COVID-19 DEATH AND VACCINATION RATES

FOR LATINOS IN NEW YORK CITY

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Acknowledgements

About Our Centers

The UCLA Center for Neighborhood Knowledge specializes in empirical spatial analysis to inform policy and planning action and explicitly emphasizes the study of immigrant enclaves, low-income neighborhoods, and minority communities.

The UCLA Latino Policy and Politics Initiative addresses the most critical domestic policy challenges facing Latinos and other communities of color through research, advocacy, mobilization, and leadership development to expand genuine opportunity for all Americans.

The Center for Puerto Rican Studies, Hunter College, CUNY (Centro) is the nation's leading university-based institution devoted to the interdisciplinary study of the Puerto Rican experience in the United States. Centro is dedicated to understanding, preserving, and sharing the Puerto Rican experience in the United States. Centro seeks to link scholarship to social action and policy debates, and to contribute to the betterment of our community and the enrichment of Puerto Rican studies.

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PREFACE

The disproportionate impacts of the Coronavirus Disease 2019 (COVID-19) pandemic on racial and ethnic minority groups in the United States are already well-documented. However, Black, Asian, and Hispanic communities are not monolithic populations. Rather, they experience unequal impacts across age groups, geographies, and social contexts. Healthcare researchers and social scientists are examining these factors to better measure the unequal distribution of health outcomes in the context of the pandemic and the potential role of existing underlying disparities in these outcomes.

While aggregate group comparisons between White, Hispanic, and Black populations are possible, data at the neighborhood level is rarely collected or disaggregated for subpopulations within these major racial and ethnic groups. Existing national studies, such as the U.S. Census Bureau's Household Pulse Survey measuring household experiences during the pandemic, do not currently have a large enough sample size to disaggregate the major racial and ethnic groups and assess in-group differential impacts. Consequently, researchers must use indirect approaches to estimate the impact of the pandemic on population subgroups.

This study uses bivariate correlations at the ZIP code level to examine COVID-19 death and vaccine disparities within the Hispanic population in New York City. The study disaggregates Hispanics by age, education, and ethnicity. Disparities are evident and consistent with historical findings for this population. Hispanics are disadvantaged relative to non-Hispanic Whites, even among the elderly and highly educated. Ethnic differences among Hispanics are minor, indicating a shared liability. In other words, Hispanics consistently bear a disproportionate share of COVID-19 deaths while facing barriers to vaccination.

By contributing to our understanding of the sources and patterns of disparities between Hispanics and other groups and within Hispanic subpopulations, this study contributes to determining and implementing public health measures that will have the greatest beneficial impact on those most affected by the pandemic. As the authors conclude, we still have a long road ahead. More studies are necessary to measure the differential impact of COVID-19 between and within racial and ethnic groups. A more concerted effort is needed to collect data that will allow a more direct assessment of health outcomes and the factors contributing to disparities.

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EXECUTIVE SUMMARY

This brief compares the overall Coronavirus Disease 2019 (COVID-19) death and vaccination rates of Latinos and non-Hispanic whites (NH Whites) and describes the geographic pattern of these rates across neighborhoods in New York City (NYC).[i] As the first major epicenter of the COVID-19 pandemic, NYC is an important case study. During the initial three months of the pandemic, there were 203,000 confirmed cases with a crude fatality rate of 9.2 percent overall and 32.1 percent among those hospitalized.[ii] NYC is home to 2.6 percent of the nation's population, but 5.7 percent of the nation's COVID-related deaths occurred there.[iii]

The available data on the pandemic reveal that Latinos were disproportionately impacted by COVID-19 infections, hospitalization, and deaths.[iv] Given this disparity, prioritizing this population for vaccination is critically important. The effort should focus on immunizing individuals in predominantly Latino neighborhoods to lower contagion risk, given that elevated risks are associated with both individual and neighborhood characteristics.[v] To assess whether vaccines are adequately reaching this population, we analyze available data to compare outcomes for Latinos and NH Whites (see Appendix for a discussion on data and methods).

Our major findings and recommendations are:

- **Latinos in NYC are 1.4 times more likely to be infected and almost twice as likely to be hospitalized and die from COVID-19 as NH Whites.**

- **Despite disproportionately high COVID-19 impacts, vaccination rates among Latinos in NYC are less than three-fifths that of NH Whites.**

- **Differences in reluctance to vaccination are insufficient to explain the disparity faced by Latinos.**

- **On average, NYC neighborhoods with the highest death rates have lower vaccination rates, creating a vaccination gap between neighborhoods with the greatest need and the least need.**

- **There are geographic disparities in NYC COVID-19 death rates and vaccination rates. Neighborhoods in the Bronx and portions of Queens, Brooklyn, and Staten Island have high death rates and low vaccination rates, while neighborhoods in Manhattan south of Harlem (excluding Chinatown) and in some parts of Brooklyn and Queens closer to Manhattan have relatively lower death rates and high vaccination rates.**

- **Relative to NH Whites, Latinos at various ages and education levels disproportionately reside in NYC neighborhoods with the greatest death-vaccination gap, meaning that they have relatively high death rates and relatively low vaccination rates.**

- **Political commitments to an equitable distribution of vaccines should be aggressively implemented through evidence-based actions, greater community engagement, and performance-based accountability.**

The brief is organized as follows. We begin with a background section describing COVID-19 vaccination policies and efforts in New York City to date and the structural disadvantages Latinos in NYC might face to access the vaccine. We then present the findings from our analyses, which include quantification of city-wide COVID-19 death and vaccination disparities between Latinos and NH Whites and a spatial-racial analysis of these disparities. We end with a conclusion and recommendations.

BACKGROUND

COVID-19 VACCINATION POLICIES AND EFFORTS IN NEW YORK CITY

New York City (NYC) made history when a critical care nursing director in Queens received the first vaccine administered in the United States on December 14, 2020. That day marked the start of vaccination distribution across the country.[vi]

Since then, New York has administered vaccinations using a tiered rollout system based on prioritization of population groups deemed most vulnerable. Under this system, healthcare workers and all residents and staff in approximately 600 nursing homes and long-term care facilities across the state were first priority.[vii] The state then expanded vaccinations for essential workers, people over 60, and people with other high-risk health conditions.[viii] On March 30, 2021, Governor Andrew Cuomo announced that all individuals 30 years and older were eligible for vaccination.[ix] On April 6, 2021, he extended vaccine eligibility to all New York residents over the age of 16.

The state's guiding principles for vaccine distribution emphasize an "equitable and clinically driven distribution." Despite efforts and concerns surrounding equitable distribution, including New York City Mayor Bill de Blasio's vow to expand access in communities most affected by the virus, Latino and Black communities are being vaccinated at lower rates than non-Hispanic White (NH White) communities.[x]

STRUCTURAL DISADVANTAGES IN LATINOS' ACCESS TO THE COVID-19 VACCINE

Certain demographic characteristics of the Latino population in NYC, including age, income, and education, could pose challenges to vaccine access.[xi]

Approximately 2.4 million Latinos reside in NYC, comprising about 29 percent of the city's population. NYC is home to proportionately more Latinos and fewer NH Whites than the nation as a whole (Figure 1). Outreach to such large populations poses logistical challenges for public health authorities.
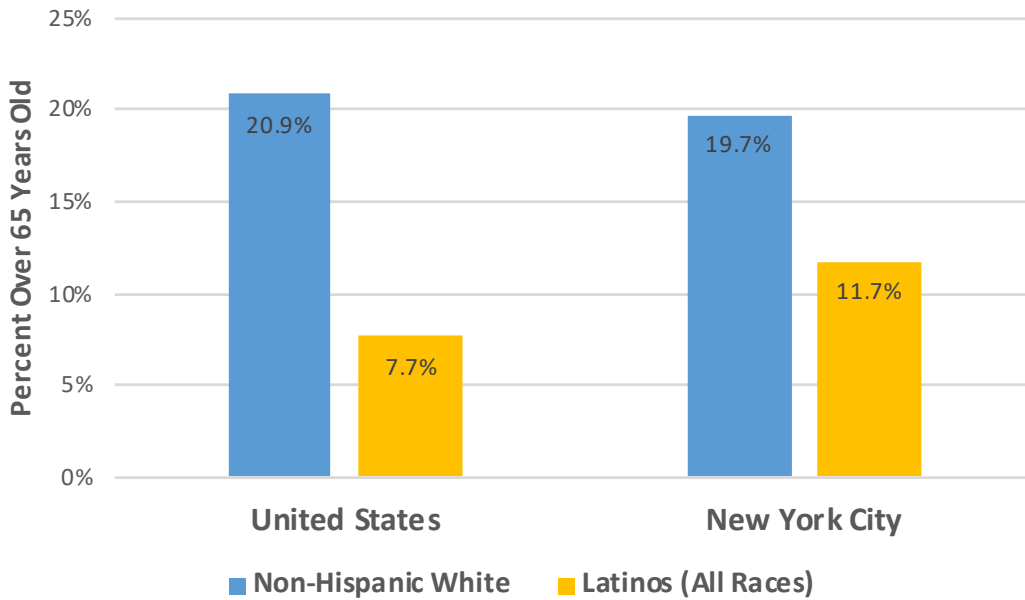
Figure 1: Population by Race/Ethnicity in the United States and New York City, 2019
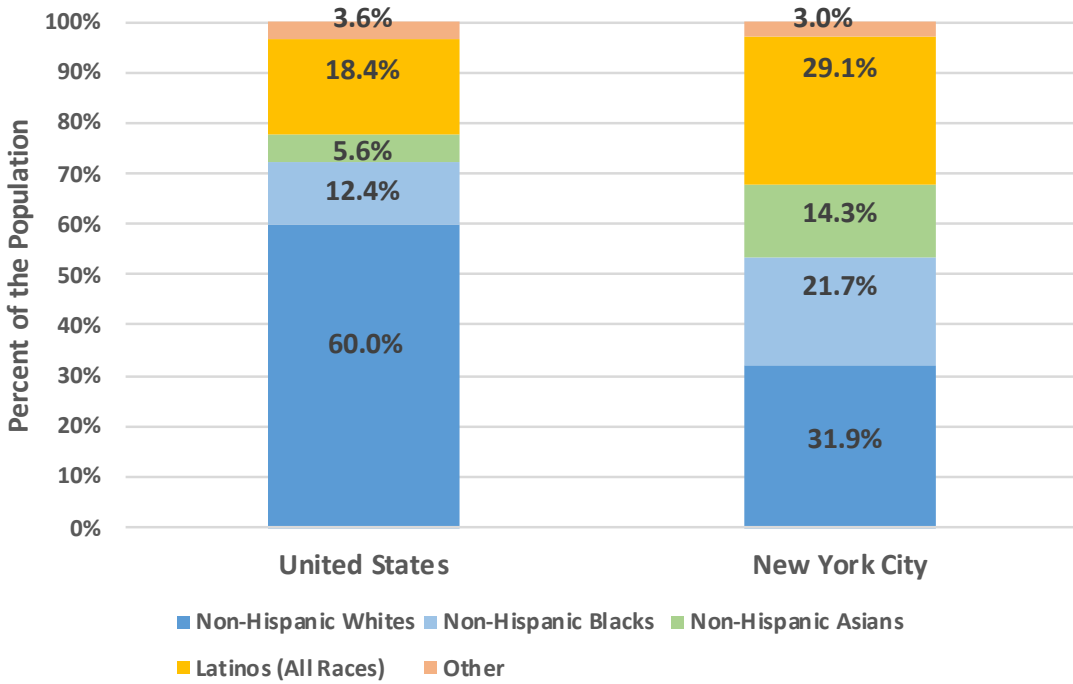
Note: While we use the term Latino, the data analyzed is from the U.S. Census, which uses the term Hispanic.
Sources: American Community Survey, 2019.

The Latino population is proportionally younger than other racial/ethnic groups in New York City. For example, less than 12 percent of Latinos are over 65 years old compared to almost 20 percent of NH Whites. Consequently, comparatively fewer Latinos had access to the vaccine in the early stages of the rollout.

Figure 2: Percent Over 65 Years Old by Race/Ethnicity in the United States and New York City, 2019

Note: While we use the term Latino, the data analyzed is from the U.S. Census, which uses the term Hispanic.
Sources: American Community Survey, 2019.

Latinos face other structural disadvantages that likely impact access to the vaccine.[xii] Latinos have a median income in the city at $47,000, which is less than half the median income of NH Whites (Figure 3). Studies have shown both a higher vulnerability to COVID-19 and lower vaccine coverage for low-income communities.[xiii]

Figure 3: Median Income by Race/Ethnicity in the United States and New York City, 2019
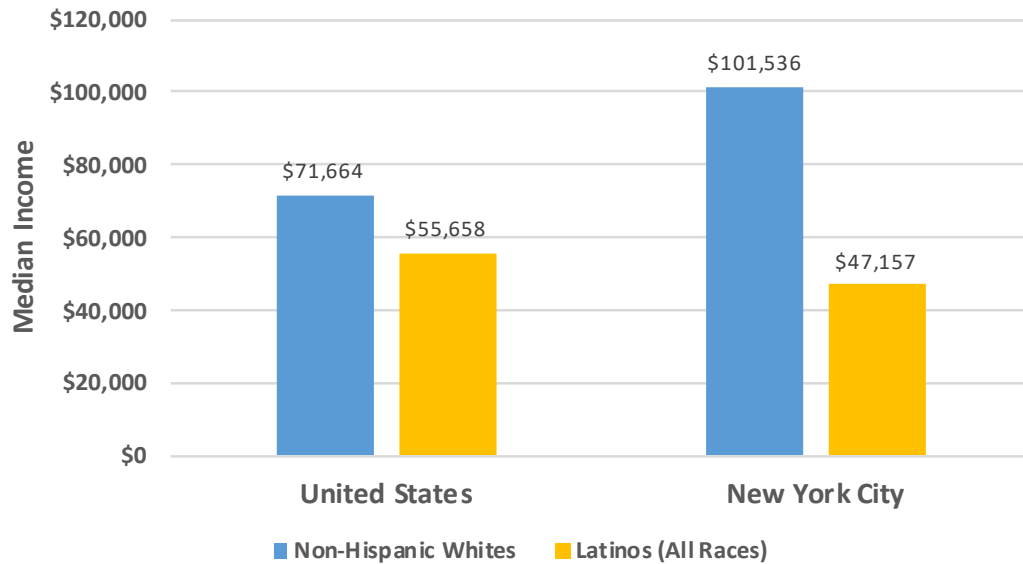

Note: While we use the term Latino, the data analyzed is from the U.S. Census, which uses the term Hispanic.
Sources: American Community Survey, 2019.

Latinos in NYC have less access to education, and studies show that communities with lower educational attainment have had lower vaccination coverage.[xiv] As seen in Figure 4, slightly less than 20 percent of Latinos have a bachelor's degree compared to almost 62 percent of NH Whites.

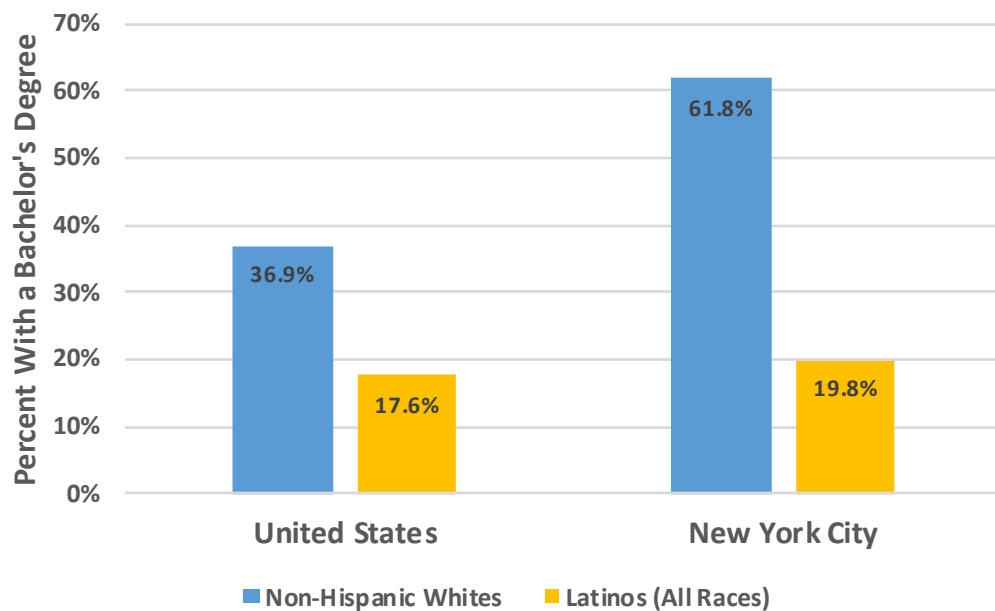**Figure 4: Percent of the Population with a Bachelor's Degree by Race/Ethnicity in the United States and New York City, 2019.**

Note: While we use the term Latino, the data analyzed is from the U.S. Census, which uses the term Hispanic.
Sources: American Community Survey, 2019.

Reports indicate that socioeconomic characteristics are affecting Latinos' access to the vaccine. Language barriers, confusion about the sign-up process, lack of internet access, exclusionary hours at clinics that do not accommodate work schedules, and the desire to not miss pay for missed work all contribute to lower vaccination rates among Latinos.[xv] Additionally, appointments at sites intended to reach communities of color were taken up by NH White residents with better access to information, transportation, and flexibility to travel.[xvi]

The next section presents our findings on the extent to which these structural factors affect vaccination outcomes in Latino communities.

FINDINGS

We conducted several analyses to better understand COVID-19 impacts on Latinos in New York City. First, we compared Latino COVID-19 death, hospitalization, vaccination, and case rates with those of NH Whites. Then, we mapped death rates and vaccination rates by neighborhood across New York City to assess place-based exposure risk. Additionally, we did a spatial-racial analysis to determine disparities in death and vaccination rates.

These results are based on data from March 11, 2021. Using U.S. Census definitions of race and ethnicities, we use the terms "Hispanic" and "NH White" to refer to Latino and Non-Hispanic White neighborhoods. More detailed information on data sources and methods can be found in the Appendix.

CITY-WIDE COVID-19 DEATH AND VACCINATION DISPARITIES

To understand disparities between Hispanics and NH Whites, we first analyzed COVID-19 metrics from the NYC Department of Health, including cases, deaths, hospitalizations, and vaccination rates. Figure 5 displays the Hispanic to NH White ratio for these metrics, with parity at 1.0. Across all metrics, there are disparities between the two groups: COVID-19 cases are 1.4 times higher among Hispanics, and hospitalizations and deaths are almost twice the rate for Hispanics as NH Whites. The lower ratio of cases compared to deaths/hospitalizations could be due to the presence of testing barriers for Hispanics. Despite disproportionate COVID-19 impacts, vaccination rates among Hispanics are less than three-fifths that of NH Whites. Hispanics have borne a larger share of negative COVID-19 health outcomes but have received a smaller share of the protection afforded by the vaccine.

COVID-19 Death and Vaccination Rates for Latinos in New York City

**Figure 5: COVID-19 Metrics: Hispanic to Non-Hispanic White Ratio in New York City**
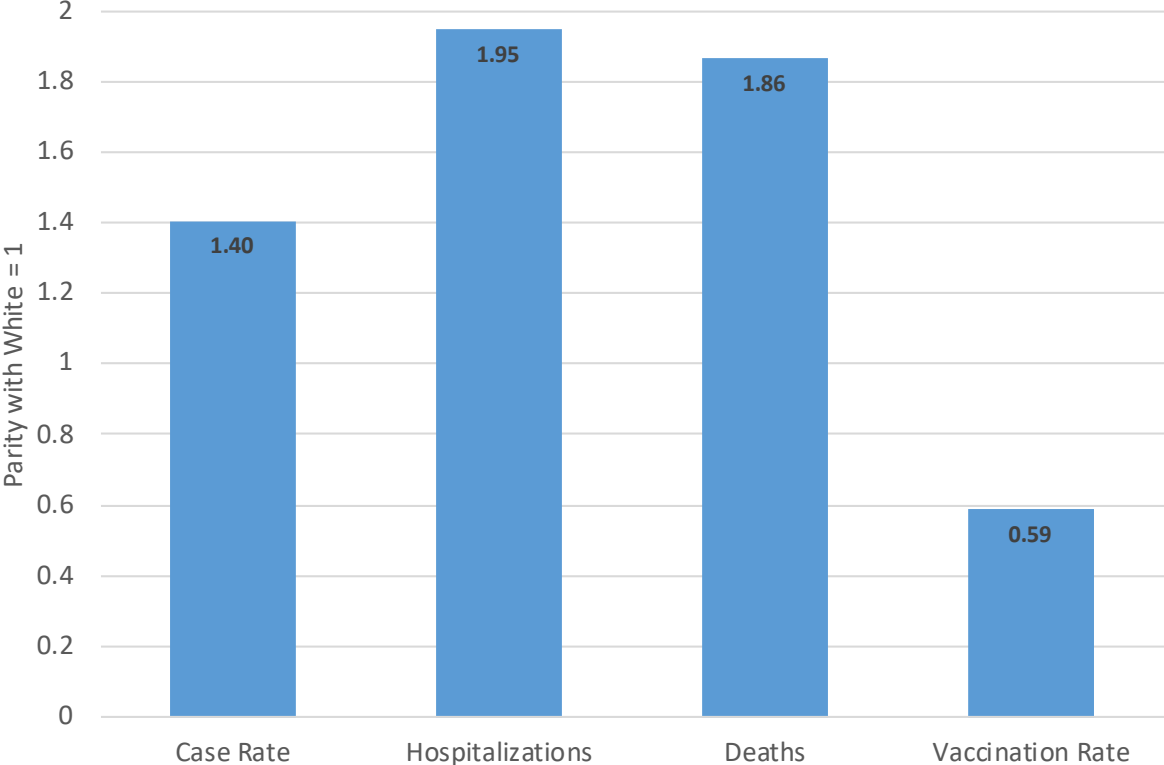
Source: NYC Department of Health

The U.S. Census Bureau's Household Pulse Survey (see Appendix) provides additional evidence of disproportionate impacts faced by Hispanics. Figures 6 and 7 show overall vaccination rates and reluctance for Hispanics and NH Whites. We also compared responses between 1) older adults, who had priority access to vaccines, and 2) people with high levels of education, who have greater access to information, are more likely to trust medical experts and are more likely to have the digital technology skills and equipment to sign up.

Consistent with the NYC Public Health data, U.S. Census data indicate that the vaccination rate among Hispanics was about half that of NH Whites as of March 2021. Vaccination rate differences between Hispanics and NH Whites persisted among older adults and people with high levels of education, although the gap is smaller in the U.S. Census Bureau's dataset (see Figure 6).). This indicates a need to target outreach and information efforts to reach these individuals.

Figure 6: Vaccination Rates by Age, Educational Level, and Race/Ethnicity New York City
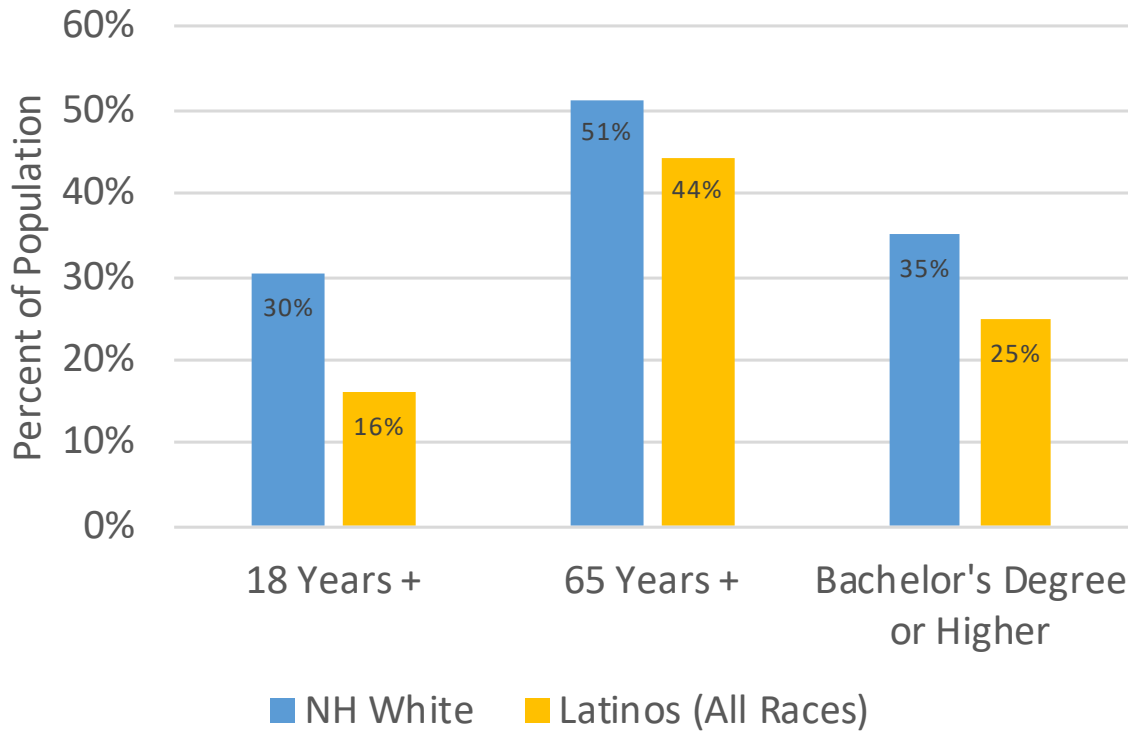
Source: U.S. Census Household Pulse Survey

While there are some differences in vaccine reluctance (two percentage points), this is likely not sufficient to explain the disparity faced by Hispanics. About 15 percent of NH White respondents and 17 percent of Hispanic respondents expressed that they would "probably not" or "definitely not" get vaccinated, suggesting that differences in vaccination rates cannot be explained by vaccine reluctance alone. However, Hispanics were slightly more likely to "definitely not" get a vaccine than NH Whites (7 percent vs. 5 percent).

GEOGRAPHY OF COVID-19 DEATHS AND VACCINATION

We mapped the death rates and vaccination rates by neighborhood across New York City to assess place-based exposure risk. Our unit of analysis is the ZIP Code Tabulation Area (ZCTA), as defined by the U.S. Census Bureau. We use the terms "ZCTA" and "neighborhood" interchangeably throughout. More detailed information on data sources and methods can be found in the Appendix.

Note that our analysis assesses neighborhood risk, as opposed to individual risk – for example, a person living in a neighborhood with a high rate of car accidents is more likely to be in an accident.

Figure 7 illustrates the COVID-19 death rate by neighborhood, with lighter brown indicating a lower death rate and darker brown indicating a higher death rate. Overall, neighborhoods with higher death rates were located in the Bronx and portions of Queens, Brooklyn, and Staten Island. Neighborhoods with lower death rates were located in Manhattan south of Harlem (excluding Chinatown) and in some parts of Brooklyn and Queens closer to Manhattan.

Figure 7: COVID-19 Death Rate by ZIP Code Tabulation Area in New York City

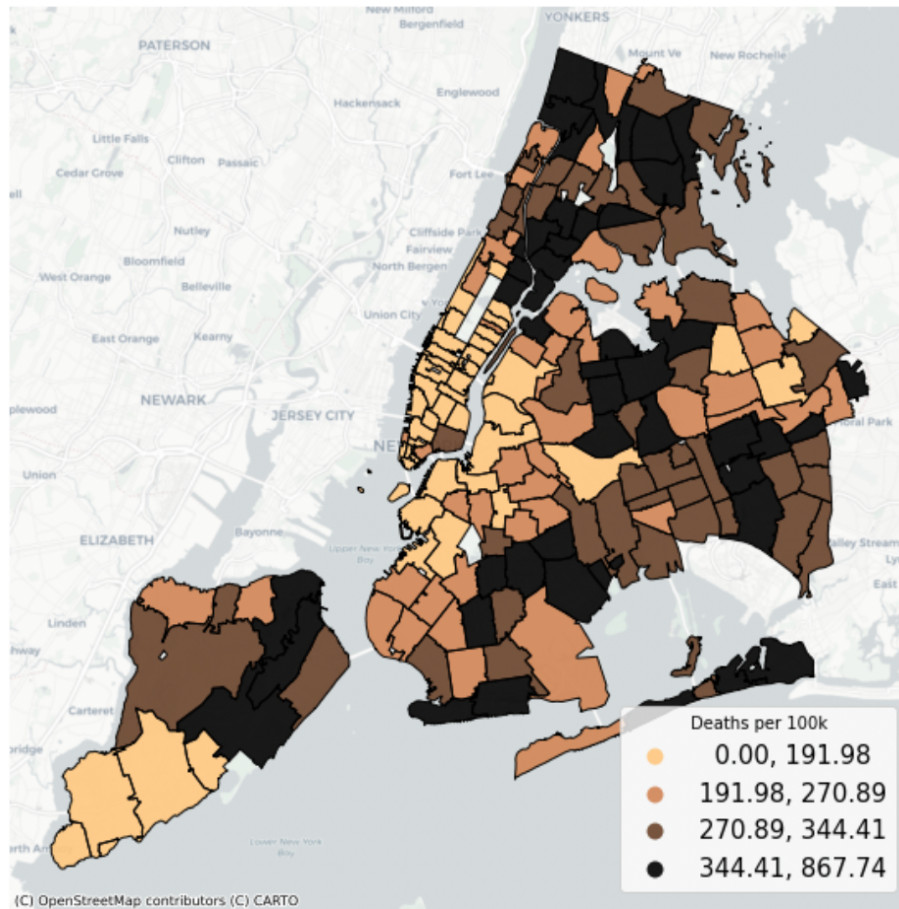Figure 8 displays vaccination rates, with lighter green indicating lower vaccination rates and darker green indicating higher rates. In contrast to the COVID-19 death rate, neighborhoods with high vaccination rates are located in Manhattan, particularly in the Upper East and West Side and the outer parts of Queens. Low vaccination rates are primarily located across the Bronx and Brooklyn and some sections of Queens.

Figure 8: COVID-19 Vaccination Rate by ZIP Code Tabulation Area in New York City
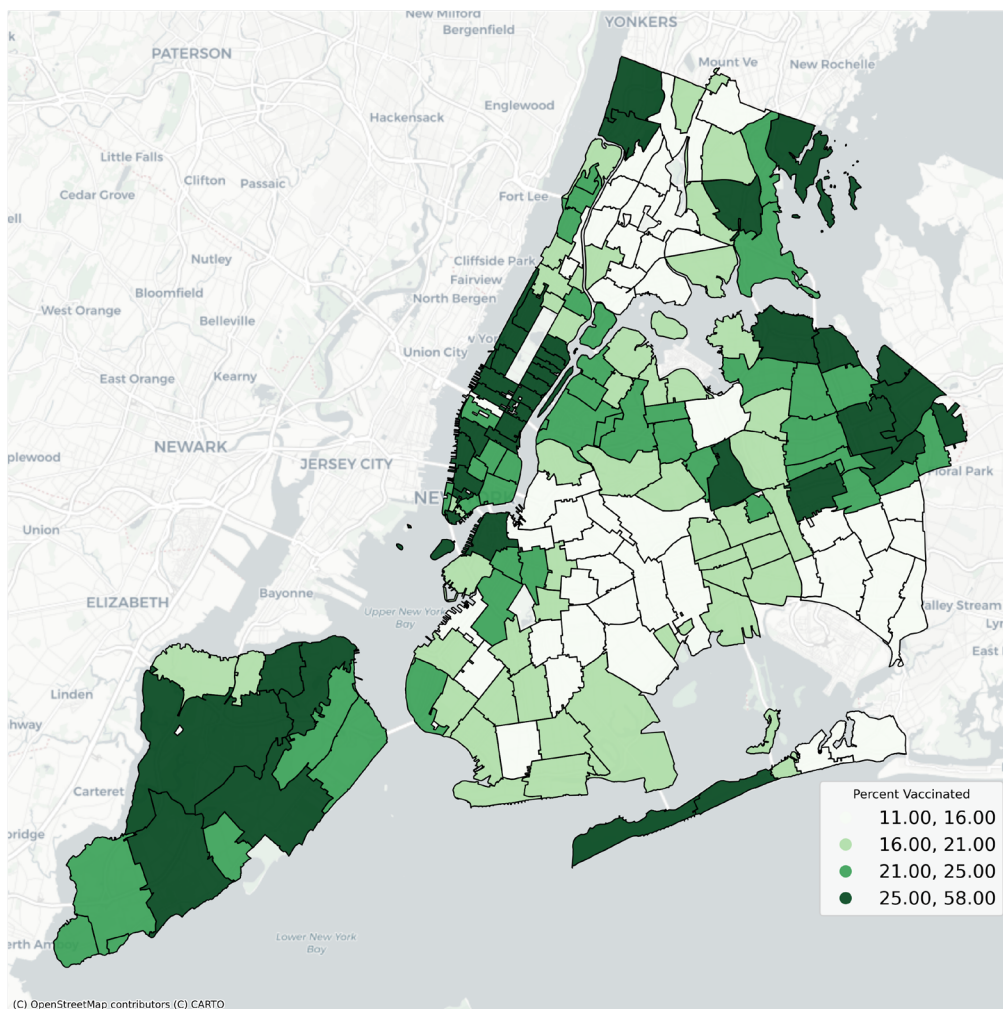

There is significant geographic inequality in the odds of dying from COVID-19 or receiving the vaccine. Visually, the two rates appear to be inversely correlated; that is, many ZTCAs with high death rates are also ZTCAs with low vaccination rates. People living in these areas therefore face multiple factors indicating greater COVID-19 risk.

We developed a "death-vaccination gap metric" (hereby referred to as "gap metric") to quantify these spatial disparities between neighborhoods. Overall, we observe an inverse relationship between death rates and vaccination rates: ZCTAs with low death rates have on average higher vaccination rates (a smaller gap) and ZCTAs with high death rates have on the average lower vaccination rates (a bigger gap). More information about how we developed this metric can be found in the Appendix.

The following map is based on classifying the gap metric values into three categories: the smallest gap (green) is the bottom quartile, the medium gap (tan) is the middle two quartiles, and the biggest gap (red) is the top quartile.

Figure 9: Death-Vaccination Gap by ZIP Code Tabulation Area in New York City
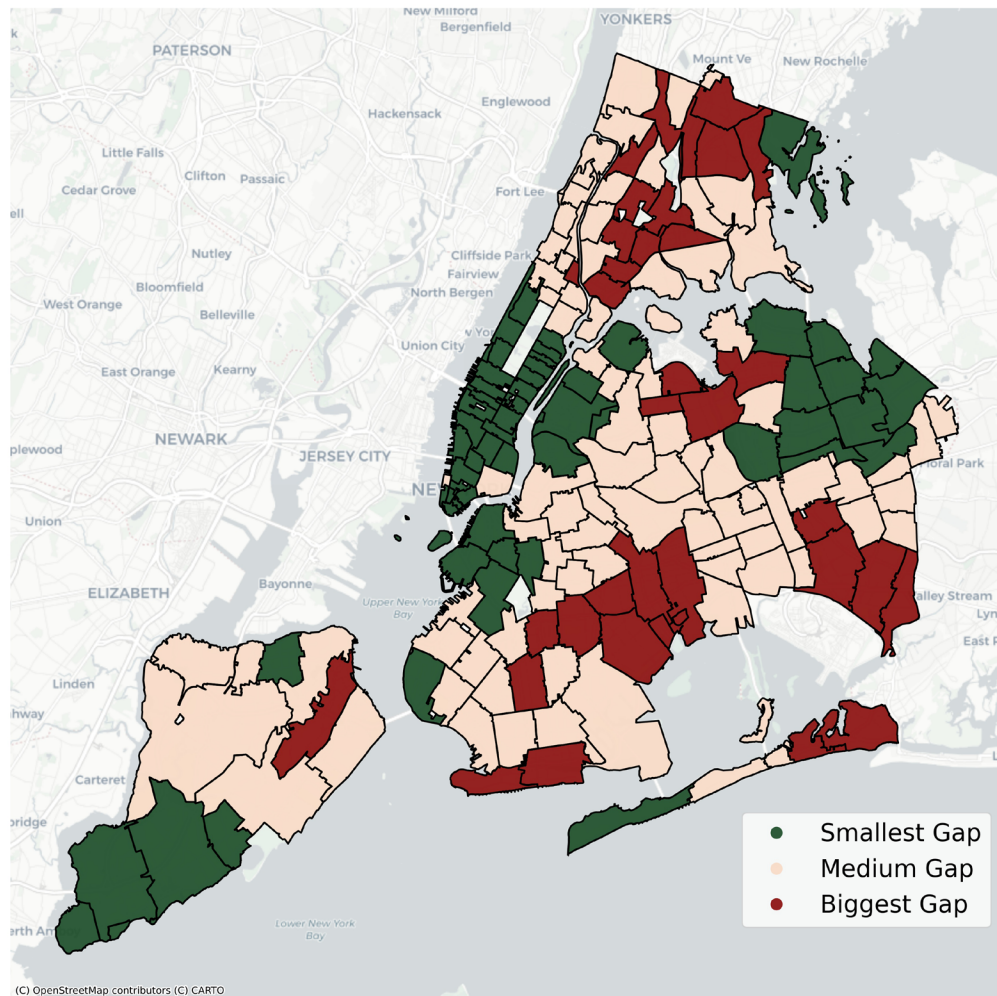

Overall, we find that neighborhoods with lower COVID-19 death rates tend to have higher vaccination rates. Neighborhoods with the smallest gaps are located in Manhattan south of Harlem (excluding Chinatown). In contrast, areas with the highest death gaps are located in the Bronx and portions of Brooklyn and Queens. Many places with the greatest gap between deaths and vaccinations are also communities of color, meaning that racial/ethnic minorities in NYC often face the greatest risks of COVID-19.

SPATIAL-RACIAL DISPARITIES

Figure 10 showcases neighborhoods by majority or plurality Hispanic or NH White. Overall, we find that neighborhoods with a majority NH White population are located in Manhattan below Harlem and neighborhoods with a majority Hispanic population are located in the Bronx. Visual inspection of Figures 8 and 9 reveals that neighborhoods with a high share of Hispanic population tend to have the "biggest gap" between deaths and vaccines. In contrast, neighborhoods with a high share of NH White population tend to be located within the "smallest gap" category.

Figure 10: Racial Majority/Plurality by ZIP Code Tabulation Area in New York City
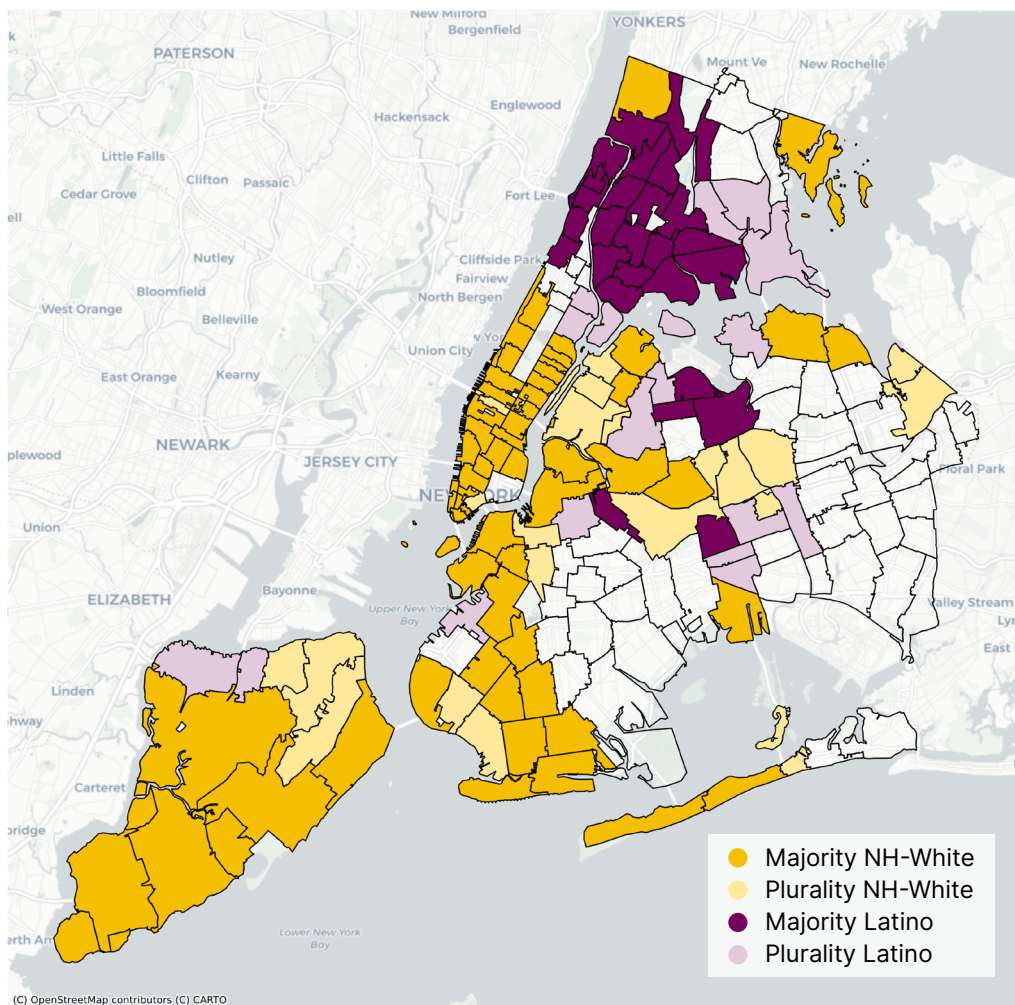
To quantify the observed geographic racial disparities in deaths, vaccinations, and the gap metric, we used population-weighted quintiles to rank the ZCTAs. We compare Hispanic and NH White populations to the total city population. Population-weighted quintiles mean the top quintile will contain 20 percent of the population, not 20 percent of the ZCTAs (which vary in population size). Therefore, the quintiles for the entire city population fall roughly equally in the quintiles, while we see variation in the distribution of the Hispanic and NH White populations.

Figure 11 shows the population distribution by death rate. As expected, we find the total population distributed evenly across ZCTAs within the five quintiles. However, we find the nearly 40 percent of the NH White population resides in ZCTAs within the lowest death rate quintile, as compared to only 10 percent of the Latino population.

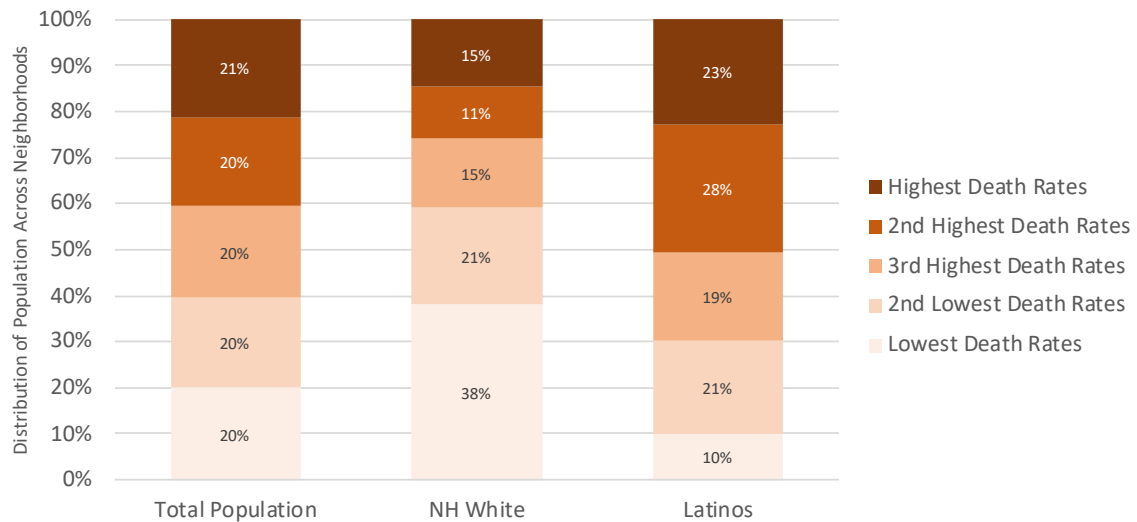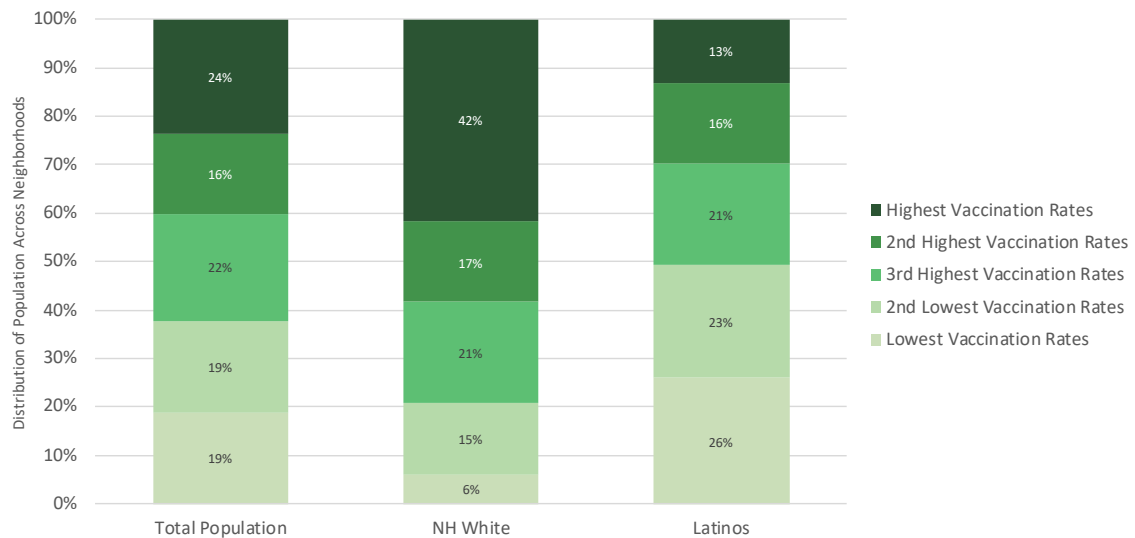**Figure 11: Population Distribution by Death Rate in New York City**

Figure 12 displays the population distribution by vaccination rate. Again, we find an even distribution for the total population but significant disparities between NH Whites and Latinos. Over 40 percent of NH Whites live in ZCTAs in the highest quintile of vaccination rates compared to just over 10 percent of Latinos. This result aligns with the Household Pulse Survey, which showed higher vaccination rates for NH White populations.

Figure 12: Population Distribution by Vaccination Rate in New York City

Finally, Figure 13 illustrates the population distribution by the death-vaccination gap. Consistent with the results for death rate and vaccination rate distribution, we find equal distribution for the total population, while 40 percent of NH Whites reside in the ZCTAs in the lowest quintile of the death-vaccination gap and only 10 percent of Latinos in the lowest quartile.

The charts reveal that, relative to NH Whites, Latinos are more likely to be overrepresented in the riskiest places for COVID-19 exposure, including areas with high death rates, low vaccination, and a bigger gap between death and vaccination rates.

Figure 13: Population Distribution by Death-Vaccine Gap in New York City
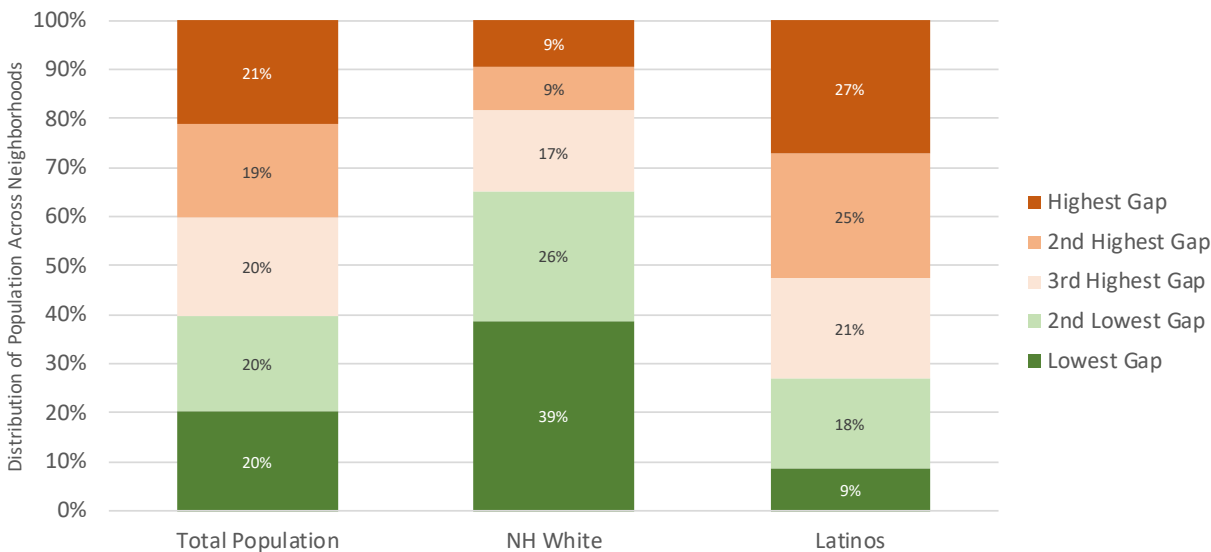
To further disaggregate disparities among different subpopulations within NH White and Latino populations, we examined average neighborhood risk across death rates, vaccination rates, and the gap metric. In Figure 14, the death rate is deaths per 100,000 people, the vaccination rate is a percentage of the population, and the death-vaccination gap is the normalized rate (with a higher value indicating a larger gap).

Overall, Latinos reside in neighborhoods with a higher risk of COVID-19 impacts than NH Whites. The death rate and the gap metric is much higher for Latinos, while the vaccination rate is lower than for NH Whites. These disparities hold true for elderly and educated populations with potential advantages to vaccine access. Even among these more advantaged groups, Latinos still have higher place-based exposure risk to COVID-19.

We are also interested in disparities within Latinos ethnic groups. By comparing COVID-19 metrics between Dominican, Mexican, and Puerto Rican neighborhoods, we find only minor variations between the ethnic groups. Puerto Rican neighborhoods see slightly higher vaccination rates and slightly lower death rates, though the difference is negligible. Regardless of age, education, or ethnicity, Latinos are more likely to live in neighborhoods with a higher risk of COVID-19 exposure and have lower access to vaccination as compared to NH Whites.

Figure 14: Average Neighborhood COVID-19 Risk Indicators in New York City

	DEATH RATE	VACCINATION RATE	DEATH-VACCINE GAP
All	294	20.5	99
Race			
NH White	250	23.6	71
Hispanic	316	18.7	114
Hisp-NHW Ratio	*1.26*	*0.79*	*1.60*
65 Years or Older			
NH White	279	24.5	74
Hispanic	317	19.6	109
Hisp-NHW Ratio	*1.14*	*0.80*	*1.47*
Bachelor's Degree or Higher			
NH White	228	24.9	60
Hispanic	284	21.1	93
Hisp-NHW Ratio	*1.25*	*0.85*	*1.54*
Hispanic Ethnicity			
Dominican	317	17.9	120
Mexican	314	18.3	115
Puerto Rican	312	18.9	113
Largest Ratio	*1.01*	*0.95*	*1.06*

CONCLUSION AND RECOMMENDATIONS

The disparities documented in this brief are not surprising: both the media and the populace are aware of COVID-19's disproportionate impacts on certain groups. This brief's contribution is quantifying the pattern and magnitude of the problem in New York City. Racial stratification is not unique to the impacts of the pandemic. [xvii] Existing disadvantages faced by racial and ethnic groups have made Latinos more vulnerable to COVID-19 infection, hospitalization, and death. Such disadvantages include residing in riskier built environments (e.g. overcrowded housing), relying more heavily on public transit, and working in essential sectors. [xviii] This inequality is also visible in the differences in vaccination rates, which further compounds the divide between NH Whites and Latinos as recovery from the pandemic begins.

These unequal outcomes occurred despite political promises of racial justice and fairness. These disparities would likely have been worse without such efforts. Nevertheless, persistent inequalities reveal that public actions to date have been insufficient. The results reveal the overwhelming power of institutions, economic markets, and structures of privilege to build new forms of racial stratification on the foundation of old forms of racial inequality.

The governor and mayor must aggressively implement their expressed commitments to racial equity through evidence-based policies and programs, greater community engagement and participation, and explicit performance-based accountability. Clearly, there is an urgent necessity to address the immediate crisis and particularly to close the vaccination gap. It is not too late to formulate a socially fair recovery plan that focuses help on those disproportionately harmed by the pandemic. This restorative approach should be a starting point for a renewed and broader fight against systemic inequality. "Race-blind" strategies fail to recognize the existence of systemic racism and would ultimately perpetuate societal inequalities or even widen the racial divide.

APPENDIX: DATA AND GAP INDEX CONSTRUCTION

Table A1 lists the multiple public data sources used for this analysis. The neighborhood-level analysis is conducted at the ZIP Code Tabulation Area (ZCTA) level, as defined by the U.S. Census Bureau. The terms "neighborhood" and "ZCTA" are used interchangeably throughout.

Table A1: Data Sources

DATA SOURCE	ACCESS DATE	VARIABLES	GEOGRAPHY
NYC Health Coronavirus Data	March 11, 2021	COVID-19 Cases and Deaths per 100,000 residents	ZCTA
NYC Health Vaccination Dashboard	March 11, 2021	Percent of population that has received at least one COVID-19 vaccine	ZCTA
American Community Survey (2015-2019)	March 11, 2021	Hispanic and Non-Hispanic Race; Hispanic Ethnicities; Over 65; Bachelor's Degree or Higher	ZCTA
Household Pulse Survey	March 15, 2021	Vaccination Rates by Age and Education; Reluctance to Vaccination by Race	New York State proportion of the NY-NJ-PA Metropolitan Area

The New York City Department of Health and Mental Hygiene is one of the largest public health agencies in the world, with over 6,000 employees serving 8 million New Yorkers.[xix] The department makes COVID-19 data available through its data and mapping portal, with detailed and downloadable information housed at Github. Confirmed case, death, and vaccination data are available for ZCTAs. Although the data are updated daily, the statistics can lag behind as long as a week because of delays in reporting.

We use COVID-19 death rates, as opposed to case rates, to measure the impact of the pandemic on a neighborhood. Case rates are a more problematic measure due to limited access to testing early in the pandemic and significant racial disparities in testing rates. A study of testing rates in New York during March and April 2020 found higher testing rates in ZCTAs with a larger NH-White population.[xx] COVID-19 death rates are a better indicator because the information comes from death certificates; nonetheless, it is also subject to some racial misclassification.[xxi]

The ZCTA-level data on race, age, and education come from the 2015—2019 five-year average American Community Survey (ACS) estimates. The ACS is a continuous survey conducted by the U.S. Census Bureau to collect housing, demographic, social, and economic information. On an annual basis, the sample represents about 2.0—2.5 percent of households and individuals; as such, reported statistics are subject to sampling variation. For small geographies (less than 65,000 persons), statistics are reported as a five-year average. ZCTAs fall into this five-year reporting category.

The Household Pulse Survey is conducted by the U.S. Census Bureau in collaboration with multiple federal agencies to collect data on the social and economic effects of COVID-19 pandemic on American households. The online survey is conducted in English and Spanish and includes questions on vaccination and intention to vaccinate, along with socioeconomic and demographic data. For our analysis, we use the sample from January 6 to March 15, 2021, which surveyed 5,859 Non-Hispanic White and Hispanic respondents residing in the New York State portion of the NY-NJ-PA metropolitan area.

Our gap metric identifies spatial disparities between neighborhoods hit hardest with high COVID-19 death rates and least protected by vaccination, and neighborhoods with low COVID-19 death rates but high vaccination protection. Overall, we observe an inverse relationship between the outcomes: ZCTAs with low death rates have on average higher vaccination rates and ZCTAs with high death rates have on the average lower vaccination rates. This negative correlation can be seen in Figure A1.

Figure A1: COVID-19 Vaccination and Death Rates in NYC
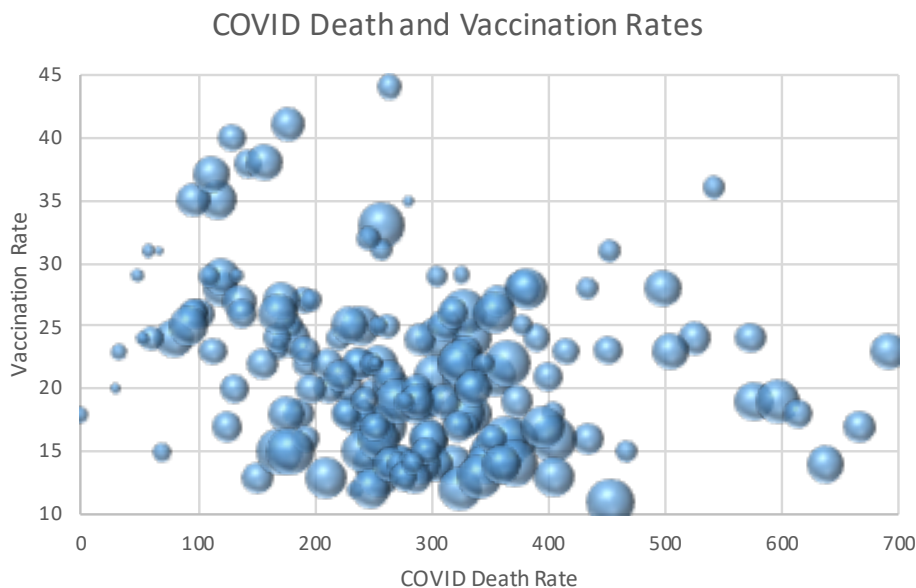
To quantify the gap, we created an index measuring the difference between the death rate and the vaccination rate in a neighborhood. This is done in two steps: the first part normalizes each input (due to different scales with different distributions) by converting the two values into a population-weighted normalized z-score, then taking the difference:

Death-Vaccination Gap for ith ZCTA =
(Z-score of Death Rate for ith ZCTA) - (Z-score of Vaccination Rate for ith ZCTA)
For ZCTAs from 1 ... n.

We then rank the gap metric by classifying each ZCTA into one of three categories: top quartile, middle half, and bottom quartile. For the maps, categories are population weighted such that the top quartile consists of 25 percent of the total population, not 25 percent of the ZCTAs. For the distribution analysis reported in the bar charts, we use population-weighted quintiles, which enable us to estimate the number of people exposed to risky environments with high gap metrics. For the table, we report the average ranking, where higher values means higher risk.

ENDNOTES

[i] While the data analyzed in this brief uses the U.S. Census Bureau definition and term "Hispanic," we use Latino and Hispanic interchangeably in this brief.

[ii] Corrine N. Thompson, Jennifer Baumgartner, Carolina Pichardo, et al. (November 2020). "COVID-19 Outbreak — New York City, February 29–June 1, 2020," MMWR Morb Mortal Wkly Rep 2020; 69:1725–1729, available online.

[iii] "Tracking Coronavirus in New York: Latest Map and Case Count" (Updated April 20, 2021), *New York Times*, available online.

[iv] Laura E. Martínez, Arturo Vargas-Bustamante, Yohualli Balderas-Medina Anaya, Rodrigo Domínguez-Villegas, Seira Santizo-Greenwood, Sonja F.M. Diaz, David E. Hayes Bautista (July 2020). *COVID-19 in Vulnerable Communities: An Examination by Race/Ethnicity in Los Angeles and New York City*, UCLA Latino Policy & Politics Initiative, available online.
See also: "COVID-19 Cases in New York City, a Neighborhood-Level Analysis" (April 2020), NYU Furman Center, available online.

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