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RESEARCH ARTICLE

Nurse Staffing Patterns and Patient Experience of Care: An Empirical Analysis of U.S. Hospitals

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Objective. To examine the relationship between nurse staffing patterns and patients' experience of care in hospitals with a particular focus on staffing flexibility.

Data Sources/Study Setting. The study sample comprised U.S. general hospitals between 2010 and 2012. Nurse staffing data came from the American Hospital Association Annual Survey, and patient experience data came from the Medicare Hospital Consumer Assessment of Healthcare Providers and Systems.

Study Design. An observational research design was used entailing a pooled, cross-sectional data set. Regression models were estimated using generalized estimating equation (GEE) and hospital fixed effects. Nurse staffing patterns were assessed based on both levels (i.e., ratio of full-time equivalent nurses per 1,000 patient days) and composition (i.e., skill mix—percentage of registered nurses; staffing flexibility—percentage of part-time nurses).

Principal Findings. All three staffing variables were significantly associated with patient experience in the GEE analysis, but only staffing flexibility was significant in the fixed-effects analysis. A higher percentage of part-time nurses was positively associated with patient experience. Multiplicative and nonlinear effects for the staffing variables were also observed.

Conclusions. Among three staffing variables, flexibility was found to be the most important relative to patient experience. Unobserved hospital characteristics appear to underlie patient experience as well as certain nurse staffing patterns.

Key Words. Hospitals, nurse staffing, patient experience, part-time staffing, skill mix

Much research has been devoted to studying the relationship between nurse staffing patterns in hospitals and the quality of patient care (Aiken, Clarke, and Sloane 2002; Needleman et al. 2002; Mark et al. 2004). This research has been motivated in part by concerns that hospitals have been responding to financial pressures and nurse staff shortages through reductions in nurse staffing that compromise patient care (Havlovic, Lau, and Pinfield 2002; Park

et al. 2015). While this research stream has largely focused on the relationship between nurse staffing levels and clinical indicators of quality such as mortality and complications (Aiken, Clarke, and Sloane 2002; Needleman et al. 2002), more recent studies have investigated whether nurse staffing patterns influence patients' own reports of their hospital experience (Jha et al. 2008; Kang 2013; Kemp et al. 2015; Martsolf et al. 2016). Indeed, patients' self-reported experience with hospital care (i.e., patient experience of care) has become a widely used type of quality measure. Many purchasers of health care services include such measures as a core component of their pay-for-performance programs and provider report cards (Kutney-Lee et al. 2009; Federal Register 2011; Mehta 2015).

Moreover, this type of quality measure is a very relevant end point for studying the impact of nurse staffing patterns. Nurses are the bedside staff of patients and usually are the most visible health professional that patients encounter during a hospital stay (Kutney-Lee et al. 2009). Nurses thus are likely to affect patients' experience with their care by the way they interact and communicate with them (Elliott et al. 2009). Extant research generally points to a relationship between nurse staffing patterns and patient experience of care (Jha et al. 2008; Kutney-Lee et al. 2009; Kang 2013), although a recent study by Martsolf et al. (2016) suggests that this relationship may at least in part be attributable to hospital characteristics that are not readily measurable but likely to influence both nurse staffing patterns and the quality of patient care (Jha et al. 2008; Kutney-Lee et al. 2009; Kang 2013; Martsolf et al. 2016).

This article reports results from our investigation of nurse staffing patterns and patient experience of care. Our study extends this small but growing literature in several ways. *First*, we conducted our study with a large, national sample of hospitals and accounted for a wide range of hospital characteristics. As much of the previous research on this topic has been confined to samples that were limited in size and geography and also did not control for many types of hospital characteristics, our study provided an opportunity to more fully examine the effects of nurse staffing on patient experience of care.

Second, our investigation included a potentially important, but also understudied, dimension of nurse staffing—flexibility. By staffing flexibility,

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we refer to the composition of a hospital's nursing staff in terms of part-time and full-time personnel. While several studies have examined measures of patient experience relative to nurse staffing levels and skill mix, staffing flexibility has received little attention. Yet the effects of staffing flexibility are important to understand as it has long been common for nurses to be employed on a part-time basis by hospitals (May, Bazzoli, and Gerland 2006; KPMG 2011). Part-time staffing offers hospitals opportunities to fill vacancies in the presence of nurse staffing shortages (e.g. Havlovic, Lau, and Pinfield 2002; Everhart et al. 2013), but it also raises concerns as to its impact on the coordination and continuity of patient care (e.g. Harrington et al. 2000).

Third, we investigated multiplicative and nonlinear effects among nurse staffing variables. At present, there is limited knowledge about whether key nurse staffing variables (i.e., levels, skill mix, and flexibility) interact in ways that influence nursing care in hospitals (e.g., Blegen et al. 2011; Martsolf et al. 2016). We also know little about these staffing variables' potential for diminishing returns, and whether some hospitals as currently staffed have reached such thresholds.

CONCEPTUAL FOUNDATION AND HYPOTHESES

Our conceptual model is depicted in Figure 1. In the following section, we advance hypotheses regarding the effects of each of three nurse staffing variables—staffing levels, skill mix, and staffing flexibility—on patient experience of care.

Staffing Levels

As noted, much research has examined nurse staffing levels in relation to quality of patient care. These studies indicate generally that higher staffing levels are associated with better clinical outcomes for patients and also better patient experience (e.g., Needleman et al. 2002; Jha et al. 2008; Kutney-Lee et al. 2009). Although the underlying mechanisms for observed relationships between these variables have not been well explicated, some research suggests that inadequate staffing levels can produce burnout and stress for nurses and these intermediate outcomes, in turn, result in deficient patient care (e.g., Aiken, Clarke, and Sloane 2002; Sheward et al. 2005). It has also been suggested that inadequate staffing contributes to excessive workloads for nurses such that they fail to deliver necessary care (Martsolf et al. 2016). Such missed

Figure 1: Conceptual Model

care, which can occur during various nurse–patient interactions such as medication management, leads to negative experiences for patients. Accordingly, we advance the following hypothesis:

H1: Higher nurse staffing levels are positively associated with patient experience of care.

Staffing Skill Mix

Researchers have also been interested in whether the quality of patient care is sensitive to the skill mix of the nursing staff as indicated by educational and training credentials such as RN status and academic degrees (Blegen, Vaughn, and Goode 2001; Mark et al. 2004; Clark et al. 2007; Blegen et al. 2011; Kalisch and Lee 2012; Kang 2013; Park et al. 2014). More advanced training for nurses has often been presented as a way to improve patient care (e.g., Blegen et al. 2013). In line with this perspective, several studies have reported a positive relationship between skill mix and patient experience of care (Clark et al. 2007; Tervo-Heikkinen et al. 2008; Kang 2013). By contrast, a study by Martsof et al. (2016) found that for patient experience of care, skill mix was a

much less important variable than staffing level and suggested higher skill mix may possibly have negative effects for certain dimensions of patient experience. Thus, previous findings for the effects of skill mix are not entirely consistent possibly due to differences in study samples and operationalization of the skill mix variable. However, for purposes of the present study, we draw from the larger literature on skill mix to advance the following hypothesis.

H2: A higher staffing skill mix (i.e. a higher percentage of RNs) is positively associated with patient experience of care.

Staffing Flexibility

From a theoretical perspective, we believe staffing flexibility has the potential to have both positive and negative effects on patient experience of hospital care. On the positive side, flexible staffing arrangements may generally promote a better working environment for nurses that can translate into better patient care. That is, while hospitals use staffing flexibility as a strategy to recruit nurses particularly in the presence of nurse staffing shortages, at least some degree of staffing flexibility may also promote better patient care. The majority of nurses today are in the age range where they are caring for children as well as elderly dependents (Bureau of Labor Statistics 2014). Moreover, it is widely recognized that nursing has become more stressful due to high staff vacancy rates, more efficient bed usage, and deteriorating patient behavior (e.g. Adams and Bond 2000; Brooks 2000). As such, part-time employment may be a way for some nurses to cope with stress and burnout while staying in the profession (e.g. Wetzel, Soloshy, and Gallagher 1990). Research suggests that nurses who work part-time experience less pressure in coordinating work, family, and social activities and, in turn, less interference in their nonwork lives (Havlovic, Lau, and Pinfield 2002) as well as higher quality of working life (Wetzel, Soloshy, and Gallagher 1990; Armstrong-Stassen et al. 1998). Moreover, from the perspective of the Person–Environment (P-E) fit theory, which broadly considers the similarity or convergence between a particular set of person-related attributes and a particular set of environment-related attributes (Kristof-Brown, Zimmerman, and Johnson 2005; Zatzick and Zatzick 2013), a better fit between one's actual employment status and preferred employment status will likely result in better job-related performance (Krausz, Sagie, and Bidermann 2000). Accordingly, greater availability of

part-time staffing opportunities might contribute positively to patient experience of care.

However, negative effects from part-time nursing arrangements are also possible due to difficulties in ensuring continuity of care. Although all hospitals face challenges in effectively managing the continuity of patient care, the inclusion of many part-time nursing personnel likely exacerbates these challenges (e.g., Edwards and Robinson 2004). Because a higher proportion of part-time nurses means there will be more patient hand-offs for a given nursing staff, this can negatively impact the overall flow of communication for patient care and clinical collaboration generally (Bowers, Swan, and Koehler 1994; Van Walraven et al. 2010). Further, part-time nurses may compound difficulties of patient hand-offs as they may be somewhat less oriented to all of a hospital's clinical policies than nurses working on a full-time schedule. The continuity of patient care will suffer as a result.

Because nurse staffing flexibility potentially has positive and negative effects, and there is limited empirical evidence addressing which types of effects are more likely to occur, we advance competing hypotheses.

H3a: A higher staffing flexibility (i.e. a higher percentage of part-time nurses to full-time nurses) is positively associated with patient experience of care.

H3b: A higher staffing flexibility (i.e. a higher percentage of part-time nurses to full-time nurses) is negatively associated with patient experience of care.

Multiplicative and Nonlinear Effects

As noted, we were also interested in examining multiplicative and nonlinear effects for nurse staffing variables. Although we do not advance specific hypotheses for such effects, they may occur through multiple pathways. For example, the negative effect of low staffing levels on a nurse's ability to meet patient needs might be exacerbated by a relatively high proportion of part-time nurses due to the communication and coordination issues outlined in hypothesis 3a. Also, increasing staffing levels at an already well-staffed hospital may lead to no further improvements in patient care because nurses already have sufficient time to treat patients. Prior research focusing on clinical outcomes found a nonlinear relationship between nurse staffing levels and mortality (Mark et al. 2004).

METHODS

Research Setting and Data

As a research setting, we focused on U.S. general hospitals. We combined secondary hospital-level data from two sources: the American Hospital Association (AHA) Annual Survey database from which we obtained data on nurse staffing variables, and the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey from which we obtained data for patient experience of care. The HCAHPS survey is conducted by the Centers for Medicare and Medicaid Services (CMS), the federal agency responsible for the Medicare program, and these survey data have been used in prior research focusing on patient experience of care (e.g., Jha et al. 2008; Martsoff et al. 2016). The CMS survey is administered to a random sample of patients who received care from short-term, general hospitals. Hospital-level results are publicly reported on the CMS Hospital Compare website (Centers for Medicare & Medicaid Services 2010).

To promote the comparability of the hospitals in the sample, we excluded hospitals with fewer than 30 full-time equivalent (FTE) nursing staff and fewer than 1,000 patient days per year. We also eliminated hospitals that had outlier values for the nurse staffing pattern and/or control variables. In line with prior research, we specified outlier values for nurse staffing levels as those that were smaller than 1 or greater than 100 nurses per 1,000 adjusted patient days (Martsoff et al. 2016).

We merged the AHA data set for years 2010 through 2012 with the HCAHPS survey data for the same years. The final sample was restricted to hospitals for which we had complete data for the variables presented in the measures section for all 3 years. The final sample was composed of 3,026 individual U.S. hospitals nationwide and a total of 9,078 hospital-year observations.

Measures

Nurse Staffing Patterns. To assess nurse staffing patterns, we examined three different staffing variables that were measured with data from the AHA database: staffing levels, staffing skill mix, and staffing flexibility. The AHA reports full-time equivalent (FTE) nurses for each hospital as well as the numbers of full-time and part-time RNs and LPNs. The AHA defines full-time as working 35 hours or more per week and part-time as working less than 35 hours per week (AHA 1999). These staffing data are reported for the entire hospital as well as those working in ambulatory, long-term care, and ancillary

departments (Spetz et al. 2008). We excluded nursing staff working in nursing home and long-term care units.

We measured *staffing levels* as the number of FTE nurses (RNs and LPNs) per 1,000 adjusted patient days. Adjusted patient days are reported in AHA data and calculated as inpatient days + (inpatient days * outpatient revenue/inpatient revenue). This approach to measure staffing levels is in line with prior research using AHA data and commonly used in the literature as a measurement of hospital-level nurse staffing because the numbers of nurses for each hospital that are assigned to inpatient care units are not known (Jiang, Friedman, and Begun 2006; Jha et al. 2008; Spetz et al. 2008). We measured *staffing skill mix* as the percentage of licensed nursing staff (RNs and LPNs) that are RNs, which accounts for staffing differences in education and training (Jiang, Friedman, and Begun 2006; Martsolf et al. 2016). Referring to prior research, we measured *staffing flexibility* as the percentage of licensed nurses classified as part-time staff (e.g., Michie, and Sheehan 2005).

Patient Experience of Care. The HCAHPS survey comprises 11 measures of patients' experience with hospital care, including seven composite topic measures each composed of two or three individual survey questions. In addition, there are two individual topic measures (Cleanliness of the Hospital Environment and Quietness of the Hospital Environment) and two global measures (Overall Rating and Recommend the Hospital) (Centers for Medicare & Medicaid Services 2014). The Cleanliness and Quietness items as well as the items comprising six of seven composites were measured on a 4-point Likert scale ranging from 1 ("never") to 4 ("always") and are aggregated to the hospital-level. The Discharge Information composite employs yes/no response options. Response options are 0–10 for the Overall Rating (with 0 labeled "worst possible" and 10 labeled "best possible") and definitely no, probably no, probably yes, and definitely yes for the "Recommend to Friends and Family" item. After certain adjustments for patient-level characteristics (e.g., self-rated health) and other factors, all HCAHPS measures are linearly rescaled to a possible range of 0–100 for comparability and are made publicly available through the CMS website (Centers for Medicare & Medicaid Services 2010).

In consideration of our study goals, we focused on the HCAHPS items that are likely to be the most sensitive to nursing care. Specifically, we relied on the composite measures of Nurse Communication, Responsiveness of Hospital Staff, Pain Management, Communication about Medicines, Discharge Information, and Care Transition. A principal component factor analysis revealed that all selected items loaded onto a single factor with loadings

ranging from 0.746 to 0.943 and explaining 73 percent of the total variance. Thus, for each hospital, a single index of perceptions of quality was computed as an average of six composite measures ($\alpha = 0.94$). The selected items are presented in the Appendix SA2.

Control Variables. For our analyses, we accounted for hospital characteristics that have been found to be associated with patient experience of care but are not pertinent to the study's central hypotheses (Jha et al. 2008; Isaac et al. 2010; Park et al. 2015). We obtained data for these characteristics from the AHA survey database and CMS website. We included the CMS case mix index (CMI) to account for differences in the severity of patients' clinical status (Weech-Maldonado et al. 2004; Park et al. 2015). Hospital size (based on number of beds) was included to control for organizational differences in resources and scale as such differences may have implications for patients' experiences of care (e.g., Havlovic, Lau, and Pinfield 2002). Because the ownership type of hospitals has been associated with quality of care (e.g. McKay and Deily 2005), we used a set of indicator variables to account for type of ownership (i.e., investor-owned, public, and nonprofit) with nonprofit as the reference group. We controlled for contract management, that is, whether the hospital's day-to-day management has been outsourced to a management company, which in turn might affect quality of care. Further, we controlled for hospital teaching status (i.e., member of Council of Teaching Hospitals) as this designation may be relevant to quality of care. We also controlled for whether a hospital was affiliated with a multihospital system, defined as two or more hospitals under common ownership. System-affiliated hospitals may have better access to financial and other resources that may influence quality of care. We also included the CMS wage index (WI) to account for differences among hospitals in labor market conditions that may influence hospitals' staffing decisions.

Analytical Approach

The unit of analysis for the study was the hospital, and all analyses were conducted using *STATA* version 12. To test study hypotheses, we estimated regression models using generalized estimating equation (GEE) including Huber–White standard error estimates (i.e., robust sandwich estimators) (Hardin and Hilbe 2003). From a conceptual perspective, a GEE model is particularly suitable if the scientific interest is less in the pattern of change over time of the outcome measures but rather more simply in the dependence of the outcome on

the covariates (Zeger and Liang 1986). In this study, we sought to analyze on a cross-sectional basis all observations in the sample for a certain point of time and test whether the association between the staffing variables and patient experience of care holds for different points of time. As our dependent variable was somewhat skewed, we used log values for the analyses. To test for multiplicative effects, we specified interaction terms for the various combinations of staffing variables. We tested for nonlinear terms by specifying squared terms for each staffing variable.

Sensitivity Analyses

To test the robustness of our study results, we performed two sensitivity analyses. The first analysis was conducted to account for the possibility that unobserved, time-invariant hospital characteristics might bias the relationship between nurse staffing patterns and patient experience of care (Martsolf et al. 2016). Specifically, we re-estimated our analyses performing hospital fixed-effects regression models to account for unobserved, time-invariant hospital characteristics. As a second robustness analysis, we re-estimated the regression models using the composite measure of nurse communication as the only dependent variable, thus excluding the other composite measures that might be also sensitive to the actions of other clinicians, primarily physicians, such as pain management or care transition.

RESULTS

Table 1 presents descriptive statistics for study hospitals for the three-year time frame. The three staffing variables were not correlated above 0.13. None of the control variables were correlated above 0.43.

Table 2 presents the regression results for the relationship between nurse staffing variables and patient experience of care. The staffing variables were log-transformed to facilitate interpretation and can be interpreted as the percentage change in the dependent variable, while all other variables in the model are held constant. With regard to *staffing levels*, a higher staffing level, as measured by FTE nurses per 1,000 adjusted patient days, was positively and significantly associated with patient experience. Thus, H1 is supported. With regard to *skill mix*, a higher skill mix, as measured by the percentage of RNs to licensed nursing staff, was positively and significantly associated with patient experience. Thus, H2 is supported. With regard to *staffing flexibility* (H3),

Table 1: Descriptive Statistics for Study Variables ($n = 9078$ Hospital-Year Observation)

<i>Variables</i>	<i>Mean (or Frequency For Dichotomous Variables)</i>	<i>SD</i>
Patient experience of care	70.52	4.53
Staffing patterns		
Staffing level	4.04	1.87
Staffing flexibility (in %)	31.14	17.12
Staffing skill mix (in %)	89.15	10.01
Control variables		
Size	174.89	123.04
System affiliation (in %)	58.61	
Contract managed (in %)	15.50	
Teaching status (in %)	5.81	
Investor-owned hospital (in %)	17.21	
Public hospital (in %)	20.09	
Nonprofit hospital (in %)	62.70	
Case Mix Index	1.44	0.31
Wage Index	0.98	0.18

greater flexibility, as measured by the percentage of part-time nurses to full-time nurses, was positively and significantly associated with patient experience. Thus, our results support H3a, and H3b is rejected. Comparing effect sizes of the three different staffing variables, staffing flexibility had the strongest association with patient experience. Among control variables, teaching status was positively and significantly associated with patient experience. By

Table 2: Regression Results for GEE Models ($n_{\text{per year}} = 3026$)

<i>Variable</i>	<i>Estimate</i>	<i>SE</i>
Staffing patterns		
Log Staffing level	0.383***	0.001
Log Staffing skill mix	0.301***	0.012
Log Staffing flexibility	1.956***	0.005
Control variables		
Size	-0.002***	0.001
System affiliation	-0.003*	0.002
Contract managed	0.002	0.003
Teaching status	0.007*	0.003
Investor-owned hospital	-0.012***	0.003
Public hospital	-0.005*	0.002
Case Mix Index	0.011	0.005
Wage Index	-0.023***	0.007

Note. SE, Standard Errors.

* $p < .05$, *** $p < .001$.

contrast, wage index, system affiliation, and hospital size were negatively and significantly associated with patient experience. Public hospitals and investor-owned hospitals had lower patient experience scores compared to their non-profit counterparts.

Table 3 presents results from the models testing for multiplicative and nonlinear effects. To facilitate interpretation of the interaction and squared terms, we mean-centered each staffing variable. We found significant two-way interactions for all three staffing variables. Figure 2 displays the simple slopes for these effects using low and high values for the staffing variables (one standard deviation below and above the mean). The diamonds (squares) indicate a low (high) level of both staffing pattern variables. The relationship between staffing levels and patient experience of care was stronger in the presence of higher staffing flexibility (Plot 1 Figure 2). Similarly, the relationship between staffing levels and patient experience of care was stronger in the presence of

Table 3: Regression Results for Nonlinear and Multiplicative Effects ($n_{\text{per year}} = 3,026$)

Variable	Nonlinear Effects		Interaction Effects	
	Estimate	SE	Estimate	SE
Staffing patterns				
Log Staffing level	0.041*	0.005	0.042**	0.003
Log Staffing skill mix	0.067*	0.014	0.066*	0.012
Log Staffing flexibility	1.127*	0.007	1.147*	0.005
Quadratic terms				
Log Staffing level squared	−0.012**	0.001		
Log Staffing skill mix squared	−0.071*	0.008		
Log Staffing flexibility squared	−0.021	0.004		
Interaction effects				
Log Staffing level x Staffing flexibility			0.041*	0.003
Log Staffing flexibility x Skill mix			0.180**	0.006
Log Staffing level x Staffing skill mix			0.098*	0.007
Control variables				
Size	−0.002	0.001	−0.002***	0.001
System affiliation	−0.003*	0.002	−0.003*	0.002
Contract managed	0.001	0.004	0.002	0.003
Teaching status	0.002*	0.001	0.007*	0.002
Investor-owned hospital	−0.011***	0.002	−0.012***	0.002
Public hospital	−0.006*	0.003	−0.007*	0.002
Case Mix Index	0.011*	0.004	0.011	0.005
Wage Index	−0.027***	0.002	−0.023***	0.002

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

higher skill mix (Plot 2 Figure 2). Finally, the relationship between staffing flexibility and patient experience of care was stronger in the presence of higher skill mix (Plot 3 Figure 2).

Figure 2: Interaction Plots of Multiplicative Effects

We also found significant nonlinear effects for staffing levels indicating diminishing returns for nurse staffing levels. Specifically, we found gains in patient experience of care from increases in staffing levels up to approximately 3.42 nurses per 1,000 adjusted patient days. In addition, we found a nonlinear effect for skill mix indicating diminishing returns. We observed gains in patient experience of care from increases in skill mix up to approximately a 95 percent.

With respect to the sensitivity analyses, after re-estimating our models using a hospital fixed-effects specification, only the positive effect of staffing flexibility remained significant. We found relatively little difference between 2010, 2011, and 2012 in average nurse staffing pattern variables. Over time variation for staffing pattern variables was 0.45 FTE nurses per 1,000 patient days (staffing levels), 3.02 percent for the percentage of all nurses who were part-time nurses (staffing flexibility), and 2.82 percent for the percentage of all nurses who were registered nurses (staffing skill mix).

In the models testing multiplicative and nonlinear effects, the two-way interaction effects remained stable in terms of significance and direction. Also, the nonlinear effects for staffing levels and skill mix both remained significant. Results from the other sensitivity analysis indicate that the signs of the relevant coefficients did not change when we re-estimated the models using nurse communication as the only dependent variable, thus indicating the robustness of the results.

DISCUSSION

Overall, our study findings suggest that nurse staffing patterns have some influence on patient experience of care. Study findings for nurse staffing levels and skill mix are consistent with many previous studies indicating that higher staffing levels and higher skill mix are associated with better quality of patient care (Needleman et al. 2002; Jha et al. 2008; Blegen et al. 2011). However, consistent with Martsolf et al. (2016), the results of our study also suggest that to some degree unobserved hospital characteristics may underlie the relationship between these nurse staffing variables and patient experience of care. Neither staffing levels nor skill mix was significantly associated with patient experience of care when hospital fixed effects were included in the analyses. As such, further research is needed to enhance our understanding of the hospital characteristics that are associated with nurse staffing patterns but also contribute to better patient experience of care.

Staffing flexibility proved to be the most important nurse staffing variable in our study. In contrast to the other two staffing variables, the effect of staffing flexibility on patient experience remained significant after controlling for unobserved hospital characteristics (i.e., fixed-effects model). This staffing variable also had the largest effect sizes. While we believe theoretically that part-time staffing has the potential for both positive and negative effects for patient experience of care, our results line up with positive effects. While part-time employment for nurse staffing offers hospitals advantages in terms of nurse recruitment and possibly reduced labor costs, it may also offer advantages for the quality of patient care possibly because such arrangements contribute to a more positive work environment for nurses (e.g., Kutney-Lee et al. 2009).

This finding is in line with prior research at the nurse level of analysis, which found that part-time nurses reported providing higher quality service to patients, liked their present work schedules more, and experienced less interference between their work and nonwork activities (Havlovic, Lau, and Pinfield 2002).

Study results also revealed multiplicative and nonlinear effects for nurse staffing variables. We found that staffing levels, skill mix, and staffing flexibility interact in ways that seemingly affect how nurses perform their work. As such, hospital managers need to carefully consider that adjustments to one staffing variable may amplify the effects of other staffing variables for patient experience of care. Also, we found that some hospitals have staffing levels and skill mix ratios that are already at points of diminishing returns suggesting that their future investments in human resources should be made elsewhere.

The results of our study should be considered in light of three key limitations. One limitation pertains to the measurement of nurse staffing patterns with aggregate hospital-level data. Such aggregate measures cannot fully account for differences among hospital nursing units in workload and inpatient activity even with adjustments for the proportion of hospital revenue from inpatient settings (Spetz et al. 2008). Further, the use of aggregate data may have masked important differences among hospitals that potentially should be taken into account. In particular, we were unable to account for specific clinical activities at the patient-care unit level such as patient hand-offs/ward transfers, which, as noted, present challenges for hospitals regarding patient experience of care including nurse–patient communication.

A second limitation relates to the measure of staffing levels, that is, the ratio of FTE nurses per 1,000 adjusted patient days. The measure of FTE

nurses calculated and reported in the AHA data potentially over- or underestimates the use of nursing staff. This is because FTE is computed by adding together all full-time and all part-time personnel where all full-time personnel are counted as 1 FTE and all part-time personnel are counted as 0.5 FTE regardless of how many hours per week they work (American Hospital Association 1999). Thus, a nurse who works 10 hours per week and a nurse who works 34 hours per week would each be counted as one-half of an FTE, while a nurse who works 35 hours per week and a nurse who works 40 hours per week would each count as one FTE (Spetz et al. 2008). As we cannot overcome this issue given the nature of the AHA data set, further research should be conducted with microlevel data sets to test our research hypotheses and to assess the robustness of our findings.

Third, we lacked information from our AHA data set to construct a measure of nursing skill mix that included nursing assistants. Taking into account that nursing assistants can provide a substantial amount of the nursing care in nonintensive care units with delegation and oversight by an RN, future research should attempt to replicate our findings with a measure of skill mix that includes nursing assistants. Finally, due to restrictions in our data set, we assumed part-time nurses are a single, undifferentiated group. However, some studies have considered the diversity of the part-time workforce, particularly in terms of participation in other work and nonwork roles (Martin and Sinclair 2007). Thus, further research could extend our study by analyzing whether and how different types of part-time nurses may differ from one another and whether these differences are associated with patient experience of care. Also, prior research indicates that, demographically, part-time nurses are in many ways distinct from their full-time counterparts. Part-time nurses are typically older in age and more experienced in the nursing profession (e.g., Wetzel, Soloshy, and Gallagher 1990). Because we were unable to control for age or experience for hospital nurses, the positive effect we observed for staffing flexibility might be due to the fact that part-time nurses typically have more job experience.

These limitations notwithstanding, our study offers evidence that nurse staffing patterns are an important consideration for hospital managers in terms of patient experience of care. At least some types of nurse staffing variables seem to matter and to some degree may be interdependent in relation to patient experience of care. Future research will hopefully shed more light on how managers can most effectively use the level, skill mix, and flexibility of their nurse staffing patterns to achieve the highest quality of care possible for patients. To date, with respect to nurse staffing, the focus of public

policy has been on staffing levels (e.g., minimum staffing ratios). The results of this study also point to the importance of staffing flexibility at least with respect to patient experience of care. Thus, we hope future policy and research initiatives will give serious consideration to this dimension of nurse staffing.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the supporting information tab for this article:

Appendix SA1: Author Matrix.

Appendix SA2: HCAHPS Survey Items Used to Measure Patient Experience of Care.