A COVID-19 SPECIAL REPORT

Analysis of Demographics and Mobility Across D.C. During COVID-19

January 26, 2021

A report by Talus Analytics for the Office of the District of Columbia Auditor

Office of the District of Columbia Auditor

Kathleen Patterson, District of Columbia Auditor

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Prepared For
Office of the D.C. Auditor
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Prepared by
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This is the third report from a collaborative effort between Talus Analytics and the Georgetown University Center for Global Health Science and Security, a research effort to be completed over a six-month period to help understand what COVID-19 mitigation policies have been and will be most effective in National Capital Region. The first analysis focused on COVID-19 policies and demographics in the region, and the second analysis focused on COVID-19 and education policy. This analysis provides an overview of the relative impacts of COVID-19 on different populations across the District with a specific focus on the demographics of those impacted most significantly by caseload and deaths, including an analysis of their employment as it relates to the differential effects on the populations across the District.

Talus Analytics is a research and development company that specializes in translating complex data into actionable information for global decision makers, specifically in context of risk. By blending scientific, economic, and policy analysis into interactive decision-making tools, partners can make real time decisions with profound impacts. During the COVID-19 pandemic, Talus Analytics has supported the US Centers for Disease Control and Prevention in developing response tools for hospital visibility and the Nevada Governor's Office to provide real time analytical support and data analysis for the response. In addition, the Talus team has worked closely with the Georgetown University Center for Global Health Science and Security to develop a comprehensive dataset of the policies implemented globally to mitigate COVID-19 provide web-based visual tools to explore those data; this platform has served as the basis for much of the work presented in this report.

Executive Summary

In the early days of the COVID-19 pandemic, decision makers across the world created policies to curb the spread of the disease. These policies influenced many aspects of society in an effort to reduce COVID-19 caseload and deaths and limit economic impacts. There is now a growing set of data capturing policies, the effects on the policy environment, and the ongoing impacts of the pandemic itself on different regions and populations, as measured by these different impacts. Together, these data provide a basis to better understand how and whether policies achieved their intended outcomes and, where possible, to inform future policymaking to best support those continuing to experience the impacts of the pandemic. This report describes the analysis of these impacts across different communities within Washington, D.C., and provides the foundation for further analysis for the relative impact of policies on each of these groups.

Analysis of COVID-19 cases and fatalities in the context of regional demographic differences within D.C. showed that Wards with more COVID-19 cases and deaths are least likely to be employed in sectors that support work from home, which correlates with lower income rates and higher mobility throughout the pandemic. Though D.C. residents were much more likely to stay home since the start of the pandemic, those in Wards 7 and 8 had the smallest increase in people staying home, both in the spring when stay-at-home orders were in place and through the end of 2020, consistent with needing to leave home for work. These results are consistent with trends reported nationally: underserved and socially and economically vulnerable populations face disproportionate impacts from COVID-19.

Key Findings

- The effect of social distancing policies and efforts to promote work from home did not increase stay-at-home behavior equally and evenly across D.C.
- Essential and frontline workers appear to be more mobile, concentrated in Wards 7 and 8, and to a lesser extent, Wards 4 and 5.
- Geographical areas of D.C. with large populations not able to work from home are the same as those areas most impacted by COVID-19 and those areas with the largest Black and Hispanic populations.
- At the neighborhood scale, inability to work from home is also aligned with other social and economic risk factors including lower income, lower high school graduation rates, and higher indexed measures of social vulnerability.
- Together, these data suggest that future policy aimed at protecting frontline and essential workers can also help to protect those most vulnerable for social and economic reasons.

Better understanding these impacts can help to form a stronger basis for future policymaking that promotes equity and protects the most vulnerable to COVID-19, from informing how industries return to work and operate to reinforcing access to healthcare and providing a rationale for the

prioritization of COVID-19 vaccination.

Introduction

As the COVID-19 pandemic unfolded, the global community has struggled to understand the relative impact of the disease on populations and the way in which policymakers and governments can help mitigate those impacts and protect the public. With only limited information about how the disease impacted different demographic subsectors, but with an acknowledgment that some types of work and services were critical for support of the population as a whole, governments implemented a broad range of social distancing measures and both private and public sector closures, in addition to a vast array of policies on other topics, including enabling and relief measures, testing and contact tracing policies, and travel restrictions.[1] These policies included a specific focus on essential work, whether defined as those in health care, those providing frontline public safety and medical services, and those maintaining the food supply for the public, such as grocery store workers and truck drivers. However, as the pandemic has continued and there have been iterative phases of closures and reopenings, and as additional data have become available about who is most at risk to COVID-19 infection and death, there has been a renewed focus on better understanding the intersection between risk and policy.

Over the past year there has been a significant amount of research conducted to understand which demographic groups are the most impacted by COVID-19 cases and deaths. As the pandemic has progressed, evidence has accumulated to suggest that not all groups are similarly impacted and that numerous risk factors increase susceptibility. Age and medical preconditions have been widely reported, with one such study finding those 55-64 years old had more than eight times and those 65 or older more than 62 times mortality rates than those in younger age brackets.[2] Those with preexisting conditions, especially for those with cancer, kidney disease, COPD, heart conditions, immunosuppression, obesity, sickle cell disease, type 2 diabetes, and those who smoke or are pregnant are at the highest increased risk for severe illness according to the CDC.[3,4] These patients are more likely to have a severe immune system response called a cytokine storm, and for those with underlying and preexisting conditions their immune system's ability to fight off the infection is compromised.[5]

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1 COVID AMP Visualizing the impact of policies on COVID response. https://covidamp.org/.

2 Yanez, N.D., Weiss, N.S., Romand, J., & Treggiari, M.M. COVID-19 mortality risk for older men and women. *BMC Public Health* (2020, November 19). https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-020-09826-8#:~:text=Persons%20age%2065%20or%20older,CI%20%3D%201.74%2C%201.79.

3 Scientific Evidence for Conditions that Increase Risk of Severe Illness. *Centers for Disease Control and Prevention* (2020, November 2). https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/evidence-table.html.

4 People with Certain Medical Conditions. *Centers for Disease Control and Prevention* (2020, December 29). https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html.

5 COVID-19: Who's at higher risk of serious symptoms? *Mayo Clinic* (2020, December 22). https://www.mayoclinic.org/diseases-conditions/coronavirus/in-depth/coronavirus-who-is-at-risk/art-20483301.

In addition to age and underlying conditions, research shows that throughout the United States, racial and ethnic minorities are at an increased risk of severe disease and mortality from COVID-19.[6] The virus does not inherently impact minorities, as their case severity and fatality rates are similar to Caucasians, but increased risk has been attributed to their higher risk of exposure which is likely exacerbated in cases where these same populations also lack health insurance or access to health care and higher rates of co-morbidities.[7] [8,9,10] Compounding this, socioeconomic factors also increase COVID-19 risk, with populations in substantially non-white and low-income households being eight times more likely to be infected and with fatality rates that are nine times higher.[11] These populations are also often at higher exposure levels because they are more likely to be essential workers, have less access to healthcare, live in more crowded households, and rely on public transportation.[12] Those populations with higher mobility are generally at higher risk due to more exposure.[13]

This report analyzes this intersection of risk between socioeconomic risk factors, merged with the underlying risk factors associated with those who continue to work in person, including jobs in contact with the general public, and the disproportionate role of underserved populations in performing the essential and frontline work. D.C. has implemented a wide range of policies intended to mitigate the impacts of COVID-19 and protect its population.[14] This report provides a demographic analysis of the relative impacts of COVID-19 across the District with a specific focus on those elements for which policies may be able to serve a mitigating role.

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6 Rentsch, C.T., Kidwai-Khan, F., Tate, J.P., Park, L.S., King Jr., J.T., Skanderson, M., Hauser, R.G., Schultze, A., Jarvis, C.I., Holodniy, M., Lo Re III, V., Akgün, K.M., Crothers, K., Taddei, T.H., Freiberg, M.S., & Justice, A.C. Patterns of COVID-19 testing and mortality by race and ethnicity among United States veterans: A nationwide cohort study. *PLOS Medicine* (2020, September 22). https://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1003379.

7 Gold, J, et al. Race, Ethnicity, and Age Trends in Persons who Died from COVID-19 – United States, May-August 2020. *Morbidity and Mortality Weekly Report* (2020, October 23). https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6942e1-H.pdf.

8 Zelner, J., Trangucci, R., Naraharisetti, R., Cao, A., Malosh, R., Broen, K., Masters, N., & Delameter, P. Racial Disparities in Coronavirus Disease 2019 (COVID-19) Mortality Are Driven by Unequal Infection Risks. *Clinical Infectious Diseases* (2020, November 21). https://www.academic.oup.com/cid/advance-article/doi/10.1093/cid/ciaa1723/5998295.

9 Rentsch et al. (2020).

10 Artiga S, Corralo B, & Pham O. Racial Disparities in COVID-19: Key Findings from Available Data and Analysis. (2020, August 17). https://www.kff.org/report-section/racial-disparities-in-covid-19-key-findings-from-available-data-and-analysis-issue-brief/.

11 Adhikari, S., Pantaleo, N.P., Feldman, J.M., Olugbenaga, O., Thorpe, L., & Troxel, A.B. Assessment of Community-Level Disparities in Coronavirus Disease 2019 (COVID-19) Infections and Deaths in Large US Metropolitan Areas. *JAMA Network Open* (2020, July 28). https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2768723?resultClick=1.

12 Zelner et al. (2020).

13 Badr, H.S., Du, H., Marshall, M., Dong, E., Squire, M.M., & Gardner, L.M. Association between mobility patterns and COVID-19 transmission in the USA: a mathematical modeling study. *Lancet Infectious Diseases* (2020, July 1). https://www.thelancet.com/pdfs/journals/laninf/PIIS1473-3099(20)30553-3.pdf.

14 COVID AMP Visualizing the impact of policies on COVID response. https://covidamp.org/.

Key Data Sources

Case and death data are from the D.C. coronavirus website, https://coronavirus.dc.gov/data. The D.C. demographic data are from DC Health Matters https://www.dchealthmatters.org/, and the Centers for Disease Control (CDC) Behavioral Risk Factor Surveillance System https://www.cdc.gov/brfss/index.html. Socio-economic and health demographic factors were extracted from the most recently reported year (2017, 2018, or 2020), and aggregated to the D.C. ward-level (n=8). Occupation data from the American Community Survey (2014-2018), https://www.census.gov/programs-surveys/acs/data.html, was used for census tract-level resolution of broad categories of occupations of D.C. residents.

Mobility data is from the SafeGraph social distancing dataset, from January 2020 to October 20, 2020, https://docs.safegraph.com/docs; https://www.safegraph.com/data-examples/covid19-shelter-in-place. SafeGraph's completely_home_device_count was used to measure relative changes in mobility. This change in mobility is measured as the percent increase in devices that did not leave their home location compared to pre-pandemic levels. The home location is determined by finding the most common location, down to a ~153m x ~153m area, where each device resides at night. To understand how many jobs categories can transition to working from home, the methods and results from Dingel and Neiman (June 19, 2020) were used (https://github.com/jdingel/DingelNeiman-workathome/blob/master/DingelNeiman-workathome.pdf) including the code (https://github.com/jdingel/DingelNeiman-workathome). O*NET is a data source consisting of detailed descriptions of various occupations, including which tasks are performed. Using this information, Dingel and Neiman were able to approximate the likelihood that a given occupation could be conducted via telework. Their code and resulting datasets are here: https://github.com/jdingel/DingelNeiman-workathome. This includes a link to the flags associated with each occupation, the likelihood of working from home by industry, etc. This indicator has been shown to be inversely correlated with Safegraph's completely_home_device_count measure. This correlation appeared at the census tract level in D.C. as well. The O*NET data can be matched to the occupation data in an area to get an approximation of the number of people in occupations that can transition to telework.

Results

Within the National Capital Region (NCR) and nationally, response and policymaking have not equally mitigated the impacts of COVID-19 for all groups and geographical areas. As part of a previous report focused on analyzing the effect of COVID-19 policies in the NCR, initial findings about the effects of COVID-19 policies were reported, including in the context of unequal burdens

of COVID-19 cases in different parts of the NCR.[15,16] Here, this analysis is extended, with a focus on the District of Columbia, to identify patterns in demographics (age as well as race and ethnicity), socioeconomic characteristics (prevalence of poverty, population levels of educational attainment), and in what sectors people tend to be employed (e.g., essential workers required to travel in person for work versus those who can work from home) to better understand these differential impacts of COVID-19 cases and fatalities and inform future policy.

Social distancing policies did not reduce mobility equally across D.C.

Policy is most effective when applied consistently and followed. In general, the goal of most policies during the pandemic was to encourage as many residents as possible to stay home and reduce social contact–to increase social distancing. Stay-at-home orders and policies encouraging businesses to operate remotely or requiring non-essential businesses to cease in-person operations were widely adopted to stop the spread of COVID-19. The ability for any individual to change their behavior is part choice, part necessity. For people who have work that is considered essential (e.g., healthcare, public safety and first responders, sanitation workers, grocery store employees) or who must return to 'frontline' work with exposure to the public in order to make a living (e.g., restaurants, public transit), leaving the house for work is required.

When stay-at-home orders were issued in D.C., District-wide general mobility patterns changed accordingly with a rapid and significant increase in people staying entirely at home, even before the April 1, 2020, stay-at-home order, and roughly aligned with the first mass gathering restrictions and private sector closures in the District on March 13 and 15, 2020, respectively (Figure 1).[17] The SafeGraph social distancing mobility changes were calculated as the average change in devices that were classified as 'stay at home', using the time period of January 1-February 1 as the baseline behavior. The percent change was calculated using this baseline, by day and at the census block group level, then averaged for all of D.C. Notably, this pattern was reflected widely across the US, including in Maryland and Virginia and was significant, but did not necessarily correspond to when policies were implemented in each state.[18] The increase in D.C. residents staying home persisted through the end of the stay-at-home order on May 29, 2020. It has since been decreasing though mobility data measuring mobile phones that stayed entirely at home shows that residents still stay home more than they did in early 2020.[19]

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15 As defined by the Metropolitan Washington Council of Governments and for this report, the National Capital Region includes: Washington, D.C.; in Maryland: Town of Bladensburg, Bowie City, College Park City, Charles County, Frederick County, Gaithersburg City, Greenbelt City, Hyattsville City, Laurel City, Montgomery County, Prince George's County, Rockville City, Takoma Park City; in Virginia: Alexandria City, Arlington County, Fairfax City, Fairfax County, Falls Church City, Loudon County, Manassas City, Manassas Park City, and Prince William County.

16 COVID-19 Special Report: Mitigation Policy During the Pandemic (November 3, 2020). https://dcauditor.org/report/mitigation-policy-during-the-pandemic/.

17 Ibid.

18 Ibid.

19 SafeGraph. https://docs.safegraph.com/docs/social-distancing-metrics.

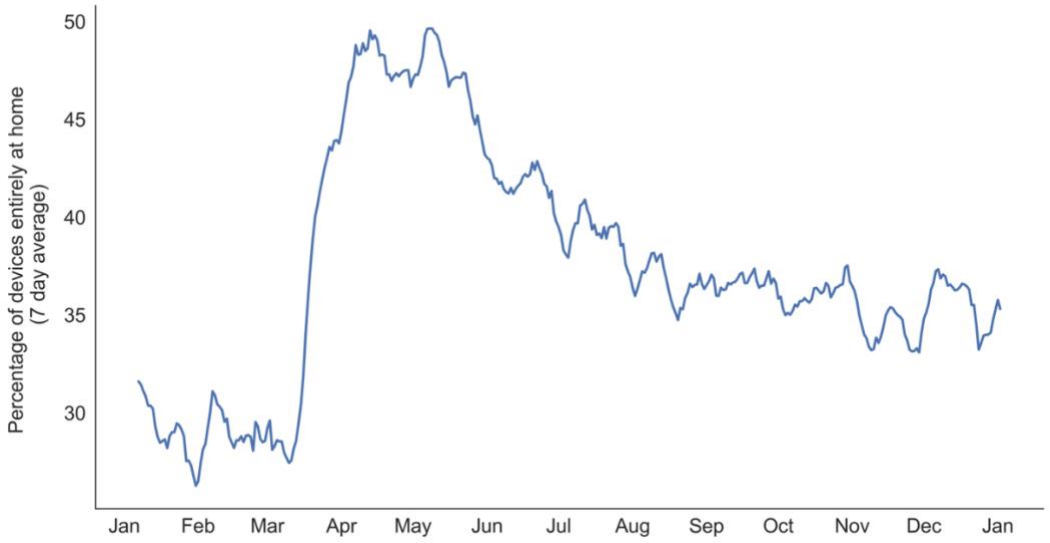

Figure 1: Increase in residents staying at home during COVID-19 pandemic. SafeGraph mobility changes for all of the District of Columbia measuring daily location of mobile devices as a proxy for residents that did not leave home.

The increase in residents staying home was not uniform across D.C. Wards 7 and 8 showed lower peak stay-at-home activity in the spring. The increase in residents staying home was not uniform across D.C. During the spring, Wards 7 and 8 did not have as much of a change in their ability to stay at home, relative to their pre-pandemic behavior, especially when compared to the other wards. By October, the disparity between wards remained, and although there was a 30% sustained increase in fully stay-at-home behavior citywide, Ward 3 still had a nearly 50% increase in devices measured as staying entirely at home, while Wards 7 and 8 were at 19% and 14% respectively (Figure 2).

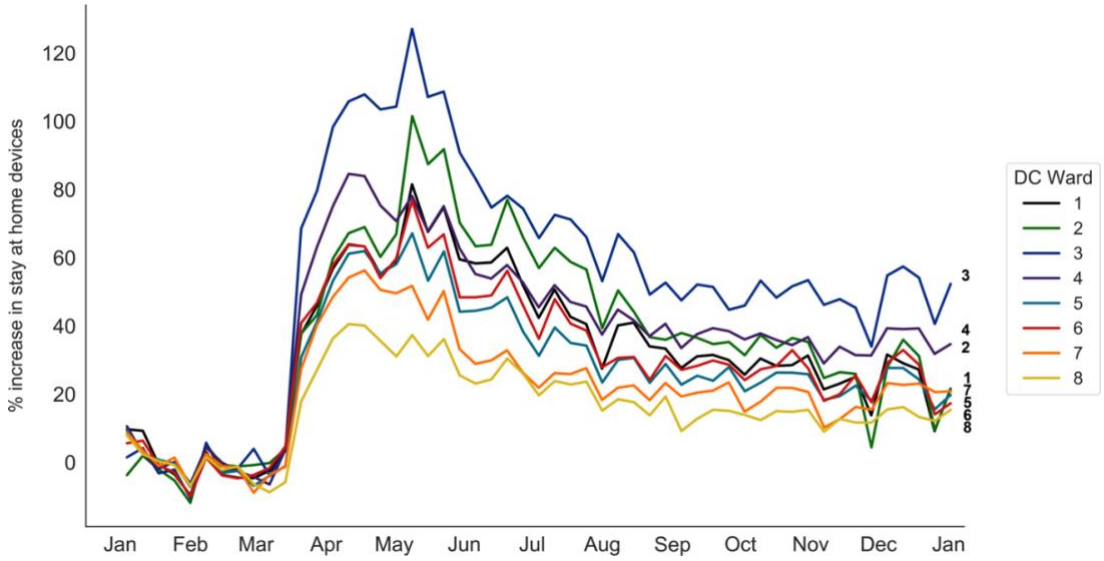

Figure 2: Increase in residents staying at home during COVID-19 pandemic, by Ward. SafeGraph mobility changes in each ward across the District measuring daily location of mobile devices as a proxy for residents that did not leave home.

More essential and frontline workers live in Wards 7 and 8.

With regard to the policies implemented across the United States with a focus on social distancing, private and public sector closures largely exempted significant portions of the employment sector. Essential businesses were, in fact, encouraged to remain open, necessitating that those working for those businesses continue to leave their homes. These essential businesses included not only healthcare and public health operations, but essential infrastructure, grocery stores, food delivery workers, and those in the construction and trades that "are necessary to maintaining the safety, sanitation, and operation of residences and Essential Businesses."[20] Most states use the Department of Homeland Security's Cybersecurity and Infrastructure Security Agency guidelines to determine essential businesses, with a few exceptions.[21] Eight states that did not declare any businesses essential or nonessential. A few states, including Washington, New York and Florida did not, for example, originally include construction on their lists of essential workers, but as of summer 2021 most included a construction category. Given that essential workers would need to continue to leave their homes to perform essential work, it was hypothesized that this would likely align with the reduction in mobility. Indeed, the employment categories available from the Census Bureau American Community Survey were used to map the relative likelihood that a given job could transition to telework using methods developed by Dingel and Neiman.[22] Across the District, people who lived in Wards 7 and 8 were less likely to have a job that allowed them to work from home compared to other Wards. Conversely, over 50% of people living in Wards 1, 2, 3 and 6 had jobs that were likely to support transition to working from home (Figure 3). Employment information was used from the American Community Survey (2014-2018), which captures the broad employment titles based on an individuals' residence.

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20 Mayor Bowser Orders Closure of Non-Essential Businesses. March 24, 2020. https://coronavirus.dc.gov/release/mayor-bowser-orders-closure-non-essential-businesses.

21 U.S. Department of Homeland Security Cybersecurity and Infrastructure Security Agency Guidance on the Essential Critical Infrastructure Workforce. As of December 16, 2020. https://www.cisa.gov/publication/guidance-essential-critical-infrastructure-workforce.

22 Dingel, J. Neiman, B. *How Many Jobs Can be Done at Home?* https://github.com/jdingel/DingelNeiman-workathome.

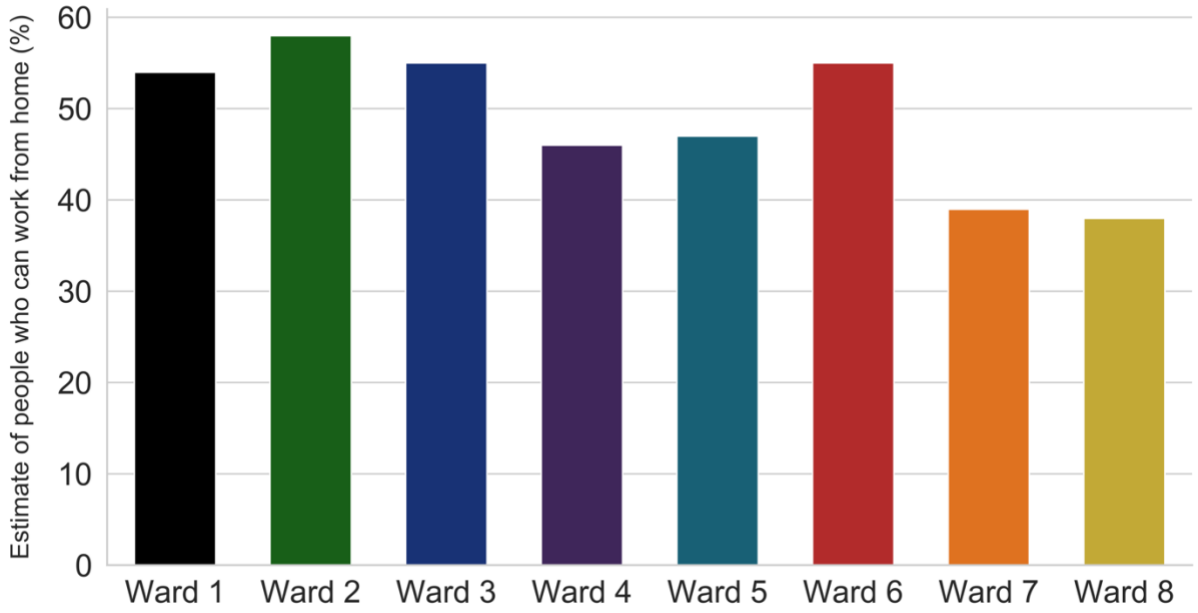

Figure 3: Estimates of the portion of the population in each Ward of D.C. that can work from home. Using the methods outlined in Dingel and Neiman combined with the job title categories in the American Community Survey (2014-2018), the approximate proportion of who could work from home was calculated, by ward.

Disparities in the ability to transition to work from home align with the patterns seen in mobility (comparing Figures 2 and 3). Wards 7 and 8, where residents work in industries least amenable to telework, the smallest increases were seen for residents staying at home. Indeed, between April 1-May 29, 2020, Ward 8 only had a 41% increase in those staying at home whereas Ward 3 had a nearly two-fold increase (additional quantification of the data presented in Figure 2), when measuring the average percent change in SafeGraph's completely_home_devices measure compared to baseline (January 1-February 1).

Measuring the relationship between ability to work from home and proportion of residents staying at home was even more evident when considering Census Tracts, smaller geographic units derived from the American Community Survey of the Census Bureau, which comprise neighborhood-sized continuous geographic regions with populations of several thousand, as opposed to tens of thousands for each Ward. Using the combination of data from the American Community Survey (2014-2018) and the estimated telework score from Dingel and Neiman,[23] the estimated proportion of the population was calculated at a census tract level of resolution. This was used to compare the actual mobility changes seen from the SafeGraph social distancing dataset, plotting the average percent increase. Figure 4 shows the relationship between the likelihood that someone's profession can transition to working from home, by Census Tract, and the percent increase in devices that were

[23] Dingel, J. Neiman, B. *How Many Jobs Can be Done at Home?* https://github.com/jdingel/DingelNeiman-workathome.

considered completely at home (January-April, 2020). Indeed, Wards 4, 7, and 8 dominate the Census Tracts for which less than 40% of the population are in employment that is likely to support work from home.

Figure 4: Relationship between ability to transition to work from home and staying at home. Using the methods outlined in Dingel and Neiman combined with the job title categories in the American Community Survey (2014-2018), the approximate proportion of who could work from home was calculated by ward. This was compared to the actual average change in mobility (using SafeGraph) during the stay-at-home period from the pre-pandemic baseline (January-February 2020). Note: when considering percent change, the value can be read as "1.5 times (150%) the baseline mobility level. Correlation coefficient 0.42, $p<0.0001$.

There are disparities in COVID-19 burden across D.C.

Given the distribution between each Ward and the differential ability to stay home, aligned with employment in sectors that least support work from home, the next question was whether this aligned with differential rates in COVID-19 caseload and fatalities. Indeed, as shown in Figure 5, Wards 4, 5, 7, and 8 have the greatest burden of cases among wards in D.C, as measured as cases per 100,000 residents. Ward 3 has a dramatically lower number of COVID-19 cases per capita, which aligns with the mobility data that show the ward as having the largest proportion of the population staying at home and a high proportion of workers likely to be able to work from home (compare to Figures 2 and 3).

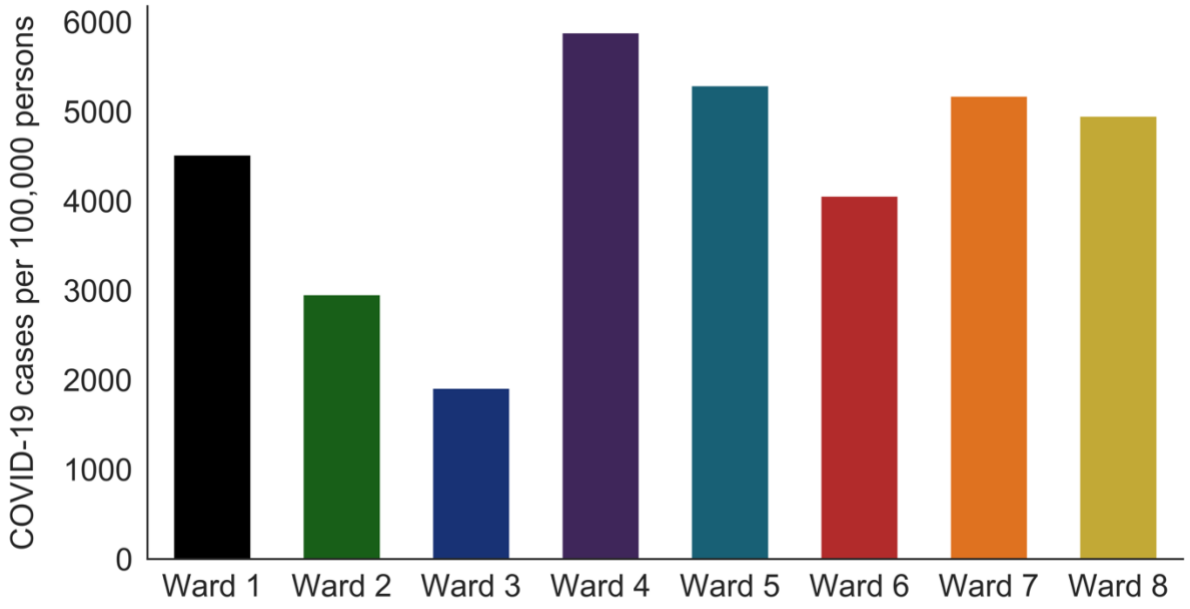

Figure 5: COVID-19 cases rates by D.C. ward, as of January 14, 2021. Wards 4 and 5 have the highest COVID-19 cases. Wards 3 and 2 have the lowest reported COVID-19 cases.

The link between race and ethnicity and higher rates of infection and deaths from COVID-19 in the United States has been well-established.[24,25,26,27,28] The Wards where the greatest proportion of the population identify as Black or Hispanic (Figure 6) are also those experiencing the highest COVID-19 infections (compare to Figure 5), based on data from the D.C. coronavirus website, https://coronavirus.dc.gov/data. In contrast, Wards 2 and 3, the Wards in D.C. where the greatest proportion of residents identify as White, cases per 100,000 residents are the lowest (Figures 5 and 6).

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24 Gold, J, et al. Race, Ethnicity, and Age Trends in Persons who Died from COVID-19–United States, May-August 2020. *Morbidityand Mortality Weekly Report* (2020, October 23). https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6942e1-H.pdf.

25 Zelner, J., Trangucci, R., Naraharisetti, R., Cao, A., Malosh, R., Broen, K., Masters, N., & Delameter, P. Racial Disparities in Coronavirus Disease 2019 (COVID-19) Mortality Are Driven by Unequal Infection Risks. *Clinical Infectious Diseases* (2020, November 21). https://www.academic.oup.com/cid/advance-article/doi/10.1093/cid/ciaa1723/5998295.

26 Rentsch et al. (2020).

27 Artiga S, Corralo B, & Pham O. Racial Disparities in COVID-19: Key Findings from Available Data and Analysis. (2020, August 17). https://www.kff.org/report-section/racial-disparities-in-covid-19-key-findings-from-available-data-and-analysis-issue-brief/.

28 Andrasfay T, Goldman N. Reductions in 2020 US life expectancy due to COVID-19 and the disproportionate impact on the Black and Latino populations. Proceedings of the National Academy of Sciences (2021, February). https://www.pnas.org/content/118/5/e2014746118.

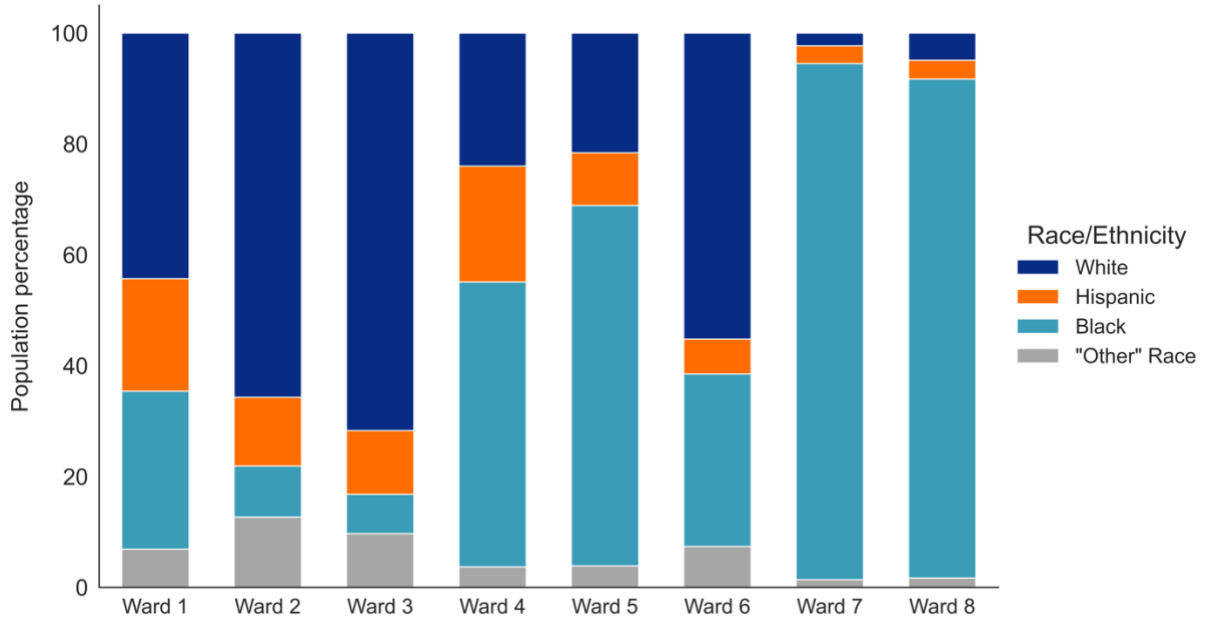

Figure 6: Race proportion by D.C. ward (2018). The Black community is the most prominent race in Washington, D.C., at about 47%. Black residents primarily live in Wards: 4, 5, 7 and 8.

Wards 4, 5, 7 and 8 also had the greatest number of deaths from COVID-19, measured as total lives lost and as deaths per 100,000 ward residents,[29] consistent with the fact that highest numbers of lives lost occur where there are the most people infected. A third measure, case fatality rate, calculates the percentage of known COVID-19 cases that result in death. Case fatality rate does not depend on the absolute number of cases and instead captures factors contributing to the severity of illness, such as age of the population, prevalence of underlying health conditions in the population, access to health care and seeking early treatment. Ward 8 has the highest case fatality rate in addition to being among the Wards with the most loss of life (Figure 7). Though health insurance coverage in D.C. is high compared to most regions of the country, it is notable that within the District Ward 8 has the highest percentage of people without health insurance.[30]

29 D.C. Government coronavirus website. https://coronavirus.dc.gov.

30 Office of the D.C. Auditor, COVID-19 Special Report: Mitigation Policy During the Pandemic (November 3, 2020). https://dcauditor.org/report/mitigation-policy-during-the-pandemic/.

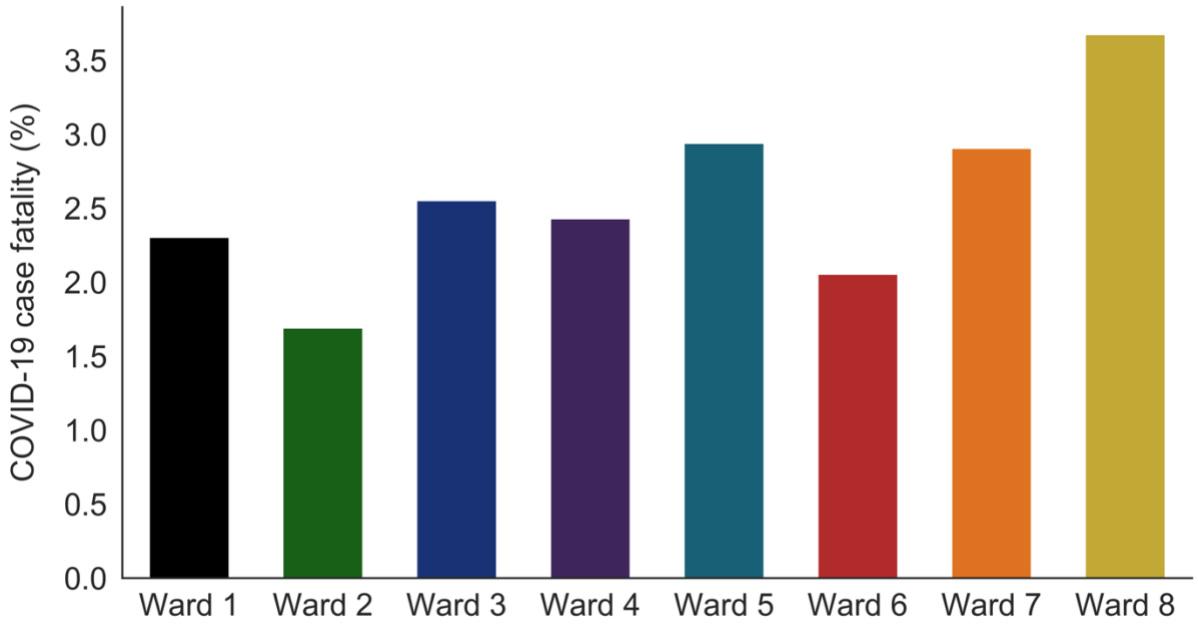

Figure 7: COVID-19 case fatality rates by D.C. ward, as of January 14, 2021. Ward 8 has the highest COVID-case fatality rate.

Differences in fatality rate for those who have had COVID-19 across D.C. do not appear to be entirely explained by the age of the population (the most significant risk factor for dying after contracting COVID-19) as the Wards with the highest fatalities rates do not have disproportionally older populations, particularly considering Ward 8 where case fatality has been highest but with also one of the youngest populations (Figure 8).[31] It is possible that the distribution of cases in each Ward is not directly proportional to the population; additional analysis will be required to further understand this relationship.

[31] D.C. Health Matters. https://www.dchealthmatters.org/.

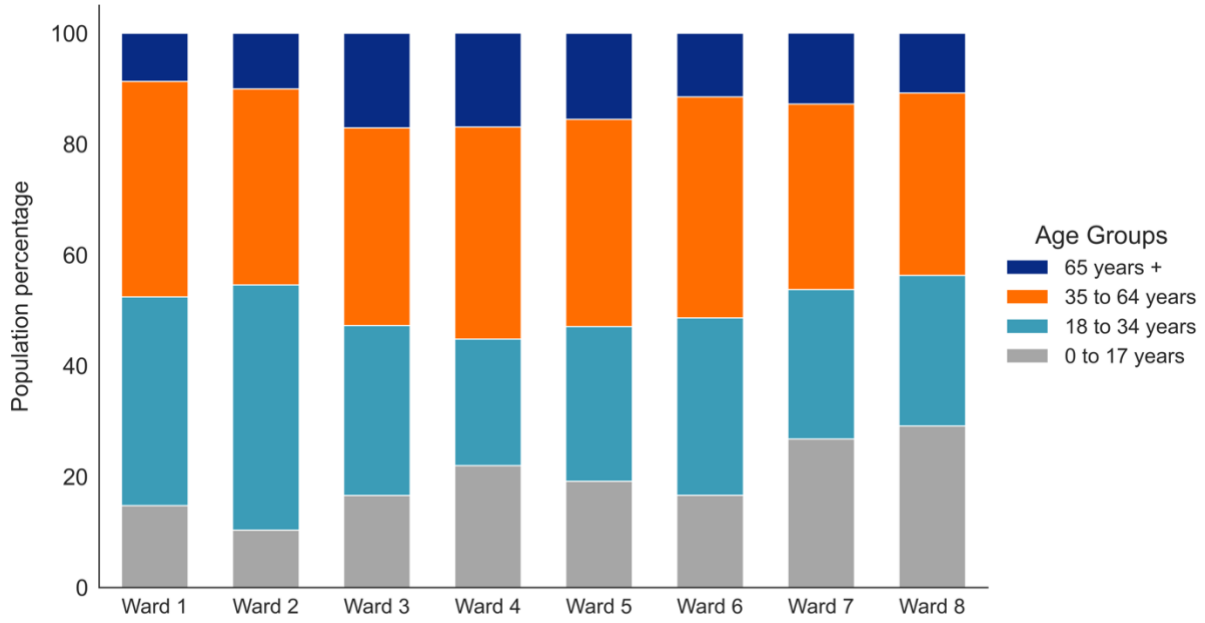

Figure 8: Age proportion by D.C. ward (2018). Younger populations primarily reside in Wards 7 and 8, while larger proportions of older populations (65 years+) reside in Wards 3, 4, and 5.

Wards 4 and 5 were analyzed more closely to better understand the dynamics driving conditions where case counts were high but where there did not seem to be as many essential and frontline workers as in Wards 7 and 8 (see Figures 2 and 3). Wards 4 and 5 were found to have intermediate proportions of the population staying at home and having the ability to work from home. Occupation patterns in Wards 4 and 5 that might be associated with greater risk of exposure as a potential factor were also evaluated. Interestingly, these wards both have the highest number of workers in the healthcare industries, particularly home health care workers (Ward 4) and general medical personnel (Ward 5) occupations with an increased COVID-19 exposure risk and may account for the difference.[32,33]

The burden of COVID-19 is driven by an intersection of risk factors.

Taken together, the results above suggest significant and aligned disparities in the District for who can work from home, which relates to factors that are related to COVID-19 risk in D.C. and nationally. Using the approach described above to estimate the ability of residents to work from home, further analysis was performed to better understand the correlation between these risk factors. For this analysis, the CDC Social Vulnerability Index (SVI) data was aggregated to the census tract level and compared against the telework estimates from the American Community

[32] D.C. Department of Employment Services, Washington, D.C. Economic Insights dashboard. https://does.dc.gov/page/labor-statistics.

[33] These data are based on location of the employer, not the worker; further analysis will be required.

Survey data, using the methods outlined by Dingel and Neiman.[34] [35] CDC SVI is a composite metric of 15 factors—such as measures of poverty, access to transportation, and whether housing conditions are crowded—that sociological research has identified as associated with greater vulnerability to hazardous events, from disease outbreaks to natural or man-made disasters. When measured against the ability to work from home, the two are strongly related: the neighborhoods in D.C. measured as most socially vulnerable also have the residents in jobs least likely to be able to work from home (Figure 9).

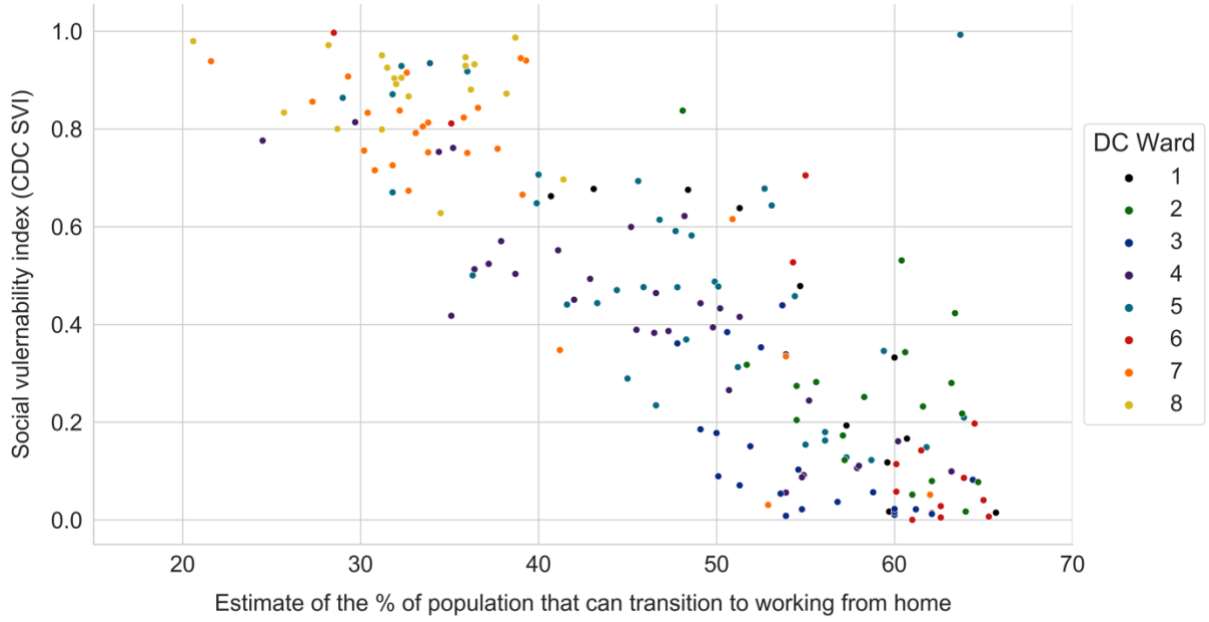

Figure 9: Ability to work from home is inversely related to measures of social vulnerability. Higher scores (assessed as more vulnerable neighborhoods) are seen in the regions with populations least likely to have the ability to transition to work from home during the pandemic. The social vulnerability index (from CDC) is normalized from 0 to 1. (correlation coefficient: -0.82, $p<0.0001$)

Similarly, measures of both income and educational attainment had a relationship to ability to work from home that points to a compounding of factors that increase risk to COVID-19[36]. Per capita income was positively associated with ability to work from home with more wealth found in areas where residents are most likely to be able to work from home (Figure 10).

[34] CDC Social Vulnerability Index. https://data.cdc.gov/browse?tags=social%20vulnerability%20index.

[35] Dingel, J. Neiman, B. *How Many Jobs Can be Done at Home?* https://github.com/jdingel/DingelNeiman-workathome.

[36] Seligman B, Ferranna M, & Bloom D. Social determinants of mortality from COVID-19: A simulation study using NHANES. PLOS ONE (2021, January 11). https://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1003490.

Figure 10: Higher income correlates with ability to work from home. Higher incomes are seen in the regions with populations least likely to have the ability to transition to work from home during the pandemic. (correlation coefficient 0.7, p<0.0001)

Finally, educational attainment, as measured by the percentage of the population with a high school diploma, was associated with ability to work from home. Wards with larger populations lacking a high school diploma were generally those with the lowest proportion working in sectors that could not easily work from home (Figure 11). Said differently, D.C. neighborhoods with fewer high school graduates had more workers who likely had to physically work in person during the COVID-19 pandemic.

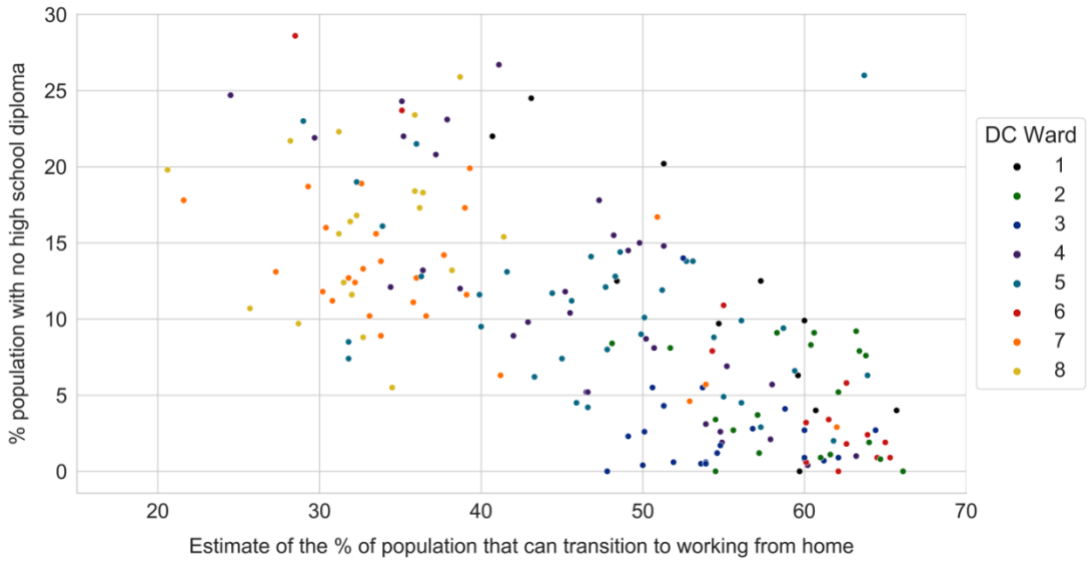

Figure 11: High school attainment correlates with the ability to work from home. Regions of D.C. with fewer high school graduates have populations less able to work from home. (correlation coefficient -065, p<0.0001)

These factors are all expected to interact and contribute to the disproportionate burden of COVID-19 seen in Wards 4, 5, 7 and 8 and Wards 7 and 8 in particular. Across the correlations seen in Figures 9-11, neighborhoods[37] in Wards 7 and 8 (darkest purple dots) tend to cluster in the portion of the chart representing the least ability to work from home and the lowest per capita income, highest rates of lacking a high school diploma, and highest measures of social vulnerability. Together, these findings provide an opportunity to inform future policy so that it supports those more vulnerable to COVID-19 because they are essential and frontline workers as well as those vulnerable for social and economic factors, which in the District of Columbia are largely intersecting and not competing interests.

Conclusions

COVID-19 has strained the limits of public health governance. Many of the critical early steps taken to manage and mitigate the outbreak had to be implemented in the absence of a robust understanding for the relative impact those actions and policies would have. Not only were there inconclusive data about the specific mechanism of spread, but also of the relative impact the disease would have on different populations. As 2021 begins, there is new context for these policies and the relative impacts.

The analysis presented here describes an intersection of risk factors related to disproportionate COVID-19 impacts for areas of D.C. that are home to more workers who work in sectors where they travel in person to work. Those most likely to be employed in essential work—those who were needed for critical functions throughout the pandemic and least able to work from home—are the same groups most likely to experience more caseload and higher case fatality rates. Based on analysis at the neighborhood level, these neighborhoods with more essential workers (concentrated in Wards 7 and 8 as well as Wards 4 and 5 to a lesser extent) are home to more Black and Hispanic residents, and, on aggregate are also areas with greater measures of social and economic vulnerability, including those related to income level and education. These trends are consistent with an emerging picture of who is most at risk from COVID-19 that goes beyond the first-characterized medical factors related to being elderly or having existing medical conditions.

As the pandemic continues and additional policies are put in place, including plans for vaccine distribution and administration, these challenges and inequities can be addressed. Helping ensure access to testing, early health care, and coverage for COVID-19 treatment will help people identify when they are contagious and receive the care they need once sick. The current focus in the District's vaccination plan is well aligned with this focus on testing essential workers, with clear targets for vaccinating high risk essential workers starting January 11, 2021, with remaining essential

[37] Captured as Census Tracts.

workers eligible as of February 1, 2021. Ensuring that these groups feel comfortable receiving the vaccine and have easy access to places of vaccination will be key.[38]

Future analysis will focus on the relative impact of different policies during the COVID-19 pandemic in reducing caseload and death both across the United States and within the District and the surrounding areas. These results can also then be applied to a more detailed analysis of how application of these policies may help further address and reduce the inequities in the impacts of this disease and the broader impacts of the pandemic.

[38] D.C. Government coronavirus website. https://coronavirus.dc.gov/vaccine.

About ODCA

The mission of the Office of the District of Columbia Auditor (ODCA) is to support the Council of the District of Columbia by making sound recommendations that improve the effectiveness, efficiency, and accountability of the District government.

To fulfill our mission, we conduct performance audits, non-audit reviews, and revenue certifications. The residents of the District of Columbia are one of our primary customers and we strive to keep the residents of the District of Columbia informed on how their government is operating and how their tax money is being spent.

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