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Geographic differences in the mortality burden of the Covid-19 pandemic

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EXECUTIVE SUMMARY

This study examines how the mortality burden of the Covid-19 pandemic varied across US states during the time period April 2020 through December 2022. The disparities were substantial, with figures ranging from 318 years of life lost (YLL) per 10,000 population in New York to 1,285 YLL per 10,000 population in New Mexico. Illinois experienced a loss of 588 YLL per 10,000, situating it within the bottom third of states in terms of total loss of life. Overall, Southern and Western states exhibited the highest YLL, while Northeastern states, the upper Midwest, and the Pacific Northwest exhibited the lowest YLL. States that voted for the 2020 Republican presidential candidate experienced greater losses. This loss of life will have multifaceted implications for public finances.

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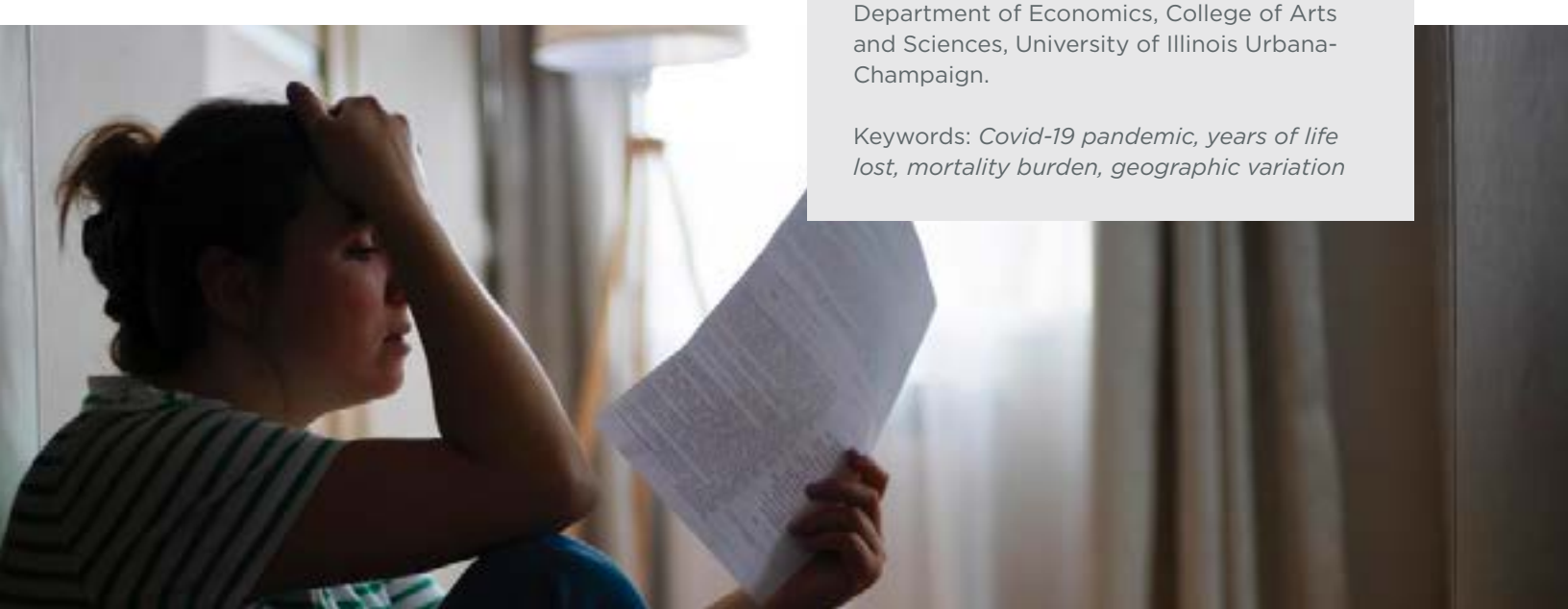

BACKGROUND

The Covid-19 pandemic has profoundly influenced public health and the economy in the United States. Nonetheless, the pandemic's mortality burden has been unevenly distributed across the nation, with some areas experiencing substantially greater losses of life than others. Measuring these disparities is important for the development of interventions that target the neediest populations, and may help identify policies that reduced (or exacerbated) the death toll.

"During the first two and a half years of the pandemic, Illinois lost about 588 years of life per 10,000 people, situating it within the bottom third of states in terms of total loss of life."

An initial step in this direction involves generating state-by-state assessments of life lost due to the pandemic. This report evaluates these losses in terms of life-years, which is crucial for determining the most severely impacted populations. We examine geographic and political patterns in these losses, and discuss their potential effects on public finances.

MEASURING MORTALITY BURDEN

The mortality burden of the Covid-19 pandemic has typically been measured using "excess deaths." Excess deaths refer to the number of deaths above what we would normally expect to see in a certain time period. For example, if we expect a certain number of people to die in a certain month based on previous years' data, but we see a higher number of deaths than expected, then those additional deaths are considered excess deaths. Excess deaths is a useful measure because it accounts for deaths that are not directly related to the event, such as deaths from missed medical appointments, and because it does not require knowledge of the underlying cause of death, which has potential for misclassification.

While excess deaths is the most common measure of mortality burden, this report measures that burden using YLL. YLL takes into account not only the number of premature deaths, but also the number of years lost from those deaths. For example, the premature death of a young person results in a higher number of YLL than the premature death of an older person, because the young person had more years of life ahead of them. While age is the primary determinant of remaining years of life, other factors such as pre-existing chronic conditions and sex matter as well. We use a YLL measure based on work which takes into account about 15 different factors, including age, sex, race/ethnicity, smoking behavior, obesity, and cancer[1]. Table 1 reports our estimates of YLL per excess death for the years 2020-2022, by age, race/ethnicity, and sex. YLL per death is higher for younger individuals, for Hispanics, and for females.[2] These disparities, which reflect differences in life expectancy across demographic groups, are caused by a variety of socioeconomic factors.

We calculate geographic differences in the mortality burden of the pandemic in two steps. First, we obtain CDC data on excess deaths by state, sex, race/ethnicity, and age during the time period April 2020 through December 2022. For each group we also obtain the number of deaths caused by Covid-19. We then calculate the (possibly negative) number of excess deaths from all non-Covid-19 causes. Table 2 provides an example of these calculations.

In the second step, we convert those deaths into YLL using the estimates reported in Table 1. Those estimates from Table 1 are not state specific; consequently, the difference in YLL observed across states can be attributed to differences in excess mortality and differences in the demographic composition amongst states. For example, YLL will be higher in states that suffered higher excess mortality and higher in states where decedents were younger than average. To facilitate comparison, we normalize YLL by state population. Final estimates are reported in Table 3. We discuss them below.

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GEOGRAPHIC VARIATION IN YLL ACROSS US STATES

Figure 1 illustrates the disparity in YLL during the Covid-19 pandemic across various states. This figure accounts for both Covid-19-related deaths and non-Covid-19-related excess deaths. New Mexico experienced the most significant loss of life, with 1,285 YLL per 10,000 population, while New York experienced the least, with 318 YLL per 10,000. In general, the Southern and Western states exhibited the highest YLL, while the Northeastern states, the upper Midwest, and the Pacific Northwest had the lowest YLL. Illinois experienced a loss of 588 YLL per 10,000, situating it within the bottom third of states in terms of total loss of life.

If we examine the loss of life separately by Covid-19 and non-Covid-19-related excess deaths, we observe a different pattern, as demonstrated in Figure 2. Although Covid-19-related YLLs remain concentrated in the South, as shown in Figure 1, non-Covid-19-related YLLs are more dispersed. For instance, South Dakota ranks in the bottom two quintiles of Covid-19-related YLLs, but in the top two quintiles of non-Covid-19-related excess YLLs. Figure 3 provides further evidence supporting these observations. The correlation between YLLs caused by Covid-19 and those resulting from non-Covid-19 factors is positive but not perfect. New York and Oregon suffered the same proportionate loss of lives due to Covid-19, but Oregon's non-Covid-19 excess mortality burden is four times higher. In addition, Figure 3 shows that Illinois' Covid-19 mortality burden is not only below average, but also that its non-Covid-19 mortality burden is lower than expected. Overall, these results suggest that while there is a connection between Covid-19- and non-Covid-19-related excess deaths, some of them are influenced by distinct underlying mechanisms.

"Overall, Republican states endured an average loss of 875 YLL per 10,000, approximately 43 percent greater than the 610 YLL per 10,000 observed in Democratic states."

DISCUSSION

Government spending

The untimely loss of life due to the pandemic has a complex impact on public finances, with various outcomes counterbalancing each other.[3] Early deaths among the workforce can lead to decreased tax revenue, while the demise of beneficiaries can result in reduced expenditures on public programs. Since over 74% of fatalities during the first three years of the pandemic were among individuals over age 65, the primary effect on public finances will likely be a decrease in program expenditures. In fact, recent projections for Medicare suggest that the program's solvency has improved due to the pandemic, mainly because of early deaths among individuals with high healthcare costs.[4]

At the state level, the public spending consequences of premature deaths are primarily channeled through the Medicaid program, where costs are shared almost equally between state and federal governments. Although Medicaid offers health insurance to low-income individuals of all ages, the majority of its spending is directed towards the ill and elderly, particularly those residing in nursing homes. Consequently, states like New Mexico and Tennessee, which experienced among the highest loss of life due to the pandemic, may witness reduced Medicaid expenditures in the future compared to pre-pandemic projections (Figure 1).

Covid-19 vs non-Covid-19 deaths

Although the Covid-19 virus was predictably a major contributor to the excess mortality burden during the pandemic, non-Covid-19 causes also played a significant role (Figure 2). One reason for the rise in non-Covid-19 deaths was the difficulty in accessing medical care. Ziedan et al. (2022) estimated that a decline in healthcare consumption accounted for about a quarter of total non-Covid-19 excess deaths during the pandemic's first year.[5] Several studies found a significant drop in hospitalizations due to acute heart conditions but a considerable increase in mortality, suggesting that some patients died after failing to seek medical attention during the pandemic.[6] Limited medical capacity, such as overcrowded hospitals and staff shortages, also made it challenging to receive medical care and risky to visit facilities in person. French et al. (2022) observed that excess deaths surged two weeks after intensive care units (ICUs) experienced strain.[7]

Other factors contributing to excess mortality include increased alcohol consumption, drug overdoses, violent crimes, and vehicular accidents.[8] Covid-19-related stress led to more frequent and heavier drinking, and an accompanying increase in alcohol-related deaths.[9] Drug overdoses spiked particularly among racial and ethnic minorities.[10] Firearm homicide rates increased significantly as well.[11]

Interestingly, studies found no significant increase in suicides during the Covid-19 pandemic, even during stay-at-home orders.[12] Ruhm (2022) reported fewer suicide deaths than predicted based on pre-pandemic levels.[13] However, this does not mean there was no negative impact on mental health. Anecdotal evidence suggests that isolation in nursing homes and assisted living facilities during lockdowns could have contributed to excess deaths, particularly among Alzheimer's patients who were not allowed to see their families during the pandemic.[14]

Policy responses

The United States saw a variety of responses to the Covid-19 pandemic, with some states implementing stricter lockdown measures than others. For example, California issued stay-at-home orders, ordered non-essential business to close, and enacted mask mandates. South Dakota, by contrast, did not implement any stay-at-home orders and did not close non-essential businesses at the state level.

The effect of lockdown policies on the pandemic's mortality burden is theoretically uncertain, as it requires balancing various health effects. For instance, while mandating people to stay at home could limit the virus's spread, it might also harm mental health and deter individuals from seeking medical assistance. Opinions on these policies were often divided along political lines, suggesting that the mortality burden might vary based on political affiliation. Allcott et al. (2020) argue that regions with more Republican voters practiced less social distancing,[15] and Wallace et al. (2022) find higher excess death rates among registered Republicans compared to registered Democrats.[16]

Figure 3 illustrates some of these patterns. States that voted for the 2020 Republican presidential candidate (Trump) are displayed in red, while those that voted for the Democratic candidate (Biden) are represented in blue. Most Republican states fall to the right of the blue dashed line, indicating a higher-than-average mortality burden from Covid-19, possibly due to more relaxed Covid-19 measures. It is less evident whether this lenient response resulted in a lower mortality burden from non-Covid-19 factors. Some states, such as Ohio, experienced a below-average mortality burden from non-Covid-19 factors, while others, like Arizona, faced a higher-than-average burden. Overall, Republican states endured an average loss of 875 YLL per 10,000, approximately 43 percent greater than the 610 YLL per 10,000 observed in Democratic states. This YLL disparity is similar to the excess death disparity estimated by Sehgal et al. (2022), who compare Democratic counties to Republican counties,[17] and less than the excess death disparity estimated by Wallace et al. (2022), who compare excess deaths between registered Republicans and registered Democrats in Florida and Ohio.[18]

CONCLUSION

In conclusion, this spotlight highlights the significant disparities in the Covid-19 pandemic's mortality burden across the United States, with Southern and Western states being the most affected. These measures can help policymakers to identify the populations most affected by the pandemic and to quantify changes in public spending affected by the loss of life caused by the pandemic.

Table 1. Years of life lost (YLL) per excess death, by age, race/ethnicity, and sex

Age	Race/ethnicity	Female	Male
25-29	Non-Hispanic Black	49.8	45.1
30-49	Non-Hispanic Black	34.9	33.1
50-54	Non-Hispanic Black	24.8	25.0
55-64	Non-Hispanic Black	19.2	16.3
65-74	Non-Hispanic Black	11.3	10.1
75-84	Non-Hispanic Black	7.5	6.2
85+	Non-Hispanic Black	3.7	3.3
25-29	Hispanic	56.4	54.1
30-49	Hispanic	40.9	40.5
50-54	Hispanic	31.4	28.9
55-64	Hispanic	21.6	18.0
65-74	Hispanic	14.3	11.9
75-84	Hispanic	8.1	7.1
85+	Hispanic	4.2	3.4
25-29	Non-Hispanic White	53.7	50.6
30-49	Non-Hispanic White	37.7	36.9
50-54	Non-Hispanic White	28.3	26.5
55-64	Non-Hispanic White	21.0	18.8
65-74	Non-Hispanic White	14.7	12.5
75-84	Non-Hispanic White	8.7	7.4
85+	Non-Hispanic White	3.9	3.5

Notes: Years of life lost (YLL) are measured using the model described in Reif et al. (2021), using data from April 2020 to December 2022. Table values include YLL from both Covid-19 and non-Covid-19 causes.

Table 2. Example calculation of excess deaths

Total number of deaths (observed)	16,500
Expected number of total deaths (calculated)	10,000
Total excess deaths	6,500 = 16,500 – 10,000
Number of Covid-19 deaths (observed)	3,000
Non-Covid-19 excess deaths	3,500 = 6,500 – 3,000

Notes: This table provides an example calculation showing how to calculate total excess deaths, Covid-19 excess deaths, and non-Covid-19 excess deaths. Data on total number of deaths and on number of Covid-19 deaths are available from the CDC. The expected number of total deaths is calculated by the CDC.

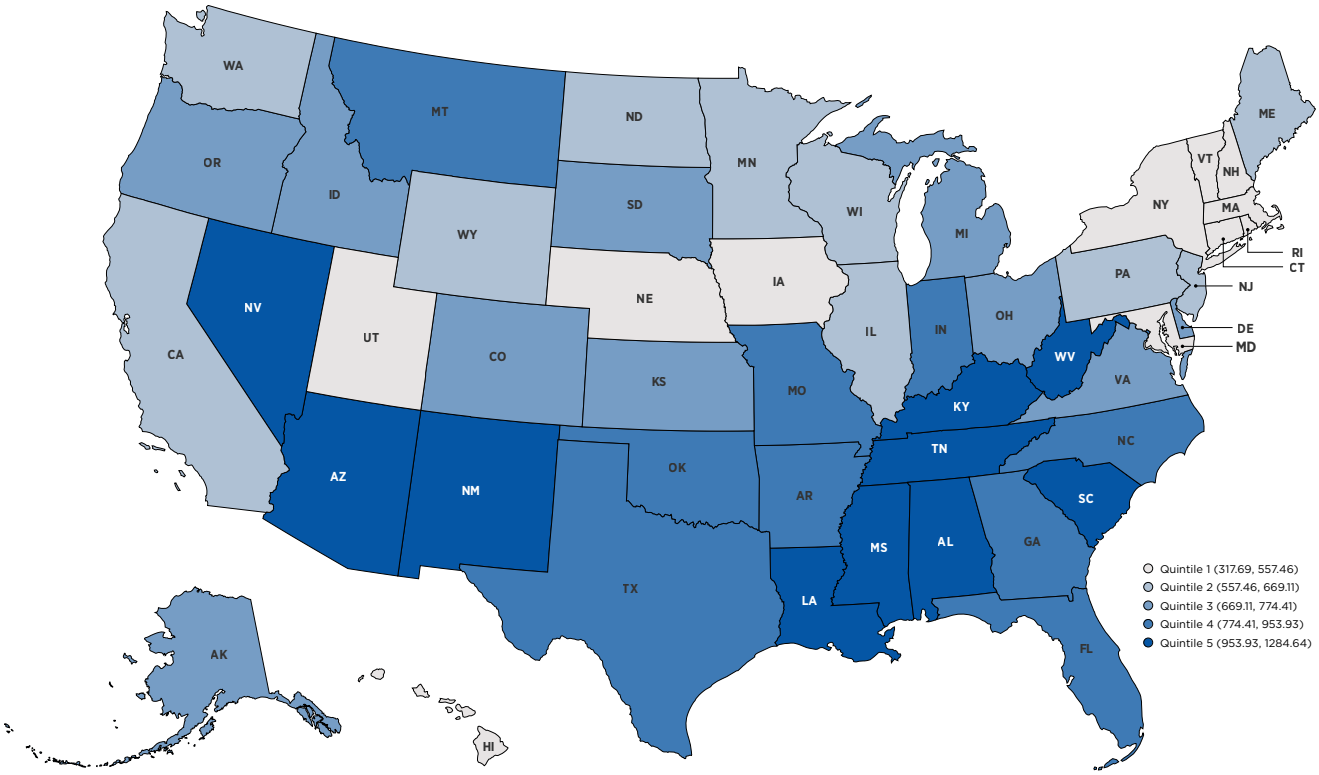
Table 3. Years of life lost (YLL) per 10,000 population, April 2020 – December 2022

State	YLL per 10k	Covid-19 YLL per 10k	Non-Covid-19 YLL per 10k
NM	1284.6	525.4	759.3
AZ	1217.4	521.9	695.4
TN	1160.0	530.1	629.9
WV	1100.8	511.2	589.5
MS	1080.5	588.5	492.0
SC	1045.0	462.7	582.3
AL	997.6	524.4	473.2
KY	988.1	502.1	486.0
NV	971.6	445.8	525.8
LA	971.4	437.5	533.9
AR	942.3	455.6	486.7
OK	895.1	518.3	376.8
TX	882.3	499.0	383.3
GA	876.4	423.8	452.6
FL	842.6	435.2	407.4
NC	840.7	368.2	472.5
MT	819.6	326.0	493.6
IN	803.5	420.1	383.4
MO	792.8	404.3	388.5
DC	775.3	234.3	541.0
SD	770.8	287.1	483.8
DE	757.8	257.6	500.2
CO	731.2	271.7	459.5
OH	723.9	446.1	277.8
KS	714.0	323.5	390.5
ID	699.8	286.4	413.4
AK	693.2	117.1	576.0
VA	681.7	274.6	407.1
OR	675.8	200.8	475.0
MI	672.8	387.1	285.7
ND	668.2	293.3	374.8
CA	667.5	342.6	324.9
WY	652.2	237.3	414.9
WI	632.8	266.2	366.6
ME	618.3	206.9	411.4
WA	596.0	181.5	414.5
PA	590.6	403.6	187.0
IL	588.3	317.1	271.1
NJ	573.5	389.2	184.3
MN	558.4	224.1	334.3
IA	556.0	302.3	253.8
MD	542.0	293.7	248.3
CT	534.7	284.2	250.5
NE	492.5	249.6	243.0

UT	467.5	180.0	287.5
VT	462.8	65.6	397.1
RI	457.5	247.8	209.7
NH	407.4	165.8	241.6
HI	401.9	62.8	339.1
MA	387.7	245.0	142.7
NY	317.7	194.8	122.9
USA	728.7	368.1	360.6

Notes: States are listed in descending order of YLL per 10,000 population. Estimates are equal to the number of CDC excess deaths in the state multiplied by the average number of YLL per excess death, as estimated in Table 1, and then divided by state population times 10,000. The YLL estimates account for the sex, race/ethnicity, and age distribution of each state, as well as the number of Covid and non-Covid excess deaths.

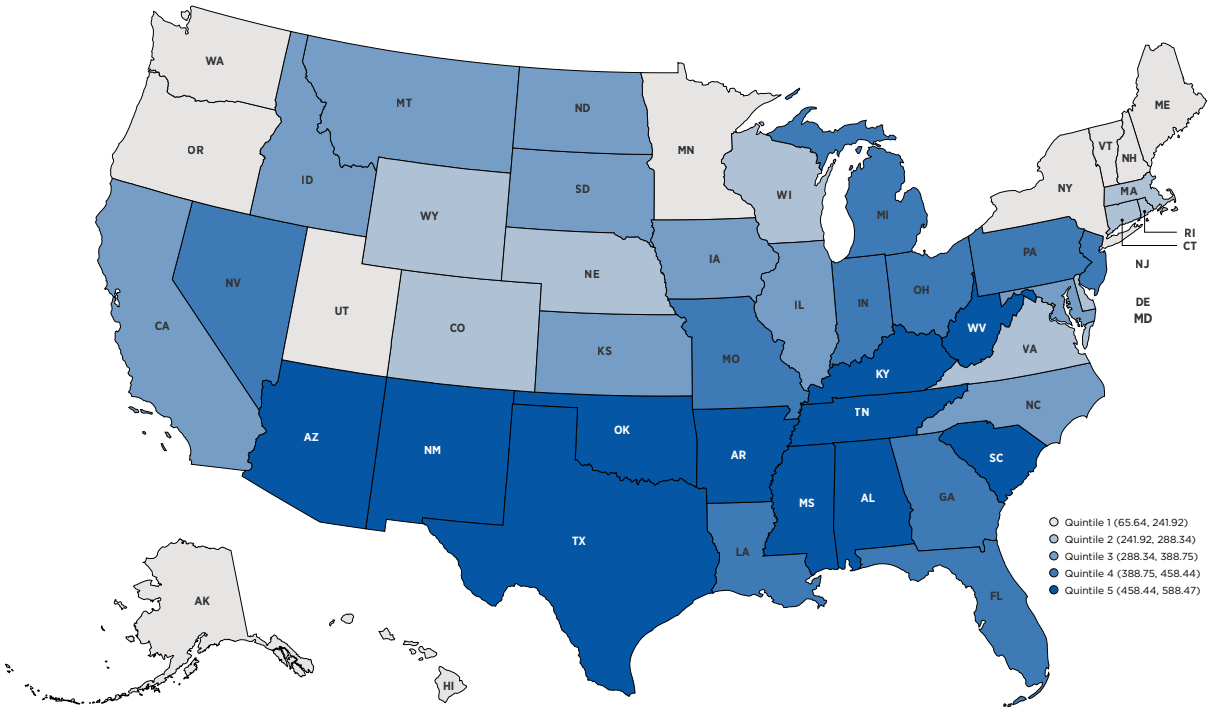
Figure 1. Years of life lost (YLL) per 10,000 population, April 2020 – December 2022



Notes: Individual values for each state are reported in Table 3.

Figure 2. Years of life lost (YLL) per 10,000 population by underlying cause of death, April 2020 – December 2022 2022

(a) Underlying cause of death was Covid-19



(b) Underlying cause of excess death was not Covid-19

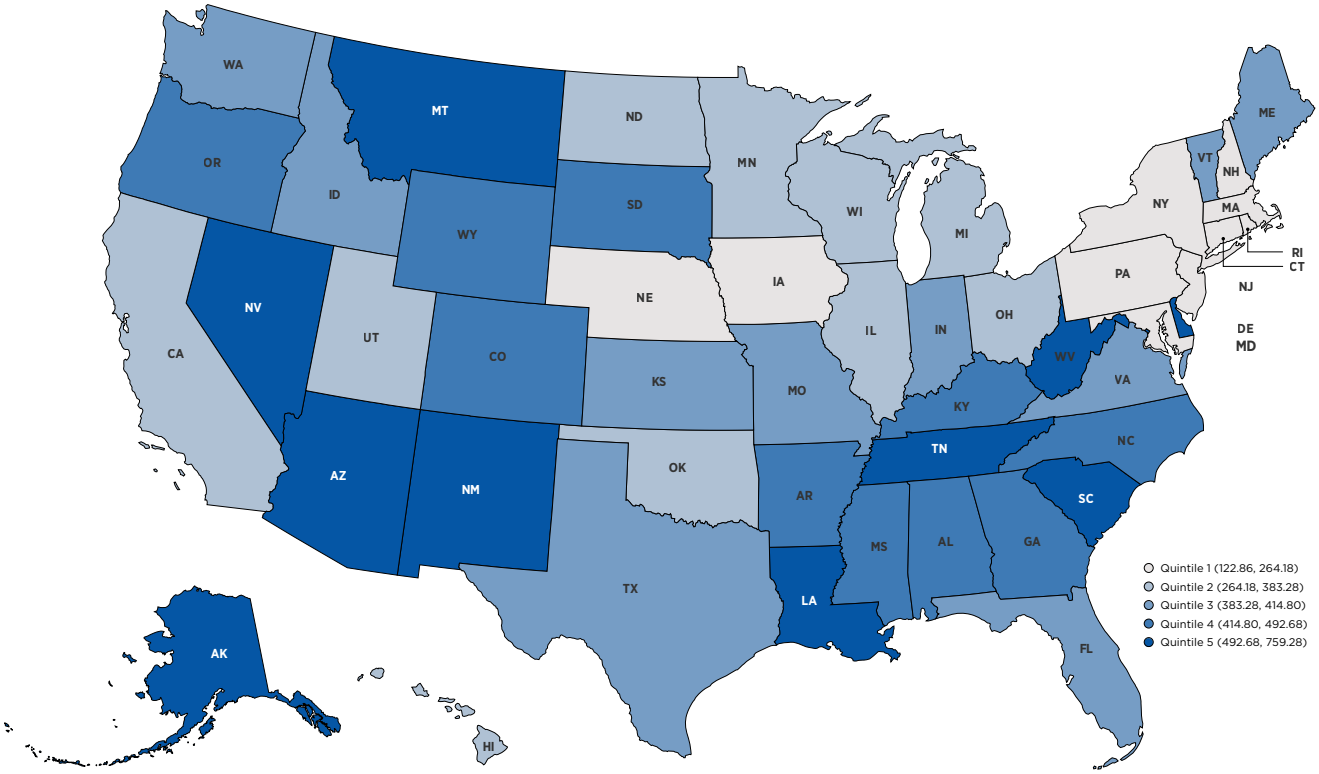
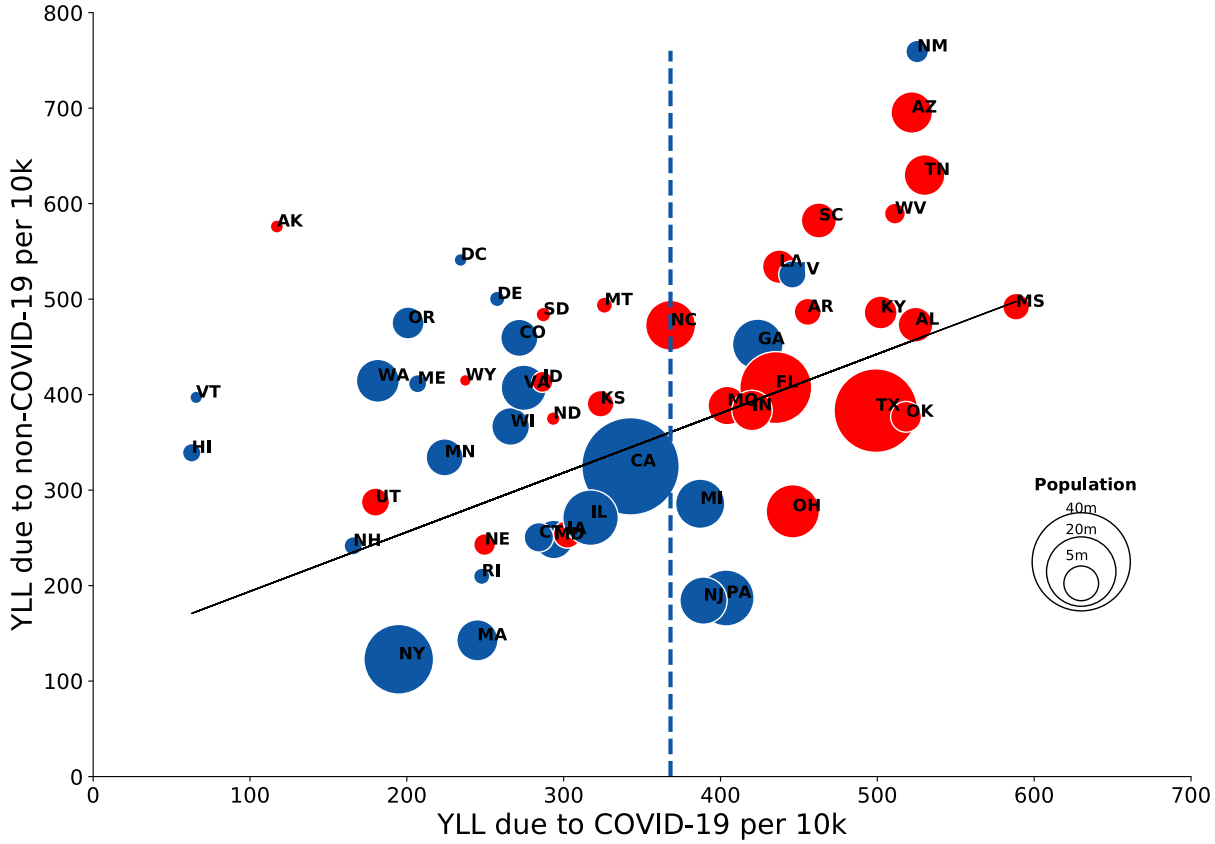


Figure 3. Relationship between year of life lost (YLL) per 10k due to Covid-19 and non-Covid-19 factors.



Notes. Circle size is proportional to the state's April 2020 population. Red circles are states that voted for the 2020 Republican presidential candidate, and blue circles are states that voted for the 2020 Democratic presidential candidate. The solid black line reports the linear relationship between non-Covid-19 YLL per 10k and Covid-19 YLL per 10k, weighted using state population. The slope of this trend line is 0.621, with a standard error of 0.226. The weighted mean of Covid-19 YLL per 10k is equal to 368 and is depicted by the blue vertical dashed line.

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Acknowledgements

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Pg. 1 - Silhouette of a sad woman sitting on the floor of her apartment, #1474877422 by Andrii Zorii
Pg. 2 - Worried senior woman looking through window at home, #1368011562 by FG Trade