and Kim A Eagle. 2009. 'Satisfaction with current health status in patients with a history of acute coronary syndrome', *Current medical research and opinion*, 25: 683-89.

Fisher, Elliott S, David E Wennberg, Thrse A Stukel, Daniel J Gottlieb, F Lee Lucas, and Etoile L Pinder. 2003. 'The implications of regional variations in Medicare spending. Part 2: health outcomes and satisfaction with care', *Annals of internal medicine*, 138: 288-98.

Fisher, Matthew, George E Newman, and Ravi Dhar. 2018. 'Seeing stars: How the binary bias distorts the interpretation of customer ratings', *Journal of Consumer Research*, 45: 471-89.

Freeman, Jonathan, and John E McGowan Jr. 1978. 'Risk factors for nosocomial infection', *Journal of Infectious Diseases*, 138: 811-19.

Fu, Alex Z, and Nan Wang. 2008. 'Healthcare expenditures and patient satisfaction: cost and quality from the consumer's perspective in the US', *Current medical research and opinion*, 24: 1385-94.

Grøndahl, Vigdis Abrahamsen, Marie Louise Hall-Lord, Ingela Karlsson, Jari Appelgren, and Bodil Wilde-Larsson. 2013. 'Exploring patient satisfaction predictors in relation to a theoretical model', *International journal of health care quality assurance*.

Halladay, Jacqueline R, Katrina E Donahue, Crystal W Cené, Quefeng Li, Doyle M Cummings, Alan L Hinderliter, Cassandra L Miller, Beverly A Garcia, Edwin Little, and Margorie Rachide. 2017. 'The association of health literacy and blood pressure reduction in a cohort of patients with hypertension: The heart healthy lenoir trial', *Patient education and counseling*, 100: 542-49.

Hauck, Katharina, and Xueyan Zhao. 2011. 'How dangerous is a day in hospital? A model of adverse events and length of stay for medical inpatients', *Medical care*: 1068-75.

Heckman, James J, Hidehiko Ichimura, and Petra Todd. 1998. 'Matching as an econometric evaluation estimator', *The review of economic studies*, 65: 261-94.

Huerta, Timothy R, Eric W Ford, Lori T Peterson, and Keith H Brigham. 2008. 'Testing the hospital value proposition: An empirical analysis of efficiency and quality', *Health Care Management Review*, 33: 341-49.

Hussey, Peter S, Samuel Wertheimer, and Ateev Mehrotra. 2013. 'The association between health care quality and cost: a systematic review', *Annals of internal medicine*, 158: 27-34.

Johnson, Bev, Marie Abraham, Jim Conway, Laurel Simmons, Susan Edgman-Levitan, Pat Sodomka, and D Ford. 2008. 'Partnering with patients and families to design a patient-and family-centered health care system', *Institute for Patient-and Family-Centered Care and Institute for Healthcare Improvement*.

Jonsson, Patrik, Mats Johansson, Alessandro Ancarani, Carmela Di Mauro, and Maria D Giammanco. 2011. 'Patient satisfaction, managers' climate orientation and organizational climate', *International Journal of Operations & Production Management*.

Kelly, Michelle M, Anping Xie, Pascale Carayon, Lori L DuBenske, Mary L Ehlenbach, and Elizabeth D Cox. 2013. 'Strategies for improving family engagement during family-centered rounds', *Journal of hospital medicine*, 8: 201-07.

Kleinbaum, David G, Lawrence L Kupper, and Keith E Muller. 1988. 'Applied regression analysis and other multivariable methods Boston', *Massachusetts: PWS-Kent Publishing Company*.

Kralik, Debbie, Kay Price, and Kerry Telford. 2010. 'The meaning of self-care for people with chronic illness', *Journal of Nursing and Healthcare of Chronic Illness*, 2: 197-204.

Lewbel, Arthur. 2012. 'Using heteroscedasticity to identify and estimate mismeasured and endogenous regressor models', *Journal of Business & Economic Statistics*, 30: 67-80.

Li, Ling X, and WC Benton. 1996. 'Performance measurement criteria in health care organizations: Review and future research directions', *European Journal of Operational Research*, 93: 449-68.

Locatelli, Sara M, Jennifer N Hill, Barbara G Bokhour, Laura Krejci, Gemmae M Fix, Nora Mueller, Jeffrey L Solomon, Carol Van Deusen Lukas, and Sherri L LaVela. 2015. "Provider perspectives on and experiences with engagement of patients and families in implementing patient-centered care." In *Healthcare*, 209-14. Elsevier.

Marley, Kathryn A, David A Collier, and Susan Meyer Goldstein. 2004. 'The role of clinical and process quality in achieving patient satisfaction in hospitals', *Decision Sciences*, 35: 349-69.

Moons, Philip, K Van Deyk, Sabina De Geest, Marc Gewillig, and Werner Budts. 2005. 'Is the severity of congenital heart disease associated with the quality of life and perceived health of adult patients?', *Heart*, 91: 1193-98.

Oates, Julian, W Wayne Weston, and John Jordan. 2000. 'The impact of patient-centered care on outcomes', *Fam Pract*, 49: 796-804.

Okkonen, Eila, and Hannu Vanhanen. 2006. 'Family support, living alone, and subjective health of a patient in connection with a coronary artery bypass surgery', *Heart & Lung*, 35: 234-44.

Reidenbach, R Eric, and Gordon W McClung. 1999. 'Managing stakeholder loyalty', *Marketing Health Services*, 19: 20.

Reinhard, Susan C, Barbara Given, Nirvana Huhtala Petlick, and Ann Bemis. 2008. 'Supporting family caregivers in providing care.' in, *Patient safety and quality: An evidence-based handbook for nurses* (Agency for Healthcare Research and Quality (US)).

Rockville, MD, Maureen Maurer, Pam Dardess, Kristin L Carman, Karen Frazier, and Lauren Smeeding. 2012. 'Guide to patient and family engagement: Environmental scan report', Rockville, MD, Agency for Healthcare Research and Quality.

Rosenbaum, Paul R, and Donald B Rubin. 1985. 'Constructing a control group using multivariate matched sampling methods that incorporate the propensity score', *The American Statistician*, 39: 33-38.

Roter, Debra L. 1989. 'Which facets of communication have strong effects on outcome-a meta-analysis', *Communicating with medical patients*: 183-96.

Rubin, Donald B. 2001. 'Using propensity scores to help design observational studies: application to the tobacco litigation', *Health Services and Outcomes Research Methodology*, 2: 169-88.

Rubin, Haya R, Peter Pronovost, and Gregory B Diette. 2001. 'The advantages and disadvantages of process-based measures of health care quality', *International Journal for Quality in Health Care*, 13: 469-74.

Salzarulo, Peter A, Kurt M Bretthauer, Murray J Côté, and Kenneth L Schultz. 2011. 'The impact of variability and patient information on health care system performance', *Production and Operations Management*, 20: 848-59.

Senot, Claire, Aravind Chandrasekaran, Peter T Ward, Anita L Tucker, and Susan D Moffatt-Bruce. 2016. 'The impact of combining conformance and experiential quality on hospitals' readmissions and cost performance', *Management Science*, 62: 829-48.

Shumaker, Sally A, and D Robin Hill. 1991. 'Gender differences in social support and physical health', *Health psychology*, 10: 102.

Sobel, Michael E. 1982. 'Asymptotic confidence intervals for indirect effects in structural equation models', *Sociological methodology*, 13: 290-312.

Sousa, Rui. 2003. 'Linking quality management to manufacturing strategy: an empirical investigation of customer focus practices', *Journal of Operations Management*, 21: 1-18.

Staiger, Douglas, and James H Stock. 1994. "Instrumental variables regression with weak instruments." In.: National Bureau of Economic Research.

Steca, P, A Greco, D Monzani, A Politi, R Gestra, G Ferrari, G Malfatto, and G Parati. 2013. 'How does illness severity influence depression, health satisfaction and life satisfaction in patients with cardiovascular disease? The mediating role of illness perception and self-efficacy beliefs', *Psychology & health*, 28: 765-83.

Steffens, Linda, Stacy Jaeger, Susan Herrmann, Kimberly Thomas, Katherine Barker, and Audrey Eggleston. 2009. 'Hospital readmission: The move toward pay for performance', *JONA: The Journal of Nursing Administration*, 39: 462-64.

Stukel, Therese A, Elliott S Fisher, David A Alter, Astrid Guttmann, Dennis T Ko, Kinwah Fung, Walter P Wodchis, Nancy N Baxter, Craig C Earle, and Douglas S Lee. 2012. 'Association of hospital spending intensity with mortality and readmission rates in Ontario hospitals', *Jama*, 307: 1037-45.

Tokunaga, Junya, and Yuichi Imanaka. 2002. 'Influence of length of stay on patient satisfaction with hospital care in Japan', *International Journal for Quality in Health Care*, 14: 493-502.

Ware Jr, John E, Mary K Snyder, W Russell Wright, and Allyson R Davies. 1983. 'Defining and measuring patient satisfaction with medical care', *Evaluation and program planning*, 6: 247-63.

Wu, Robert C, Kim Tran, Vivian Lo, Kevin J O'Leary, Dante Morra, Sherman D Quan, and Laure Perrier. 2012. 'Effects of clinical communication interventions in hospitals: a systematic review of information and communication technology adoptions for improved communication between clinicians', *International journal of medical informatics*, 81: 723-32.

Wyskiel, Rhonda M, Bickey H Chang, Adrian A Alday, David A Thompson, Michael A Rosen, Aaron S Dietz, and Jill A Marsteller. 2015. 'Towards expanding the acute care team: Learning how to involve families in care processes', *Families, Systems, & Health*, 33: 242.