# Interactive choropleth of COVID-19 measures across counties in the USA

Sam Parmar*
University of Illinois

Joseph Allen†
University of Illinois

Vishwa Kapoor‡
University of Illinois

## Abstract

The COVID-19 pandemic has caused massive economic and social disruption in the USA. Many counties in the USA have especially been hit hard by the pandemic. Choropleth visualizations present a way to concisely represent population health measures at the county-level over time. In order to better understand the impact COVID-19 across the US population, we built a dashboard in d3js to monitor disease impact across counties.

**Keywords**: COVID-19, d3js, Dashboard, USA, Public Health.

**Index Terms**: Dashboard—Visualization—USA

## 1 Introduction

Many local health departments (LHDs) across the USA have faced serious capacity challenges to leverage public health informatics to guide county-wide disease response. Unfortunately, as many as 68% of LHDs in the USA have no interoperable information systems or have only some systems that are interoperable. Additionally, LHDs most commonly use paper records for storage of clinical and nonclinical data [1]. This highlights the need to enhance informatics infrastructure in the United States to implement more effective information sharing and response strategies.

*email: samirtp2@illinois.edu

†email: jaallen2@illinois.edu

‡email: vpk2@illinois.edu

Mindful of the resource constraints of many public health departments, there is an opportunity for academic institutions and students to engage with public health data and initiate collaborations to provide analytical solutions for public health staff to utilize. The work here leverages Johns Hopkins Center for Systems Science and Engineering (CSSE) county-level COVID-19 data provided as daily case report CSV files posted on Github (https://github.com/CSSEGISandData/COVID-19/tree/master/csse_covid_19_data) [2]. We present a web-based interactive choropleth map of COVID-19 cases, deaths, and recoveries in the United States available on https://parmsam.github.io/cs519-project/.

## 2 Implementation

Choropleths provide an opportunity to represent aggregate summaries of a measure such as disease incident rate within each geographic area of interest. It also serves as a great way to show variability over the area. The areas here are counties across the USA. An exponential color map was used to represent measures. Measures of interest included incident rate (cases per 100,000 persons), case fatality ratio (number recorded deaths/number of cases), and number of deaths (estimated based on media reports and local reporting). CSSE Daily case reports from December 14, 2020 to December 16, 2021 were utilized. A clickable slider was used to move across reporting dates. A tooltip with complete county-specific measures is provided to the user upon mouse hover over a county. The interactive dashboard was developed using D3.js and designed for Google Chrome. Zooming in and out is facilitated by the browser. Single hue progressions are used with different colors for each mapped measure.

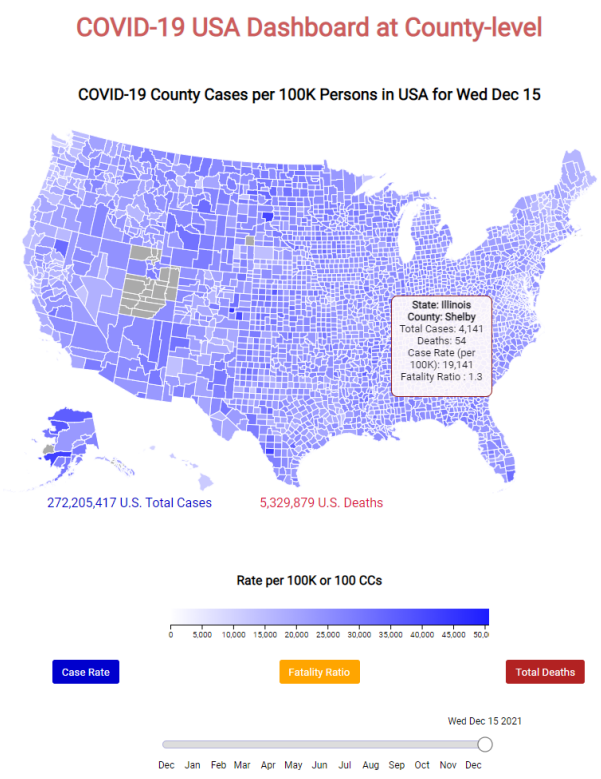


Figure 1: Interactive choropleth showing county-specific incident rate on December 16, 2021 across the USA.

## 3 Discussion

This project implements an up-to-date interactive visualization of multivariate data related to COVID-19. The implementation of the visualization allows the user to perform dynamic queries by selecting various measures and specific dates associated with those measures. The user is able to see the progression of these measures over time and gain insight into what areas in the United States have been most affected by the pandemic.

The implementation of this visualization presents some limitations, however. First, given that COVID-19 is a novel virus, the data for some of the relevant measures is not always available. For example, the group wanted to include a measure to represent the number of individuals who have recovered from the virus, but due to how this measurement is reported, this measurement was essentially nullified within the dataset. Additionally, viewing every county in the US can be taxing on a user's eyesight. A potential fix for this could be to give the user the option to view only states of interest and the counties within that state. This would most likely also require implementing zoom functionality to allow the user to better view the state or region of the US that they are interested in.

Given some of the limitations, this visualization works well to demonstrate the progression of the virus within the US and highlight some of the most-affected areas in the country. Because the user has the ability to view multiple measures related to COVID-19, the user can see how the virus has progressed and what measures are correlated with one another, if at all.

## 4 Conclusion

While many public health departments face resource constraints that make it difficult to fully leverage public health informatics, academic institutions and students can help fill this gap by providing informatics for utilization by public health staff. By leveraging the public county-level COVID-19 data collected by John Hopkins Center for Systems Science and Engineering (CSSE), as well as the D3.js JavaScript library, this study established that choropleths are an effective visualization tool for identifying trends and correlations related to the COVID-19 pandemic. While representing every county on a single visualization has certain limitations, these limitations can be significantly mitigated with the implementation of various features.

Possible future work on this visualization would include giving the user the ability to select which states and regions within the United States they want to view. Additionally, the visualization could also include the ability to zoom in on areas of interest. One of the primary benefits of the D3.js library is that, while implementation of features can sometimes be complex, this complexity also offers the freedom to create extremely versatile informatics allowing for deeper insight into the issues being explored.

## References

[1] Khurshid, Anjum MD, PhD; Shah, Gulzar H. PhD, MStat, MS; Nguyen, Tran H. DrPH, MPH; Jones, Jeff A. PhD, MA Building Informatics Capacity of Local Health Departments to Combat COVID-19: A Call to Action, Journal of Public Health Management and Practice: July/August 2020 - Volume 26 - Issue 4 - p 322-324 doi: 10.1097/PHH.0000000000001201

[2] Dong E, Du H, Gardner L. An interactive web-based dashboard to track COVID-19 in real time. Lancet Inf Dis. 20(5):533-534. doi: 10.1016/S1473-3099(20)30120-1