Title: The Mortality Burden and Fiscal Spending Consequences of the US COVID-19 Pandemic

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The COVID-19 pandemic has imposed considerable excess mortality burdens on the United States. Measuring this mortality burden is critical for characterizing which populations are most vulnerable and for evaluating the fiscal effects of the pandemic on public programs such as Social Security, Medicaid, and Medicare.

However, existing measures of mortality burden are limited. Excess death estimates are insufficient for calculating years of life lost (YLLs), a standard measure of mortality burden. Because excess deaths are concentrated among older adults, who have lower life expectancy than the young and middle-aged, existing excess death estimates for the COVID-19 pandemic may understate the mortality burden borne by the young relative to the old. Moreover, the few extant studies estimating YLLs from COVID-19 adjust for age differences, but not for common, empirically documented COVID-19 mortality risk factors such as obesity or diabetes, or for quality-of-life differences. These prior YLL estimates may overstate the mortality burden if frail individuals with low life expectancies are more likely to die from COVID-19.

We propose to use two widely published microsimulation models, the Future Adult Model and the Future Elderly Model, to estimate the YLLs due to COVID-19 excess mortality for the US population ages 25 and over. Our analysis accounts for the age, sex, and race characteristics of decedents as well as the following individual COVID-19 mortality risk factors: obesity (three categories), smoking behavior, high blood pressure, lung disease, heart disease, diabetes, cancer, stroke, dementia, and nursing home status. We also estimate the number of quality-adjusted life-years (QALYs) lost. QALYs are useful because they combine longevity and morbidity into a single metric, embedding the notion that a year in good health is worth more than one in poor health. Finally, our analysis estimates the net present value of lifetime changes in medical spending and social security income resulting from this loss of life as well as from increased medical spending on COVID-19-related moribidities.

We have three main aims:

1. Estimate the number of life-years lost and number of QALYs lost due to the COVID-19 pandemic, accounting for the age, sex, race, and comorbidities of decedents.
2. Estimate the increase in medical spending attributable to the morbidity effects of the COVID-19 pandemic.
3. Estimate the offsetting fiscal savings to Medicare, Medicaid, and Social Security that result from the loss of life calculated in aim #1. Compare the net fiscal effect to the monetized value of loss of life calculated in aim #1.

Table 1 presents preliminary estimates of the YLLs and QALYs lost from the US COVID-19 pandemic as of March 13, 2021 for the population ages 25 and over. A period life table analysis—which adjusts for the age, sex, and race of decedents but not their comorbidities—estimates 10.7 million YLLs. The microsimulation analysis estimates 9.08 million YLLs, about 15% less than the life table estimate, which reflects the fact that COVID-19 decedents had lower counterfactual life expectancy than their peers of the same age, sex, and race. Accounting for quality-of-life yields an estimate of 6.62 million QALYs lost. Assuming a standard value of $100,000 per life-year implies that the monetized value of life-years lost from the US COVID-19 pandemic as of March 13, 2021 is $662 billion.

Table 1. Years of life lost and quality-adjusted life-years lost from the US COVID-19 pandemic

Outcome	Ages 25-64	Ages 65+	Ages 25+
Population, thousands	167,910	55,182	223,092
CDC excess deaths			
Deaths	173,995	566,252	740,247
Deaths per 10k	10.4	102.6	33.2
Mortality burden			
YLLs, thousands			
Period life table	5,163	5,514	10,678
Microsimulation	4,668	4,412	9,080
YLLs per 10k			
Period life table	308	999	479
Microsimulation	278	800	407
QALYs lost, thousands			
Microsimulation	3,574	3,046	6,620
QALYs lost per 10k			
Microsimulation	213	552	297

This table reports the years of life lost (YLLs) and quality-adjusted life-years (QALYs) lost over the time period March 22, 2020 through March 13, 2021 as a result of the US COVID-19 pandemic. The mortality burden estimates presented in this table are based on the number of excess deaths reported by the Centers for Disease Control and Prevention (CDC). Period life table estimates of YLLs are equal to the number of excess deaths multiplied by life expectancy obtained from a 2018 CDC period life table that varies by age, sex, and race. The YLLs and QALYs lost estimates for the microsimulation analysis are derived from the Future Elderly Model and the Future Adult Model, which produce individual-level forecasts of mortality and quality-of-life for the US population ages 25+. The microsimulation analysis assigns all COVID-19-related excess deaths within the age-sex-race subgroup in proportion to estimates of COVID-19 comorbidity mortality odds ratios, and assigns non-COVID-19-related deaths in proportion to the 2020 (pre-COVID-19) annual mortality hazard projected by the microsimulation.