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Organizational Determinants of Hospital End-of-Life Treatment Intensity

Caroline Y. Lin, MD^{*}, Max H. Farrell^{*}, Judith R. Lave, PhD^{*,†,‡}, Derek C. Angus, MD, MPH^{*,†,‡}, and Amber E. Barnato, MD, MPH, MS^{*,†,‡}

^{*}Center for Research on Health Care, University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania

[†]Department of Health Policy and Management, University of Pittsburgh Graduate School of Public Health, Pittsburgh, Pennsylvania

[‡]Department of Critical Care Medicine, Clinical Research, Investigation, and Systems Modeling of Acute Illness (CRISMA) Laboratory, University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania

Abstract

Background—There is substantial hospital-level variation in end-of-life (EOL) treatment intensity.

Objective—To explore the association between organizational factors and EOL treatment intensity in Pennsylvania (PA) hospitals.

Research Design—Cross-sectional mixed-mode survey of Chief Nursing Officers of PA hospitals linked to hospital-level measures of EOL treatment intensity calculated from PA Health Care Cost Containment Council (PHC4) hospital discharge data.

Hospitals—One hundred sixty-four hospitals, of which 124 (76%) responded to the survey.

Measures—The dependent variable was an index of hospital EOL treatment intensity; the independent variables included administrative data-derived structural and market characteristics and 29 survey-derived hospital or ICU programs, policies, or practices.

Results—In models restricted to independent variables drawn from administrative sources (available for all 164 hospitals), bed size ($P < 0.001$), proportion of admissions among black patients ($P < 0.001$), and county-wide hospital market competitiveness (Herfindahl-Hirschman index) ($P = 0.001$) were independently associated with greater EOL treatment intensity (adjusted $R^2 = 0.5136$). In models that additionally included hospital programs, policies, and practices (available for 124 hospitals), only an ICU long length of stay review committee ($P = 0.03$) was independently associated with greater EOL treatment intensity (adjusted $R^2 = 0.5357$).

Conclusions—Information about hospital and ICU programs, policies, and practices believed relevant to the treatment of patients near the end of life offers little additional explanatory power in understanding hospital-level variation in EOL treatment intensity than administratively-derived variables alone. Future studies should explore the contribution of more difficult to measure social norms in shaping hospital practice patterns.

Keywords

intensive care units; terminal care; life support care; hospitals; organization and administration

Nearly 40% of all deaths nationwide occur in the acute care setting and 20% involve the use of intensive care services.¹ The use of acute care hospital and intensive care services for patients in their last 12 months of life consumes one-quarter of total Medicare spending for inpatient care.² Wide variation in expenditures and in the use of intensive care and specific life-sustaining procedures at the end of life between hospital referral regions raises concerns about efficiency.^{3,4} Regional variation in end-of-life inpatient service use and expenditures have been attributed in part to physician, hospital, and ICU bed supply,³ which may translate into different local provider practice norms⁵ but are not necessarily reflective of local patient preferences.⁶ Less is known about the factors that influence variation in treatment intensity between hospitals, although bed supply and local practice norms⁷ undoubtedly play a role. Hospitals are perhaps more attractive than hospital referral regions for study because they are potentially accountable organizations with a more proximate locus of control over decisions to use intensive treatments.

The purpose of the current study was to explore organizational determinants of hospital-level variation in end-of-life treatment intensity. We used a newly developed index of hospital end-of-life treatment intensity that quantifies the use of ICU and life-sustaining treatments among patients at a high probability of death, rather than among those retrospectively identified as decedents,⁴ to address biases introduced by the decedent follow-back method.⁸ Further, we augmented traditional hospital characteristics—such as size, teaching status, and case mix or illness severity—with information about the hospital programs, policies, and practices that may have direct and indirect impacts on rates of ICU and life-sustaining treatment use. A better understanding of the organizational factors associated with end-of-life treatment intensity could be used to better align patient preferences with end-of-life treatment.^{9,10}

Methods

Study Design

We conducted a retrospective analysis of hospital treatment patterns among patients admitted to Pennsylvania acute care hospitals, using Pennsylvania Health Care Cost Containment Council (PHC4) hospital discharge data between April 1, 2001 and March 31, 2005. We chose PHC4 data because it contains a predicted probability of in-hospital mortality calculated from key clinical findings abstracted from the medical chart during the first 48 hours of admission.¹¹ We then linked hospital-level data from PHC4 to a cross-sectional survey of the respective hospital Chief Nursing Officers (CNOs), fielded between June 1, 2005 and May 31, 2006. The survey elicited information about 15 hospital-wide (eg, a palliative care consult service, a hospitalist program) and 14 ICU-specific (eg, daily multidisciplinary rounds, symptom management protocols) programs, policies, and practices that were hypothesized to directly or indirectly impact end-of-life treatment intensity.

Hospital Intensity

The primary dependent variable was an index of each hospital's "end-of-life" treatment intensity. As we describe in detail elsewhere,⁴ the index is a factor score of 6 case-mix standardized (observed-to-expected) treatment ratios for admissions over age 65 with a high probability of dying. We defined high probability of dying as those in the 95th percentile of predicted risk of death upon admission, corresponding to a probability of 0.21 or higher (mean = 0.41, 25th percentile = 0.26, 75th percentile = 0.51). We calculated an end-of-life intensity index for hospitals with at least 50 decedents and 50 admissions with a high probability of dying during the study period. The 6 standardized ratios included in the index were empirical Bayes' shrinkage estimates¹² of: (1) the ICU admission rate, (2) ICU length of stay, (3) intubation and mechanical ventilation rate, (4) hemodialysis rate, (5) tracheostomy rate, and (6) gastrostomy rate during the 4 study years. These 6 measures were chosen using clinical

judgment and empirical data reduction techniques among several intensive, life-sustaining treatments. Among acute care PA hospitals in our study, the treatment intensity index scores range from -2.08 to 3.12 (increasing values indicating higher treatment intensity), with a mean of -0.04 , median of -0.03 , and standard deviation of 0.99 .

Hospital Characteristics

Structural and Market Characteristics—We obtained or calculated hospital characteristics during the study period from PHC4 administrative and discharge data, from Centers for Medicare and Medicaid (CMS) administrative data, and US Department of Agriculture rural-urban continuum codes. These characteristics included bed size, resident-to-bed ratio, mean illness severity, composite quality score, proportion of admissions among black patients, urbanicity, and the Herfindahl-Hirschman index (a 0–1 measure of area-level competitiveness based on countywide hospital market share; higher numbers reflect less competition [1 is an area monopoly]).¹³

Hospital and ICU Programs, Policies, and Practices—We identified the candidate hospital-wide and ICU programs, policies, and practices through a structured review of the literature and semi-structured interviews with over 100 informants from 14 Pennsylvania hospitals. On the basis of these semi-structured interviews, we identified the CNO/Vice President of Patient Care Services as the single best informant about these hospital programs, policies, and practices.

We asked 2 national experts in end-of-life care to review the survey instrument for face validity before field testing and revised the instrument accordingly. We then field tested the revised web-based survey with 10 Pennsylvania hospital CNOs and debriefed the 6 respondents by phone after survey completion, revising the user interface and response options in response to their feedback.

We fielded the final survey to the CNOs of all Pennsylvania acute care hospitals between June 2005 and May 2006 using a mixed-mode (self-administered web-based followed by computer-assisted telephone interview for nonresponders). Each respondent received a letter of invitation signed by one of the authors (AEB) describing the study and providing a link to the web-based survey, a username, and password. This invitation was accompanied by a letter endorsing the study signed by the Pennsylvania Secretaries of Health and Aging.

CNOs who did not complete the self-administered web-based survey after 1 round of mail invitations and 2 follow-up telephone or e-mail reminders were contacted and scheduled to complete a telephone interview. We offered no financial incentive for participation.

Statistical Analyses—We calculated descriptive statistics of the administratively-derived hospital characteristics for all hospitals in the sample, and compared these observable characteristics between survey nonresponder and responder hospitals using 2-sample Student t tests and χ^2 tests as appropriate. To explore organizational determinants of end-of-life treatment intensity, we performed univariable tests of association with 2-sample Student t tests and χ^2 tests on the entire hospital sample for administratively-derived independent variables (structural and market characteristics) and for the subsample of survey respondents for the survey-derived independent variables (programs, policies, practices). We then implemented 2 multivariable linear regression models including variables significant at the $P < 0.1$ level in univariable tests: a model restricted to the administratively-derived dependent variables available for all hospitals in the sample and a model that additionally included survey-derived variables in the subsample of survey respondents. We performed all analyses with STATA 10.0 (StataCorp, College Station, TX).

Institutional Review Board Approval—This study was approved by the University of Pittsburgh Institutional Review Board and deemed exempt from the requirement of written informed consent.

Results

Sample Characteristics

There were 188 adult acute care Pennsylvania hospitals reporting data to PHC4 between April 1, 2001 and March 31, 2005. Fourteen of these hospitals closed, became nonacute care facilities, or fully merged with other hospitals (thereby losing their unique PHC4 identifier) before fielding of the survey (June 2005–May 2006). Of the remaining 174 hospitals, 10 did not meet eligibility criteria for calculating the intensity index (having at least 50 decedents or 50 admissions with a high probability of dying). Of the remaining 164 eligible acute care Pennsylvania hospitals, 124 (76%) completed the survey. We present descriptive statistics of the overall sample, survey respondents, and nonrespondents in Table 1.

Nonrespondent hospitals were in more competitive markets than respondent hospitals (Herfindahl-Hirschman index 0.330 vs. 0.432, respectively; $P = 0.040$), but were otherwise similar with respect to end-of-life treatment intensity, bed size, teaching status, measures of illness severity (mean probability of death upon admission and percentage of admissions comprised of transfers from outside facilities), mean compliance with 10 core measures of quality promulgated by the “Hospital Compare” program, proportion of admissions among black patients, and urban location (Table 1).

Hospital Characteristics and Intensity

In univariate analyses among all study hospitals ($N = 164$), the administratively-derived structural and market characteristics associated with greater end-of-life treatment intensity at the $P < 0.1$ level included bed size, resident-to-bed ratio, percent of admissions comprised of transfers from other facilities, percent of admissions among black patients, urban location, and higher market competition (Table 2).

In multivariable linear regression including only those characteristics that were significant at the $P < 0.1$ level in univariate testing, only bed size, percent of admissions among black patients, and higher market competition were independently associated with greater end-of-life treatment intensity (adjusted R^2 for model = 0.5136). The remaining 3 variables were no longer significant: resident-to-bed ratio, percent of admissions comprised of transfers from other hospitals, and urban location (Table 2).

We present the prevalence of hospital and ICU programs, policies, and practices hypothesized to impact end-of-life treatment intensity reported among respondent hospitals in Table 3. In univariate analyses among the 124 survey respondent hospitals, the hospital and ICU programs, policies, and practices associated with greater end-of-life treatment intensity at the $P < 0.1$ level included having a training program in either palliative care, pastoral care, or critical care; an ethics consult service; daily multidisciplinary ICU rounds; a private ICU conference room for family meetings; an ICU long length of stay review committee; regularly scheduled ICU family meetings with an attending physician; and an ICU clinical protocol for withdrawing or withholding life-sustaining treatment (Table 4).

In multivariable modeling among the 124 hospitals with both administratively and survey-derived data, the variables that remained independently associated with greater end-of-life treatment intensity at the $P < 0.05$ level included hospital bed size, percent of admissions comprised of black patients, area-level competition, and the presence of an ICU long length

of stay review committee (Table 5). These variables explained just over half of the total variation in end-of-life treatment intensity (adjusted R^2 0.5357).

Discussion

In this study of the organizational predictors of hospital end-of-life treatment intensity in 164 acute care Pennsylvania hospitals, we found that administratively-derived structural and market characteristics, including larger bed size, greater proportion of admissions among black patients, and higher area-level hospital market competition, were more powerful predictors of end-of-life treatment intensity than specific hospital programs, policies, or practices, with the exception of an ICU long length of stay review committee. Despite our effort to capture a comprehensive set of explanatory variables, almost half of hospital-level variation in end-of-life treatment intensity remained unexplained.

We found that hospitals with most of the studied programs, policies, and practices had higher mean hospital end-of-life treatment intensity indices than hospitals without such organizational initiatives, although most of these did not reach statistical significance. This paradoxical relationship between organizational initiatives that we hypothesized would be inversely related to intensity may reflect “reverse causation” in our cross-sectional analysis. Specifically, these initiatives may have been implemented in response to perceptions of higher than average use of ICU and life-sustaining treatments among patients at the end of life. Indeed, a longitudinal—not cross-sectional—design that could assess utilization changes associated with policy implementation would have been optimal. The finding that most programs, policies, and practices significantly associated with intensity in univariable tests were no longer significant in the multivariable model that included structural and market characteristics suggests that our study could have been underpowered or the associations could simply have been spurious due to confounding by structural characteristics. However, a recent national study demonstrated an inverse cross-sectional relationship between state-level penetration of one kind of program—hospital-based palliative care—and total end-of-life Medicare spending¹⁴; national hospital-level analyses are lacking.

The association between the concentration of black patients in a region,¹⁵ hospital,^{16,17} or nursing home¹⁸ and greater end-of-life treatment intensity is not new. It is not entirely clear whether this observation reflects black patients' preferences for these life-sustaining treatments^{19–23} or some other phenomenon. For example, the higher observed end-of-life ICU use among blacks is attributable to black patients' disproportionate use of hospitals with greater end-of-life ICU use for both black and white patients.^{16,17}

Our study also revealed a significant positive relationship between larger hospitals and end-of-life treatment intensity. This relationship was not attributable independently to tertiary care status (measured by transfers) or to teaching status (measured by the resident-to-bed ratio). It is possible that local practice norms play a significant role in this relationship, in addition to the ease of access to beds and other technologies in larger facilities. Area-level bed supply, as distinct from institution-specific supply, has a well-documented association with utilization and spending.^{24–28} Variation in hospice use, on the other hand, is not explained by area-level market characteristics.²⁹ This may be because hospice use is more dependent on patient preferences, demographics, and local social norms, and may have very low levels of penetration in certain counties.

In our study, higher market competition was associated with higher end-of-life intensity. This relationship existed even after controlling for bed size, a proxy for technological resources. It is possible that more competitive environments lead to higher intensity treatments because of the incentive to acquire and offer more technology and resources to compete for highly

remunerated cases—such as transplant and coronary-artery bypass grafting. This may, in turn, result in greater use of those resources for patients at a high risk for dying.

There are several limitations to our study. The validity and reliability of the survey responses provided by a single informant, the CNO, was not assessed and is likely imperfect. Although the CNO is likely the single best informant, she/he may not have been knowledgeable about all aspects of hospital and ICU policy. Reassuringly, 84% reported that they felt “confident” or “very confident” in their answers to the survey questions.

Our study is unable to establish cause-effect relationships between organizational initiatives and end-of-life treatment intensity in this cross-sectional study. We did attempt to ascertain the direction of the relationship by asking CNOs in our survey when each initiative was implemented. However, many of the responses to timing of implementation were “don't know” (on average 50%–75% of responses), leading to inadequate sample sizes for analysis.

Likewise, the timing of the survey did not coincide exactly with the timing of the selected PHC4 discharge data. The dates of the hospital discharge data used to develop estimates of each hospital's treatment intensity (2001–2005) abutted, but did not overlap, the dates of the survey (2005–2006). Each hospital's practice pattern was stable over the 4 years of available data, but we are nonetheless unable to attribute temporal associations or direction of effect.

Although it was a strength to compare hospitals in 1 state with a uniform regulatory, legal, and financing environment, our study may have been underpowered and is not generalizable to other states. The response rate to our survey was impressive at 76%, but nonetheless reflects only 124 hospitals. And, based on the comparison of observable characteristics, survey nonrespondent hospitals were more likely to be in higher competition markets, confirming a likely response bias.

Unlike outcomes such as end-of-life treatment costs, our end-of-life treatment intensity index itself does not have a natural metric, given that it is a factor score based on 6 underlying standardized utilization ratios. It is not strictly possible to explain that a difference in the index of, for example, 1 point is directly related to X% fewer intubations or ICU admissions. Thus, it cannot be used to compare utilization of individual life-sustaining treatments across hospitals.

Another potential weakness is that our end-of-life treatment intensity index was calculated for all admissions, rather than just among ICU admissions, which may have diluted the “true” contribution of ICU-specific practices on intensity. However, because the treatments included in the index were ICU use (admission and length of stay) and those commonly delivered only in the ICU (mechanical ventilation), we believe that our hospital-specific measure is closely tied to ICU-specific treatments. However, among respondent hospitals with more than 1 ICU ($N = 105$), we asked the CNO to give us information about programs, policies, and practices implemented in the ICU that takes care of the “majority of chronically ill elders” in their hospitals (typically the MICU or a mixed medical-surgical ICU). We did not ask about the programs, policies, and practices in the other ICUs. For these 105 hospitals, there may be some misspecification—the hospital's overall intensity index is affected by practice in an ICU that we have no information about and which may have different practices than the “sampled” ICU.

Finally, it is always possible that unmeasured case-mix variation contributes to the higher end-of-life treatment intensity seen at larger hospitals. However, we did account for as much case-mix variation as possible by including the mean “predicted risk of death on admission” among the elderly (mean illness severity)—derived from key clinical factors on admission—as an independent variable. We did not find a relationship between the hospital's mean predicted risk of death and intensity in univariable analysis. In addition to this variable, each hospital's transfer-in rates and resident-to-bed ratio were eligible for model inclusion—both of which

may measure staffing/equipment/capacity for taking care of sick patients. Although each variable was significantly associated with intensity in univariable analyses, neither was retained in the parsimonious multivariable model. However, hospital bed size and share of black patients may be capturing some of this “resource” construct.

In summary, the presence of the 29 hospital programs, policies, and practices that we assessed provide only minimal additional explanation of the large variation in hospital end-of-life treatment intensity in Pennsylvania acute care hospitals. Although several structural and market characteristics were associated with end-of-life treatment intensity, the mechanism of these effects remains opaque, and almost half of the variation remains unexplained. Future studies should explore the contribution of more difficult-to-measure social norms in shaping hospital practice patterns.

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TABLE 1

Characteristics of Study Hospitals

Hospital Characteristic	Full Sample (N = 164)	Survey Respondents (N = 124)	Survey Nonrespondents (N = 40)	P
End-of-life treatment intensity index, mean (SD) [*]	−0.043 (0.987)	−0.106 (0.948)	0.150 (1.089)	0.188
Bed size, mean (SD)	253 (189)	250 (184)	264 (205)	0.683
Teaching status, [†] %				0.194
Major teaching	13.6%	11.4%	20.5%	
Minor teaching	29.0%	27.6%	33.3%	
Non-teaching	57.4%	61.0%	46.2%	
Mean probability of death among admissions >65, probability	0.047 (0.007)	0.047 (0.007)	0.047 (0.008)	0.5329
Percentage of admissions >65 that are transfers, [‡] %				0.787
Quartile 1: 0%–0.025%	25.0%	25.0%	25.0%	
Quartile 2: 0.0251%–0.06%	25.0%	23.4%	30.0%	
Quartile 3: 0.061%–0.22%	25.0%	26.6%	20.0%	
Quartile 4: 0.221%–5.61%	25.0%	25.0%	25.0%	
Mean probability of compliance with 10 “core measures” of hospital quality, [§] proportion	0.856 (0.079)	0.856 (0.083)	0.859 (0.064)	0.827
Proportion of admissions >65 among black patients, [‡] %				0.190
Quartile 1: 0%–0.26%	25.0%	27.4%	17.5%	
Quartile 2: 0.261%–1.41%	25.0%	25.8%	22.5%	
Quartile 3: 1.411%–4.37%	25.0%	25.8%	22.5%	
Quartile 4: 4.371%–9.44%	25.0%	21.0%	37.5%	
Urban location, %	17.1%	14.5%	25.0%	0.125
Herfindahl-Hirshman index, mean (SD)	0.407 (0.302)	0.432 (0.312)	0.330 (0.253)	0.040

^{*} The end-of-life intensity index is a factor score based upon observed-to-expected ratios of ICU use, ICU length of stay, intubation/mechanical ventilation, tracheostomy, hemodialysis, and gastrostomy tube placement for patients at a high probability of dying during the hospitalization. The score has a mean of ~0 and ranges from a low of −2.08 to a high of 3.12.

[†] Resident-to-bed ratio is non-normally distributed and categorized here into 3 levels for comparison: major teaching (resident-to-bed ratio >0.25); minor teaching (resident-to-bed ratio >0 but <0.25); and non-teaching (resident-to-bed ratio = 0).

[‡] Percent admissions that were transfers from outside facilities and percent admissions among black patients are non-normally distributed; we categorize them into quartiles for comparison purposes.

[§] Summary compliance with each of 10 inpatient processes of care for acute myocardial infarction, congestive heart failure, and pneumonia.

TABLE 2

Univariable and Multivariable Associations Between Hospital Structural/Market Characteristics and “End-of-Life” Treatment Intensity*

	Univariable Associations			Multivariable Associations		
	β -Coefficient	P	95% CI	β -Coefficient	P	95% CI
Bed size	0.768	<0.001	0.589–0.947	0.332	0.002	0.123–0.540
Resident-to-bed ratio	2.169	<0.001	1.398–2.940	–0.499	0.318	–1.484 to 0.486
Herfindahl-Hirschman Index (area-level competition)	–1.743	<0.001	–2.173 to –1.313	–0.678	0.004	–1.138 to –0.218
Urban location	1.193	<0.001	0.831–1.554	0.222	0.268	–0.172 to 0.616
Percent of admissions among black patients	0.330	<0.001	0.270–0.390	0.209	<0.001	0.132–0.286
Mean probability of death (illness severity) for elderly admissions	–11.732	0.294	–33.737 to 10.272	—	—	—
Percent of admissions comprising transfers from other facilities	26.020	<0.001	11.834–40.205	4.551	0.547	–10.346 to 19.449

* In multivariable collinearity testing, all variance inflation factor (VIF) scores were <10.

TABLE 3

Prevalence of Hospital and ICU Programs, Policies, and Practices (N = 124 Hospitals)

Program, Policy, or Practice	Yes N (%)	No N (%)	Don't Know N (%)
Hospital			
Formal code policy or form for cardiopulmonary arrest	117 (95)	3 (2)	4 (3)
Clinical ethics consult service	105 (85)	12 (10)	7 (5)
Educational program on palliative and EOL care to nurses	94 (76)	20 (16)	10 (8)
Doctors get feedback on length of stay and spending by DRG	90 (73)	15 (12)	19 (15)
Educational program on palliative and EOL care to doctors	76 (61)	28 (23)	20 (16)
Emergency department complies with out-of-hospital DNR orders	64 (52)	39 (31)	21 (17)
Bereavement program	60 (48)	59 (48)	5 (4)
Required code status discussion on admission	52 (42)	65 (52)	7 (6)
Hospitalist program	50 (40)	74 (60)	0 (0)
Palliative care consult service	47 (38)	70 (56)	7 (6)
Designated or "flex" palliative care beds	39 (31)	81 (65)	4 (4)
Pastoral care training program	23 (19)	101 (81)	0 (0)
Formal futility policy	20 (16)	94 (76)	10 (8)
Critical care training program	9 (7)	115 (93)	0 (0)
Palliative care training program	5 (4)	119 (96)	0 (0)
Intensive care unit			
Case managers	109 (88)	11 (9)	4 (3)
Standard protocol for nurses to assess and chart patient symptoms	102 (82)	17 (14)	5 (4)
Standing quality improvement process	90 (73)	27 (22)	7 (5)
Physician in-house overnight ICU coverage	76 (61)	44 (35)	4 (4)
Private conference room for family meetings	75 (60)	46 (37)	3 (3)
Daily multidisciplinary rounds	63 (51)	57 (46)	4 (3)
Clinical protocols for symptom management	59 (48)	39 (31)	26 (21)
Clinical protocol for withdrawing/withholding life-sustaining treatments	51 (41)	66 (53)	7 (6)
Pastoral care representative visits without being called	49 (40)	69 (56)	6 (4)
Length of stay review committee	32 (26)	86 (69)	6 (5)
Main ICU type is medical ICU (MICU)	14 (11)	110 (89)	0 (0)
Closed ICU staffing model (intensivist is primary physician)	12 (10)	106 (85)	6 (5)
Collects/reports APACHE data to care team within 48 h of admission	11 (9)	92 (74)	21 (17)
Regularly scheduled family meetings with attending physician	8 (6)	110 (89)	6 (5)

EOL indicates end-of-life; DNR, do-not-resuscitate; DRG, diagnosis-related group; APACHE, acute physiology and chronic health evaluation; ICU, intensive care unit.

TABLE 4

Univariable Associations Between Hospital and ICU Programs, Policies, and Practices and “End-of-Life” Treatment Intensity* (N = 124 Hospitals)

Program, Policy, or Practice	Mean Treatment Intensity: Present	Mean Treatment Intensity: Absent	Difference in Treatment Intensity	P
Hospital				
Training program (critical care, palliative care, pastoral care)	0.329	-0.236	0.565	0.010
Hospitalist program	-0.002	-0.176	0.174	0.296
Hospital bereavement program	-0.072	-0.190	0.118	0.490
Ethics consult service	-0.067	-0.573	0.506	0.049
Palliative care consult service	-0.030	-0.179	0.149	0.362
Formal futility policy	-0.026	-0.122	0.096	0.666
Education programs on end-of-life care to doctors	-0.063	-0.219	0.156	0.386
Education programs on end-of-life care to nurses	-0.084	-0.320	0.236	0.221
Designated or “flex” palliative care beds	-0.273	-0.037	-0.236	0.182
All patients required to have code status discussed on admission	-0.112	-0.113	0.001	0.999
ED complies with out-of-hospital DNR orders (including verbal)	0.029	-0.149	0.178	0.371
Doctors get feedback on length of stay and spending by DRG	-0.138	-0.421	0.283	0.219
Formal code policy or form for cardiopulmonary arrest	-0.095	-0.800	0.705	0.229
Intensive care unit				
Daily multidisciplinary rounds	0.107	-0.332	0.439	0.011
Designated private conference room for family meetings	0.101	-0.462	0.563	0.002
Length of stay review committee	0.321	-0.287	0.608	0.004
Quality improvement process	-0.082	-0.263	0.181	0.405
Pastoral care representative visits	-0.170	-0.078	-0.092	0.598
Regularly scheduled family meetings with attending	0.481	-0.139	0.620	0.089
Collect/report APACHE data to care teams within 48 h	-0.128	-0.084	-0.044	0.844
Standard protocol for assess/chart patient symptoms	-0.058	-0.385	0.327	0.181
Clinical protocol to withdraw/withhold life-sustaining treatment	0.124	-0.258	0.382	0.027
Clinical protocol for symptom management	0.013	-0.114	0.127	0.549
Case managers to facilitate discharge and decrease length of stay	-0.074	-0.489	0.415	0.330
Physician in-house overnight ICU coverage	0.233	-0.710	0.943	<0.001

Program, Policy, or Practice	Mean Treatment Intensity: Present	Mean Treatment Intensity: Absent	Difference in Treatment Intensity	<i>P</i>
Closed ICU staffing model (intensivist is primary physician)	0.189	−0.151	0.340	0.185

* The end-of-life treatment intensity index is a normally distributed factor score with a mean of ~0 and ranging from a low of −2.08 to a high of 3.12. DNR indicates do-not-resuscitate; DRG, diagnosis-related group; APACHE, acute physiology and chronic health evaluation; ICU, intensive care unit.

TABLE 5

Parsimonious Multivariable Model of “End-of-Life” Treatment Intensity, Including Hospital Structural/Market Characteristics and Hospital/ICU Organizational Characteristics (N = 124 hospitals)*

	β -Coefficient	<i>P</i>	95% CI
Bed size	0.354	0.001	0.151–0.558
Herfindahl-Hirschman Index	−0.582	0.013	−1.040 to −0.124
Percent of admissions among black patients	0.191	<0.001	0.111–0.271
ICU long length of stay review committee	0.300	0.030	0.030–0.570

* Among structural/market characteristics, only bed count, Herfindahl-Hirschman index, and percent of admissions among black patients were included in multivariable modeling here (see Table 2: multivariable results for significant and non-significant structural/market characteristics).

Among hospital/ICU organizational characteristics, variables included in modeling here included: training program in palliative, critical, or pastoral care; ethics consult service; a designated private conference room for family meetings in the ICU; an ICU long length of stay review committee; regularly scheduled family meetings with an attending in the ICU; a clinical protocol to withdraw/withhold life-sustaining treatment; and dichotomized (0,1) physician in-house overnight ICU coverage (univariable $P < 0.1$). Only the ICU long length of stay review committee remained significant in multivariable modeling and was kept in the final model, shown here.