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Racial Disparities in COVID-19 Deaths and Years of Life Lost in Connecticut: An Examination of Aggregation Biases in COVID-19 Analyses

Abstract

Using a novel dataset provided by the Connecticut Department of Health (CTDoH), this manuscript shows the necessity for and added utility from analyzing disaggregated COVID-19 outcome data for applied research. Connecticut is currently ranked the fourth highest state in death rates per 100,000 people from COVID-19 in the United States. Using deidentified death record files provided by the CTDoH, we take a deep dive into the racial and geographic disparity of COVID-19 deaths. The data shows a disproportionately large effect on young minority populations. Comparing the number of deaths in the state from March through May during the pandemic to the previous eight years shows that all ethnic and racial groups have seen an increase in mortality in 2020, but this increase is significantly more dramatic in minority populations, at around a 2-fold increase for blacks and Hispanics. We observe a similar pattern spatially, as towns with a minority-white population have much higher COVID-19 death rates, with some clustering found around the state's major population centers. We also find very little death from COVID-19 in rural towns. We examine other causes of deaths from 2012-2020 as a point of comparison and find some evidence of racial disparities in other forms of death, though all are magnitudes smaller than COVID-19, suggesting that the impact of COVID-19 is unique. There is evidence of some differences in the types of comorbidities present in COVID-19 deaths, but the number of comorbidities is very similar across racial and ethnic groups. Our analysis conforms to much of the published research on racial disparities in COVID-19 deaths but differs in several conclusions. These differences arise because of data aggregation issues and have critical policy implications.

JEL-Code: 114, J15

Keywords: COVID-19; health disparities; ethnic disparities; pandemics; coronaviruses; health risk factors

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¹ Thomas Krumel, Economic Research Service; Nathan Fiala, University of Connecticut, Makerere University and RWI; Corey Goodrich, University of South Florida. – The views expressed herein are those of the author and not of the Economic Research Service or the U.S. Department of Agriculture.-All correspondence to: Thomas Krumel, Economic Research Service, e-mail: thomas.krumel@usda.gov

1. Introduction

By the end of May, the state of Connecticut had nearly 4,000 deaths from COVID-19.ⁱ While this total number ranked the state eighth in the county at the time, when factoring in the population size, Connecticut is in the top-five of states, vaulting over larger states like California and Illinois. In addition to having a comparatively high death per 100,000 population, the state is flagged as likely having a high racial disparity in deaths.ⁱⁱ

In this paper, we present several issues that have arisen when aggregating COVID-19 outcome data, highlighting examples of results differing because of distinct types of aggregation bias. Our paper aims to collate and extend the related analyses using a single novel dataset provided by the Connecticut Department of Health (CTDoH),ⁱⁱⁱ with the intent of demonstrating the need for utilizing data aggregated to the appropriate level in applied research on COVID-19 related outcomes, using racial disparities as our example. We also provide additional preliminary analyses on this topic currently beyond the ability of data being used in other studies.

The CTDoH data contains information on the characteristics (including personal demographics, such as: age, gender, ethnicity, race, and town of residence) of individual deaths for all state mortalities, dating back to 2012. Related to the death itself, we can observe the primary cause, all associated comorbidities, the conditions under which the individual died, and the location of death.

We start by discussing three examples of problems with current aggregation of data. We then present the results of exploring the CTDoH data carefully and how this can lead to different conclusions. Our work highlights the need to look carefully at heterogeneous impacts of COVID-19 at the state and sub-state level.

2. Issues with aggregating data

When comparing the racial disparity in COVID-19 deaths, it is important to factor in the relative population size. There is a similar problem when ranking COVID-19 deaths for states since it is possible to under rank a particular group if the relative population is not considered. Recent press articles suggest this is a serious issue with the data. A Brookings Institute analysis systematically illustrates that when controlling for the population size by age grouping, minority groups can jump to nearly ten times the death rate, compared to whites, ^{iv} in certain age groups (contrasted to the much smaller differences illustrated in recent New York Times analysis, that did not account for the heterogeneities across age).^v The New York Times demonstrating that blacks and Hispanics were nearly three times the prevalence in cases over the entire population is striking; however, some nuance and subsequent impact is lost in the aggregate.

Aggregate data masking important differences in outcomes is partly a function of the current literature exploring COVID-19 related impacts relying on publicly available data sources.^{3,vi} These publicly available data sources tend to be highly aggregated on multiple levels, typically some combination of demographic, spatial and temporal.^{vii,viii,ix} A companion study to our analysis in a neighboring state (Massachusetts) solved the spatial aggregation issue, but did so at the expense of directly observing demographic composition.^x That study examines total COVID-19 cases by town, merging demographic variables from Census data to help explain COVID-19 spread. Because the authors were unable to directly observe who got COVID-19 in those towns, the need for statistical inference was required. The inference based on the town-level characteristics was "that a 10 percentage point increase in the Black population was associated with a 312.3 increase in COVID-19 cases per 100,000, while a 10 percentage point increase in the Latino population

³ For a discussion of aggregation bias contributing to conflicting results, see the recent dissertation Krumel (2020).

was associated with an increase of 258.2 cases per 100,000." While an important first step in identifying quantifiable health disparities, their analysis cannot say for certain who actually contracted the virus, which needs to be emphasized.^{4,xi,xii} Our analysis produces comparable results. However, we can more directly assess our COVID-19 outcome, as we have the demographic characteristic for everyone who died in our study area at the same level of geographic granularity.

The Brookings piece mentioned above disaggregates demographics at the expense of a less granular spatial scale (their unit of analysis is the entire county). Their analysis concludes that, "[w]hile geography may be part of the explanation for the race gaps, it does not look to be the main one." Again, we produce nearly identical results to their analysis;^{5,xiii} however, given the disaggregated spatial data, we come to a different conclusion: when examining spatially disaggregated data, where individuals live appears to have a strong correlation with minority deaths from COVID-19, as well as the converse, implying that geography matters a lot.

Most recently, the CDC produced an estimate of excess mortality by age, ethnicity, and race.^{xiv} The analysis was limited to addressing that singular question. We calculate excess deaths in a slightly different manner and produced nearly identical results when comparing overlapping time periods, which illustrates that their analysis is robust. The one conclusion we differed slightly from their analysis is the minority group most disaffected from excess deaths COVID-19. This difference exists because of the different timeframe examined, suggesting that temporal bias can also arise.⁶

⁴ Similar issues can be observed in Do and Frank (2020), and Benitez, Courtemanche, and Yelowitz (2020). While using community characteristics helps to paints an important picture in analyzing outcomes related to COVID-19, by using these broad classifications readily available, it is impossible to determine the actual impact. The measured correlation is likely very similar to the realized outcome, but it is impossible to know for sure.

⁵ Our calculated numbers are slightly smaller than their national averages because "[a]djusted for age, Connecticut, Massachusetts and New Jersey have experienced the highest COVID-19 mortality rate among their White residents."

⁶ Additionally, national trends might differ from specific states, which is again a spatial aggregation bias.

3. Study data and results

The first death from COVID-19 in the state of Connecticut was registered on March 17, 2020. Over the course of the next two and a half months, the death toll from COVID-19 would increase to nearly 4,000. Since the end of May, the next five months would witness a significant decrease in COVID-19 deaths, adding only approximately 500 to the total. Because of this sharp decrease in deaths in the subsequent months, it makes sense for our analysis to focus on the peak of the pandemic in the state to attempt to retrospectively analyze the mortality rates across different racial and ethnic groups. We focus on the three largest racial and ethnic groups in the state (white, Hispanic, and black), which constitute approximately 95 percent of the total state population (we exclude demographic groups with less than 5 percent of the total population, as analysis on these small samples will be subject to noise). We employ a novel dataset provided by the CTDoH to conduct this analysis.



Figure 1: COVID-19 deaths per 100,000 by race and age category

4. Study results

Establishing a baseline of comparison, Exhibit 1 presents the death rates per 100,000 population for the entire state, by race as a relative density. As Exhibit 1 illustrates, there is an exponential increase in the population-weighted death rate as the population ages. Working-age individuals appear to have a minimal risk of dying from COVID-19, with a significant rise occurring for individuals over the age of 75. This result is consistent with what is known about the susceptibility to the virus for elderly populations.

Given the magnitude of deaths in the oldest age bracket in Figure 1, it is difficult to observe the extent to which there exist racial disparity in the younger populations because of the scaling used. Figure 2 present the relative differences for blacks and Hispanics compared to whites.



Figure 2: Relative COVID-19 deaths per 100,000 by race and age category (relative to whites, March-May)

Starting at the age bracket 45-54, blacks are six times more likely to die from COVID-19 as whites, and the largest difference between Hispanics and whites is 55-64 at just over four times more likely to die from COVID-19. Working up the age categories, a convergence occurs. Minorities are still dying at higher rates than whites, but at the 85 and older category, the difference is only two times higher for blacks and is negligible for Hispanics. Combined, Exhibit 1 and 2 suggest that older people die from COVID-19, regardless of race or ethnicity, but minorities are significantly more likely to die from COVID-19 at the younger age brackets. This result and our numbers are in line with the previous Brookings' Analysis.

Because older individuals are disproportionately impacted regardless of racial or ethnic group it makes sense to extend this analysis by attempting to categorize excess deaths. The tool we use to perform this analysis is to examine the years of life lost using the standard expected years of life lost (SEYLL) index. ^{xv}

SEYLL= $\sum_{i=0}^{n} d_i e_i$

SEYLL is calculated by taking the sum of number of deaths (d_i) at each age *i* multiplied by the life expectancy at that age (e_i) , where *n* is the oldest age in the sample. To determine the life expectancy for each age we used actuarial tables from the CDC on males and females for blacks, Hispanics, and whites. ^{xvi}



Figure 3: Loss of years per 100,000 by race and year category (relative to 2012-2019 average, March-May)

Exhibit 3 displays the population-weighted years of life lost relative to the average for 2012-2019 during the months of March-May using 2018 population estimates. The years lost measure is relatively stable over the period of 2012-2019 for whites, with some year-to-year fluctuations in the black and Hispanic populations. These fluctuations, however, are dwarfed by the differences in 2020, with all three groups having seen increased mortality in 2020; however, the differences across groups are stark. Whites have seen an increase of 35% in years lost, less than half the increase observed for blacks and Hispanics, at 85% and 82%, respectively, compared to their eight-

year average.^{7,8} These results align with the pattern observed in Exhibit 2, as well as giving insight to the differential impact experienced in terms of excess mortality by minority populations.

As mentioned above, the Brookings' article concludes by stating "while geography may be part of the explanation for the race gaps, it does not look to be the main one." This is one area our conclusion differs from their analysis, as our ability to observe within county heterogeneities from our data suggests that geography is strongly correlated with the ethnic and racial death rates from COVID-19.

Exhibit 4 presents the total deaths per 100,000 population from COVID-19 by town. As this map illustrates, there is significant clustering occurring around three of the five major population centers in the state (Bridgeport, Hartford, and Waterbury). There is also a strong correlation between towns that are white-minority (10 towns) and COVID-19 deaths.^{9,10} All but 4 of these towns are in the highest quartile of towns that have a COVID-19 death. These towns represent 1/6 of the towns in the highest quartile for deaths per 100,000.

Conversely, we observe that of the 68 rural towns in the state, 25 had not recorded a death from COVID-19 during our study period (only one non-rural town had zero deaths over this timeframe).^{11,12,13, xvii} Another 18 of these rural towns are contained in the lowest quartile and 14

⁷ If we remove COVID-19 deaths, these numbers are in line (or slightly below) with the eight-year averages. This suggests that over this period, COVID-19 is driving the calculated excess mortality in the state of Connecticut.

⁸ Our conclusion differs from the CDC report on excess deaths slightly. In that report they conclude that Hispanics had a slightly larger increase in excess deaths compared to blacks. This difference exists because their analysis is National and goes through October. By examining Figure 3 in their report, Hispanics had a second peak in deaths during June and July, whereas blacks had a more modest increase during this time. To contextualize this difference, it is important to remember that the outbreaks in the meatpacking industry were at their peak in May (for reference see: https://www.ers.usda.gov/covid-19/rural-america/meatpacking-industry/). When comparing our results to the corresponding timeframe in the CDC report, we calculate nearly identical amounts.

⁹ Defined as any town with less than 50 percent of the population being identified as white.

¹⁰ These ten towns account for a total of 21 percent of the state's population, 57 percent of the total state black population, and 48 percent of the total state Hispanic population. This means that a majority of all the state's minority population lives in these ten locations.

¹¹ Defined by the Connecticut Office of Rural Health as: "all towns with a population census of 10,000 or less and a population density of 500 or less people per square mile are designated as rural."

¹² Combined, these towns represent 10 percent of the total state population, while only containing 1 percent and 2 percent of the total black and Hispanic population, respectively.

¹³ Income in these rural towns are similar to the state averages. Per capita income in these 68 rural towns have an average of \$ 47,759.43, compared to \$46,262.98 for the rest of the state.

more are contained in the second lowest quartile. Based on how these towns are classified (requiring a low population total), a single death has a significantly larger impact on the deaths per 100,000 population; however, only a 16 percent of rural towns are contained in the two highest quartiles.



Figure 4: Cumulative COVID-19 deaths per 100,000 population by town (March-May)

Legend	
	County
F	Rural Town
<u>////</u> \	White-Minority_Town
Deaths per 100,000 Population	
)
-	1 - 46
4	17 - 82
8	33- 127
1	128 - 305

The population-weighted average for the 10 white-minority towns is 129 deaths per 100,000 population, for the 68 rural towns it is 44 deaths per 100,000, and finally for the other 91 towns in the state, it is 103 deaths per 100,000, on average. ¹⁴ This analysis suggests that within county heterogeneities are important and currently are largely unexplored in the popular press, as well as academic literature.

We further examine the disproportionate effects of COVID-19 on the Hispanic and black population by evaluating the primary causes of death by age and race over the last 8 years in the state.

Exhibit 5 presents the differences for blacks and Hispanics, relative to whites, for primary causes of death based on their relative populations,^{xviii,15} from 2012-2020. This figure shows that for blacks and Hispanics prior to the age of 85 there is a much higher prevalence, relative to whites, of certain infectious and parasitic diseases (e.g. tuberculosis). Additionally, blacks are much more prone to diseases of the circulatory system (e.g. heart disease), diseases of the genitourinary system (e.g. kidney disease), and endocrine, nutritional, and metabolic diseases (e.g. obesity). Compared to these broadly defined primary causes of death, COVID-19 is the most skewed towards minority groups for all ages in our analysis (45+). This further illustrates the disproportionate impact that COVID-19 is having on minority populations within the state. This is a value-added extension to the current literature, as we believe that we are the first research team to examine racial health disparities from COVID-19 using this measure.

¹⁴ An omitted factor in the above analysis is obviously population density; however, our aim is only to demonstrate the spatial pattern of deaths from COVID-19 in the locations where minorities reside, not to fully explain those deaths. In the state of Connecticut, a majority of the state's minority population live in the towns that have seen particularly high death rates. The locations that have a small fraction of the minority population happen to be in low population density areas that also have seen comparatively low deaths from COVID-19. Based on where different populations live seems to be an important piece in the story of explaining the differential COVID-19 deaths, which provides additional context to our previous results.

¹⁵ The primary causes of death are defined using the broad categories from ICD-10. For simplicity, codes for special purposes is renamed COVID-19 since it is the only cause of death in our dataset within that group. The totals for each category were based on the total number of deaths during the time frame 2012 to 2020 and any category that had less deaths than COVID-19 for any age group was dropped in order to avoid small sample sizes.

An additional utility from the data utilized is the ability to analyze comorbidities. It is beyond the scope of this study to engage in a detailed dive of these measures, in fact, such analysis likely requires a research paper itself. Our quick analysis suggests a very similar racial disparity in types of comorbidities as described above, but not the number of comorbidities. The average number of comorbidities we calculated was very similar to a recent CDC study that did not separate by race.^{xix}

5. Discussion

Our analysis collates much of the current research on racial and ethnic disparities in deaths from COVID-19 using a self-contained data source, meaning we were able to directly observe our outcomes. We show the areas that we can replicate and the critical distinctions that we draw based on potential aggregation biases. At the same time, we are aware of the data constraints currently existing and acknowledge the need for timely analysis using imperfect data. This analysis aims not to discourage such research but only to demonstrate how the current research holds up under more granular scrutiny. Also, it is important to mention that more granularity is not necessarily better. Research should be conducted at the level of aggregation that is appropriate for the analysis being undertaken. For example, if the number of observations are too small, the results will likely be noisy and lack dependability.

We do believe that our analysis points to research being most useful to policymakers when tailored to the local conditions. Examining national or regional patterns will likely have major heterogeneities that are lost in the aggregate. Finally, we are not making the case that this analysis of Connecticut is nationally representative, but rather pointing out where the single state differs from national averages.





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