

# Preface

The spread of an infectious disease is a social as well as a biological process. An infectious disease spreads as a function of its and our biology but it is also aided by a host of social factors from the face to face interactions of people to the decisions people make regarding vaccines and hand hygiene. In this book I give a brief introduction to epidemiology from the perspective of one of the social sciences, economics.

Fundamental to the study of economics are the choices that people make. People choose whether to spend their money on ice cream, new shoes, or to save. Of course one cannot spend money that he does not have either from past earnings, savings, or borrowing. Thus economists study the choices people make in conjunction with the constraints they face. I have \$100, what do I do with it? The choices that economists study are not solely monetary decisions. In our day to day lives we also choose whether to go to a party or stay home, whether we take public transportation or drive to work, and whether to get a yearly influenza vaccine or not. Each of these decisions is also a constrained choice that depends on things like whether our friends invite us to a party, whether we have enough money to buy a car, and whether we have enough time to be vaccinated. All of these decisions can have an impact on the spread of an infectious disease both from an individual perspective and a population level perspective. If we go to a party, or take public transportation we expose ourselves to the risk of acquiring an infectious disease. In addition, if we become infected we also make it more likely that other people in the population become infected. If I catch a cold at a party on Saturday night, I expose my coworkers to the virus on Monday morning. Economists call this type of interdependence an externality. My choice (in this case to go to a party) has an effect on other people who do not take part in my choice. Similarly, decisions like getting a yearly influenza vaccine not only protect me, but also partly protect the people I come in contact with because I cannot infect them (assuming the vaccine is effective). Further some of the choices we make and the consequences of those choices depend on the people with whom we interact. If everyone around me makes risky decisions with regard to infectious disease that may influence how careful I am. Thus we live in an interconnected web of individual decisions, incentives, and risks. These are exactly the topics that economists study. In this book I use economic modeling to attempt to better understand and describe how

infectious disease spreads and the choices that individuals and policy makers choose in response.

In this book I will provide a basic introduction to the ways in which economics can be applied to a set of basic epidemiological phenomena. The goal of the book is to provide a starting point for a discussion between three groups of people interested in the spread of infectious disease: medical professionals, social scientists, and public health officials (as well as students pursuing careers in these fields). In doing so I provide a basic introduction to some elements of each of these fields so that this discussion has a starting point. Hopefully, if I have done my job well, economists will learn some basic epidemiology, and public health and medical professionals will learn a little economics that can be applied to their field.

As an outline, I begin by discussing the basic structure of the most simple models of epidemiology and introduce readers with a social science background to some of the core concepts of epidemiology. With this starting point, I use these core concepts to discuss how the spread of an infectious disease creates economic externalities. Further, this externalities perspective allows me to discuss how an economist would view public health interventions to stop or slow the spread of an epidemic. The next sections of the book introduce both reality and complications into our understanding of epidemics. As mentioned above, many infectious diseases that interest us today spread from person to person. This makes an understanding of the structure of interactions between people paramount in understanding the spread of an infectious disease. Thus, I provide an introduction to the field of social network analysis and discuss how to use measures common to this field to better understand the spread of an epidemic. Finally, again as an economist, I must reintroduce the element of choice and more explicitly strategic choice into the discussion. We not only make decisions for various personal reasons, we also make decisions in conjunction with others. For instance, policy makers attempt to induce individuals to make decisions that benefit society, for example, the provision of a subsidy for a vaccine. We also make choices individually that have effects on each other's well being. For instance if your closest friend chooses to be vaccinated for a particular infectious disease, your incentive to be vaccinated diminishes because there is one less person you know that can infect you. Both of these examples suggest that there can be strategic elements to public and individual health decisions. As such I provide a brief discussion of game theory in the final section of the book.

I would like to acknowledge several sources that allowed me to write this book. My interest in the intersection of infectious disease and economics has two origins. The first is a group of colleagues who sparked my interest in the field through their own work while I was a post-doctoral research fellow at the University of Michigan Center for the Study of Complex Systems. Most notably, Mark Newman, Carl Simon, and Chris Warren all had interests at the intersection of social networks, economics, and epidemiology that inspired and educated me. My advisor, Scott Page gave me the freedom to investigate a diverse set of topics as well as providing unending sources of encouragement and guidance. The second origin was Phil Polgreen and Alberto Segre who brought me into the fold of the

Computational Epidemiology Research Group at the University of Iowa and gave me access to very rich sources of data. More recently, each fall for the past decade, Henry Schwalbenberg has allowed me to teach the course from which this book developed in the Fordham University International Political Economy and Development program to classes of exceptional students. Fordham University, both my home economics department and the university in general, has been very supportive of my research agenda and generously provided a research fellowship that gave me the opportunity to complete this manuscript. I am grateful to Barbara Fess at Springer for supporting and encouraging this project. Finally, much gratitude and love to Mary Beth, Katherine, and Nicholas for your love, support, and never-ending moments of joy and happiness.



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