Agent-based modelling of workplace transmission

This project is developing a mathematical simulation model of the workplace that integrates information from various sources in order to study how transmission of the COVID-19 virus occurs within it, identify higher risk settings and generate evidence on the effectiveness of control strategies.

Transmission of SARS-CoV-2 (the virus that causes COVID-19) in the workplace and the likelihood of workplace outbreaks depends upon a number of interacting factors, including the workplace environment, levels of infection in people of working age in the wider community, and worker behaviour – especially the extent of their contact with co-workers, and the nature of and compliance with workplace COVID-19 controls.

The model being developed will account for all these factors. It is thus enabling a range of different policy options for controlling the COVID-19 virus in different types of workplaces and at different stages of the pandemic to be tested out, with the findings being presented to a range of UK Government networks. The model will provide insights that can be used to improve workplace risk assessments and inform return-to-workplace policies, and will be shared with industry and employer organisations.

The research questions the project aims to address include:

- How important to transmission is very close contact (within 1.5 meters) compared to contact at greater distances within the same workplace?
- How is the likelihood and magnitude of workplace outbreaks affected by the type of workplace setting and by various control measures?
- What can be learnt about workplace transmission by applying the developed model to data from real-world workplace outbreaks investigated in the COVID-OUT study?

The project uses a stochastic simulation model, within which the simulated individuals are labelled as ‘Susceptible’, ‘Infected’ or ‘Recovered’. It incorporates:

- Use of contact networks to represent contact behaviour within a workforce (based upon data from the Wear-It study).
- Use of dose-response models to calculate the probability of transmission between individuals taking account of the duration and distance of their contact, their infectiousness at the time of contact, and the workplace environment.
- Use of a simplified in-host model of viral dynamics to describe the profile of viral load, shedding and infectiousness over the course of an individual’s infection, and how these differ between individuals.

By integrating data from various sources (including studies on worker contact patterns, transmission rates, and the progression of the viral infection within individuals) the model can predict the relative effects of various combinations of control measures (such as social distancing, face coverings, increased ventilation, rapid testing and vaccination) on the likely rate of COVID-19 virus transmission, and thereby the likelihood and scale of workplace outbreaks.

Project team

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