

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

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The introduction is self-contained and tells a reader everything they need to know including: 1) broader context to motivate; 2) some detail about what the paper is about; 3) a clear gap that needs to be filled; 4) what was done; 5) what was found; 6) why it is important; 7) the structure of the paper. A reader should be able to read only the introduction and know what was done, why, and what was found. Likely 3 or 4 paragraphs, or 10 per cent of total. The estimand is clearly stated in the introduction.

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), `webshot` (Chang 2023a), `webshot2` (Chang 2023b), and `scales` (Wickham, Pedersen, and Seidel 2023).

2.3 Data Measurement

A thorough discussion of measurement, relating to the dataset, is provided in the data section.

2.4 Data Visualization

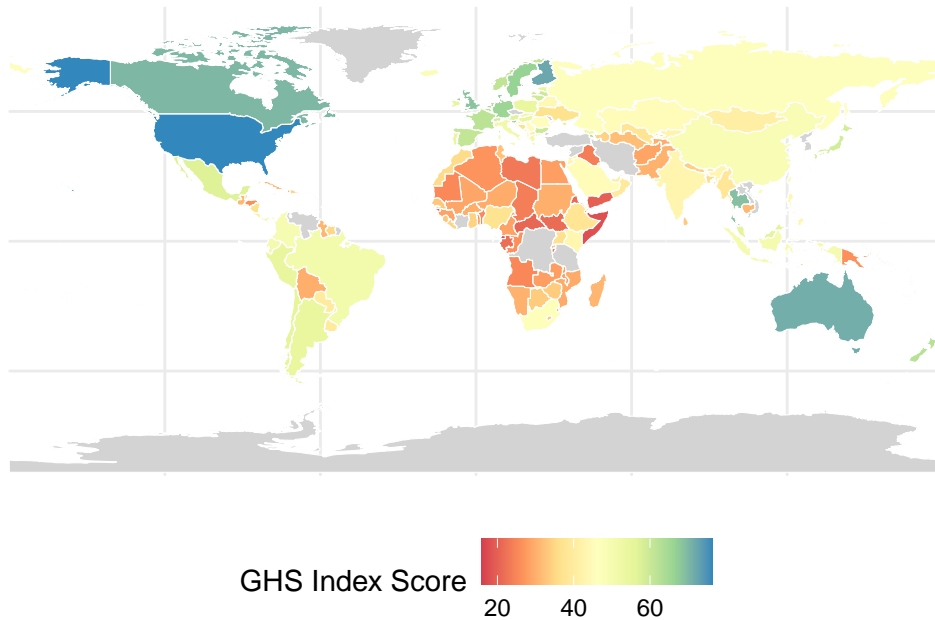


Figure 1: Global Health Security Index Scores by Country

3 Results

Our results are summarized in Figure 1.

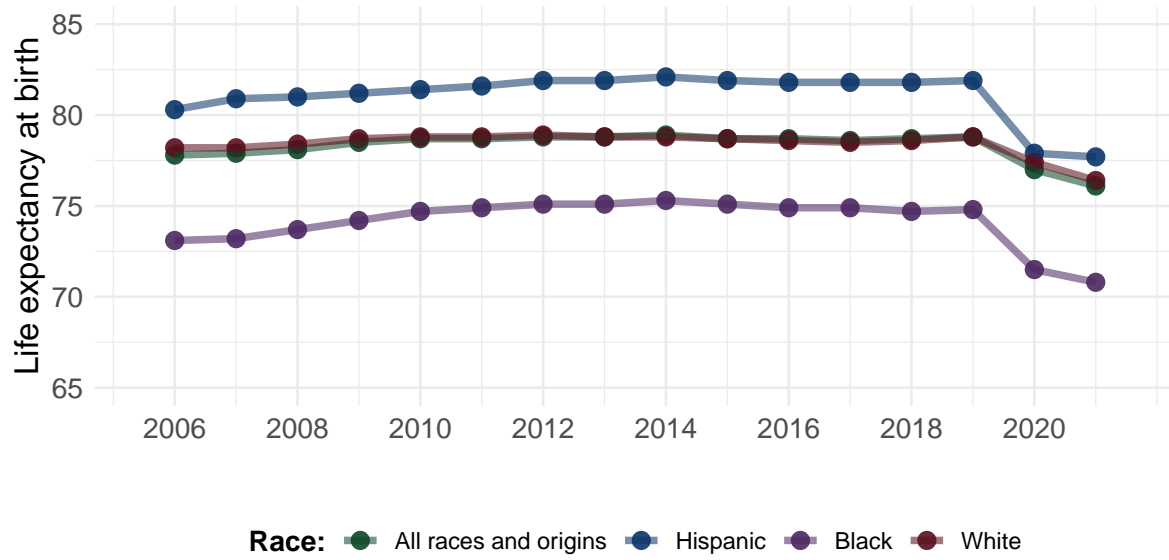


Figure 2: Estimates of Life Expectancy at Birth, by Race 2006-2021

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

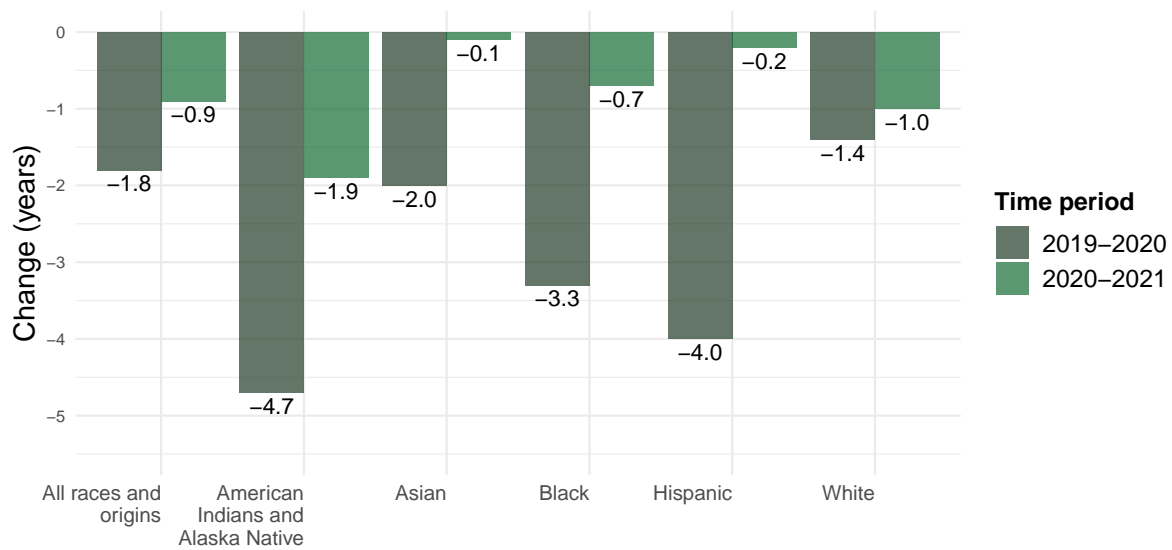


Figure 3: Change in Life Expectancy at Birth from the Previous Year

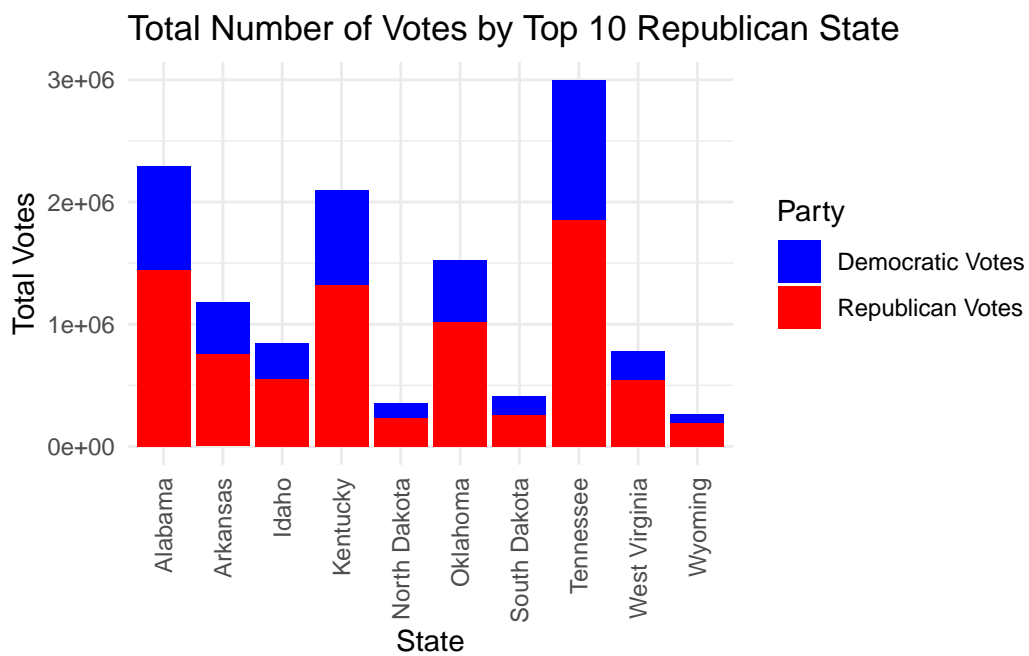


Figure 4: Total Number of Votes in Top 10 States with Highest Proportion of Republican Votes

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 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.

The COVID-19 pandemic starkly highlighted how social vulnerabilities and disparities in healthcare access exacerbated the impact of global health crises, contributing to significant variations in disease outcomes and underscoring the need for targeted public health strategies that address these disparities' root causes. Social vulnerabilities, such as socioeconomic status, race, ethnicity, and housing conditions, critically determined COVID-19 outcomes' severity, with populations in crowded housing, limited access to sanitation, and lower socioeconomic brackets experiencing higher transmission rates due to social distancing and hygiene maintenance challenges. An independent study done by the **Government of Canada** states that it "identified that the risk of COVID-19 related deaths in Black, Asian and minority ethnic groups was nearly 1.5 times higher than White individuals" (Emily Thompson 2021). Another news article done by the **MSN** (Dr. Sushama R. Chaphalkar 2024) states that 'racial minority participants reported more negative impacts on health status, activity, and absence from work as compared to the White population.' The pandemic's economic toll further limited these

groups' healthcare access, amplifying vulnerabilities. Disparities in healthcare access played a significant role in influencing COVID-19 morbidity and mortality, with communities facing healthcare facility shortages, provider scarcities, and barriers due to insurance or financial constraints at heightened risk. These disparities were evident in the uneven vaccine distribution and access, highlighting the advantages of regions with strong healthcare infrastructure. Marginalized populations, including racial and ethnic minorities, faced compounded risks from social vulnerabilities and healthcare disparities, evidenced by higher infection, hospitalization, and death rates due to factors like essential service employment and prevalent pre-existing conditions. A news article from CNN (Powell 2020) talks about how many essential workers, who cannot work from home, are from black and Latinx communities. These include healthcare professionals, grocery cashiers, delivery workers, and public transport employees. Despite their crucial roles, they often lack adequate pay, protection, and respect. Addressing these disparities in future pandemics requires public health strategies that prioritize equity and inclusivity, including community-based healthcare investments, enhanced vulnerable community outreach, and equitable healthcare resource access policies. By incorporating social determinants of health into public health preparedness plans, responses can effectively protect at-risk populations, making future public health responses more resilient, inclusive, and effective in safeguarding all population segments.

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

To address the fragmentation in data collection and sharing witnessed during the pandemic, it's crucial to establish integrated data platforms that enable seamless health data exchange among various health agencies and stakeholders, utilizing cloud computing and APIs for real-time accessibility and usability. Equally important is enhancing data standardization and interoperability through universal standards like FHIR (Fast Healthcare Interoperability Resources) to facilitate efficient data sharing. Investing in digital surveillance systems, which employ AI and machine learning to sift through diverse data sources for early outbreak detection, is essential for rapid response to health threats. Furthermore, fostering public-private partnerships can harness the agility of the private sector and the public health expertise of governmental agencies to enhance data analytics capabilities. Ensuring the privacy and security of health data through robust governance frameworks and advanced encryption is paramount to maintaining public trust. Engaging communities in these initiatives ensures their relevance and fosters trust, while building global data sharing networks encourages international collaboration, crucial for a concerted response to pandemics. Collectively, these strategies are fundamental to bolstering public health decision-making and preparedness, making our health systems more resilient against the challenges posed by emerging infectious diseases.

4.5 Weaknesses and next steps

Weaknesses and next steps should also be included.

5 Conclusion

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