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Mapping Disparities in COVID-19: Determining the Demographic, Economic, Educational, Housing, Quality of Life, and Health Factors that Relate to Disparities in COVID-19 infections and Deaths

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Background:
Though everyone in the United States has been impacted by the COVID-19 pandemic, certain racial/ethnic minorities, particularly Hispanics and African Americans, have experienced disproportionately high infection, hospitalization, and death rates [1-3]. In order to address the disparities in COVID-19 rates, researchers must first analyze the factors behind racial disparities in health. Research reveals that, compared to whites, African Americans and Hispanics experience greater chronic disease severity, higher rates of preventable hospitalizations, and higher rates obesity, diabetes, and HIV/AIDS conditions which increase risk for COVID-19. [4-6]. These same groups suffer from substandard housing more than their white counterparts, and crowded/dilapidated housing increases risk for infectious disease [7-8]. Furthermore, African Americans and Hispanics may avoid seeking treatment when infected with COVID-19 due to high rates of uninsurance and limited access to primary care [9-10]. Furthermore, compared to whites, Hispanics and African Americans experience lower socioeconomic status, increasing risk for disease and COVID-19 infection. Though each of these aforementioned factors are important in determining health, housing, income, education, quality of life, and healthcare factors intersect to create the observed racial/ethnic disparities in COVID-19 infection and death rates. In order to reveal areas of possible intervention, we set out to determine which of these factors predicted disparity in COVID-19 infection.

Methods:
Using USAFacts data from June 2, we calculated the infection rate (cases per person) for every county in the United States [12]. We then selected the 150 counties with the highest infection rates and collected data from the U.S. Census Bureau and other sources on COVID risk factors relating to demographics, housing, health, quality of life, economics, and education [13-16]. We then used statistical t-testing to compare the 25 counties with the highest white population (not Hispanic or Latino) to the 25 counties with the highest black population and those with the highest Hispanic/Latino population. Though useful, the county level analysis was not specific and could not reveal areas of concentrated risk that were nested within well-off counties. To analyze COVID-19 and related risk factors at a more specific level, we used PolicyMap to collect a series of data for zip codes in Chicago (Cook County) and New York City (Manhattan, Kings, Bronx, Richmond, and Queens County). We then used statistical t-testing to compare the 40 zip codes with the highest white populations to the 40 zip codes with the highest African American and Hispanic/Latino populations. We also did a correlation analysis, relating COVID cases per 100,000 people to each of our variables. Finally, we sent our data to ArcGIS consultant Beth Wilkerson who performed do zip code level mapping for several of our variables.

Results:
County-Level Analysis: County level analysis revealed significant differences between predominantly white and predominantly black zip codes (see Figure 1). Namely, compared to the counties with a larger African American demographic, the more white-populated counties demonstrated lower COVID death rates, higher high school and college graduation rates, higher labor force participation, a higher median income, lower poverty and unemployment, greater vehicle use, lower rates of uninsurance, obesity, smoking, diabetes, HIV, and low birthweight, higher life expectancy, and less premature death. Furthermore, these predominantly white counties were had higher high school graduation rates, lower uninsurance rates, and greater vehicle access than predominantly Hispanic counties.

Zip Code Level Analysis: For both Cook County and the NYC counties, predominately white zip codes demonstrated better outcomes than zip codes with large black and/or Hispanic populations (see figures 2 and 3). Correlation Analysis: For both Cook County and the NYC counties, crowded housing, dilapidated housing, high rates of minority populations, low economic status, low educational attainment, certain pre-existing conditions, and limited physical activity were correlated with higher COVID-19 rates.

Conclusions:
1. Zip Codes with large African American and/or Hispanic populations in NYC and Chicago exhibited high rates of COVID-19.
2. COVID-19 risk factors cluster together. Zip Codes with large minority populations, low income, and low educational attainment demonstrate high infection rates.
3. Variables such as crowded housing, dilapidated housing, and pre-existing conditions are also related to increased COVID-19 risk.
4. Interestingly, zip codes with high COVID rates and large minority populations also had lower flu vaccination rates and a lower percentage of people with a primary doctor. These factors may increase COVID-19 risk, preventing individuals in these high-risk zip codes from seeking COVID-19 testing, treatment, or vaccination.

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