

Impact of Socioeconomic Variables on Population's Cooperation with Healthcare Officials in the COVID-19 Era

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Introduction

Since the COVID-19 pandemic spread in early 2020, extensive research has been performed on the impact of various social, political, and economic variables on how well people across the world have followed government officials mandates and executive orders. This issue is of great importance because for a respiratory virus like COVID-19, simple and easy remedies such as mask usage and stay at home orders can significantly lower the spread so the healthcare system would not be overwhelmed with new patients, and a lower rate of infection would be observed.¹

What is generally believed is that all governmental and international organizational orders in times of pandemic will be treated the same by the populations and if people respond positively to one mandate, they will without a doubt respond the same way to the others as well.

For example, it is a common belief that during the COVID-19 pandemic, people who did not follow healthcare official's mask mandate because of various socio-political reasons did not also follow shelter in place orders and ended up not participating in vaccination procedures once it became available.

This belief is in fact not true and we show that impact of each socioeconomic variable on population's willingness to cooperate with healthcare officials when expected to follow a mandate or to participate in vaccination depends on a variety of factors such

¹ <https://www.sciencedirect.com/science/article/pii/S2468042720300117>

as politician's behavior, level of education, proximity to densely populated cities, etc. In short, we show that people responded differently to different mandates by healthcare officials and U.S. government orders and the reason behind this discrepancy is further analyzed in this work.

Data

The data used in this work along with their sources can be found below.

Dataset:	Mask Mandate Adoption per U.S. County
Fields used:	FIPS NEVER RARELY SOMETIMES FREQUENTLY ALWAYS
Source:	New York Times ²
Dates Used:	July 2, 2020 - July 14, 2020

Dataset:	Movement Range Map Data per U.S. Country
Fields used:	FIPS Change_in_Movement Inplace_Percentages
Source:	Facebook's Data for Good Initiative ³
Dates Used:	July 2, 2020 - July 14, 2020

Dataset:	Population Density
Fields used:	FIPS Pop_Density
Source:	Census.gov ⁴
Date Updated:	June 8, 2020

Dataset:	Presidential Election Decisions
Fields used:	FIPS Trump_Winner Biden_Winner
Source:	GitHub ⁵
Dates Used:	2020

²<https://github.com/nytimes/covid-19-data/tree/master/mask-use>

³<https://data.humdata.org/dataset/movement-range-maps>

⁴<https://covid19.census.gov/datasets/USCensus::average-household-size-and-population-density-county/about>

⁵ https://raw.githubusercontent.com/kjhealy/us_elections_2020_csv/master/results_current.csv

Dataset:	Unemployment per U.S. County
Fields used:	FIPS Unemployment_Value
Source:	ERS.USDA.GOV ⁶
Date Updated:	2019

Dataset:	Poverty Estimates per U.S. County
Fields used:	FIPS Poverty_Estimates_Value
Source:	ERS.USDA.GOV ⁷
Date Updated:	2019

Dataset:	Education Level per U.S. County
Fields used:	FIPS Percent_Bachelors_or_Higher
Source:	ERS.USDA.GOV ⁸
Date Updated:	2019

Dataset:	Crime Data per U.S. County
Fields used:	FIPS Crime_per_100K
Source:	UMICH.EDU ⁹
Date Updated:	2016

⁶ <https://www.ers.usda.gov/webdocs/DataFiles/48747/Unemployment.csv?v=8780.3>

⁷ <https://www.ers.usda.gov/webdocs/DataFiles/48747/PovertyEstimates.csv?v=8780.3>

⁸ <https://www.ers.usda.gov/webdocs/DataFiles/48747/Education.csv?v=8780.3>

⁹ <https://www.icpsr.umich.edu/web/pages/>

Dataset:	Rurality Percent per U.S. County
Fields used:	FIPS Percent_Rurality
Source:	GitHub ¹⁰
Date Updated:	2010

Dataset:	Vaccinations per U.S. County
Fields used:	FIPS Completeness_Percent
Source:	US COVID ATLAS ¹¹
Date Updated:	June 15, 2021

Dataset:	COVID Testing Counts per U.S. County
Fields used:	FIPS COVID_Average_Testing
Source:	US COVID ATLAS ¹²
Date Updated:	June 1, 2021

Dataset:	COVID New Confirmed Rate in 7 days period per U.S. County
Fields used:	FIPS COVID_Average_Confirmed
Source:	US COVID ATLAS ¹³
Date Updated:	June 1, 2021

Dataset:	COVID New Death Rate in 7 days period per U.S. County
Fields used:	FIPS COVID_Average_Death
Source:	US COVID ATLAS ¹⁴
Date Updated:	June 1, 2021

¹⁰https://raw.githubusercontent.com/css-mit/maskmandate/main/Data/County_Rural_Lookup.xlsx?token=AUGD2HIMYCC3P2QKTNVSL2DAWDPI6

¹¹<https://theuscovidatlas.org/data>

¹²<https://theuscovidatlas.org/data>

¹³<https://theuscovidatlas.org/data>

¹⁴<https://theuscovidatlas.org/data>

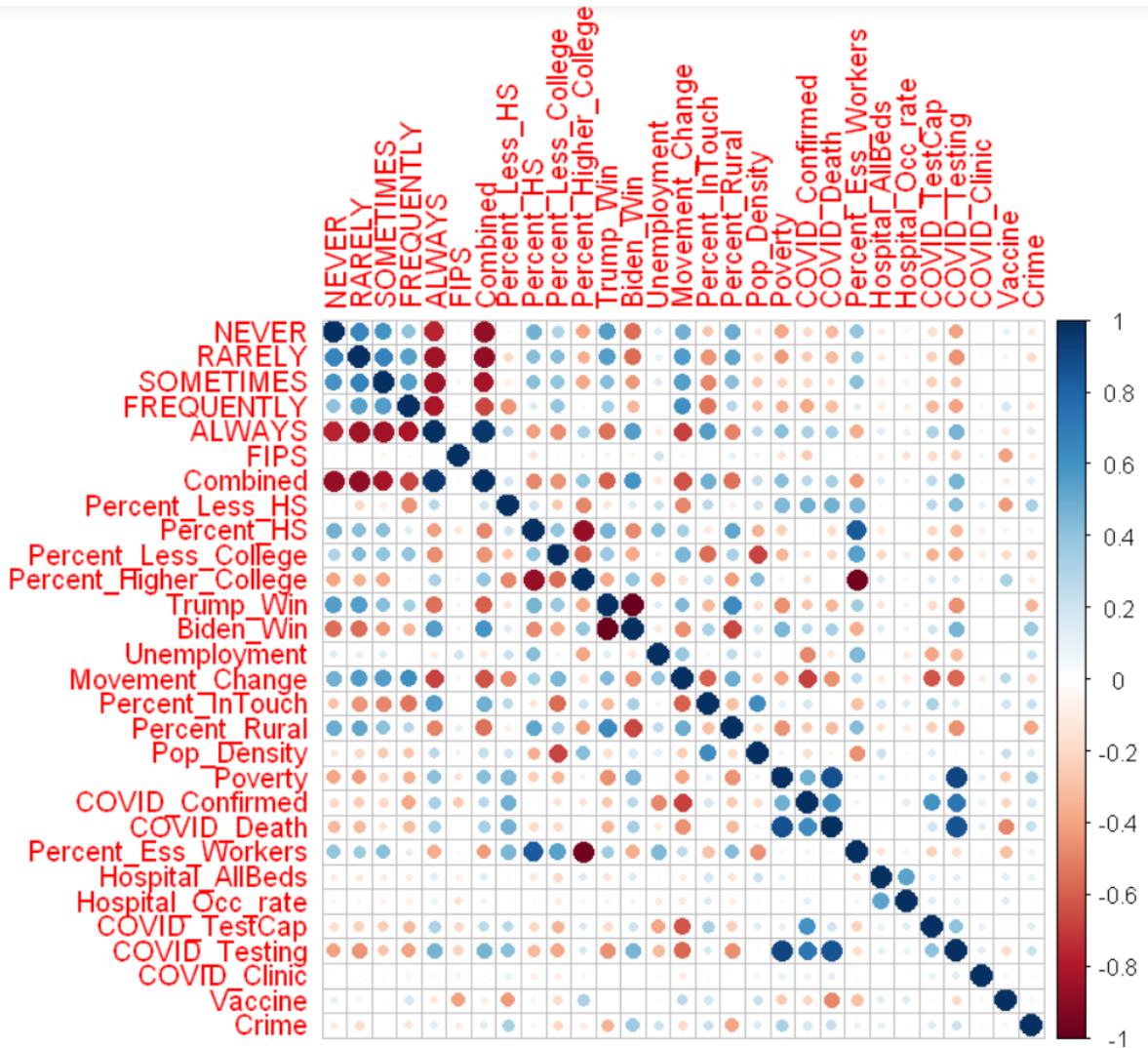
Dataset:	Percent Essential Workers per U.S. County
Fields used:	FIPS COVID_Essential_Workers_pct
Source:	US COVID ATLAS ¹⁵
Date Updated:	June 1, 2021

Dataset:	Testing Clinics per U.S. County
Fields used:	FIPS COVID_Clinic_Testing
Source:	US COVID ATLAS ¹⁶
Date Updated:	June 1, 2021

¹⁵<https://theuscovidatlas.org/data>

¹⁶<https://theuscovidatlas.org/data>

Correlations



Positive Correlations	High School Degree	vs	% Essential Workers
	Poverty Levels	vs	COVID Testing Counts
	Mask Always	vs	Biden Win
	College Degree or Higher	vs	Mask Always
Negative Correlations	College Degree or Higher	vs	% Essential Workers
	Mask Always	vs	Trump Win
	COVID Confirmed Average	vs	Movement Range
	Vaccination	vs	High School Degree or Less

Regressions

Mask U: Mask Usage Always

Move C: Movement Change

Vacc P: Vaccination Participation

PD : Population Density

HC : % College Education or Higher

PO : Poverty Estimates

UN : Unemployment Rates

COVT : COVID Testing Count

TC : Testing Clinic

EW : % Essential Workers

COVC : COVID Confirmed Rate

TW : Trump Win

CR : Crime Rate per 100K

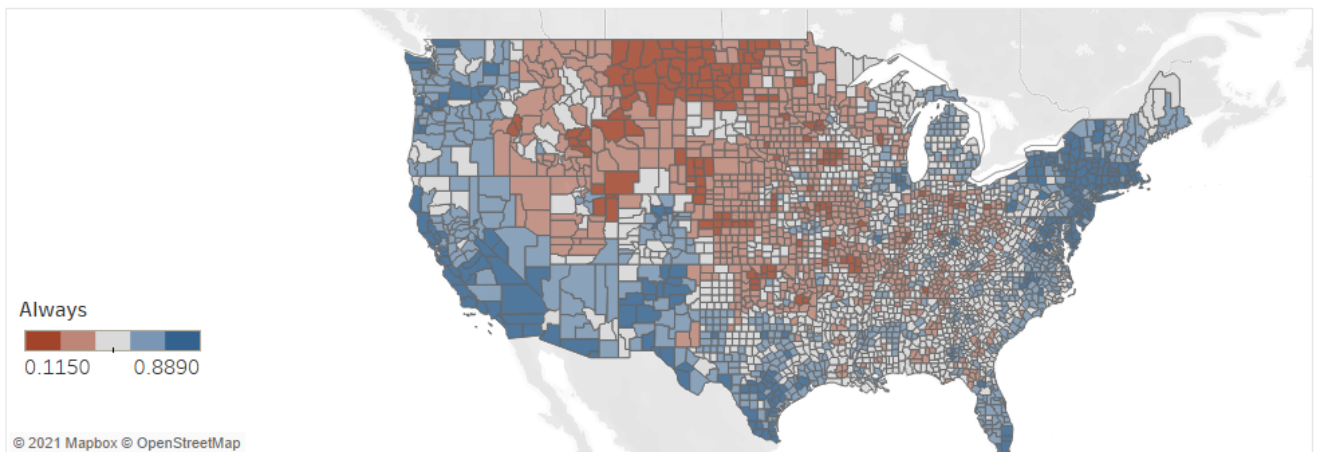
HO : Hospital Occupancy Rate

[illegible][illegible][illegible]

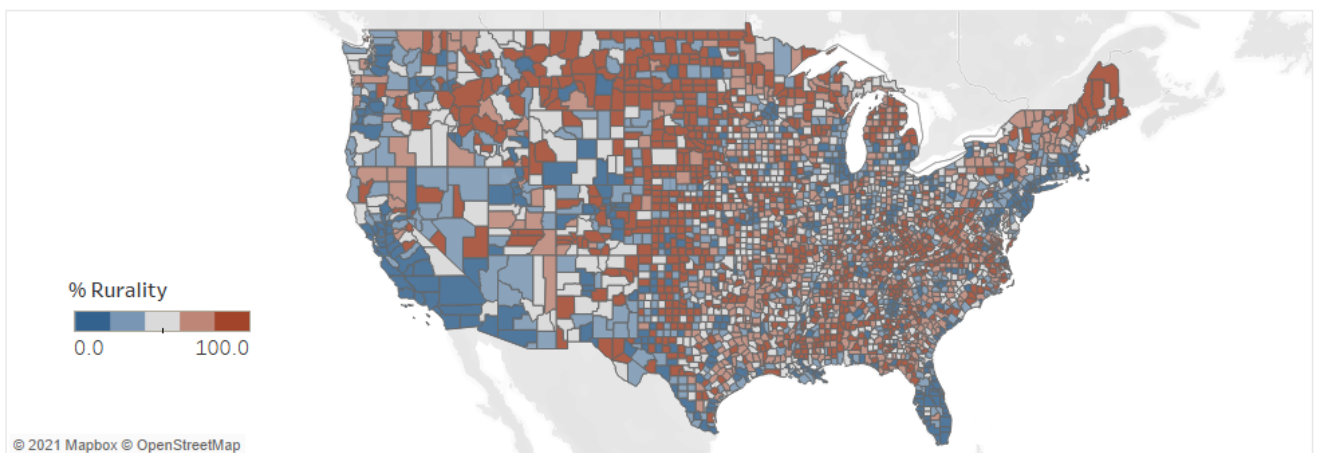
Clustering & Comparison

1. Mask Use - Always vs % Rurality n = 5

Mask Use Always n = 5 Comparison

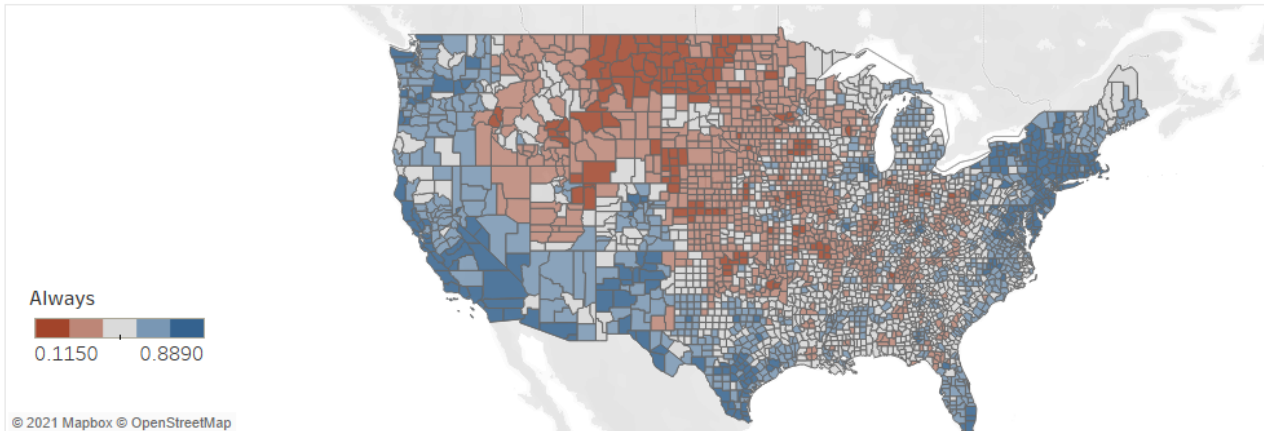


% Rurality n = 5 Comparison

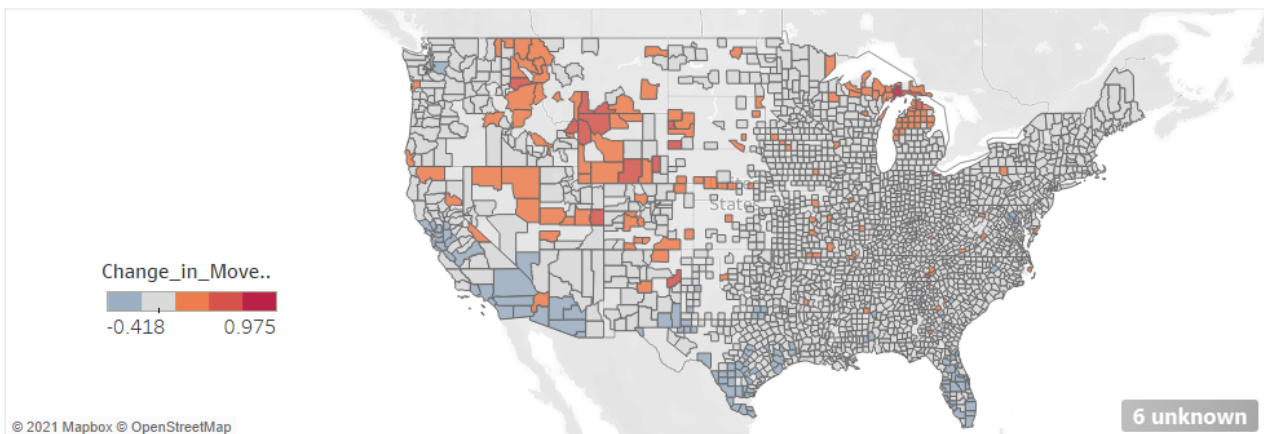


2. Mask Use - Always vs Movement Change n = 5

Mask Use Always n = 5 Comparison

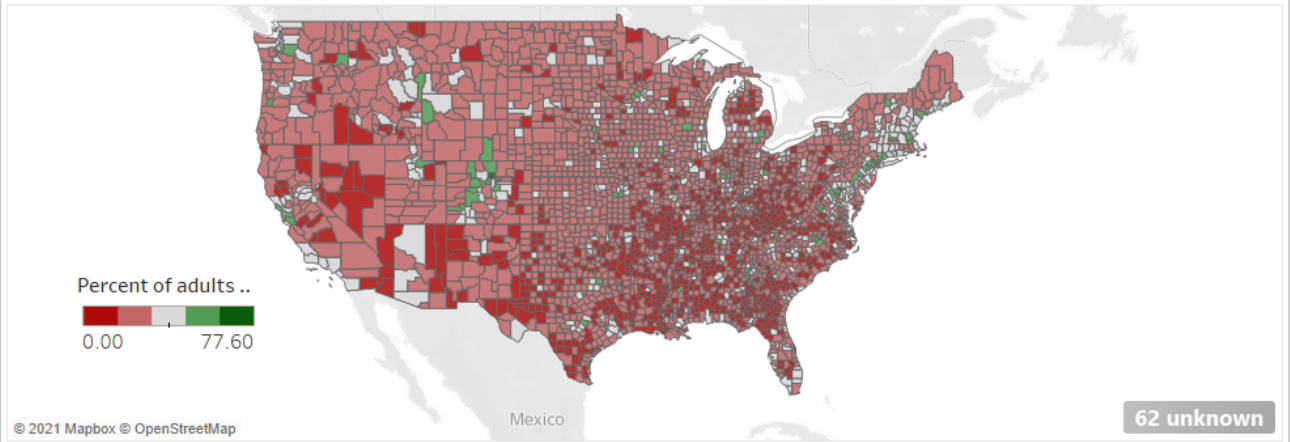


Movement n = 5

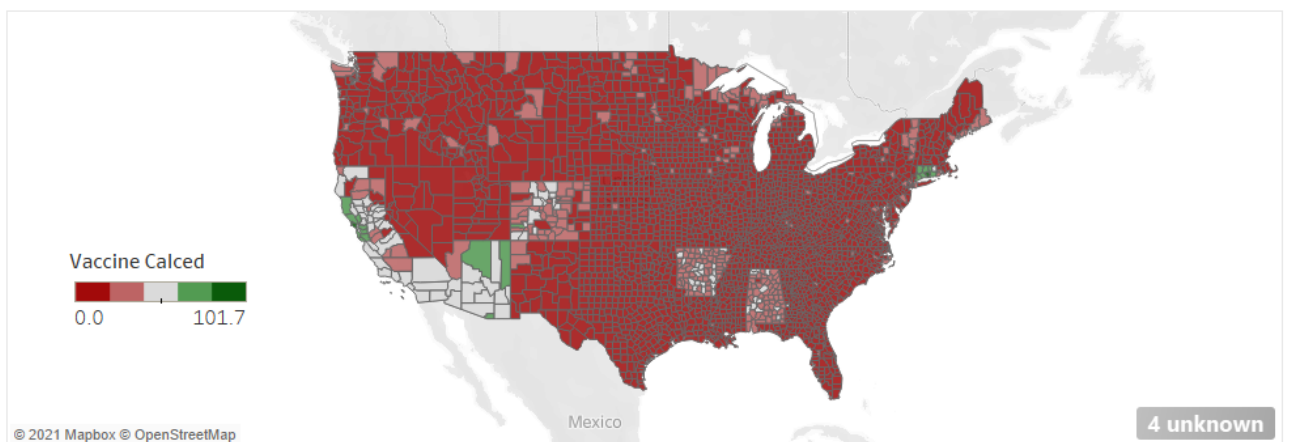


3. Education Level vs Vaccination Participation

Education n = 5

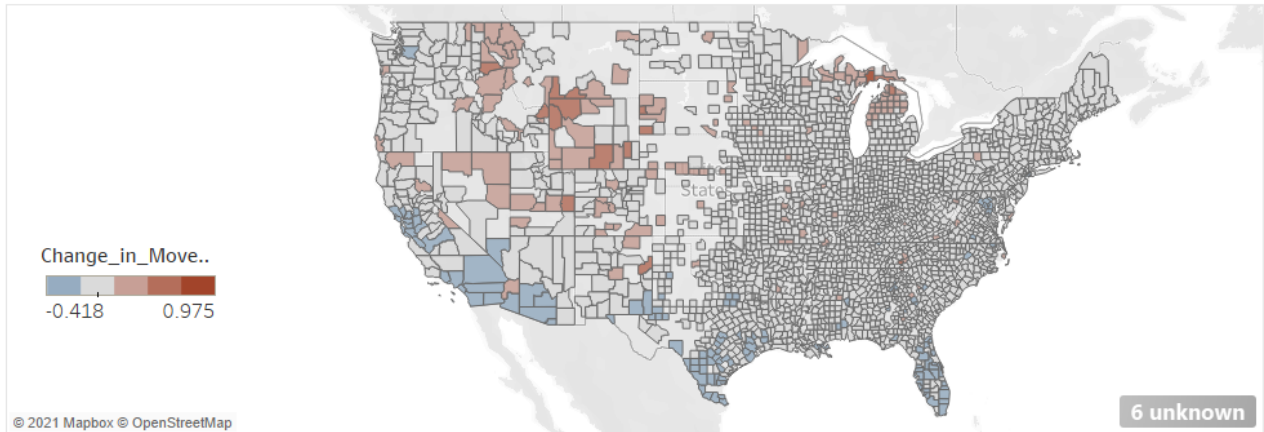


Vaccination

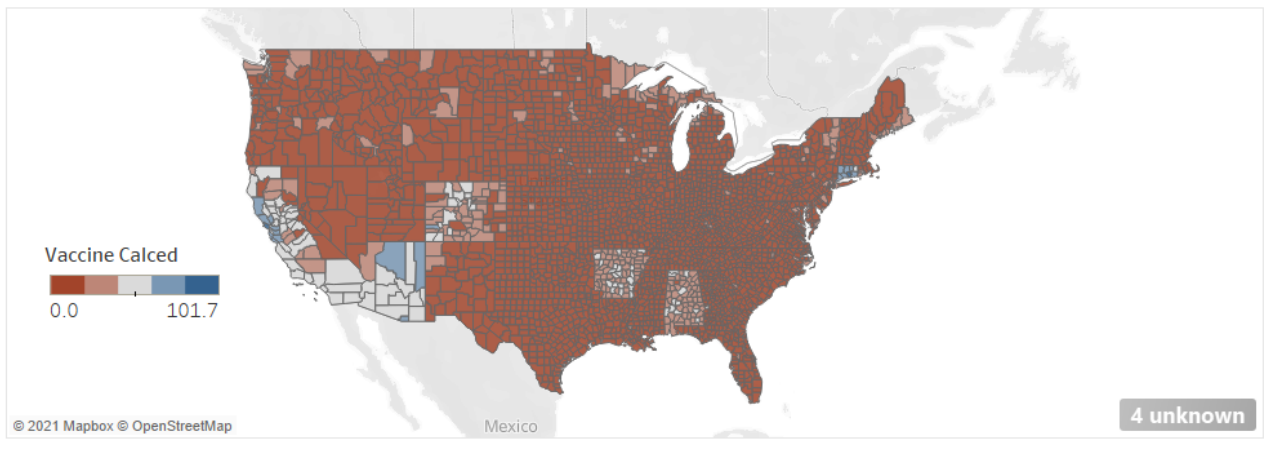


4. Movement Change vs Vaccination

Movement Comparison



Vaccination Comparison



Discussion

When looking at various socioeconomic variables and attempting to isolate their impact on Mask Adoption, Movement Change, and Vaccination Participation, several key facts need to be considered:

Mask Mandate Adoption is not necessarily highly correlated with other governmental orders such as Shelter in Place orders which is captured under Movement Change in this work. We show that using %Essential Workers Population in each county. These are people who may want to comply with any and all governmental mandates but because they have to be mobile, will not be able to stay at home, but that does not necessarily mean they do not follow other governmental orders.

As can be seen in the regression tables, Essential Workers in each country did not comply with the Mask Mandate and also moved significantly more compared to other people but took up the vaccination at a good rate.

Another example of this can be counties where Trump had the highest share of votes in the 2020 elections, 4 months after the collection of movement and mask adoption data used in this research. As it can be seen, in those counties, there is a lower Always mask adoption and more change in movement, however, unlike what would be expected, there is no correlation between voting for Trump and Vaccination Participation.

This can be explained by the behaviour of politicians and how impactful their behaviours can be on the population. Since the Trump administration was the government in charge when the vaccine was developed and released, the vaccination participation, or in other words following governmental orders, has been shown to be far more compliant than mask use adoption and stay at home orders.

Another important factor to consider when comparing population's response to governmental orders in time of pandemic is considering how dense the population is and how rural that county might be based on the most recent measurements to come to an accurate conclusion.

As can be seen in the US map comparisons between %Rurality and Mask Use Adoption, there is a positive correlation between a county being rural and complying less with the mask mandate. One possible explanation might be that since the population of people is less dense in the rural areas, people might not see the need to 'Always' follow the mask mandate but if they would be in a more populated city, they will put on a mask at all times.

There also seems like a strong correlation between %population with at least a college degree or higher and vaccination participation. This can be a good policy recommendation which can suggest to governments to invest more on educating the population so in times of pandemics they would be more compliant with beneficial remedies such as vaccination.

Finally, it is important to point out that performing sufficient testing seems to have a strong correlation with more mask wearing, less change in movement, and more vaccination participation. Same relationship can be seen in the announcement of confirmed COVID cases or COVID death cases which suggests that being transparent and educating the public and at the same time providing enough testing to them significantly improves governmental order adoption by the population.

Conclusion

Observed in the Data	Policy Recommendation
No correlation between voting for Trump and Vaccination Participation in Counties voting for Trump	Politician's behaviour matters and impacts people's response to remedies to pandemics
Strong correlation between Education (College Degree or Above) and Vaccination Participation	Governments should invest more on high education as it seems like it has externalities in healthcare as well
Difference in Essential Workers response to different governmental orders	Governments need to take into account segmentation of people in each county when analyzing population's response to orders
Availability of Testing and Clinics in each county and transparency in confirmed or deceased cases from COVID has strong correlations with being compliant	Governments should provide ample testing and plan on being transparent with people about the COVID statistics since it leads to population's cooperation.
Strong correlation between not complying with Mask Mandate and %Rurality in counties	In addition to considering people's socioeconomic status when analyzing population's response to governmental orders, governments should investigate other county specific variables such as %Rurality and Population Density to better understand people's behaviour in times of pandemic and in response to orders.