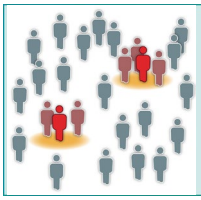

Modeling Disease Spread

hhmi | BioInteractive

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Transcript

INTRODUCTION

VIDEO: Modeling the Spread of Infectious Disease

[NAHID BHADELIA:] Epidemiologists are researchers, scientists, or practitioners who seek to understand how diseases impact entire populations or specific segments of the population. I'm an infectious diseases physician, and earlier in my career, I was also a hospital epidemiologist. I used epidemiology to help understand when there were clusters of new infections within the hospital.

There are epidemiologists that look at diseases that we've known about for a while, such as HIV or tuberculosis. And there are others who tend to focus a bit more on diseases that are emerging, such as SARS-CoV-2, the virus that causes COVID-19.

[JAMIE CALDWELL:] I got into my current field of research because I realized there was a need to understand how both changing climate and environmental patterns affect disease spread. And while doing fieldwork, I just became absolutely fascinated with the process of disease spread, first in wildlife populations and then in humans. I use mathematical models to understand the relationship between environmental drivers and disease spread, and use those relationships to predict outbreaks.

[BHADELIA:] Outbreaks are a cluster of infectious diseases cases that occur over a short period of time in one geographical area that you weren't expecting. I've been part of outbreak response, where my work has focused on working with epidemiologists and other public health experts in trying to assess new cases and how they may impact our hospitals and healthcare systems.

[CALDWELL:] I primarily look at outbreaks such as dengue, chikungunya, Zika, and malaria. I also look at how climate patterns influence the number, frequency, and duration of outbreaks and how that might change in the future with changing climate conditions. My research is entirely focused on modeling disease spread and predicting outbreaks, and I use these types of analyses to provide information to public health officials, policymakers, and other stakeholders so that they can make informed decisions.

The models that I create are only as good as the data that I put into them. So collecting the right type of data at the right times and in the right locations is critical to better understand how and why diseases spread.

[BHADELIA:] Models that are based on reliable data can give a prediction to people who are working on a whole gamut of issues related to outbreaks. For people who are responding on the ground, they can give us a sense of where the resources need to go, and they tell us how big of a response is needed.

[CALDWELL:] I think it's really valuable to have a basic understanding of epidemic models to make informed personal decisions given information provided by the government, public health agencies, and the media. If the general population better understood some common attributes of infectious disease spread, we would likely have a much safer and healthier population, because I think more people would be comfortable with making certain health decisions that would improve the health of the whole community.

SIR MODEL BASICS
SIR BACKGROUND

VIDEO: What is an SIR model?

[JAMIE CALDWELL:] Epidemic models allow us to simulate how disease spreads from person to person within a population. SIR models split the population into three compartments. S stands for the susceptible compartment, I stands for the infectious compartment, and R stands for the removed compartment. So when we think of disease spread in the population, what we can do is model the movement of individuals or proportion of the population from each of those compartments.

So, for example, when a person gets infected, they'll move from the susceptible compartment to the infectious compartment. And as they recover, they'll move from that infectious compartment to the removed compartment. So you can track the number of individuals moving from the susceptible to the infectious compartment and the infectious to the removed compartment. And over time, that leads to the epidemic curves that you see as an outbreak peaks and then drops as you run out of susceptible individuals to infect.