

Book

Modelling can tell us so much, politics explains the rest

I've been self-isolating with my family because we developed fevers. Whether this is any virus or SARS-CoV-2 (COVID-19) is hard to say given the UK Government's position on community testing. I must have contracted an infection somewhere, and I've likely passed it on. But how this infection started, how many people I might have infected, and how adhering to public health guidance to remain at home alters patterns of disease transmission is vital information. For this knowledge, policy makers need epidemiologists and mathematical models of how diseases spread in different populations, as described by Adam Kucharski in *The Rules of Contagion*. This book details the history and logic behind how a disease's spread is forecast, and what assumptions are vital to public health planning. Kucharski describes how models of contagion can be applied to many areas of life and how insights from these domains can improve our understanding of social networks and disease transmission. An unexpected consideration is what disease dynamics can contribute to other areas of contagion for the financial world, online gaming, social media trends, or clusters of gun violence. Kucharski elucidates how the same rules of contagion can apply to things involving individual agency and behaviour in their transmission.

In the past few years amid the wave of populist politicians' rejection of experts, modellers have not been centre stage. But now modelling communities are receiving unprecedented attention and criticism given their role in informing governments' policies on COVID-19. Chris Whitty, the UK's Chief Medical Officer, is quoted in this book describing how models are "most useful when they identify impacts of policy decisions which are not predictable by common sense", such as when is the right time to deploy and relax lockdown. Yet models are exceptionally complex and need to be fine-tuned and reconsidered as a disease outbreak progresses, which can lead to changing opinions about what is the best public health intervention at any one time. This nuance and dynamism is key for disease modelling.

Since the start of the COVID-19 pandemic there has been an onslaught of armchair epidemiologists in the media. I wish they could all read this book and understand the assumptions that are built into models and how outbreaks are not just exponential curves. Kucharski explains how historically scientists took descriptive approaches to understanding disease spread. It was Ronald Ross who introduced disease models to predict outbreaks, allowing some element of pre-warning of how disease might spread and thus possible disease mitigation strategies. This approach was originally tested by Ross in the case of malaria and extended by William Kermack and Anderson Gray McKendrick to develop the Susceptible-Infectious-Recovered (SIR) model used widely today. In relating these developments, Kucharski's ability to convey complex mathematical dynamics to the general reader is immense.

While public health policy decisions can, and arguably should, be driven by models, what this book overlooks is the complex political contexts in which such decisions are made. Decisions to lockdown nations are inherently political, and governments heed not only modelling advice but also the demands of their economies, popular sentiment, and the political costs of different decisions. Kucharski engagingly describes some of the key

moments and figureheads in the history of epidemiology, from disease specific models of cholera and malaria, to creating more general laws of epidemics, yet these interventions are discussed without broader exploration of political contexts. Without understanding the motivations for a public health intervention and the specific political and social contexts in which they take place, disease models are somewhat moot. Moreover, as Kucharski discusses in this book, modellers must be careful not to overstate their role in disease control. During the outbreak of Ebola virus disease in west Africa in 2013–16, local communities instigated their own social distancing practices before modelling recommendations, and thus these alternative community-based approaches must be recognised as important.

What governments can control within pandemics is when to launch interventions, whether there is enough surge capacity within health systems for testing in laboratories or enough ventilators in intensive care units. Kucharski informs us that in the case of Zika virus and Guillain Barré syndrome, these were exactly the assumptions that were incorporated into models used by health policy makers.

However exasperated many of us are by our government's response to COVID-19, such decisions are ultimately political. We should hold politicians to account for public health shortcomings, and recognise and value the complex specialist work that disease modellers undertake. Kucharski's book is a timely reminder of the importance of disease modelling. Without such models, we would be in far greater trouble battling COVID-19.

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