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The impact of race on intensity of care provided to older adults in the Medical Intensive Care Unit

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Abstract

Background—African Americans and Hispanics receive disproportionately less aggressive non-critical treatment for chronic diseases than their Caucasian counterparts. However when it comes to end of life care, minority races are purportedly treated more aggressively in Medical Intensive Care Units (MICU) and are more likely to die there.

Objective—We sought to determine the impact of race on the intensity of care provided to older adults in the Medical Intensive Care Unit (MICU) using the Therapeutic Intervention Scoring System-28 (TISS-28) and other MICU interventions.

Methods—A prospective study of a cohort of 309 patients aged 60 years and older in the MICU. Interventions such as mechanical ventilation, vasopressors, new onset dialysis, feeding tubes and pulmonary artery catheterization were recorded. Primary outcomes were TISS-28 scores and MICU interventions.

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Guarantor statement

C.Chima-Melton takes responsibility for the content of the manuscript, including the data and analysis.

Authors' Contributions

C.Chima-Melton formulated the research question, conducted the background research and prepared the paper. K. L. B. Araujo managed the data and prepared figures and tables for the paper. T. E. Murphy performed the necessary statistical research and statistical analysis for this paper. M. Pisani enrolled patients and collected the data for this study. In addition, M. Pisani mentored C.Chima-Melton for study design and paper preparation.

Conflict of interests

Chidinma Chima-Melton M.D, Terrence E. Murphy, PhD, Katy L. B. Araujo MPH and Margaret A. Pisani M.D., MPH declare that they have no conflicts of interests.

Informed Consent

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). Informed consent was obtained from all patients for being included in the study.

Results—Non-white patients were younger, had more dementia and delirium although there was no difference in ICU mortality. The amount of critical care delivered to non-white and white patients were equivalent at $p = 0.05$ based on their respective TISS-28 scores. Non-white patients received more renal replacement therapy than white patients.

Conclusions—Our study adds to the growing body of literature demonstrating that the relationship between race, patient preference and the intensity of care provided in MICUs is multifaceted. Although prior studies have reported that non-white populations often opt for more aggressive care, the similar proportions of non-white and white ‘Full code’ patients in this study suggests that this idea is overly simplistic.

Keywords

End-of-life; Race; Ethnicity; Healthcare Disparities; Medical Intensive Care Unit

Introduction

In 2012, persons of racial minority were 37% of the U.S. population and are projected to comprise 57% of the population in 2060[1]. Minority race is defined as persons who do not self-report as Caucasian. Although a decade has passed since the publication of the seminal Institute of Medicine report *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care*[2] and despite advances in racial equality, African Americans and Hispanics still receive disproportionately less preventative care, fewer interventions and treatment for diseases than their Caucasian counterparts[3-7]. Minority communities continue to have lower socioeconomic status, greater barriers to health-care access, and greater risks for and burden of disease[8, 2]. However when it comes to end of life care, minority races are purportedly treated more aggressively in Medical Intensive Care Units (MICU) and are more likely to die there [9-12].

The role that race exerts on outcomes in a cohort of older MICU patients has not been fully established and to our knowledge, no studies have evaluated the influence of race on intensity of care received by older MICU patients while adjusting for important clinical factors such as premorbid medical condition.

Scoring systems that measure severity of illness such as the Acute Physiology and Chronic Health Evaluation (APACHE II) score are useful in describing patient acuity and predicting mortality but do not perform well in evaluating the intensity of care patients receive in the ICU. The TISS-28 score is a simple validated scoring tool for describing both the severity of illness and the intensity of nursing care delivered to ICU patients[13].

Our study sought to determine whether there were differences in provision of MICU care captured by the TISS-28 score and other therapeutic interventions in an older cohort of patients.

We hypothesize that, given no significant difference in the baseline health status between white and non-white patients at ICU admission, the intensity of care provided to non-white patients will be greater than that provided to white patients. This hypothesis is driven by

prior studies demonstrating that non-white decedents were treated more aggressively in the ICU and were more likely to die with full support[9, 10]. We also hypothesize that ICU mortality and 15-month mortality of MICU survivors will not differ significantly by race based on earlier studies that demonstrated very small, if any, mortality benefit in patients who received more aggressive end of life treatment.[14-16]

2. Materials and Methods

2.1. Participants and Setting

The study was a prospective cohort of 309 patients aged 60 years and older in the medical intensive care unit of Yale-New Haven Hospital (YNHH), who were enrolled from September 5, 2002 to September 30, 2004. YNHH is a 1541-bed urban teaching hospital with a 36-bed medical ICU (MICU) serving a large urban community as well as a significant referral population. Patients were excluded if there was no identifiable proxy to provide information about the patient, if they were transferred from another hospital or ICU, if the patients died before the proxy was identified, or they did not speak English. Informed consent was obtained from the proxy and/or patients according to procedures approved by the Institutional Review Board of Yale University School of Medicine.

2.2. Study Procedures

2.2.1. Proxy Interviews—As previously described, proxy respondents were the primary sources of baseline information due to critical illness [17-20]. Information on premorbid functional and cognitive status was obtained.

2.2.2. Patient Factors—Charts were reviewed at the time of enrollment to obtain demographic information, admission diagnosis, preexisting depression, medication use at admission, and the Charlson Comorbidity Index (CCI) [21]. Severity of illness was assessed with the Acute Physiology and Chronic Health Evaluation II Score (APACHE II) [22].

2.2.3. MICU and Hospital Factors—Use of MICU interventions such as mechanical ventilation, vasopressors, new onset dialysis, feeding tubes and pulmonary artery catheterization were recorded. Total number of days in the MICU and days of mechanical ventilation were recorded. Patients were assessed daily for delirium using the confusion assessment method for the ICU (CAM-ICU). Changes in resuscitation status during the MICU admission were documented. Continuous sedative and opioid drug administration were tracked using Infusion Administration Pumps, which recorded total dose delivered to the patient.

2.2.4. TISS-28—The TISS-28 is a simple, validated scoring system designed to quantify severity of patient illness and therapeutic activities in the ICU in terms of nursing workload [20]. TISS-28 scores range from 1 to 78 points. Each TISS-28 point correlates with 10.6 minutes of nursing care [13]. The TISS-28 score is compiled from seven general groups: Basic Activities (dressing changes, laboratory blood draws, single medication administration, etc.), Ventilatory Support (mechanical ventilation, care of airway, intratracheal suctioning, etc.), Cardiovascular Support (arterial lines, central venous lines,

vasoactive medications, intravenous fluid resuscitation, etc.), Renal Support (active diuresis, quantitative urine output, dialysis), Neurologic Support (measurement of intracranial pressures), Metabolic Support (treatment of complicated metabolic acidosis or alkalosis, enteral feeding, intravenous hyperalimentation), and Specific Interventions (pacemakers, cardioversions, endoscopies, emergency surgeries, etc.). For this study, the information for the TISS-28 was collected prospectively from the nurses' bedside flow sheet and the medical record. Data from the entire MICU stay, ranging from admission through discharge, were utilized in the calculation. For patients who died during their MICU stay, the TISS-28 was calculated to include all interventions through time of death.

2.3. Outcomes.

We examined race differences at three time points. We compared baseline factors at MICU admission, interventions during the MICU stay including the TISS-28 scores, and outcomes including mortality and length of stay. Fifteen-month mortality was determined by follow-up telephone interview.

2.4 Statistical Analysis

Admission characteristics stratified by race were summarized for important characteristics associated with admission to the ICU. Tests for baseline differences by race were based on T-tests for continuous variables and the Pearson chi-square for dichotomous variables. For these tests the null hypotheses assumed equality of admission characteristics for non-whites and whites. Likewise, factors related to the ICU stay were also compared with the same test statistics and null hypotheses.

When comparing two groups with the statistical techniques described above, a lack of statistical difference does not signify that the two groups received the same treatment. To demonstrate the latter condition a much more rigorous test, called a test of equivalence, is required. We wanted to evaluate if treatment between non-whites and whites was the same using a formal test of statistical equivalence. A non-parametric, Mann-Whitney test of equivalence for discrete distributions was used to compare the TISS-28 scores between non-whites and whites during their stay in the MICU. The null hypothesis in this case was that non-whites and whites received different amounts of overall critical care. We chose equivalence limits of $\pm 15\%$ to reflect the percentile differences around the median value on the TISS-28 scale based on our experience with critical care for older persons in the MICU. The equivalence test was performed using the SAS macro "mwte_xy" written by Wellek[23, 24, 19] with $P = 0.05$ indicating statistical significance. We note that the Mann-Whitney-based test of equivalence does not adjust for covariates. In supplementary analysis we therefore modeled the count values of each person's TISS-28 with a negative binomial distribution as a function of race with adjustment for covariates. The covariates included age, APACHE II at admission, the number of basic activities of daily living (ADL) for which help was needed, BMI, history of cancer, code status change, delirium at any time during the ICU stay, gender, intubation, and Medicaid insurance. All statistical tests were two-tailed, with $P < 0.05$ indicating significance. Analysis was performed with SAS version 9.3 software[24].

3. Results

3.1. Comparison between white and non-white patients admitted to the MICU

Table 1 indicates that our study population consisted of 258 (83%) white patients and 51 (16.5%) non-white patients. 23 (3%) patients out of 725 screened were excluded due to not being able to speak English. Non-white patients were younger (71.5 versus 75.3; $p=0.003$) and were more frequently enrolled in Medicaid (39% versus 9%; $p<0.0001$). Non-white patients also had significantly fewer years of education (11.5 versus 12.6; $p=0.01$).

There was more dementia in the non-white patients (46% vs 28%; $p=0.01$) and there was a trend towards more depression in white patients (18 versus 29; $p=0.08$). No significant difference in premorbid functional status was seen. The admitting diagnoses were evenly split between both groups with the exception of a neurological diagnosis which was more common in non-white patients (8% versus <1%; $p=0.003$).

3.2. TISS-28 Scores, APACHE II Scores and MICU Mortality

Figure 1 shows that the amount of critical care delivered to non-whites and whites were equivalent based on their respective TISS-28 scores (23.3 versus 26.0). Figure 2 shows that APACHE II scores were also not significantly different (24.0 versus 23.0; $p=0.80$).

Differences between non-white and white patients were present in those receiving hemodialysis (12% versus 6%; $p=0.04$) and Continuous Veno-Venous Hemofiltration (CVVH) (10% versus 3%; $p=0.05$). There were no statistical differences between non-white and white patients in the bivariate comparisons of MICU interventions (such as mechanical ventilation, tracheostomy, positive airway pressure, pulmonary artery catheterization, enteral nutrition). There were also no significant differences between white and non-whites in APACHE II score or “Do Not Resuscitate (DNR)” orders (Table 2).

Lastly, because the Mann-Whitney based test of equivalence did not adjust for covariates, we modeled the count outcome of the TISS-28 as a function of race with adjustment for important covariates using a negative binomial distribution. These multivariable results are presented in Table 3 and show that non-white race does not demonstrate any significant association with TISS-28 score. Only the covariates BMI, change in code status, delirium, and intubation exhibited any significantly positive associations with the TISS-28 outcome. Impairment in IADL showed a marginally negative association.

4. Discussion

It has been previously reported in the oncology and end-of-life literature[25, 26] that non-white patients receive more aggressive end-of-life care than white patients and consistent with this trend, our conditional hypothesis that non-white patients will receive more aggressive ICU care than white patients was seen with respect to renal replacement therapy. In all other interventions, non-white and white patients received equivalent care after accounting for relevant covariates.

In our population of critically ill older adults, non-white patients admitted to the MICU were younger than white patients, a difference that may be related to disparities in accessibility to preventative care in the African-American and Hispanic sub-populations. This age difference may also be related to a survival benefit in the white patients, i.e. the older non-white patients may have already died.

Additional differences between non-white and white patients on MICU admission included receipt of Medicaid and years of education, which could be surrogates for socioeconomic status.

We also demonstrate that non-white patients have higher rates of baseline dementia and also greater rates of delirium during their MICU stay. This finding is consistent with prior literature showing that minority patients often have higher levels of baseline cognitive impairment and are at greater risk of developing delirium in the hospital, where it is often undertreated [27-30].

Most notably, the TISS-28 score between non-white and white patients in our study was equivalent. The majority of the interventions patients received, even after accounting for severity of illness by the APACHE II Score were not statistically different by race. The only differences were seen in the renal replacement therapies, CVVH and hemodialysis.

Multi-variable analysis further delineates this lack of association between race and TISS-28 whereas other variables that we would clinically expect to show a positive correlation with TISS-28 scores, such as higher BMI, delirium and intubation, did demonstrate this. Notably, a change of code status to less aggressive was positively correlated with the TISS-28 score. This could be because these patients were so sick that they still required intense nursing attention despite the de-escalation of their resuscitation status, or that the decision to change code status was made only after very aggressive measures had already been performed.

Although prior studies have reported that non-white populations often opt for more aggressive care[31], the similar proportions of non-white and white 'Full code' patients in this study suggests that this idea is overly simplistic. In the past, these differences have been explained by patient preference[32, 10]. Alternatively, this trend may be due to physicians beliefs that minority patients are more likely to prefer intensive life-sustaining treatment[33] despite literature demonstrating that non-white patients often lacked knowledge of advanced directives[34, 35]. Additionally black patients more frequently wished to discuss CPR preferences with their physicians but were less likely to have had these discussions[36, 37]. Furthermore black patients who have had end of life (EOL) discussions with their physicians were more likely to prefer symptom-directed care and to have DNR orders in place than black patients who did not have EOL discussions[37]. These findings suggest that overly aggressive end-of-life treatments for non-white critically ill patients may be in part due to poor physician-patient communication[37, 38]. Our study adds to the growing body of literature demonstrating that the relationship between race, patient preference and the intensity of care provided in MICUs is multifaceted, subject to provider bias and cannot be easily generalized.

Further study should be focused on understanding the various determinants of patient and family preferences including eliciting expectations, terminal illness awareness and improving relationships between families and medical providers. When these factors do not align, tragic misunderstandings can occur and inappropriate care is delivered[39, 38].

Some study limitations exist. This was a single-site ICU in a large academic medical center so results may not be representative of care provided in other subspecialty ICUs or community hospitals. Another limitation is that the TISS-28 does not account for patient preferences or changes in acceptable levels of intensive care over the past several years. In addition, the TISS-28 was derived to measure ICU nursing activities which may not fully correlate with aggressiveness of ICU care especially with respect to the use of more advanced technologies such as the use of ventricular assist devices and extracorporeal membrane oxygenation. Finally the smaller numbers of non-whites compared to white patients participating in the study is another limitation. While we excluded non-English speaking patients they only consisted of 3% of our screened population.

Strengths of this study include the large sample size of older MICU patients and a clinically rich prospective data set using validated instruments. The average TISS-28 score in our older MICU population was 23.3 for non-white and 26.0 for white patients which is consistent with the range of TISS-28 scores from other studies [40]. To our knowledge, this is the only study to examine detailed and validated measures of intensity of care delivered in the MICU accounting for interventions by race.

5. Conclusions

In summary, in this older cohort, non-white patients receive statistically equivalent intensity of care and MICU interventions except for renal replacement therapies.

Despite this, we found that there was no difference in ICU mortality or 15-month mortality between non-white and white patients in this cohort. As the U.S. population continues to diversify, it becomes increasingly important to draw awareness to the disparities in the delivery of care between racial groups. Future research should focus on understanding the factors including provider communication that contribute to ethnic minority patients choosing to pursue aggressive end-of-life care.

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List of Abbreviations

ADL	Activities of Daily Living Scale
APACHE II	Acute Physiology and Chronic Health Evaluation

CCI	Charlson Comorbidity Index
COPD	Chronic Obstructive Pulmonary Disease
IQCODE	Informant Questionnaire on Cognitive Decline in the Elderly
IADL	Instrumental Activities of Daily Living Scale
MICU	Intensive care unit
SAPS	Simplified Acute Physiology Score
TISS-28	Therapeutic Intervention Scoring System-28
YNHH	Yale-New Haven Hospital

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Key Messages

- Non-white patients received more renal replacement therapies than their white counterparts. We did not detect any other race-based differences in rates of MICU interventions or intensity of care as measured by the TISS-28 score with respect to most aspects of critical care.
- Multi-variable analysis delineated the lack of association seen between race and TISS-28 whereas other variables, such as higher BMI, delirium and intubation, showed a positive correlation with TISS-28 scores.
- In our population of critically ill older adults, despite being significantly younger, non-white patients had similar mortality rates to white patients.
- Our study demonstrates that non-white patients had higher baseline rates of dementia and greater rates of ICU delirium.
- This work adds to the growing body of literature demonstrating that the relationship between race and intensity of care provided is multifaceted, complicated and cannot be easily generalized.

Figure 1. Therapeutic Intervention Scoring System-28 by Non-white and White race
Median Therapeutic Intervention Scale Score 28 (TISS28) plotted with +/- 15% equivalence limits

Figure 2. Acute Physiology and Chronic Health Evaluation II score by Non-white and White race

Median Acute Physiology and Chronic Health Evaluation II (APACHE II) score plotted with $\pm 15\%$ equivalence limits

Table 1Medical Intensive Care Unit Admission Characteristics of Patients Enrolled in Study (N=309)^a

Characteristic	Non-white (n=51)	White (n=258)	Overall (n=309)	P value
Age in years, Mean (SD)	71.5 (8.2)	75.3 (8.4)	74.7 (3.5)	0.003
Medicaid status	20 (39)	23 (9)	43 (14)	<0.0001
Years of education, Mean (SD)	11.5 (3.0)	12.6 (2.7)	12.5 (2.8)	0.01
Baseline Medical Status				
Body Mass Index (BMI, m ² /kg), Mean (SD) ^b	29.1 (10.4)	27.2 (8.0)	27.5 (8.4)	0.25
Chronic respiratory failure	15 (29)	86 (33)	101 (33)	0.59
Chronic heart failure	10 (20)	67 (26)	77 (25)	0.34
Chronic renal insufficiency	11 (22)	45 (17)	56 (18)	0.48
Hepatic Failure	0 (0)	2 (1)	2 (<1)	0.53
Malignancy	4 (8)	14 (5)	18 (6)	0.51
Depression	9 (18)	76 (29)	85 (28)	0.08
Dementia by IQCODE ^b	23 (46)	72 (28)	95 (31)	0.01
Any Impairment in Activities of Daily Living (0-4 scale)	23 (45)	88 (34)	111 (36)	0.14
Any Impairment in Activities of Instrumental Daily Living (0-6 scale)	44 (86)	220 (85)	264 (85)	0.85
Admitting Diagnosis				
Sepsis	7 (14)	44 (17)	51 (17)	0.56
Respiratory	25 (49)	131 (51)	156 (50)	0.82
Neurologic	4 (8)	1 (<1)	5 (2)	0.003
Gastrointestinal haemorrhage	7 (14)	45 (17)	52 (17)	0.52
Other	8 (16)	37 (14)	45 (15)	0.80

P-values were calculated from t-tests for continuous variables and from chi-square statistics for dichotomous).

^a All variables presented as n (%) except where indicated.^b Missing data present for some subjects. For BMI missing=9; Dementia missing=3

Table 2

Comparing Factors related to time in MICU by Race

Continuous Descriptor of MICU Stay	Non-white (n=51)	White (n=258)	P value ^a
	Median (IQR)	Median (IQR)	
Days of stay in ICU (LOS) ^b	4.0 (3.0)	5.0 (6.0)	0.39

Dichotomous Descriptors of MICU Stay	n (%)	n (%)	P value ^a
Mechanical Ventilation	27 (53)	140 (54)	0.86
Full Code on ICU Admission ^c	45 (88)	220 (85)	0.58
DNR ICU Admission ^c	6 (12)	36 (14)	0.67
Tracheostomy	5 (10)	10 (4)	0.08
Continuous Positive Airway Pressure (CPAP) or BiLevel Positive Airway Pressure (BiPAP)	9 (18)	63 (24)	0.30
Pulmonary Artery Catheterization	1 (2)	28 (11)	0.06
Enteral Nutrition (Nasogastric Tube or Percutaneous Endoscopic Gastrostomy Tube)	13 (25)	100 (39)	0.07
Hemodialysis	6 (12)	11 (4)	0.04
Continuous Veno-Venous Hemofiltration (CVVH)	5 (10)	8 (3)	0.05
Change in code status to "Less aggressive"	9 (18)	73 (28)	0.12
Outcomes			
ICU Delirium ^d	44 (88)	195 (77)	0.08
ICU Mortality	9 (18)	44 (17)	0.92
Overall Mortality (15 months from ICU admission)	27 (53)	144 (56)	0.71
Mortality (during entire surveillance period, 8 deaths beyond 15 m)	28 (55)	151 (59)	0.63

TISS-Therapeutic Intervention Scoring System, ICU-intensive care unit, APACHE II-acute physiology and chronic health evaluation II, MICU = Medical Intensive Care Unit

All variables presented as n (%) except where indicated.

^a Chi-square tests for categorical variables and Wilcoxon rank sum tests for continuous variables were used with statistical significance defined as p-value 0.05.

^b Length of stay was for first admission.

^c Missing data present for some subjects. Code status missing=1.

^d Delirium was defined by either positive ICU Confusion Assessment Method (CAM) or chart indication of delirium during ICU stay.

Table 3

Multivariable Associations between Explanatory Variables and Score Values of TISS-28 Based on a Negative Binomial Distribution

Explanatory Variable	Relative Risk (95% Confidence Interval)	P-value ^a
Non-white race (dichotomous)	1.10 (0.87 , 1.39)	0.43
Age in years (continuous)	1.00 (0.99 , 1.01)	0.69
Male Sex (dichotomous)	1.00 (0.86 , 1.17)	0.98
Medicaid (dichotomous)	0.80 (0.6227 , 1.03)	0.08
Body Mass Index (continuous)	1.01 (1.00 , 1.02)	0.01
Basic Activities of Daily Living (count 0 – 7)	1.05 (0.99 , 1.11)	0.08
Instrumental Activities of Daily Living (count 0 – 7)	0.95 (0.90 , 1.00)	0.05
History of Cancer (dichotomous)	0.89 (0.63 , 1.27)	0.52
Code Less Aggressive (dichotomous)	1.34 (1.12 , 1.61)	<0.01
Delirium during ICU Stay (dichotomous)	1.38 (1.06 , 1.80)	0.02
Intubation (dichotomous)	2.82 (2.32 , 3.43)	<0.01
APACHE II at admission (continuous)	0.99 (0.98 , 1.01)	0.28

TISS-Therapeutic Intervention Scoring System, ICU-intensive care unit, APACHE II-acute physiology and chronic health evaluation II

^abased on negative binomial distribution of TISS-28