Racial Variation in End-of-Life Intensive Care Use: A Race or Hospital Effect?

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Objective. To determine if racial and ethnic variations exist in intensive care (ICU) use during terminal hospitalizations, and, if variations do exist, to determine whether they can be explained by systematic differences in hospital utilization by race/ethnicity.

Data Source. 1999 hospital discharge data from all nonfederal hospitals in Florida, Massachusetts, New Jersey, New York, and Virginia.

Design. We identified all terminal admissions ($N = 192,705$) among adults. We calculated crude rates of ICU use among non-Hispanic whites, blacks, Hispanics, and those with "other" race/ethnicity. We performed multivariable logistic regression on ICU use, with and without adjustment for clustering of patients within hospitals, to calculate adjusted differences in ICU use and by race/ethnicity. We explored both a random-effects (RE) and fixed-effect (FE) specification to adjust for hospital-level clustering.

Data Collection. The data were collected by each state.

Principal Findings. ICU use during the terminal hospitalization was highest among nonwhites, varying from 64.4 percent among Hispanics to 57.5 percent among whites. Compared to white women, the risk-adjusted odds of ICU use was higher for white men and for nonwhites of both sexes (odds ratios [ORs] and 95 percent confidence intervals: white men $= 1.16$ (1.14–1.19), black men $= 1.35$ (1.17–1.56), Hispanic men $= 1.52$ (1.27–1.82), black women $= 1.31$ (1.25–1.37), Hispanic women $= 1.53$ (1.43–1.63)). Additional adjustment for within-hospital clustering of patients using the RE model did not change the estimate for white men, but markedly attenuated observed differences for blacks (OR for men $= 1.12$ (0.96–1.31), women $= 1.10$ (1.03–1.17)) and Hispanics (OR for men $= 1.19$ (1.00–1.42), women $= 1.18$ (1.09–1.27)). Results from the FE model were similar to the RE model (OR for black men $= 1.10$ (0.95–1.28), black women $= 1.07$ (1.02–1.13) Hispanic men $= 1.17$ (0.96–1.42), and Hispanic women $= 1.14$ (1.06–1.24))

Conclusions. The majority of observed differences in terminal ICU use among blacks and Hispanics were attributable to their use of hospitals with higher ICU use rather than to racial differences in ICU use within the same hospital.

Key Words. Intensive care units, terminal care, life support care, ethnic groups, hospitals

One in five Americans die in the hospital using intensive care unit (ICU) services, and these hospitalizations consume over 80 percent of all terminal hospitalization costs (Angus et al. 2004). Variations in end-of-life ICU admission exist by geography (Wennberg and Cooper 1999) and age (Yu et al. 2000; Levinsky et al. 2001; Angus et al. 2004), but less is known about racial or ethnic differences in ICU use at the end of life (Degenholtz et al. 2003). Paradoxically, racial variations in end-of-life care appear to follow an entirely different pattern than is observed for other medical services in the United States. While minorities, and blacks in particular, generally are treated less intensively than whites (Smedley et al. 2002), including lower rates of invasive cardiac procedures (Ayanian et al. 1993; Whittle et al. 1993), surgical treatment for lung cancer (Bach et al. 1999), and renal transplantation (Epstein et al. 2000), blacks appear to receive higher rates of intensive treatment at the end of life. For example, blacks are more likely to die in the hospital (Pritchard et al. 1998) and less likely to use hospice (Greiner et al. 2003) and have higher overall spending in their last 12 months than whites (Hogan et al. 2001; Levinsky et al. 2001; Shugarman et al. 2004). As dying patients can be considered more or less equivalent in their illness severity (Fisher et al. 2003a,b), studies of end-of-life treatment variations are less subject to confounding by inadequate risk-adjustment methodology. Many scholars have tried to explain these phenomena by citing differences in patient preferences. Indeed, several studies

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report that blacks and Hispanics prefer more aggressive life-sustaining treatment than whites (Garrett et al. 1993; O'Brien et al. 1995; McKinley et al. 1996; Diringer et al. 2001), and that physicians' preferences for end-of-life treatment follow the same pattern by race as patients' preferences (Mebane et al. 1999). However, we also know that treatment preferences for care at the end of life do not reliably predict actual treatment (Teno et al. 1997; Pritchard et al. 1998), and so it seems implausible that preferences alone drive observed patterns of care.

Because minority populations often live in different neighborhoods and access different providers than majority populations, observed differences in treatment patterns may be a function of physician or hospital and not race per se (Kahn et al. 1994; Skinner et al. 2003; Bach et al. 2004; Bradley et al. 2004; Barnato et al. 2005). Indeed, at the hospital referral region, racial differences in end-of-life Medicare spending are driven more by region of residence than by race (Baicker et al. 2004). If dying patients seek care at the nearest hospital rather than at the hospital that provides the type of care patterns they prefer, and minority populations use systematically different hospitals than majority populations due to residential segregation in the United States, then prevailing hospital practice patterns may drive end-of-life treatment intensity rather than patient preferences. Clarifying this issue is critical to inform any policy designed to better match patients' preferences with treatment.

In this study we explore the relationship between race/ethnicity and ICU admission and costs among patients who died in the hospital. We asked two questions. Do differences exist? And, if so, can they be explained by provider rather than by race and ethnicity?

METHODS

Analytic Sample

We retrospectively identified all nonfederal hospital discharges in 1999 from five states, Florida (FL), Massachusetts (MA), New Jersey (NJ), New York (NY), and Virginia (VA), using state hospital discharge data. We then selected all adults (age ≥ 18) whose discharge status was "dead" to identify patients who died in an acute care hospital. From each decedent's terminal admission, we abstracted the patient's age, sex, race (white non-Hispanic, black non-Hispanic, Hispanic, and other), International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM) diagnoses and procedures, dates and type of admission (urgent/emergent medical, elective surgical, urgent/

emergent surgical), hospital provider number, insurance status (expected source of payment listed as Medicaid, Medicare, commercial, other insured, uninsured), and use of intensive care. We used ICD-9 diagnosis codes to identify the presence of each of 15 Charlson–Deyo comorbidies (Deyo et al. 1992) in primary and secondary diagnosis fields. These comorbidities included myocardial infarction, diabetes, diabetes with complications, peripheral vascular disease (PVD), cerebrovascular disease, hemiplegia, chronic pulmonary disease, mild liver disease, severe liver disease, renal disease, rheumatologic disease, malignancy, metastatic solid tumor, HIV infection, and dementia. We entered each diagnosis into the regression models as a categorical indicator variable rather than as a weighted Charlson score because the score weighting was developed to risk adjust for mortality (not ICU use). As all of our patients died the Charlson score would not necessarily be the appropriate weighting for risk adjustment; rather, we wanted to adjust for differential effect of individual diagnoses on ICU admission. For example, some diagnoses, such as cancers, make ICU admission less likely (Angus et al. 2004). We categorized patients whose only surgical procedure was a tracheostomy (40 percent of all patients with tracheostomy) as medical admissions rather than surgical admissions under the assumption that these were medical admissions with prolonged mechanical ventilation. We excluded patients with missing race ($N=$ 11,938). We additionally removed one hospital outlier in which no decedents ($N=1,784$) received intensive care services, suggesting coding error.

Dependent Variables

ICU Services. We categorized any decedent with ICU or Coronary Care Unit (CCU) room charges >0 or who was mechanically ventilated as using "ICU services" during the admission. We used mechanical ventilation in the absence of ICU charges to capture services delivered in intermediate care units. Dates of ICU admission or of extubation are not available in these data. ICU length of stay (LOS), available for three of the five states (MA, NJ, and NY), was the same as hospital LOS in 40 percent of terminal admissions with ICU care. Of the remaining admissions, we could not determine if persons who died in the hospital following ICU admission were still in the ICU on the day of death (e.g., died "in" an ICU) or had been transferred to a general floor or step-down unit, although in the majority of cases the hospital LOS was ≤ 1 day longer than the ICU LOS. To address this uncertainty, we define the dependent variable for this analysis as death "with ICU services" rather than death "in an ICU" per se.

Hospital Admission Patterns

We calculated the rate of terminal ICU admission among white decedents at each hospital. We then arrayed hospitals into deciles of lowest to highest white intensive care use. Using hospitals with at least five black decedents ($n = 408$ hospitals), we then determined the proportion of all black and white inpatient decedents who were treated at hospitals within each decile. Finally, we calculated the black and white terminal admission rates within each decile of white terminal ICU use for comparison.

Statistical Analysis

We categorized patients into those whose terminal admission included ICU services and those whose did not and calculated terminal hospitalization costs for each patient. We explored the univariate relationships between age, sex, race, clinical condition, admission type, and insurance status and ICU admission. Age was not linearly related to ICU use, so we specified age as a categorical variable (18–24, 25–34, 35–54, 65–69, 70–74, 75–79, 80–84, 85–89, 90–94, ≥ 95 years) for regression analyses. For each race/ethnic group, we compared demographic and clinical characteristics using a χ^2 test for difference. We explored whether observed racial and ethnic differences in the use of ICU services at the end of life persisted after adjustment for differences in these characteristics using multivariable logistic regression models. We retained independent variables and any interactions with race/ethnicity using backward stepwise selection with coefficients significant at the $p < .05$ level. We then used two different statistical methods to adjust for the effect, beyond case-mix bias, of provider-level clustering: generalized estimating equations (GEE), which treats hospital as a random effect (RE), and fixed effects (FE) logistic regression. In contrast to the GEE (Zeger and Liang 1986; Localio et al. 2001; Greenfield et al. 2002; Panageas et al. 2003) approach most commonly used in the health services research literature (which treats each hospital as a set of repeated measures and adjusts for unobserved hospital-level factors that were omitted from the model and which systematically raise or lower utilization of all patients in that hospital) the FE logistic regression estimates a separate intercept for each hospital. The FE model does not make the assumption that these unobserved hospital characteristics are uncorrelated with race. If, as we assert, black patients are more likely to die in hospitals with greater end-of-life intensive care use, models with hospital-level adjustment should produce statistically different parameter coefficient estimates than the model without the hospital-level adjustment.

We report odds ratios (ORs) for ICU use, by race, compared to the group with the lowest use rate, white women. Because the outcome modeled is common, the OR does not approximate the risk ratio and should be interpreted as the ratio of the log odds of ICU use. We used *SAS* (version 8.2, SAS Institute, Cary, NC) and *STATA* (version 8.2, StataCorp, College Station, TX) to execute statistical analyses. The study was approved by the University of Pittsburgh Institutional Review Board and the authors had complete autonomy from the funding agency in data analyses and manuscript preparation.

RESULTS

Sample Characteristics

The analytic sample contained 192,705 patients who died in 674 acute care hospitals. The mean (± SD) age of the patients was 73.8 ± 14.9 years (range, 18–113). Women comprised 51.1 percent of the sample. Non-Hispanic whites represented 70.8 percent of the patients, blacks 11.2 percent, Hispanics 5.7 percent, and "other" races 12.4 percent. Eighty-two percent of admissions were urgent/emergent medical admissions. The primary payer was Medicare for 66.1 percent of patients, Medicaid for 4.5 percent, and commercial insurance for 17.2 percent, while 3.3 percent of decedents were uninsured. Each of the demographic and clinical variables measured were significantly different between race/ethnicity subgroups (Table 1). Minorities were younger, had higher rates of diabetes, liver disease, renal disease, and HIV; lower rates of chronic pulmonary disease and myocardial infarction; and were more likely to be insured by Medicaid or to be uninsured.

Hospital Admission Patterns

Black patients disproportionately died in hospitals with greater end-of-life ICU use as measured by the white terminal ICU admission rate (Figure 1A). Yet within deciles of hospital terminal ICU admission rates, the rate among blacks and non-Hispanic whites was roughly equivalent (Figure 1B).

Use of ICU Services

Overall, 58.8 percent of terminal admissions involved ICU care. Sixty-four percent of black decedents, 64.4 percent of Hispanics, and 58.4 percent of other nonwhites used ICU services during the terminal admission, compared with 57.5 percent of non-Hispanic whites (Table 1). Adjusting for case mix using demographics, insurance status, admission type, and presence of chron-

Table 1: Demographic and Clinical Characteristics of Patients

Characteristic	White (N= 136,338)	Black (N= 21,591)	Hispanic (N= 10,883)	Other (N= 23,893)	p-Value
Age (years)	75.6	65.5	70.7	72.1	<.0001
Women (%)	51.0	52.8	49.2	51.0	<.0023
Chronic conditions (%)					
Myocardial infarction	3.0	1.2	1.8	2.1	<.0001
Diabetes	14.6	18.3	19.0	15.8	<.0001
Diabetes with complications	2.6	4.7	3.0	2.8	<.0001
Peripheral vascular disease	4.0	4.1	3.3	3.6	<.0001
Cerebrovascular disease	2.8	3.8	2.7	3.2	<.0001
Hemiplegia	2.0	1.9	1.6	2.1	.0300
Chronic pulmonary disease	17.2	9.2	12.7	12.9	<.0001
Mild liver disease	3.2	3.8	6.6	4.2	<.0001
Severe liver disease	2.7	3.6	5.4	3.7	<.0001
Renal disease	5.2	6.8	6.1	5.7	<.0001
Rheumatologic disease	1.5	1.4	1.0	1.5	.0022
Malignancy	19.8	20.1	18.5	21.1	<.0001
Metastatic solid tumor	14.2	15.2	12.6	14.8	<.0001
HIV infection	0.6	8.9	5.7	2.8	<.0001
Dementia	2.6	2.1	2.0	2.6	<.0001
Admission type (%)*					
Urgent/emergent medical	81.1	80.8	81.7	80.1	<.0001
Urgent/emergent surgical	15.5	16.9	15.7	16.7	
Elective surgical	3.4	2.3	2.6	3.3	
Insurance type (%)*					
Medicare	71.5	46.8	51.5	59.8	<.0001
Commercial	16.8	17.2	19.4	18.7	
Medicaid	2.2	13.4	10.8	6.2	
Other insured	7.2	15.7	12.6	10.2	
Uninsured	2.2	7.0	5.8	5.1	
Used intensive care (%)	57.5	64.1	64.4	58.4	<.0001
Median hospitalization cost ($)	7,511	9,653	9,557	9,257	<.0001

*May not sum to 100% due to rounding.

ic conditions, blacks and Hispanics were still more likely than non-Hispanic white decedents to receive ICU care at the end of life (Figure 2). However, adjustment for the clustering of patients within hospitals markedly attenuated the differences for blacks and Hispanics, regardless of model specification (Figure 2). The magnitude of decrease between the case-mix adjustment model and the models that additionally adjust for within-hospital clustering of black and Hispanic patients in Figure 2 reflects the degree to which these patients' care is driven by their use of hospitals with different practice patterns (in this case, higher rates of end-of-life ICU service use).

Figure 1:   (A, B) Intensive Care Unit (ICU) Use among Terminal Admissions, by Decile of Hospital Treatment Intensity
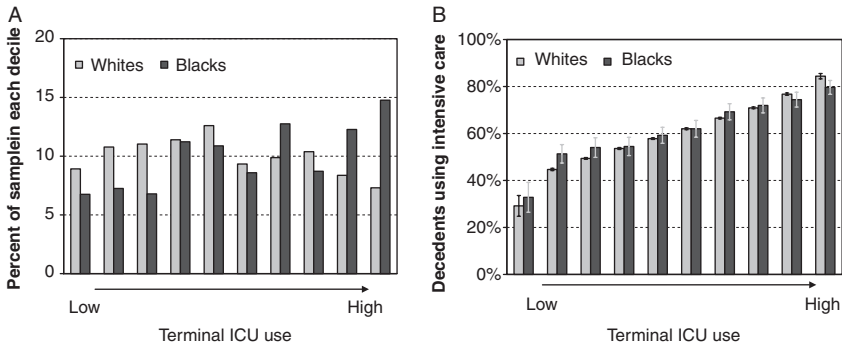

We grouped 408 hospitals into deciles arrayed from the group of hospitals with the lowest (21 percent) to the highest (87 percent) terminal ICU use among whites (266 of the 674 hospitals are not in this figure because they treated < 5 black decedents and we could not calculate a "black" rate). Panel A demonstrates that more blacks were treated at high (white) ICU use hospitals, whereas more whites are treated at lower ICU use hospitals. Panel B demonstrates that ICU service among black and white decedents in each decile was roughly equivalent. Error bars represent 95 percent confidence intervals around the decile rate estimates.

For 12 of the chronic conditions, there were no significant interactions between race and disease. But for three conditions, PVD, metastatic solid tumors, and other malignancies, the effect of the condition on end-of-life ICU service followed a different pattern by race. Specifically, the model adjusting for case mix identified no significant differences in ICU use, by race, among decedents with PVD, increased use among black men and women and Hispanic women but not Hispanic men among decedents with metastatic solid tumors, and increased use among black women, Hispanic men and women, but not black men in patients with other malignancies. In models adjusting for hospital-level clustering, black race remained significantly associated with higher ICU use during the terminal admission among patients with metastatic cancer.

The elderly, women, and those with non-Medicare insurance were less likely to use ICU services. Unlike race, the parameter estimates for the effect of age, gender, chronic conditions, and admission type were not significantly affected by the additional adjustment for hospital-level clustering, suggesting that these variables do not systematically vary between hospitals. In other

Figure 2:   The Odds of ICU Use during the Terminal Admission, by Race/Ethnicity
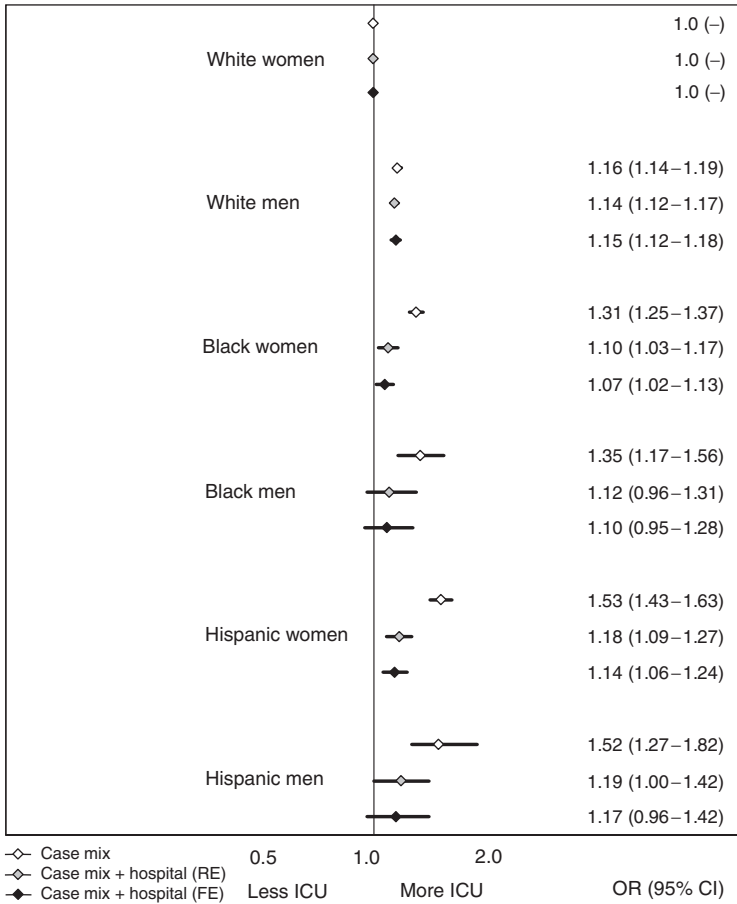
The point estimates and 95 percent confidence intervals represent the ratio of the odds of ICU service use during the terminal admission among each race/ethnicity group compared to white women using three statistical models: a model adjusting for demographics, insurance status, admission type, and chronic conditions (case mix), and two models that additionally adjust for the clustering of patients within hospitals, one of which treats the hospital as a random effect (RE), and one of which treats the hospital as a fixed effect (FE). For both black and Hispanic patients, the added adjustment for hospital effect, regardless of specification, decreased the odds ratio of ICU use compared to white women. The magnitude of the change in the point estimate for blacks and Hispanics suggests that the majority of observed differences in terminal ICU use were due to between-hospital differences in ICU use and not within-hospital differences in ICU use by race/ethnicity.

words, adults of varying ages, genders, and conditions are not concentrated in some hospitals more than others. Additionally, changes in parameter estimates for insurance status were not significantly different between the unadjusted and adjusted models, although the change in the parameter estimate for "uninsured" approached statistical significance. We report the parameter estimates for each variable included in all models in Tables E1, E2, and E3 available in the online data supplement to this article.

DISCUSSION

Among hospital decedents in five U.S. states, black, Hispanic, and other non-white patients were more likely to die with ICU services than whites. However, the majority of the difference in ICU use by blacks and Hispanics compared with whites could be explained by the differential use of hospitals with higher terminal ICU admission patterns by these minority populations. Thus, the majority of the racial/ethnic difference in terminal ICU use was due to *between-hospital* differences rather than *within-hospital* differences. This finding emphasizes that race and ethnicity-based treatment differences may be misattributed to unequal treatment rather than to differential access patterns if the confounding effect of hospital is not addressed.

The current study has both strengths and limitations. It was based on a large and diverse sample of adult decedents in the United States. The sample cannot be considered representative, however, as the East was over-represented and states in the South and Southwest with significant minority populations were not included. The quality of race and ethnicity information drawn from hospital discharge data is always a concern in administrative data analyses (LaVeist 1994). Nonetheless, many such studies have informed U.S. policy on racial and ethnic disparities, and often without the benefit of one of this study's strengths, the use of statistical adjustments for provider-level clustering. Regarding adjustment for provider-level clustering, the use of a FEs model is probably superior to a model that treats hospital as a RE because unobserved hospital characteristics, including treatment patterns, may be correlated with race. However, the findings were qualitatively similar with both model specifications. Another limitation is our inability to distinguish between hospital decedents who died in the ICU and those who died in another unit of the hospital after the use of intensive care. However, for the majority of decedents, hospital LOS was ≤ 1 day longer than ICU LOS (Angus et al. 2004). Thus, ICU care dominated their terminal admission. We

have no information on patient preferences and it remains possible that patients who prefer more intensive care patronize more intensive hospitals, though such discrimination among critically ill patients seems unlikely. Furthermore, generalizing our findings to differences in care among patients who are or who may be "dying" is impossible as the sample was selected not on the basis of expectancy of death but by retrospective identification of their hospital course as a terminal one (Bach et al. 2004). We studied ICU use as a binary variable; it is possible that LOS and time to withholding or withdrawal of life-sustaining treatments once in the ICU may follow different patterns. Finally, although we report on the rates of ICU use among different race and ethnic groups, we cannot compare these values to any quality or appropriateness benchmarks as it is unknown what the "right" rate of end-of-life intensive care should be.

A study of Medicare fee-for-service (FFS) inpatient decedents in 1999 found that 39.8 percent of patients had an ICU stay during the terminal admission (Angus et al. 2004). That study differed from the current study both by restricting the analysis to patients 65 and older and by defining the outcome variable using ICU and CCU charges > 0. The current study includes younger adult decedents who would be expected to be treated more intensively and expanded the definition of intensive care services to include patients with prolonged mechanical ventilation without ICU charges to capture intensive services delivered at hospitals without licensed ICUs (e.g., "special care units" that are extensions of medical/surgical inpatient units in smaller hospitals). Another descriptive report from the same Medicare study found that black decedents were more likely than nonblack decedents to be admitted to an ICU in the last year of life and during the terminal admission, but that black survivors were less likely to be admitted to the ICU (Barnato et al. 2001). These analyses adjusted for age and sex but not for illness severity or provider-level clustering. Finally, a recent analysis by Baicker et al. (2004) found that differences in end-of-life care are driven more by region of residence than by race, but that higher ICU admission rates at the end of life among blacks persisted even after adjustment for the patient's hospital referral region of residence. This study differs from ours by focusing on ICU use in the last 6 months of life, rather than solely the terminal admission, and also by adjusting for hospital referral region and not hospital.

Previous studies of racial variations in intensive care focused on resource use after ICU admission and not on differences in ICU admission rates. Williams et al. (1995) used data from ICU admissions at 40 hospitals in an analysis not restricted to decedents which found black patients had shorter

risk-adjusted ICU length of stay and slightly lower resource using during the first week of admission. This study did not adjust for within-hospital clustering. Risk, preference, and site-adjusted estimates of treatment intensity from the five-site SUPPORT trial suggested lower treatment intensity among hospitalized blacks and no differences in decisions to withhold or withdraw life-sustaining therapies (Phillips et al. 1996, 2000; Borum et al. 2000). A retrospective chart review of nonelective ICU admissions in one center found blacks less likely to have mechanical ventilation withdrawn (Diringer et al. 2001).

When faced with hypothetical scenarios, black patients (Caralis et al. 1993; Garrett et al. 1993) and black doctors (Mebane et al. 1999) are more likely than white patients and doctors to anticipate wanting life-sustaining treatments in the face of terminal illness or persistent vegetative state. Indeed, our finding that black patients with metastatic solid tumors are so much more likely to die using ICU services than whites, even after adjustment for the hospital effect, is consistent with these observations and also the observations that blacks are less likely to have completed advance care planning (Degenholtz et al. 2002) and less likely to use hospice (Virnig et al. 2000; Greiner et al. 2003). This difference may be condition specific and we urge caution generalizing to end-of-life preferences among black patients with other diseases.

A handful of research reports in recent years explored the relationship between variations in racial/ethnic treatment patterns and geography or provider. In one study, half of observed black–white differences in receipt of evidence-based clinical preventive services were explained by black patients belonging to lower quality health plans rather than by differences in quality among blacks and whites within the same plan (Schneider et al. 2002). In another study, two of the four measures of breast cancer treatment quality found to be lower among blacks were explained by differences in quality of hospitals used rather than within-hospital treatment differences (Diehr et al. 1989). Using a nationally-representative sample of U.S. households, Haas et al. (2004) found that blacks, Hispanics, and whites living in high-minority density counties were more likely to report difficulty in obtaining health care, delaying obtaining care, or not receiving health care they thought they needed. As reviewed in the introduction, half of lower care quality among black and poor patients could be explained by hospital (Kahn et al. 1994), lower rates of knee replacement among blacks and Hispanics is partially explained by their living in lower-utilization regions (Skinner et al. 2003). In the treatment of myocardial infarction a substantial portion of the racial and ethnic disparity in

treatments are accounted for by the specific hospital to which patients were admitted, in contrast to differential treatment by race and ethnicity inside the hospital (Bradley et al. 2004; Barnato et al. 2005). These findings have obvious implications for improving quality of care for evidence-based treatments among minority patients: focusing interventions on low performing plans, hospitals, or regions will make disparity reduction more efficient.

But because there is no "right" rate of ICU service use during the terminal admission, the primary contribution of the current study is not to identify a "disparity" (which implies a difference in effective care), but to expand our understanding of the determinants of such care. In particular, differential use of hospitals with greater rates of terminal ICU use can explain the majority of the higher end-of-life ICU service use among blacks and Hispanics compared to whites. The explanatory power of the hospital may be capturing a particular hospital practice culture (e.g., "intensive" treatment style), sociodemographic characteristics of the community (e.g., religiosity, education, prevalence of advance care planning), or both. Nonetheless, within-hospital variations in ICU service use among racial/ethnic minorities at the end of life do exist. Future research should focus on understanding what drives hospital-level variations in end-of-life treatment patterns in addition to continued elucidation of racial/ethnic differences in treatment within hospitals.

ACKNOWLEDGMENTS

APPENDIX

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Supplementary Material

The following supplementary material for this article is available online:

Table E1. Coefficients for the simple logistic regression on terminal ICU admission

Table E2. Coefficients for the GEE logistic regression on terminal ICU admission

Table E3. Coefficients for the fixed effects logistic regression on terminal ICU admission (individual hospital coefficients not shown)