

# How Diseases Spread

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### **Section 1: Pathogens and Infectious Disease**

Pathogens and infection are defined and explored. An overview of the human immune system is presented.

- COVID-19: A Global Pandemic
- Pathogens Cause Disease
- What Is an Infection?
- The Human Immune System
- Check Your Understanding
- Section Summary

### **Section 2: Modeling Epidemics**

Disease patterns are explored using a basic model of susceptible, infected, and recovered individuals (SIR). Diseases can recur in cycles.

- Modeling Disease Spread
- Susceptible, Infected, Recovered: The SIR Model
- Three Determinants of Disease Spread
- A Closer Look at the SIR Model
- Basic Reproductive Number
- Epidemic Threshold
- Births, Deaths, and Disease Cycles
- Check Your Understanding
- Section Summary

### **Section 3: Controlling Disease Spread**

Vaccination can impart herd immunity, which depends on the disease's basic reproduction number. Infectious diseases can be controlled with community mitigation strategies.

- Smallpox: A Disease Eradicated
- Vaccinating Against Smallpox
- Herd Immunity
- Measles: A Different Story
- Critical Immunization Threshold
- How Does Behavior Affect Disease Spread?
- Flattening the Curve
- Public Health Options Are Limited by Disease Attributes
- Check Your Understanding
- Section Summary

### **Section 4: Vector-Borne Diseases**

The dynamics and challenges of diseases spread indirectly via vector are explored, using malaria as an example.

- Many Pathogens Have Multiple Hosts
- Disease Transmission Modes
- An SIR Model for Vector-Borne Disease
- Modeling Endemic Malaria

- Tools for Fighting Malaria
- Check Your Understanding
- Section Summary

### **Section 5: The Evolving Nature of Disease**

The basics of pathogen evolution are investigated, and the virulence trade-off hypothesis discussed.

- Shining Evolution's Light on Disease
- How Does Influenza Evolve?
- Spillovers, Reassortment, and Pandemics
- What Makes a Disease Successful?
- Evolution Favors the Optimal Level of Virulence
- Check Your Understanding
- Section Summary

### **Section 6: Graded Questions**

Graded Questions

### **Section 7: Disease Spread Playground**

Open-ended exploration of SIR model and Simpliod simulation.

- Two Disease "Plague-grounds"