

3.1.3 Mapping the COVID-19 Pandemic and Potential Risk Factors

Development of an Interactive Viewer to Support Visualization and Analysis of COVID-19 Prevalence and Mortality Around the World

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The rapid increase in Coronavirus Disease 2019 (COVID-19) cases around the world throughout 2020 has highlighted the many uncertainties in how the disease spreads through communities, across national borders, and between continents. In early 2020, there was widespread speculation about risk factors that might contribute or inhibit exposure to the virus and vulnerability to its impacts. Reporting of COVID-19 cases and mortality was incomplete and inconsistent, and the ability to detect COVID-19 infections in both symptomatic and asymptomatic individuals was still developing. The Johns Hopkins University & Medicine (JHU) Coronavirus Resource Center, in collaboration with Esri, developed the widely viewed COVID-19 Dashboard⁶ that gathered and visualized case, mortality, and testing data from around the world, providing an ongoing overview of the pandemic. However, this Dashboard mainly focused on total cases and deaths by country and available subnational units, and did not provide data on the overall population that could be exposed to the virus. With this in mind, the NASA Socioeconomic Data and Applications Center (SEDAC), operated by the Center for International Earth Science Information Network (CIESIN) at Columbia University, decided to create the SEDAC Global COVID-19 Viewer⁷ to support visualization and analysis of COVID-19 cases and deaths in relationship to the population in areas of interest to users around the world. Given initial observations that COVID-19 was spreading more quickly in densely settled urban areas, it was clear that population density was a key variable of concern, and one that was incorporated into many epidemiological models for predicting the virus' spread (e.g., Chinazzi *et al.*, 2020). Furthermore, it became evident that the elderly had higher mortality risk, and that males were more at risk than females, indicating the relevance of a population's age and sex structure in interpreting mortality data and assessing future COVID-19 vulnerability (Heuveline and Tzen, 2020). Other potential risk factors included exposure to poor air quality, degree of urbanization, elevation, and air temperature (Petroni *et al.*, 2020; Segovia-Juarez *et al.*, 2020).

To create the Global COVID-19 Viewer, SEDAC drew on readily available data sources, including data on *Basic Demographic Characteristics* from its Gridded Population of the World version 4.11 (GPWv4.11) collection, *Degree of Urbanization* from the Global Human Settlement Layer Settlement Model (GHS-SMOD), *Elevation* from the Altimeter Corrected Elevations, v2 (ACEv2) dataset, and *Aerosol Optical Depth* (AOD) from the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument on NASA's Terra and Aqua satellites (a measure of air pollution). SEDAC quickly repurposed code and interface designs from other interactive mapping tools and integrated open data services from both internal and external providers, including an Application Programming Interface provided by JHU and three Hosted Feature Layers from JHU supported by Esri's Living Atlas. The initial version of the Viewer was released in April 2020. It provided the ability to create age-sex "pyramids" for custom areas of interest defined by the user for comparison with available JHU case and mortality data. A second release in July 2020 added data on rates of COVID-19 cases and mortality per 100,000 people and visualization of trends. As the pandemic evolved, it became increasingly important to track existing and developing COVID-19 "hotspots," as well as areas that had managed to keep the pandemic under control. The latest version of the Viewer, released in September 2020, expanded visualization of trends on different time scales, providing choropleth maps updated daily with 7-day moving averages of mortality and prevalence rates per 100,000 population (Figure 22). The Viewer also displays trends in daily cases and deaths, and 7-day moving averages, for time scales of one, three, and six months, and since the pandemic began (Figure 23). Charts based on *Degree of Urbanization* from GHS-SMOD show population and land area by settlement classes for both existing and user-defined geographic areas (Figure 23). SEDAC received extensive feedback from users, including its User Working Group, and continues efforts to improve the Viewer to meet the needs of diverse users. With COVID-19 still spreading rapidly in many parts of the world in late 2020, and with vaccines expected to be distributed widely in 2021, the need to monitor and predict the course of the virus remains critical. Information services such as the JHU COVID-19 Dashboard and SEDAC's Global COVID-19 Viewer are essential to gathering, integrating, and communicating complex data about this deadly disease that has dramatically affected our Human Planet during 2020.

⁶ <https://coronavirus.jhu.edu/map.html>

⁷ <https://sedac.ciesin.columbia.edu/mapping/popest/covid-19/>

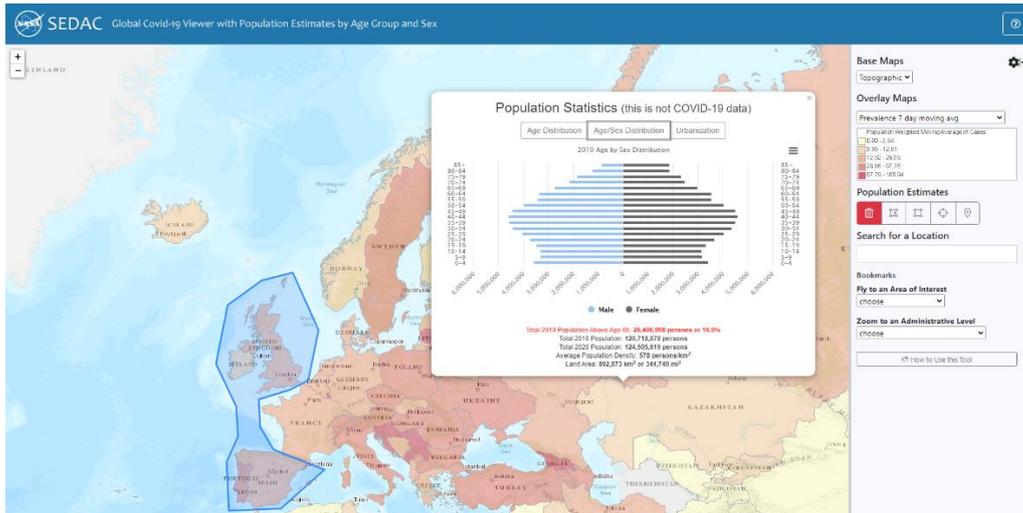


Figure 22 SEDAC Global COVID-19 Viewer showing a population-weighted 7-day moving average of cases in Europe as of 1 December 2020 and an age pyramid for the combined populations of the UK, Spain, and Portugal.

COVID-19 Statistics for India



Population Statistics (this is not COVID-19 data)

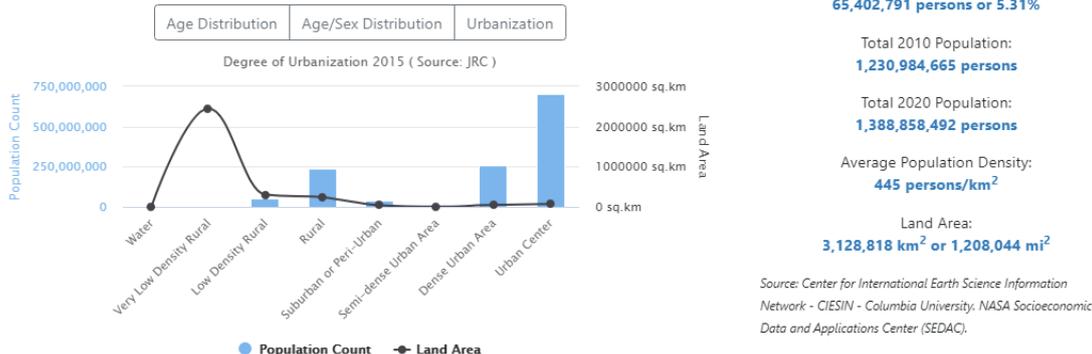


Figure 23 SEDAC Global COVID-19 Viewer showing charts of daily and 7-day moving average of COVID cases, and degree of urbanization population and land area estimates for India

References

- [Chinazzi et al. 2020](#). Preliminary assessment of the International Spreading Risk Associated with the 2019 novel Coronavirus (2019-nCoV) outbreak in Wuhan City.
- [Heuveline and Tzen. 2020](#). Beyond Deaths per Capita: Comparative CoVID-19 Mortality Indicators.
- [Petroni et al. 2020](#). Hazardous air pollutant exposure as a contributing factor to COVID-19 mortality in the United States.
- [Segovia-Juarez et al. 2020](#). High altitude reduces infection rate of COVID-19 but not case-fatality rate.