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GEOG 28602-1 GIS III

Final Project

Background and Motivation

Throughout the course of the coronavirus pandemic in the United States and abroad, local governments have heavily recommended the wearing of face masks as a method of stopping the airborne transmission of the disease[1] For many municipalities and states, this has been enforced through mask mandates, which usually require the wearing of face masks in public places, or specifically inside of stores. An example of a mask mandate is the one from the state of Illinois, which requires the wearing of face masks "when in a public place and unable to maintain a six-foot social distance. Face-coverings are required in public indoor spaces such as stores"[2] While initially nearly every state and municipality across the US adopted a mask mandate in spring or summer 2020, they quickly became unpopular with conservative politicians, which led to the repealing of mask mandates in a number of states in early 2021. One example of this was in Alabama, where the state repealed its mask mandate on April 9, but the major cities of Birmingham and Montgomery maintain their mask orders into May[3]. As the rate of vaccinated people increases, the number of outbreaks has decreased but information about whether mask mandates actually decrease the spread of the disease will pay dividends for future similar events, where a debate has to be met between maintaining public confidence in public health measures and decreasing the spread of the disease.

[1] "Masks Protect You and Me"
[2] "Executive Order 2020-32"
[3] Tomberlin

I believe that spatial information can offer some new insights into the question of whether mask mandates lead to substantively different rates of COVID cases in an area, because the situation is predominately spatial. The areas that repealed mask mandates at different times are each specific spatial objects within the broader United States. The overall research question to be answered is whether states that repealed mask mandates while in a similar region and risk level during the pandemic saw a sharp increase in cases compared to states that did not, or whether there was no detectible association between the two.

Data Sources, Spatial and Temporal Scale

The data source for this experiment is a New York Times COVID tracking portal, which updates daily on Github, containing case and death data for every US county from COVID-19 (link in Works Cited). This, along with a couple of ZIP code datasets, should be in the R package used in the experiment—I did not end up using the cleaned Illinois and Minnesota ZIP code data because of difficulty including layers in an interactive RShiny application, although they are also in the package. The background maps were from the R Tigris package, cited here[4] The spatial scale of this experiment is the seven states in the Upper Midwestern United States—Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio, and Wisconsin—I selected those because they form a clearly delineated region within the country with a good mixture of cities, rural areas and suburbs. The temporal scale is February 6, 2021 to May 29, with data collected weekly. The reason for collecting data in that range is that it coincides with when mask mandates were present in some, but not all, states in the Midwest. In the region, the first state to repeal its statewide mask mandate was Iowa, doing so on February 7, 2021[5]. Wisconsin's mask mandate

[4] Walker and Rudis
[5] Schlesselman

was ended by a state Supreme Court order on March 31, 2021[6], while Indiana ended theirs on April 7[7]. The other four states in the region ended their mandates either partially or fully only after the CDC order on May 14 that stated outdoor mask mandates were no longer necessary, so a reliable 3-week interval does not yet exist for them, although they do still form an effective control group against the states that ended their mandates early[8][9][10][11]

Methods Used

The primary statistic that would be used to measure COVID impact in this experiment was to take the ratio of cases per county at the end of the time period to cases per county at the start of the time period. The reasoning for this was that (a) case rate was the most available COVID-related statistic from state websites and (b) it was fairly high in general so that it was less vulnerable to sudden jumps if a state or county released a large number of older reports at the same time. The time periods for study were 3-week intervals (to allow for a delay in people showing symptoms or testing), with the start of the interval being the event to test against (like the repeal of a mask mandate). The advanced spatial techniques used in this experiment were creating an interactive RShiny dashboard that allows the user to select the time period that they want to study, and saving the data for this experiment after cleaning in an R package form.

Results

[6] "Supreme Court of Wisconsin"
[7] DePompei
[8] Petrella et al.
[9] Ainsworth
[10] Callaghan
[11] Steer

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COVID-19 Data and Mask Mandates in the Upper Midwest

Select a time period here

Data will display change in COVID cases for the given range.

Select a time period here

Since Iowa mandate repealed

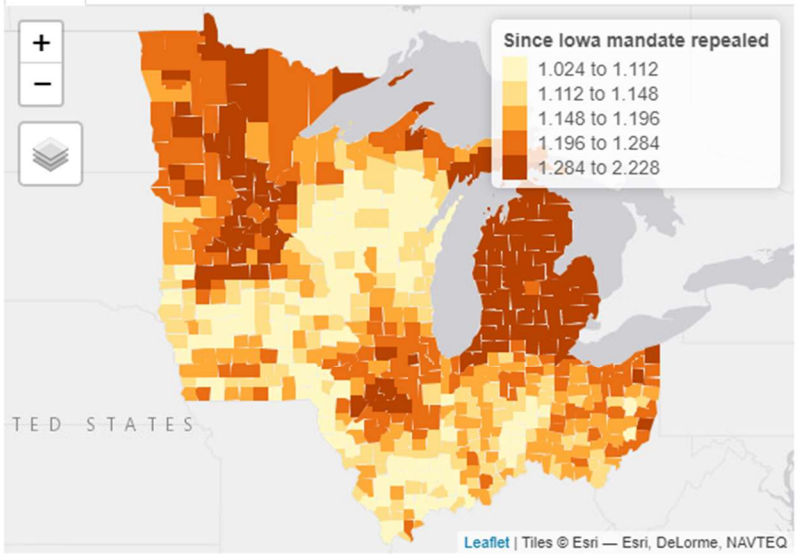
About

COVID-19 cases at the end of the time range, with May 29 the end date if not provided, as a ratio of cases at the start of the time range

Data Source

This data is from the New York Times.

Map



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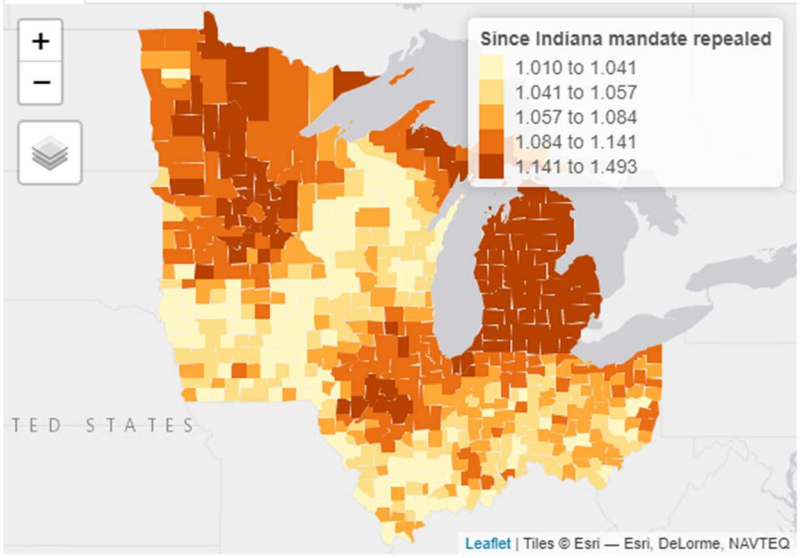

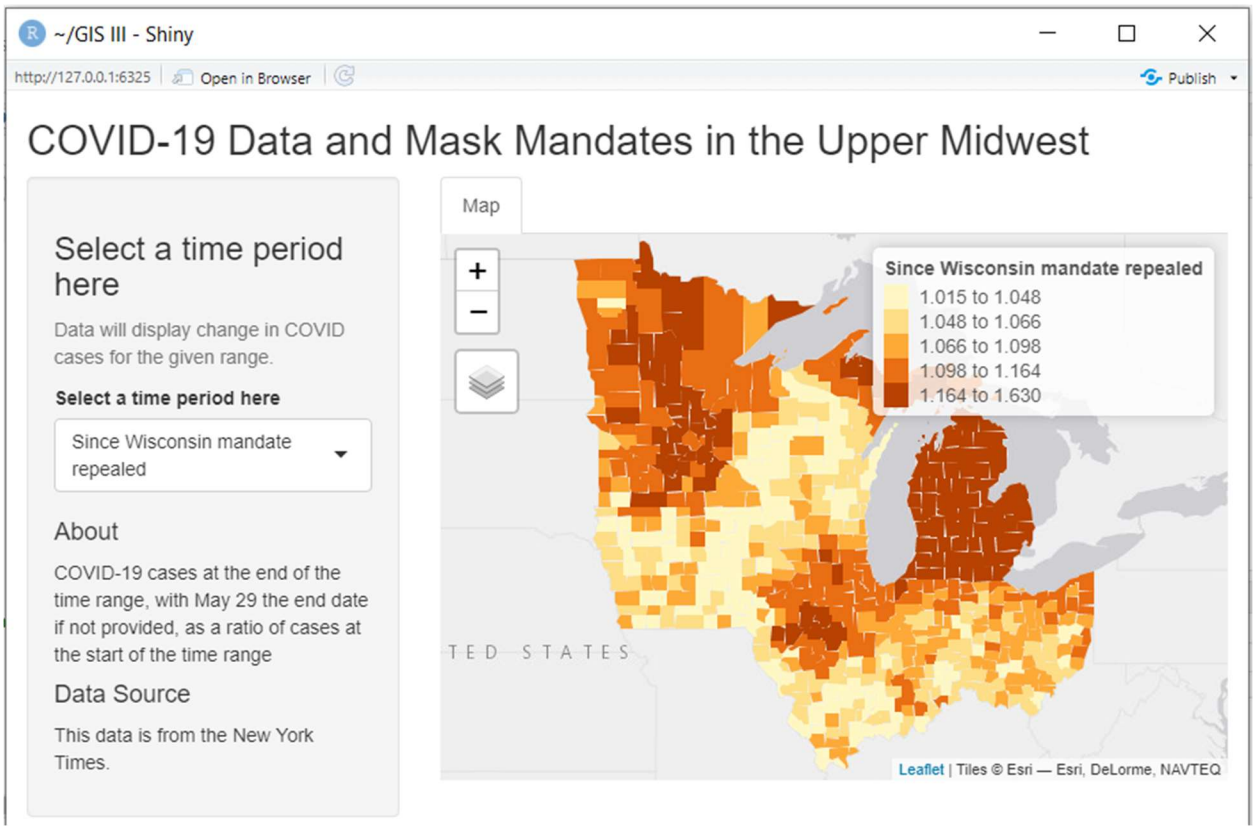

These three screenshots from the RShiny app coded in the project show the ratio of COVID cases since the Iowa mask mandate was repealed, since the Indiana mandate was repealed, and since the Wisconsin mandate was repealed, respectively.

The data showed mixed results, although by and large, it did not seem like there was any association between whether a state had a mask mandate in place or not. Throughout March and April, there was a huge COVID surge in Michigan, which still had a mask mandate in place—and is far larger than the rest of the rest of the Midwest. I wasn't able to find regular data for the entire region at a smaller level of scale, like the ZIP code scale or citywide, so cities like Iowa City[12] that continued to have mask mandates even while their state repealed theirs are still lumped in with the state as a whole. However, there are not many locations where a specific

[12] "City Revises Local Mask Mandate"

county has a much different case rate than an adjacent county, so it is unlikely that those made a large difference. The impact of the pandemic does seem to be strongly regional, however, as can be seen by the several counties in northern Iowa bordering Minnesota having sharply different changes in their COVID statistics compared to the rest of the state of Iowa overall. Furthermore, the rate of increase in COVID cases in these seven states was fairly low as a whole, as early February was the end of the major winter surge, while cases nationwide have been in sharp decline since then.

Limitations, Future Work, Conclusions

While the data fails to support a claim that mask mandates generally lead to a lower rate of increase in COVID cases, there are a couple of limitations in this experiment. Firstly, the historical data was not sufficient to analyze data at a scale below the county level, so if a city still had a mask mandate but the surrounding county did not, these differences could not be fleshed out in this experiment. Also, the irregular rate of data being updated on state websites means that these 3-week ranges may still have been subject to the state website adding a large backlog of cases immediately, although that is unlikely. Furthermore, the focus on just the seven Great Lakes states makes them more subject to one high outlier in case increase (Michigan), rather than focusing on the entire US, but the high amount of required data made that difficult for this experiment.

As far as future work, acquiring more precise data at finer levels could be one step forward, along with extending the scope of the project to cover more data points. Perhaps focusing on the imposition of mask mandates, as well as repeal, could be worthwhile although I found data from that period to be even harder to find. Furthermore, data from this study could be

combined with other studies that covered the actual rate at which masks were worn during the time the mandate was in place.

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