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SYNOPSIS

11/16/2020

Review of “Mobility network models of COVID-19 explain inequities and inform reopening”

Article citation: Chang S, Pierson E, Koh PW, Gerardin J, Redbird B, Grusky D, et al. Mobility network models of COVID-19 explain inequities and inform reopening. Nature. 2020 Nov 10 [Epub ahead of print]. Available from: https://doi.org/10.1038/s41586-020-2923-3

One-minute summary

- Integrating mobility networks data into the SEIR epidemiological model, the authors **compared the estimated risks of infection with full reopening** of non-residential points of interest (POIs) frequented by people, **with stringent reopening by restricting peak occupancy at certain POIs,** and **identified populations at risk of COVID-19 infection**.
- A small number of POIs were associated with most infections. **POIs that have higher visit densities and/or longer duration of visits tend to have a higher risk of infection**. Examples of POIs that carry a higher risk of infection when reopened included full and limited service restaurants, gyms, hotels, cafés and religious organizations.
- The modelled risk of infection was higher among **disadvantaged racial and socioeconomic groups** who were **less able to reduce their mobility** and tend to frequent **smaller and more crowded POIs** (the average grocery store visited by these groups had 59% more hourly visitors per square foot and their patrons stayed 17% longer on average).
- **Limiting peak occupancy levels** at each POI is predicted to **reduce transmission more effectively than full reopening** by spreading out the same number of visits over less busy times (e.g., capping the maximum occupancy at 20% in the Chicago metro area reduce infection by over 80%, and by about 76% for people of low socioeconomic stratum).

Additional information

- The modelling used aggregated anonymized cell phone data from March 1 to May 2, 2020 to map the hourly movements of 98 million people from 56,945 geographical units with between 300 and 6,000 population, to 552,758 specific points of interest. The geographical units are located in large metropolitan statistical areas in the United States (US) (Atlanta, Chicago, Dallas, Houston, Los Angeles, Miami, New York City, Philadelphia, San Francisco and Washington, DC).
- Data analyzed for each POI include: industry classification; physical area; hourly number of visitors; estimated median duration of visit; and aggregated estimates of visitors’ home geographical units.
- From the modelling results, the authors urged for more effective and equitable COVID-19 response policies through:
    - Limiting the occupancy at POIs.

- Setting up emergency food distribution centres to reduce crowdedness in high-risk POIs.
- Enhancing accessibility to testing in areas at high risk of infection.
- Reducing mobility by supporting sick workers to stay home.
- Enhancing workplace infection prevention practices for essential workers (e.g., provision of appropriate personal protective equipment, improving ventilation, maintaining physical distancing).

PHO reviewer's comments

- As COVID-19 continues to spread globally, public authorities aim to identify control measures that are both effective and minimally disruptive. To this end, studies of outbreak clusters and case studies provide information on the locations where COVID-19 may be spread. A study of an outbreak onboard a cruise ship showed that COVID-19 is likely to be transmitted in crowded environments.[1] Meanwhile, a case study has showed early on in the pandemic that a masked symptomatic individuals with COVID-19 may have a relatively low probability of transmission onboard a flight, so long as they are properly masked.[2] Such case studies provide important insights into environments where COVID-19 transmission may occur; however, they do not provide an accounting of the total role of different types of environments in driving transmission.
- Prior studies have shown that human mobility data, based on cellular phone GPS data, can be used to provide standardized, and internationally comparable measures of physical distancing, and can predict future COVID-19 incidence.[3,4] In this study, using granular human mobility data on the time spent in a variety of locations of interest, and a simple mathematical model of COVID-19 transmission, the authors have been able to provide insights into the role of different environments in driving COVID-19 transmission. First, the model was able to identify the relationship between crowded environments and levels of future COVID-19 incidence in US cities. Armed with this model, the authors were able to test simple hypotheses regarding the proportional role of specific classes of locations in driving COVID-19 incidence in those locations.

Additional references

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3. Soucy J-PR, Sturrock SL, Berry I, Westwood DJ, Daneman N, MacFadden DR, et al. Estimating effects of physical distancing on the COVID-19 pandemic using an urban mobility index. medRxiv 20054288 [Preprint]. 2020 May 24 [cited 2020 Nov 16]. Available from: http://medrxiv.org/lookup/doi/10.1101/2020.04.05.20054288

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Citation

Ontario Agency for Health Protection and Promotion (Public Health Ontario). Review of “Mobility network models of COVID-19 explain inequities and inform reopening”. Toronto, ON: Queen’s Printer for Ontario; 2020.

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