Trauma Surgery & Acute Care Open

Racial disparities in end-of-life suffering within surgical intensive care units

Diane N Haddad ,[1] Nicole Meredyth,[2] Justin Hatchimonji ,[1] Elizabeth Merulla,[1] Amy Matta,[1] Jason Saucier,[1] Catherine E Sharoky,[1] Gary Alan Bass ,[1] Jose L Pascual,[1] Niels D Martin [1]

► Additional supplemental material is published online only. To view, please visit the journal online (https://doi.org/10.1136/tsaco-2024-001367).

[1]Department of Surgery, University of Pennsylvania, Philadelphia, Pennsylvania, USA
[2]Department of Surgery, Northwestern Medicine, Chicago, Illinois, USA

Correspondence to
Dr Niels D Martin; niels.martin@pennmedicine.upenn.edu

This work was presented at the American College of Surgeons Clinical Congress 2023.

Received 8 January 2024
Accepted 9 August 2024

To cite: Haddad DN, Meredyth N, Hatchimonji J, *et al*. *Trauma Surg Acute Care Open* 2024;**9**:e001367.

ABSTRACT

Background End-of-life (EOL) care is associated with high resource utilization. Recognizing and effectively communicating that EOL is near promotes more patient-centered care, while decreasing futile interventions. We hypothesize that provider assessment of futility during the surgical intensive care unit (SICU) admission would result in higher rates of Do Not Resuscitate (DNR).

Methods We performed a retrospective review of a prospective SICU registry of all deceased patients across a health system, 2018–2022. The registry included a subjective provider assessment of patient's expected survival. We employed multivariable logistic regression to adjust for clinical factors while assessing for association between code status at death and provider's survival assessment with attention to race-based differences.

Results 746 patients—105 (14.1%) traumatically injured and 641 (85.9%) non-traumatically injured—died over 4.5 years in the SICU (mortality rate 5.9%). 26.3% of these deaths were expected by the ICU provider. 40.9% of trauma patients were full code at the time of death, compared with 15.6% of non-traumatically injured patients. Expected death was associated with increased odds of DNR code status for non-traumatically injured patients (OR 1.8, 95% CI 1.03 to 3.18), but not for traumatically injured patients (OR 0.82, 95% CI 0.22 to 3.08). After adjusting for demographic and clinical characteristics, black patients were less likely to be DNR at the time of death (OR 0.49, 95% CI 0.32 to 0.75).

Conclusion 20% of patients who died in our SICU had not declared a DNR status, with injured black patients more likely to remain full code at the time of death. Further evaluation of this cohort to optimize recognition and communication of EOL is needed to avoid unnecessary suffering.

Level of evidence Level III/prognostic and epidemiological.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ End-of-life care in the USA is often expensive and fragmented and can prolong discomfort without improving quality of life. Provider recognition of medical futility at the end of life provides an opportunity to engage with families to avoid invasive, unnecessary suffering.

WHAT THIS STUDY ADDS

⇒ Of patients dying in the surgical intensive care unit, black trauma patients were more likely to be full code when compared with similar white patients. Provider perceived futility was associated with Do Not Resuscitate status in a non-trauma cohort, but not for injured patients.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Standardization of communication among the provider team is essential to avoid unnecessary suffering at the end of life, especially in vulnerable populations.

INTRODUCTION

End-of-life (EOL) care in the USA is associated with high resource utilization and high cost. Futile care efforts at EOL result in unnecessary pain and suffering and further this high resource utilization and cost. The gravity of this can be recognized by noting that approximately one in five people in the USA die in an intensive care unit (ICU).[1] Further, many of those deaths are predictable; fewer than one in five patients who undergo cardiopulmonary resuscitation (CPR) after in-hospital cardiac arrest survive to discharge.[2] For patients in the ICU with the highest predicted mortality, 'full code' status confers no additional survival benefit when compared with propensity-matched patients who are 'DNR' (Do Not Resuscitate).[3] Sadly, the futile care delivered at EOL actually often contradicts the goals of the intended patient.[4]

Facilitating the widespread existence of futile care is the lack of international consensus or guidelines regarding medical futility in critically ill patients.[5] Prior studies have used a variety of definitions for medical futility, including risk scores for favorable neurological outcomes, provider-assessed low probability of survival, specific conditions such as age, multisystem organ failure or advanced malignancy, or the descriptive outcome of 'prolonging the patient's suffering and therefore harming the patient'.[5] Predictive models have been established that rely on criteria for frailty along with indicators of low success of good functional outcome.

In the critical care setting, challenges arise when establishing goals of care, not with the patient, but with family members of incapacitated patients. When framed as a decision to 'do everything' for their loved one, there is an intrinsic human desire to not withhold any life-sustaining treatment and to pursue aggressive care.[6] This is often despite the conviction of the healthcare providers that

aggressive care will not alter the patient's ultimate outcome. These discordant conclusions are particularly common among under-represented racial groups, with a historically justified mistrust of the medical establishment, leading to more aggressive care at the EOL.[7 8]

The study evaluates a group of critically ill patients in which resuscitative efforts have clinically been deemed futile, but who remain full code even through the time of their death. In this study, we aim to evaluate the prevalence of DNR status in patients who die in the surgical ICU (SICU) when resuscitative efforts are clinically deemed to be futile. We will also evaluate factors associated with code status at the EOL in the ICU, focusing on differences between patient factors, including race and disease processes.

METHODS

Population

We performed a retrospective review of a prospectively collected registry of all patients admitted to the SICU within our academic, quaternary referral center from June 1, 2018 through January 31, 2023. Our health system comprised three urban hospitals, including a community hospital, a quaternary regional referral center for multiple surgical specialties (including transplant surgery, vascular surgery, neurological and spine surgery, otorhinolaryngologic and gynecologic oncology and complex emergency surgery) and a level I trauma center. Our SICU cohort spans three closed ICUs staffed by a combination of surgical and anesthesia critical care intensivists with support from a team of advanced practice providers as well as resident and fellow trainees. All patients who died in the SICU were included. The prospectively maintained SICU registry data were linked to data from the electronic medical record (EMR) to identify the date and time of SICU admission and death. This was used to generate duration of time spent in the SICU and the timing of specific orders placed during the SICU admission, including DNR orders. Additional information was extracted from the EMR, including the presence and timing of any operative intervention. We evaluated the final ICU admission preceding the patient's death and excluded all previous ICU admissions. As part of standard data collection, this registry prompts the provider at the time of discharge to retrospectively indicate whether the patient would have been expected to die at the time of admission. This is part of ongoing quality improvement projects in our SICU and the determination is subsequently reviewed by the SICU leadership at the time of multidisciplinary mortality assessment.

Due to the expected differences between patients based on admission diagnosis related to injury or otherwise, we planned a subgroup analysis of the total population, evaluating outcomes between traumatically injured and uninjured surgical patients.

Outcomes

The primary outcome of interest was code status at the time of death. This was categorized in a binary fashion as either full code or DNR at the time of death. Due to the high proportion of intubated patients at the time of death, we included patients with both DNR and DNI (Do Not Intubate) orders and those with DNR orders only in the DNR group. Our secondary outcomes included time-based measures extracted from the EMR. We evaluated the timing of the DNR order in relation to SICU admission and time of death, as well as the timing of palliative care consultation.

Covariates

We collected demographic data for all patients who died, including age at admission, race and insurance status. Clinical characteristics surrounding admission including admission diagnosis, type of surgical intervention, intubation status and timing, and comorbid conditions and Acute Physiology and Chronic Health Evaluation II (APACHE II) scores were evaluated. The presence of other ICU interventions was also assessed including palliative care consultation, complications, and prior SICU admissions. We evaluated any surgical procedures that occurred during the patient's final hospital admission.

Statistical approach

We compared characteristics of patients based on code status and whether the death was deemed to be expected or unexpected using univariate analysis, parametric and non-parametric tests for continuous variables and χ^2 test and Fisher's exact test for categorical variables. We compared demographic and clinical characteristics between patient records successfully linked to the EMR and those that remained missing. We used multivariable logistic regression to adjust for clinical factors while assessing for association between code status at death and provider's admission survival assessment.

RESULTS

Description of population

During a four-and-a-half-year period of observation, 12 705 patients were admitted to the SICU, of which 746 died, with an overall mortality rate 5.9% (figure 1). Median age of the deceased was 69 years (IQR 57–77) with a bimodal distribution in traumatically injured patients (figure 2). The most common SICU admission diagnoses were trauma (14.0%), emergency surgery (13.1%), and respiratory distress (10.4%). Of all patients who died, 432 (57.9%) had an operation during their hospital admission. Most patients were white (55.8%) while 36.1% were black. The average APACHE II score was 26.2 (SD 10.2), indicating the high acuity of this population. Median length of stay in the SICU was 5 days (IQR 2–13). Full descriptive characteristics of the population by code status can be found in table 1.

At the time of death, 80.8% (n=603) of all deceased patients were DNR, while 143 (19.2%) were full code. Patients who remained full code were more likely to be younger (median 59 years old (IQR 34–74) vs. 69 years old (IQR 57–77), p<0.001) as well as black (51.8% vs. 32.3%). This remained true in the subset of traumatically injured patients. Injured patients (n=105) who were full code were more likely to be younger (29 years old (IQR 21–42)) than those who were DNR (65 years old (IQR 44–78), p<0.001), and also more likely to be black (83.7% vs. 40.3%, p<0.001). When evaluating non-trauma patients (n=641), there was a significant association between increasing age and DNR status; patients who were full code were younger (median 66 years old (IQR 56–75)) than those who were DNR (median 70 years old (IQR 61–78), p=0.013) and more frequently black (38.0% vs. 31.4%, p=0.002). In multivariable logistic regression, there was a direct correlation between increasing age and odds of being DNR at the time of death (OR 1.02, 95% CI 1.01 to 1.03). Even after adjusting for age, mechanism of injury and clinical characteristics, black patients were less likely to be DNR (OR 0.51 (0.3–0.8)) (table 2).

A DNR status at the time of death was associated with a longer median ICU length of stay compared with those who were full code (6 days (IQR 3–14) vs. 2 days (IQR 1–8), p<0.001), which remained true for both traumatically and non-traumatically

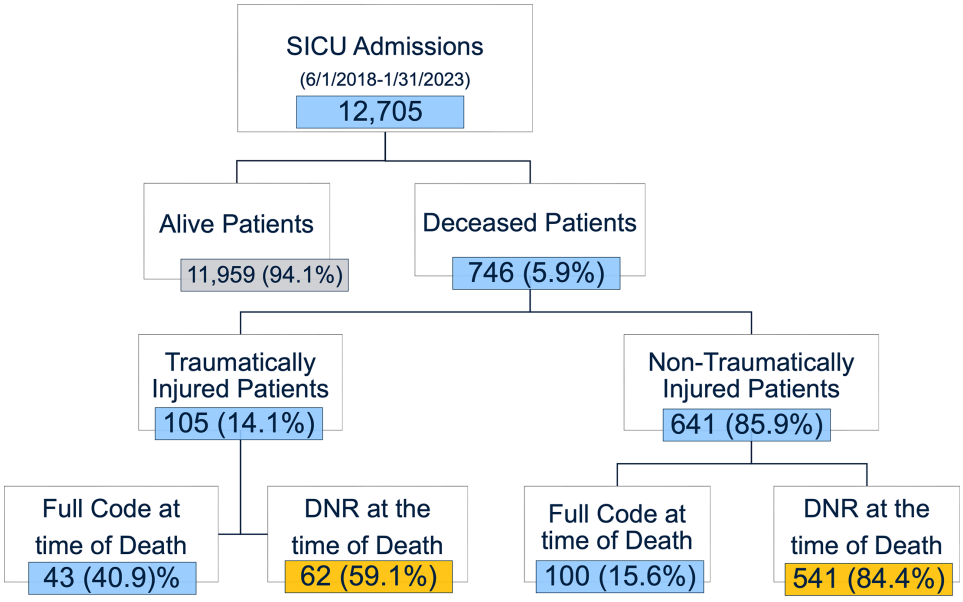

Figure 1 Flow diagram of surgical intensive care unit (SICU) patient population, June 1, 2018 to January 31, 2023. DNR, Do Not Resuscitate.

injured subsets. There was no difference in gender, operative intervention, or APACHE II score between those who were DNR and full code after subgroup analysis. See online supplemental table 1 for subgroup analysis in the injured patients.

Expected versus unexpected death characteristics

Of the 746 patients who died, 196 (26.3%) were determined in retrospect to have been expected by an ICU provider, confirmed on multidisciplinary mortality review. Expected deaths had higher average APACHE II scores (29.2 (SD 10.7) vs. 25.5 (SD 10.0), p=0.003). Across our population, there was no difference in code status at the time of death between expected and unexpected deaths (80.6% vs. 80.9%, p=0.9). Patient deaths that were deemed expected had shorter median ICU length of stay than those that were unexpected (3 days (IQR 2–8) vs. 7 days (IQR 3–15)) (table 3). There was no difference in code status at the time of death between expected and unexpected deaths for all patients in our cohort in multivariable regression (OR 1.41, 95% CI 0.87 to 2.28) (table 2).

When evaluating the traumatically injured subset of patients, expected deaths were surprisingly less likely to be DNR than unexpected deaths (41.9% vs. 66.2%, p=0.02), highlighting the challenge around EOL in this vulnerable population. Trauma patients with expected deaths were more likely to have received an operation than the unexpected deaths (online supplemental table 2). In multivariable logistic regression, expected death

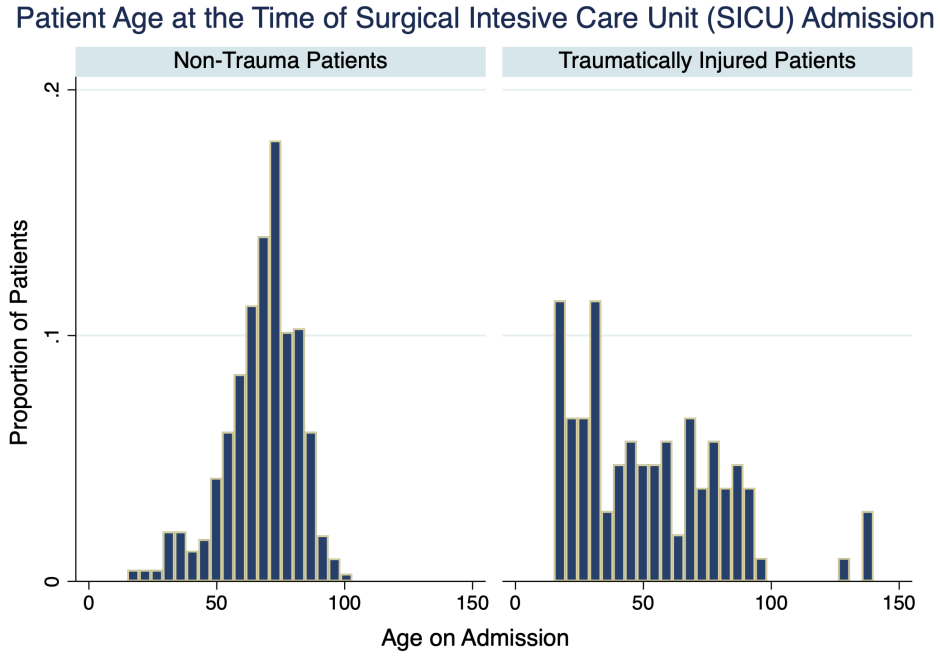

Figure 2 Distribution of patient age at the time of surgical intensive care unit (SICU) admission for deceased non-trauma patients versus traumatically injured patients, June 1, 2018 to January 2023.

Table 1 Baseline characteristics of deceased patients in the surgical intensive care unit (SICU), June 1, 2018 to January 31, 2023

	All patients	Do Not Resuscitate (DNR)	Full code	P value
Patients, n (%)	746 (100)	603 (80.8)	143 (19.2)	
Age, median (IQR)	69 (57–77)	70 (60–78)	59 (34–74)	0.0001
Male sex, n (%)	417 (55.9)	325 (53.9)	92 (64.3)	0.024
Race, n (%)				<0.001
White	416 (55.8)	361 (59.9)	55 (38.5)	
Black	269 (36.1)	195 (32.3)	74 (51.8)	
Other**	51 (6.8)	40 (6.6)	11 (7.7)	
Missing	10 (1.3)	7 (1.2)	3 (2.1)	
Admission diagnosis, n (%)				
Respiratory failure	78 (10.5)	66 (11.0)	12 (8.4)	
Sepsis	46 (6.2)	38 (6.3)	8 (5.6)	
Penetrating trauma	40 (5.4)	10 (1.7)	30 (21.0)	
Blunt trauma	65 (8.7)	52 (8.6)	13 (9.1)	
Operation, n (%)	432 (57.9)	345 (57.2)	87 (60.8)	0.4
ICU LOS, median (IQR)	5 (2–13)	6 (3–14)	2 (1–8)	0.0001
Expected death on ICU admission, n (%)	196 (26.3)	158 (26.2)	38 (26.6)	0.93
Intubated, n (%)	627 (84.1)	495 (82.1)	132 (92.3)	0.003
Tracheostomy, n (%)	61 (9.7)	54 (10.9)	7 (5.3)	0.056
APACHE II score, mean (SD)	26.2 (10.2)	26.3 (10.1)	26.1 (10.5)	0.876
Palliative care consultation, n (%)	328 (44.0)	295 (48.9)	33 (23.1)	<0.001

*Other race: Asian, Hispanic, other.
APACHE II, Acute Physiology and Chronic Health Evaluation II; ICU, intensive care unit; LOS, length of stay.

in trauma patients was not associated with odds of DNR code status (OR 0.82, 95% CI 0.22 to 3.08).

When evaluating non-trauma ICU patients in our cohort, expected deaths also had shorter ICU length of stay (median 3 days (IQR 2–9 days)). However, in multivariable logistic regression, determination of expected death was associated with DNR code status at the time of death (OR 1.81, 95% CI 1.03 to 3.18).

Critical care interventions

611 patients (82%) from the SICU registry were able to be successfully merged to data from the EMR. Of these patients, for expected deaths, the median time between ICU admission and change in code status was 1 day (IQR 0–2 days), with the median time between code status change and death of less than 1 day (IQR 0–2 days). For unexpected deaths, the time from admission to change in code status was a median of 3 days (IQR 1–9 days), with a median time between change and code status and death of 1 day (IQR 0–2 days). Both findings demonstrate the ongoing goals-of-care discussions and final changes to patient code status at the EOL.

Of the 611 patients with available EMR data, 328 (53.7%) received a palliative care consultation during their hospitalization. There was no difference between palliative care consultations between expected and unexpected deaths (42.9% vs. 44.4%, p=0.7). However, patients with palliative care consultations were more likely to be DNR than patients without palliative care consultation (48.9% vs. 23.1%, p<0.001). Black patients were less likely to have palliative care consultations (34.2%) than white or other race patients (48.6% vs. 54.9%, p<0.001). This remained true for non-injured patients (38.5%

Table 2 Results of multivariable logistic regression for odds of Do Not Resuscitate (DNR) status in deceased surgical intensive care unit (SICU) cohort, June 1, 2018 to January 31, 2023

	OR (95% CI)		
Characteristics	All patients (n=746)	Non-traumatically injured patients (n=631)	Traumatically injured patients (n=105)
Expected death	1.41 (0.87 to 2.28)	1.81 (1.03 to 3.18)*	0.82 (0.22 to 3.08)
Age at admission	1.02 (1.01 to 1.03)*	1.02 (1.01 to 1.04)*	1.02 (1.00 to 1.04)*
Race			
White	Ref	Ref	Ref
Black	0.51 (0.3 to 0.8)*	0.68 (0.41 to 1.10)	0.11 (0.03 to 0.38)*
Other	0.59 (0.27 to 1.28)	0.77 (0.32 to 1.84)	0.10 (0.01 to 0.95)*
Female gender	1.19 (0.78 to 1.80)	1.33 (0.84 to 2.11)	0.58 (0.16 to 2.12)
ICU length of stay	1.01 (0.78 to 1.80)	1.00 (0.99 to 1.01)	1.06 (0.99 to 1.12)
Surgery	0.60 (0.39 to 0.92)*	0.64 (0.39 to 1.04)	0.59 (0.18 to 1.95)
Intubation	0.58 (0.29 to 1.17)	0.60 (0.29 to 1.25)	0.34 (0.02 to 6.56)
Palliative care consultation	2.95 (1.81 to 4.79)*	3.36 (1.98 to 5.72)*	1.79 (0.48 to 6.65)

*P<0.05.
ICU, intensive care unit.

Table 3 Characteristics of deceased patients in the surgical intensive care unit (SICU), June 1, 2018 to January 31, 2023

Characteristics	All patients	Expected ICU death at admission	Unexpected ICU death at admission	P value
Patients, n (%)	746 (100.0)	196 (26.3)	550 (73.7)	
Age, median (IQR)	69 (57–77)	68 (52–76)	69 (59–77)	0.04
Race, n (%)				<0.001
White	215 (53.0)	67 (40.4)	148 (61.7)	
Black	163 (40.2)	82 (49.4)	81 (33.8)	
Other	28 (6.9)	17 (10.2)	11 (4.6)	
Male gender, n (%)	343 (55.7)	93 (56.0)	250 (55.6)	0.9
ICU LOS, median (IQR)	5 (2–13)	3 (2–8)	7 (3–15)	<0.001
APACHE II score, mean (SD)	26.6 (10.2)	29.2 (10.7)	25.5 (10.0)	0.003
DNR at SICU admission, n (%)	37 (5.0)	23 (11.7)	14 (2.6)	0.005
DNR at time of death, n (%)	603 (80.8)	158 (80.6)	445 (80.9)	0.9
Operation, n (%)	432 (57.9)	118 (60.2)	314 (57.1)	0.4
Intubated, n (%)	627 (84.1)	162 (82.7)	465 (84.6)	0.5
Palliative care consultation, n (%)	328 (44.0)	84 (42.9)	244 (44.4)	0.7

APACHE II, Acute Physiology and Chronic Health Evaluation II; DNR, Do Not Resuscitate; ICU, intensive care unit; LOS, length of stay.

vs. 50.3% vs. 55.6%, p=0.01), but not for traumatically injured patients (19.7% vs. 31.6% vs. 50.0%, p=0.12). In multivariable logistic regression adjusting for clinical characteristics and disease severity, palliative care consultation was associated with higher odds of DNR status at the time of death (OR 2.95, 95% CI 1.8 to 4.8) for all patients, including non-traumatically injured patients (OR 3.36, 95% CI 1.98 to 5.72), but not for injured patients (OR 1.79, 95% CI 0.48 to 6.65).

DISCUSSION

In the USA, approximately 20% of patients die in an ICU, with ICU costs accounting for approximately 20% of all hospital costs.[9] Providers often recognize the futility of pursuing invasive, aggressive interventions, such as CPR, at the EOL. However, they may struggle to communicate futility adequately to grieving families. This study examined the factors associated with DNR status at the time of death in a wide range of patients across multiple SICUs, including an evaluation of provider perceived futility. Across multiple SICUs, provider perceived futility—despite being reasonably accurate—was not associated with a higher rate of DNR at time of death. Provider recognition of high-acuity, critically ill patients with poor life expectancy was significantly associated with shorter ICU length of stay; however, it had no significant association with code status at the time of death for our overall patient cohort. On the other hand, provider expectation of death was associated with DNR status at the time of death for non-traumatically injured ICU patients. Taken together, these findings demonstrate missed opportunities of health system recognition and communication around complex EOL issues in vulnerable patient populations, resulting in low value care delivery.

Provider ability to predict futility is variable. There are factors associated with caring for a patient in an ICU that are not able to be currently captured by existing scoring systems. Additionally, our ability as providers to predict death at the time of ICU admission was not reliable, with only one in four deaths in our population classified as expected. Prior studies have implemented EMR-based 'nudge' interventions to screen and encourage hospital-based providers to engage in EOL conversations with high-risk patients and families.[10] This resulted in improvement in the number of goals-of-care conversations for inpatient and under-represented minorities. The predictive utility of our provider assessment has yet to be studied across the population; however, previous studies of provider assessed futility have also been varied.[11 12]

Additional communication challenges exist at the EOL in this cohort. In a SICU, where the critical care team is traditionally only a consulting service and not the primary caregiver, challenges also arise in communication of futility as both the primary surgical team and the critical care team share the responsibility of conveying important information to family members. After major surgery, these conversations are particularly challenging in the setting of postoperative complications.[13 14] This is similarly reflected in our population where postoperative patients were less likely to be DNR in multivariable regression. Further challenges arise when balancing realistic conversations with overly pessimistic prognostication leading to a self-fulfilling prophecy bias where a patient receives limited or incomplete care due to perceived futility.[15] In fact, multiple prior studies have demonstrated that the presence of a DNR status is independently associated with mortality in the ICU.[16–18]

Communicating perceived futility is particularly challenging in the care of traumatically injured patients, as they are often younger and face devastating, unexpected injury. In our cohort, the burden of penetrating traumatic injury was much more highly experienced by black patients as compared with other races. This contributed to black patients being more likely to remain full code at the time of death, potentially exposing them to aggressive interventions, despite higher rates of expected death in this subgroup. Prior studies have demonstrated that non-white patients were less likely to have DNR orders and similarly less likely to have life-sustaining therapies withdrawn.[19] As a result, non-white patients who died in the ICU were more likely to have CPR performed and to have invasive medical interventions such as dialysis and mechanical ventilation. Differences in culturally held beliefs and medical literacy may explain some of these differences, as well as reluctance among minority groups to engage in these conversations.[20] However, attributing the entire disparity to mistrust may oversimplify the situation by removing the responsibility of the provider to engage in culturally appropriate conversations about essential issues.

Communication about EOL with diverse patient populations must address culturally sensitive beliefs and practices, as the faith of both physicians and patients helps inform discussions regarding withdrawal.[21] Religion and spirituality play an essential role in the approach of many black patients to the process

of dying, particularly beliefs that only God has the power to decide life and death.[22–24] Conversations regarding EOL must acknowledge commonly held beliefs of some black families in divine miracles carried out by God who acts through physicians, but still shoulders the ultimate responsibility for physical and spiritual health.[22] Principles of trauma-informed care, including cultural humility, empathy and transparency, must all be employed in communicating the limits of invasive interventions that may artificially prolong duration of time on this earth while interfering with the 'home going' that is promised.

Social cognition and implicit bias must be recognized in these crucial, high-stakes interactions. In other contexts, communication with race concordant physicians has been demonstrated to result in better satisfaction in patient–physician communication.[25 26] Cultural sensitivity furthered by providers that more closely represent their patient population may help overcome many of these barriers. The diversification of the critical care workforce may further promote holistic care and reduce unnecessary suffering at the EOL.[27] Our study did not collect specific demographic data on the care team for each individual patient, but this may identify opportunities for more effective verbal and non-verbal communication.

Black patients were also less likely to receive palliative care consultation in our study population. On subgroup analysis, this was only true for non-trauma patients and not for our traumatically injured patient cohort. Underuse of palliative care among black patients has previously been described, spanning cultural, spiritual and social patient considerations along with the lack of provider delivery of trauma-informed care.[24] The potential benefit of palliative care in this population is complicated, as palliative care consultation in black patients has not always been found to decrease healthcare costs or utilization, as it does in white patients.[28] Geographic differences in access to palliative care have also been reported with poorer rural areas being less likely to access palliative care programs.[29] Race-based differences in EOL care in the ICU have been previously attributed to differences within health systems that care for black and Hispanic patients rather than differences within the same hospital.[30] This study took place across one health system with a similar provider group at every level caring for patients (attendings, advanced practice providers, critical care fellows) with palliative care availability to mitigate such hospital-system influences.

Palliative care consultation across our cohort was associated with increased odds of DNR at the time of death. This was only true for non-traumatically injured patients, but not for traumatically injured patients even after adjusting for race and ICU characteristics in multivariable regression. Palliative care consultation has been associated with higher acuity patients with longer ICU length of stay and higher rates of mortality.[31] However, proactive palliative care consultation has been demonstrated to shorten ICU length of stay in a study of patients in the medical ICU.[32] Engaging palliative care providers may aid in the communication of expected futility with aggressive intervention.

Our study examined provider assessment of futility and code status at the EOL, identifying lower rates of DNR status in traumatically injured patients, particularly black patients. To address these disparities, we are developing a uniform process of screening for provider assessed futility at the time of SICU admission and adopting a standardized approach to future interventions, including family discussions of goals of care and palliative care consultations. We plan on implementing this initiative in our trauma SICU with the ultimate goal of tailoring expansion to other sites in the hope of promoting culturally sensitive, family-based approach to ICU EOL discussions.

Limitations

Our study has several limitations, namely the retrospective nature of our analysis with data primarily abstracted from EMR chart review. This approach allowed access to concrete data on ICU progression of care, but did not provide the motivation or reasoning for the provider and family decisions that would have required primary chart or even qualitative interviews with the families. Our findings represented a heterogenous patient sample across multiple SICUs, including traumatically injured patients in an urban academic medical center, which may not be applicable to other populations. Our current provider assessment of futility is also subject to observer bias, particularly as it related to racial differences within our population. Our analysis also did not account for many of the important social determinants of health, such as insurance status, primary language, and household income, and other essential factors which influence health outcomes and discussions regarding EOL care.

Additionally, missing data due to failed EMR linkage in 18% of patients in our SICU registry which were not able to be linked to the EMR introduce the potential of bias of our findings related to the critical care interventions such as timing of code status change and presence of palliative care consultation (online supplemental figure 1). This is likely due to the multiplicity of medical record numbers per patient registered into our multihospital health system or provider entry error into the registry. When comparing characteristics between patients successfully linked to the EMR versus not, there were significant differences between race, injury mechanism and operative intervention (online supplemental table 3). While this may confound our findings regarding the utility of palliative consultation, our primary findings regarding code status and race remain unchanged. While the collinearity of age and race with admission diagnosis is also a potential confounder in our population, limiting the generalizability of our results, they also provide opportunities for local quality improvement initiatives.

CONCLUSIONS

Across our cohort, 20% of SICU deaths did not have a DNR status. There is a higher frequency of full code status in traumatically injured patients compared with uninjured patients. This exists despite provider perception of futility and likely represents challenges in engaging in EOL discussions, particularly for younger patients with unexpected injury. Our responsibility as providers is to appropriately communicate with families to ensure that our patients, especially under-represented trauma patients, do not suffer unnecessarily at the EOL. Further evaluation of this cohort to optimize recognition of EOL and communication to decision makers is needed.

X Diane N Haddad @dianehaddadmd

Contributors Conception and study design: DNH, NM, JH, EM, AM, JS, CES, JLP, NDM. Data acquisition: DNH, NM, JH, EM, AM, JS, GAB. Data analysis: DNH, NM, JH, CES, JLP, NDM. Data interpretation: DNH, NM, EM, AM, JH, JS, CES, JLP, NDM. Writing: DNH, NDM. Critical revision: DNH, NM, JH, EM, AM, JS, CES, GAB, JLP, NDM. NDM is the guarantor.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not applicable.

Ethics approval This study received ethics approval from the University of Pennsylvania Institutional Review Board (IRB 852872) and was deemed exempt from informed consent.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. All data relevant to the study are included in the article or uploaded as supplementary information. All data relevant to the study are included in the article or uploaded as supplementary information.

ORCID iDs
Diane N Haddad http://orcid.org/0000-0002-0723-0832
Justin Hatchimonji http://orcid.org/0000-0001-6497-3272
Gary Alan Bass http://orcid.org/0000-0002-1918-9443
Niels D Martin http://orcid.org/0000-0002-2157-0825

REFERENCES

1 Angus DC, Barnato AE, Linde-Zwirble WT, Weissfeld LA, Watson RS, Rickert T, Rubenfeld GD, Robert Wood Johnson Foundation ICU End-Of-Life Peer Group. Use of intensive care at the end of life in the United States: an epidemiologic study. *Crit Care Med* 2004;32:638–43.
2 Ehlenbach WJ, Barnato AE, Curtis JR, Kreuter W, Koepsell TD, Deyo RA, Stapleton RD. Epidemiologic study of in-hospital cardiopulmonary resuscitation in the elderly. *N Engl J Med* 2009;361:22–31.
3 Baldor DJ, Smyrnios NA, Faris K, Guilarte-Walker Y, Celik U, Torres U. A Controlled Study in CPR-Survival in Propensity Score Matched Full-Code and Do-Not-Resuscitate ICU Patients. *J Intensive Care Med* 2022;37:1363–9.
4 Lee RY, Brumback LC, Sathitratanacheewin S, Lober WB, Modes ME, Lynch YT, Ambrose CI, Sibley J, Vranas KC, Sullivan DR, *et al*. Association of Physician Orders for Life-Sustaining Treatment With ICU Admission Among Patients Hospitalized Near the End of Life. *JAMA* 2020;323:950–60.
5 Beck K, Vincent A, Cam H, Becker C, Gross S, Loretz N, Müller J, Amacher SA, Bohren C, Sutter R, *et al*. Medical futility regarding cardiopulmonary resuscitation in in-hospital cardiac arrests of adult patients: A systematic review and Meta-analysis. *Resuscitation* 2022;172:181–93.
6 Kopar PK, Visani A, Squirrell K, Brown DE. Addressing Futility: A Practical Approach. *Crit Care Explor* 2022;4:e0706.
7 Hostetter M, Klein S. Understanding and ameliorating medical mistrust among black americans. Commonwealth Fund; 2021. 10.
8 Lee MJ, Reddy K, Chowdhury J, Kumar N, Clark PA, Ndao P, *et al*. Overcoming the legacy of mistrust: African Americans' mistrust of medical profession; 2018.
9 Kyeremanteng K, Gagnon LP, Thavorn K, Heyland D, D'Egidio G. The Impact of Palliative Care Consultation in the ICU on Length of Stay: A Systematic Review and Cost Evaluation. *J Intensive Care Med* 2018;33:346–53.
10 Curtis JR, Lee RY, Brumback LC, Kross EK, Downey L, Torrence J, LeDuc N, Mallon Andrews K, Im J, Heywood J, *et al*. Intervention to Promote Communication About Goals of Care for Hospitalized Patients With Serious Illness: A Randomized Clinical Trial. *JAMA* 2023;329:2028–37.
11 Detsky ME, Harhay MO, Bayard DF, Delman AM, Buehler AE, Kent SA, Ciuffetelli IV, Cooney E, Gabler NB, Ratcliffe SJ, *et al*. Discriminative Accuracy of Physician and Nurse Predictions for Survival and Functional Outcomes 6 Months After an ICU Admission. *JAMA* 2017;317:2187–95.
12 Barrera R, Nygard S, Sogoloff H, Groeger J, Wilson R. Accuracy of predictions of survival at admission to the intensive care unit. *J Crit Care* 2001;16:32–5.
13 Schwarze ML, Redmann AJ, Brasel KJ, Alexander GC. The role of surgeon error in withdrawal of postoperative life support. *Ann Surg* 2012;256:10–5.
14 Pecanac KE, Kehler JM, Brasel KJ, Cooper Z, Steffens NM, McKneally MF, Schwarze ML. It's big surgery: preoperative expressions of risk, responsibility, and commitment to treatment after high-risk operations. *Ann Surg* 2014;259:458–63.
15 De Georgia MA. The intersection of prognostication and code status in patients with severe brain injury. *J Crit Care* 2022;69:153997.
16 Fuchs L, Anstey M, Feng M, Toledano R, Kogan S, Howell MD, Clardy P, Celi L, Talmor D, Novack V. Quantifying the Mortality Impact of Do-Not-Resuscitate Orders in the ICU. *Crit Care Med* 2017;45:1019–27.
17 Bradford MA, Lindenauer PK, Wiener RS, Walkey AJ. Do-not-resuscitate status and observational comparative effectiveness research in patients with septic shock*. *Crit Care Med* 2014;42:2042–7.
18 Creutzfeldt CJ, Becker KJ, Weinstein JR, Khot SP, McPharlin TO, Ton TG, Longstreth WT, Tirschwell DL. Do-not-attempt-resuscitation orders and prognostic models for intraparenchymal hemorrhage. *Crit Care Med* 2011;39:158–62.
19 Muni S, Engelberg RA, Treece PD, Dotolo D, Curtis JR. The influence of race/ethnicity and socioeconomic status on end-of-life care in the ICU. *Chest* 2011;139:1025–33.
20 Orlovic M, Smith K, Mossialos E. Racial and ethnic differences in end-of-life care in the United States: Evidence from the Health and Retirement Study (HRS). *SSM Popul Health* 2019;7:100331.
21 Bülow H-H, Sprung CL, Reinhart K, Prayag S, Du B, Armaganidis A, Abroug F, Levy MM. The world's major religions' points of view on end-of-life decisions in the intensive care unit. *Intensive Care Med* 2008;34:423–30.
22 Johnson KS, Elbert-Avila KI, Tulsky JA. The influence of spiritual beliefs and practices on the treatment preferences of African Americans: a review of the literature. *J Am Geriatr Soc* 2005;53:711–9.
23 Nye WP. Amazing grace: religion and identity among elderly black individuals. *Int J Aging Hum Dev* 1992;36:103–14.
24 Crawley L, Payne R, Bolden J, Payne T, Washington P, Williams S, Initiative to Improve Palliative and End-of-Life Care in the African American Community. Palliative and end-of-life care in the African American community. *JAMA* 2000;284:2518–21.
25 Shen MJ, Peterson EB, Costas-Muñiz R, Hernandez MH, Jewell ST, Matsoukas K, Bylund CL. The Effects of Race and Racial Concordance on Patient-Physician Communication: A Systematic Review of the Literature. *J Racial Ethn Health Disparities* 2018;5:117–40.
26 Cooper LA, Roter DL, Johnson RL, Ford DE, Steinwachs DM, Powe NR. Patient-centered communication, ratings of care, and concordance of patient and physician race. *Ann Intern Med* 2003;139:907–15.
27 Lane-Fall MB, Miano TA, Aysola J, Augoustides JGT. Diversity in the Emerging Critical Care Workforce: Analysis of Demographic Trends in Critical Care Fellows From 2004 to 2014. *Crit Care Med* 2017;45:822–7.
28 Starr LT, Ulrich CM, Appel SM, Junker P, O'Connor NR, Meghani SH. Goals-of-Care Consultations Are Associated with Lower Costs and Less Acute Care Use among Propensity-Matched Cohorts of African Americans and Whites with Serious Illness. *J Palliat Med* 2020;23:1204–13.
29 Hoerger M, Perry LM, Korotkin BD, Walsh LE, Kazan AS, Rogers JL, Atiya W, Malhotra S, Gerhart JI. Statewide Differences in Personality Associated with Geographic Disparities in Access to Palliative Care: Findings on Openness. *J Palliat Med* 2019;22:628–34.
30 Barnato AE, Berhane Z, Weissfeld LA, Chang C-C, Linde-Zwirble WT, Angus DC, Robert Wood Johnson Foundation ICU End-of-Life Peer Group. Racial variation in end-of-life intensive care use: a race or hospital effect? *Health Serv Res* 2006;41:2219–37.
31 Hsu-Kim C, Friedman T, Gracely E, Gasperino J. Integrating Palliative Care into Critical Care: A Quality Improvement Study. *J Intensive Care Med* 2015;30:358–64.
32 Norton SA, Hogan LA, Holloway RG, Temkin-Greener H, Buckley MJ, Quill TE. Proactive palliative care in the medical intensive care unit: effects on length of stay for selected high-risk patients. *Crit Care Med* 2007;35:1530–5.