Hospital staffing patterns and safety culture perceptions: The mediating role of perceived teamwork and perceived handoffs

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Background: As hospitals are under increasing pressure to improve quality and safety, safety culture has become a focal issue for high-risk organizations, including hospitals. Prior research has examined how structural characteristics directly impact safety culture. However, and based on Donabedian's structure–process–outcome quality model, there is a need to understand the processes that intermediate the relationship between structural characteristics and safety culture perceptions.

Purpose: The processes by which registered nurse (RN) and hospitalist staffing may affect safety culture perceptions were examined in this study. Specifically, this study investigates the processes of perceived teamwork across units and perceived handoffs.

Methodology: Data sources for this research included Hospital Survey on Patient Safety Culture from the Agency for Healthcare Research and Quality, the American Hospital Association's Annual Survey Data, the American Hospital Association Information Technology supplement, and the Area Health Resource File. Two separate mediation models

Key words: handoffs, staffing, safety culture, teamwork

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for each process were used. Propensity weights were assigned to each hospital in the sample (N = 207) to adjust for potential nonresponse bias of hospitals that did not assess employee's safety culture perceptions.

Results: Results suggest that RN staffing influences safety culture perceptions, but hospitalist staffing does not. In addition, RN staffing has an indirect effect on safety culture perceptions through better processes.

Practice Implications: Our study sheds light on how staffing affects safety culture perceptions. Specifically, our findings suggest that positive perceptions of teamwork across units and handoffs are integral in the relationship between RN staffing and safety culture perceptions. Hospital managers should, therefore, invest resources in staff recruitment and retention. In addition, a targeted focus on perceived teamwork and handoffs may allow hospital managers to improve safety culture perceptions.

Safety culture is an important strategy for organizations and an imperative precursor to filling the widespread gaps in patient safety outcomes in the health care system (Pronovost & Sexton, 2005). The Joint Commission (2017) defines patient safety culture as the "product of individual and group beliefs, values, attitudes, perceptions, competencies, and patterns of behavior that determine the organization's commitment to quality and patient safety." A key feature of safety culture is perceptions among employees regarding the importance of patient safety in their organizations and serves as a building block for far reaching distal outcomes such as reduced mortalities, hospital acquired infections, complications, and readmissions (Fan et al., 2016). Hospitals are under pressure to improve patient safety and safety culture, particularly given the increasing attention to this issue by the Institute of Medicine and the Affordable Care Act (The Patient Protection and Affordable Care Act, 2010; Wachter, 2004). In response to this challenge, hospitals should consider changing specific structural characteristics, which would improve processes, subsequently resulting in better outcomes (Donabedian, 1988).

Although a growing body of literature has supported the role of structural characteristics, registered nurse (RN) and hospitalist staffing, as practical steps toward improving safety and safety culture perceptions (Ford, Silvera, Kazley, Diana, & Huerta, 2016; McHugh et al., 2016), there has been a dearth of research exploring the intricacies of the relationship between structural characteristics and safety culture perceptions. The impact of structural characteristics such as RN staffing and hospitalist staffing on safety culture perceptions may be dependent, in part, on specific intermediary mechanisms that need to be affected to influence a positive change on safety culture perceptions. Two of these potential intermediate mechanisms, perceived teamwork across units, and perceived handoffs are considered in this study as process characteristics. Although there is research on the effects of teamwork and handoffs on safety culture perceptions (Choi & Staggs, 2014; Greenstein, Arora, Staisiunas, Banerjee, & Farnan, 2013), there is a need to further understand how these concepts may mediate the relationship between hospital structures and desired quality and safety outcomes. Therefore, the purpose of this study is to examine how structural characteristics may enhance processes—specifically perceived teamwork across units and handoffs—which in turn may improve the outcome of safety culture perceptions.

Conceptual Framework

This article uses Donabedian's (1988) structure–process–outcome quality framework to conduct a three-pronged approach to assessment of quality. Structure refers to attributes of the environment where care occurs, process refers to the actions involved in the giving and receiving of care, and outcome refers to the effects of care on the patients and broader populations (Donabedian, 1988). This model assumes that good structure makes it more likely to have robust processes, which in turn increase the chances of having better care outcomes (Donabedian, 1988). In Figure 1, we introduce perceived teamwork across units and perceived handoffs as mediators (process) to explain the mechanisms that connect RN and hospitalist staffing (structure) and safety culture perceptions (outcome) more completely.

Staffing, a structural characteristic that includes attributes of human resources, plays an essential role in the provision of high-quality and safe care (Alenius, Tishelman, Runesdotter, & Lindqvist, 2014; Brennan, Daly, & Jones, 2013). RN staffing, an essential precursor to the quality of patient care, is associated with patient outcomes like mortality rates, falls, and pressure ulcers (Cho et al., 2015). Similarly, hospitalist staffing influences patient outcomes such as mortalities, readmission rates, complications, and length of stay (Chin, Wilson, Bang, & Romano, 2014; Epane & Weech-Maldonado, 2015).

Teamwork across units and handoffs are care coordinating mechanisms done to and for the patient during the delivery of care and were therefore chosen as processes that provide mediating mechanisms (O'Leary, Sehgal, Terrell, & Williams, 2012; O'Malley, Draper, Gourevitch, Cross, & Scholle, 2015). According to the National Quality Forum (2012), care coordination implies a need for meaningful

Figure 1

Conceptual framework
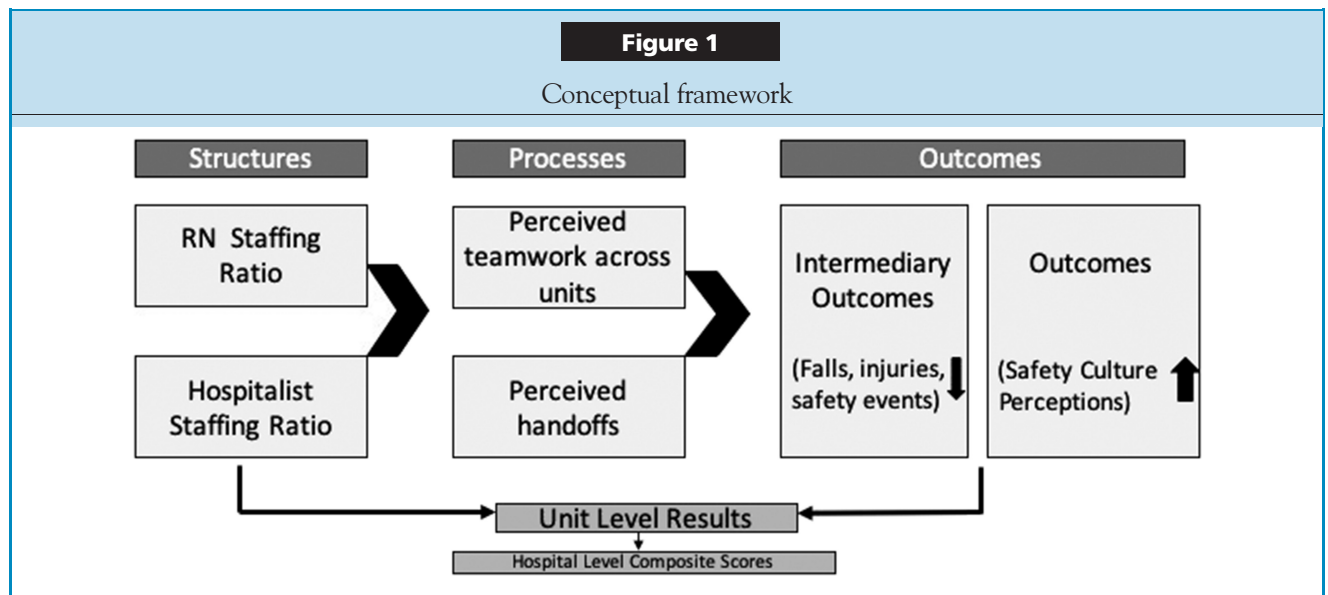
communication and cooperation among providers for patients to receive efficient, safe, and high-quality care. Teamwork across units refers to collaboration and coordination between two or more individuals across hospital units (Kalisch & Lee, 2009). For teamwork across units to be effective, nurses and physicians need to interact interdependently and dynamically toward a common goal of safety to avoid breakdowns in communication (Horwitz et al., 2013; O'Leary et al., 2012). Previous studies have shown that loopholes in communication due to lack of collaboration has resulted in retained sponges, mismatched blood transfusion, incorrect extremity nerve blocks and surgery sites, and sentinel events resulting in catastrophic consequences for patients and their families (Weaver, Callaghan, Cooper, Brandman, & O'Leary, 2014).

A handoff is a process by which the responsibility for a patient passes from one health care professional to another, to exchange accurate information about patients' care, current condition, expected changes, and treatment and services needed (Cohen & Hilligoss, 2010). As a point of transition, handoffs are known to introduce vulnerabilities in communication and continuity of care (Greenstein et al., 2013; Riesenberg, Leisch, & Cunningham, 2010). Inconsistency in handoff processes may present clinical errors and potential adverse events (Riesenberg et al., 2010). In expressing concerns for the risk of errors and adverse events, the Joint Commission has highlighted the importance of standardized approaches to handoffs and information transfer (Greenstein et al., 2015). Retaining important patient information during handoffs is critical in meeting patient safety goals (Cohen & Hilligoss, 2010; Riesenberg et al., 2010). In the subsequent sections, we explain the relationships of (a) structure and outcomes, (b) structure

and process, and (c) the mediating role of process between structure and outcome.

Structure and Outcomes

Extant research suggests two key structural characteristics, which may affect safety culture perceptions: RN staffing and hospitalist staffing. RN staffing refers to having adequate numbers of RNs scheduled to handle the workload as well as ensuring shift schedules (or the number of hours per shift) for RNs are appropriate to provide the best care to patients (Cho et al., 2015). Low or inadequate RN staffing ratio has been associated with adverse patient safety outcomes, such as in-hospital falls, medication errors, pressure ulcers, and hospital-acquired infections (McHugh & Ma, 2014; Pettker et al., 2011). Furthermore, RN staffing ratio has been positively associated with RN's assessment of patient safety culture at their hospital (Alenius et al., 2014; Brennan et al., 2013; Cho et al., 2015). To examine the direct association between RN staffing and safety culture perceptions, we suggest the following hypothesis:

Hypothesis 1a: RN staffing ratio is positively related to safety culture perceptions.

Hospitalists are specialists in hospital medicine that have served a vital role in the growing patient safety needs amidst the increasing complexity of care of hospitalized patients. One advantage of having hospitalists is that they are readily available to detect and treat inpatient problems and have a role in preventing or reducing morbidities (West et al., 2014). In addition, high hospitalist staffing intensity has been associated with a lower length of stay (Epane &

Weech-Maldonado, 2015), which minimizes the probability of having infections and complications. To examine the direct relationship between hospitalist staffing and safety culture perceptions, we hypothesize:

Hypothesis 1b: Hospitalist staffing ratio is positively related to safety culture perceptions.

Structure and Process

As noted above, we have considered two structural characteristics, (a) RN staffing ratio and (b) hospitalists staffing ratio, and two processes, (a) perceived teamwork across units and (b) perceived handoffs. Perceived teamwork refers to the discernment of the quality of collaboration and cooperation among providers within a designated group (Weaver et al., 2014), whereas perceived handoffs refer to the assessment of the quality of the handoff exchange.

Research on teamwork across intensive care units, operating rooms, and in general medical contexts has confirmed that discrepancies exist in the perceptions of quality of collaboration and cooperation (e.g., teamwork), which may associate with appropriate staffing levels (Weaver et al., 2014). Higher RN staffing, or at least minimum nurse staffing where shortages do not negatively affect care of patients and increase burden of other employees, may improve cooperation across team members, for example, providing support in terms of physical assistance (e.g., helping another team member ambulate a patient) or through verbal reminders (e.g., reminding a fellow team member to wash their hands) by ensuring the availability of other team members when need arises and preventing staff from being overburdened (Kalisch & Lee, 2009). Low nurse staffing groups when compared to high nurse staffing groups had better processes (Alenius et al., 2014). Therefore, at least a minimum or higher RN staffing ratio is needed so that teams can effectively coordinate activities across units to exchange critical information about patients (Riesenberg et al., 2010; Tscholl et al., 2015).

Similarly, RN staffing ratios need to be adequate for smoother handoffs. These ratios are especially important during transfer of patients from physically and cognitively demanding workspaces such as the Emergency Department, where a balance between continuity of care and restricting demands on health care professionals needs to be maintained (McHugh et al., 2016). Ensuring at least minimum nurse and patient ratio so that there are enough RNs to overlap work shifts for seamless handoffs minimizes the likelihood of RNs from the prior shift feeling overworked, thereby having ample time for rest and for the handoff to the next RN, particularly in a time-constrained environment (Choi & Staggs, 2014). Thus, we suggest the following hypotheses:

Hypothesis 2a: RN staffing ratio is positively related to perceived teamwork across units.

Hypothesis 2b: RN staffing ratio is positively related to perceived handoffs.

Hospitalists have a role in improving teamwork across units and handoffs given their broad clinical expertise (Messler & Whitcomb, 2015). They are expected to play a role in stimulating effective team coordination across units by supporting an increase in the frequency of communication, strengthening shared goals, and encouraging mutual respect; these attributes are related to reduced postoperative pain, improved postoperative functioning, and decreased length of stay (Fan et al., 2016). In addition, hospitalists provide verbal handoffs supported with documentation to other physicians for the exchange of important information, such as a checklist of elements for an ideal discharge of elderly and high-risk patients with multiple comorbidities (Greenstein et al., 2013). These verbal handoffs are particularly useful for retention of information to facilitate better handoffs and minimize patient information from falling through the cracks (Horwitz et al., 2013). Thus, we suggest the following hypotheses:

Hypothesis 2c: Hospitalist staffing ratio is positively related to perceived teamwork across units.

Hypothesis 2d: Hospitalist staffing ratio is positively related to perceived handoffs.

Mediating Role of Process in the Relationship Between Structure and Outcome

Perceptions of teamwork across units and handoffs are intrinsic to the relationship between structural characteristics and safety culture perceptions because they involve interpersonal dynamics (Pronovost & Sexton, 2005; S. J. Weaver et al., 2013). In hospitals, better care coordination among staff leads to effective teamwork across units and smoother handoffs, which can influence employees' safety culture perceptions. This is because better care coordination minimizes confusion, prevents staff from disregarding specific tasks to reduce their workload during busy periods, and helps them prioritize important activities (Antonelli, McAllister, & Popp, 2009). Staffing allows for better care coordination so that workload distributes evenly and exchange of critical information about patients improves knowledge about their health issues (Tscholl et al., 2015; West et al., 2014). Therefore, we expect staffing to have an indirect effect on safety cultural perceptions via perceived

teamwork across units and perceived handoffs. Thus, we suggest the following hypotheses:

Hypothesis 3a: RN staffing ratio will have an indirect positive effect on safety culture perceptions through its positive effect on perceived teamwork across units.

Hypothesis 3b: Hospitalist staffing ratio will have an indirect positive effect on safety culture perceptions through its positive effect on perceived teamwork across units.

Hypothesis 3c: RN staffing ratio will have an indirect positive effect on safety culture perceptions through its positive effect on perceived handoffs.

Hypothesis 3d: Hospitalist staffing ratio will have an indirect positive effect on safety culture perceptions through its positive effect on perceived handoffs.

Methods

Data and Sample

This study uses the following data sets: (a) the 2016 Hospital Survey on Patient Safety Culture (HSOPSC) data set from the Agency for Healthcare Research and Quality (AHRQ), (b) the American Hospital Association's (AHA) Annual Survey Data, (c) the AHA Information Technology supplement, and (d) the Area Health Resource File. The HSOPSC survey is a voluntary survey administered by hospitals to the employees. Employees' perceptions on patient safety culture are collected as part of these data. The 2016 HSOPSC database is a pooled cross-sectional data set that contains survey data from years 2014 and 2015. Of the 680 hospitals that submitted their results to AHRQ, 207 provided identifiable information for research purposes. We merged the HSOPSC data with the AHA data set, the AHA Information Technology supplement, and the Area Health Resource File data to obtain a final analytic sample of 207 hospital observations. Each of these was a unique observation, and there were no repeated measures. Our study obtained approval from the institutional review board.

Dependent Variable

The outcome represents the average positive score for "perceptions of safety," one of the safety culture dimensions from the HSOPSC data. This measure has been psychometrically validated in prior research (Blegen, Gearhart,

O'Brien, Sehgal, & Alldredge, 2009). The perceptions of safety composite measure includes the following items: (a) "It is just by chance that more serious mistakes don't happen around here." (b) "Patient safety is never sacrificed to get more work done." (c) "We have patient safety problems in this unit." (d) "Our procedures and systems are good at preventing errors from happening." The average positive score for the perceptions of safety culture composite measure consists of the average of the percentages of positive responses to each item and is measured by aggregating unit-level results to hospital level (Famolaro et al., 2016).

Independent Variables

To measure RN staffing ratio, we use the following formula that normalizes the number of full-time employees (FTE): (Number of registered nurse FTE / Total inpatient days) * 100. To measure hospitalist staffing ratio, we use the following formula that normalizes the number of FTE: (Number of hospitalist FTE / Total inpatient days) * 100.

Mediating Variables

We consider the average positive scores for two process measures: (a) perceived teamwork across units and (b) perceived handoffs and transitions. Psychometric analyses of HSOPSC survey have validated these dimensions at the hospital level (Blegen et al., 2009). The following four questions are under the composite dimension "teamwork across units': (a) hospital units do not coordinate well with each other, (b) there is good cooperation among hospital units that need to work together, (c) it is often unpleasant to work with staff from other hospital units, and (d) hospital units work well together to provide the best care for patients. "Hospital handoffs and transitions" is composed of the following four questions: (a) things fell between the cracks when transferring patients from one unit to another, (b) important patient care information is often lost during shift changes, (c) problems often occur in the exchange of information across hospital units, and (d) shift changes are problematic for patients in this hospital (Famolaro et al., 2016). Individual employees were asked the above questions at the unit level, and the results were aggregated to obtain hospital-level composite scores.

Control Variables

The following control variables were used in this study: (a) Ownership status (not-for-profit, for-profit, government), (b) size (small, 0–99 beds; medium, 100–299 beds; and large, 300 and above beds), (c) teaching status (hospitals were coded as "teaching" if they were member of the Council of Teaching Hospitals, or if they were affiliated to a medical school, or if they provided a residency program), (d)

system membership (hospitals were coded as a system member if they were a member or affiliate of a large health care system), (e) proportion of Medicare patients (Hospital Medicare inpatient days / Hospital inpatient days * 100), (f) proportion of Medicaid patients (Hospital Medicaid inpatient days / Hospital inpatient days * 100), and (g) electronic health record (EHR) presence, categorized in three ways: no EHR (no functionalities), basic EHR (10 functionalities fully or partially implemented), and advanced EHR (24 functionalities fully implemented).

We use the following as market-level control variables: (a) market competition (Hirschman–Herfindahl index; values ranged from 0 to 1, wherein 1 indicates monopolistic market and values close to 0 indicate highly competitive markets). For Hirschman–Herfindahl index, market was defined as the particular health services area to which the hospital belongs to. To calculate market competition, we used a two-step approach: (1) Market share = (Inpatient days for hospital X / Total inpatient days for all hospitals in the market) and (2) Sum of square of market shares for each market = (Σ(Market share)^2); (b) location (metro (a population of 250,000 to 1 million and more), urban (a population of 2,500 to 20,000), and rural (less than a population of 2,500); and (c) percent per capita income (proxy for socioeconomic status of patients). For both location and per capita income, market was defined as the county in which the hospital is located.

Analytic Approach

Multivariable regression was used to test two mediation models: (a) In Model 1, perceived teamwork across units was used as a mediator, and (b) in Model 2, perceived handoffs were used as a mediator. Baron and Kenny's (1986) method of testing mediation was used, in which: First, the dependent variable (outcome) was regressed on the independent variable (structures); this regression was the direct effect of structural characteristics on outcome. Second, the mediators (processes) were regressed on the independent variables (structures). Finally, the dependent variable (outcome) was regressed on both the independent variable (structure) and the mediator (process). This was the indirect effect of structural characteristics on outcome. Equations for the first model were as follows:

$$Y_{(safety\_culture\_perceptions)} = B_0 + B_{1\ RN\_staffing}$$
$$+ B_{2\ hospitalist\_staffing} + B_{3\ controls}$$

$$Y_{(perceived\_teamwork\_across\_units)} = B_0 + B_{1\ RN\_staffing}$$
$$+ B_{2\ hospitalist\_staffing}$$
$$+ B_{3\ controls}$$

$$Y_{(safety\_culture\_perceptions)} = B_0 + B_{1\ RN\_staffing}$$
$$+ B_{2\ hospitalist\_staffing}$$
$$+ B_{3\ perceived\_teamwork\_across\_units}$$
$$+ B_{4\ controls}$$

A similar set of equations was used for the second model. We also ran the Sobel–Goodman test to assess what percentage of the total effect is being mediated. To adjust for potential response bias of hospitals participating in the HSOPSC, we included propensity score weights in the regression analysis, which were calculated by calculating the inverse of the propensity scores for hospitals that participated in the HSOPSC.

Results

Table 1 presents the descriptive statistics of all the variables included in this study. Average RN staffing ratio per 100 hospital inpatient days (IPD) is higher at 1.3 than the average hospitalist staffing ratio per 100 hospital IPD at 0.04, as expected. The average positive scores for perceived teamwork across units, perceived handoffs, and safety culture perceptions were 60.7%, 47%, and 67.1%, respectively.

Table 2 presents the direct effect of staffing variables on the outcome, safety culture perceptions. Hypothesis 1a was supported, because there was a positive relationship between RN staffing and safety culture perceptions. Every additional RN FTE per 100 hospital IPD is associated with a 3.1% increase in safety culture perceptions. Hypothesis 1b was not supported. Hospitalist staffing ratio was not significantly associated with safety culture perceptions.

Table 3 presents regression results of processes (perceived teamwork across units and perceived handoffs) on staffing variables. For Model 1, Hypothesis 2a was supported. Regression results show that RN staffing ratio is positively associated with perceived teamwork across units. Every additional RN FTE per 100 IPD is related to a 3.1% increase in average positive score of perceived teamwork across units ($p < .001$). On the other hand, Hypothesis 2b was not supported. Hospitalist staffing ratio was not significantly associated with perceived teamwork across units. With respect to control variables, for-profit hospitals, as compared to nonprofit hospitals, tend to have a reduced perception of teamwork across units by 10.6%.

For Model 2, Hypothesis 2c was supported. Every additional RN FTE per 100 IPD is associated with a 2.6% increase in perceived handoffs ($p < .001$). On the other hand, Hypothesis 2d was not supported. Hospitalist staffing is not significantly associated with perceived handoffs.

Finally, Table 4 presents the last step in mediation analysis, as suggested by Baron and Kenny (1986), the indirect effect of staffing variables on safety culture perceptions via

Table 1

Descriptive statistics of all variables in the sample (N = 207)

	Mean	SD
Structural characteristics		
RN staffing ratio (per 100 days)	1.37	1.12
Hospitalist staffing ratio (per 100 days)	0.04	0.05
Process measures		
Perceived teamwork across units	60.7%	11.5%
Perceived handoffs	47.0%	10.3%
Outcome		
Safety culture perceptions	67.1%	9.3%

Controls	Frequency	%
Organizational characteristics		
Ownership		
Not for profit (Ref)	160	77.6%
For profit	6	2.9%
Government nonfederal	40	19.4%
Size		
Small (Ref)	91	44.1%
Medium	54	26.2%
Large	61	29.6%
Teaching status		
Teaching (Ref)	111	53.8%
Nonteaching	95	46.0%
System affiliation		
System (Ref)	136	66.0%
Nonsystem	70	33.9%
EHR presence		
No EHR (Ref)	22	10.6%
Basic EHR	103	50.2%
Advanced EHR	81	39.1%

	Mean	SD
Proportion Medicaid population	20.81	37.94
Proportion Medicare population	51.42	42.73

Market characteristics	Frequency	%
Location		
Metro (Ref)	144	69.9%
Urban	59	28.6%
Rural	3	1.4%

	Mean	SD
Market competition (HHI)	0.60	0.36
Per capita income (per 1,000)	44.08	11.59

Note. RN = registered nurse; Ref = reference; EHR = electronic health record; HHI = Hirschman–Herfindahl index.

process characteristics. In the first model, the outcome, safety culture perceptions, is regressed on both RN staffing and perceived teamwork across units. In this model, adding perceived teamwork across units reduces the coefficient size for RN staffing, but RN staffing remains significant. This suggests that the relationship between RN staffing and safety culture perceptions is partially mediated by perceived teamwork across units, lending partial support to Hypothesis 3a. Every additional RN FTE per 100 IPD is associated with a 1.8% increase in safety culture perceptions when the mediator-perceived teamwork across units is accounted for ($p < .01$). Results from the Sobel–Goodman test of mediation show that the mediation effect of perceived teamwork across units was statistically significant and explained approximately 68% of the total effect (of RN staffing ratio on safety culture perceptions). Because there was no significant direct relationship between hospitalist staffing and safety culture perceptions, the mediation model for hospitalist staffing was not considered. Therefore, Hypothesis 3b is not supported.

In Model 2, safety culture perceptions are regressed on RN staffing and perceived handoffs. In this model, adding perceived handoffs reduces the coefficient size for RN staffing, but RN staffing remains significant, which shows partial support for Hypothesis 3c. Every additional RN FTE

Table 2

Regression results of the direct relationship between RN and hospitalist staffing and safety culture perceptions (N = 207)

Safety culture perceptions		
	B	**SE**
RN staffing ratio	3.17***	(0.62)
Hospitalists staffing ratio	7.52	(7.72)
EHR presence (Ref = No EHR)		
Basic EHR	1.61	(3.19)
Advanced EHR	1.53	(3.18)
Ownership (Ref = Nonprofit)		
Government nonfederal	−2.79	(1.44)
Profit	−4.22	(3.74)
Size (Ref = small)		
Medium	−1.5	(1.60)
Large	−4.24	(2.54)
Teaching status (Ref = teaching)		
Nonteaching	2.6	(1.63)
System membership (Ref = No)		
Yes	−2.90*	(1.31)
Proportion Medicaid population	−0.09***	(0.01)
Proportion Medicare population	0.05*	(0.02)
Location (Ref = Metro)		
Urban	0.81	(1.51)
Rural	1.33	(3.10)
Market competition (HHI)	0.3	(2.06)
Per capita income (per 1,000)	0.08	(0.05)

Note. RN = registered nurse; Ref = reference; EHR = electronic health record; HHI = Hirschman–Herfindahl index.

*$p < .05$. **$p < .01$. ***$p < .001$.

Table 3
Regression results of the relationship between RN and hospitalist staffing and perceived teamwork across units and perceived handoffs (N = 207)

	Perceived teamwork across units (Model 1)		Perceived handoffs (Model 2)	
	B	*SE*	*B*	*SE*
RN staffing ratio	3.19***	(0.79)	2.62***	(0.73)
Hospitalists staffing ratio	10.85	(7.59)	–2.16	(6.88)
EHR presence (Ref = No EHR)				
Basic EHR	–5.83	(3.72)	–3.02	(4.64)
Advanced EHR	–3.79	(3.89)	–2.37	(4.7)
Ownership (Ref = Nonprofit)				
Government nonfederal	0.042	(2.60)	–0.85	(2.74)
Profit	–10.67**	(–3.31)	–6.06	(3.18)
Size (Ref = Small)				
Medium	–0.77	(1.81)	–0.60	(1.81)
Large	–6.28	(3.01)	–3.31	(2.90)
Teaching status (Ref = Teaching)				
Nonteaching	2.73	(2.30)	2.41	(2.20)
System membership (Ref = No)				
Yes	1.74	(1.92)	3.08	(1.90)
Proportion Medicaid population	–0.04	(0.03)	–0.07**	(0.02)
Proportion Medicare population	0.04	(0.03)	0.09**	(0.02)
Location (Ref = Metro)				
Urban	–2.21	(2.07)	1.00	(1.87)
Rural	–3.36	(3.94)	3.90	(2.45)
Market competition (HHI)	–1.60	(2.41)	–1.71	(2.65)
Per capita income (per 1,000)	0.04	(0.09)	0.11	(0.08)

Note. RN = registered nurse; Ref = reference; EHR = electronic health record; HHI = Hirschman–Herfindahl index.
*$p < .05$. **$p < .01$. ***$p < .001$.

per 100 IPD is related with a 2% increase in safety culture perceptions when the mediator-perceived handoffs are included ($p < .01$). Results from the Sobel–Goodman test show that the mediation effect of handoff was statistically significant and explained approximately 54% of the total effect (of RN staffing ratio on safety culture perception). Because the direct effect between hospitalist staffing and safety culture perceptions was not significant, a mediation model was not considered. This shows that Hypothesis 3d is not supported. For both models, hospitals that belong to a system are likely to have reduced safety culture perceptions as compared to hospitals that do not belong to a system.

Discussion

The purpose of this study was to examine the association between staffing and safety culture perceptions via processes (perceived teamwork across units and perceived handoffs). Findings suggest that RN staffing influences safety culture perceptions, and RN staffing has an indirect effect on safety culture perceptions through better processes. However, hospitalist staffing was not associated with safety culture perceptions.

Our observation regarding the positive linkage between RN staffing and safety culture perceptions is consistent with previous studies that have shown that a higher level of RN staffing is related to better patient outcomes, including lower hospital related mortality, decreased infections in the intensive care unit, a shorter length of stay in the intensive care units, and lower odds of several adverse patient events (Choi & Staggs, 2014; Lee, Blegen, & Harrington, 2014). A higher level of RN staffing reflects a hospital's commitment to high-quality care, value for nurses, and an effective nurse recruitment and retention strategy. A more robust RN staffing ensures that nurses do not get overworked or exhausted, thereby avoiding potential medical errors (McHugh & Ma, 2014). Likewise, given that daily patient care activities require coordination, better RN staffing may increase the likelihood of improved coordination across teams and proper handoffs. However, although we have found that that there is a potential link between high nurse staffing and better safety culture, there may be

	Table 4			

Regression results of the indirect relationship between RN and hospitalist staffing and safety culture perceptions through Model 1: Perceived teamwork across units and Model 2: Perceived handoffs (N = 207)

DV = Safety culture perceptions	Model 1		Model 2	
	B	*(SE)*	*B*	*(SE)*
RN staffing ratio	1.83**	(0.60)	2.04**	(0.61)
Hospitalists staffing ratio	2.97	(6.03)	8.46	(6.78)
Perceived teamwork across units	0.42**	(0.15)		
Perceived handoffs			0.43***	(0.10)
EHR presence (Ref = No EHR)				
Basic EHR	4.06	(2.35)	2.91	(3.26)
Advanced EHR	3.12	(2.34)	2.56	(3.12)
Ownership (Ref = Nonprofit)				
Government nonfederal	−2.80*	(1.38)	−2.42	(1.47)
Profit	0.26	(3.50)	−1.61	(3.64)
Size (Ref = Small)				
Medium	−1.17	(1.30)	−1.23	(1.31)
Large	−1.60	(1.83)	−2.81	(1.93)
Teaching status (Ref = Teaching)				
Nonteaching	1.46	(1.37)	1.57	(1.32)
System membership (Ref = No)				
Yes	−3.64***	(1.07)	−4.23***	(1.05)
Proportion Medicaid population	−0.07***	(0.01)	−0.06**	(0.02)
Proportion Medicare population	0.03	(0.02)	0.01	(0.02)
Location (Ref = Metro)				
Urban	1.73	(1.13)	0.38	(1.32)
Rural	2.74	(4.01)	−0.37	(3.12)
Market competition (HHI)	0.97	(1.52)	1.03	(1.73)
Per capita income (per 1,000)	0.06	(0.05)	0.03	(0.05)

Note. RN = registered nurse; Ref = reference; EHR = electronic health record; HHI = Hirschman–Herfindahl index.
*p < .05. **p < .01. ***p < .001.

a point where more nurses no longer associates with safety culture. For example, a hospital that is constrained with financial resources may impede access to patient's care by diverting funds from other beneficial uses into meeting high RN ratio. This may not be in the best interest of patient safety, especially in the case of safety net hospitals (Conway, Konetzka, Zhu, Volpp, & Sochalski, 2008).

Our findings extend previous work by establishing designated processes as the intervening mechanisms between staffing and safety culture perceptions. Partial mediation by perceptions of teamwork across units and handoffs is an indication that these processes provide a bridging link between RN staffing and safety culture perceptions. Adequate RN staffing is correlated to higher perceptions of teamwork and handoffs, resulting in increased perceptions of safety culture. With adequate staffing, RNs perform better in teams (Kalisch & Lee, 2009). Alternatively, RN staffing shortages leading to use of supplemental/temporary nurses, who do not fully understand the policies and

procedures of the hospital, may cause safety concerns for the patients (Alenius et al., 2014).

Another key finding was that hospitalist staffing ratio does not have a direct or indirect relationship with safety culture perceptions. One potential explanation for this is that the question items in the AHRQ HSOPSC survey may inquire about more nurse sensitive outcomes that are outside the purview of hospitalists. For instance, given the training and background of hospitalists, they may focus on accreditation, technology, and malpractice systems as important dimensions of safety. Another potential explanation is that this survey usually has a greater participation from RNs rather than physicians, including hospitalists. The percentage of RN respondents in our sample is 20.9%, whereas the percentage of hospitalist respondents is 2.5%. The variation within hospitalist staffing ratio as compared to that of RN staffing ratio was less, as shown in Table 1, which may have accounted for lack of significant findings. Although the role of hospitalists may be different than that of RNs, their

work still requires interprofessional teamwork and handoffs in an effort to serve their key role—coordination of patient care within a hospital (Chesluk et al., 2012).

Our study has some limitations. First, because of the low participation rate (30%) on the AHRQ HSOPSC survey and low availability of identifiable data, our study sample is small; this limits the generalizability of our findings to the broader national hospital population. Second, self-reported surveys may be predisposed to a methodological issue, common method variance, which may alter associations among variables. We used composite scores based on multiple items for patient safety culture to avoid bias due to common method variance and deidentified data to keep the anonymity of respondents.

Future studies should further investigate whether hospitalists' perspectives about patient safety and safety culture may be different as compared to that of other employees including RNs and, if so, what effect it may have on overall safety culture perception scores. In addition, performing these analyses at the unit level to capture various nuances of different units would be an interesting projection of this hospital-level study. For example, some units may require high-intensity work and may be very demanding, such as intensive care unit or trauma as compared to low-intensity units such as OB/GYN. An in-depth fine-grained exploration of the above analyses at the unit level is a topic that future studies should consider.

Practical Implications

Our study highlights the importance of processes that connect the link between structural characteristics (staffing) and proximal quality outcomes (safety culture perceptions). Specifically, our study begins to illuminate "whether" and "how" structural characteristics affect safety culture perceptions.

There are implications of adequate staffing levels on certain other areas such as workforce, systems, and health care delivery. Staffing levels may affect stress, burnout, and exhaustion among the workforce. Adequate staffing levels may reduce stress associated with over exhaustion and keeps motivation levels high among the workforce, further affording better teamwork and handoffs (West et al., 2014). Improvement in quality and safety requires a focus on both individuals and systems; therefore, managers should invest in time and resources toward staff recruitment and retention as well as to train employees for better care coordination to achieve a safety culture. High turnover rates of the health care workforce impact processes that are needed to execute patient care and patients' safety. Finally, from a policy standpoint, given the economic and human costs associated with adverse medical events, health care systems need to be improved. Some errors may not lead to harm, but they provide a learning opportunity to identify system improvements for safety to be designed within the health care delivery system. Although the workforce needs to be vigilant and careful, improving systems for better patient safety would provide promising results in the years to come.

Acknowledgments

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