Simulating cities under pandemic conditions to make predictions about future outbreaks

January 27 2021, by Bob Yirka

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An international team of researchers has used modeling techniques borrowed from chemistry applications to create a new kind of city simulator. In their paper published in the journal *Proceedings of the*

Royal Society A, the group describes using their models to create simulations of of COVID-19 spread for two real-world cities: Birmingham England and Bogota Columbia.

One of the more frightening aspects of the current global pandemic is the knowledge that it could be a lot worse—it could have been a disease that killed everyone it infected. So scientists have been hard at work trying to develop tools to more effectively handle the next pandemic. In this new effort, the researchers have improved on city modeling tools to create simulations that accurately show how a disease will impact a given city under different scenarios. The models demonstrated the effectiveness of mitigation strategies such as lockdowns, the use of masks and social distancing.

The team, which was composed of both epidemiologists and engineers, borrowed models that have been developed for chemistry applications to create models that mimic human activity in a city. They note that chemical reactions in some cases behave in very similar ways to a disease spreading through a population.

With their new models, the researchers added real-world data for Birmingham and Bogota, such as population densities, employment levels and commuting histories. They also factored in less predictable activities such as people going shopping or going out for dinner. With all of the data in place, the researchers set mitigation parameters and then allowed the simulation to run on a supercomputer for several hours, which mimicked several months in the simulated city.

They found that the simulations were quite accurate in some ways and less accurate in others. They were not as accurate as hoped in simulating how people move within a given city, but they were very good at matching real-world infection rate data in both cities under lockdown parameters.

The researchers note that there is room for improvement with the simulations and suggest more work would allow for expanding beyond just cities, perhaps to whole countries, and eventually, the entire world.

More information: A. Alexiadis et al. Simulation of pandemics in real cities: enhanced and accurate digital laboratories, *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences* (2021). DOI: 10.1098/rspa.2020.0653