

What are models and what purpose do they serve?

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WHO Collaborating Centre
for Viral Hepatitis
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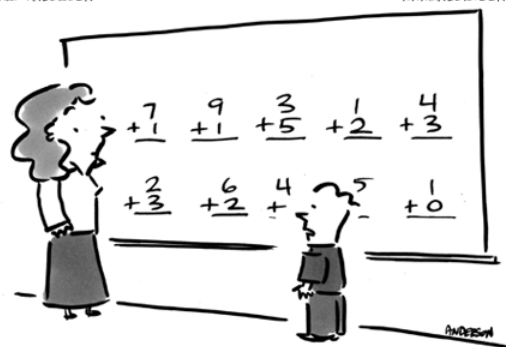


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Why mathematical models?

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"All I'm saying is we plug these into Excel, let it do its thing, and then we can all play until lunch!"

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What are mathematical models?

A model is a simplified representation of complex reality.

Good models are easier to understand than reality, but the aim is that they provide us with insights that are useful in the real world.

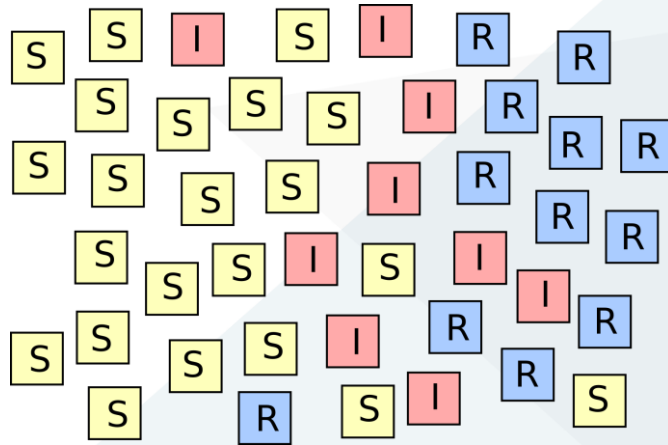
For infectious diseases, we use models as a tool to:

- Understand the dynamics of how a pathogen spreads through a population
- Forecast possible future patterns of transmission
- Compare and evaluate potential interventions to control transmission

What are mathematical models?

- Infectious disease models are **dynamic** models – they describe how an infection spreads through a population over time.
- Models have **states**, which describes all relevant aspects of the system at a particular point in time.
 - Such as which people are currently healthy or sick.
- Models have **rules**, which describe how the state of a model changes over time.
 - How do healthy people become sick
- These rules often involve **parameters**, which can be varied to calibrate the rules to real world scenarios.

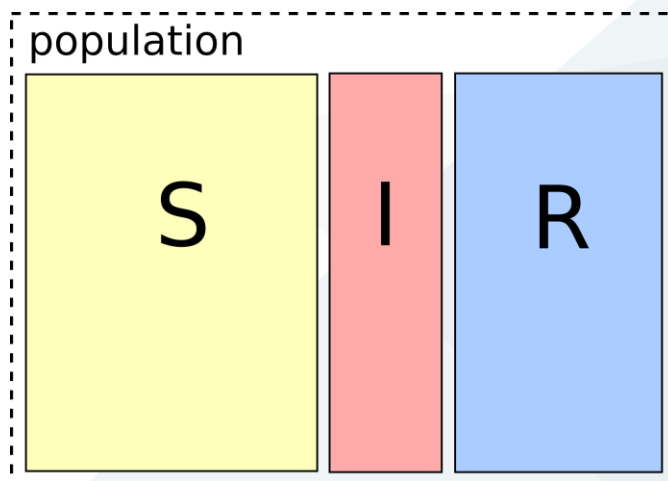
Susceptible, Infectious, Recovered



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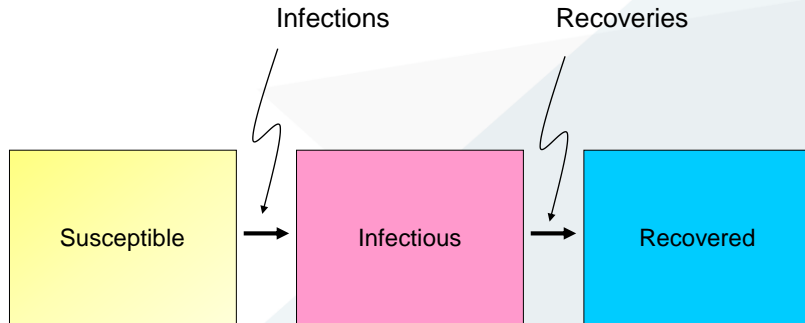
Sorting into compartments



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The SIR Paradigm



What goes into the models?

- Model **parameters** determined by data, known disease characteristics
 - Variable susceptibility, infectiousness, severity
 - Disease incubation and infectious periods
 - Social mixing that drives infection spread between age classes and social groups
 - Environmental determinants and exposures

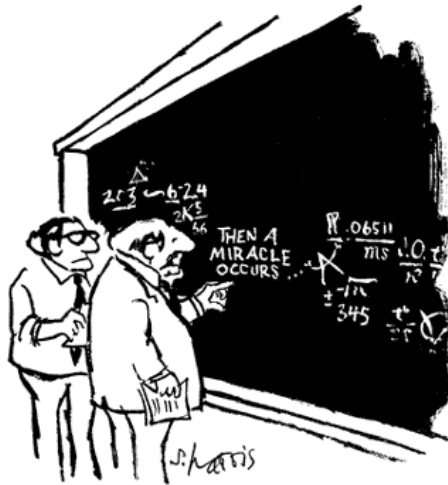
How models are used in public health

- Choice of model depends on the **questions** we want to answer.
 - Epidemic vs endemic diseases
 - 'Big picture' models can yield valuable insights into underlying process
 - Epidemiology and natural history inform the number of specific subgroups who are relevant
 - Models to inform targeted policies will require more granular levels of detail

Modelling time frames

- Retrospective
 - Using historic data, models can be used to help understand disease characteristics
- Current
 - Models can be used in near real time to aid situational assessment and decision making
- Predictive
 - Models can be used to 'forecast' likely future behaviour and scenarios

Questions?



"I think you should be more explicit here in step two."