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Network and ABM models of SARS-CoV-2

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Abstract
This research investigates the role of road network infrastructure and the socioeconomics of urban space in enabling the spread of airborne disease (SARS-CoV-2). Data from Ireland’s Central Statistics Office was modelled on the national scale, modelling the relationship between road network accessibility and SARS-CoV-2 cases (SARS-CoV-2 14 day incidence rates per 100k of the population) aggregated per Local Electoral Area (LEA). We also modelled time series of SARS-CoV-2 cases in Ireland (August 2020 – November 2021), cases aggregated per 100k for each LEA, to highlight the peak and look for socioeconomic and mobility factors. On the city scale, we modelled Dublin’s road network infrastructure in order to investigate its impact on access to healthcare and the rise in SARS-CoV-2 infections. We used unsupervised learning (PCA analysis) and multivariate analysis to model urban variables and distinguish those that bear a relationship to SARS-CoV-2 cases. On the local neighbourhood scale, we presented an agent-based modelling simulation of Dublin’s city centre, using standard automata, agents weighted by longest line of sight, and agents weighted Per bin distance. Outcomes of a survey on SARS-CoV-2 cases and the underlying socioeconomic and spatial factors will be presented in order to understand the local dynamics of disease spread on a neighbourhood scale, and distinguish socioeconomic and built environment factors that may have contributed to the rise of SARS-CoV-2 cases. These factors may include the size of household, occupation, air pollution, exposure to biohazards, dwelling conditions (age of building, records of mould), and underlying health conditions that are likely to increase vulnerability. ABM models of survey variables will be presented in order to simulate the dynamics of disease spread.