

## Introduction

- Boarding is the practice of physically holding patients in the ED after hospital admission.
- Prolonged boarding in the ED is associated with a host of patient-centered adverse outcomes, including increased mortality, increased rates of medication error, prolonged length of stay, and decreased patient satisfaction.<sup>1, 2, 3</sup>
- We are unaware of any studies linking boarding time with patient-level race/ethnicity data. Therefore, we endeavored to assess the associations between minority race and Hispanic ethnicity with the duration of ED boarding across a large number of visits in an academic hospital in the Mountain West.

## Methods

### Design

In this single-center, retrospective cohort study, we used electronic health record data (Epic Systems, Verona, WI) to explore patient-reported demographics for all ED patients admitted to the hospital from 2014 through 2019.

### Setting



The University of Colorado Hospital is an urban, academic tertiary care, level I trauma center with an annual ED visit volume ranging from between 97,000 and 101,000 and a 17% admission rate. The local community is 45% non-Hispanic white, 28% Hispanic or Latino, and 16% Black.<sup>4</sup>

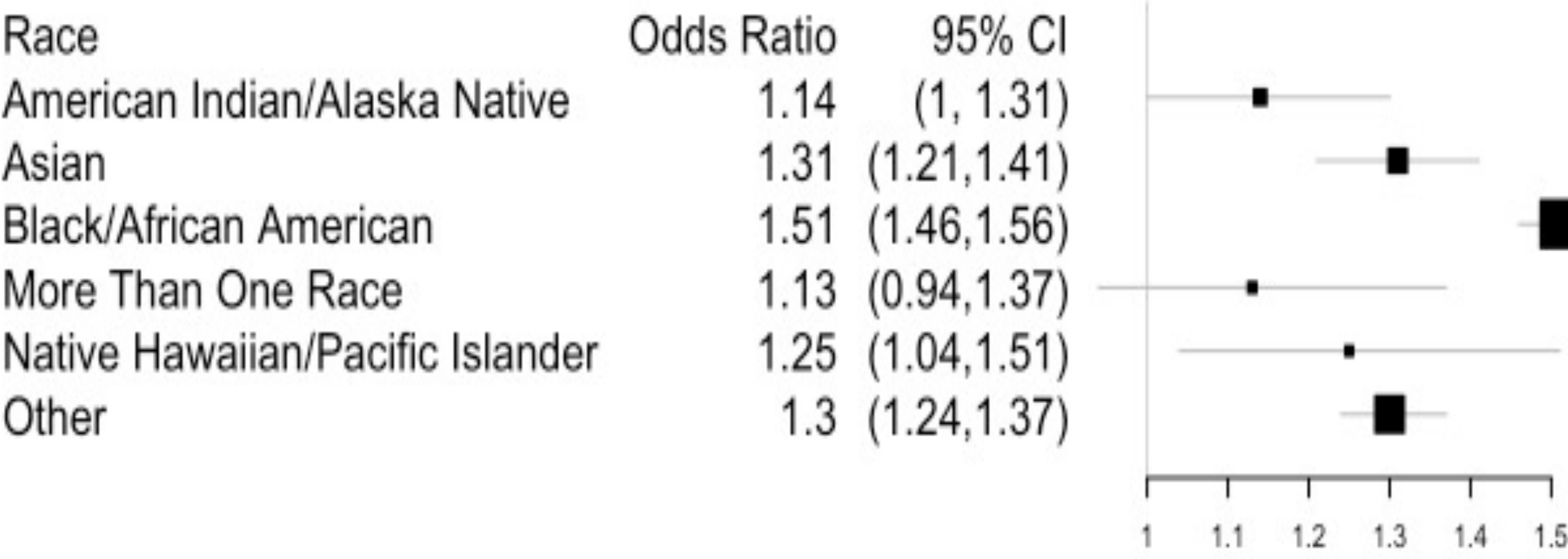
### Outcome Measures

Our primary outcome was ED boarding time, defined as the time from admission order until a patient is moved to an inpatient bed. Our secondary outcomes were ED LOS, ED door-to-provider time, and ED door-to-disposition decision time.

### Statistical Analysis

- Descriptive statistics were created by race and ethnicity for each outcome and each additional covariate.
- Linear mixed effects models were used to identify how each of our primary variables (race, ethnicity, gender and age) were associated with each outcome of interest. All outcomes were log transformed prior to analysis to address skew in the time variables.
- A separate regression modeling framework was performed for each outcome and each of the primary variables of interest. We then created a fully adjusted model, simultaneously modeling all of the primary variables of interest and adjusting for confounders (primary care provider, primary language, insurance, observation status, month, year) and the precision variable (arrival mode group).
- A p-value of <0.01 was used for statistical significance to roughly control for the number of primary variables and number of outcomes in the analysis. Binomial regression was also used to see if there was a relationship between race and boarding longer than 120 minutes.

## Results



**Figure 1. Forest plot predicting change in odds of waiting longer than 120 minutes by race after adjusting for ethnicity, age, gender, arrival mode, CDU flag, primary care physician, primary language, insurance, month and year (as shown in Table 1).**

**Non-white patients were more likely to experience boarding greater than 2 hours compared to white patients (Figure 1).**

Race	Univariate Analysis					Adjusted Model		
	Mean boarding time (SD)	Median boarding time (Q1, Q3)	%Change in boarding time	95% CI	P-value	%Change in boarding time	95% CI	P-value
American Indian and Alaska Native	133.4 (139.6)	94.0 (64, 154)	5.4	(0.5, 10.5)	0.029	6	(1.2, 11)	<0.0001
Asian	142.4 (146.6)	99.0 (67, 162)	12.8	(10, 15.7)	<0.0001	9.6	(6.8, 12.5)	<0.0001
Black or African American	150.0 (155.6)	106 (71, 170)	18.5	(17.1, 19.9)	<0.0001	17.7	(16.4, 19.1)	0.012
More than one race	144.1 (157.6)	98.0 (65,154)	9.8	(2.6, 17.5)	0.007	8.9	(1.9, 16.3)	0.012
Native Hawaiian and Other Pacific Islander	143.9 (158.0)	96.5, (64,134)	10.9	(3.9, 18.3)	0.002	12	(5.1, 19.4)	<0.0001
Other	142.1 (148.9)	99.0 (66, 161)	11.3	(10, 12.5)	<0.0001	12.1	(10.2, 14)	<0.0001
White, Hispanic	137.3 (145.3)	96 (63, 155)	3.9	(2.9, 5)	<0.0001	-2.5	(-3.9, -1)	0.65
White, Non-Hispanic	129.4 (141.6)	91 (62, 145)	reference			reference		

**Table 1. Results from simple linear regression and a multiple linear regression, predicting percent change in boarding time. Estimates and 95% CI in percentages.**

**On average, non-white races had 5.4% to 18.5% longer boarding time compared to whites. Hispanic ethnicity was also associated with a 3.9% (95% CI: 2.9, 5.0) longer boarding time.**

## Conclusions

- We observed differential exposure to boarding among racial and ethnic minorities, which is gravely concerning because this confers excess mortality risk that may be inequitably distributed to these groups.
- Usually, inpatient beds are assigned through partially blinded workflows, though the opportunity to advocate for faster transfer or timely patient acceptance exists in the verbal handoff phase of patient care and may represent an opportunity for implicit bias to affect boarding time.
- It is suspected that disparities in health care access result in greater reliance on the ED for care of chronic end-stage diseases by members of racial minority groups.<sup>5</sup> The observed longer boarding times may then also be a reflection of this phenomenon, where members of minority groups are more likely to have acutely complex presentations as a result and board for longer in the ED due to increased bed requirements.
- This study contributes to a growing literature on health inequities between different demographic groups and invites a more thorough examination of both social determinants of health and intrahospital operations that may contribute to ED boarding.

## Limitations

- Many uncontrolled variables including acuity, patient comorbidities, admission diagnosis, and time of day or day of week might confound observations of disparities in these data, but it is counterintuitive to expect that any of these factors would affect boarding time after an admission decision is reached.
- Additionally, we were unable to identify patients with multiple admission orders during one ED visit, which may be an important consideration given the potential for implicit bias to play a role in the acceptance of patients to a particular team.

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## Conflicts of Interest

The authors of this work have no conflicts of interest to declare.

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