Socioeconomic and Demographic Characteristics of Both Inpatients and Outpatients with Positive Testing for SARS-CoV-2

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There have been marked disparities in both infections and deaths from the COVID-19 pandemic in the USA, highlighting societal and structural factors. Some limitations of previous work include restriction to inpatients[1,2] and inability to distinguish between ecological/group and individual associations.[3,4] In that setting, we used a granular dataset of SARS-CoV-2 testing including inpatients and outpatients to assess the association between positive tests and socioeconomic and demographic characteristics of individuals.

METHODS

We queried SARS-CoV-2 tests from March 3 to December 14, 2020, within a large, integrated network that includes 14 hospitals, community physicians, health centers, and urgent care centers. Tests were included for patients with medical record numbers attributable to the Massachusetts General Hospital (MGH), which are patients who have received care at MGH including outpatient clinics and community health centers at any point in the past. We identified positive and negative tests, then queried the integrated electronic health record to determine patient-level gender, race/ethnicity, insurance status, and zip code. We then extracted zip code level median household income, pre-pandemic unemployment rate, poverty rate, and proportion of workers in service occupations as defined in the 2015–2019 American Community Survey (ACS). Patients with missing zip code data (0.05%) and patients who live outside Massachusetts were excluded. Test positivity was defined as a binary, patient-level outcome. When patients had multiple tests, we used the last test. Due to high collinearity (data not shown), we decided to present bivariate chi-squared tests between the primary outcome of interest and each socioeconomic and demographic variable separately. To assess for selection bias, we also queried the proportion of patients receiving any type of care at MGH who are uninsured. This study was performed in SAS version 9.4 and was approved by the Mass General Brigham Institutional Review Board.

RESULTS

Of 394,536 tested patients, 29,977 (7.6%) had positive tests (Table 1). Males had more positive tests than females (8.2% vs. 7.2%, $p < 0.0001$). Hispanic and Black patients had more positive tests than White patients (17.2% vs. 11.9% vs. 5.6%, respectively, $p < 0.0001$ for both). Medicaid patients had more positive tests than commercial insurance patients (14.2% vs. 6.8%, $p < 0.0001$).

In terms of differences among zip codes, zip codes with median household income less than or equal to \$70,000 per year had more positive tests than zip codes with an estimated household income greater than \$100,000 per year (13.3% vs. 4.7%, $p < 0.001$); zip codes with unemployment of greater than 5% had more positive tests than patients in zip codes with unemployment of 3.5% or less (10.7% vs. 5.8%, $p < 0.001$); and zip codes with greater than 20% of people working in the service sector had more positive tests than those in zip codes with 10% or fewer of people working in the service sector (13.4% vs. 4.2%, $p < 0.001$).

Including all predictor variables in multivariate regression did not change the directionality of our findings.

DISCUSSION

Positive SARS-CoV-2 tests are highly correlated with race and poverty. Black and lower income patients tested positive more than double the proportion of White and higher-income patients. Patients in zip codes with higher proportions of service sector workers had more than triple the likelihood of positive tests. A notable strength of our analysis is that we used patient-level data for gender, race, and insurance, although we imputed measures of poverty and employment from zip code medians and proportions. A limitation of our analysis is the external validity of extrapolating MGH patients to broader populations, particularly if there are differences in socioeconomic and demographic characteristics. We are reassured, however, for example, that the Black population

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Table 1 Association of Positive Tests with Individual and Zip Code Characteristics

Covariate	Total no. of patients, *N* (%)	Tested negative, *N* (%)	Tested positive, *N*(%)	*p* value
Individual characteristics				<0.0001
Gender				
Male	165,539 (42.0)	151978 (91.8)	13561 (8.2)	
Female	228,997 (58.0)	212581 (92.8)	16416 (7.2)	
Race/ethnicity				<0.0001
Asian	14,859 (3.8)	13959 (93.9)	900 (6.1)	
Black	27,467 (7.0)	24211 (88.1)	3256 (11.9)	
Hispanic	5679 (1.4)	4703 (82.8)	976 (17.2)	
White	287,441 (72.9)	271327 (94.4)	16,114 (5.6)	
Others	30,342 (7.7)	24593 (81.1)	5749 (18.9)	
Declined or missing	28,748 (7.3)	25766 (89.6)	2982 (10.4)	
Payor				<0.0001
Commercial	261,586 (66.3)	243798 (93.2)	17,788 (6.8)	
Medicaid	54,989 (13.9)	47194 (85.8)	7795 (14.2)	
Medicare	70,854 (18.0)	66964 (94.5)	3890 (5.5)	
Uninsured	1902 (0.5)	1607 (84.5)	295 (15.5)	
Missing	5205 (1.3)	4996 (96.0)	209 (4.0)	
Zip code characteristics*				
Median HH income				
70K|less	10,5849 (26.8)	91788 (86.7)	14,061 (13.3)	
71K–100K	124,648 (31.6)	116465 (93.4)	8183 (6.6)	
> 100K	164,039 (41.6)	156306 (95.3)	7733 (4.7)	
Unemployment rate				<0.0001
3.5% or less	140,014 (35.5)	131845 (94.2)	8169 (5.8)	
3.6–5.0%	147,514 (37.4)	137144 (93.0)	10,370 (7.0)	
>5%	107,008 (27.1)	95570 (89.3)	11,438 (10.7)	
Poverty rate				<0.0001
5% or less	122,118 (31.0)	116713 (95.6)	5405 (4.4)	
5.01–15.0%	195,369 (49.5)	181427 (92.9)	13,942 (7.1)	
>15%	77,049 (19.5)	66419 (86.2)	10,630 (13.8)	
% Working in service occupations				<0.0001
≤10%	76,905 (19.5)	73701 (95.8)	3204 (4.2)	
10.01–20%	203,635 (51.6)	192128 (94.3)	11,507 (5.7)	
>20%	113,996 (28.9)	98730 (86.6)	15,266 (13.4)	

**Data Source: American Community Survey 2015–2019. All neighborhood characteristics are defined at the zip code level*

in this dataset (7.0%) is similar to the proportion in New England (8.1%) although the proportion of Hispanic patients is lower than in New England (11.6%).[5] This difference may in part reflect less SARS-CoV-2 testing in less affluent communities in Massachusetts.[6] We found that the proportion of all MGH patients who are uninsured is 0.4%, similar to this dataset of tested patients (0.5%) but less than the uninsured in Massachusetts (2.9%). As such, our results may not be generalizable to systems that care for more uninsured patients.[7] Our results suggest a large role of structural and societal inequities in the consequences of the COVID-19 pandemic in the USA.

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Declarations:

Conflict of Interest: *The authors declare that they do not have a conflict of interest.*

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