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Commentary

Infectious Disease Modelling during COVID-19

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Description

The coronavirus disease 2019 (COVID-19) pandemic is likely the most notable instance of how infectious disease modelling is crucial to the response to infectious disease outbreaks. While the scientific literature focuses on the models' accuracy and underlying assumptions, our experience working with state and local governments during COVID-19 and other public health crises has shown that a key barrier to the successful application of modelling to public health decision-making is the capacity of decision-makers and modellers to collaborate effectively. Therefore, based on our experience, we provide a set of guiding principles for interactions between decision-makers and modellers. Regardless of the specific epidemic in issue or the precise modelling methodologies being utilised, we believe that these guidelines will increase the usefulness of infectious disease modelling for public health decision-making.

The COVID-19 pandemic has brought to light the use of mathematical models in predicting epidemiological parameters, forecasting the development of disease outbreaks, and assessing the outcomes of various intervention or control strategies. These models are more than just exercises in mathematics; they were a major factor in the British government's decision to enforce a stringent lockdown in March 2020. However, despite concentrating on the disease's spread, the majority of these models have completely overlooked the influence of alterations in knowledge (and consequently compliance with public health rules) brought on by increasing information transmission through internet media.

Many elements of our life have been drastically altered by the on-going COVID-19 epidemic, particularly the way in which we connect and communicate. Approximately 62.5% of the world's population was online as of January 2022, a 4% rise from the previous year. Nine out of ten of them use social media, up 10% from the previous year. Online media, including websites, search engines, and social media platforms, are thus quickly becoming as important sources of news as well as information and guidance on health-related topics. Due to the epidemic, this increased access to information has also increased the availability of false information, deception, rumours, and conspiracy theories. According to a study of COVID-19 disinformation on social media, between 0.2 to 28.8% of postings contained inaccurate material. Online media can cause both good and negative behavioural changes in attitudes regarding non-pharmaceutical therapies, immunisation, and therapy since such contradicting and seemingly reliable material is readily available. They might therefore affect how the general public perceives the danger of infection, which would have an impact on the dynamics of the disease and its transmission.

Several publications have introduced the inclusion of societal psychological behaviour into reactions to illness frequency. The authors establish saturated transmission rates that are based on the prevalence rate of the illness in actual practise. According to Cabrera et al., the transmission rate is predicted to rise for low illness prevalence and begin to fall once the prevalence passes its critical threshold in 2021. Proposed a compartmental model that somewhat alters the way the socio-Behavioral component is included; they included the interaction distance to gauge how society reacts to the incidence of sickness. The interaction distances are therefore integrated by the nonlinear transmission rate. The impact of airborne infections is, however, hardly taken into account. Bazant and Bush's research from 2021 shows the tremendous impact of aerial transmissions on society's activities. Even though airborne infections, like SARS-CoV-2, only have an hour-long half-life, indoor transmission is essential for infectious disease modelling, particularly in settings like schools or offices where there are lots of indoor activities.

Thoughts of infectious illness models typically associate them with population-level transmission; however this is not always the case. Some models solely consider how the illness develops within the host, while others try to foretell the likelihood that the disease would ever infect a population [for example, zoonosis risk or risk connected to travel-associated importation].

In this part, we concentrate on the more typical idea of an infectious disease model, which depicts the process of disease transmission from infected to uninfected hosts, resulting in epidemic patterns at the population level. Infected and uninfected hosts are shown in two different ways in disease transmission models. Compartmental models list every state that the model could be able to depict and utilise equations to control changes in state. Agent-based models count the number of people while using equations to control their behaviour and interactions. There are several options for model architectures under the compartmental and agent-based model categories.

During a public health emergency, real-time infectious disease modelling can be crucial decision assistance. During the HIV/AIDS, COVID-19, and other infectious disease emergencies, methods and applications of infectious disease modelling for decision-making considerably improved, but problems and possibilities still exist. Future infectious disease emergencies will benefit from improved modelling and calibration techniques, data accessibility and analysis, and training on communicating model results.

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Conflict of Interest

There are no conflicts of interest.