

Hands-On Cohort State Transition Models

Decision Modeling for Public Health Workshop

December 5, 2022

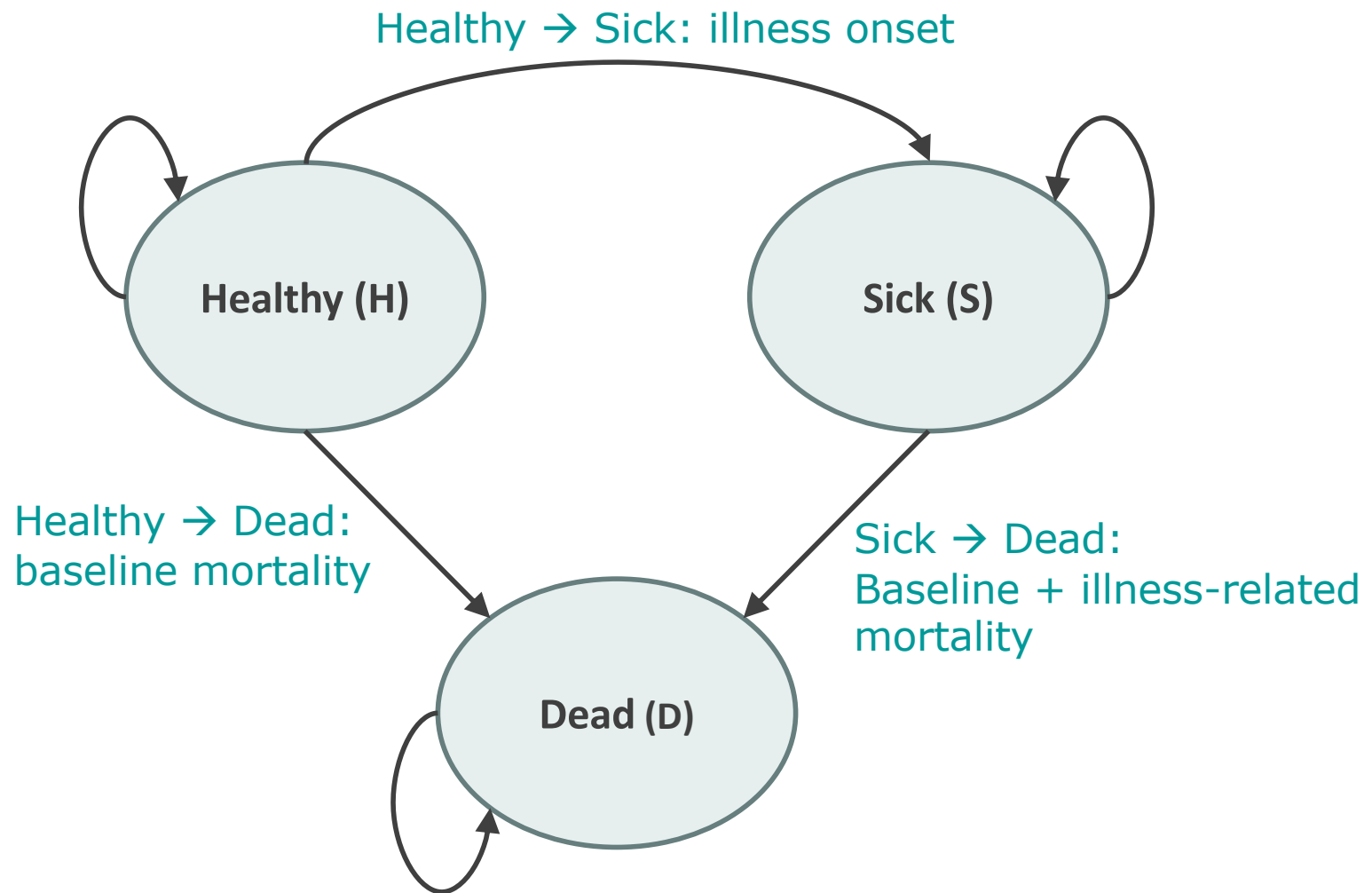
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Health-Sick-Dead Example

State Transition Diagram



Strategies

- Standard of Care
- Treatment A
 - Taken while healthy to prevent onset of illness (lowers transition probability from Healthy to Sick)
 - Costs \$800 per year
- Treatment B
 - Even lower risk of illness onset
 - Costs \$1,400 per year
- Which strategy is cost-effective?

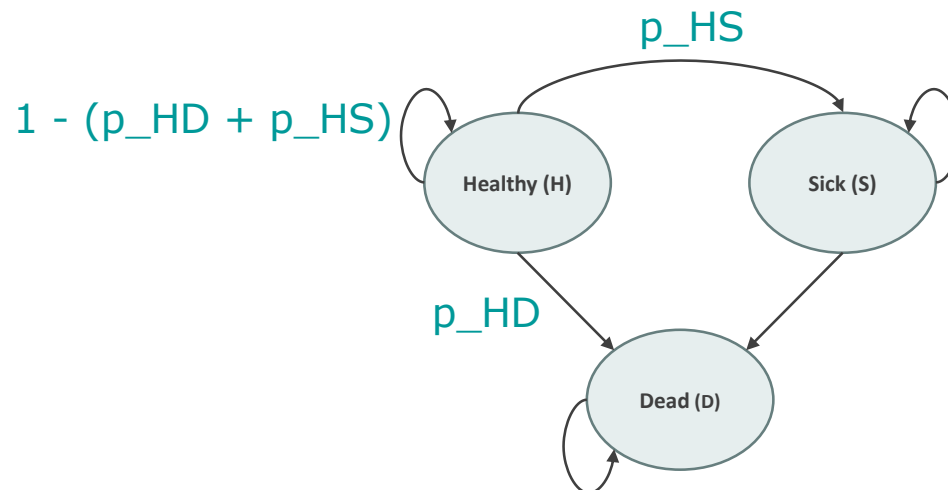
Rates vs. Probabilities

- Discrete-time model dynamics are described by transition probabilities
- However, sometimes convenient to parameterize a model using "event rates"
 - Event rate definition: # of events expected to occur per unit time
 - Easy to convert rates to different time periods
$$r_{\text{monthly}} = r_{\text{annual}} / 12$$
- Convert between rates and probabilities
 - $p = 1 - e^{-r}$
 - $r = -\ln(1 - p)$
- Can also use these equations to convert from annual probabilities to cycle-specific probabilities

Conditional Transitions

- Sometimes assume that transitions between non-dead health states are conditional on surviving that cycle
- Example: You have the following parameters estimated from literature
 - p_{HD} : probability of dying from healthy state
 - p_{HS} : probability of becoming sick from healthy state

If **not conditional**
on survival:

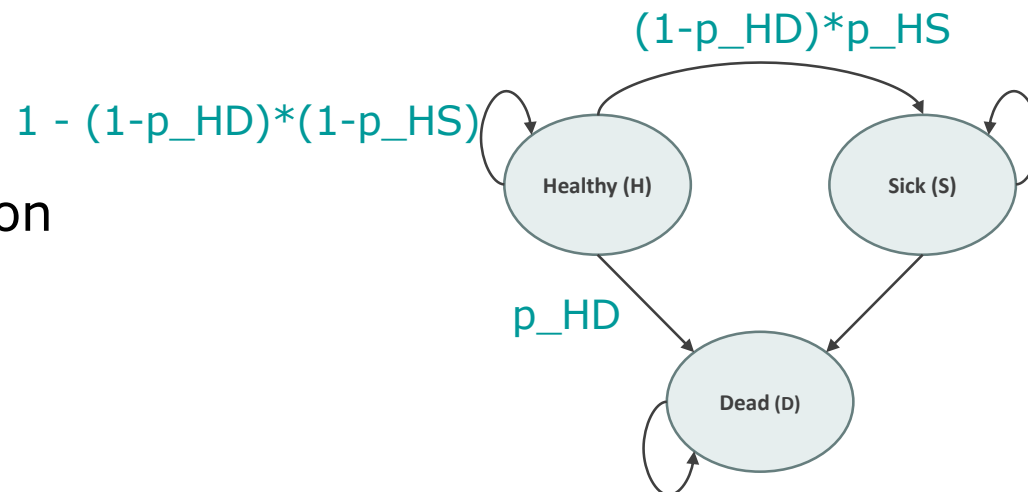


- *Ultimately whether this makes sense for models depends on the data informing parameter estimates*

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Structuring R Code

Step 1

Load packages and functions

Step 2

Define parameters and assign values

Calculate internal model parameter values

Steps 3

Set up model (construct transition matrix)

Step 4

Run model (for loop over time)

Step 5

Visualize and summarize model output

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