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Quality of Care and Patient Satisfaction in Hospitals With High Concentrations of Black Patients

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Abstract

Purpose—To examine the influence of nursing– specifically nurse staffing and the nurse work environment– on quality of care and patient satisfaction in hospitals with varying concentrations of Black patients.

Design—Cross-sectional secondary analysis of 2006–2007 nurse survey data collected across four states (Florida, Pennsylvania, New Jersey, and California), the Hospital Consumer Assessment of Healthcare Providers and Systems survey, and administrative data. Global analysis of variance and linear regression models were used to examine the association between the concentration of Black patients on quality measures (readiness for discharge, patient or family complaints, health care–associated infections) and patient satisfaction, before and after accounting for nursing and hospital characteristics.

Results—Nurses working in hospitals with higher concentrations of Blacks reported poorer confidence in patients' readiness for discharge and more frequent complaints and infections. Patients treated in hospitals with higher concentrations of Blacks were less satisfied with their care. In the fully adjusted regression models for quality and patient satisfaction outcomes, the effects associated with the concentration of Blacks were explained in part by nursing and structural hospital characteristics.

Conclusions—This study demonstrates a relationship between nursing, structural hospital characteristics, quality of care, and patient satisfaction in hospitals with high concentrations of Black patients.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Supplemental Table 1. Distributions of Nurse-Assessed and HCAHPS Outcomes by Concentration of Black Patients in Hospitals

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Clinical Relevance—Consideration of nursing factors, in addition to other important hospital characteristics, is critical to understanding and improving quality of care and patient satisfaction in minority-serving hospitals.

Keywords

Health disparities; nursing; Blacks; patient satisfaction; quality

Racial and ethnic minorities in the United States, especially Blacks, experience persistent disparities in the quality of care they receive, specifically in acute care settings (Regenbogen, Gwande, Lipsitz, Greenberg, & Jha, 2009). Black patients suffer higher operative mortality (Lucas, Stukel, Morris, Siewers, & Birkmeyer, 2006) and greater rates of complications, such as sepsis (Martin, Mannino, Eaton, & Moss, 2003), and are more likely to express lower satisfaction with healthcare services and providers (LaVeist, Nickerson, & Bowie 2000). While the mechanisms underlying these differences are multifaceted, hospital-based disparities have been linked to complex interactions at the provider level and to variations at the sites where minorities receive care (Bach, 2005; Institute of Medicine, 2003).

The growing number of studies that have examined the relationship between the organization of care in hospitals and disparities in patient outcomes have centered either on the roles of physicians (Saha, Arbelaez, & Cooper, 2003) or on structural components of hospitals, such as volume (Hasnain-Wynia et al., 2007; Liu et al., 2006). The increased focus on the association between organizational aspects of care and disparities has failed, however, to consider the role of nurses despite their principal role in the provision of direct patient care. Over the past decade, the quality of nurses' working conditions, including the presence of resources to provide quality care, collegial nurse-physician relationships, and support provided by nurse managers and administrators, as well as nurse staffing levels, have been linked to lower mortality rates (Aiken, Clarke, Sloane, Lake, & Cheney, 2008) and to higher ratings of overall satisfaction among patients in hospitals (Kutney-Lee et al., 2009).

While research linking nursing to high-quality health care is growing, little is known about the influence of nursing on minority patient outcomes, and no studies have examined this association across hospitals with varying concentrations of Black patients. To fill this void, this study used data from a nurse survey conducted across four large states in 2006–2007 to compare nurses' reports of the quality of care delivered in hospitals with differing concentrations of Black patients. In addition, data from the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey were used to study the relationship between patient satisfaction ratings and the concentration of Black patients in hospitals. In addition to examining these relationships in the aggregate using simple bivariate methods, we used multivariate models to assess whether the relationships were independent of other hospital and nursing characteristics, and whether they were due in part to differences in the nurse work environments and nurse staffing levels in hospitals with varying concentrations of Black patients.

Conceptual Framework

This study was guided by the Quality Health Outcomes Model (QHOM; Mitchell, Ferketich, Jennings, 1998). The model is frequently used to guide evaluations of the relationships between nursing characteristics such as the practice environment, adequate nurse staffing (Aiken et al., 2008), and patient outcomes (Mitchell & Lang, 2004). According to the QHOM model, hospital characteristics include items such as bed size, teaching status, and

technology. Nursing characteristics, on the other hand, include features of the nursing profession such as staffing, nurse education, and the practice environment. According to our guiding framework, nursing characteristics are embedded within hospital structures and are hence viewed as distinct features of the hospital system. In this view, while hospital characteristics are not modifiable, we contend that many aspects of nursing are.

Methods

Sample/Setting

This study included all adult nonfederal acute care hospitals in California, Pennsylvania, New Jersey, and Florida that (a) had nurse survey responses from the University of Pennsylvania Multi-State Nursing Outcomes study, (b) reported patient discharge data to state agencies, (c) responded to the American Hospital Association (AHA) Annual Survey, and (d) had a Medicare Case Mix Index (CMI) reported in the inpatient provider-specific file. From the resulting set of 568 hospitals, 429 reported HCAHPS data between October 2006 and June 2007. HCAHPS data are publicly available on the Hospital Compare website (www.hospitalcompare.hhs.gov).

Patient discharge data from 2006 to 2007 were obtained from respective state offices, including California's Office of Statewide Health Planning and Development, Florida's Agency for Health Care Administration, New Jersey Department of Health and Senior Service, and the Pennsylvania Health Care Cost Containment Council. These state agencies collect administrative claims data for all inpatient hospital discharges within their respective states.

Nursing data were collected in 2006–2007 through a mail survey conducted of large samples of registered nurses in California, Pennsylvania, New Jersey, and Florida. The methodology associated with the nurse survey is described elsewhere (Aiken et al., 2010). The use of surveys sent directly to nurses' homes significantly reduced the potential for response bias at the hospital level, particularly if the data were sought from hospital administrators whose views of nursing and quality of care in their respective institutions might jeopardize the validity of the study. The survey included questions about the nurse work environment and staffing levels in the nurse's employing hospital. Nurses were also asked specific questions about the occurrence of adverse events, including hospital-acquired infections (HAIs) and patient or family complaints. Nurses were asked to identify their employer and were assured confidentiality. The study was reviewed and approved by the Institutional Review Board of the University of Pennsylvania. The response rate was 36% (approximately 98,000 nurses) and represents the largest survey of nurses to date. Similar large (> 1,000) mail surveys of physicians have on average achieved 52% response rates (Cummings, Savitz, & Konrad, 2001). The final sample for this analysis consisted of 26,186 staff nurses working in direct patient care. An average of 46 nurses in each study hospital responded to the survey, with a range of 10 to 282 nurses.

Measures

Concentration of black patients—The percentage of Black patients in each hospital was calculated from the patient discharge data from the four states. We selected patients with the same medical, surgical, and maternity diagnosis-related groups (DRGs) used for HCAHPS sampling (Centers for Medicare & Medicaid Services [CMS], 2011a) and determined the percentage of Black patients in each hospital. The percentage of Black patients in the hospital was divided into three groups based on the distribution across study hospitals. The lowest group included hospitals where the percentage of patients was less than 11% (below the mean) Black. The middle group ranged from 11% to 23% (between the

mean and one standard deviation above the mean) Black. Finally, the highest group included hospitals where greater than 23% (more than one standard deviation above the mean) of the patients were Black. We conducted several sensitivity analyses that used several different variations of the percentage of Black patients in the hospital, including continuous measures, dichotomies, terciles, and deciles. Bivariate and multivariate analyses using these different measures produced roughly similar results.

Nursing characteristics—The nurse work environment was measured by the Practice Environment Scale of the Nursing Work Index (PES-NWI). The PES-NWI is a psychometrically sound instrument composed of five subscales that measures aspects of the nurse work environment, including the presence of adequate support to provide quality care, collegial nurse-physician relationships, nurse manager leadership ability, and nurse participation in hospital affairs (Lake, 2002). One subscale (Staffing and Resource Adequacy) was excluded due to its high correlation with the nurse staffing measure used in our multivariate analyses. To classify hospitals based on their work environments, nurses' individual responses were aggregated to the hospital level. The reliability of the four subscales at the hospital level was assessed using the intraclass correlation coefficient (ICC[1,k]). The ICC(1,k) values met the minimum criterion of 0.60 (Glick, 1985) and ranged from 0.73 for the collegial nurse-physician relations subscale to 0.90 for the participation in hospital affairs subscale. The median for the hospital sample was calculated for each subscale, and hospitals were classified into three groups according the number of subscales in each hospital that were above the median. Hospitals with 0, 1–2-3, and 4 subscales above the median were classified as having "poor," "mixed," and "better" work environments, respectively. Nurse staffing was measured as the average nurse workload in the hospital. On the nurse survey, nurses were asked how many patients they cared for on their last shift. Responses from nurses that reported caring for at least 1 but not more than 20 patients were used in estimating the average workload in the different hospitals. The ICC(1,k) across hospitals for the nurse staffing measure was acceptable at 0.78.

Hospital characteristics—Structural hospital characteristics were obtained from the AHA Annual Survey and included size, high technology status, teaching status, ownership, and core-based statistical area (CBSA), a census-based measure of population density defined by the Office of Management and Budget. In addition, Medicare Case Mix Index (the average DRG weight for Medicare patients in the hospital) was obtained from the inpatient provider-specific file (CMS, 2011b).

Outcomes—Nurse-assessed quality of care was measured by four questions from the nurse survey. Nurses were asked how confident they were in patients' ability to manage their care when discharged. Nurses responded on a 4-point Likert-type scale ranging from "not at all confident" to "very confident." For ease of interpretation, the percentage of nurses who were not confident (not at all confident- somewhat confident) was used as the outcome in the analysis. Nurses were also asked to provide the relative frequency of HAIs (including central line–associated bloodstream infections and ventilator-associated pneumonia) and complaints from patients or their families. For these items, nurses responded on a 7-point ordinal scale ranging from "never" to "every day." Based on the distribution of nurse responses, events were considered "frequent" if they occurred more than once a month. The ICC(1,k) across hospitals for the outcome measures ranged from 0.50 (frequent patient or family complaints) to 0.61 (confidence in patients' ability to manage care when discharged). While these values are modest, past research has shown that nurse reports of the relative frequency of adverse events (Gerolamo, 2008; Olds, 2010) and patient conditions (Justice, Aiken, Smith, & Turner, 1996) are accurate and reliable, including those for HAIs (Olds, 2010).

The HCAHPS instrument is composed of 27 items and is randomly given to medical, surgical, and maternity patients after discharge. Prior to public reporting on the *Hospital Compare* website, results are aggregated to hospital-level percentages. In addition, percentages are risk adjusted for patient characteristics and for factors related to the administration of the survey (Department of Health and Human Services, 2011). For the purposes of this study, we chose four measures closely related to nursing care, including three composite items related to communication with nurses, responsiveness of staff, and adequacy of discharge information, and one global measure of satisfaction that measured patients' willingness to recommend the hospital to friends and family.

Data Analysis

We descriptively examined hospital and nursing characteristics for all study hospitals with differing concentrations of Black patients. We explored similarly the distribution of the nurse-assessed quality and HCAHPS outcomes across hospitals with lower and higher percentages of Black patients. Global analyses of variance, as well as a series of post-hoc Bonferroni tests, were performed to detect statistically significant differences between hospitals with the lowest, middle, and highest Black patient concentrations. We then used ordinary least squares regression models to examine the association between the percentage of Black patients in the hospital and two sets of outcomes– nurse-assessed quality and HCAHPS ratings– at the hospital level. Four models were constructed for each set of outcomes: (a) unadjusted models, (b) partially adjusted models controlling for nursing characteristics, (c) partially adjusted models controlling for hospital characteristics, and (d) fully adjusted models that accounted for nursing and hospital characteristics, as well as state. Nurse-assessed quality outcome models included controls for hospital size, technology status, and teaching status. In addition, Medicare CMI was included to control for the relative severity of illness of the hospital's patient population. Hospital size, teaching status, CBSA, and ownership were included in the modeling of HCAHPS outcomes. These characteristics were associated with hospitals' participation in HCAHPS during 2006–2007 while data collection was still voluntary (Goldstein, 2008). The HCAHPS models were additionally adjusted for patient response rate. In all of our tests, *p* values of .05 or lower were considered statistically significant.

Results

The distribution of the percentage of Black patients across our study hospitals is unimodal and positively skewed, with a median of 6.0%, mean of 10.5%, and a standard deviation of 13.0. These numbers are consistent with the average percentage of Black patients admitted to hospitals each year in the United States (National Center for Health Statistics, 2010).

Table 1 shows the nursing and hospital characteristics of our study hospitals, first across all hospitals and then across the three categories of hospitals defined by the percentage of Black patients. The average workload across all hospitals was roughly five patients per nurse. Approximately equal percentages of hospitals were classified as having poor (26%) and better (27%) work environments. There were no statistically significant differences in nurse staffing ratios and nurse work environments across the hospitals with differing percentages of Black patients. Hospitals with the highest percentages of Black patients were significantly more likely to be large, urban, teaching hospitals ($p < .001$ in all cases).

We also descriptively examined differences in nurse-assessed and HCAHPS outcomes across hospitals with differing percentages of Black patients (see supplemental Table available online, see directions at end of article). There were significant differences across hospitals with higher and lower concentrations of Black patients in every outcome we considered.

Table 2 presents the results of using ordinary least squares regression models to estimate the association between the concentration of Blacks, nurse staffing, work environment, and nurse-assessed quality outcomes. In the unadjusted models, the percentage of Black patients in the hospital was a statistically significant predictor of each outcome. For example, the percentage of nurses who were not confident that patients could manage their care upon discharge was over 7 points higher in hospitals with the highest percentage of Blacks (>23%) as compared to those hospitals with the lowest percentage of Black patients (<11%).

In the first set of partially adjusted models that controlled only for nursing characteristics, nurses working in hospitals with the highest percentage of Black patients continued to report poorer confidence in patients' ability to manage their care upon discharge and more frequent adverse events. Controlling for nurse staffing and the nurse work environment, however, appeared to slightly attenuate the coefficients associated with high concentrations of Black patients. The second set of partially adjusted models accounted for structural hospital characteristics. After controlling for structural hospital characteristics, the effect associated with the percentage of Black patients in the hospital was markedly attenuated in size for three of the four outcomes. The coefficient associated with the high concentration of Black patients became statistically insignificant in the case of frequent patient or family complaints.

In the fully adjusted model, the concentration of Blacks remained a significant and strong predictor of the nurses' confidence in patients' management of care after discharge and frequent adverse events. In the HAI models, we observed that the coefficients associated with the concentration of Blacks were lessened the most by controlling for nursing staffing, work environment, and hospital characteristics simultaneously. Nurse staffing was significant ($p < .001$) for three of the four outcomes (poor confidence in ability to manage care after discharge, frequent patient/family complaints, and ventilator-associated pneumonia), and in all cases, higher workloads were associated with more nurses reporting poorer quality. Nurses working in better work environments reported more confidence in patients' readiness for discharge and less frequent complaints and adverse events, net of the effects of the concentration of Blacks and nurse staffing.

Table 3 displays the regression models for the HCAHPS measures. In the unadjusted models for all four outcomes, the concentration of Black patients in the hospital was a significant predictor of lower satisfaction scores. In the models adjusting for nursing characteristics, the concentration of Black patients remained a significant predictor, but the effect was attenuated in three of the four outcomes. In the model that accounted only for hospital characteristics, the effect of being in a hospital with a higher concentration of Black patients was again lessened in three of the four HCAHPS outcomes and became statistically insignificant for "staff gave patients discharge information." In the fully adjusted model that took nursing and hospital characteristics into account, as well as the hospital's state and patient response rate, the racial concentration effect became insignificant in all HCAHPS outcomes except the global "definitely recommend" measure. The work environment was a strong predictor of the other three HCAHPS measures in the fully adjusted models, while nurse staffing was predictive of staff giving patients discharge information.

In the fully adjusted model, the proportion of patients who would definitely recommend the hospital was over 2% lower in hospitals where 11% to 23% of the patient population was Black, as compared to hospitals with less than 11% Black patients. In this same model, as a nurse's average workload in a hospital increased by one patient, the proportion of patients who would definitely recommend the hospital decreased by approximately 1.5%. Finally, the proportion of patients who would definitely recommend the hospital increased by approximately 4% in hospitals that had mixed environments as compared to poor (or better

as compared to mixed). This finding would translate into an increase of 8% in the proportion of patients who would definitely recommend the hospital if a "poor" work environment was improved to be "better." We have transformed the estimates for this outcome into percentiles to demonstrate the relative magnitude of the effects across the range of values taken by the factors we are investigating. Consider, for example, the percentage of patients who would definitely recommend their hospital, which has a standard deviation in this sample of 9.8. If hospitals were to improve their work environments from poor to good and reduce nurses' workloads by an average of one patient per nurse, their patients' satisfaction would shift from the 50th to the 84th percentile of all hospitals.

Discussion

To our knowledge, this is the first study to demonstrate relationships between the organization of nursing care, nurse-assessed quality measures, and patient satisfaction in hospitals with high concentrations of Black patients. We use two independent sources of patient outcomes data– a survey of nurse-assessed adverse events and a survey of patients' satisfaction– to explore differences in quality between hospitals with low and high concentrations of Black patients. Findings from both assessments demonstrate a link between patient outcomes, the hospitals where minorities receive care, and the importance of nursing within these institutions.

As "front line" providers of care in hospital settings, nurses' assessments of quality vis-à-vis their reports of adverse events serve as a critical lens into the nature of patient care service. The quality data presented in this study reveal that nurses employed in hospitals with large concentrations of Black patients were much less confident of their patients' ability to manage their care after discharge, and were more apt to report frequent complaints and HAIs, particularly those acquired in intensive care settings. HCAHPS data revealed a similar pattern of lower patient reports of satisfaction in hospitals with higher concentrations of Black patients. Disparities in patient satisfaction and nurse-assessed quality were explained in part by the nurse work environment and nurse staffing across our hospital sample. These results are consistent with previous studies, which document strong associations between nursing organization and quality of care (Aiken et al., 2008) and patient satisfaction (Kutney-Lee et al., 2009). Our findings add to this literature but suggest that attention must be directed to improve quality of care disparities through more comprehensive examinations of the organization of nursing in acute settings.

We note that nursing influences alone did not moderate patient satisfaction and quality reports. Across all of our models, concentration of Black patients was a significant predictor of poor satisfaction and nurse-assessed outcomes. Much of this difference, however, was diminished after accounting for differences in structural hospital characteristics. Within our data, Black patients were most likely to receive care in large, urban, teaching hospitals. While it is yet unclear how these institutional characteristics directly influence disparities, our findings suggest that differences in quality outcomes may be due to differences in care setting or geographical location. This finding is consistent with other research noting that higher proportions of minority patients receive care in particular settings. Earlier work by Birkmeyer et al. (2003) found that the volume of procedures performed at a particular hospital was inversely related to the percentage of Black patients treated at that hospital, and concluded that Blacks received their care to some extent in lower quality hospitals than Whites. Similarly, Chandra and Skinner (2003) evaluated sites of care for Blacks and Whites experiencing myocardial infarction in order to see if differences could be explained by differences in treating physicians. They examined Medicare beneficiaries and found that 50% of Black care occurred in a subset of hospitals in which only 14% of non-Blacks received their care. The consensus from these studies and others suggests that Blacks and

Whites receive their care to a great extent from a different set of providers and in different settings (Gray, Schlesinger, Siegfried, & Horwitz, 2009; Regenbogen et al., 2009). The findings of these studies equally affirm the hypothesis that differences in sites of care are linked to disparities in clinical care quality (Bach, 2005). Our findings add to this thesis but underscore the importance of evaluating both the specific structural features of hospitals where Blacks receive care as well the quality of nursing care embedded within these institutions.

The findings from both the nurses and the HCAHPS survey suggest that the quality of care patients receive and patients' perceptions of care across hospital settings are influenced by the overlapping effects of nursing care and the structural characteristics of hospitals that care for large numbers of Black patients. Though disparities clearly persisted in some quality measures even when accounting for both nursing and hospital characteristics, our findings represent an important first step. To date, few studies have directly focused on the combined influence of nursing care and hospital characteristics on minority patient outcomes. Our results, however, suggest good reason for doing so. Because a relatively small number of hospitals disproportionately treat a large number of Black patients (Skinner, Chandra, Staiger, Lee, & McClellan, 2005), interventions targeting nursing capacity at these hospitals have the potential to reduce racial disparities in these acute care settings. By this we do not discount the impact of the hospital characteristics, which were clearly significant in our predictive models. These characteristics are, however, time invariant and not easily amenable to change. Nevertheless, hospital administrators do have multiple options through which to improve nursing capacity, including strengthening the nurse work environment (Aiken et al., 2008). Hence, if disparities in outcomes are to be addressed further, attention must be afforded to the deeper underlying problems of resource adequacy and professional practice environments within institutions where large numbers of Blacks are hospitalized. Disentangling hospital effects from those of nursing is an important next step in efforts to understand and ameliorate health disparities.

Limitations

We noted several limitations to our study. Currently, HCAHPS data are only publicly available to researchers at the hospital level. Therefore, we were only able to examine overall patient satisfaction in hospitals by proportion of Black patients as determined by state hospital discharge data. Individual level data would have allowed us to examine within-hospital disparities. It is difficult to comment on the clinical magnitude of our findings related to the HCAHPS measures. Small effect sizes are not uncommon when working with aggregated data, such as HCAHPS, where a significant amount of the true variation in the measures is lost. Despite this limitation, we noted consistent and statistically significant results across measures. In some hospitals, even the smallest percentage differences in satisfaction may potentially represent hundreds of dissatisfied patients. Beginning in October 2012, performance on the HCAHPS will be linked to a hospital's reimbursements by the CMS (2011c). Even small differences in patient satisfaction scores could impact a hospital's fiscal bottom line. This study reinforces the value of nursing from both an organizational and patient care perspective.

We found little difference in the structural characteristics of nurse survey hospitals that did and did not participate in HCAHPS; however, hospitals that did not participate in the initial reporting of HCAHPS had poorer nurse staffing and served larger percentages of Black patients. To the extent that hospital reporting bias affects our estimates, it is likely that patient satisfaction in hospitals with high concentrations of Blacks is underestimated. The diverse states in our sample (both in geography as well as the race or ethnicity of their populations) provide a fair portrayal of hospitals across the country. While some studies

have demonstrated a link between patient–provider racial concordance (Meghani et al., 2009), we were unable to determine the influence of provider race on our studied outcomes due to small numbers of minority nurses in our sample.

The findings related to the nurse outcomes examined in this study should be interpreted with some caution. Although the ICC(1,k) falls slightly below the usual "rule-of-thumb" criterion of 0.6 for three of the four outcomes, we remain confident in our findings. These findings may be due to the fact that we use ratings from nurses across all units in a hospital for our analyses. We chose to use the reports given by all nurses in a hospital, rather than restrict to nurses in a particular unit, because patients are cared for by nurses in multiple units throughout their hospital stay. Finally, the cross-sectional design of the study limits our ability to assign causality to the relationships we observe.

Conclusions

Recent studies on racial disparities have demonstrated that differences in outcomes are related to structural feature variations of the sites where minorities receive care (Gray et al., 2009; Skinner et al., 2005). Our findings extend the focus on the structural characteristics of institutions serving high proportions of minority patients and offer a new contribution through the additional examination of the largest provider of direct inpatient services in acute care settings– registered nurses. Through an in-depth analysis of the interplay between minority patient outcomes and sites of care, this study has uncovered some of the specific nursing characteristics that affect quality of care in hospitals with large concentrations of Black patients. Health disparities are not unique to the United States. Every country has marginalized populations with special healthcare needs (Marmot, Friel, Bell, Houweling & Taylor, 2008). In the United States, racial minorities and particularly Blacks constitute the largest number of people whose access to care and quality of care appear to be at risk of compromise. Nurses in all countries will find this topic useful as they provide care to patients across a range of diverse backgrounds and cultures. These results suggest that a promising strategy for reducing disparities in hospital outcomes may be to make further investments into research studies that explore nursing contributions to the quality of care in minority-serving hospitals nationally and internationally.

Clinical Resources

- U.S. Department of Health and Human Services, Hospital Compare. http://www.hospitalcompare.hhs.gov
- National Quality Forum Performance Measures. http://www.qualityforum.org/Measures_List.aspx#

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Distribution of Hospital Characteristics by Concentration of Black Patients in Hospitals

	Concentration of Black Patients in Hospitals				
	All (*n* = 568)	**<11% *N* = 393**	**11–23% *N* = 112**	**>23% *N* = 63**	***P****
Nurse characteristics					
Nurse staffing, mean (SD)	;5.0(1.1)	5.0(1.1)	4.9(1.0)	4.9(1.0)	.39
Nurse work environment, no. (%)					.62
Poor	146(25.7)	97(24.7)	31(27.7)	18(28.6)	
Mixed	271(47.7)	184(46.8)	55(49.1)	32(50.8)	
Better	151(26.6)	11 2(28.5)	26(23.2)	13(20.6)	
Hospital characteristics					
Bed size, no. (%)					<.001
≤ 100 beds	63(11.1)	59(15.0)	3(2.7)	1 (1.6)	
101–250 beds	251 (44.2)	188(47.8)	43(38.4)	20(31.8)	
>250 beds	254(44.7)	146(37.2)	66(58.9)	42(66.7)	
Technology status					.08
High	253(44.5)	163(41.5)	56(50.0)	34(54.0)	
Teaching status, no. (%)					<.001
None	285(50.2)	225(57.3)	44(39.3)	16(25.4)	
Minor	238(41.9)	151(38.4)	55(49.1)	32(50.8)	
Major	45(7.9)	17(4.3)	13(11.6)	15(23.8)	
Core based statistical area, no. (%)					
Division	235(41.4)	122(31.0)	64(57.1)	49(77.8)	<.001
Metro	280(49.3)	219(55.7)	47(42.0)	14(22.2)	
Micro	45(7.9)	44(11.2)	1(0.9)	0	
Rural	8(1.4)	8(2.0)	0	0	
Ownership, no. (%)					.15
Government	53(9.3)	29(7.4)	15(13.4)	9(14.3)	
Non-profit	408(71.8)	290(73.8)	78(69.6)	40(63.5)	
For-profit	107(18.8)	74(18.8)	19(17.0)	14(22.2)	

* P-values generated from analysis of variance for staffing variable. P-values generated from chi-squares, except where cell counts less than 5 where Fisher's exact test was used.

Table 2

Effects of Concentration of Black Patients in Hospitals, Nurse Staffing and Nurse Work Environment on Nurse-Reported Quality Outcomes (n = 568)

Nurse-reported quality outcome (% of nurses that reported:)	Unadjusted parameter estimate	*P*	Partially adjusted for nursing characteristics	*P*	Partially adjusted for hospital characteristics	*P*	Fully adjusted with state dummies	*P*
Not confident patients can manage their care upon discharge								
Concentration of Blacks (< 11%; reference)								
11%–23%	1.78	.21	1.43	.27	2.28	.12	2.25	.09
> 23%	7.12	<.001	6.54	<.001	7.79	<.001	7.78	<.001
Nurse staffing			1.54	<.01			2.22	<.001
Nurse work environment			−6.67	<.001			−6.83	<.001
Frequent patient/family complaints								
Concentration of Blacks (< 11%; reference)								
11%–23%	2.70	<.05	2.59	<.05	2.02	.11	1.48	.20
> 23%	2.25	.15	2.00	.18	1.26	.44	0.66	.66
Nurse staffing			1.84	<.001			2.02	<.001
Nurse work environment			−4.23	<.001			−3.75	<.001
Frequent central line infections								
Concentration of Blacks (< 11%; reference)								
11%–23%	4.43	<.001	4.07	<.001	2.62	.01	2.23	.02
> 23%	7.32	<.001	6.88	<.001	4.38	<.001	4.02	<.001
Nurse staffing			−1.37	<.001			−0.69	.12
Nurse work environment			−2.21	<.001			−1.95	<.001
Frequent ventilator-associated pneumonia								
Concentration of Blacks (< 11%; reference)								
11%–23%	2.95	.001	2.54	<.01	1.54	.09	1.37	.13
> 23%	5.74	<.001	5.26	<.001	3.56	<.01	3.54	<.01
Nurse staffing			−1.84	<.001			−1.10	<.01
Nurse work environment			−1.98	<.001			−1.91	<.001

Note. Partially adjusted models included controls for nursing (nurse staffing and nurse work environment) or hospital characteristics (bedsize, technology status, and teaching status, Medicare Case Mix Index).Parameter estimates for concentration of Blacks represent the change in the percentage of nurses reporting the outcome associated with being in hospitals where 11–23% as opposed to less than 11% of the patients are Black, and in hospitals where > 23% as opposed to less than 11% of the patients are Black. Parameter estimates for nurse staffing represent the change in the percentage of nurses reporting the outcome associated with an increase of one patient per nurse. Parameter estimates for nurse work environment represent the change in the percentage of nurses reporting the outcome associated with working in hospitals with better vs. mixed (or with mixed vs. poor) environments. State dummies include California, Florida, New Jersey, and Pennsylvania.

Table 3

Effects of Percentage of Black Patients in Hospitals, Nurse Staffing and Nurse Work Environment on HCAHPS Outcomes (n = 429)

HCAHPS outcom (% of patients that agree with statement)	Unadjusted parameter estimate	*P*	Partially adjusted for nursing characteristics	*P*	Partially adjusted for hospital characteristics	*P*	Fully Adjusted with state dummies/ response rate	*P*
Patients who would definitely recommend the hospital								
Concentration of Blacks (<11%; reference)								
11%–23%	−2.74	<.05	−2.91	<.01	−3.90	.001	−2.60	.02
> 23%	−3.46	<.05	−2.52	.09	−4.27	<.01	−1.39	.35
Nurse staffing			−0.93	<.05			−1.47	<.01
Nurse work environment			5.26	<.001			4.54	<.001
Nurses always communicated well								
Concentration of Blacks (<11%; reference)								
11%–23%	−2.75	<.01	−2.36	<.01	−2.37	<.01	−0.91	.22
> 23%	−1.43	.21	−1.08	.32	−.47	.68	0.67	.51
Nurse staffing			1.18	<.001			−.56	.11
Nurse work environment			2.62	<.001			2.16	<.001
Patients always received help as soon as they wanted								
Concentration of Blacks (<11%; reference)								
11%–23%	−3.24	<.001	−2.84	<.01	−2.27	.01	−0.81	.34
> 23%	−2.95	<.05	−2.71	<.05	−1.22	.32	−0.18	.88
Nurse staffing			1.28	<.001			−.68	.08
Nurse work environment			2.02	<.001			1.72	<.001
Staff gave patients discharge information								
Concentration of Blacks (<11%; reference)								
11%–23%	−1.72	<.01	−1.66	<.01	−1.05	.06	−0.27	.61
> 23%	−1.21	.12	−0.96	.20	0.25	.74	0.96	.17
Nurse staffing			0.09	.68			−.77	.001
Nurse work environment			1.54	<.001			1.58	<.001

Note. Partially adjusted models included controls for nursing (nurse staffing and nurse work environment) or hospital characteristics (core based statistical area (division, metro, micro, rural), bedsize, ownership and teaching status). Parameter estimates for concentration of Blacks represent the change in the percentage of patients reporting the outcome associated with being in hospitals where 11–23% as opposed to less than 11% of the patients are Black, and in hospitals where >23% as opposed to less than 11% of the patients are Black. Parameter estimates for nurse staffing represent the change in the percentage of patients reporting the outcome associated with an increase of one patient per nurse. Parameter estimates for nurse work environment represent the change in the percentage of patients

reporting the outcome associated with working in hospitals with better vs. mixed (or with mixed vs. poor) environments The fully adjusted model includes dummy variables for state (California, Florida, New Jersey, and Pennsylvania) and HCAHPS response rate.