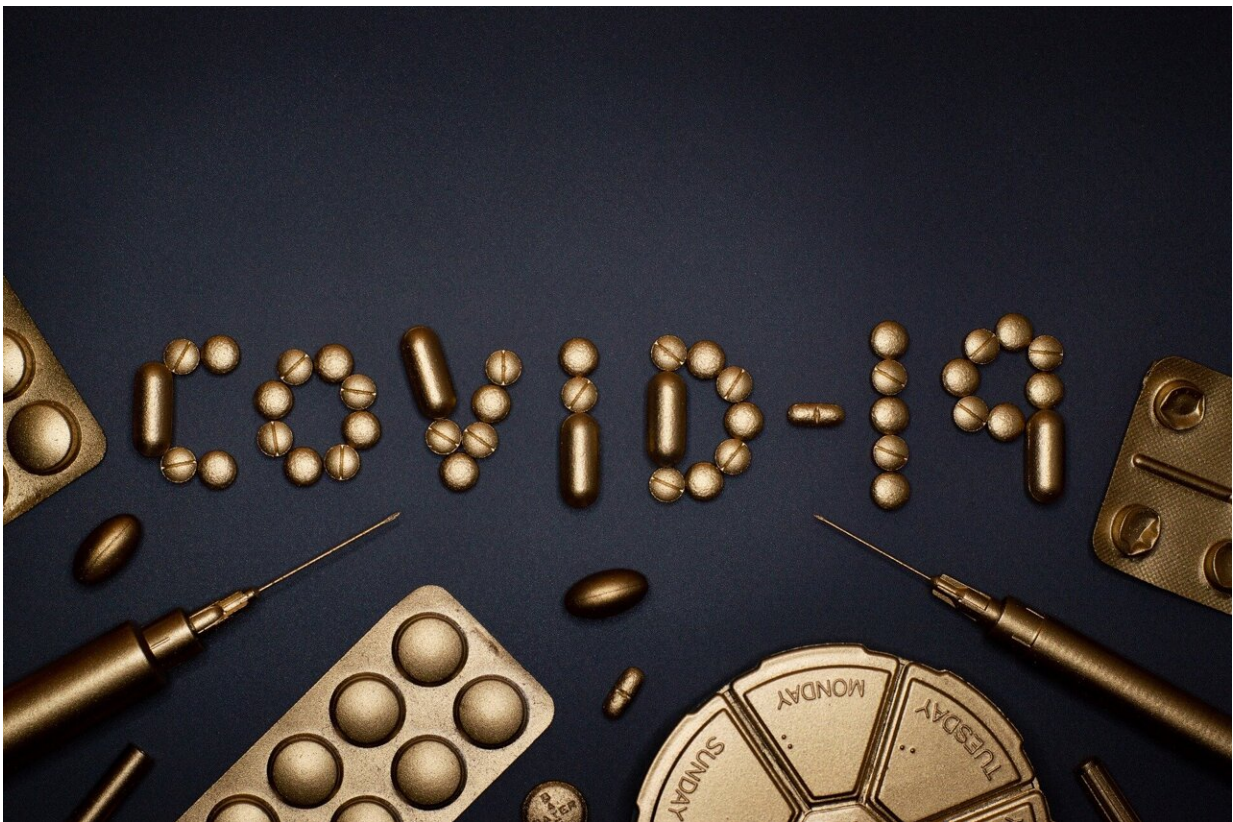# New excess mortality estimates show increases in US rural mortality during second year of COVID-19 pandemic

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Credit: Pixabay/CC0 Public Domain

Between the first and second year of the COVID-19 pandemic, excess deaths decreased in large metropolitan counties and increased in rural

counties in the United States, according to a new study led by Boston University School of Public Health (BUSPH) and The University of Pennsylvania (UPenn).

The novel study presents the first-ever monthly estimates of excess mortality rates for every US county during the first two years of the pandemic.

Excess mortality, which compares observed deaths to the number of deaths that would be expected under normal conditions in a given period, provides a reliable estimate of the true mortality impact of the pandemic over time and across geographic regions that is unaffected by variability in cause-of-death assignment practices.

Published in the journal *Science Advances*, the findings show that the high excess death rates that burdened large metropolitan areas in the Northeast and Mid-Atlantic regions in the initial months of the pandemic began to shift to non-metropolitan areas in the South and West as early as August 2020, with the sharpest increases occurring during the surge of the highly contagious Delta variant in the spring and summer of 2021.

The study identifies a total of 1,179,024 excess deaths from March 2020 through February 2022, including an estimated 634,830 excess deaths from March 2020 to February 2021, and 544,194 estimated excess deaths from March 2021 to February 2022.

This excess mortality data is now publicly available for researchers and the broader public to view in a first-of-its-kind online database and interactive tool that the researchers created to serve as a resource for people to further examine the social, structural, and policy drivers of excess mortality during the pandemic.

"Despite the availability of vaccines, there were nearly as many excess

deaths as in the first year, prior to the vaccine era," says study corresponding author Dr. Andrew Stokes, assistant professor of global health at BUSPH. "While the pandemic slowed down after the first year in large metropolitan areas, rural areas continued to experience a significant burden of excess deaths throughout the second year of the pandemic."

The reasons for the sustained high numbers are multi-faceted, Stokes says. "The emergence of a rural disadvantage reflects a combination of social, structural, and policy factors, including a lack of state policies designed to protect communities at greatest risk for COVID-19 death, state disinvestment in rural health care and social programs, and vaccine hesitancy fueled by a toxic mix of partisanship and misinformation."

"Detailed information on the impact of the pandemic can help policymakers make informed choices regarding the appropriate measures to help communities recover from the negative impacts of COVID-19," says study lead author Eugenio Paglino, Ph.D. student in demography at UPenn. "This information was lacking in the United States, and we aimed to address this gap with this study."

"Excess mortality statistics can also be extremely useful as part of a toolkit to detect future epidemics and intervene before they develop into full-blow pandemics; they can provide early signs of a spreading disease and help prioritize areas to direct resources," says Dr. Ioannis Paschalidis, Director of the Boston University Hariri Institute for Computing and Computational Science and Engineering, and principal investigator on a joint National Science Foundation project with Dr. Stokes focused on pandemic prevention.

Dr. Nahid Bhadelia, Founding Director of the Boston University Center for Emerging Infectious Diseases Policy and Research (CEID), says "Studies like this one help elucidate how excess mortality analyses can

highlight areas where we need to focus on pandemic preparedness investments moving forward, in terms of training, public health education and access to care."

For the study, Dr. Stokes, Paglino, and colleagues from BUSPH, UPenn, The University of Washington School of Public Health, RTI International, and The Robert Wood Johnson Foundation estimated all-cause excess mortality for 3,127 counties, examining mortality by county, month, Census division, and metropolitan and nonmetropolitan areas between the first and second year of the pandemic.

The total excess death count between March 2020 to February 2022 aligns with national excess [death](#) tallies from the [Centers for Disease Control & Prevention](#), as well as the World Health Organization. But by evaluating estimates at the county level, this new study exposes the hardest-hit communities and reveals how the burden of mortality evolved amid policy changes, vaccine development, and new COVID-19 variants over this time.

"Excess mortality rates at the state level obscure additional heterogeneity whereby some counties within those states were especially vulnerable, depending on rurality, partisanship, and other factors" says Stokes. "Across the state of Florida, for example, some counties had exceptionally [high mortality rates](#) during Delta, far exceeding the state average." This county-level insight also dispels some narratives in the media that Florida had "tremendous success" during the pandemic, he says.

Other noteworthy findings:

- Among large metropolitan areas, the decrease in excess mortality between the first and second year of COVID-19 was particularly notable in the Mid-Atlantic, New England and the Pacific areas.

- The increase in excess mortality in nonmetropolitan areas was largest in the Pacific, New England, and Mountain regions.

- The regions with the highest excess mortality in nonmetropolitan areas during the second year were Mountain, South Atlantic, East South Central, and West South Central.

- The regions with the highest cumulative excess mortality at the end of February 2022 were nonmetro areas in the South, large metros in the West, medium and small metros in the South, large metros in the South, and nonmetro areas in the West.

"Much of the attention to addressing the mortality impacts of the COVID-19 pandemic, including inequities by race, ethnicity, socioeconomic status, and disability has focused on urban areas," says study co-author Dielle Lundberg, Ph.D. student in health services at the University of Washington School of Public Health. "The substantial variation in rural mortality across the country suggests that investments are needed not only in rural health but in addressing inequities in rural health between and within rural areas."

For example, counties with high percentages of indigenous residents such as the Navajo Nation in Arizona reported persistently high excess mortality rates throughout the first two years of the pandemic, despite highly coordinated community responses around vaccination. This underscores the disproportionate social, structural, and policy determinants of rural health for indigenous people and their ongoing impact on COVID-19 exposure and mortality.

These geographical shifts widen a growing gap in mortality between urban and rural areas over the past 20-30 years, says study co-author Dr. Irma Elo, professor of sociology at UPenn.

"When the pandemic started in large metro areas of the Mid Atlantic the rest of the country didn't think they would be affected and viewed it as a 'big-city' problem," Dr. Elosays. "But what our findings really show is that nobody is safe from this pandemic. The spread may take time, but it's reaching all corners of the country. Investments in rural health and social infrastructure are urgently needed to prevent further excess deaths from occurring in the future."

More information: Eugenio Paglino et al, Monthly excess mortality across counties in the United States during the COVID-19 pandemic, March 2020 to February 2022, *Science Advances* (2023). DOI: 10.1126/sciadv.adf9742. www.science.org/doi/10.1126/sciadv.adf9742

Provided by Boston University

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