Disparities in COVID-19 Testing and Positivity in New York City

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Introduction: Existing socioeconomic and racial disparities in healthcare access in New York City have likely impacted the public health response to COVID-19. An ecological study was performed to determine the spatial distribution of COVID-19 testing by ZIP code Tabulation Area and investigate if testing was associated with race or SES.

Methods: Data were obtained from the New York City coronavirus data repository and 2018 American Community Survey 5-year estimates. A combined index of SES was created using principal component analysis and incorporated household income, gross rent, poverty, education, working class status, unemployment, and occupants per room. Multivariable Poisson regressions were performed to predict the number of total tests and the ratio of positive tests to total tests performed, using the SES index, racial composition, and Hispanic composition as predictors.

Results: The number of total tests significantly increased with the increasing proportion of white residents ($\beta=0.004, \text{SE}=0.001, p=0.0032$) but not with increasing Hispanic composition or SES index score. The ratio of positive tests to total tests significantly decreased with the increasing proportion of white residents in the ZIP code Tabulation Area ($\beta=-0.003, \text{SE}=0.0006, p<0.001$) and with increasing SES index score ($\beta=-0.0016, \text{SE}=0.0007, p=0.0159$).

Conclusions: In New York City, COVID-19 testing has not been proportional to need; existing socioeconomic and racial disparities in healthcare access have likely impacted public health response. There is urgent need for widespread testing and public health outreach for the most vulnerable communities in New York City.

INTRODUCTION

Coronavirus disease 2019 (COVID-19) is a rapidly evolving pandemic that emerged at the end of 2019 and has infected more than 8.8 million people and caused more than 450,000 deaths around the world. The first official case in New York City (NYC) was confirmed on March 1, 2020, and since then, more than 200,000 cases, 53,000 hospitalizations, and more than 17,500 deaths have affected the city in the brief space of a few weeks. COVID-19 testing was implemented relatively late and at a very slow pace in the U.S. Although testing should be performed for contact tracing to prevent COVID-19 spread, it is also a diagnostic tool and remains an important piece in the mitigation phase of a pandemic.

The U.S. has implemented COVID-19 testing in a sporadic and disorganized way, partly because the Centers for Disease Control and Prevention (CDC) guidelines changed several times over a short time span, owing in part to the quality and speed of the diagnostic...
test that was initially very poor. At the beginning of the year, CDC guidelines for testing were restricted to those who recently traveled to China or were in contact with an infected person, and testing performed in state laboratories was halted because of problems with the test itself. The test results would require several days to be produced and released, limiting the test’s utility for contact tracing, transmission prevention, and disease containment. Currently, CDC acknowledges on their website that it may remain difficult for individuals to be tested.

Only recently, NYC has released data that minorities are disproportionately affected by COVID-196 and is recognizing the importance of performing widespread testing and surveillance, especially in less affluent neighborhoods.

To study testing rates and positivity in NYC from the onset of COVID-19 and to identify areas of urgent need, this study analyzes existing data provided by the NYC Department of Health. The objectives of this analysis are (1) to study the spatial distribution of the number of COVID-19 tests, of COVID-19 positive tests, and the ratio of positive to total tests according to ZIP code Tabulation Area (ZCTA) and (2) to determine factors associated with testing and with positive testing according to ZCTA. The authors hypothesize that testing is currently not performed according to the metropolitan area’s needs, and that the proportion of tests performed relative to the resident population is higher in areas of high SES, whereas the proportion of positive COVID-19 tests is disproportionately high among socioeconomically vulnerable populations.

METHODS

Study Sample

The number of COVID-19 tests performed and the number of positive COVID-19 tests were downloaded from the NYC Coronavirus (COVID-19) data repository hosted by the NYC Department of Health from March 2, 2020 current through April 6, 2020. The frequency of positive COVID-19 tests, total COVID-19 tests, and this ratio were mapped in ArcGIS according to ZCTA. The authors hypothesize that testing is currently not performed according to the metropolitan area’s needs, and that the proportion of tests performed relative to the resident population is higher in areas of high SES, whereas the proportion of positive COVID-19 tests is disproportionately high among socioeconomically vulnerable populations.

RESULTS

Each component of the SES index, as well as the proportion of white residents, proportion of Hispanic residents,
Widespread COVID-19 testing has been identified as a crucial step in reopening the economy. In fact, testing is necessary to track positive cases, identify asymptomatic transmitters, and trace contacts in the community. When widely available, saliva-based testing offers an alternative to nasopharyngeal swabs that may be more practical and more sensitive (Wyllie AL, PhD, unpublished data, January 2020). However, additional barriers to testing include access and cost. To remove barriers to testing, New York State prohibited cost sharing on private insurance companies for COVID-19 testing on March 2, 2020. Additionally, House Resolution (HR) 6201 dated March 18, 2020 enacted free COVID-19 testing and removed costs for traveling to be tested. However, this bill does not prevent against surprise charges. Still, the number of people who need to be tested outnumbers the available test kits, nasal swabs, and other necessary equipment for conducting the test.
## Table 1. SES Index Components, Racial Composition, Positive Tests, and Total Tests According to Quartiles of Increased SES Index

| Variable                        | Quartile 1                  | Quartile 2                  | Quartile 3                  | Quartile 4                  |
|---------------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Median household income (dollars) | 42,114.67, 39,653, 28,921, 51,521, 45, 21,149, 83,240, 14,256.98 | 60,041.11, 60,076.5, 51,345.00, 69,099.00, 44, 35,859, 85,707, 11,846.73 | 76,926.23, 71,648, 61,548.00, 86,058.00, 43, 39,207, 250,001, 30,767.51 | 115,455.7, 110,625, 91,936.00, 127,506.00, 45, 71,225, 246,813, 33,086.37 |
| Median rent (dollars)            | 1,145.44, 1,153, 1,019, 1,285, 45, 690, 1,591, 198.6        | 1,401.07, 1,403, 1,312.00, 1,508.50, 44, 963, 1,746, 166.83       | 1,620.84, 1,550, 1,392.00, 1,700.00, 43, 1,186, 3,501, 395.04       | 2,194.69, 2,174, 1,730.00, 2,472.00, 45, 607.14, 3,994, 630.37       |
| Unemployed (%)                   | 10.31, 10.32, 8.51, 12.39, 45, 5.2, 15,756.78, 2.45    | 6.84, 6.94, 5.92, 7.74, 44, 4, 2, 10.08, 1.38       | 5.39, 5.43, 4.42, 6.18, 43, 3.15, 8.04, 1.07       | 4.01, 4, 3.29, 4.79, 45, 0.61, 6.68, 1.27       |
| Living below 150% poverty line (%) | 39.74, 39.78, 30.19, 49.67, 45, 18.7, 62.49, 11.79 | 28.29, 27.23, 21.96, 33.94, 44, 13.89, 52.84, 8.63 | 54.25, 56.09, 48.97, 61.50, 43, 24.87, 86.58, 13.17 | 12.18, 10.9, 6.94, 15.12, 45, 1.12, 44.27, 7.26 |
| Education index                  | 67.13, 65.49, 60.24, 74.17, 45, 50.16, 80.4, 8.52 | 60.77, 63.11, 53.65, 67.49, 44, 38.68, 77.14, 9.19 | 1,399.53, 1,406.12, 1,376.73, 1,437.56, 43, 1,211.08, 1,564.23, 66.88 | 1,508.14, 1,522.96, 1,476.59, 1,561.51, 45, 1,353.02, 1,591.87, 63.14 |
| >1 occupants per room            | 2,228.38, 1,910, 996, 2,882, 45, 218, 6,329, 1,549.98 | 1,720.86, 1,269.5, 811.50, 2,114.50, 44, 256, 6,532, 1,465.32 | 37.24, 34.6, 21.61, 57.27, 44, 1.76, 73.7, 20.11959 | 51.84, 52.71, 37.66, 70.92, 43, 2.32, 93.78, 24.28 |
| White residents (%)              | 23.89, 17.73, 12.49, 36.1, 45, 5.2, 15.75678, 2.45 | 28.76, 24.6, 16.17, 36.43, 44, 5.1, 63.06, 15.52 | 37.24, 34.6, 21.61, 57.27, 44, 1.76, 73.7, 20.11959 | 51.84, 52.71, 37.66, 70.92, 43, 2.32, 93.78, 24.28 |
| Hispanic residents (%)           | 45.7, 47.53, 25.62, 66.57, 45, 12.43, 75.77, 20.32 | 27.06, 24.6, 16.17, 36.43, 44, 5.1, 63.06, 15.52 | 54.25, 56.09, 48.97, 61.50, 43, 24.87, 86.58, 13.17 | 12.18, 10.9, 6.94, 15.12, 45, 1.12, 44.27, 7.26 |
| Total tests/population (%)       | 0.87, 0.83, 0.77, 0.97, 45, 0.57, 1.42, 0.18 | 0.86, 0.82, 0.69, 1.04, 44, 0.48, 1.36, 0.25 | 0.56, 0.57, 0.48, 0.62, 44, 0.35, 0.73, 0.09 | 0.96, 0.94, 0.73, 1.14, 43, 0.45, 2.39, 0.33 |
| Positive tests/total tests (%)   | 0.55, 0.55, 0.53, 0.58, 45, 0.39, 0.66, 0.61 | 0.55, 0.55, 0.53, 0.58, 45, 0.39, 0.66, 0.61 | 0.56, 0.57, 0.48, 0.62, 44, 0.35, 0.73, 0.09 | 0.42, 0.42, 0.37, 0.46, 45, 0.25, 0.63, 0.08 |

Note: The education index was calculated on the population ≥25 years and is a weighted combination of the percentage of high school graduates, high school only, and more than high school, with a greater value indicating higher educational attainment.

*aTotal tests/population (%): Test per 100 persons.

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Figure 1. Spatial distribution of the proportion of total tests/population (%) (top-left), positive tests/total tests (%) (middle-left), SES index (top-right), proportion white race alone (bottom-right), and Hispanic proportion (bottom-middle) across NYC. Proportion total tests/population (%) displayed in hundreds of residents. NYC, New York City.
Despite recommendations for widespread testing and the potential option for free testing, this does not ensure that the entire population will be tested, nor does it guarantee the quantity and quality of testing kits necessary for widespread testing. If the disparities identified in this analysis continue to persist, this necessary testing may not be administered to an adequate degree in all ZCTAs within NYC, hindering overall efforts to prevent a second outbreak of COVID-19 while putting thousands at risk of infection.

Limitations

One limitation of this analysis is that Census data potentially under represent noncitizens, which would influence the SES index measures and the racial composition of each ZCTA. This highlights the fact that the provisions of HR 6201 do not extend to noncitizens, and thus an already vulnerable population would not have access to free testing. There are no assurances that undocumented immigrants would have any protections if they seek to be tested. In addition, it is important to consider that the data used in these analyses are not individual-level but instead aggregate ZCTA-level data, which limits the ability to draw individual-level conclusions. For instance, the authors cannot comment on the interaction between being nonwhite and of low SES on the likelihood of testing or of a positive test, knowledge that would help to identify the most vulnerable populations. This study was ecological in nature and there are more individual-level factors that may influence COVID-19 testing that could not be taken into account here. Taken together, these results suggest that testing was not planned or implemented according to needs in NYC, and that testing policies may need to be revisited and more resources devoted to lower-SES communities to minimize loss of life, retain the ability of essential working-class individuals to provide vital services and contribute to the economy, and eventually stop this pandemic.

CONCLUSIONS

This analysis identifies disparities in those being tested and suggests a gap in COVID-19 response policy, as well as the need for widespread testing and public health outreach to the most vulnerable populations of NYC. This is essential to stop the pandemic and reopen the economy in NYC. Future studies should focus on the reasons why these disparities in testing occurred; focus groups among residents of low-SES areas could help define if barriers to testing exist and generate suggestions on how to address such obstacles.

ACKNOWLEDGMENTS

No funding was received for this work. The corresponding author had full access to all the data in the study.

No financial disclosures were reported by the authors of this paper.

SUPPLEMENTAL MATERIAL

Supplemental materials associated with this article can be found in the online version at https://doi.org/10.1016/j.amepre.2020.06.005.

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