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RACIAL/ETHNIC AND NEIGHBORHOOD SOCIAL VULNERABILITY DISPARITIES IN COVID-19

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BACKGROUND

- The **objective** of this study is to describe disparities by race/ethnicity and neighborhood social vulnerability in COVID-19 test positivity, hospitalization, and in-hospital mortality, leveraging individual-level data from over 200,000 tested individuals and almost 6,000 hospitalized individuals with COVID-19 within a large Pennsylvania health system.
- We **hypothesized** that racial/ethnic minorities and individuals living in neighborhoods with higher social vulnerability would be at increased risk of COVID-19 test positivity, hospitalization, and in-hospital mortality.

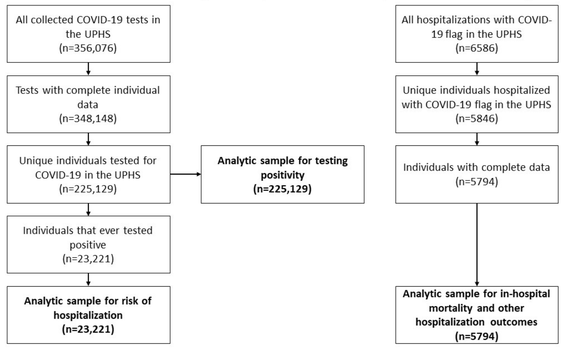
METHODS

- We operationalized a **COVID-19 testing and hospitalized cohort** using data from a repository of electronic health records from the University of Pennsylvania Health System (UPHS), collected between March 1, 2020-March 1, 2021 (Figure 1).
- Main predictors were

1) **Race/ethnicity** defined as Non-Hispanic (NH) Black, NH Whites, Hispanics, and NH Asians.
2) **Neighborhood-level social vulnerability,** measured using the CDC's Social Vulnerability Index (SVI).

- Outcome variables were **COVID-19 test positivity** (any + test during the study period), **hospitalization with COVID-19** (hospitalized 2 weeks prior or 4 weeks after the first positive test)**, and 30-day in-hospital mortality** following hospitalization with COVID-19.

Figure 1. Flowchart for COVID-19 Testing and Hospitalization Cohorts, March 1 2020-March 1, 2021



UPHS: University of Pennsylvania Health System

Main Findings:

Across the study period, racial/ethnic minorities and residents of medium or high social-vulnerability areas had significantly higher odds of testing positivity and hospitalization with COVID-19 than NH Whites (Table 2).

We found no significant disparities in 30-day in-hospital mortality among racial/ethnic groups during the first wave, but higher mortality among Hispanics and NH Asians than NH Whites during subsequent waves.

The interactions between race/ethnicity and SVI showed that Hispanics and NH Asians had a stronger association between social vulnerability and test positivity.

RESULTS

Table 1: Characteristics of testing and hospitalization cohorts, by wave

	Testing Cohort			Hospitalization Cohort		
	Overall	1st wave	Subsequent waves	Overall	1st wave	Subsequent waves
Unique Individuals	225129	60766	183823	5794	2045	3749
Unique Neighborhoods	3276	1699	2924	528	283	454
Positive test	7%	12%	5%			
Hospitalized	20%	21%	19%			
Deceased				8%	13%	6%
ICU Stay				27%	31%	26%
Mech. Ventilation				12%	17%	10%

Additional demographic characteristics:

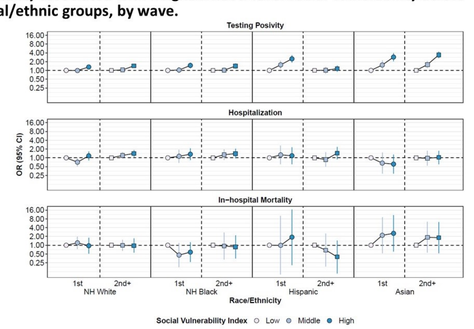
- Around 59% of tested patients were females, 62% were <60 years of age, 58% were NH White, 25% were NH Black, 5% were Hispanic, and 5% were NH Asian.
- About of hospitalized patients were 52% were female, 44% were aged <60, 38% were NH White, 43% were NH Black, 9% were Hispanic, and 5% were NH Asians.

Table 2: Odds of testing positivity, hospitalization, and in-hospital mortality associated with race/ethnicity and neighborhood-level social vulnerability by wave

	Testing Positivity (OR, 95% CI)		Hospitalization (OR, 95% CI)		In-hospital Mortality (OR, 95% CI)	
Category	1st Wave	Subsequent Waves	1st Wave	Subsequent Waves	1st Wave	Subsequent Waves
NH White	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
NH Black	2.8 (2.6-2.9)	1.5 (1.4-1.6)	1.7 (1.4-2.0)	2.0 (1.8-2.3)	0.8 (0.6-1.2)	1.1 (0.7-1.5)
Hispanic	4.2 (3.8-4.6)	2.1 (2.0-2.3)	1.8 (1.4-2.2)	1.8 (1.5-2.1)	0.7 (0.4-1.3)	1.7 (1.0-3.0)
NH Asian	1.6 (1.4-1.8)	1.4 (1.3-1.5)	1.6 (1.2-2.2)	1.5 (1.2-1.8)	1.0 (0.5-1.9)	1.6 (1.0-2.7)
Low SVI	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Medium SVI	1.1 (1.0-1.3)	1.0 (0.9-1.2)	0.9 (0.6-1.2)	1.2 (0.9-1.5)	0.9 (0.6-1.4)	1.0 (0.7-1.5)
High SVI	2.3 (2.0-2.7)	1.6 (1.4-1.8)	1.3 (1.0-1.7)	1.8 (1.4-2.3)	0.9 (0.6-1.3)	1.0 (0.7-1.5)

NH: Non-Hispanic. SVI: Social Vulnerability Index. Models control for age, age^2, sex, and hospital (for in-hospital mortality). Race/ethnicity and SVI results come from different models.

Figure 1: Odds of testing positivity, hospitalization, and COVID-19 in-hospital mortality associated with neighborhood-level social vulnerability across racial/ethnic groups, by wave.



DISCUSSION

This study analyzing disparities in COVID-19 test positivity, hospitalization and in-hospital mortality in a large health system in Philadelphia resulted in three key findings:

- First, we found substantial racial/ethnic and neighborhood social vulnerability disparities in testing positivity and risk of hospitalization with a COVID-19.
- Second, these disparities were compounded when exploring racial/ethnic and neighborhood disparities simultaneously.
- Third, in-hospital mortality after COVID-19 hospitalization decreased across waves, had no clear disparities during the first wave, and was highest among Hispanics and NH Asian during the subsequent waves.

LIMITATIONS

We acknowledge some limitations.

- First, we were limited to examining in-hospital mortality, as vital status ascertainment outside of hospitalization is incomplete. If race/ethnicity or neighborhood social vulnerability affects the place of death for hospitalized patients, we may obtain biased associations.
- We could not ascertain vaccination status or use of newly authorized treatments, which may have contributed to some of the inequalities observed.
- Not all patients tested in UPHS and requiring a subsequent hospitalization were hospitalized within UPHS, leading to bias if the place of hospitalization differs by race/ethnicity or SVI status.

CONCLUSION

In summary, racial/ethnic minorities and individuals living in higher social vulnerability areas had higher odds of testing positive for or being hospitalized with COVID-19, while the odds of mortality once hospitalized varied by specific racial/ethnic group.

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