



Racial differences in withdrawal of mechanical ventilation do not alter mortality in neurologically injured patients[☆]

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ABSTRACT

Purpose: Racial differences in withdrawal of mechanical ventilation (WMV) have been demonstrated among patients with severe neurologic injuries. We ascertained whether such differences might be accounted for by imbalances in socioeconomic status or disease severity, and whether such racial differences impact hospital mortality or result in greater discharge to long-term care facilities.

Materials and methods: We evaluated WMV among 1885 mechanically ventilated patients with severe neurologic injury (defined as Glasgow Coma Scale <9), excluding those progressing to brain death within the first 48 hours.

Results: Withdrawal of mechanical ventilation was less likely in nonwhite patients (22% vs 31%, $P < .001$). Nonwhites were younger and were more likely to have Medicaid or no insurance, live in ZIP codes with low median household incomes, be unmarried, and have greater illness severity; but after adjustment for these variables, racial difference in WMV persisted (odds ratio, 0.56; 95% confidence interval, 0.42–0.76). Nonwhite patients were more likely to die instead with full support or progress to brain death, resulting in equivalent overall hospital mortality (40% vs 42%, $P = .44$). Among survivors, nonwhites were more likely to be discharged to long-term care facilities (27% vs 17%, $P < .001$).

Conclusions: Surrogates of nonwhite neurologically injured patients chose WMV less often even after correcting for socioeconomic status and other confounders. This difference in end-of-life decision making does not appear to alter hospital mortality but may result in more survivors left in a disabled state.

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1. Introduction

A large part of mortality in the intensive care unit (ICU) occurs after decisions to limit life-sustaining interventions such as mechanical ventilation [1,2]; this is especially true for patients with severe neurologic injuries [3,4]. These difficult decisions typically follow discussions with surrogate decision makers about prognosis and patients' perspectives on functional recovery and quality of life [5,6]. A number of factors influence these critical end-of-life decisions, including cultural perspectives on life and death, health literacy, and trust in the health care system and reliability of the prognosis [7]. Understanding the determinants of these complex decisions has significant repercussions for the care of critically ill patients as well as overall resource utilization in an era when end-of-life care is increasingly being provided in the ICU [8].

Racial disparities in health care utilization and outcomes after major illness have been noted for some time but have only more recently become a priority in public health research and policy [9].

Although the general pattern of such disparities is that nonwhites receive less resources and have worse outcomes [10–15], it appears that nonwhite patients are actually more likely to receive intensive testing and treatments at the end of life, especially in the ICU [16,17]. Studies have shown that minorities are less likely to implement do-not-resuscitate (DNR) orders and limit or withdraw aggressive treatment, which translates into their dying more often with active interventions in the ICU [18,19].

The source and significance of these racial differences in end-of-life decision making have not been fully elucidated. Although cultural preferences may play a central role, racial differences may also be mediated by gaps in education and health literacy, absence of social support and advance care directives, and lack of trust in the health care system. These influences may be reflected in part by differences of socioeconomic status (SES) among minority patients as well as a greater severity of illness that may impact decisions to withdraw mechanical ventilation. Discovering the primary factors underlying differences in end-of-life decision making is imperative to differentiate whether variance is due to preference or actual bias within the health care system (ie, a true racial disparity). Although the federal government has recently recommitted to eliminating racial disparities over the next decade [20], it remains unclear whether progress has been made in diminishing existing disparities since they were first

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recognized in the ICU more than a decade ago [3]. In keeping with the Institute of Medicine's definition of *racial disparity*, we will use the term *racial difference*, as it remains unclear whether variation in withdrawal of mechanical ventilation (WMV) is due to a bias or disparity and not due to cultural preference alone [21].

Issues around WMV are particularly salient to critically ill patients with brain injuries, as their pathology often portends a poor prognosis for neurologic recovery rather than the acute systemic multiorgan failure typical in general ICU patients. In this setting, sensitive communication with families about long-term prognosis is even more paramount and subject to biases, mistrust, and varying perspectives on quality of life. Withdrawal of ventilatory support may also seem more incongruous to families in the case of a comatose brain-injured patient than in the case of a patient with refractory shock and/or respiratory insufficiency where death seems an apparent and imminent threat.

A previous study from the 1990s in our Neurology/Neurosurgery Intensive Care Unit (NNICU) found that African Americans were half as likely to discontinue ventilatory support [3]. However, that study did not fully account for SES and severity of illness confounders that may account for some of this association and did not explore whether this large difference in end-of-life decision making led to more minority patients surviving beyond hospital discharge, potentially with persistent neurologic disability. The purpose of the current study is to determine whether racial differences in WMV are still present in a contemporary cohort of patients with severe neurologic insults, accounting for broader spectrum of confounders, including SES and severity of neurologic and physiologic illness. We will then determine whether any racial differences impact overall mortality, specifically whether more nonwhite patients die instead with full ICU support and/or are more likely to be discharged to long-term care (LTC) facilities as a result of less WMV.

2. Materials and methods

We extracted data from a prospectively collected database that includes all NNICU admissions and tracks mortality and hospital disposition. The NNICU is a 20-bed neurologic and neurosurgical unit located in a large urban teaching hospital caring for a significant minority (predominantly African American) population. This analysis was restricted to patients admitted to the NNICU between November 2002 and September 2009 who were mechanically ventilated and whose lowest recorded Glasgow Coma Scale (GCS) score was less than 9 to select severely brain injured patients in whom withdrawal vs continuation of ventilatory support might be a relevant question. We excluded patients who progressed to brain death within 48 hours of ICU admission, in whom withdrawal of ventilation is not commonly discussed, per our usual practice. Patients declared brain dead later than this time were included because they may represent those in whom decisions to not withdraw ventilation permitted their progression to eventual brain death. The Washington University Human Research Protection Office approved the extraction of data for the purpose of this analysis.

Data abstracted included age, race (white vs nonwhite), sex, marital status, and prior functional status. Indicators of SES included type of insurance (private insurance or Medicare vs Medicaid or no insurance) and the patient's ZIP code. The decision to group Medicare with private insurance was based on the frequent practice of Medicare replacing private employer-based insurance after retirement age. Likewise, Medicaid and no insurance were grouped because they represent those who are dependent on social support for health care. ZIP code was used to determine median household income based on the 2000 US Census (from <http://factfinder2.census.gov>). We separated ZIP code-based median household incomes into quintiles from lowest to highest and also grouped the lowest 2 quintiles together, roughly corresponding to those living below the poverty level.

Severity of illness was derived from admission Acute Physiology and Chronic Health Evaluation (APACHE) II scores as well as the lowest GCS score (recorded daily during the ICU stay). To capture how invested families and the health care team might be in the aggressive/ongoing care of these patients, we identified patients admitted after surgery (either elective or emergent) and noted those who received invasive interventions while in the ICU (surgery/burr holes, intracranial pressure monitoring, lumbar drainage, cerebral angiography, thoracostomy, bronchoscopy, or endoscopy). We created a dichotomous variable including all patients receiving these interventions as a surrogate for aggressiveness of care. Changes in resuscitation status to DNR were also noted.

The primary outcome was WMV, as decided by patients' surrogate decision makers after discussions with the clinical team. All such cases of terminal extubation were prospectively coded in our ICU database. Secondary end points included in-hospital mortality, separating those dying after WMV from those dying without such limitation of care (either with full support or after determination of brain death). We also measured length of ICU and hospital stay, time to DNR and WMV, and hospital discharge disposition (LTC facilities vs home, rehabilitation, or other hospital).

Data were exported from the ICU database (QuIC; SpaceLabs, Redmond, WA) into SPSS (version 19.0; IBM, Armonk, NY). We compared demographic and severity of illness characteristics between white and nonwhite patients using *t* tests for normally distributed variables, Mann-Whitney tests for nonnormally distributed continuous or ordinal variables (eg, GCS, APACHE II), and χ^2 tests for categorical variables. The univariate effects of race and other variables on WMV were then analyzed using binary logistic regression.

To determine the degree to which other variables accounted for differences in rates of withdrawal between white and nonwhite subjects, we constructed a multivariable regression model for WMV, entering race as the primary independent variable, with additional variables entered in subsequent steps. Measures of SES (ie, income quintile/grouping and insurance status), as established confounders of racial disparity [22], were added to the model first, followed by variables that were significantly different between whites and nonwhites and those that were predictive of WMV in univariate analyses. These variables were added sequentially using a forward stepwise approach (enter $P < .2$, keep $P < .1$). The final model produced an adjusted odds ratio (OR) reflecting racial difference in WMV corrected for all these confounding variables. This stepwise approach allowed us to assess the proportion of (crude, unadjusted) racial difference in WMV that was explained by the addition of each subsequent variable by comparing the OR before and after addition of that particular variable [23]. Furthermore, to evaluate whether racial difference had changed over time, we entered year of study as a variable, comparing each subsequent year to 2003 (the first year with sufficient data). Collinearity was assessed by examining tolerance statistics in linear regression models of the same variables as well as ensuring standard errors in the final regression model remained low despite addition of variables.

We compared time to implementation of DNR orders and time to actual WMV between groups using Mann-Whitney *U* tests. In addition, we evaluated overall mortality to determine whether racial difference resulted in more nonwhites dying by means other than withdrawal of ventilatory support (either by progression to brain death or dying with full ICU support). Finally, we examined the disposition of patients in whom ventilation was not withdrawn to determine whether any difference in WMV resulted in discrepancy in the proportion of patients discharged to LTC.

3. Results

A total of 3781 patients were ventilated in our ICU over this 7-year period. After excluding those whose GCS was never less than 9, 2062

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