Clinical outcomes of sepsis by race at M Health Fairview University of Minnesota Medical Center

Black patients present at a younger age, with more comorbidities

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Sepsis is a life-threatening condition due to a dysregulated inflammatory response, leading to organ dysfunction. Sepsis is associated with 25 to 30 percent mortality, and the Centers for Disease Control (CDC) estimates that one of every three Americans who dies in a hospital has sepsis. Sepsis disproportionately affects Black Americans and is a top-10 leading cause of death for Black people.

The CDC reports a higher percentage of sepsis mortality in the Black population compared to the White population in America, but there are inconsistent findings when measuring sepsis mortality by race. A 2007 study using data from the New Jersey State Inpatient Database found that Black patients had more than double the mortality rate compared to White patients (208.6 deaths per 100,000 population vs. 99.6 deaths per 100,000 population). However, a 2019 meta-analysis using six previously published cohorts, largely drawing from national surveys and databases including the National Institutes of Health (NIH), found no significant relationship between race and sepsis mortality.

Our study expands on past research on racial disparities in sepsis by examining the rates of sepsis mortality by race at the M Health Fairview University of Minnesota Medical Center.

Methods

We performed a retrospective cohort study of inpatients with a diagnosis of sepsis at M Health Fairview University of Minnesota Medical Center, an 874-bed, academic, tertiary referral center. Our hospital routinely collects de-identified sepsis data for quality assurance purposes. Using this database, we reviewed all sepsis diagnoses in adults between January 1, 2020 and June 30, 2020. The database included demographic information including age, sex, race, insurance status, primary language, expected and observed mortality score, discharge status (discharged to a facility, home or deceased), treatment information and in-hospital mortality. Length of hospital stay, admission to ICU and length of ICU stay were also recorded.

Self-reported race was collected during admission or, if the patient was incapacitated, later by the nursing staff. Self-reported race was categorized as African American, White, American Indian or Alaska Native, Asian, African, Hispanic or Latino, Hawaiian or other Pacific Islander, "some other race" and "two or more races." Patients who chose not to answer were excluded from the primary analysis, but included in a sensitivity analysis. As some African immigrants defined themselves as African American, while others considered themselves African, both groups were pooled under "Black." The primary outcome was mortality at hospital discharge. Institutional review board approval was obtained through the University of Minnesota.

The expected mortality scores are derived from mortality model groups where logistic regression computes expected mortality based on many factors including age, sex, malignancy, cardiovascular comorbidities, and status on admission. The expected mortality score is the standardized value used for hospital quality-improvement metrics. Observed mortality score is the actual mortality rate of each mortality model group. The Observed/Expected (O/E) ratio was computed to compare the mortality rate across patient populations. An O/E ratio of greater than one indicated a mortality rate higher than expected, while an O/E ratio less than one indicated a mortality rate lower than expected.

Results

There were 780 cases of sepsis identified at M Health Fairview University of Minnesota Medical Center between January 1 and June 30, 2020. Of those 780 sepsis cases, 568 or 73 identified as

TABLE 1

Patient Demographics by Race

	WHITE (N=568)	BLACK (N=90)	P VALUE
Median Age (IQR) -year	61 (50 to 72)	50 (32 to 61)	0.002
Female –number (%)	274 (48%)	44 (49%)	0.909
Non-English Speaker -number (%)	3 (0.5%)	19 (21%)	<0.0001
Medicaid -number (%)	83 (14.6%)	40 (44%)	<0.0001
Medicare of those age >65 -number (%)	210 (37.0%)	19 (21%)	0.003
Median Expected Mortality (IQR)	0.051 (0.020 to 0.159)	0.0253 (0.012 to (0.066)	0.023

White, 90 or 12 percent identified as Black and 85 or 11 percent identified as another race (not Black, not White) (**Figure 1**). Thirty-seven patients either chose not to answer or were missing responses and were excluded from further analyses.

The median age for Black patients was 50 years, compared to 61 for White patients. Black patients were more likely to be on Medicaid—44 percent—than White patients, 15 percent; were more likely to be non-English-speaking, and more likely to have comorbidities at baseline. (**Table 1**). White patients were more likely to be admitted to the ICU (41 percent) during their hospital stay compared to Black patients (28 percent), however there were no statistical differences in length of hospital stay or length of ICU stay between groups (**Table 2**).

TABLE 2

Hospital Outcomes by Race

	WHITE (N=568)	BLACK (N=90)	P VALUE
Median Length of Stay (IQR) —days	7 (4 to 15)	5 (3 to 13)	0.659
In-Hospital Deaths -number (%)	107 (19%)	8 (9%)	0.024
ICU Admission -number (%)	230 (40%)	25 (28%)	0.021
ICU Median LOS (IQR) —days	3.5 (2 to 9)	4 (2 to 12)	0.858
Left AMA -number (%)	7 (1%)	4 (4%)	0.003
Median O/E ratio (IQR)	1.37 (0.50 to 3.60)	3.20 (1.22 to 5.83)	<0.001

Unadjusted survival at hospital discharge was 81 percent for Whites and 91 percent for Blacks. Unadjusted O/E ratio was higher in Blacks vs. Whites (3.20 vs. 1.37), meaning Blacks had higher observed mortality compared to what was expected based on their age and comorbidities. However, in a logistic regression analysis, after controlling for language, race, primary payer and expected mortality, race was not associated with in-hospital survival; Black patients had 1.46 increased odds of death compared to White patients (**Table 2**). Expected mortality was a significant predictor of mortality in our model.

In a sensitivity analysis, where expected mortality was not included in the logistic regression model, there was still no statistically significant difference in in-hospital mortality by race. In an additional sensitivity analysis, including those 37 patients with missing or unreported race data in the Black category, results did not change significantly.

Discussion

After controlling for expected mortality (including age, sex and baseline comorbidities), language, race and primary payer, we found that race was not associated with survival. However, Black patients presenting with sepsis were younger and had more comorbidities at baseline than White patients. Systemic racism and disparities upstream of hospitalization likely contribute to these findings.

Systemic racism creates chronic stress, segregated neighborhoods and differential access to care, increasing the onset of chronic disease at a younger age among Black populations. The chronic stress of institutional and interpersonal racism raises allostatic load and the propensity for diabetes, hypertension and kidney disease. Discriminatory housing policies and practices, including red-lining and predatory lending, are responsible for residential segregation and neighborhood disinvestment, leaving Black communities with limited access to healthcare facilities. Worsened employment opportunities for Black Americans creates disproportionate reliance upon Medicaid, which contributes to delays in getting needed medical care.

Our findings are consistent with previous retrospective studies on sepsis disparities, which have found that Black patients present with sepsis at an earlier age than White patients and are more likely to use Medicaid. A 2019 meta-analysis on sepsis-related mortality found no significant relationship between mortality and patient race, which is also consistent with our findings. It is possible that an inconsistent relationship of sepsis-related mortality and race could be explained by the differing hospital demographics and socioeconomic status of patients' served.

A limitation of this study is its retrospective nature, which can introduce bias and confounding. This study used self-reported race to categorize patients, but we took the additional step of combining the two categories, "African" and "African American," into one group "Black," as African immigrants identified with either group. This could have introduced a misclassification bias. An African immigrant and an American-born Black person may have very different comorbidities and risk factors for sepsis, although they are all classified as "Black." Another limitation was the small number of

FIGURE 1 **Sepsis Cases at UMMC between January and June 2020 by Self-Reported Race**

*Other includes the categories "Some other race" and "Two or more races."
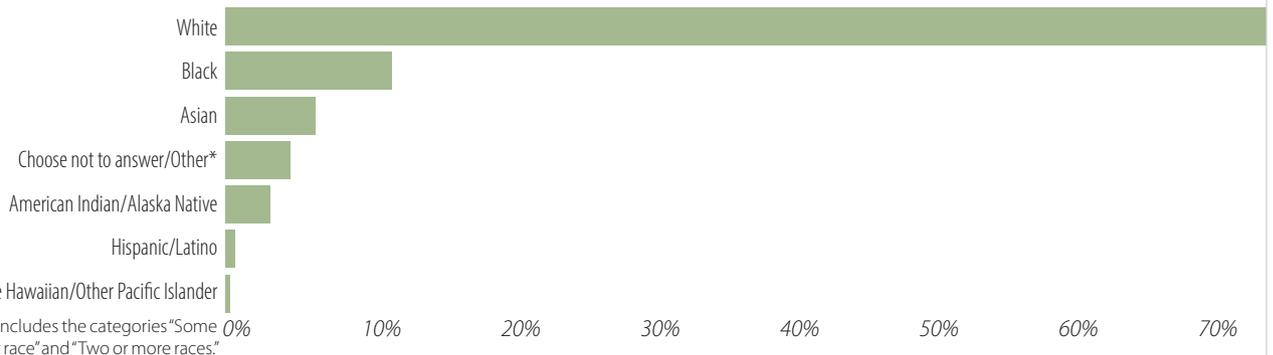
patients of races other than Black and White, which did not allow for statistical comparison of their health outcomes. Furthermore, the method in which race information was collected required the admitting department or nursing staff to ask the patient their racial identity. This could be uncomfortable and low-priority for a provider treating a septic patient, with a potentially life-threatening condition. This study was also constrained by the patient information included in the sepsis database, which was lacking socioeconomic details including income, education and ZIP code; these may be more salient factors in sepsis disparities than race. For example: we found White patients were more likely to be admitted to the ICU compared to Black patients, but we did not have sufficient data to further understand the reason for this disparity.

As our study found that Black patients treated for sepsis were significantly younger than White patients with more baseline comorbidities, future studies could further quantify the incidence and severity of comorbidities by race in our catchment area and pursue efforts to reduce such disparities in the outpatient setting. **MM**

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