

Associations between Social Determinants of Health, Air Pollution and COVID-19 Mortality among hospitalized patients in New York City

Giovanna Braganza¹, Alison Lee MD,MS²

1. State University of New York Downstate Health Sciences University, School of Public Health, Brooklyn, NY
2. Icahn School of Medicine Mount Sinai; Division of Pulmonary, Critical Care and Sleep Medicine

BACKGROUND

- ❖ Neighborhood disadvantage, which is closely associated with race, is a predictor of poor COVID-19 clinical outcomes.¹
- ❖ During the first wave, up to 32% of hospitalized patients in NYC died.²
- ❖ COVID-19 outcomes are worse among low-income Black and Hispanic communities.¹
- ❖ Urban air pollution increases the risk for COVID-19 mortality.³

OBJECTIVE

To investigate the association between individual and neighborhood SDoH indicators, air pollution exposure and COVID-19 mortality among in-patients in NYC by using latent class analysis.

METHODS

Latent class analysis (LCA) of retrospective cohort data was performed to determine the association between patterns of SDoH, SES disadvantage and mortality.

Eligibility Criteria

- ❖ Patients hospitalized between 3/1/2020 to 8/30/2020
- ❖ Adults ≥18 y.o. with a +SARS CoV-2 PCR nasal swab

Predictors

- ❖ Census block SES indicators were obtained from the 2012 – 2016 American Community Survey
 - ❖ Patients' residential addresses were geocoded to census blocks with a 1km radial buffer
 - ❖ Poverty level, education, nativity, per capita income and housing density
- ❖ Annual average concentrations of air pollutants were obtained from the Dec 2018 - Dec 2019 New York City Community Air Survey
 - ❖ Fine particulate matter (PM_{2.5}), black carbon (BC), nitrogen dioxide (NO₂)
- ❖ Individual demographic (age, sex, self-reported race/ethnicity, insurance, borough, onset time) and clinical data (hospital facility, mortality) were extracted from electronic medical records.

Outcomes

- ❖ COVID-19 mortality

RESULTS

Descriptive analysis of individual patient characteristics are summarized in **Figure 1**. Overall, this cohort was predominantly male (59.9%) and had a median age of 65 (IQR: 53,77) years old. Out of the 6542 patients studied, 2044 (31.2%) died.

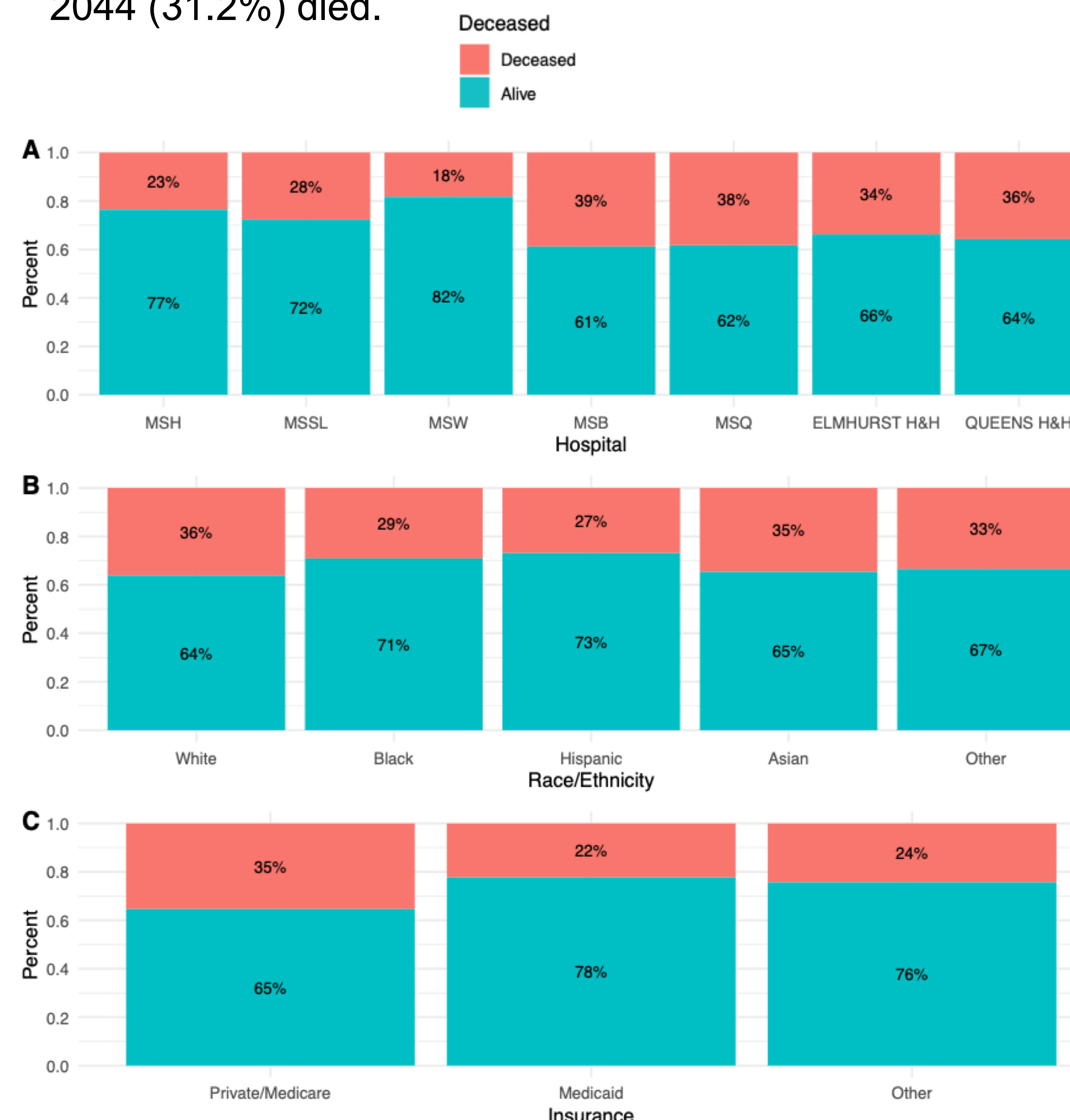


Figure 1. Inpatient COVID-19 mortality by A) hospital, B) self-identified race/ethnicity and C) insurance status. MSH (Mount Sinai Hospital), MSSL (Mount Sinai St. Luke's), MSW (Mount Sinai West, MSB (Mount Sinai Brooklyn), MSQ (Mount Sinai Queens)

SES Rank	Description	Latent Class
Lowest Disadvantage	Old, Non-Hispanic White, Manhattan, High SES, Highest Air Pollution	4
Moderate Disadvantage	Non-Hispanic Black, Brooklyn, Lowest Air Pollution	5
Moderately High Disadvantage	Asian, Queens, High Air Pollution	2
High Disadvantage	Female, Hispanic, Manhattan, Highest Poverty	1
Highest Disadvantage	Young, Medicaid, Queens, Lowest SES	3

Figure 2. After considering LCA fit statistics, the 5 class model was determined to best describe underlying COVID-19 subphenotypes. Class descriptions are above.

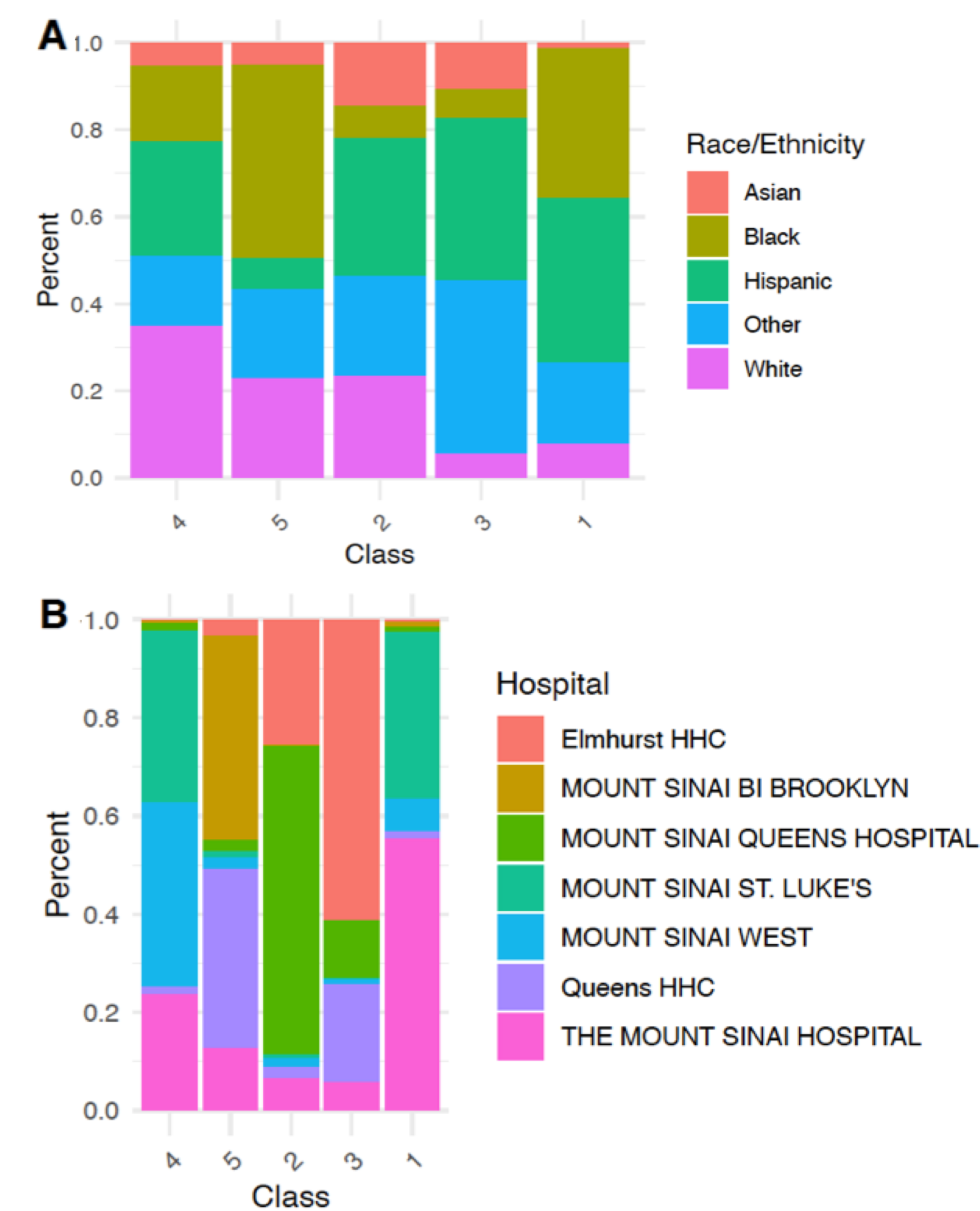


Figure 3 Individual demographic characteristics of patients by latent class assignment. A) Race/ethnicity B) Hospital facility

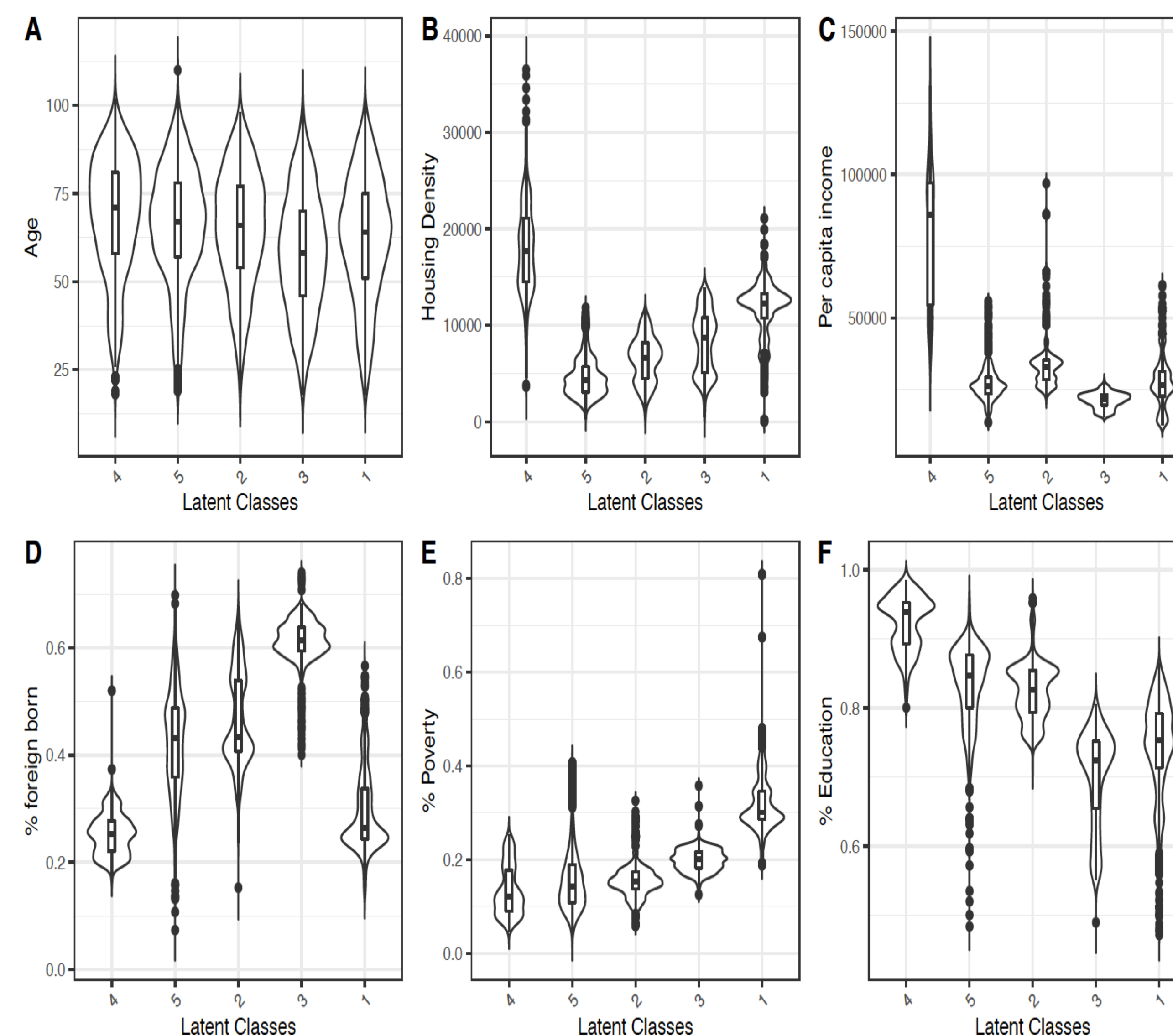


Figure 4 Demographic and socioeconomic characteristics of patients by class. A) Age; B) Housing Density (units); C) Per capita income; D) Percentage of residents foreign born in census block; E) Percentage of residents living below the poverty level in census block; F) Percentage of residents over the age of 25 with at least a high school education

RESULTS

Table 1. Associations between latent classes and COVID-19 mortality

	RR	95% CI	P	N
Mortality				
Highest Disadvantage	1.22	(1.08, 1.39)	< 0.01	1261
High Disadvantage	0.86	(0.74, 0.99)	0.03	1508
Moderately High Disadvantage	1.43	(1.27, 1.61)	< 0.01	1034
Moderate Disadvantage	1.27	(1.12, 1.42)	< 0.01	1958

Table 1 - Relative risk ratios for mortality generated using unadjusted logistic regression, shown by descending SES disadvantage. The lowest SES disadvantage class was used as the referent group.

DISCUSSION

- ❖ LCA successfully identified patterns of SDoH indicators among 5 distinct patient classes who had varying degrees of neighborhood disadvantage.
- ❖ Compared to the predominantly White, Manhattan patient sub-phenotype, sub-phenotypes representing patients from disadvantaged communities of color had higher mortality rates.

Strengths

- ❖ Focused on the latent effects of multiple SDOH indicators, independent of COVID-19 outcomes.
- ❖ Included diverse patients from two large urban health systems.

Limitations

- ❖ Did not assess all severe COVID-19 cases in the community.
- ❖ Housing density was measured, not household crowding

CONCLUSIONS

- ❖ This study underscores the need to fully assess the intersectionality of SDoH indicators that contribute most to COVID-19 mortality (low per capita income, low education, foreign born status, Medicaid)

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