Rapidly Measuring Spatial Accessibility of COVID-19 Healthcare Resources: A Case Study of Illinois, USA


Department of Geography and Geographic Information Science, College of Earth, Society, & Environment, University of Illinois at Urbana-Champaign

INTRODUCTION

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), causing the coronavirus disease 2019 (COVID-19) pandemic, has infected millions of people and caused hundreds of thousands of deaths. While COVID-19 has overwhelmed healthcare resources (e.g., healthcare personnel, testing resources, hospital beds, and ventilators) in a number of countries, limited research has been conducted to understand spatial accessibility of such resources. This study fills this gap by rapidly measuring the spatial accessibility of COVID-19 healthcare resources with a particular focus on Illinois, USA.

METHODS

Our work calculated spatial accessibility using the Enhanced Two-Step Floating Catchment Area method (E2SFCA) and aggregated the measures to a hexagonal grid (Luo & Qi). E2SFCA is a method that computes a weighted supply-to-demand ratio for each supply point which accounts for distance decay and these ratios are aggregated over demand points to produce a measure of spatial accessibility.

RESULTS

With our spatial accessibility measure calculated, we were able to identify areas in Chicago and Illinois that had abundant resources and others that were lacking. We also compared the spatial accessibility metric to the CDC Social Vulnerability Index (SVI) and our results indicate that people living in areas with low accessibility are more vulnerable in terms of socioeconomic status, housing type and transportation, and household characteristics and disability.

We wanted to ensure that our measures stayed updated as COVID-19 cases evolved, so we parallelized the code and are currently re-computing the metric daily with the results available on the WhereCOVID-19 platform. There you can explore how accessibility has changed over time. You can see a snapshot of the site below:

CONCLUSION

Rapidly measuring spatial accessibility of healthcare resources is critical to the fight against the COVID-19 crisis, particularly for better understanding how well the healthcare infrastructure is equipped to save people’s lives. As U.S. federal and state governments (e.g., HHS, IDPH) have been strongly committed to improving spatial accessibility of healthcare services, measuring spatial accessibility and identifying areas with a shortage of important public health resources in the context of COVID-19 is critical for policymakers and public-health officials’ preparedness and response actions.

ACKNOWLEDGEMENTS

This article and associated materials are based in part upon work supported by the National Science Foundation (NSF) under grant numbers: 1443080 and 1743184. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of NSF. Our computational work used Virtual ROGER, which is a cyberGIS supercomputer supported by the CyberGIS center for Advanced Digital and Spatial Studies and the School of Earth, Society and Environment at the University of Illinois at Urbana-Champaign.