VARIATION IN ORGANIZATIONAL RESOURCES AND NURSE & PATIENT OUTCOMES AT HOSPITALS SERVING ECONOMICALLY DISADVANTAGED PATIENTS

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Dedication page

To my other, John.

ABSTRACT

VARIATION IN ORGANIZATIONAL RESOURCES AND NURSE & PATIENT OUTCOMES AT HOSPITALS SERVING ECONOMICALLY DISADVANTAGED PATIENTS

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Health disparities are exacerbated by low quality care at hospitals serving economically disadvantaged patients. The organizational resources available to nurses, including appropriate levels of nurse staffing and a positive practice environment, are strongly associated with care quality, as well as nurse and patient outcomes. However, little is known about the influence of differences in organizational resources for nurses as an explanatory factor for the disparities in quality of care observed between hospitals that disproportionately serve economically disadvantaged and those that do not. To address this gap, we conducted a secondary analysis linked data from payers, hospitals, neighborhoods, nurses and patients to evaluate whether differences in nurse work environments and nurse staffing levels accounted for the hospital-level quality of care disparities based on the level of economic disadvantage of the population served by the hospital. Using a national sample of 3,782 hospitals, commonly-utilized hospital classification measures were compared, to determine which measure best represented the economic disadvantage of hospital patient populations. Using a measure reflecting the proportion of patients from high-poverty ZIP codes, nursing resources and nurse and patient outcomes were examined at a subset of hospitals in 4 states.

Lower levels of nursing resources in hospitals serving the economically disadvantaged were associated with poorer outcomes for patients, including lower levels of quality, safety and satisfaction, as well as poorer outcomes for nurses, including higher levels of job dissatisfaction, burnout and intention to leave. Compared to low-poverty hospitals, nurses at high-poverty hospitals reported less favorable nurse work environments (mean score: 2.62 vs. 2.77, $p<0.000$) and staffing levels (patients per nurse: 5.34 vs. 4.92, $p=0.002$) and were more likely to report dissatisfaction (28.2% vs. 24.4% respondents, $p=0.033$), intention to leave (19.8% vs. 14.7% respondents, $p=0.001$) and emotional exhaustion (35.8% vs. 31.7% respondents, $p=0.027$). In

models adjusted for hospital characteristics, the percentage of nurses reporting “excellent” quality care and “grade A” safety decreased by 6% and 4.4% respectively for every 10% increase in the proportion of patients in poverty. The percentage of patients rating the hospital “9” or “10” and “definitely recommend[ing]” the hospital decreased by 1.7% and 3.1% respectively. In linear regression models adjusting for differences in nurse staffing, education and work environment, the magnitude of these effects decreased by 40-100%. This study confirms that hospitals serving a high proportion of economically disadvantaged patients have including higher levels of job dissatisfaction, burnout and intention to leave for nurses and lower levels of quality, safety and satisfaction for patients. With an explicit focus on organizational resources and the utilization of a unique dataset, this study offers an actionable solution—investment in improvement of the nurse work environment and hiring of additional nurses—which may improve hospital-based health disparities.

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CHAPTER 1

Purpose

There is mounting evidence that members of certain groups, such as black and low-income patients, suffer disproportionately from poor outcomes because the quality of care where they receive healthcare services is poorer. A large body of research suggests that *minority* patients are more likely to receive care at hospitals that perform poorly on various measures of quality, including several aspects related to nursing care. Less is known, however, about care quality, organizational resources, workforce composition and patient outcomes at hospitals serving the *economically disadvantaged.*

Specific Aims and Hypotheses:

This research will examine nursing factors (organizational resources and workforce composition) at hospitals that serve high proportions of economically disadvantaged patients, and examine patient outcomes at these institutions. The first segment of this research will examine the theoretical and empirical appropriateness of available measures of hospital-level socioeconomic status (SES)[1], and determine whether the measures create comparable hospital classifications (Aim 1). Using these measures, this research will determine whether and to what extent the hospital-level SES is associated with variation in nursing factors, and explore the ethical implications of this variation (Aim 2). Finally, this research will evaluate three patient outcomes and determine the extent to which differences in nursing factors at hospitals with high proportions of economically disadvantaged patients explain differences in outcomes (Aim 3).

[1] Hospital-level SES refers to the economic characteristics of the patients served by the institution. "Available measures" describes data easily accessible to researchers, including information from the Center for Medicare & Medicaid Services, American Hospital Association and United States Census.

The Specific Aims of this research are:

1. To describe and compare ranking and classification of hospitals that arise from multiple measures of the socioeconomic characteristics of the population served
    a. H1: There will be strong agreement among measures used to classify hospitals based on socioeconomic characteristics of the population served.
2. To examine relationship of nursing factors, including workforce composition (skill mix, experience, education) and organizational resources (practice environment, staffing), to hospital-level measures of economic disadvantage, and to explore the ethical implications of variation in nursing resources.
    a. H1: Hospitals with high proportions of economically disadvantaged patients will have a nursing workforce with lower levels of credentialing, experience and education, and fewer organizational resources, including less favorable staffing ratios and practice environment, compared to hospitals serving low proportions of economically disadvantaged patients.
3. To evaluate select patient outcomes (satisfaction, quality and safety) at hospitals serving high proportions of economically disadvantaged patients, and determine whether and to what extent these outcomes are related to nursing factors.
    a. H1: Patients at hospitals serving high proportions of economically disadvantaged patients will have lower patient ratings of satisfaction, as well as lower nurse ratings of care quality and safety compared to hospitals serving low proportions of economically disadvantaged patients.

b. H2: Poorer outcomes in hospitals serving higher proportions of economically disadvantaged patients will be partially explained by variations in nursing factors.

Background & Significance

Race/ethnicity and socioeconomic status have been shown to impact the amount and quality of hospital care received (Schnittker & Bhatt, 2008). Variation in the nursing workforce and organizational resources at low-quality hospitals[2] that serve large proportions of minority patients suggests that nursing factors may play a role in disparate outcomes (Brooks Carthon et al., 2011, Jha et al., 2011, Joynt et al., 2011; Tsai et al., 2013; Popescu, Werner, Vaughan-Sarrazin & Cram, 2009). Less is known, however, about patient outcomes at hospitals serving large proportions of economically disadvantaged patients (Rhoades et al., 2013), and whether these outcomes are related to nursing factors.

As providers of direct patient care, nurses influence the type, amount and quality of care that patients receive within hospitals. While several studies have found that nurse staffing levels are lower at low-quality hospitals serving high proportions of minority patients (Jha et al., 2011; Joynt et al., 2011; Tsai et al., 2013), only two studies have explicitly examined the role of nursing care and nursing resources in hospital-based health disparities (Brooks Carthon et al., 2011, Blegen, Goode, Spetz, Vaughn & Park, 2011). It is plausible, however, that interventions directed at the nursing workforce could have significant impact on socioeconomic health disparities. Identifying factors resulting in diminished care quality at hospitals that serve minority or economically disadvantaged populations can assist hospitals to make changes that will allow them to better serve their population.

[2] Hospitals designated as "low-quality" by research comparing various procedural, structural and/or outcome factors

Institutional Health Disparities

Health disparities have many causes, including the amount, appropriateness, timeliness and quality of health care received. The 2002 IOM Report *Unequal Treatment* called for care providers to recognize, explain and amend differences in healthcare that contributed to racial and ethnic disparities. This report spurred much research regarding *institutional disparities*[3], and raised the question of whether measurable differences in the receipt and quality of hospital care by race, ethnicity and SES were attributable to *between* hospital variation (groups of people systematically receiving care at different institutions), or *within* hospital variation (groups of people systematically receiving different care within the same hospital). This finding has shaped the last fifteen years of disparities-focused health services research.

There is some evidence that cultural or language barriers contribute to with-in hospital differences in care quality (Hasnain-Wynia et al., 2010), and there is speculation that more insidious causes like discrimination may occur (IOM, 2002). However, most research suggests that institutional disparities are largely attributable to sub-optimal care at hospitals serving high proportions of black and minority patients[4][5]. Research has demonstrated differences in process of care—including timely administration of antibiotics with pneumonia (Mayr et al., 2010) and transfer to revascularization hospital after myocardial infarction (Cooke et al, 2011), end-of-life

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[3] *Institutional disparities* refer to disparate outcomes attributed to site of care. These disparities are distinguished from *individual disparities*, which result from patterns of differential treatment. This distinction is also described as *between-* and *within-hospital disparities.*

[4] Some research classifies hospitals based on proportion of black patients, other research classifies based on minority patients (including minority ethnicity and race). These two groups of literature are examined together in this paper.

[5] This is between hospital variation. Within hospital variation beyond the scope of this proposal.

intensive care utilization rates (Barnato et al., 2006), as well as Hospital Quality Alliance (Hasnain-Wynia, Kang, Landrum & Vogeli, 2007; Jha et al., 2007) and patient safety indicators (Ly et al., 2010). Additionally, research has shown that there are differences in structural characteristics at hospitals serving high proportions of minority patients, including, nurse staffing, teaching intensity, size, ownership and geographic location (Ly et al., 2010; Jha, Orav, Li & Epstein, 2007; Jha et al., 2011; Metersky et al., 2011; Joynt et al., 2012; Lopez et al., 2012). Evidence has also shown differences in outcomes, including mortality following surgery (Silber et al., 2009), pneumonia and acute myocardial infarction (Lopez et al., 2012) and in-hospital resuscitation (Chan et al., 2009), as well as readmission rate (Joynt et al., 2011), patient satisfaction (Brooks Carthon et al., 2011) and safety events (Metersky et al., 2011; Ly et al., 2010). Taken together, these studies provide strong evidence that minority patients seek and receive care in lower quality hospitals, creating institutional disparities. Less evidence exists to draw conclusions about disparities in the hospitals in which economically disadvantaged patients receive care.

Economic Disadvantage and Institutional Disparities

The term economic disadvantage is used in this research to signify financial deprivation or poverty due to social, political and economic factors. Typically, socioeconomic status is assessed with income, educational or occupational factors (Adler & Newman, 2002), and will be measured accordingly in this research. Although often used in conjunction with access factors in health research, the link between economic disadvantage and ill health remains in countries with national coverage (Adda, 2003).

Most research describing institutional disparities emphasize racial and ethnic disparities

(Braveman, 2012) for several probable reasons. First, in the United States, race is a marker of a shared social, political and economic history (Lillie-Blanton & LaViest, 1996; Fiscella, 2004), creating a high correlation between race, socioeconomic status and access factors (Burstin, Lipsitz & Brennan, 1992). Second, race is commonly considered to be the primary indicator of social injustice in the US, in contrast to many other countries, where health disparities are understood to be a class issue (Braveman et al., 2011; Schnittiker & Bhatt, 2008). Third, socioeconomic status is a complex concept, and no consensus exists regarding measurement with available data (Backlund, 1999; Zwanziger & Khan, 2008). Fourth, although research shows inaccuracies in measures of race and ethnicity in hospital administrative data (Zaslavsky, Ayanian & Zaborski, 2012) these measures may be more reliable than commonly-used measures of SES (Covoet, Fresson, Vieux & Jay, 2013), based on the way national health data is collected (Nazroo, 2003; Fiscella & Williams, 2004). Information on hospital finances may be used as a proxy for patient socioeconomic status, or measures may be absent all together. For these reasons (and perhaps more), there is less research examining the quality care in hospital serving the economically disadvantaged (Rhoads et al., 2013).

Race and socioeconomic status are distinct concepts, although overlap in measures is common, for the reasons described above. A majority of the health services research examining institutional disparities—in terms of number and impact of articles—focuses on categorizing hospitals by the proportion of black or minority patients served. However, a growing body of research demonstrates that outcomes initially attributed to race are more strongly related to neighborhood of residence (Gaskin, Price, Brandon & LaVeist, 2009; Baicker, Chandra, Skinner & Wennberg, 2004) or socioeconomic status (Bradley, Given & Roberts, 2001; Philbin, Dec, Jenkins & DiSalvo, 2001; Birkmeyer, Gu, Baser, Morris & Birkmeyer, 2008; Foraker et al., 2010; Do et al., 2012). Indeed, education, income, insurance coverage and geographical location--measures of socioeconomic status- are strongly and independently related to health status (Hasan,

Orav & Hicks, 2010; Hasnain Wynia et al., 2010; Mahmoudi & Jensen, 2012; Adler, Boyce, Chesney, Folkman & Syme 2003; Cram et al., 2009). More information is needed, however, to understand the relationship between SES and institutional disparities; this can be done by classifying hospitals based on the *socioeconomic status* of the patients served.

In the few studies that explicitly examine the quality of hospitals that serve high proportions of economically disadvantaged patients, evidence suggests poorer patient satisfaction scores (Chaterjee, Joynt, Orav & Jha, 2012), lower quality process measure scores (Culler, Schieb, Casper, Nwaise & Yoon, 2010; Jha, Orav & Epstein, 2010) and poorer adherence to evidence-based guidelines (Rhoads et al., 2013; Cullen et al., 2010; Goldman et al., 2007), as well as higher mortality for congestive heart failure (Blegen et al., 2011) and post-surgical patients (Birkmeyer et al., 2008; Werner et al., 2008). However, these studies use different methods of characterizing hospitals as serving high proportions of economically disadvantaged patients[6], limiting the ability to make inferences about the relationship between economic disadvantage and the quality of hospital care.

In addition to concerns about the generalizability and comparability of research findings, non-agreement of measures raises worries about the effectiveness and fairness of policies created to alleviate financial burden on institutions serving economically disadvantaged populations. One such fiscal policy is disproportionate share hospital (DSH) payments, which are calculated using inpatient Medicaid and Medicare days, the eligibility for which varies by state and time (McKethan, Nguyen, Sasse and Kocot, 2009). The Institute of Medicine, as well as advocacy organizations such as National Association for Public Hospitals and Health Systems (NAPH), define and use the term "Safety Net", although this can be defined many ways[7] (Zwanziger &

[6] These papers categorize hospitals as "safety-net" or "high-Medicaid hospitals" based on different definitions.
[7] Various definitions will be discussed in detail in Paper 1.

Khan, 2008). Variation in definition and in eligibility may create artificial cutoffs excluding the near-poor. The Affordable Care Act promises a large expansion in insurance coverage and access to care; policies that aim to achieve equitable results must be designed with purposeful measures.

The Role of Nursing Care

An understanding of the quality of care at hospitals serving economically disadvantaged patients must take into account the largest and most diverse workforce- nurses (Needleman & Hassmiller, 2009). Research shows that characteristics of the nursing workforce and the environment in which nurses practice are associated with the care received by patients and subsequent clinical and non-clinical outcomes (Aiken, Clarke, Cheung, Sloane & Silber, 2003; Lucero, Lake & Aiken, 2009; Kutney Lee et al., 2009; Kovner & Gergen, 1998). Indeed, many studies of institutional-level disparities report significantly different levels of nursing staffing at hospitals serving high proportions of minority patients (Ly et al., 2010; Jha et al., 2007; Jha et al., 2011; Joynt et al., 2011; Lopez et al., 2012; Metersky et al., 2011). Current research examining between-hospital variation in quality lacks adequate emphasis on nursing care and may offer incomplete understanding of the complexities contributing to disparities in care.

Specifically, this study will examine two categories of nursing factors-- workforce composition and organizational resources. Workforce composition represents the internal resources, or human capital, available to the nurse. In this study, workforce composition is represented by educational attainment (highest nursing degree obtained). Evidence suggests that a higher proportion of bachelors-prepared nurses is associated with lower levels of post-surgical mortality and failure to rescue (Aiken, 2011). The second category of nursing factors, organizational resources, captures the *external* resources available to nurses, from the institution,

management and healthcare workforce. These resources are operationalized in this study as the practice environment and staffing. The practice environment consists of the features of an organization "…that facilitate or constrain professional nursing practice." (Lake, 2002), thus optimizing (or negating) the ability of a nurse to provide the best care possible. Staffing is a measure of the availability of nurses to care for the hospital's patients. Both these measures vary widely across institutions (Lake & Friese, 2006; Sochalski, 2004) and are strongly linked to patient outcomes (Aiken et al., 2008; McHugh et al., 2013; Aiken et al., 2011; Lake, Shang, Klaus & Dunton, 2010).

Extensive research demonstrates that nursing care is an important consideration in an evaluation of the quality of hospital care. Evidence from the literature examining differences in care quality at hospitals serving high proportions of minority patients may offers insight into the link between the nursing workforce and the quality of care delivered at hospitals that serve higher proportions of economically disadvantaged patients. In the literature regarding high-minority hospitals, this link has been demonstrated both indirectly and directly. In addition to reported differences in level of nurse staffing, several studies have shown that minority-serving hospitals have lower nurse-sensitive Health Quality Assessment (HQA) scores (Jha, Orav, Li & Epstein, 2007; Hasnain Wynia et al., 2010), which is associated with higher mortality (Jha et al., 2008). Findings that minority-serving hospitals provide more high-intensity care (Mayr et al., 2010; Barnato et al., 2006), have more frequent patient safety events (Metersky et al., 2011; Coffey et al., 2005; Ly et al., 2010), and a higher rate of readmission (Joynt et al., 2011), also imply a role of nursing care.

Additionally, growing evidence directly demonstrates the role of nursing care in hospitals serving minority and low-income patients. Brooks Carthon et al. (2011) found that nurses working in hospitals with higher concentration of black patients reported less confidence that

their patients could care for themselves upon discharge and more frequent patient complaints. Blegen et al. (2011) found comparable nurse staffing ratios in safety-net and non-safety net hospitals, but a larger impact of poor staffing on patient mortality in safety-net hospitals. These two studies provide important insight into nursing care at hospitals that serve high proportions of minority and economically disadvantaged patients.

Although these findings suggest that nursing factors may be associated with differential health outcomes at low-quality hospitals, this phenomenon has not been studied extensively. Facilitating improvements in organizational resources or workforce composition may be relatively low-cost, high-yield interventions to improve patient care. Without a complete understanding of this potentially important pathway to health disparities, however, administrators may miss an opportunity to ameliorate disparities.

Measuring Outcomes Related to Nursing Care

This study examines three patient outcomes: safety, quality and satisfaction- cite each reason[8]. These outcomes were selected for three reasons. First, each outcome has been shown to vary at hospitals serving high proportions of minority and economically disadvantaged patients. Second, these outcomes have been used extensively in the literature to capture the impact of nursing care on hospitalized patients. Third, these non-clinical outcomes may be less sensitive to variations in clinical presentation and severity of disease, diminishing the probability of confounding the relationship between hospital-level demographics and clinical outcomes. As direct reports of attributes of care from those that deliver and receive it, these outcomes provide important insight into the quality of hospital care.

Higher incidence of these three outcomes has been demonstrated at hospitals that serve

[8] Variables described in table 3 on page 33.

high proportions of minority and economically disadvantaged patients. Minority-serving hospitals have poorer safety ratings, including higher rates of nosocomial infections (Metersky et al., 2010; Brooks Carthon et al., 2011), adverse drug events (Metersky et al., 2010), and post-operative complications (Ly et al., 2010). These hospitals also have lower nurse-reported care quality, measured by readiness for discharge and patient complaint frequency (Brooks Carthon et al., 2011). Lastly, lower levels of patient satisfaction have been found at hospitals in the highest tertile of black patients (Brooks Carthon et al., 2011) and in the highest quartile of Disproportionate Share Hospital Index (Chaterjee et al., 2012).

A large body of research connects these three outcomes to aspects of nursing care. Safety events, including falls (Lake et al., 2010), nosocomial infections (Rogowski et al., 2013) and adverse events (Needleman et al., 2006; Kovner & Gergen, 1998), occur less frequently with more favorable staffing and higher levels of education (Blegen et al., 2013). Nurse-reported care quality has been linked to staffing (Sochalski, 2004), and work environments (Lucero, Lake & Aiken, 2009), and is related to mortality, satisfaction, Hospital Quality Alliance scores (McHugh & Stimpfel, 2012), safety event and unfinished care (Sochalski, 2004). Patient satisfaction is associated with nurse/physician collaboration (Larabee et al., 2004), nurse staffing levels and experience (Tervo-Heikkinen et al., 2008), nurse burnout (Vahey et al., 2004) and nurse work environment (Kutney Lee et al., 2009). Empirical research thus suggests that these outcomes are important in terms of understanding the quality of the care given and received, as well as related to outcomes that matter to hospital administrators, clinicians, policy makers, and patients.

Finally, these measures may be less related to clinical factors associated with economic disadvantage-- such as increased severity and complexity of illness, later stage of presentation and treatment adherence-- and more directly linked to institutional resources. Outcomes such as mortality are complex and have many causes, including patient severity, which may lead to a

confounding relationship. Process measures, including utilization, may be troublesome when "best" rates and patient preferences are unknown (Krumholz, 2013). Safety and quality measures, however, describe aspects of care that should be provided equally to all patients at all hospitals, irrespective of need. Satisfaction measures, including responses to the HCAHPS questionnaire used in this research, are adjusted for hospital case mix. Research suggests that higher patient satisfaction may be associated with positive clinical outcomes (Glickman et al., 2010; Jha, Orav, Zheng & Epstein, 2008).

The proposed research examines three patient outcomes at hospitals serving high proportions of economically disadvantaged patient to determine the explanatory power of nursing factors in institutional disparities. Building on findings that implicitly and explicitly suggest that aspects of nursing care vary at hospitals serving high proportions of economically disadvantaged and minority patients, this research will systematically build a case for investment in nursing to improve equitability in access to high quality care.

Innovation

Although there is a sizeable literature describing the variations in quality of care and patient outcomes at hospitals that serve minority and economically disadvantaged populations, little is known about the effect of nursing resources and nursing care on disparate patient outcomes. This study will examine five nursing factors at hospitals serving high proportions of economically disadvantaged patients and determine the strength, magnitude and direction of the relationship of these factors to hospital-based health disparities. The approach undertaken here offers five innovative contributions to the research on institutional disparities.

This study will:

1. Compare current methods of measuring economic disadvantage at the hospital level and determine whether variations in measurements affect generalizability of results, providing guidance for future research.
2. Join a small group of studies that classify hospitals according to the SES of the patient population-- rather than the more common classification by race-- and compare patient outcomes across hospitals.
3. Add to burgeoning evidence regarding nursing factors -- workforce composition and organizational resources -- at hospitals that serve economically disadvantaged populations, deepening understanding of the care received at these institutions.
4. Explore the ethical implications of the variation in care quality at hospitals serving economically disadvantaged populations, which will complement current arguments that disparities are inefficient and expensive.
5. Determine the impact of nursing resources on disparate health outcomes, advancing knowledge about the many determinants of disparate outcomes in hospital care.

1. Measuring Socioeconomic Status

Socioeconomic status is a complex construct, which generally encompasses income,

education and occupation (Adler & Newman, 2002). In studies of health disparities involving national hospital samples, information on these aspects of socioeconomic status is rarely available. Three methods are often used to assess socioeconomic status: patient claims data indicating payer source, ZIP codes and hospital financial information. Hospital administrative data contains information regarding insurance status for individual patients, but is prohibitively burdensome to access in large studies, particularly in studies examining differences across hospitals where comparable data is needed for hundreds or thousands of institutions. Individual ZIP code data is available from the Center for Medicare & Medicaid Services (CMS), and can be used to attach block or neighborhood characteristics to an institution's patient population. Hospital-financial descriptors, such as percentage of patients receiving Medicaid or DSH payment, are also commonly used to account for the SES of the patient population. As this study is focused on a national sample, the later two methods of categorizing hospitals will be used.

A thorough search of the literature identified eight commonly-used proxies of institution-level patient SES for description and comparison. Three measures of hospital financial descriptors are derived from Center for Medicaid and Medicare Services Cost Reports: % Medicaid, % Medicaid +Medicare, and Disproportionate Share margin. The remaining five measures use information from the United States Census as ZIP code-derived single measures (Median income, percentage under Federal Poverty Line), composite measures (2 validated examples[9]) or as county-level measures (Gini coefficient). These individual level measures are weighted and assigned to the hospital. The first aim of the proposed research is to compare hospital classification and ranking based on these measures[10], to determine whether variation exists. The results of this analysis will provide insight into whether measures used for policy and

[9] Composite measures for Diez Roux et al. (2002) and Popescu et al. (2010) were selected for usage and are described in greater detail in the "Overview of Papers" section

[10] Further detail on methodology provided in Paper 1 Outline

research are representative of the underlying phenomenon (economic disadvantage) and whether there is agreement between these commonly used measures.

2. Determining Institutional-Level Socioeconomic Disparities

Much of the literature examining institutional-level disparities focuses on race, for the reasons discussed previously. This literature generally demonstrates that disparities occur between-hospitals, due to suboptimal care, using one of three methods, each of which may reflect underlying beliefs about the causes of variation: 1) identification of hospital random-effects, 2) isolation of structural characteristics, or 3) classification of hospitals based on patient characteristics. The literature on institutional-level socioeconomic disparities mirrors these methods.

The first group of studies demonstrates between-hospital variation using random-effects, a methodology which relaxes assumptions about unobserved hospital factors, thus allowing these factors to impact aspects of the care patients receive at a given institution[11]. Although widely used in the racial disparities literature (see footnote), only one such study utilized fixed effects to show higher post-surgical mortality for economically disadvantaged patients (Birkmeyer et al., 2008). By accounting for variation between hospitals, this methodology reflects the underlying assumption that *unobserved* hospital characteristics vary between institutions.

[11] Examples in minority-serving hospital literature: Barnato et al., 2006; Chan et al., 2009; Mayr et al., 2010; Silber et al., 2009; Cooke et al, 2011; Hasnain-Wynia, Kang, Landrum & Vogeli, 2007; Li et al, 2010.

The second body of literature demonstrates effect modification, identifying structural characteristics that interact with patient characteristics to fully or partially explain differences in quality of care. These measurable (observable) hospital characteristics have a finite range of values across hospitals; it is these levels of characteristics that are associated with racial disparities[12]. One such study showed a different effect of nurse staffing on outcomes at safety and non-safety net hospitals (Blegen et al., 2011). The underlying assumption of this methodology is that *observed* organizational characteristics are related to care quality and patient outcomes.

The third group of studies classifies hospitals based on characteristics of the patients they serve (ie,"black-serving" or "minority-serving")[13]. Six studies classify hospitals based on disproportionate share hospital index[14], (Chaterjee et al., 2012 Cullen et al., 2010;) or proportion of Medicaid patients (Goldman, Vittinghoff & Dudley, 2007 Rhoads et al 2013; Ross et al 2007; Ross et al 2012). By categorizing hospitals based on patient characteristics, this research explores the assumption that minority and economically disadvantaged populations systematically access lower quality hospitals. The research proposed here will compare hospital classification measures and examine the effect of nursing factors on patient outcomes using the second and third methodology.

3. Nursing Factors at Hospitals serving High Proportions of Minority and Economically Disadvantaged Populations

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[12] Examples in minority-serving hospitals literature: Rathore et al. 2003; Brooks Carthon et al. 2012; Silber et al., 2009.

[13] Examples in the minority-serving hospitals literature: Joynt et al., 2011; Lopez et al., 2012; Metersky et al., 2011; Ly et al., 2010;Jha et al., 2007; Hasnain-Wynia et al., 2007; Brooks Carthon et al., 2011.

[14] Disproportionate Share Hospital (DSH) payment is the partial federal compensation for which a given institution is eligible, based on a formula which includes the percentage of patients receiving Medicare and Supplemental Security Income, as well as non-Medicare-eligible patient receiving Medicaid.

Some evidence suggests that minority and economically disadvantaged patients may be cared for by providers who are different in meaningful ways. Research shows that provider availability and qualifications differ regionally. Areas with greater poverty and income inequality have fewer physicians per capita (Adler and Newman, 2002; Gaskin, Dinwiddie, Chan & McCleary, 2012), and areas with lower educational attainment have fewer baccalaureate-prepared nurses (Blustein, 2010). Additionally, research shows that certain populations are more likely to be cared for by providers with different attributes. Physicians providing care for minority patients are less likely to be board-certified (Bach, Pham, Schrag, Tate & Hargraves, 2004) and more likely to have high risk-adjusted surgical mortality rates (Mukamel et al, 2000). Physicians caring for uninsured patients and Medicaid patients are also less likely to be board-certified, and to have graduated from a top Medical School or Residency Program (Gardener & Vishwasrao, 2010). Finally, evidence suggests that financially vulnerable hospitals struggle to recruit top providers, including physician and nurses (Blustein, 2008). It is therefore possible that the characteristics of nurses caring for high proportions of economically disadvantaged patients, including credentialing, education and experience, may vary, creating divergent "asset profiles" at hospitals with higher proportions of minority and economically disadvantaged patients.

Little is known about organizational culture at hospitals serving minority and economically disadvantaged populations (Blustein, 2007), but it is possible that the physical, administrative, or human resources available to nurses at hospitals serving high proportions of economically disadvantaged patients are significantly different than those available to nurses at hospitals that serve lower proportions of economically disadvantaged. The perceived availability of these resources, which allow nurses to function to their full capacity, comprise the work environment. Although there may be reason to suspect that financially vulnerable hospitals have poorer nursing resources, Brooks Carthon and colleagues (2011) did not find a significant

difference in nursing work environment among hospitals serving differing proportions of black patients. Staffing levels, however, are less favorable at minority-serving hospitals (Jha et al., 2011; Joynt et al., 2011; Tsai et al., 2013; Li et al., 2010) and safety-net hospitals (Conway et al., 2010)[15]. More information is needed to understand whether organizational resources are poorer at hospitals serving high proportions of economically disadvantaged, and whether and to what to degree these resources are related to disparate outcomes.

4. The Ethical Implications of Variation in Access to Quality Care

Empirical findings provide powerful evidence that certain groups of patients receive care at lower quality institutions. In addition to being costly and inefficient (Jha, Orav & Epstein, 2011), this lower quality care may be morally problematic in that it exacerbates the need:care mismatch of the most vulnerable patients (Frank & Fiscella, 2008) and perpetuates past injustices (Jones, 2010). These ethical implications are rarely articulated in the health services literature focusing on between-hospital racial and ethnic disparities (Chaterjee et al., 2012; Rhoades et al., 2013; Chan et al., 2009; Cooke et al., 2011), and the moral obligation to fix disparities based on where minority and economically disadvantaged populations receive care remains an unexplored premise.

Experts in public health, philosophy and bioethics generally frame disparities in hospital care as issues of social justice arising from differences in access to care or services (Clark & Gessel, 2010). However, recent evidence suggests that the more pertinent issue may be whether minority and economically disadvantaged groups have access to *quality* care (Fiscella, 2011). Quality, says Avedis Donabedian, is "…a reflection of values and goals current in the medical care system and in the larger society of which it is a part." (Donabedian, 1966). Higher quality

[15] Lindrooth et al (2006) found no difference in nurse staffing at safety net hospitals.

care is better and more desirable, as it helps people avoid harm and injury and increases the chances of living healthy lives. Social structures and policies that deny high quality care to certain groups of people are unjust.

This injustice is predicated on factors that are morally problematic. However, not all factors that lead to institutional choice are morally problematic. Broadly, the factors influencing hospital choice fall into four categories: individual, socio-organizational, geographical and policy-dependent.

Individual determinants of institutional choice such as preference and need, to the extent that they do not reflect underlying social inequities, are not morally problematic. A Mexican patient may prefer to receive care at a lower-quality hospital with an ethnically-concordant and bilingual staff.

Socio-organizational determinants, such as referral patterns and social networks, which arise from unjust social institutions, may perpetuate disadvantage. Research shows that physicians caring for large proportions of black patients have fewer resources, including admitting privileges at high quality hospitals (Bach et al., 2004).

Geographical determinants of choice, including transportation and distance, may contribute to injustice if certain populations live closer to low-quality hospitals. The evidence on this is mixed, with data suggesting that blacks live closer to high-quality surgical hospitals but are more likely to go to low quality ones (Dimick et al., 2013).

Policy-dependent determinants, including insurance eligibility and generosity, can create unjust variations in access to high quality care. A recent study shows higher post-surgical risk-adjusted mortality rates for Medicare patients (Spencer, Gaskin and Roberts, 2013), suggesting that these patients receive lower quality of care.

These factors suggest that the quality of the care provided at hospitals serving minority and economically disadvantaged populations is an important component of a just healthcare system and that equalizing nominal access to hospital care will not ameliorate institutional disparities. As such, targeted policies that alleviate financial strain, increase resources or mandate quality improvements may increase the value of healthcare provided to the most vulnerable, fulfilling a moral mandate. Research shows that an important determinant of care quality is the nursing workforce. If hospitals serving high proportions of minority and economically disadvantaged patients have poorer nursing resources, interventions aimed at the workforce could effectively increase care quality and reduce disparities.

5. Relationship between Nursing Factors and Disparities

While disparities in provider resources and care quality may be intrinsically unfair, the outcome of this care holds a special interest. Disparities in outcomes, such as rates of mortality, morbidity or experience of care, are most often reported and are viewed as most significant. As reported above, economically disadvantaged patients suffer disproportionately from poor outcomes, although it is unknown whether these are the results of receiving care at lower quality hospitals (institutional disparities).

This research will add to the growing body of literature showing hospital-based disparities in patient outcomes, and will be the first to determine the relationship of these disparities with nursing resources. If variation in levels of nursing resources is related to disparate outcomes for economically disadvantaged patients, this insight can offer a concrete solution for hospitals, payers or policymakers aiming to improve the quality of care. Improving management practices, organizational culture, nurse-patient staffing, or employee qualifications may be relatively inexpensive and efficient means of improving outcomes.

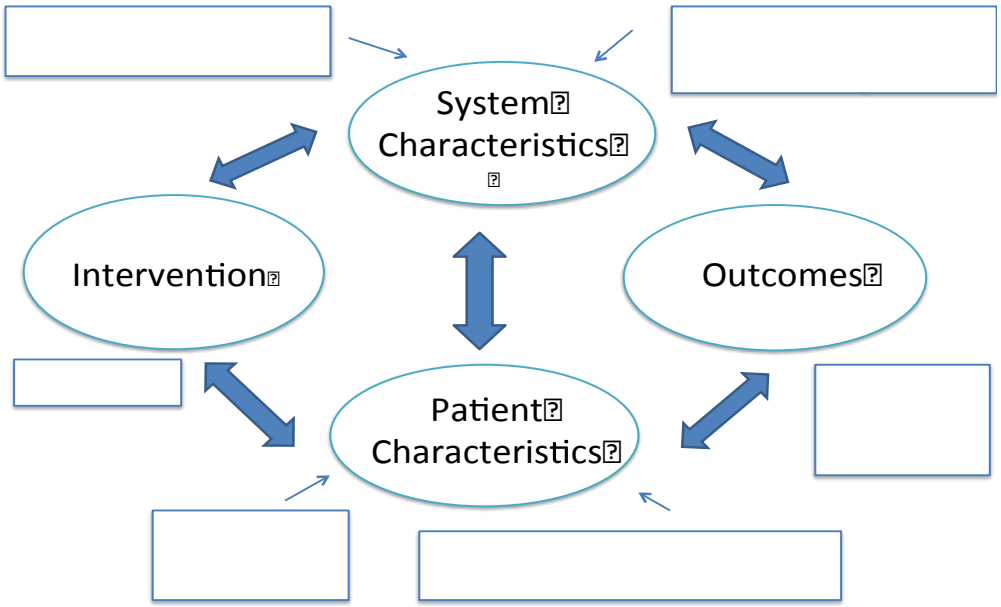
Providing high-quality care is not just based on clinical skill; it requires levels of nursing resources that allow nurses to tailor care to the specific needs of the patient (Fiscella, 2004). Cultural competence, patient-centered care and evidence-based practice require time and resources. Findings suggest that there may be important differences in nursing characteristics and organization resources at minority-serving hospitals, as well as hospitals that serve the economically disadvantaged. Resources may be even more important at hospitals that serve minority and economically disadvantaged populations, as these patients are more likely to present with a complex set of problems (Fiscella, 2004), which may be more nursing-intensive. In fact, research shows that an increase in the proportion of low SES patients is correlated with a decrease in institutional adherence to quality of care process measures for congestive heart failure and myocardial infarction (Cullen et al, 2010). Another study finds that safety net status has a significant effect on the impact of nurse staffing on patient outcomes (Blegen et al., 2013). Taken together, these findings suggest that nursing factors, including workforce characteristics and organizational resources, may play an important role in disparate outcomes at hospitals serving the economically disadvantaged.

These five innovations combine different bodies of evidence to answer the question: do outcomes vary at hospitals serving different proportions of economically disadvantaged patients, and do nursing factors explain a portion of that variation? In order to answer that question, an understanding of currently available hospital-level SES measures is necessary. With that knowledge, methods borrowed from racial disparities research will be used to classify hospitals based on patient characteristics. This study will also contribute an understanding of the ethical implications of variation in availability of high-quality hospitals, an argument that may act as a call to action where arguments based on cost and efficiency have been less successful. Findings

will also add to nascent knowledge regarding nursing factors-- workforce composition and organizational factor-- at hospitals serving minority and economically disadvantaged populations. Understanding the link between nursing factors, patient socioeconomic characteristics and outcomes offers the ability to make meaningful change in hospital systems that serve the disadvantages, thus interrupting the cycle of poor health.

Conceptual Model

This research is informed by the Quality Health Outcomes Model (QHOM) (Mitchell et al., 1998). The QHOM is an extension of Donabedian's seminal model, which identifies three indicators of quality care: process (whether "good" medical care has been applied), structure (provider and organizational characteristics, as well as the resources and tools available) and outcome (the result of the care) (Donabedian, 1966). The American Academy of Nursing Expert Panel on Quality Health Care proposed an extension of that model, reflecting growing evidence that neither structural nor process variables have a consistent relationship with outcomes when measured in isolation (Mitchell et al., 1998). The QHOM contains the four groups depicted below, and emphasizes the dynamic interplay between variable. Five two-way arrows connecting these variables reflect the belief that neither structure nor process has a direct relationship to outcomes, and that client and organizational characteristics inform the receipt and effectiveness of care. This model has served as a guide for nursing outcomes research (Aiken et al., 2002; Kutney-Lee et al., 2009; Brooks Carthon et al., 2011).



The QHOM supports the proposed research to achieve its aims in the following ways.

Aim 1

This study reflects the belief that classifying hospitals based on service population characteristics provides an opportunity to compare quality between hospitals. The QHOM includes patient characteristics as an important determinant of the operation of the organization (system), the care received (interventions), and the effect of that care (outcomes). Evidence suggesting differential access to high quality hospitals underscores the importance of considering patient characteristics as a component of the environment in which the healthcare system is situated. In this study, patient characteristics are measured at the hospital level and used to classify hospitals for comparison.

Aim 2

As in Aim 1, Aim 2 focuses on the relationship between system and patient characteristics, as depicted in the QHOM. The proposed research assumes that economically disadvantaged patients access lower-quality hospitals with poorer nursing resources, less skilled workforce and sub-optimal processes of care. These systematic differences in access to hospitals based on demographic factors are hypothesized to play a role in healthcare disparities, and are classified as unjust.

Aim 3

Aim 3, to evaluate disparities in hospitals that serve high proportions of economically disadvantaged patients, expands upon the previous aims to include the impact of the interplay between "system characteristics" and "patient characteristics" to "outcomes" in the QHOM. Disparate outcomes for patients at hospitals with high proportions of economically disadvantaged patients are hypothesized to be related to the systematic access[16] to lower quality hospitals and determined in part by the availability and nature of nursing resources at that hospital.

Overview of Papers

This study aims to understand the relationship of nursing resources to disparities in health outcomes for economically disadvantaged patients and inform strategies directed at ameliorating these disparities. To achieve this goal, three aims have been offered and will be accomplished in three distinct yet complementary empirical papers. Each Aim will build on the findings of the previous Aim. By ensuring rigorous methodology in ranking and a thorough evaluation of the relationship between nursing factors and hospitals which serve economically disadvantaged

[16] Systematic access will be determined by higher proportions of economically disadvantaged patients at certain hospitals.

patients, this research will shed light on the interaction between site of care, nursing resources and patient outcomes in hospitals that serve high proportions economically disadvantaged patients.

The first paper will evaluate Aim 1, a comparison of eight commonly-used measures to classify hospitals based on the characteristics of the population served, using correlation and ranking techniques. To determine the most appropriate analytical approach, the univariate distribution of hospital measures will be assessed using histograms and boxplots, and descriptive statistics will be calculated. The Shapiro-Wilkes statistic will be used to test normality; the Pearson's correlation coefficients will be calculated if the values follow a normal distribution, and Spearman's correlation will be used if the distribution is non-parametric (Zar, 1972).

A bimodal distribution (ie, hospital groupings) will suggest that SES measures may be best described as distinct categories, rather than as continuous variables. In this case, categorical variables will be created[17] and Kappa statistics will be calculated to determine association between measures, with values 0.61-0.8 signifying substantial agreement and 0.81-1.00 signifying almost perfect agreement (Landis & Koch, 1977). These findings will provide insight into the similarity of measures commonly used for policy and research purposes.

Table 1: Classification of Hospitals based on Patient socioeconomic status

Measure	Description
%Medicaid	Percentage of inpatient days paid for by Medicaid
%Medicare/Medicaid	Percentage of inpatient days paid for by Medicaid plus Medicare
DSH payment	Calculation of indigent care used for Federal funding
SES Composite #1	Sum of z-scores for 6 variables representing wealth/income, education, occupation/employment
SES composite #2	Sum of z-scores for 6 variables representing poverty, family disruption, male joblessness and occupation
SES composite #3	Sum of z-scores for 4 variables representing wealth, education, occupation and female head of household

[17] Tertiles, quantiles or deciles may be created.

Median Income	Median income in ZIP code
% below FPL	Percentage of residents below 150% of the Federal Poverty Line

These results will inform the selection of hospitals-level SES measures to be used in Aim 2, a determination of whether nursing resources vary at hospitals serving higher proportions of economically disadvantaged patients and the ethical implications of this variation. Using a selection of measures from Aim 1, chosen based on emergent non-agreement or policy/research relevance[18], the correlation between hospital-level SES composition measures and hospital-level nursing factors will be examined. Hospital measures will be examined as continuous and categorical variables if appropriate, so that nursing factors can be described at hospitals serving high proportions of economically disadvantaged patients. All nursing factors will be aggregated to the hospital level and examined as continuous variables. Pearson's and Spearman's correlation coefficients will again be calculated. T-tests and Analysis of Variance, with covariates, will be executed to determine whether nursing factors are significantly different at the hospitals with the highest proportions of low SES patients.

Table 2: Nursing Factors

Variable	Description
Education	Highest degree obtained
Staffing	Nurse-Patient Ratio
Practice environment	Institutional features that help/hinder nursing care

Finally, Aim 3 will assess disparities in patient outcomes at hospitals serving high proportions of economically disadvantaged patients, and determine the extent to which variations

[18] Measures will be chosen based on findings of comparability in Aim 1. If non-agreement emerges from findings, disparate measures will be chosen for inclusion in subsequent research. Special attention will be given to measures that are used in policy decisions, and they may be chosen for inclusion.

in nursing resources are related to these disparities. The first portion of the analysis will use all hospitals in sequential linear regression models to determine whether the relationship between hospital-level composition and outcomes is partially explained by nursing factors. Outcomes, detailed in the table below, will consist of continuous variables representing the aggregation of nurse and patient reports to the hospital level.

The second portion of the analysis will determine whether there is variation in the relationship of nursing factors to patient outcomes within the group of hospitals classified as serving high proportions of economically disadvantaged patients. These findings will be used to inform potential policy interventions and guide future research.

Table 3: Patient outcomes

Outcome	Source	Description
Satisfaction	HCAHPS	Experience with 10 items: never-always or 0-10
Quality	Nurse Survey	Description of quality of care on unit: excellent-poor
Safety	Nurse Survey	Grade rating of patient safety: A-F

Importance

Increased access to health insurance coverage, availability of public data on healthcare quality, and transparency of reimbursement tied to performance metrics will affect hospitals that provide care to all people. Recent policy initiatives targeting affordability and accessibility to health care are critical, but research suggests that these steps are not enough to end SES disparities (Adler, 2002). Likewise, initiatives to improve hospital quality and decrease cost are vital, but experts caution that pay-for-performance policies may unfairly penalize hospitals that serve the most financially vulnerable if proper risk-adjustment is not achieved (McHugh, Brooks Carthon & Kang, 2010; Chien, Chin, Davis & Casalino, 2007). Until we understand the myriad,

interrelated factors that influence these disparities, we will not be able to take the appropriate and necessary steps to eliminate these problematic variations.

The findings of Paper 1 will provide insight into the measurement of the socioeconomic status of patients that a hospital serves. Binary measures- such as the classification of hospitals as "safety-net" providers are not empirically appropriate (Zwanzinger & Khan, 2008), and classifying hospitals as minority-serving may not be theoretically optimal (if the relationship is in fact due to the socioeconomic status of the patient population). Although the measures examined in this Paper may be imperfect measures of socioeconomic status, they represent widely available data and thus provide realistic measures for researchers and policy makers interested in variation in the quality of hospital care.

This research aims to elucidate the relationship between nursing resources, nursing care and patient outcomes at hospitals that serve high proportions of patients of low SES. In order to achieve that goal, several relationships must be established. The implications of various methods of hospital-level measurement of patient SES must be understood. At least nine methods are currently used in the literature-- frequently without justification for the individual choice. A more complete understanding of the measurement will benefit researchers when utilizing SES-- as an independent variable or covariate- in studies involving the impact of site of care.

Information gleaned from this comparison will be used to describe the variation in nursing resources at hospitals with different populations. Differential access to high quality hospitals has both ethical and practical implications. Ethically, an increased likelihood of being treated at a low-quality hospital based on social status is unjust; if evidence exists that members of certain populations receive care at lower quality hospitals *not based on their own preference*, society is morally bound to work to correct this inequity. Practically, decreased resources or

lower care quality at these hospitals are potentially fixable factors that may go a long way in decreasing disparities in health care outcomes.

Finally, this paper hopes to shed light on the relationship between patient composition, level of resources, and outcomes. All aspects of health system inequalities that disproportionately affect certain populations may be seen as unjust; however variations in outcomes- such as increased mortality- are generally heralded as disparities demanding action. Evidence that outcomes vary help us identify barriers and facilitators (Braveman, 2011; Egerter, Woolf and Marks, 2011). Demonstrating that variations in patient outcomes are associated with differences in resources at hospitals that serve population subgroups may offer a meaningful solution to a societally important issue.

Financial incentives for quality hospital care abound, used nationally by private and public payers. Hospitals that serve higher proportions of private payers may have reaped the benefits of these rewards from insurers; hospitals that rely more strongly on public payment may be behind (Goldman et al., 2007). In fact, research by Lillie-Blanton (2008) suggests that disparities between high and low income patients are increasing at a higher rate than racial or ethnic differences. However, some research suggests that financial incentives (Jha, Orav & Epstein, 2010) and nurse staffing mandates may be particularly effective in hospitals that serve poor patients.

Finally, this research hopes to identify factors that are associated with high-quality care in hospitals that serve high proportions of disadvantaged patients. A study by Goldman et al (2007) showed that teaching and nonteaching SNH perform differently on process measures. Isolating and identifying structural and organizational characteristics associated with high quality care may provide actionable solutions to managers and policy-makers interested in correcting this social injustice.

CHAPTER 2

Do Current Designations of Hospital Populations Reflect Care of the Most Economically Disadvantaged Patients?

Evidence suggests that "high Medicaid" or "safety net" hospitals provide lower quality care, contributing to health disparities. However, it is unclear whether these hospital-based designations reflect care of the most economically disadvantaged patients. **Methods:** A cross-sectional secondary analysis of 3,782 hospitals using 2006 Medicare, Census and Hospital data. The correlation among measures was examined using the Spearman's correlation coefficient. The Cronbach's Alpha measure of internal consistency of population-based measures was generated. **Results:** Correlation of hospital-based and census-based measures ranged from none (uncompensated care and median income: rho=0.03) to moderate (percent disproportionate share payment and census socioeconomic composite: rho=0.50). The proportion of population in poverty is most representative of population-based measures (rho>0.54, CITC=0.95). **Implications:** Current studies use hospital-based measures to classify hospitals as serving high proportions of economically disadvantaged patients. Population-based measures offer additional insight and should be incorporated in these studies.

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Abstract: 140 words

Manuscript: 4,227 words (2,500-10,00)

Format: Arabic superscript

Research suggests that hospitals caring for certain vulnerable populations perform poorly on quality and safety indicators and have higher rates of mortality and adverse events[1-11], creating institutional disparities that exacerbate existing health disparities. In order to compare aspects of care quality, this body of research commonly categorizes hospitals in two ways: by features of the patient population (such as the proportion of black or Medicaid patients) or by features of the hospital (such as amount of disproportionate share payments or teaching status), some of which are associated with or are suggested to reflect the dimensions of the patient population. These categorizations allow examination of differences in quality at hospitals that serve certain populations and identification of steps that may be taken to ameliorate health disparities.

A large body of research has focused on differences in care structure[1,3,4,12,13] processes[1,5-7,14] and outcomes[1,3,8-12] at hospitals that serve large proportions of minority patients. A related group of studies has shown that hospitals classified as Safety Net (SNH) or High Medicaid (HMH) perform worse on quality indicators[15-20], and have poorer patient outcomes[21-23]. However, the lack of definitional consensus and the lack of clarity surrounding measurement choices create difficulty interpreting the latter group of findings. This makes it difficult to determine whether hospitals serving a high proportion of economically disadvantaged patient have lower quality care.

Socioeconomic Status. Socioeconomic status (SES) is a complex and multi-faceted construct. Several studies suggest that like black patients, patients of low SES may also experience institutional disparities (due to care seeking at lower quality hospitals). However, these studies measure low SES using hospital based measures, and it is unclear whether these measures reflect the provision of care to the most economically disadvantaged patients.

There are reasons to think that commonly used proxies for SES derived from hospital data are not perfectly representative of the SES of the patient population. The receipt of means-tested public insurance, such as Medicaid and the State Children's Health Insurance Program, is dependent on SES. However, the generosity and availability of public insurance varies by location, time and political landscape, creating concern about whether measures of Medicaid intensity represents the socioeconomic status of patients seen at a given hospital[24]. This limits the interpretability of studies classifying hospitals as high Medicaid hospitals (HMH). The categorization of hospitals based on status as a safety net hospital (SNH) raises additional concerns. There is no agreed-upon definition of SNH[25,26], but operationalized definitions in the literature rely on patient insurance status, state-driven reimbursements and characteristics of the hospital systems.

The use of hospital-based measures such as proportion Medicaid (HMH) or disproportionate share hospital payments and uncompensated care (SNH) as proxies for patient SES is due in part to difficulty in obtaining rigorous measures of income or SES that can be linked to a national sample of hospitals. This occurs for many reasons. First, it is difficult to collect accurate self-reported data on socioeconomic status[27]. Second, national survey data regarding SES and health cannot be linked to hospital care[27], Third, the information widely available to researchers and policymakers is limited to provider data, which has information about insurance and residence only, and hospital financial information from payers or third part surveyors such as American Hospital Association.

Measures. Safety Net status has been defined and measured different ways (see Zwanziger & Khan 2008 or McHugh et al., 2009 for thorough discussion of definitions). Most often, safety net hospitals are characterized based on disproportionate share hospital (DSH) payments, Medicaid

patients[19], or uncompensated care, although teaching status, and census measures have also been used to designate SNHs[25,26]. Among studies using the same measure to define hospitals as SNH, such as DSH payments, alternate variable specifications and data sources are used.

In studies examining HMH, Medicaid intensity is calculated based on Medicaid revenue[19], Medicaid discharges[28] or Medicaid admissions[25]. These calculations were based on data from state[19] or national payer, or from an association[28], although in several cases this information is missing[15,29]. In these studies, "high Medicaid" is defined with cut-points 1[19,28] or 2[15] standard deviation above the state[19] (Rhoads et al., 2013 and 2008) or national mean[15,28], as well as the 90th percentile[30] or quartiles[29] based on the sample. In one case the Medicaid intensity was adjusted by the mean value in the metropolitan statistical area[25].

In studies defining SNH based on DSH payments, binary variables are commonly used to represent receipt of payment[22] or payment above a threshold[31]. In other cases, DSH payments are measured as quartiles[17,21] or utilized as continuous variables[32]. Data was derived from a common source, the Medicare Impact Files, but different formulas were used to represent DSH- including total DSH[22], DSH index[18,21,32] and DSH percentage[17]. Some of these studies included sensitivity analyses with other definitions of SNH[18,21,29] or other cutpoints[18]

Currently, population based measures are predominately utilized as covariates studies examining the effect of other variables (such as race or morbidity) on outcomes. Income[33-36] , poverty[37,38] composites[11,23,25,39-41], or multiple measures[42-44] are employed in this manner. Although imperfect, neighborhood measures of patient income, wealth, education and occupation

[19] HMH are thus a subset of SNH.

obtained from census data offer a promising strategy to examine the SES of patients cared for in a given hospital[41]. In a study using neighborhood measures to classify SNH, Zwanziger and Khan (2008) use patient flow methods (attributing ZIP code characteristics to hospitals through weighted ZIP code linkage) [25]. To the authors' knowledge, the Zwanziger and Khan (2008) study is the only to use population-acquired SES measures to classify hospitals, and the quality of care at hospitals classified this way is not examined in that study.

Most studies examining economic disadvantage, as a confounder or as the main variable of interest, utilize only one measure of SES, often without explicit justification[27]. Additionally, it is often unclear which measure is being used in a study. Some authors clearly state that they are using a proxy for low-income[17] or concentration of poor and minority patients[19], other authors interchange definitions, such as HMH and SNH[19]. Studies examining quality at SNH and HMH provide insight into the care received by economically disadvantaged patients, but the implications are dependent on the measure utilized and the comparability across studies is limited when different measures are being used. For this reason, it is important to be transparent about what is measured, the implications that can be drawn from the findings, and the meaning of findings in the context of the literature.

In this study we set out to answer 3 questions:

1. Do hospital-based and population-based measures measure the same underlying construct?
2. Can hospital based measures be used as a proxy for population based measures?
3. Are composites superior to single-item population based measures?

Implications. The quality of care at hospitals serving economically disadvantaged patients is of interest to researchers and policymakers, as well as patients. Evidence suggests that these hospitals provide lower quality care, but the lack of consensus regarding definitions and

consistency regarding measurement limits interpretability of findings. This creates difficulty for hospitals wishing to benchmark, as well as with the creation, implementation and evaluation of targeted initiatives to reduce socioeconomic disparities.

Methods

Research Design and Strategy. In this study, we constructed 6 commonly-used measures that are implicitly or explicitly used to represent care of economically disadvantaged patients (see Table 1 for description of measures). These measures were obtained through financial data submitted to the Center for Medicare & Medicaid Services, hospital data collected by the American Hospital Association or census data culled from the American Community Survey. We compared alternate formulas and data sources used to construct these 6 measures, and examined the correlation between measures specified differently. We described the aspects of socioeconomic status represented by each population-based measure. We compared the distribution of hospital characteristics across the top quartile of each measure (Table 3). The relationship of hospital-based measures to each population-based measures was described with Spearman's Correlation Coefficient. Results of tests of internal consistency were interpreted to select a single measure best representing the group of population-based measures.

Data Sources. We used national data from five sources—the 2006 Medicare Health Service Area File (HSAF), 2006 Medicare Impact File, 2006 Medicare Cost File, 2005-2007 American Community Survey (ACS) and the 2006 American Hospital Association (AHA) annual survey—to evaluate readily available measures of hospital populations.

Sample. Included hospitals were all adult, nonfederal, acute care hospitals in the United States with available data on each of the 12 specifications of the 6 variables of interest (see Figure 1). The final sample included 3,782 hospitals.

Variables of Interest. Six measures identified in the literature were created for analysis, and multiple formulas and data sources were used to create alternate specifications of the measures when indicated. Table 1 describes the variables used in this study.

Population-Based Measures. Three ZIP-code level measures were chosen for inclusion in this study: median income, proportion below 150% of the federal poverty line (FPL), and an SES composite. Each census measure was calculated as a weighted proportion, to reflect the share of the population from each ZIP code served by the hospital, using a 75th percentile cutoff for ZIP codes. Median income and the proportion of residents living below 150% of the FPL were available at the ZIP code level. Median income was standardized due to the large range. The SES composite is a sum of 4-5 standardized variables available at the ZIP code level. It was specified in three ways, based on previous literature, and includes the following variables. Composite #1 includes: 1) the proportion of adults 25 years and older completing high school, 2) the proportion of adults 25 years and older completing college, 3) the proportion of adults 16 years and older with employment, 4) median income, 5) median value of housing units, and 6) income from interest, rental, or other categories[23]. Composite #2 includes: 1) the proportion of residents below the FPL, 2) the proportion of single female head of households, 3) the proportion of men 16 years or older without employment, and 4) the proportion of adults working in "blue collar" jobs[15]. The final Composite (#3) includes: 1) the proportion of adults 25 and older without HS diploma, 2)

the proportion residents identifying as non-white, 3) median income, and 4) the proportion of residents below the FPL[25]. Table 2 summarizes the aspects of socioeconomic status captured in each census measure.

Hospital-Based Measures. Measures obtained from payer data or third party survey of hospitals include the proportion of Medicaid patients, DSH payments and uncompensated care. The proportion of Medicaid patients was calculated three ways from two data sources: discharges as a portion of total discharges using data from the Medicare Cost Report, discharges as a portion of total discharges using AHA data, and days as a proportion of total days using AHA data. DSH measures were used at reported in the Medicare Impact File, as payment percentages or total payments. Uncompensated care was calculated two ways, using data from the CMS Cost Report Cost & Charges File: uncompensated care charges divided by total charges, or sum of bad debt and charity care, adjusted by the cost-to-charge ratio.

Hospital Covariates. Variables describing the structural characteristics of the hospitals were created to examine variation between measures used to classify hospitals as serving a high proportion of economically disadvantaged patients. Hospital structural characteristics from the 2006/07 AHA Annual Survey of Hospitals included teaching status, hospital size, technology status, location, core-based statistical area (CBSA) and ownership. Hospitals were classified according to teaching status: 1) none, minor and major, depending on trainee to bed ratio (0, <1:4, >1:4). Hospital size was characterized as small, medium or large based on number of beds available (<100, 101-250, >250). Hospitals were classified as high technology based on the availability of open-heart surgery and/or organ transplantation. Location was categorized as North East, Midwest, South and West region and division (>2.5 million), metropolitan (50,000-2.5 million), micropolitan (10,000-49,999) and rural (<10,000) CBSA. Hospital ownership was for-profit, not-for-profit and government. Other measures used from AHA data include critical access

provider and Sole Community Provider designations, two classes of small, rural hospitals with different Medicare payment structures.

Analysis. Hospital-based measures were linked directly to hospitals with Medicare provider numbers. Population-based measures were linked using the following process: 1) hospital service areas were created based on 2006 discharge data from the Medicare HSAF to include ZIP codes accounting for 75% of total discharges, based on previous work[25] , ZIP code level SES measures from census were linked with ZIP codes from service area, weighted to reflect the proportion of patients from that ZIP code seen at each hospital, 3) a mean value of each SES measure was assigned to the hospital. Descriptive statistics were examined for the entire sample and by hospital characteristics. For continuous variables, histograms were created to examine the distribution and means and standard deviations were calculated. For categorical variables, counts and percentages were generated.

Bivariate relationships were explored between variables calculated with different formulas (example: percent Medicaid was calculated with 2 formulas from 2 datasets), as well as between conceptually similar variables (example: three composites were created from census data). For measures with more than one specification, a single measure was selected. For measures with 1 alternate, the ease of interpretation, data integrity, and frequency of use in the literature determined selection. For measures with 2 alternates, tests of internal consistency (highest item-rest correlation) were utilized to select the most representative version of the measure.

To examine the relationships between 3 hospital-based and 3 population-based measures, Spearman rank order correlation coefficients were generated. Statistics derived from Cronbach's alpha measure of internal consistency were used to determine which population-based measure

was the most representative; including the highest corrected item-test correlation (CITC), which is a measure of the relationship of one variable to a set of items inclusive of that variable, and lowest Cronbach's alpha if deleted (CAID), which is a measure of the internal consistency of the set of items if a single variable is removed. Spearman rank order correlation coefficients of population-based measures were examined to determine which individual item correlated best with the other items.

All analysis was performed with Stata Version 12 (StataCorp., 2011).

Results

Table 1 contains the six measures used in this study and the alternate versions that were constructed. Details regarding the SES composites can be found in Table 2. The correlation between alternate versions of measures constructed for this study ranges from moderate between composite SES measures (0.40) to strong between alternate specifications of DSH payments (0.81). A single version was chosen of each measure was chosen, and is displayed in bold in this table. Two measures had one alternate construction, and the measure specified as a proportion was retained for ease of interpretation. Two measures had two alternative constructions; for these measures, tests of internal consistency were used to select the most representative version of the measure. Item-rest correlation values for these two measures were 0.67 for the selected Medicaid measure and 0.72 for the selected composite measure (results not shown).

The characteristics of the 3,782 hospitals included in this sample are detailed in Table 3. This sample includes many small hospitals (44.2%). Most hospitals are non-profit (61.5%), non-teaching (73.9%) and low-technology (74%), located in urban and suburban areas (59.0%),

throughout the country. The remaining columns display the distribution of characteristics of hospitals in the highest quartile by each measure.

For each measure, the quartiles containing the highest proportion of economically disadvantaged patients had a disproportionately high concentration of small, nonteaching and government hospitals. Hospitals located in the South tend to be overrepresented with each measure. Rural hospitals are less likely to be in the top quartile of DSH payments, although they have a relatively high proportion of Medicaid patients. For profit hospitals are more frequently in the highest quartile when characterizing hospitals by Medicaid and census measures, but not by DSH payments. Altogether, it seems that these measures are classifying different groups of hospitals as serving high proportions of economically disadvantaged.

Poverty and median income classify a disproportionate amount of small hospitals as serving high proportions of economically disadvantaged patients, while the DSH payments and the composite classify more big hospitals that way. Hospitals caring for the top quartile of low-income patients are likely to be low technology, but hospitals receiving the top quartile of DSH payments are likely to be high technology. Nearly 90% of the hospitals receiving the top quartile of low income are non-teaching hospitals, although only 60% of the hospitals in the top quartile of DSH payments are. Thirty two to 34% of hospitals classified as high-Medicaid, high-poverty or low-income are for profit hospitals- Half of the hospitals classified as top quartile by income are rural; only 13.8% of these hospitals are in the top quartile of DSH payments. Nearly 40% of the hospitals in the top quartile by income are critical access hospitals, and nearly 80% are sole community providers.

To determine whether population-based measures are similar to hospital-based measures of patient SES, Spearman's correlation test was used. The results, presented in Table 4, suggest

that hospital-based measures have minimal correlation with population-based measures, with the exception of a moderate correlation of DSH payments to two of the SES composites. The median income has an especially low correlation with the three hospital-based measures. Each other population-based measure is minimally correlated with the proportion of Medicaid patients, although only two of the three composite scores are minimally correlated with uncompensated care (the same composites that are moderately related to DSH payments).

Finally, the census measures were compared to one another to determine which measure best represents the group of measures. Results of a Spearman's correlation test, presented in Table 5, show that the proportion of the population from high poverty ZIP codes is moderately to strongly correlated with each population-based measure. Results of a test of internal consistency confirm this finding; the poverty variable has the highest Cronbach's Alpha if deleted (CAID).

Discussion

Measure selection impacts interpretation of study results as well as comparability of studies. As demonstrated in this paper, different formulas or different data sources create alternate measures that are not always strongly correlated to one another. The lack of methodological clarity in studies examining quality at hospitals serving high proportions of economically disadvantaged patients further complicates comparability of studies.

In this study, we created quartiles to define hospitals as serving a high proportion of economically disadvantaged patients. Comparing the characteristics of hospitals in the top quartile by each measure, we found significant variation. Some measures over-represent small non-teaching hospitals or large government-owned hospitals. Nearly every measure classifies a disproportionate amount of Southern and for-profit hospitals in the top quartile. Some of these

variations seem to have a clear etiology—rural poor have a lower income level than urban poor, but some findings have a less obvious explanation, such as the overrepresentation of for-profit hospitals in the top quartile of each measure, a finding that has been reported elsewhere[17,21]. These findings support literature regarding the lack of agreement between definitions of safety nets[25,26]. We included designations of critical access hospitals and sole community providers in this study because limited research shows that CAH have worse processes of care and higher mortality[10].

To determine whether commonly used hospital-based measures are reflective of population-based measures, we examined correlation between these measures. Overall, we found low levels of correlation, with the exception of moderate correlation between DSH payments and two of the three SES composites. In a longitudinal study of nearly 2,400 hospitals located in metropolitan statistical areas, Zwanziger and Khan (2008) report a moderate correlation between Medicaid intensity and an SES composite (0.52) [25]. Using the same composite (but a slightly different calculation of Medicaid intensity), we find a lower correlation (0.36), but come to the same conclusion that alternate measures lead to alternate categorizations of hospitals.

To achieve our third aim, we examined the correlation of population based measures to each other. We found that the population in poverty is moderately to strongly correlated with the other single-item measure and with the three composites. We confirm this finding with a test of internal consistency, and conclude that the measure of poverty can be used in lieu of more time-intensive composite measures. We hope this finding provides guidance to researchers.

Writing in 2005, Braveman and colleagues suggest: "Measures of SES should be selected and interpreted thoughtfully in the context of plausible explanatory pathways through which

socioeconomic factors may influence health." [27]. Despite the recommendations of this and several other studies over the last 10 years, we find that not much has changed in the selection, explanation or usage of measures of SES in the health services literature. Additionally, research shows that the use of multiple measures may be superior[25], but few studies examined here used multiple measures in a sensitivity analysis[21,29,31]. Many studies examined here operationalize measures of hospital-level economic disadvantage as categorical, presumably for ease of interpretation (as explicit detail regarding data-driven cutpoints has not been seen). Zwanziger and Khan (2007), as well as Braveman and colleagues (2005) found that the use of arbitrary cut-points is problematic[25,27].

Our review of the literature regarding hospitals serving a high proportion of economically disadvantaged patients suggests that population-based measures are underutilized as a means of categorizing hospitals. Measures derived from the census are primarily used as controls in studies examining the relationship between patient minority status and outcome, rather than as a means to classify a hospital. Additionally, census data are employed as single-item and composites, often without justification. The findings of this study suggest that a single measure—the proportion of patients from high poverty ZIP codes-- is representative of the group of census measures, and the additional construction may not be necessary. This agrees with previous work suggesting that many composites are unvalidated[27].

These findings suggest that studies using SNH or HMH categorization are conceptually and methodologically different than studies about hospitals that serve high proportions of patients of low socioeconomic status. Minimal to moderate correlation between population-based measures and both Medicaid intensity and DSH payments suggest that there is some overlap of these groups, but supports our hypothesis that there are important aspects of population-based measures

that are not captured in hospital-based measures. In fact, the correlations that we found between the two groups of measures was lower than expected, and suggests the absence of quality studies using census data to categorize hospitals is an important limitation in this body of work.

In 2010, Zwanziger found large variation over time in hospital financial measures[25]. Concerns about regional variation in policy, funding and coverage have only become stronger with the passage of the Affordable Care Act. DSH payments are being phased out and the state-by-state gap in Medicaid eligibility and generosity has increased. With states opting out of Medicaid, bigger regional differences in Medicaid proportions may not reflect the need of the population. Uncompensated care may become less important in places where the proportion of uninsured is dramatically reduced, but studies from countries with socialized medicine suggest that an increase in insurance is unlikely to eliminate SES disparities.

This study is intended to provide insight for researchers and policymakers who use measures of hospital-level economic status in evaluating quality, identifying high-risk hospitals, and informing policy decisions. However, several issues should be taken into consideration. In this study, measures were recreated to the best of our ability, given limited descriptions in the literature regarding data source and variable specification. We used only data that was publically available and free, to maximize the usability of findings for all researchers. In addition to the limitations of available data, this study has conceptual limitations. All datasets are cross-sectional, and cannot reflect the evolving nature of neighborhoods and hospitals. This study used measures that seem to represent a category better, which may not be optimal. This study doesn't examine the differential treatment of low SES patients within hospitals; rather, it follows previous studies which classify hospitals based on the patient population and examine differences in

quality. Also, SES measures are drawn from ZIP code-level census—rather than individual--data, but studies show neighborhood SES measures are representative of individual SES[45].

Research suggests that economically disadvantaged patients may experience institutional disparities, which exacerbate health disparities. Because many different measures are currently used to classify hospitals as serving high proportions of economically disadvantaged patients, the comparability of these studies is limited. To develop a consistent and convincing body of evidence regarding the quality of care at hospitals that serve high proportions of economically disadvantaged patients, consensus must be built regarding measures used to classify hospitals. This is made difficult by the lack of clarity regarding which measures were used, including how they were selected, how they were calculated, and how cut-points were determined.

Based on the findings of this study, we have several recommendations for researchers and policy makers. First, measure selection can have a big impact on interpretation of study results as well as comparability of studies; decisions about measures should depend on the research or policy question, and clarity and transparency about the decision should be available. Second, when appropriate, multiple measures should be utilized, in conjunction with each other or as part of a sensitivity analysis. Third, policy makers should consider measures that would allow for more and better publically collected data regarding SES.

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TABLES

Table 1: Measures created for Comparison: Number, Specification (data source) And Spearman's Correlation between Alternate Versions

Measure	No.	Specification	Rho
Hospital-Based			
Medicaid	3	Medicaid Days/Total Days **Medicaid Discharges/Total Discharges** (**AHA**) Medicaid Discharges/Total Discharges (MCF)	0.41- 0.70
Uncompensated Care	2	Bad Debt + Charity Care **Uncompensated Care/Total Charges**	0.76
DSH	2	**Proportion Disproportionate Share Hospital Payments** Total Disproportionate Share Hospital Payments	0.81
*Census Based**			
Income		**Median income**	--
Poverty		**Proportion below 150% federal poverty line**	--
Socioeconomic Composite+	3	Sum of standardized variables (#): wealth, education, occupation (6) **wealth, education, occupation, other (4)** wealth, education, occupation, other (4)	0.40-0.58

* Census measures are hospital weighted average of ZIP code measures + table 2 details measures included

Bolded measures are retained for analysis

AHA= American Hospital Association MCF= Medicare Cost File

Table 2: Aspects of Socioeconomic Status Measured in Census Single-Items and Composites

Aspect of Socioeconomic Status	Income	Poverty	Comp. #1	Comp. #2	Comp. #3
Wealth					
Median Income	**X**		**X**		**X**
Proportion below 150% FPL		**X**		**X**	**X**
Interest/Rental/Other Income			**X**		
Median Housing Value			**X**		
Education					
Proportion 25+ H.S. diploma			**X**		**X**
Proportion 25+ College diploma*			**X**	**X**	
Occupation					
Proportion 16+ employed**			**X**		
Proportion Blue Collar Employed				**X**	
Other					
Proportion Female HoH				**X**	
Proportion Minority					**X**

*Composite #1 is proportion with diploma, Composite #3 is proportion without

**Composite 1 is 16+ employed, #2 is 16+ males unemp

H.S.= high school HoH= head of household

Table 3: Distribution of Hospital Characteristics in Full Sample and Top Quartile by Measures (percentages) (N=3782, n=948)

Hospital Characteristics		Full Sample	*Hospital-Based*			*Population-Based*		
			UC	**DSH**	**Medcaid**	**Comp.**	**Poverty**	**Income**
Bedsize	small	44.2	38.6	28.0	38.4	37.1	57.1	69.0
	medium	30.7	32.5	34.1	35.1	32.2	26.4	22.4
	large	25.0	26.9	39.1	26.5	30.7	16.5	8.6
Techno-logy	high	26.0	25.3	32.0	20.1	27.4	25.3	9.3
Teaching status	none	73.9	67.8	59.9	69.0	66.0	81.3	88.5
	Minor	20.9	22.6	27.8	21.6	25.0	13.5	10.0
	major	5.2	9.5	12.3	9.4	9.0	5.2	1.5
Owner-ship	For profit	21.8	25.8	24.8	32.0	26.8	32.2	34.3
	Nonprofit	61.5	61.6	47.1	60.6	50.2	45.1	47.3
	Gov'ment	16.7	12.6	28.1	7.4	23.1	22.8	18.5
CBSA	Rural	22.3	19.4	13.8	26.9	19.1	37.3	50.1
	Micro	18.7	25.0	17.2	19.7	17.5	24.7	28.3
	Metro	44.1	40.0	42.6	37.8	41.3	26.7	18.1
	Division	14.9	15.8	26.4	15.7	22.2	11.4	3.5
Region	Northeast	14.1	17.1	10.9	15.8	9.0	5.0	5.0
	Midwest	17.1	15.3	6.0	12.8	17.8	7.4	6.5
	South	39.1	37.8	54.8	35.1	53.0	66.7	65.6
	West	29.6	29.8	28.4	36.3	20.2	21.0	22.9
Critical Access Hospital		22.7	6.2	0	25.4	15.7	28.4	38.1
Sole Community Provider		10.5	19.7	14.6	12.8	9.5	16.1	78.9

- Income variable is reverse coded, to reflect the inverse association with economic disadvantage[i]
- **Comp= compositte**

Table 4: Correlations of Population-Based Measures to Hospital-Based Measures: Spearman's Correlation Coefficient (N=3782)

	Poverty	Income	Composite #1	Composite #2	Composite #3
% Medicaid	0.29	-0.12	0.23	0.35	0.36
Uncomp Care	0.10	0.03	0.05	0.21	0.20
% DSH	0.29	-0.04	0.20	0.44	0.50

Table 5: Correlations between Population-Based Measures: Spearman's Correlation Coefficient (N=3782)

	Poverty	Income	Comp #1	Comp #2	Comp #3
Income	-0.84				
Comp #1	0.84	-0.85			
Comp #2	0.54	-0.23	0.41		
Comp #3	0.63	-0.27	0.49	0.58	
CAID	0.77	0.84	0.81	0.86	0.87

CHAPTER 3

Nursing Resources at Hospitals Serving High Proportions of Economically Disadvantaged Patients

Objectives: Hospitals serving high proportions of economically disadvantaged patients provide lower quality care, exacerbating health disparities. Organizational nursing resources impact patient and nurse outcomes, but little is known about resources at these hospitals. **Methods:** This is a cross-sectional secondary data analysis examining reports of nursing resources and outcomes by 23,629 nurses at 503 hospitals in 4 states. Hospitals are classified by quartiles of patient poverty and model adjusted means are calculated. **Results:** Compared to low-poverty hospitals, nurses at high poverty hospitals reported less favorable nurse work environments (mean score: 2.62 vs. 2.77, $p<0.000$) and staffing levels (patients per nurse: 5.34 vs. 4.92, $p=0.002$) and were more likely to report dissatisfaction (28.2% vs. 24.4% respondents, $p=0.033$), intention to leave (19.8% vs. 14.7% respondents, $p=0.001$) and emotional exhaustion (35.8% vs. 31.7% respondents, $p=0.027$). **Conclusions:** Nurses at high-poverty hospitals work with fewer resources and are more likely to experience negative outcomes. These nurses care for patients with complex needs; increasing the availability of resources may benefit nurses and, ultimately, patients.

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Writing thirty years ago, Allen Buchanan (1984) said:

> "…once the case has been made for expending public resources on public health measures, there is a moral (and perhaps constitutional) obligation to achieve some standard of *equal protection* from the harms these measures are designed to prevent".

The Patient Protection and Affordable Care Act was created to expand access to healthcare services for uninsured and underinsured American citizens and provide incentives for the delivery of high-quality care, among other goals. Through the Hospital Readmission Reductions Program (HRRP) and the Hospital Value Based Purchasing (HVBP) program, hospital reimbursement will be linked to reported measures of quality. Although all can agree that high quality care is a worthy goal, some worry that these programs will unfairly burden hospitals serving the economically disadvantaged, which are often low-resourced and perform poorly these measures of quality[16,31,46,47]. Some worry that these changes in payment will cause hospitals serving the economically disadvantaged to fall further behind[29,48]. Indeed, preliminary research suggests safety net hospitals had higher Medicare withholdings in the first year of HVBP[32].

Research shows that many factors besides preference influence where patients receive care[49-53]. The fact that care for low-income and minority patients is highly concentrated in a group of hospitals that provides lower quality care[7,10,13,54-56] raises concern about cost, inefficiencies[13], and social justice[57,58]. Understanding the sources of variation in quality at these institutions is therefor critical. Nurses are the largest body of providers of direct patient care at hospitals with high concentrations of low-income and minority patients, and research has shown that the workforce composition and organizational resources available to nurses influence the quality of care nurses provide[11,59-62]. These aspects of nursing care vary widely from institution to institution[63], and burgeoning evidence suggests that structural aspects of nursing care play a role in institutional disparities[11,22].

As yet, little is known about nursing resources and outcomes at hospitals that serve economically disadvantaged patients. As policy makers and hospital administrators make decisions and investments in quality improvement initiatives, it is crucial that we understand the many sources of variation that contribute to patient disparities. To maximize equity and to improve patient and nurse outcomes, quality improvement initiatives should be carefully designed to improve the resources available to nurses at these hospitals. This study examines the variation in nursing resources and nursing outcomes across a large and diverse group of hospitals, and may offer guidance for these decision makers.

Institutional Disparities

A large body of work documents institutional disparities, the unjust or preventable differences in care at hospitals caring for underserved populations that perpetuate or exacerbate health disparities. This body of work has primarily focused on two groups of patients: black/minority[1,3-14] and Medicaid/economically disadvantaged[17,19,21-23,31,64]. Documented differences in the quality of care draws attention to the small group of highly concentrated hospitals for quality improvement, but few actionable solutions are offered.

Nursing Resources

When examining the quality of care in hospitals, nursing matters. Nurses are the primary providers of direct patient care for most hospitalized patients. Research shows that the resources available to nurses—including the organization in which they work, the training they have received and the workload they are assigned-- affect the care received by patients and subsequent clinical and non-clinical outcomes[63,66-68].

Nursing care is intricate and complex. Nurses across disciplines and settings provide a range of care, only some of which can currently be measured. Some aspects of individual nursing

characteristics, such as educational preparedness, can be measured and have been linked to patient outcomes[59,69,70]. However, a large body of evidence suggests that it is the system in which a nurse provides care, rather than aspects of the individual nurse, that impacts patient outcomes.

Staffing is a widely-used system-level measure of nursing care. Indeed, many studies of institutional-level disparities report significantly lower levels of nurse staffing at hospitals serving high proportions of minority or Medicaid patients[1,3,12-14,21,47]. One study examining nursing care in an academic research consortium concluded that poor staffing had a larger impact on patient mortality in safety net hospitals[22]. These results suggest that staffing is a nursing resource that may contribute to institutional disparities.

The organization climate- which describes both the work environment and the ethical climate- is the context in which nurses provide care, has a direct impact on both nurse and patient outcomes. The work environment represents the properties of this climate that help or hinder nurses from providing effective care, including the adequacy of staffing, the responsiveness of management, the communication and collaboration with colleagues, the involvement of nurses in decision making and the availability and strength of nursing leadership. The work environment has been linked to nurse and patient outcomes[59,71-74]. Another important component of the organizational resources is the ethical climate, which provides a context for nurses to engage in reflective practices and value-aligned care, including access to ethics support and advice, as well as opportunities to discuss ethics[75]. A positive ethical climate is also associated with increased nursing outcomes[75-77], which likely affect patient outcomes, although this link has not yet been evaluated in the published literature.

Nursing Outcomes

The causes and effects of negative nursing outcomes have been studied extensively.

Positive nurse environment[78] , positive ethical climate[76], and lower staffing ratios[79] have been shown to be protective against negative nursing outcomes. These negative nurse outcomes include moral distress, dissatisfaction, burnout, intention to leave, and attrition[71,75,80,81]. They impact nurses who experience them and the system in which they work, as well as the patients to whom they provide care. At hospitals with higher levels of burnout, there are lower rates of patient satisfaction[81,82] and nurse-reported quality of care[83], and higher rates of nosocomial infections[84].

Methods

Data and Sample

We conducted a secondary analysis using observational, cross-sectional, national data from four sources: the 2006 Medicare Health Service Area File (HSAF), the 2005-2007 American Community Survey (ACS), the 2006 American Hospital Association (AHA) annual survey and the 2006/2007 University of Pennsylvania Multi-state Nursing Care and Patient Safety Survey. Included hospitals met the following criteria: 1) adult, nonfederal acute care hospitals in the United States, 2) reliable, linkable data from each of the data sources and 3) at least 10 nurse respondents.

Reports of nurse workload and work environment, as well as satisfaction, emotional exhaustion, depersonalization and intention to leave were generated from a 2006-2007 survey sent to 272,783 nurses in four states. Responding to this questionnaire were 27,509 nurses representing 617 hospitals (initial response rate 39%, follow up response rate 91%). Resurvey methods demonstrated no significant difference in responders and non-responders. The parent study measured nurse workloads, education, work environment, demographics, burnout, job dissatisfaction, intent to leave, quality of care patient safety indicators and frequency of adverse

events and missed care. The final sample contained 23,629 direct care nurses (mean 47, range 10-282) reporting on care at 503 hospitals.

Variables of Interest

Nursing Resources The Nurse Work Environment was measured with the Practice Environment Scale of the Nursing Work Index, an instrument that has been extensively used in the literature and with this population[59,71-73,85]. Individual responses to four subscales of questions regarding the support, collaboration, leadership and participation[86] were summed and aggregated to the hospital level. Nurse education was represented as the hospital-level proportion of nurses with a bachelor's degree in nursing (BSN). Staffing was based on the average reported number of patients on a given unit divided by the average reported number of nurses on the same unit, and reported here as a hospital-level average. As in previous work, we excluded values of less than one or more than twenty, as this is an improbable assignment.

Hospital Poverty American Community Survey data includes the proportion of people from each ZIP code below 150% of the Federal Poverty Line. Medicare Hospital Service Area Files were used to create hospital service areas which included 75% of the patients discharged from each hospital in the year 2006. The hospital-level measure of poverty used in this study is a weighted proportion of patients from these ZIP codes. Quartiles of poverty were created with a national sample; thus, the top quartile in this sample represents hospitals that would be classified as such in a national sample; these hospitals are referred to here as "high-poverty hospitals".

Outcome Variables Three nurse outcomes were used in this study. Dissatisfaction was measured using a 4-point Likert scale, ranging from "very satisfied" to "very dissatisfied" , classifying nurses as dissatisfied if they responded as "a little dissatisfied" or "very dissatisfied" to the question, "How satisfied are you with your job?". This measure specification has been used

in this sample previously[81]. Intention to leave was captured with a dichotomous measures, "Do you plan to be with your current employer one year from now?" (yes or no). Nurse Burnout is the sum of responses to nine 6 point Likert-scale questions corresponding to emotional exhaustion subscale adapted from the Maslach Burnout Inventory-HSS. Nurses are classified as exhibiting burnout if their scores fell into the predetermined range of the scale. This outcome has also been used extensively in this population[62,71,78,81]. All three outcomes were examined here at the hospital level, as a proportion of nurses exhibiting each outcome.

Hospital Characteristics Six hospital structural characteristics from the 2007 AHA Annual Survey of Hospitals were included in this study as hospital covariates. Hospitals were classified according to teaching status as none, minor or major, depending on trainee to bed ratio (0, <1:4, >1:4). Hospital size is characterized as small, medium or large based on number of beds available (<100, 101-250, >250). Technology status is dichotomized by the availability of open-heart surgery or organ transplantation as defined by Silber (2007) as contributing to failure to rescue. Location is categorized by state (NJ, PA, FL, CA) and core based statistical area (division >2.5 million, metropolitan 50,000-2.5 million, micropolitan 10,000-49,999 and rural <10,000). Hospital ownership in this sample was identified in the following ways: for profit, not-for-profit and government.

Analysis

All analyses were conducted at the hospital level. Measures of nursing resources reported at the individual nursing level were aggregated to the hospital level, as means (staffing and environment) or proportions (BSN). Measures from census data were linked to hospitals through the creation of hospital service areas accounting for ZIP codes containing 75% of the patients served, based on previous work[25]. These measures were assigned to the hospital based on the

relative weight of the number of patients from each ZIP code in the service area. Categories were created to represent hospitals caring for different proportions of patients in poverty, based on a national sample. Linear regression controlling for hospital characteristics was performed. Model-based means and standard errors for each category of hospital were obtained.

All analyses were performed with Stata Version 12 (StataCorp., 2011).

Results

Table 1 shows the characteristics of all hospitals included in the full sample and in each poverty quartile. In the full sample, nearly half of the hospitals were large, non-teaching, and located in metro areas. More than half of these hospitals were high tech and non-profit. Compared to the full sample, low-poverty hospitals were slightly smaller and less likely to be teaching or high technology, and they were more likely to be not non-profit, urban and located in New Jersey. No rural hospitals were categorized as low poverty. High-poverty hospitals were more likely to be large and major teaching hospitals, and were less likely to be non-profit and more likely to be urban and located in California.

Means and standard deviations of nursing resources and outcomes are displayed in Table 2. In this sample, the mean rating for work environment was 2.73 out of 4. The mean number of patients a nurse cares for was 5.05 and the average percentage of nurses with a bachelors degree in nursing was 37.4%. On average, 26.2% of nurses reported dissatisfaction with their job, 33.7% reported burnout and 15.8% reported that they intend to leave their job within the year.

Figure 1 shows the distribution of nursing resources by quartiles of poverty, adjusted for hospital covariates. Compared with hospitals with low levels of poverty, hospitals with higher levels of poverty had poorer staffing (5.34 patients per nurse vs. 4.92, p=0.002), and poorer nurse

work environments (2.62 vs. 2.77, $p<0.001$), but no difference in the education level of nurses (0.38 vs 0.38 $p=0.633$).

Figure 2 shows nurse outcomes at hospitals with varying levels of poverty, adjusted for covariates. Compared to nurses in low poverty hospitals, nurses in high poverty hospitals were more likely to be dissatisfied with their job (28.2% vs 24.1%, $p=0.033$) and report emotional exhaustion (35.8% vs 31.7%, $p=0.027$). These nurses were also more likely to report an intention to leave their current position (19.8% vs 14.2%, $p=0.001$).

Discussion

High-poverty hospitals in this sample are disproportionally large, urban, high technology, teaching hospitals in urban California. These hospitals were likely to be for profit hospitals, a finding similar to the sample of safety net hospitals in a study by Chatterjee and colleagues (2012) and Culler and colleagues (2010) [17,21]. These hospitals had lower levels of nursing resources, including poorer work environment and worse staffing levels, and higher levels of negative nursing outcomes, including dissatisfaction, burnout and intention to leave. No difference was found in the percentage of nurses with bachelor's degrees.

Disparities in nursing resources at hospitals caring for high proportions of economically disadvantaged patients raises concerns for nurses, patients and hospitals. Overcoming challenges, stress and complications are part and parcel of the daily work of a nurse. Without the resources to provide appropriate and high-quality care, however, poor nursing outcomes may be inevitable. These poor outcomes are symptoms of systematic issues and are dangerous for the nurses who care for the sickest patients. Just as the availability of nursing resources raises equity concerns for patients seen at hospitals caring for underserved populations, poor nursing outcomes in these

hospitals raise social justice concerns. Nurses in these hospital care for patients with complex medical and psychosocial needs. Like nurses everywhere, these nurses depend on organizational resources to perform their job. When these resources and positive climate are lacking, negative nursing outcomes may occur, with implications for the retention of nurses and the quality of hospital care.

This lack of resources may affect the ability of nurses to provide high quality care to the economically disadvantaged patients seen at these hospitals, and may lead to disparate patient outcomes that exacerbate existing health disparities. Research shows that poor nursing outcomes like the ones found in this study are associated with poor patient outcomes[62,84,87]. It is plausible that the nursing resources and nursing outcomes at hospitals serving high proportions of economically disadvantaged patients could be related to the poorer patient outcomes at these hospitals.

The greater levels of dissatisfaction, burnout and intention to leave raise concerns that existing institutional disparities could get worse, if hospitals with poor staffing lose additional nurses and appropriate resources are not available to resolve the practical and ethical challenges of patient care. As hospital reimbursement shifts towards payment for quality, hospitals that serve high proportions of economically disadvantaged patients may face threats to financial solvency[16,88,89]. These findings suggest that quality improvement interventions that target nursing resources, such as initiatives to improve the work environment, or the hiring of additional staff, could improve both nursing and patient outcomes at hospitals serving high proportions of economically disadvantaged patients. In fact, in a longitudinal study of hospital nurses, Kutney-Lee and colleagues (2013) found that improvements in the work environment were significantly negatively associated with each of the outcomes studied here[78].

This study is the first to examine nursing resources and outcomes at hospitals that serve high proportions of economically disadvantaged patients, and the study has several strengths and several limitations. This study is a snapshot of nursing resources in 503 hospitals at a single point in time, no inferences about causality or directionality can be made. This data is from 2006/2007; although we don't hypothesize a big change in nursing resources at high-poverty hospitals in the years immediately following this data collection, recent policy significantly changing hospital financing may impact the relationships explored here. The included hospitals are located in four large and geographically diverse states, and represent organizations caring for over a quarter of hospital patients. However, these states may not be representative of the economic and racial demographics of all states, including the Midwest and the deep-south. To address concerns about lower levels of poverty in the included states, quartiles created with a national sample. Lastly, this study was also limited by the available data, and no conclusions could be drawn regarding other unexplored variables, such as nurses' perceptions of the ethical climate, moral distress or attrition rate.

Economically disadvantaged populations are more likely to suffer from a complexity of diseases and limited access to a regular source of healthcare, and nurses working at hospitals that serve a high proportion of economically disadvantaged patients may therefor have unique needs. A complete understanding of the presence and relative importance of resources available to nurses that take care of vulnerable patients must also take into account the ethical climates in these hospitals, where conflicts may arise due to differences in culture, communication or values between administration, healthcare workers and patients.

Findings from the institutional disparities literature focusing on minorities suggest that there may be differences in the ethical climate at hospitals caring for underserved populations. At high-minority hospitals there is higher terminal intensive care usage[6], as well as lower nurse-

reported confidence that patients can take care of themselves post-discharge[11] and higher rates of readmission[47]. When nurses feel as though they cannot provide adequate care for their patients because of institutional or other types of constrains, they often suffer from moral distress and intend to leave their position[77,80,90]. It seems plausible that high rates of readmission and low levels of confidence in their patients ability to care for themselves post-discharge may make nurses feel high levels of ethical stress, helplessness and other negative outcomes.

Conclusions

According to some theories of justice, the benefits of progress should accrue to all members of society equally. Initiatives designed to improve quality at hospitals, such as the Readmissions Reduction Program and Value-Based Purchasing, aim to ensure good value for payment. However well-intentioned, these initiatives raise the worrisome possibility that the gap between low and high quality hospitals may widen, further burdening people who seek care at lower quality hospitals, and the nurses who care for the patients there. These and similar policies must be carefully designed to promote equality and social justice, and ensure that all people enjoy the benefits of higher quality care. A thorough understanding of the context in which nurses provide care, and the perceived support that nurses receive is critical to designing interventions which can improve outcomes for patients and nurses.

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Tables and Figures

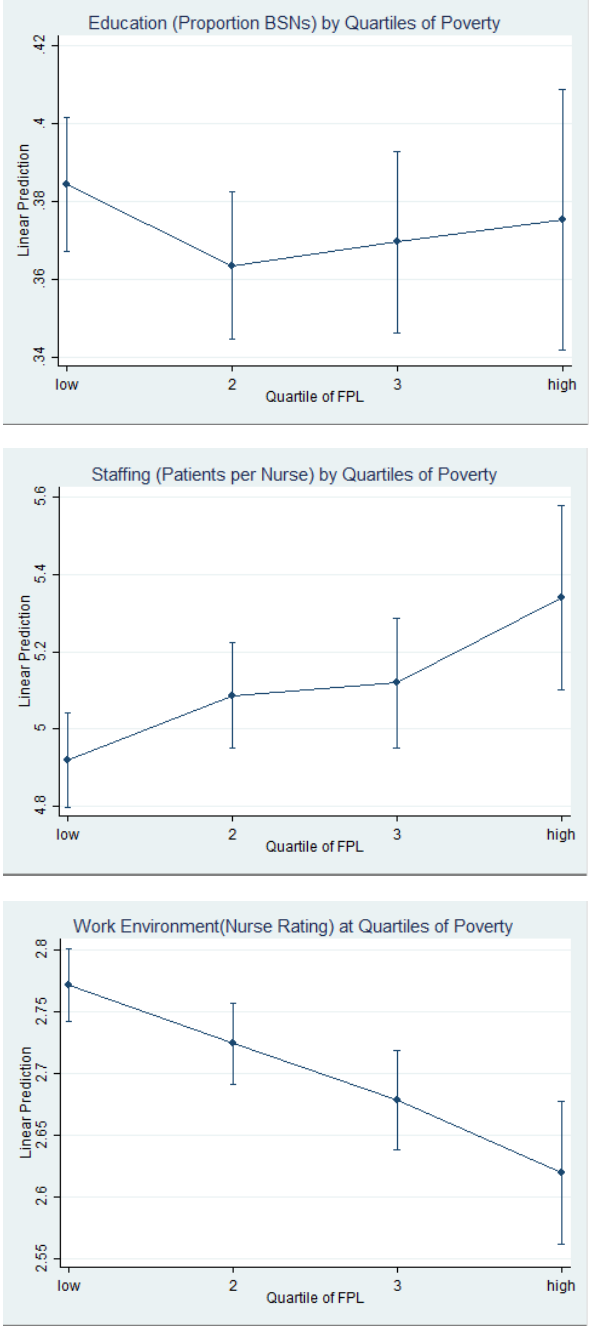
Table 1: Characteristics of Hospitals Included in Sample

	Full Sample (n=503)	Low Poverty (n=196)	2nd Quartile (n=155)	3rd Quartile (n=102)	High Poverty (N=50)
Size: (beds)	**No. (%)**	**No. (%)**	**No. (%)**	**No. (%)**	**No. (%)**
Small (<100)	55 (10.9)	22 (11.2)	13 (8.4)	16 (15.7)	4 (8)
Med (100-250)	214 (42.5)	90 (45.9)	67 (43.2)	38 (37.3)	19 (38)
Large (>250)	234 (46.5)	84 (42.9)	75 (48.4)	48 (47.1)	27 (54)
Teaching Status					
None	241 (47.9)	99 (50.5)	71 (45.8)	50 (49.0)	21 (42)
Minor	221 (43.9)	84 (42.9)	72 (46.5)	43 (42.1)	22 (44)
Major	41 (8.2)	13 (6.6)	12 (7.7)	9 (8.8)	7 (14)
Tech : high	283 (56.3)	81 (41.3)	72 (46.5)	40 (39.2)	27 (54)
Ownership					
For profit	57 (11.3)	14 (7.1)	23 (14.8)	11 (10.8)	9 (18)
Not for profit	347 (69.0)	150 (76.5)	94 (60.7)	74 (72.6)	29 (58)
Government	99 (19.7)	32 (16.3)	38 (24.5)	17 (16.7)	12 (24)
CBSA					
Division	202 (40.2)	97 (49.5)	47 (30.3)	29 (28.4)	29 (58)
Metro	251 (49.9)	90 (45.9)	87 (56.1)	56 (54.9)	18 (36)
∫Micro	42 (8.4)	9 (4.6)	17 (11.0)	14 (13.7)	2 (4)
Rural	8 (1.6)	0	4 (2.6)	3 (2.9)	1 (2)
Location					
CA	181 (36.0)	63 (32.1)	44 (28.4)	43 (42.2)	31 (62)
FL	133 (26.4)	37 (18.9)	61 (39.4)	26 (25.5)	9 (18)
NJ	62 (12.3)	46 (23.5	5 (3.2)	7 (6.9)	4 (8)
PA	127 (25.3)	50 (25.5)	45 (29.0)	26 (25.5)	6 (12)

Table 2: Nursing Resources and Outcomes at 503 Hospitals included in Sample

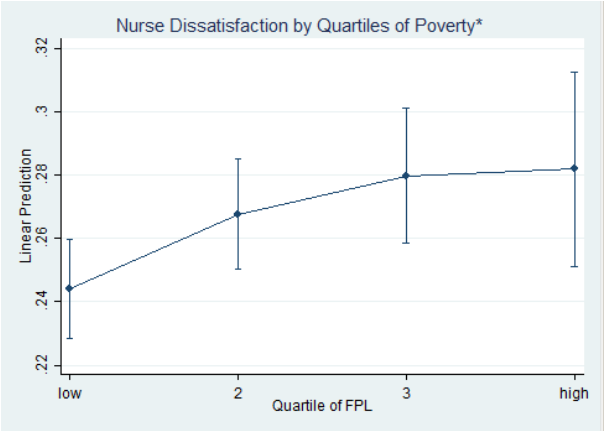
Nursing Resources	**Mean**	**SD**
Environment	2.73	0.22
Staffing	5.05	1.07
Education	37.39	13.41
Nursing Outcomes:		
Dissatisfaction	26.23	11.44
Burnout	33.66	11.66
Intention to Leave	15.76	9.85

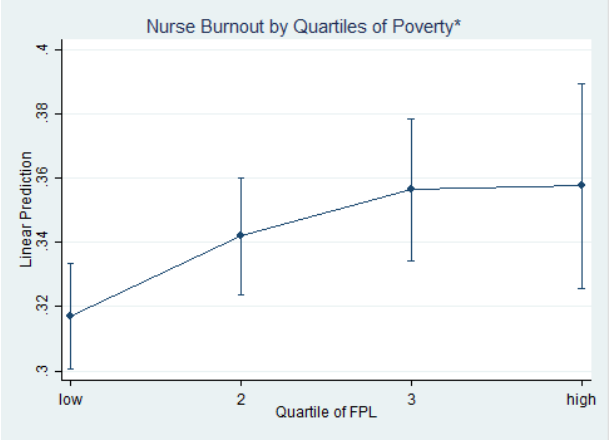
Figure 1: Mean Values of Nursing Resources from Model Adjusted for Hospital Covariates, by Quartiles of Poverty (n=503)

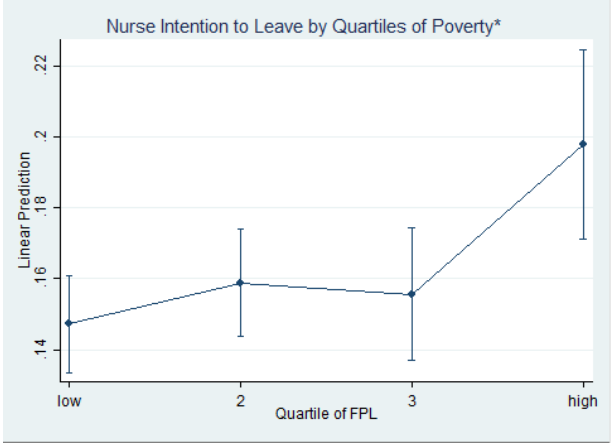


Model adjusted means based on linear regression with controls for hospital characteristics (bedside, teaching status, technology status, ownership, CBSA, location)

Figure 2: Mean Values of Nursing Outcomes from Model Adjusted for Hospital Covariates, by Quartiles of Poverty (n=503)







Model adjusted means based on linear regression with controls for hospital characteristics (bedside, teaching status, technology status, ownership, CBSA, location)
*indicates that highest quartile is significantly different from the lowest quartile at $p<0.05$

CHAPTER 4

Quality, Safety and Satisfaction at Hospitals Serving Economically Disadvantaged patients: A Case for Investment in Nursing

Health disparities are exacerbated by poor outcomes at hospitals serving economically disadvantaged patients. The level of organizational resources available to nurses is strongly associated with care quality and patient outcomes. However, little is known about organizational resources at these hospitals and their impact on outcomes. We examined reports of quality, safety and satisfaction by nurses at 503 hospitals and patients at 375 hospitals and found that the percentage of nurses reporting "excellent" quality care and "grade A" safety decreased by 6% and 4.4% respectively for every 10% increase in the proportion of patients in poverty. The percentage of patients rating the hospital "9" or "10" and "definitely recommend[ing]" the hospital decreased by 1.7% and 3.1% respectively. In fully-adjusted models including nursing characteristics, the magnitude of these effects decreased by 40-100%. These results suggest that improving the nurse work environment and increasing staffing levels is a potential strategy to decrease health disparities.

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Body: 3771 (max 5,000 with abstract)
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Health disparities are exacerbated by low quality care at institutions serving high proportions of economically disadvantaged patients[17,19,21,28,29,34]. These findings raise concerns about cost and inefficiency, as well as equity and social justice. Although this body of work helps to identify low quality care at hospitals that serve vulnerable populations, few actionable solutions to improving care at these institutions have been offered.

The impact of structural aspects of nursing care on patient outcomes is well established[59,67,91]. Although a group of studies indicates that there is lower staffing at hospitals that serve economically disadvantaged patients[15,21,92], little is known about how nursing contributes to institutional disparities. This study explores the impact of nursing resources and workforce characteristics on patient outcomes at hospitals that serve high proportions of economically disadvantaged patients, and offers insight into tangible solutions to improve the quality of care—and thus mitigate disparities—at these hospitals.

The Patient Protection and Affordable Care Act (ACA) was designed to ensure access to healthcare for all Americans, in part by expanding options for affordable insurance coverage. These coverage expansions and subsidies are funded in part by decreased Disproportionate Share Hospital (DSH) payments, the federal expenditures which alleviate the financial burden of uncompensated care on hospitals that serve high proportions of economically disadvantaged patients[93]. In addition to reductions in DSH payments, two programs aimed at aligning hospital reimbursements with the quality of care will change the way that hospitals are reimbursed: the Hospital Value Based Purchasing Program (HVBP) and Hospital Readmission Reduction Program (HRRP). These programs provide incentives to meet benchmarks for three target areas:

evidence-based process measures (HVBP), patient satisfaction (HVBP) and hospital readmission rates, respectively (HRRP).

Research suggests that hospitals serving high proportions of economically disadvantaged patients perform poorly in each of these three target areas[17,21,31,47,94], raising concerns that these quality improvement initiatives will exacerbate disparities in hospital care. Preliminary research shows that hospitals caring for the most economically disadvantaged patients received lower Medicare payment adjustments[32]. These studies offer important insight into the care provided at these hospitals, but largely fail to take into account the work of the largest body of direct care providers—nurses.

In fact, a large body of research establishes the link between structural aspects of nursing care, quality and patient outcomes[63,66,67,70]. The characteristics of the nursing workforce, as well as the availability of nursing resources, have been linked to patient outcomes including infections[84], falls[73], readmissions[91], failure to rescue and mortality[59], as well as satisfaction and discharge knowledge[11]. An understanding of the characteristics of the nursing workforce and the organizational resources available to nurses at hospitals that serve high proportions of economically disadvantaged patients could provide critical insight into the factors contributing to institutional disparities.

This study expands on previous studies to examine the association between three aspects of the nursing workforce—educational attainment, staffing levels and work environment—and quality, safety and patient satisfaction at hospitals serving the economically disadvantaged. Using responses from large, multi-state surveys of hospital nurses and hospitalized patients, we examine differences in the nursing workforce and the organizational resources available to nurses at these hospitals, and explore how these differences impact patient outcomes. Identifying structural

aspects of institutions that are amenable to improvement offers an important means of improving care for patients seen at hospitals serving high proportions of economically disadvantaged patients. A hospital is unlikely to be able to modify the size, ownership, availability of high-technology interventions, or patient population, but evidence suggests that hospitals can improve the work environment for nurses[78]. As initiatives aligning reimbursement with quality proliferate, hospitals with limited resources will need to make important decisions to improve quality, safety and satisfaction. It will be important to take into account variation in the organizational resources available to direct patient care providers.

Study Data and Methods

Data

This study utilized data from five data sources—the 2006/07 University of Pennsylvania Multi-state Nursing Care and Patient Safety Survey, the 2006 American Hospital Association (AHA) Annual Survey, the 2006 Medicare Hospital Service Area Files (HSAF) the 2005-2008 American Community Survey (ACS) and the 2006 Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) Survey—to examine the quality of nursing care and patient outcomes in high-poverty hospitals.

Measures of nurse workload and work environment, as well as nurse-reported quality and safety were created from the responses to a 2006-2007 survey sent to 272,783 nurses in four states. Responding to this questionnaire were 27,509 staff nurses representing 617 hospitals (initial response rate 39%, follow up response rate 91%). Survey of non-respondents demonstrated no significant difference in responders and non-responders. Among the items

measured in the parent study were nurse workloads, educational attainment and work environment, as well as perceived quality and safety of care provided on the nursing unit.

Hospital data is derived from three sources. The AHA Annual Survey contains demographic information on over 6,500 hospitals in the United States, with an annual response rate of over 70%. The Medicare HSAF was used to create hospital service areas (HSA) including ZIP codes accounting for 75% of patients discharged in 2006, based on previous work[25]. The ZIP codes included in the HSA were linked to ACS data to obtain a measure of patient socioeconomic status. This measure was weighted by ZIP code and aggregated to the hospital level, to represent the proportion of economically disadvantage patients.

We use publically reported data from the 2006 HCAHPS survey to obtain measures of patient outcomes. The survey has 27 items, which are available to researchers as 10 risk-adjusted items, including 6 composite measures, 2 single item measures and 2 global measures[95]. Only the latter category is used in this study. These items are risk adjusted based on patient demographics, including self-reported health status, service usage, age, mode of admission, education age, primary language and response percentile.

The sample includes hospitals that meet the following criteria: 1) adult, nonfederal acute care hospitals, 2) inclusion in the HSAF, 3) at least 10 nurse respondents to the Multi-state Nursing Care and Patient Safety Survey. A subset of hospitals was linked to available HCAHPS data.

Variables

Predictors *Nursing.* The Nurse Work Environment was measured with the Practice Environment Scale of the Nursing Work Index, an instrument that has been extensively used in the literature and with this population[59,71-73,85]. Individual responses to four subscales of questions regarding the support, collaboration, leadership and participation[86] were summed and aggregated to the hospital level. The fifth subscale, staffing and resource adequacy, was omitted due to high levels of correlation with the staffing variable. The measure of work environment was used as a continuous predictor in linear regression, and reported as the impact of a one standard deviation increase on the dependent variable.

Nurse education was represented as the hospital-level proportion of nurses with a bachelor's degree in nursing (BSN). Staffing was based on the average reported number of patients on a given unit divided by the average reported number of nurses on the same unit, and reported here as a hospital-level average. As in previous work, we excluded values of less than one or more than twenty, as this is an improbable assignment.

Hospital. Economic disadvantage was the weighted proportion of people from each ZIP code who are below 150% of the federal poverty line, assigned at the hospital level through the HSA procedure detailed above. Quartiles were created using a national sample, thus the top quartile in this sample represents hospitals that would be classified that way in a national sample, these hospitals are referred to here as "high-poverty hospitals".

Outcomes *Patient-Reported.* The publically-available HCAHPS measures are reported as the percentage of patients giving "top box" responses[95]. In the case of the global measures that is a "9" or "10" to the question "*Using any number from 0 to 10…what number would you used to*

rate this hospital during your stay?" and "definitely yes" to the question, *"Would you recommend this hospital to your friends and family?"*.

Nurse-Reported. High quality care is measured as the percentage of nurses at each hospital who responded "excellent" to the 4 point Likert-scale (excellent-poor) question, "*If you are permanently assigned to a unit or to a patient caseload*, in general, how would you describe the quality of nursing care delivered to patients in this setting?". High safety care is the percentage of nurses at each hospital who answered "A (Excellent)" to the 5 point Likert-scale (A-F) question, *"Please give your unit/practice area an overall grade on patient safety."* Individual nurse answers were aggregated to create a mean hospital-level score that was used as an outcome variable.

Covariates Hospital structural characteristics include teaching status, hospital size, technology status, location, ownership, and core-based statistical area (CBSA). Hospitals were classified according to teaching status as none, minor and major, depending on trainee to bed ratio (0, <1:4, >1:4). Hospital size is characterized as small, medium or large based on number of beds available (<100, 101-250, >250). Technology status is dichotomized by the availability of open-heart surgery or organ transplantation. Hospital location is categorized as Pennsylvania, New Jersey, Florida and California and density as division (>2.5 million), metropolitan (50,000-2.5 million), micropolitan (10,000-49,999) and rural (<10,000) CBSA. Hospital ownership in this sample was for profit, not-for-profit and government.

Data Analysis

Linear regression analysis was performed in three incremental steps. The first step was a bivariate regression of each outcome on hospital poverty (model 1). In the second step, hospital covariates were added to the model (model 2). In the final step, nursing structural characteristics were added

to create the fully adjusted model (model 3). Linear regression with models 2 and 3 was repeated using quartiles of hospital poverty to obtain model-based means at each quartile.

All analyses were at the hospital level, and performed with Stata Version 12 (StataCorp., 2011).

Results

Five hundred and three hospitals were included in the sample, using reports from 23,629 direct care nurses (mean 47, range 10-282). Nearly half of the hospitals were large, non-teaching and high-technology and metropolitan hospitals. Well over half were non-profit, with geographical distribution matching state populations. The subset of the sample with HCAHPS data included 375 hospitals which were similar to parent sample, with slightly higher proportions of large, non-teaching, low technology, and government-owned hospitals. Characteristics of hospitals included in the sample are displayed in Table 1.

Table 2 examines the level of three structural aspects of nursing care at each quartile of patient poverty. The highest quartile of patient poverty (determined using national data) includes 50 hospitals for nurse reported outcomes (9.9% of hospitals) and 33 for patient reported outcomes (8.8%). Compared with hospitals in the lowest quartile, hospitals in the highest quartile have poorer staffing (5.34 patients per nurse vs. 4.92, $p=0.002$), and poorer nurse work environment (2.62 vs. 2.77, $p<0.001$), but no difference in the education level of nurses (0.38 vs 0.38 $p=0.633$).

Displayed in Table 3 are the results of the incremental linear regression with 3 models. In models adjusted for hospital characteristics (Model 2), a 10% increase in the proportion of patients in poverty is associated with a 6.4 percentage point decrease in nurses reporting excellent

quality of care. When nursing variables are added (model 3), the magnitude of the effect diminishes; in this model, a 10% increase in the proportion of patients in poverty is associated with a 3.2 percentage point decrease in nurses reporting excellent quality of care. Nurse-reports of the unit safety grade follow a similar pattern. In models adjusted for hospital characteristics, a 10% increase in the proportion of patients in poverty is associated with a 4.8 percentage point decrease in nurses rating safety as "grade A". In the fully adjusted model, the effect size is decreased; in this model, a 10% increase in the proportion of patients in poverty is associated with a 2.8 percentage point decrease in the proportion of nurses rating safety as "grade A".

For both nurse-reported outcomes, the work environment has a large and significant effect, with a 1standard deviation (0.22 units) increase in the mean rating of work environment corresponding approximately to a 9 percentage point increase in nurses reporting that the quality of care was excellent and a 6 percentage point increase in nurses grading safety on their unit as an "A". Staffing was not a significant predictor of quality of care, and a 1 patient increase in average nursing assignment was found to correspond an increase in the proportion of nurses reporting grade "A" safety of less than 1 percentage point. The proportion of BSN-educated nurses was not a significant predictor of these outcomes (results not shown).

In models of patient-reported outcomes adjusted for hospital characteristics (Model 2), a 10% increase in the proportion of patients in poverty is associated with a 1.7 percentage point decrease in patients giving the hospital a high rating. When nursing variables are added (Model 3), the relationship between the proportion of hospital patients in poverty and hospital ratings is no longer significant. In models adjusted for hospital characteristics (Model 2), a 10% increase in the proportion of patients in poverty is associated with a 3.1 percentage point decrease in patients reporting that they would definitely recommend the hospital. When nursing variables are added,

this effect size decreased to a 1.8 percentage point decrease in patients reporting that they would definitely recommend the hospital.

The addition of nursing covariates in model 3 suggests that a 1 standard deviation increase in nurse work environment is associated with a 4.3 percentage point increase in patients giving hospitals a rating of "9" or "10", and a 4.4 percentage point increase in patients reporting that they would definitely recommend the hospital. Nurse staffing was a significant predictor of hospital rating only, with one additional patient corresponding to a nearly 1% decrease in patients rating hospitals "9" or "10".

Table 4 shows the percentage of nurses and patients giving favorable ratings of quality, safety and satisfaction at hospitals separated into quartiles of poverty. Compared to low-poverty hospitals, 13.1% fewer nurses at high poverty hospitals rate the quality of care as excellent and 8.5% fewer give their unit an "A" for safety. Patients report similar patterns; compared to low-poverty hospitals, 4.1% fewer patients give high poverty hospitals high ratings and 9.0% fewer would definitely recommend the high poverty hospital. The results of Model 3 show that accounting for nursing factors diminishes the variation in outcomes across quartiles of patient poverty. In the case of patients giving hospitals a high rating, accounting for nursing factors eliminates the relationship between poverty concentration and patient outcomes.

Discussion

Using nurse and patient reports, this study confirms findings that hospitals with high concentration of low-income patients have poorer outcomes, and is the first to demonstrate that poorer nurse work environment partially explains the lower quality, safety and satisfaction at these hospitals. We found that nurses at high-poverty hospitals have lower levels of resources,

including poorer work environment and staffing levels. Accounting for differences in these nursing resources, the magnitude of the relationship between hospital poverty concentration and poor patient outcomes is decreased by 40-100%. This suggests that nursing resources play a role in institutional disparities

Previous studies examining patient outcomes at hospitals serving the economically disadvantaged have reported poorer outcomes including process of care quality[17,31], adherence to evidence-based guidelines[17,19,64] and patient satisfaction[21], as well as longer lengths of stay[10] and higher mortality for congestive heart failure[22] and post-surgical patients[23]. We find consistent negative outcomes; compared to low-poverty hospitals, in high-poverty hospitals 13.1% fewer nurses rate the quality of care as excellent and 8.5% fewer rate their unit an "A" for safety. Additionally, 4.1% fewer patients gave the hospital high ratings and 9.0% fewer would definitely recommend the hospital.

The cause of these disparate outcomes is multifactorial, but the role of nursing care is often overlooked. Two studies offer insight into the role of nursing care in facilities serving high proportions of economically disadvantaged patients. In a study of California hospitals, Conway and colleagues (2007) found that Safety Net Hospitals (SNHs) had lower levels of nurse staffing before the staffing mandate, and were slower to comply with compulsory levels following the mandate[96]. In a study of 54 large, academic hospitals in the University Health Consortium, Blegen and colleagues (2011) found that although SNH and non-SNH had comparable nurse staffing ratios, poor staffing had a larger impact on patient mortality in SNHs[22]. However, 46 of the 54 hospitals in that study were designated as safety net, limiting the generalizability of the results. These two studies, which focus on nurse staffing levels only, suggest that differences in nursing care may impact outcomes at hospitals serving high proportions of economically

disadvantaged patients. This study confirms findings that nurse staffing is lower at hospitals serving high proportions of economically disadvantaged patients[21,96] and provides new evidence that these hospitals have poorer work environments as well.

The outcomes used in this study are indicators of the quality of care provided at hospitals. Nurse reported quality is highly correlated to indicators of process of care quality and clinical outcome measures[97], that are targeted with HVBP and the HRRP respectively. Patient reported satisfaction is also tied to HVBP reimbursement rates[21]. Patient safety is addressed in part by a 2008 Center for Medicaid & Medicare Services policy change eliminating payments for "never events", and may be a part of pay-for-performance initiatives in the future. These changes, coupled with a dramatic reduction in DSH payments, raise concerns about financing at hospitals serving a high proportion of economically disadvantaged patients, especially in nearly half of the states that declined to expand Medicaid[89].

The findings of this study, however, offer tangible solutions to decrease or eliminate differences in quality, safety and satisfaction at hospitals serving high proportions of economically disadvantaged patients. Improvements in the nurse work environment and staffing levels can have significant effects on patient outcomes. It is possible that investing in nurse staffing and a good nurse work environment can help hospitals, especially those serving high proportions of economically disadvantaged, avoid financial penalties. For example, the results of this study show that differences in the percentage of patients rating a hospital highly (the solitary satisfaction measure used in HVBP) were eliminated when nursing staffing and work environment were taken into account. Now more than ever, an investment in nursing makes sense.

Implications for ACA if insurance doesn't change whether someone is poor, what are the implications? Maybe talk about sensitivity analysis with another measure?

In fact, a recent study shows that achieving Magnet Status, a rigorous and expensive process that requires proof of an excellent nurse work environment, has a sizeable return on investment. Jayawardhana and colleagues show that investment costs are offset by increases in patient revenue of more than $100 dollars per discharge[98]. Additionally, evidence suggests that improvements in staffing are more effective (in terms of decreasing negative patient outcomes) in hospitals with the best work environments[59]. Taken together, these studies suggest that although initiatives to improve the nursing work environment require upfront investment, financial gains can be realized, especially at hospitals facing penalties for failing to reach quality benchmarks.

Strengths and Limitations

This study has several strengths, and also several limitations. The outcomes used in this study were reported by nurses and patients and allowed us to examine the influence of the nurse work environment on the relationship between high poverty hospitals and quality outcomes from the perspective of those delivering and those receiving health care. By using hospital level outcomes chosen to represent global appraisals of quality, safety and satisfaction, this analysis should be less sensitive to differences in patient acuity or complex patient needs that may be different in a high-poverty population. However, these outcomes do not reflect the care provided by an individual nurse or received by an individual patient. Additionally, this study is cross-sectional, so causality cannot be established. This study can be used to inform future research designed to allow causal inference.

There are limitations with the data used in this study but steps were taken to address these limitations. The Multi-State Nursing Care and Patient Safety Survey includes 4 states, which may not be representative of hospitals nationally. To address this concern, quartile cutoffs for the poverty measure were created in a national data set to ensure that the highest quartile will be representative nationally. Census data used to determine the level of economic disadvantage for each hospitals' patient population was based on ZIP code linkage rather than a direct measure of each patients socioeconomic status. Research suggests, however, that ZIP code level measures are representative of individual socioeconomic status[45]. In 2006, HCAHPS responses were voluntary, raising concerns about non-response bias- We compared the hospitals used in each sample here to all hospitals in the 4 states and found that smaller hospital were less likely to respond to HCAHPS, as reported previously[81].

Conclusions

There are many factors that contribute to health disparities, and thus many possible solutions. In the past decade, research has illuminated the role of health care institutions in perpetuating or worsening health disparities, but few practical solutions have been offered. This research builds on a large body of literature examining the link between nursing resources, nursing care and patient outcomes and adds insight regarding the interrelation of these factors at hospitals serving economically disadvantaged populations. Understanding the mechanism through which nursing care may contribute to institutional disparities offers potential for interventions, such as federal assistance to increase enrollment in nursing school and geographic redistribution of qualified nurses, as well as hospitals hiring and administrative and management practices. These solutions may decrease cost and inefficiencies, as well as health disparities.

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Table 1: Characteristics of Hospitals included in Sample

	Outcomes	
	Nurse-Reported (n=503)	**Patient-Reported (n=375)**
	No. (%)	**No. (%)**
Size: (beds)		
Small (<100)	55 (10.9)	34 (9.1)
Med (100-250)	214 (42.5)	154 (41.1)
Large (>250)	234 (46.5)	187 (49.9)
Teaching Status		
None	241 (47.9)	183 (48.8)
Minor	221 (43.9)	163 (43.5)
Major	41 (8.2)	29 (7.7)
Tech : high	283 (56.3)	181 (48.3)
Ownership		
For profit	57 (11.3)	36 (9.6)
Not for profit	347 (69.0)	260 (69.3)
Government	99 (19.7)	79 (21.1)
CBSA		
Division	202 (40.2)	150 (40.0)
Metro	251 (49.9)	191 (50.9)
Micro	42 (8.4)	29 (7.7)
Rural	8 (1.6)	5 (1.3)
Location		
CA	181 (36.0)	140 (37.3)
FL	133 (26.4)	104 (27.7)
NJ	62 (12.3)	39 (10.4)
PA	127 (25.3)	92 (24.5)

Nursing Characteristics at Hospitals Included in the sample (n=503)

Nursing Factors	Mean (SD)	Min	Max
Staffing	5.05 (1.07)	2.93	9.79
Work environment	2.72 (0.22)	2.11	3.38
Education	0.37 (0.13)	0	0.74

Table 2: Model-Adjusted Mean Values of Nursing Resources, by National Quartiles of Poverty

Measure	Nurse Outcomes		Patient Outcomes	
	Margin (SE)*	P value**	Margin (SE)*	P value**
Staffing				
Low	4.92 (0.06)	---	4.87 (0.07)	---
2	5.09 (0.07)	0.079	5.00 (0.07)	0.204
3	5.12 (0.08)	0.065	5.11 (0.10)	0.047
High	5.34 (0.12)	0.002	5.20 (0.15)	0.043
Work Environment				
Low	2.77 (0.02)	---	2.79 (0.02)	---
2	2.72 (0.02)	0.037	2.74 (0.02)	0.043
3	2.68 (0.02)	0.000	2.69 (0.02)	0.002
High	2.62 (0.03)	0.000	2.63 (0.04)	0.000
Education				
Low	0.38 (0.01)	---	0.391 (0.01)	---
2	0.36 (0.01)	0.114	0.370 (0.01)	0.125
3	0.37 (0.01)	0.322	0.375 (0.01)	0.359
High	0.38 (0.02)	0.633	0.378 (0.02)	0.573

*Model adjusted means based on linear regression with controls for hospital characteristics, including: bedside, teaching status, technology status, ownership, CBSA, location)
**P value reflects test that mean is significantly different than mean for low category

Table 3: Effects of Poverty and Nursing Resources on Patient Outcomes (unit of change)

Excellent Quality of Care (n=503)			
	Model 1	Model 2	Model 3
Poverty (10%)	-6.01*** (0.76)	-6.37*** (0.79)	-3.16*** (0.61)
Work Environment (1 SD)	---	---	8.98*** (0.46)
Staffing (1 patient)	---	---	-0.80 (0.50)
Safety Grade "A" (n=503)			
	Model 1	Model 2	Model 3
Poverty (10%)	-4.36*** (0.59)	-4.77*** (0.61)	-2.79*** (0.52)
Work Environment (1 SD)	---		6.19*** (0.40)
Staffing (1 patient)	---	---	0.863* (0.43)
Overall Rating "9" or "10" (n=375)			
	Model 1	Model 2	Model 3
Poverty (10%)	-1.71 ** (0.63)	-1.74** (0.63)	-0.02 (0.57)
Work Environment (1 SD)	---	---	4.33*** (0.42)
Staffing (1 patient)	---	---	-0.97* (0.47)
Definitely Recommend (n=375)			
	Model 1	Model 2	Model 3
Poverty (10%)	-3.13*** (0.68)	-3.64*** (0.68)	-1.89** (0.63)
Work Environment (1 SD)	---	---	4.36*** (0.46)
Staffing (1 patient)	---	---	-1.00 (0.52)

Model 1 is unadjusted Model 2 includes hospital covariates: teach, tech, bedsize, CBSA, state
Model 3 includes nursing covariates: BSN, environment, staffing. BSN was not significant in any models and is excluded here.
*p<0.05 **p<0.01 ***p<0.001

Table 4: High Ratings of Quality, Safety and Satisfaction by Quartiles of Poverty

Outcome	Model 2		Model 3	
	Margin (SE)*	P value**	Margin (SE)*	P value**
Quality of care excellent (n=503)				
1st Quartile	36.07 (1.11)	---	33.57 (0.70)	---
2nd Quartile	31.57 (1.17)	0.002	31.29 (0.77)	0.032
3rd Quartile	29.08 (1.55)	0.000	30.96 (0.95)	0.031
4th Quartile	22.91 (2.31)	0.000	27.79 (1.38)	0.000
Safety (n=503)				
1st Quartile	26.48 (0.86)	---	25.21 (0.61)	---
2nd Quartile	23.61 (0.91)	0.009	23.47 (0.66)	0.057
3rd Quartile	21.37 (1.20)	0.000	22.23 (0.82)	0.004
4th Quartile	18.03 (1.79)	0.000	20.78 (1.19)	0.001
High Rating (n=375)				
1st Quartile	60.76 (0.72)	---	59.68 (0.64)	---
2nd Quartile	58.71 (0.76)	0.054	58.76 (0.67)	0.329
3rd Quartile	59.12 (1.01)	0.192	60.13 (0.88)	0.681
4th Quartile	56.63 (1.50)	0.014	58.95 (1.33)	0.627
Definitely Recommend (n=375)				
1st Quartile	67.11 (0.77)	---	66.00 (0.70)	---
2nd Quartile	63.49 (0.82)	0.002	63.56 (0.73)	0.18
3rd Quartile	63.75 (1.08)	0.013	64.78 (0.96)	0.319
4th Quartile	58.13 (1.61)	0.000	60.49 (1.48)	0.001

Model 2 includes hospital covariates: teach, tech, bedsize, CBSA, state
Model 3 includes nursing covariates: BSN, environment, staffing. BSN was not significant in any models and is excluded here.
**P value reflects test that mean is significantly different than mean for low category

FINAL CHAPTER

Institutional disparities are prevalent and problematic. Ample research shows that certain patient groups—such as minorities and low-income—systematically receive care at lower-quality hospitals, contributing to existing health disparities. This study was undertaken to determine what role the structural aspects of nursing care plays in institutional disparities for the economically disadvantaged. This study joins a small group of studies examining the role of nursing care organization and resources in institutional disparities.

In paper 1, we found that census-derived measures of patient economic disadvantage are minimally correlated with commonly-used measures from hospital financial or survey data. We compare two individual and three composite measures representing the socioeconomic status of ZIP codes, and determine that the proportion of residents in poverty is most representative of available measures. We conclude that the census measures may better represent the socioeconomic status of the patient population than measures contingent on political, social and temporal factors.

In paper 2, we found that hospitals caring for high proportions of economically disadvantaged patients report less favorable work environment and staffing, as well as higher rates of negative nursing outcomes, including dissatisfaction, burnout and intention to leave. Nurses in these hospitals care for patients with complex medical and psychosocial needs, who may have minimal access to regular care. These findings suggest that these nurses have fewer resources; they are asked to care for a greater number of vulnerable and complex patients with poorer organizational assets. In this context, higher levels of negative nursing outcomes may not be surprising.

In paper 3, we found that an increase in the proportion of economically disadvantaged patients was associated with a decrease in nurse and patient reported outcomes regarding the quality, safety and satisfaction of hospital care. Research shows that economically disadvantaged patients are susceptible to sub-optimal hospital care. Results presented here reinforce those findings, and offer insight into the role of the structural aspects of nursing care at these hospitals. We show that poor nurse staffing and work environment at hospitals serving the economically disadvantaged explain part or all of the disparities in outcomes at these hospitals.

These studies offer several areas of insight into current understanding of institutional disparities. Paper 1 explores the relationship of commonly-used measures of patient socioeconomic status to measures derived from the US Census, which are free from dependence on the generosity of social insurance programs, and may be more accurate predictors of patient income. Paper 2 provides the first thorough exploration of both nursing resources and nursing outcomes in hospitals serving high proportions of economically disadvantaged patients, using a large and diverse sample of hospitals. Paper 3 demonstrates that nurse staffing and work environment mitigate the relationship between the proportion of economically disadvantaged patients and negative patient outcomes.

Taken together, these studies suggest that the lower levels of nursing resources in hospitals serving the economically disadvantaged are associated with poorer outcomes for patients and nurses. Accounting for these lower levels of resources decreases the association between high proportions of economically disadvantaged patients and negative patient outcomes. By systematically comparing commonly-used measures of hospital-level economic disadvantage, we can be confident that we are capturing aspects of patient socioeconomic status.

Completion of Aims

This study was undertaken with 3 aims: to compare hospital-level measures of the socioeconomic status of patients, to describe nursing resources at hospitals serving high proportions of economically disadvantaged patients and to explore the relationship between nursing resources and patient outcomes at these hospitals. While the papers presented here broadly address each aim, not all details set forth in the proposal came to fruition.

To satisfy Aim 1, I originally created multiple versions of 11 measure used in the literature to classify hospitals or individual patients as economically disadvantaged in Aim 1. As I carefully reviewed the literature and conceptualized relationships of measures, it became clear that 3 measures were overwhelmingly used to indicate socioeconomic status of patients at the hospital level, with 3 additional measures representing a group predominately used to indicate individual socioeconomic status. Therefore, 12 versions of 6 measures were included in the final analysis. Additionally, several statistical methods were utilized but not included in the final analysis, including comparisons of data cut-points and confirmatory factor analysis. In the proposal, measure agreement was to be compared, without "taking sides". However, it became frustratingly clear that ultimately one measure must be chosen (with others used for sensitivity analysis, if indicated). This measure, the proportion of patient poverty, was chosen based on group representativeness and was the only measure used in papers 1 and 2, adding clarity to theory and interpretation.

The analysis for paper 2 was similar to the proposed plan, although only one measure was used to describe hospital-level patient socioeconomic status as described above. For ease of interpretation, quartiles of poverty were created, and nursing resources across these quartiles were examined. During analysis, a strong statistical relationship was found between the poverty

concentration of the hospital and nursing outcomes. These findings enhanced the ethical argument for improving resources at high-poverty hospitals and were thus included.

Paper 3 matched the corresponding Aim closely, and the analysis, findings and implications were very similar to what was proposed. Although the expected interaction between poverty concentration and nursing resources was not found, the level of nursing resources had measureable impact on nurse and patient reported outcomes. Two of the HCAHPS variables were chosen for inclusion in the final analysis, based on strength of relationship and importance in the research literature and in policy initiatives. Other nurse-reported patient outcomes, such as the frequency of infection and falls were examined during an exploratory phase, but were ultimately inconclusive.

Limitations

Limitations of this study are discussed in each paper. This study was designed to make use of a unique existing data source containing information on nursing resources, nursing outcomes and nurse-reported patient outcomes from 27,509 nurses representing 617 hospitals in 4 states. The novel approach linked this data with data from several publically available sources, with data on hospital finances, hospital organizational characteristics, patient ZIP codes, ZIP-code based socioeconomic measures, and patient satisfaction.

There are 3 major limitations of the data sources and two of the study design. This data is from 2005-2007. Although there is no strong reason to believe the organization of nursing care has changed substantially since that time, recent years have seen big changes in the way health care is financed and it is possible that high-poverty hospitals have taken proactive or reactive measures in response to these changes. Additionally, HCAHPS did not become mandatory for hospitals until 2007, so the group of hospitals used in this study may differ from the hospitals that

weren't used, although sensitivity analysis suggests that is not the case. Another limitation is the loss of information that inevitably arises from linking multiple data sources, even sources from the federal government related to hospital reimbursement or the census. The linkage of multiple data sources was necessary to answer Aim 1, but with fewer data sources we would have been able to retain a greater number of hospitals for analysis. A third limitation is the inability to measure the socioeconomic status of individual patients. Census data has been validated for use in this context, but individual data would have more accurately represented patient socioeconomic status.

The findings of this study are also constrained by the study design. This study is cross-sectional, so we are unable to say that poor nursing resources *caused* worse patient outcomes. A longitudinal design, especially one that included hospitals that had improved their work environment (such as newly-minted "Magnet Hospitals") would have allowed for stronger causal inference. Another limitation is that all analysis occurs at the hospital level, so care cannot be examined at the nurse-patient level. This level of analysis was appropriate for our study, in which we examined hospital characteristics associated with poor outcomes, but studies show that uninsured and underinsured patients suffer poorer outcomes than other patients care for in the same hospital, and this study was unable to capture that level of variation.

Contribution to the Literature

Although incidental findings suggest that nursing care may play a role in institutional disparities, this study joins two others in explicitly examining the structural and organizational aspects nurses of nursing care at these hospitals. In the context of reimbursement changes, hospital administrators and policy makers will continue to search for strategies to improve quality at hospitals that serve high proportions of economically disadvantaged patients. Findings

documenting the importance of nursing resources at these hospitals can inform these interventions and improve outcomes for patients.

This study confirms that hospitals that serve a high proportion of economically disadvantaged patients have poorer patient outcomes. It supports concerns of several studies that new ways of financing care may cause these hospitals to fall further behind. With an explicit focus on nursing resources and the utilization of a unique dataset, this study offers an actionable solution—investing in improvement of the nurse work environment and the hiring of additional nurses—which may have a significant impact on hospital-based health disparities.

As detailed previously, this study provides 5 key findings that contribute to the current body of knowledge surrounding institutional disparities:

1. The correlation between hospital-based and population-based measures ranges from none to moderate, suggesting that these two groups are measuring distinct (but in some cases overlapping) concepts.
2. Categorizing hospitals by the proportion of patients from high poverty ZIP codes provides a novel form of classification and confirms that patients from hospitals serving the economically disadvantaged experience poor outcomes.
3. Hospitals serving economically disadvantaged patients have poorer work environments and lower levels of staffing, confirming findings regarding staffing and offering new insight about the work environment at these hospitals.
4. Higher levels of negative nursing outcomes are found in conjunction with poorer nursing resources, suggesting for the first time that nurses at hospitals serving the economically disadvantaged may not have adequate resources to provide high-quality care to patients.

5. Lower levels of nursing resources at hospitals serving the economically disadvantaged explain a portion of the poorer patient outcomes at these hospitals, joining 2 other studies showing that structural aspects of nursing care cannot be ignored in interventions aimed at ameliorating hospital-based disparities.

By systematically examining the care at hospitals serving high proportions of economically disadvantaged patients—from the classification of these hospitals through the association of the structural aspects of nursing care to patient outcomes—we were able to show that nursing matters. These findings have direct implications for hospital administrators, policy makers, researchers and nurses.

Implications

As hospital administrators grapple with tough issues like quality improvement, reimbursement and strategic planning, findings that both patients and nurse have poor outcomes at hospitals serving high proportions of economically disadvantaged patients should be a catalyst for change. Ample evidence shows that without enough staff or enough resources, nursing care suffers, and findings presented here show that this is the case at hospitals that serve high proportions of economically disadvantaged patients. Investment in the nursing workforce will help these hospitals remain financially solvent, while providing a good environment for their nurses, and delivering high quality care to all patients.

These findings also have implications for policy makers as the design payment strategies that reward efficient, high-quality care. Without appropriate organizational resources, hospitals serving high proportions of economically disadvantaged patients may suffer disproportionally from these initiatives. Policies designed to incentivize investment in infrastructure known to impact quality, such as nurse staffing or the strength of the nurse work environment, may allow

these hospitals to remain competitive in the face of changing reimbursement. Additionally, policy makers should keep in mind that when it comes to categorizing hospitals that serve the highest proportion of economically disadvantaged Americans, measures matter. In the context of quality-focused reimbursement and growing gaps in insurance availability between states, deliberate choices of measures to identify hospitals caring for these patients are essential.

These findings have several implications for researchers. First, the measure used to define hospitals as serving a high proportion of economically disadvantaged patients must be deliberate and thoughtful, as it affects the conclusions that can be drawn from findings, as well as the comparability of studies. Second, the role of the nursing workforce, nursing work environment and nursing care must not be overlooked in studies of patient outcomes, including studies examining institutional disparities. Third, these findings reinforce the validity of the Quality Health Outcomes Model (QHOM) in explaining institutional disparities. This model has previously been used in this context by Brooks Carthon and colleagues (2011), who looked at patient outcomes in hospitals serving high proportions of black patients.

This study has implications for nurses, who are the frontline providers of care in hospitals serving economically disadvantaged patients. As we see in the QHOM, no intervention happens in a vacuum, but rather the effectiveness of nursing care can be helped or hindered by the system in which it is provided. It is likely that nurses working in these hospitals are aware of the lack of resources; in fact, it probably contributes to poorer nursing outcomes. However, findings presented here may empower nurses to demand more for their patients, and for themselves.

Areas for Future Research

Data from the Multi-State Nursing Care and Patient Safety Study has been used to examine the impact of the work environment on a multitude of patient and nurse outcomes. This

work has informed research and policy, and has changed how we thing about the organization of nursing care. The ethical climate has been widely studied, and there is strong evidence of the impact on nursing outcomes. However, there has not yet been a large multi-site study, limiting understanding of how the ethical climate varies from institution to institution, which hospital characteristics are associated with the variation and what effect the variation has on nursing care. Additionally, there is no research connecting the ethical climate to patient outcomes. Although evidence of poor nursing resources and negative nursing outcomes should be an impetus for changing practice, patient outcomes may receive more attention.

Future research examining the impact of nursing on institutional disparities should be designed to demonstrate causality. As data from the next Multi-State Nursing Care and Patient Safety Study become available, longitudinal examinations of nursing work environment on patient outcomes at hospitals serving high proportions of economically disadvantaged patients can be undertaken. Combined with current data on hospital finances and census demographics, future studies can examine how changes in nursing resources impact patient outcomes at hospitals serving the economically disadvantaged.

To develop a more complete understanding of the causal pathway to poor patient outcomes at hospitals serving high proportions of economically disadvantaged patients, additional information about nurses and patients should be utilized. Due to missing data, this study did not examine skill mix or experience, although in a subset of the sample mean years of experience were lower at hospitals serving high proportions of economically disadvantaged patients, although there was no statistical difference in skill mix. Patient data would also enhance understanding of the relationship between nursing resources and patient outcomes, and clinical outcomes would be an important addition to this body of research.

AN AUTHORS ASIDE ON WORK ENVIRONMENT AND ETHICAL CLIMATE

When I began my doctoral studies and read about the nurse work environment, it resonated deeply with me. As a nurse practicing in four settings in three academic medical centers over the last eight years, I have a first-hand understanding of the impact of the nursing work environment. Besides a small increase in knowledge (switching every 1.5-3 years, I barely reached competence in any unit), I was the same nurse working in each setting, but my care produced very different results.

After college, I landed my dream job on the Labor and Delivery Unit of a major New York City hospital. Several years prior to the IOM Future of Nursing Report, Nurse Residency Programs were in their infancy. I had what I now know to be a very comprehensive, well-designed orientation over my first year, where I joined 6 other new hires to my unit and what I remember to be about 100 new hires to the hospital, in classes, workshops and social(ish) events. The unit worked like a well oiled machine, with many nurses with decades of experience, a manager who was recently raised from staff nurse on that unit and the availability of several nursing roles (triage, floor, scrub and circulating) about which nurses could make their preference known. Overall, nurses had a high level of autonomy, good relationship with physicians and staff, and a manager whose door was "always open". I never knew how good I had it until I left.

Just when I reached competency, and was set to begin training for charge nurse, I felt the itch to "learn about what the hospital is really like". Switching units was as easy as calling Human Resources and my unit wished me goodbye fondly. I had a brief stint in the adult emergency department, but ultimately landed in the small pediatric unit. In the pediatric emergency department, we had a fluid staffing model with more nurses there during the busiest time of day. Several nurses who had worked on that unit since the day it opened were there to mentor and provide guidance and feedback. Although the manager was strict and unapproachable,

there was an assistant manager who we felt “had our back”, and always remembered to ask me how school was going or tell me that he wished I had been there when a patient with imminent delivery was carried in by her husband. We socialized outside of work with the residents, social workers and child life specialists, who felt like an integral part of our team. I think our patients did very well too.

When I moved to Philadelphia, I began working per diem on an adult telemetry unit at a quasi-community teaching hospital which had joined a large university system a decade prior. This unit was chronically understaffed, but unable to hire more nurses (hence, hiring per diem nurses like me to work full time hours). I had never worked in inpatient medicine, and was given a 6-day orientation to learn about many things I never experienced, including feeding tubes, time management on an inpatient unit and working with adult male patients. During times of low patient census, nurses were sent home mid-shift or canceled 2 hours prior to their shift, and forced to use vacation time. Nurse managers never wore scrubs and were very far removed from the nursing staff. There were never enough hands to change dressings, turn patients or generally address many patient needs. Nurses were unhappy, and there was high turnover in the short time I was there. Patients were unhappy too, and poor Press-Ganey scores were often the topic of our one-sided staff meetings held in the cramped dimly-lit break room, where problem-solving or constructive comments were not encouraged.

Currently I work at a different academic medical center, in a newly created unit that is the extension of the Emergency Department. When I was hired by the ED manager, we talked about my masters degree and my aspirations, and we told me he would be excited to have “someone like me” to build the new unit “from where the paperclips go to the nursing workflow” (his rhyme). He wears scrubs most days and can be seen on the floor checking in with nurses and is always available on his work or personal cell phone. When I decided to return to school full-time,

he congratulated me, changed my status and took me off nights, and asked me to present my research to the nursing staff when I was ready.

These experiences have taught me that the same nurse can have a very different experience (affecting nursing outcomes) and a very different impact (affecting patient outcomes) depending on the organization in which he works. On the telemetry unit I often felt that I was providing unsafe care; on the Labor and Delivery unit I felt that I had autonomy but that I would never face retribution for asking for help or admitting that I couldn't handle a situation. My studies and research have increased my interest in other aspects of the organizational resources, including the ethical climate. In none of my jobs have I had good resources to explore ethical dilemmas, and it is only with the training and knowledge that I have gained over the past few years that has helped me understand that I have faced these dilemmas in the workplace. Issues surrounding fertility during active maternal disease, resuscitation under conditions of known futility, pain management for obtunded non-verbal patients and the inability to provide necessary care due to time constraints are all ethical quandaries that have been part of my life as a nurse.

I am very proud of the work that nurses do, but I firmly believe nursing care should not be a series of heroic feats. We must give nurses the training, assistance and resources they need to provide high-quality care for patients, and to feel rewarded and empowered by the work that they do. A better understanding of all aspects of the environment in which nurses provide care, and its effect on patient and nurse outcomes, will allow us to design organizations that enhance the capability, compassion and critical thinking that allow nurses to provide the best possible care to all patients.

IRB EXEMPTION LETTER

University of Pennsylvania
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INSTITUTIONAL REVIEW BOARD
(Federalwide Assurance # 00004028)
11-Apr-2014
Matthew D Mchugh
Attn: Mary Viscardi
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PRINCIPAL INVESTIGATOR : Matthew D McHugh
TITLE : The Impact on Variations in Nursing Factors at Hospitals Serving the Economically Disadvantaged
SPONSORING AGENCY : No Sponsor Number
PROTOCOL # : 819644
REVIEW BOARD : IRB #8
Dear Dr. McHugh:
The above-referenced research proposal was reviewed by the Institutional Review Board (IRB) on 10-Apr-2014. It has been determined that the proposal meets eligibility criteria for IRB review exemption authorized by 45 CFR 46.101,category 2.This does not necessarily constitute authorization to initiate the conduct of a human subject research study. You are responsible for assuring other relevant committee approvals.
Consistent with the federal regulations, ongoing oversight of this proposal is not required. No continuing reviews will be required for this proposal. The proposal can proceed as approved by the IRB. This decision will not affect any funding of your proposal.
Please Note: The IRB must be kept apprised of any and all changes in the research that may have an impact on the IRB review mechanism needed for a specific proposal. You are required to notify the IRB if any changes are proposed in the study that might alter its IRB exempt status or HIPAA compliance status. New procedures that may have an impact on the risk-to-benefit ratio cannot be initiated until Committee approval has been given. If your study is funded by an external agency, please retain this letter as documentation of the IRB's determination regarding your proposal.
Please Note: You are responsible for assuring and maintaining other relevant committee approvals.

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