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Title: Social behavior for epidemiological simulation: A preliminary model

Abstract:

The ongoing COVID-19 pandemic has highlighted the importance of two aspects for epidemic management: One, simulation models that help us understand dynamics of disease spread and support policy decisions; two, the interconnectedness of human social behavior and epidemic progression. That is, the success of public health measures, e.g., a mask mandate, depends on each individual's behavior. However, it is challenging both to understand what drives such behavior and to simulate it. Inter alia, introducing more complexity increases computational cost and can decrease intelligibility. Our aim is therefore to develop an empirically based model of social behavior in epidemics that is usable for simulation.

To develop the model, we are drawing on theory and evidence from the social sciences. To test the model's explanatory capacity, we are planning to fit regression models using both meta-analysis data from the COVID-19 pandemic and newly collected data. To ensure the model's suitability for simulation, we will conduct sensitivity analyses and test its effects in a large-scale agent-based simulation.

As a preliminary result, we propose a process model of social behavior in epidemics that incorporates the influence of public health measures and an individual's resources, as well as heterogeneous social, deliberative, and automatic influences. While these five additional variables are conceivably manageable in a simulation, we can introduce more complexity using a multi-level approach, especially for statistical modeling. This allows us to accommodate the diversity of existing evidence while preserving the necessary parsimony for using the model for simulation. A potential drawback is that currently, a separate behavioral model has to be implemented for each behavior or public health measure, as the five influences defined above would differ drastically, e.g., between mask-wearing and self-isolation. Efforts to test the model in both contexts are ongoing or outstanding. It hence remains to be seen whether the model assumptions are appropriate.