COVID-19 Surveillance Dashboard

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Overview

The COVID-19 pandemic may well represent one of the gravest challenges that the world has faced during the past 50 years. As of today, March 19, 2020, several regions of the US have imposed strict social distancing measures. The death rate in Italy and several other parts of the world continues to rise, and, as of today, the total number of reported infections is over 240,000 and the number of deaths has crossed 9,800. These numbers are set to rise rapidly.

A number of researchers have developed innovative dashboards to visualize the outbreak. One of the first such dashboards was produced by Johns Hopkins University [JHU] and continues to be very popular. See [HealthMap,UW,WHO] for examples of other dashboards. Dashboards made using ESRI GIS tools can be viewed on the ESRI site [ESRI]. Most of these dashboards focus on the current state of the disease. Furthermore, while data can be viewed, it is often hard to search for a region of interest, and datasets are not downloadable from most of these sites.

In this paper, we describe our team's mobile-friendly dashboard (https://nssac.bii.virginia.edu/covid-19/dashboard/) that is designed to provide users with both the current state of the epidemic as well as its history. Distinctive features of our dashboard include:

- A time slider to allow users to see how conditions have evolved over the course of the epidemic;
- An interactive chart where users can view cumulative and daily case counts by attribute (Active, Confirmed, Deaths, and Recovered);
- A heatmap of a selected attribute (Active, Confirmed, Deaths or Recovered) on an interactive map, filterable by date;
- A query tool that allows advanced users to focus on regions of interest;
- A search tool that allows users to filter the dataset down to specific records;
- The ability to select multiple regions by clicking on the map;
- The ability to add or remove attributes from charts by clicking on their captions;
- Sort and export subsets of the data for analysis using external tools;

- A feature that allows users to view incidence curves for each region individually (since version 1.1.4).

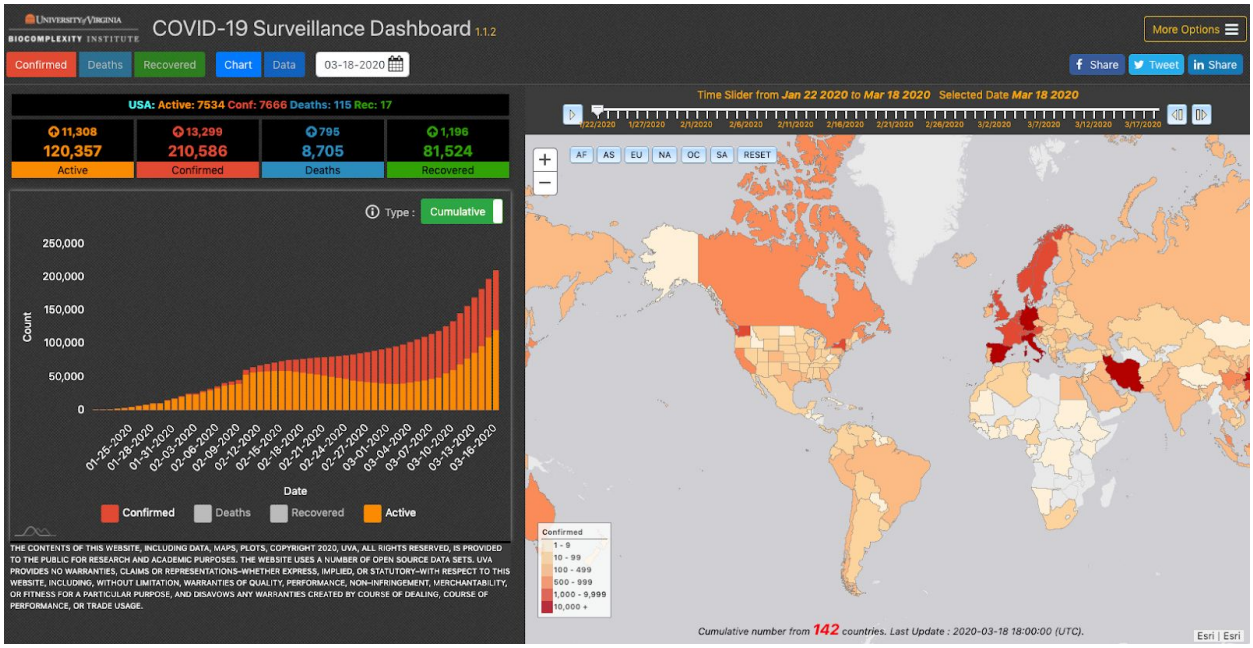

Figure 1: A screenshot of our dashboard as of 2pm, March 18, 2020. By default, it shows the Chart tab and the Map view, and users can click on the Data tab to view/download the data.

The unique movie-like feature, i.e., the time slider, allows users to visualize the temporal spread of the epidemic. Furthermore, the dashboard supports certain spatio-temporal queries so that a user can explore the disease spread in time and space. When COVID-19 began spreading across the United States, we complemented the important work done by the JHU team [JHU] by providing detailed county-level data. This feature is crucial for modelers who would like to calibrate their models for state and county-level analyses.

Usage statistics: The dashboard has seen very active use by the world-wide community. In the last two weeks (March 6, 2020 to March 19, 2020), our map has received over 12.4 million requests from more than 220 countries.

Sample charts and analysis that can be conducted:

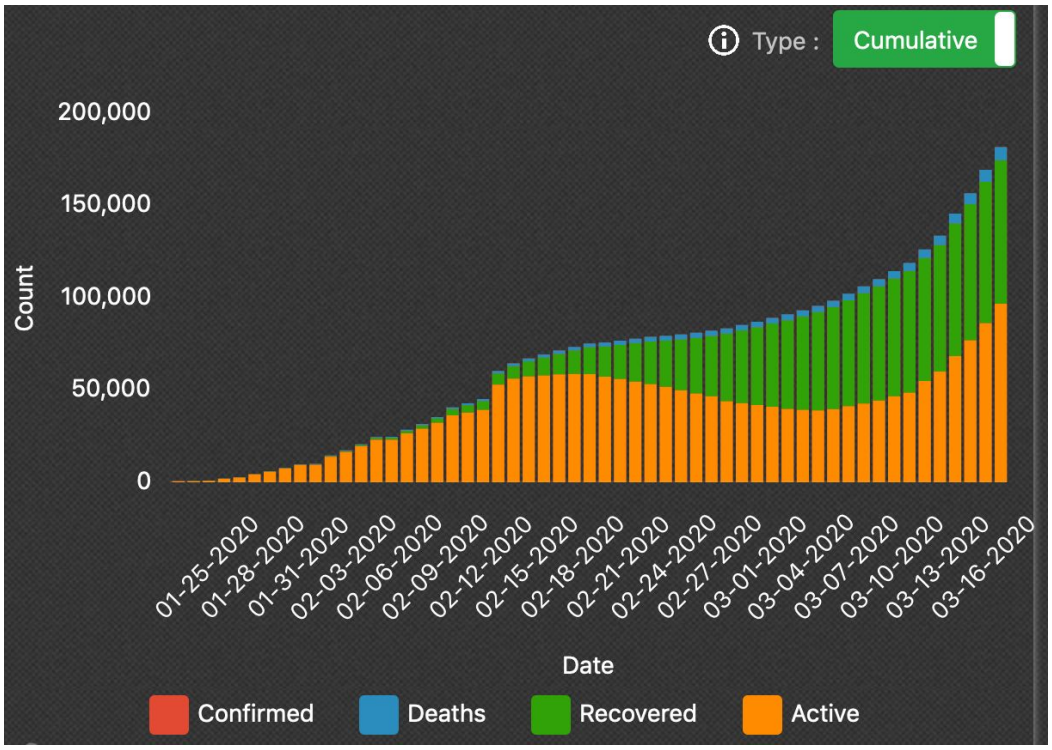

Figure 2: Global cumulative number of deaths, recoveries and active cases (prevalence) as of March 16, 2020. The first peak for active infections was on February 17, 2020 when there were 58,718 active cases. It gradually decreased to a local minimum of 39,012 active cases on March 14, 2020, but resumed its rapid increase afterwards.

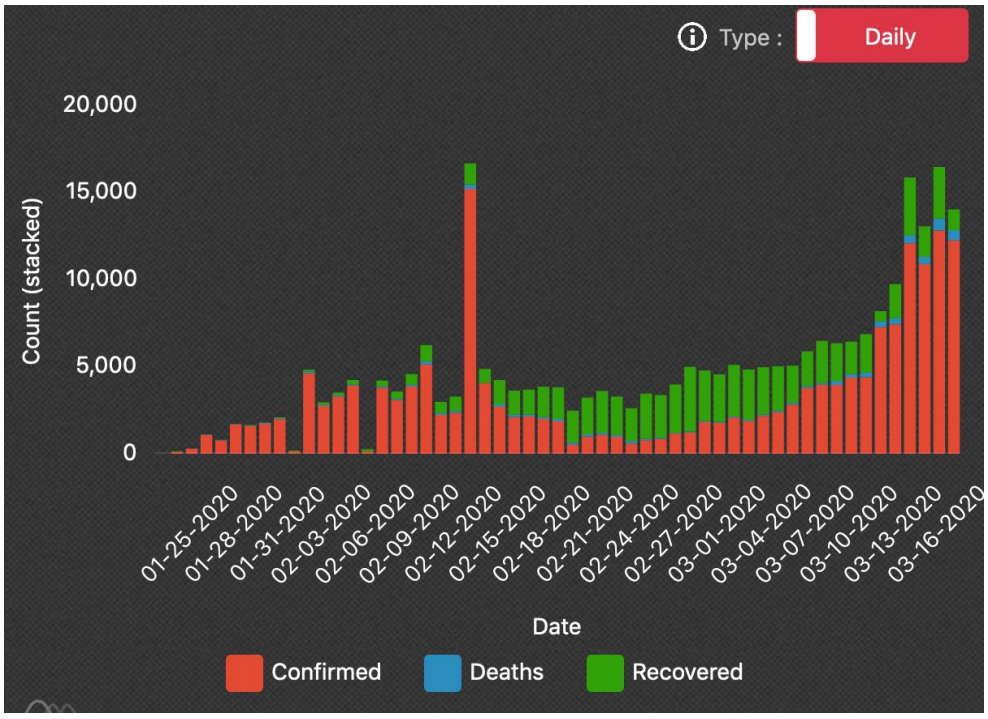

Figure 3: Global daily incidence of confirmed cases, deaths and recoveries as of March 16, 2020.

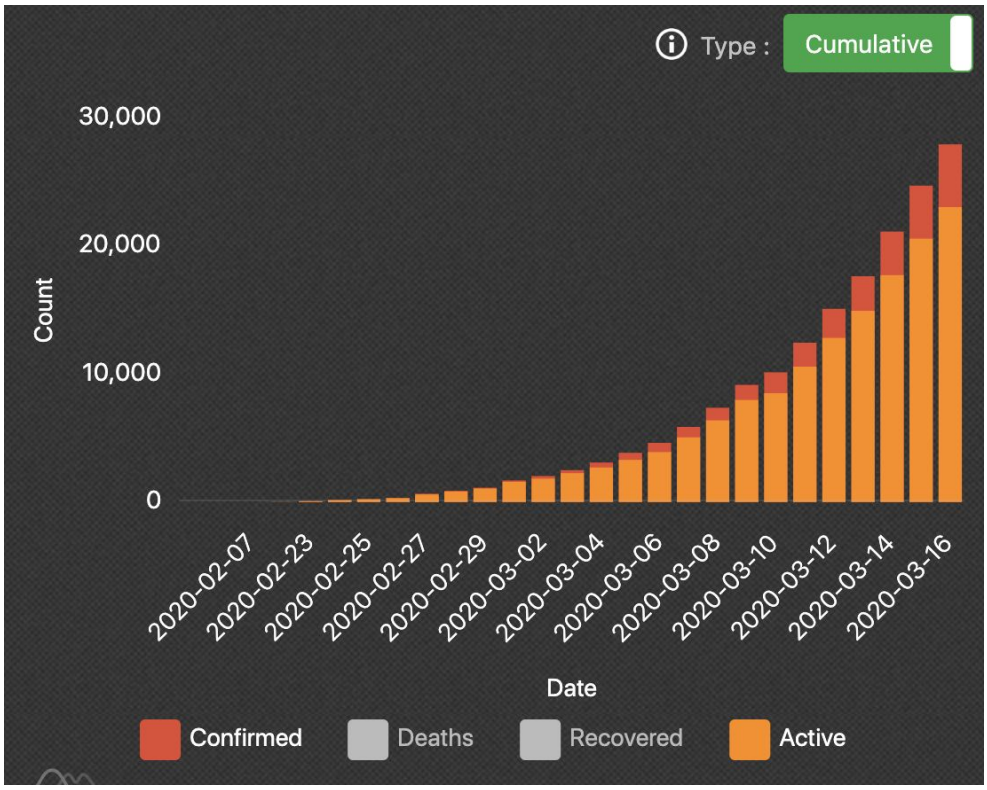

Figure 4: Cumulative confirmed and active cases over time for Italy as of March 16, 2020 (this feature will be included in version 1.1.3 release.).

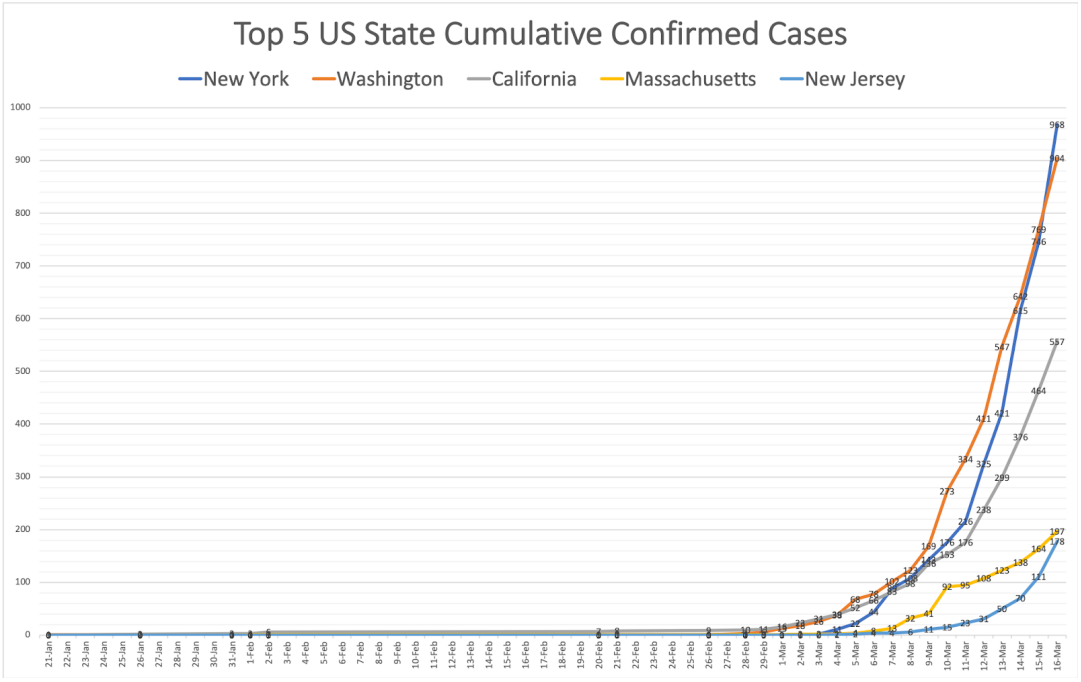

Figure 5: Cumulative confirmed cases over time for the top 5 US States as of 9pm EDT, March 16, 2020. (Figures 5-7 use data shown on the Dashboard)

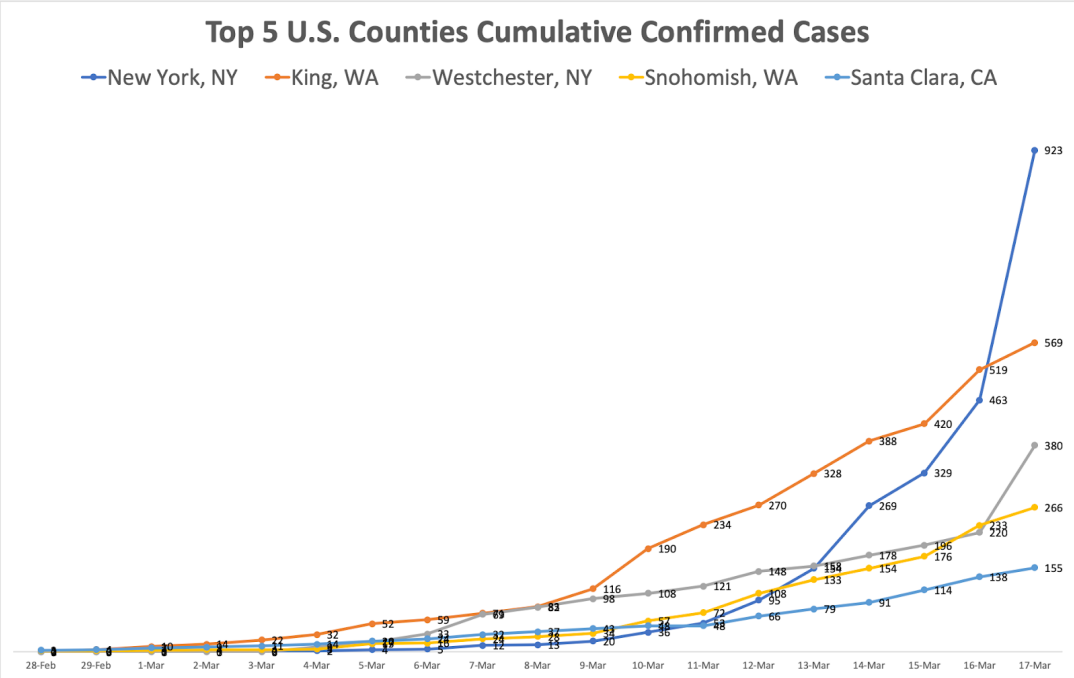

Figure 6: Cumulative confirmed cases over time for top 5 US counties as of 11pm March 17, 2020 EDT.

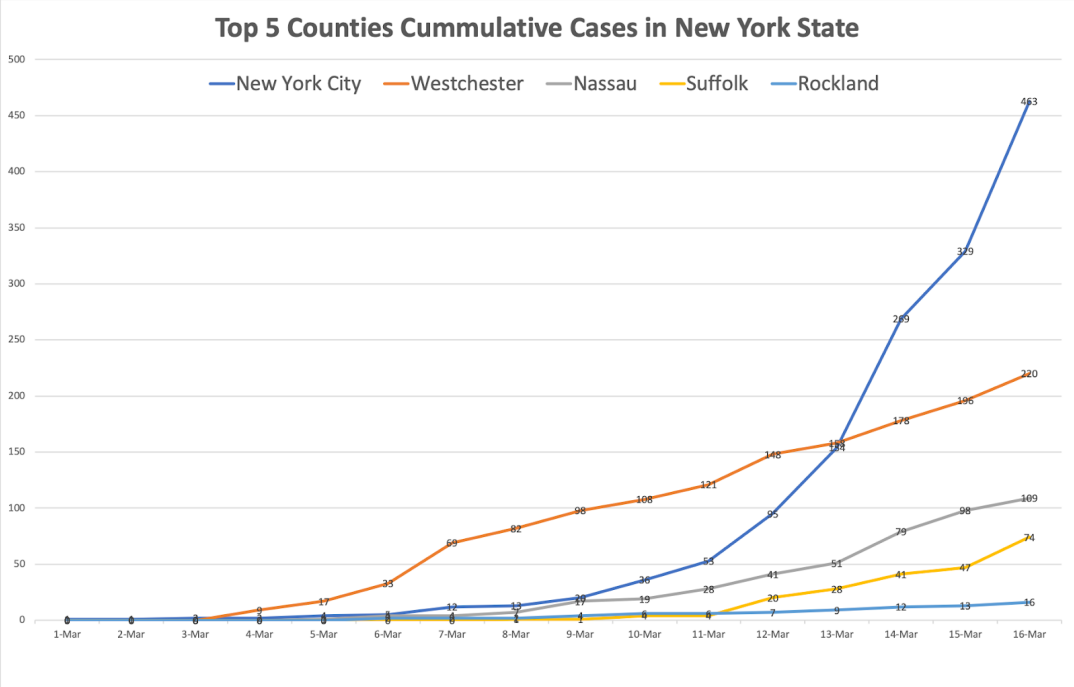

Figure 7: Cumulative confirmed cases over time for top 5 counties in New York State as of 9pm March 16, 2020 EDT.

Data sources and curation

Our data sources are the World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC), the European Centre for Disease Prevention and Control (ECDC), National Health Commission of the People's Republic of China (NHC), dxy.com (DXY), tencent.com (QQ), bnonews.com (BNO), 1point3acre.com (ACRE), JHU and some volunteers from Twitter.

Data curation is an evolving process. We always start with a manual process when we identify a new reliable data source and then build a programmatic approach along the way. We mostly use one data source for a particular region. To be specific, we use QQ for China; ACRE for the USA; volunteers for some countries, namely, Germany, Chile, Brazil and Colombia; QQ, BNO and JHU for other countries. Data integration is a merging process with manual steps involved. In particular, when there are conflicts in the data between different sources, we manually resolve the difference by searching the web.

A source of synthesized and machine-readable data

Currently users can download filtered and sorted data at the time resolution of one day. Future enhancements are underway to provide a downloadable zipped file including both country and state level data.

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