**Title: Spatiotemporal relationships between spatial accessibility to intensive care unit beds and fatalities of COVID-19 in the state of Texas**

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Abstract:

During the COVID-19 pandemic, many patients could not receive timely healthcare services due to limited access to hospital infrastructure and human resources. Previous research showed that sufficient access to healthcare resources, such as intensive care unit (ICU) beds and ventilators, is important to save lives. However, little attention has been paid to the underlying temporal dynamics of resource availability and COVID-19 cases. To fill this gap, our study aims to investigate the spatiotemporal relationships between spatial accessibility to ICU beds and the case fatality ratio of COVID-19 under the changes of available healthcare resources and confirmed cases. We first integrate the historical temporal changes of these two factors to assess daily spatial accessibility to ICU beds with a two-step floating catchment area (2SFCA) method. We then observe the temporal relationship between the accessibility of insufficient ICU beds and fatality and how quickly the case fatality ratio of COVID-19 increased in the case that healthcare resources were at full or near capacity. Given the dynamic changes of the two factors, the retrospective examination is critical to uncover the relationship between spatial accessibility to ICU beds and the fatality of COVID-19. In addition, our study can identify the vulnerable areas where low spatial accessibility levels were more highly related to deaths during the COVID-19 pandemic. The identification of these areas could support policymakers to anticipate where supplementary healthcare resources might have a significant impact on saving lives for future pandemic scenarios.

Bios**:**

Dr. Jinwoo Park is a Postdoctoral Research Associate in the Department of Geography and Geographic Information Science at University of Illinois at Urbana-Champaign and is also affiliated with CyberGIS Center for Advanced Digital & Spatial Studies. He received a Ph.D. in Geography (2021) from Texas A&M University, College Station, Texas. He holds a B.S. in Geography (2013) and an M.S. in Geography (2016) from Kyung Hee University in Seoul, South Korea. His research focuses on Geographic Information Science (GIScience), particularly the spatial accessibility to urban infrastructure and its temporal dynamics upon the recent data-rich environment.

Fangzheng Lyu is a Ph.D. student in the Department of Geography and Geographic Information Science from the University of Illinois at Urbana-Champaign. He received his B.E. in Computer Engineering from The University of Hong Kong (2018) and M.S. in Geography and GIS from the University of Illinois at Urbana-Champaign (2021). His research focuses on using high-performance geospatial computing to solve urban dynamics problems.

Alexander Michels is a research assistant at the CyberGIS Center for Advanced Digital and Spatial Studies and PhD student studying Spatial Informatics under Dr. Shaowen Wang at the University of Illinois at Urbana-Champaign (UIUC). His research is focused on CyberGIS: utilizing and developing high-performance and scalable software and cyberinfrastructure for advanced spatial analysis and modeling. His work on reproducible computation in the geosciences lead to an upgrade of CyberGISX and CyberGIS-Jupyter for Water (CJW) and his work on rapidly measuring spatial accessibility during the COVID-19 pandemic was deployed as part of the WhereCOVID-19 Spatial Accessibility Explorer.

Dr. Su Yeon Han is a teaching assistant professor in the department of geography and geographic information science at University of Illinois at Urbana-Champaign and a research fellow at CyberGIS Center for Advanced Digital & Spatial Studies. She received her Ph.D. in geography from the joint doctoral program between the San Diego State University and the University of California, Santa Barbara, and received her M.S. in Geography and Geographic Information Science at the University of Illinois at Urbana Champaign. She majored in geography and minored in computer science during her undergraduate study at the University of North Carolina at Chapel Hill. Her research interests include geovisualization, social media, geospatial big data science, neighborhood dynamics, web-based GIS, and cyberGIS.

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Dr. Shaowen Wang is a Professor and Head of the Department of Geography and Geographic Information Science at the University of Illinois Urbana-Champaign (UIUC). He is also Founding Director of UIUC’s CyberGIS Center for Advanced Digital and Spatial Studies. He received his BS in Computer Engineering from Tianjin University, MS in Geography from Peking University, and MS of Computer Science and PhD in Geography from the University of Iowa. His research interests include geographic information science and systems (GIS), advanced cyberinfrastructure and cyberGIS, complex social and environmental problems, computational and data sciences, geospatial sciences and technologies, high-performance and distributed computing, and spatial analysis and modeling. He has published 170+ peer-reviewed papers including articles in 40+ journals. He has served as an Action Editor of GeoInformatica and guest editor or editorial board member for multiple other journals, book series, and proceedings.