How did local health infrastructure and socio-political factors within different states and counties in the United States affect the disparities in COVID-19 outcomes, and what lessons can be learned for more targeted public health preparedness and response strategies in future pandemics?*

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First sentence. Second sentence. Third sentence. Fourth sentence.

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*Code and data are available at: https://github.com/hannahyu07/US-Covid-Analysis.git

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1 Introduction

This reproduction was performed after a replication on the Social Science Reproduction platform: ***link here***

2 Data

2.1 Source

The datasets utilized in this paper were mainly obtained from the 'original paper' (Nuzzo and Ledesma 2023). Additionally, to address the original paper's lack of US Covid statistics and political party support data, we incorporated information from Jack and Oster (2023) and Elflein (2023).

Jack and Oster (2023) discusses the long-term impacts of COVID-related school closures. From this source, we utilized the dataset on voting shares during the 2020 election by county. Elflein (2023) provides summaries of COVID-19 death rates in the United States as of March 2023, organized by state. Analyzing results from both datasets allows us to explore the relationship between political affiliation and COVID-19 outcomes.Our reproduction aims to fill these gaps and also includes tables and graphs that were not presented in the original paper to support our findings.

2.2 Methodology

`R` (R Core Team 2022) was the language and environment used for the bulk of this analysis, alongside `tidyverse` (Wickham et al. 2019), `sf` (Pebesma 2018), `readxl` (Wickham and Bryan 2023), `knitr` (Xie 2014), `janitor` (Firke 2023), `lubridate` (Grolemund and Wickham 2011), `dplyr` (Wickham et al. 2023), `data.table` (Barrett et al. 2024), `RColorBrewer` (Neuwirth 2022), `ggpubr` (Kassambara 2023), `ggplot2` (Wickham 2016), `here` (Müller 2020), `kableExtra` (Zhu 2024), and `scales` (Wickham, Pedersen, and Seidel 2023).

2.3 Data Measurement

2.4 Data cleaning

2.5 Data Visualization

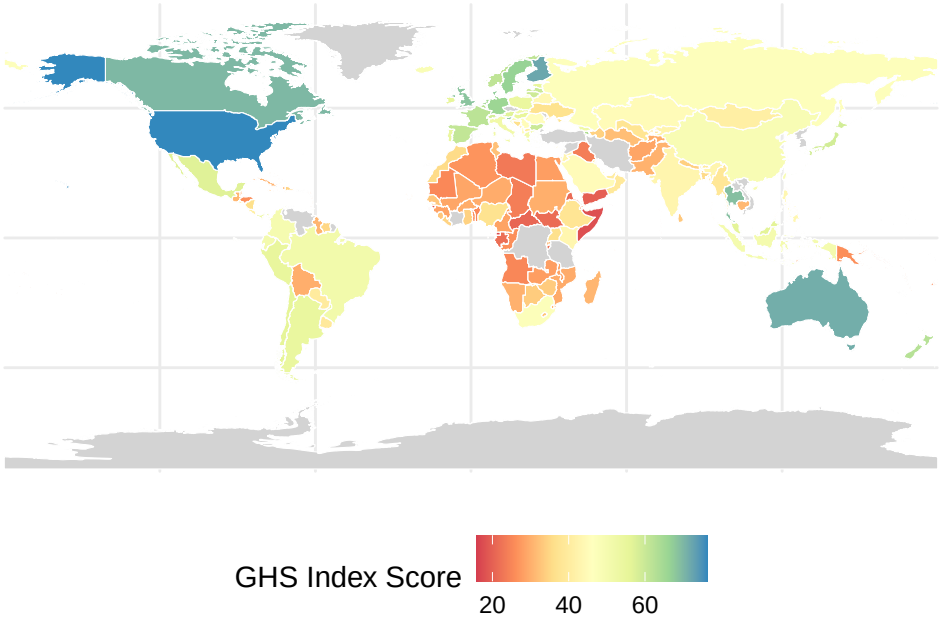

Figure 1: Global Health Security Index Scores by Country

3 Results

Our results are summarized in Figure 1.

Table 1: Top 10 States with Highest Death Rates from COVID-19 (per 100,000 people)

Rank	State	Deaths
1	Arizona	455
2	Oklahoma	454
3	Mississippi	449
4	West Virginia	444
5	New Mexico	432

6	Arkansas	431
7	Alabama	429
8	Tennessee	428
9	Michigan	423
10	Kentucky	406

4 Discussion

This begs the question as to why we are seeing these results. There isn't exactly a single answer to this question, however we can certainly point out some considerable factors to this result.

4.1 Influence of political polarization on adherence to health guidelines.

Political polarization has significantly impacted the adherence to health guidelines during the COVID-19 pandemic. The divergence in political ideologies has translated into differing attitudes towards health directives, including mask mandates, social distancing, and vaccination uptake.

Various studies and our own results have shown that areas with higher support for one political party exhibited distinct behaviors and compliance levels with health recommendations, which directly correlated with COVID-19 case rates and mortality. An news article from `ABC News` (Diab and Kumar 2023) shows that the top states with the highest COVID-19 deaths are Arizona, and Washington with 581 deaths and 526 deaths respectively per 100,000 people. According to 2020 presidential voting data published by `CNN`, we have both states having the electoral vote of democrat with Washington wining by 58% (*2020 Election Results by State, Washington* 2020) and Arizona winning by 49.4% (*2020 Election Results by State, Arizona* 2020). Another news article by `ContagionLive` (Parkinson 2023) also makes the claim of both Arizona and Washington having the highest COVID-19 mortality. This polarization has not only influenced individual behavior but also shaped state and local health policies, further entrenching the disparities in health outcomes.

The adherence to health guidelines are evident in the varied health outcomes observed across the United States. Regions with lower compliance to health directives, often influenced by political leanings, have experienced higher rates of COVID-19 transmission, hospitalizations, and deaths. The disparities in vaccine uptake, driven by political affiliations, have further exacerbated these outcomes, leaving certain communities more vulnerable to the virus and its variants. In order to mitigate the influence of political polarization on public health, it is imperative to depoliticize health guidelines and focus on evidence-based approaches to disease prevention and control. Building trust in health institutions and promoting bipartisan support for public health measures are essential steps towards achieving higher compliance and better

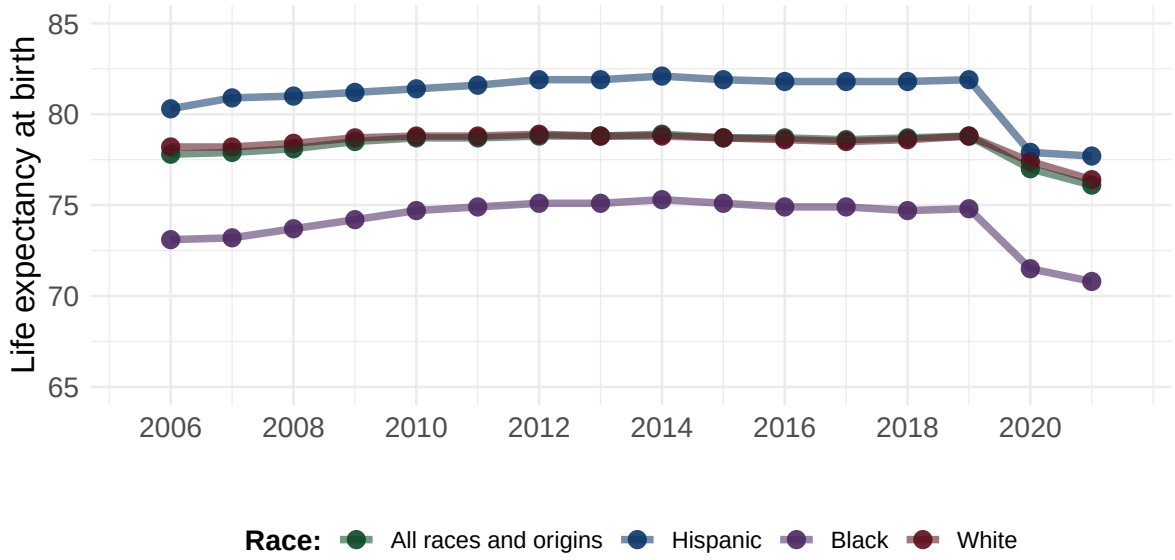

Figure 2: Estimates of Life Expectancy at Birth, by Race 2006-2021

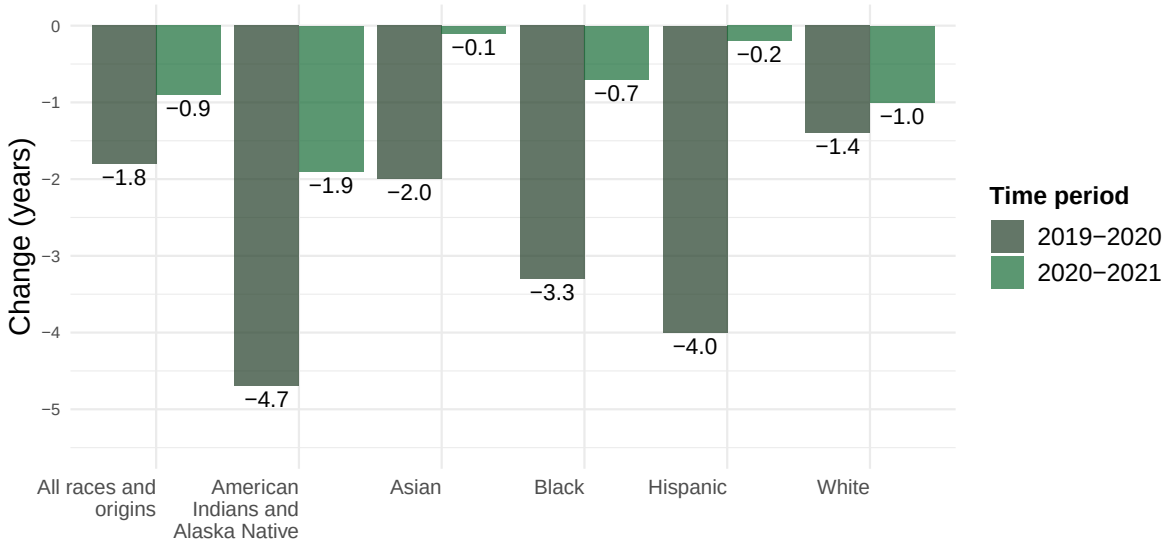

Figure 3: Change in Life Expectancy at Birth from the Previous Year

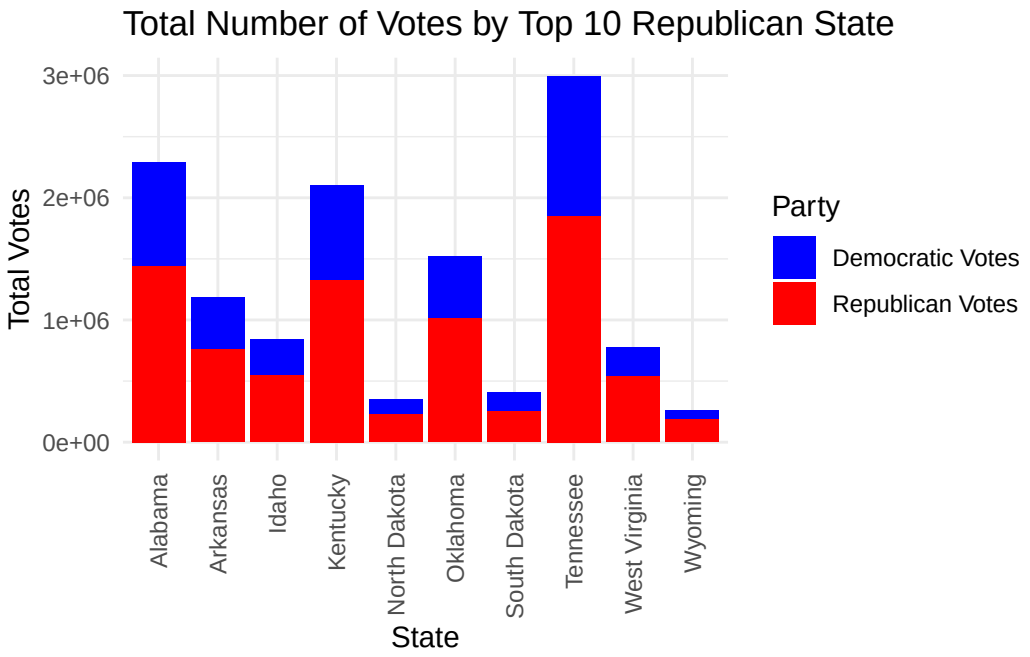

Figure 4: Total Number of Votes in Top 10 States with Highest Proportion of Republican Votes

health outcomes. Engaging trusted community leaders and utilizing targeted communication strategies can also help bridge the divide and encourage adherence to health guidelines.

4.2 Impact of government transparency and consistent communication on public trust.

The politicization of health guidelines and mixed messages from political and health leaders during the COVID-19 pandemic have significantly undermined the effectiveness of public health messaging, leading to confusion, skepticism, and eroded trust among the public. Initially, inconsistencies in recommendations, such as on mask usage, challenged the principle of clear, consistent, and science-based communication essential for an effective public health response. Moreover, the transparency of government actions and decision-making processes is crucial in building and maintaining public trust, especially during health crises. The level of public trust was greatly affected by the openness and accuracy with which governments, at all levels, communicated about the evolving situation, the reasoning behind guidelines, and the measures taken to combat the virus, emphasizing the importance of transparent reporting of data related to case counts, hospitalizations, vaccine distribution, and side effects. Furthermore, consistent communication from public health officials and government leaders is key to ensuring adherence to health guidelines, where inconsistencies, such as changes in

mask-wearing guidelines without clear explanations, have led to public confusion. The direct correlation between government transparency, consistent communication, and public behavior is self-evident, with populations receiving clear and transparent information being more likely to adhere to guidelines, participate in testing and tracing efforts, and accept vaccination. Drawing lessons from the pandemic, strategies for improving government transparency and communication in future health emergencies should include establishing centralized information hubs, ensuring regular and predictable communication from health authorities, engaging community leaders in information dissemination, and harnessing digital platforms and social media to amplify public health messages, thus reinforcing public trust and compliance.

4.3 Role of social vulnerabilities and healthcare access disparities in pandemic impact.

4.4 Strategies for improving real-time data collection and sharing for public health decisions.

4.5 Weaknesses and next stepsa

Weaknesses and next steps should also be included.

References

2020 Election Results by State, Arizona. 2020. CNN. https://www.cnn.com/election/2020/results/state/arizona.

2020 Election Results by State, Washington. 2020. CNN. https://www.cnn.com/election/2020/results/state/washington.

Barrett, Tyson, Matt Dowle, Arun Srinivasan, Jan Gorecki, Michael Chirico, and Toby Hocking. 2024. *Data.table: Extension of 'Data.frame'*. https://CRAN.R-project.org/package=data.table.

Diab, Dr. Alaa, and Dr. Keerthana Kumar. 2023. *COVID-19 Death Rates Varied Dramatically Across US, Major Analysis Finds*. ABC News. https://abcnews.go.com/Health/covid-19-death-rates-varied-dramatically-us-major/story?id=98055024.

Elflein, John. 2023. "U.s. COVID-19 Death Rate by State." *Statista*. https://www.statista.com/statistics/1109011/coronavirus-covid19-death-rates-us-by-state/.

Firke, Sam. 2023. *Janitor: Simple Tools for Examining and Cleaning Dirty Data*. https://CRAN.R-project.org/package=janitor.

Grolemund, Garrett, and Hadley Wickham. 2011. "Dates and Times Made Easy with lubridate." *Journal of Statistical Software* 40 (3): 1–25. https://www.jstatsoft.org/v40/i03/.

Jack, Rebecca, and Emily Oster. 2023. "COVID-19, School Closures, and Outcomes." *Journal of Economic Perspectives* 37 (4): 51–70. https://doi.org/https://doi.org/10.1257/jep.37.4.51.

Kassambara, Alboukadel. 2023. *Ggpubr: 'Ggplot2' Based Publication Ready Plots*. https://CRAN.R-project.org/package=ggpubr.

Müller, Kirill. 2020. *Here: A Simpler Way to Find Your Files*. https://CRAN.R-project.org/package=here.

Neuwirth, Erich. 2022. *RColorBrewer: ColorBrewer Palettes*. https://CRAN.R-project.org/package=RColorBrewer.

Nuzzo, Jennifer B., and Jorge R. Ledesma. 2023. *Why Did the Best Prepared Country in the World Fare so Poorly During COVID?* https://www.aeaweb.org/articles?id=10.1257/jep.37.4.3.

Parkinson, John. 2023. *Which States Saw Greatest COVID-19 Mortality?* ContagionLive. https://www.contagionlive.com/view/which-states-saw-greatest-covid-19-mortality-.

Pebesma, Edzer. 2018. "Simple Features for R: Standardized Support for Spatial Vector Data." *The R Journal* 10 (1): 439–46. https://doi.org/10.32614/RJ-2018-009.

R Core Team. 2022. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. https://www.R-project.org/.

Wickham, Hadley. 2016. *Ggplot2: Elegant Graphics for Data Analysis*. Springer-Verlag New York. https://ggplot2.tidyverse.org.

Wickham, Hadley, Mara Averick, Jennifer Bryan, Winston Chang, Lucy D'Agostino McGowan, Romain François, Garrett Grolemund, et al. 2019. "Welcome to the tidyverse." *Journal of Open Source Software* 4 (43): 1686. https://doi.org/10.21105/joss.01686.

Wickham, Hadley, and Jennifer Bryan. 2023. *Readxl: Read Excel Files*. https://CRAN.R-

project.org/package=readxl.

Wickham, Hadley, Romain François, Lionel Henry, Kirill Müller, and Davis Vaughan. 2023. *Dplyr: A Grammar of Data Manipulation*. https://CRAN.R-project.org/package=dplyr.

Wickham, Hadley, Thomas Lin Pedersen, and Dana Seidel. 2023. *Scales: Scale Functions for Visualization*. https://CRAN.R-project.org/package=scales.

Xie, Yihui. 2014. "Knitr: A Comprehensive Tool for Reproducible Research in R." In *Implementing Reproducible Computational Research*, edited by Victoria Stodden, Friedrich Leisch, and Roger D. Peng. Chapman; Hall/CRC.

Zhu, Hao. 2024. *kableExtra: Construct Complex Table with 'Kable' and Pipe Syntax*. https://CRAN.R-project.org/package=kableExtra.