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decomposing multistate models

Tim Riffe

28 May, 2021
REVES annual meeting

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Consider parameterizing in terms of conditional probabilities when decomposing discrete time multistate models

Tim Riffe

28 May, 2021
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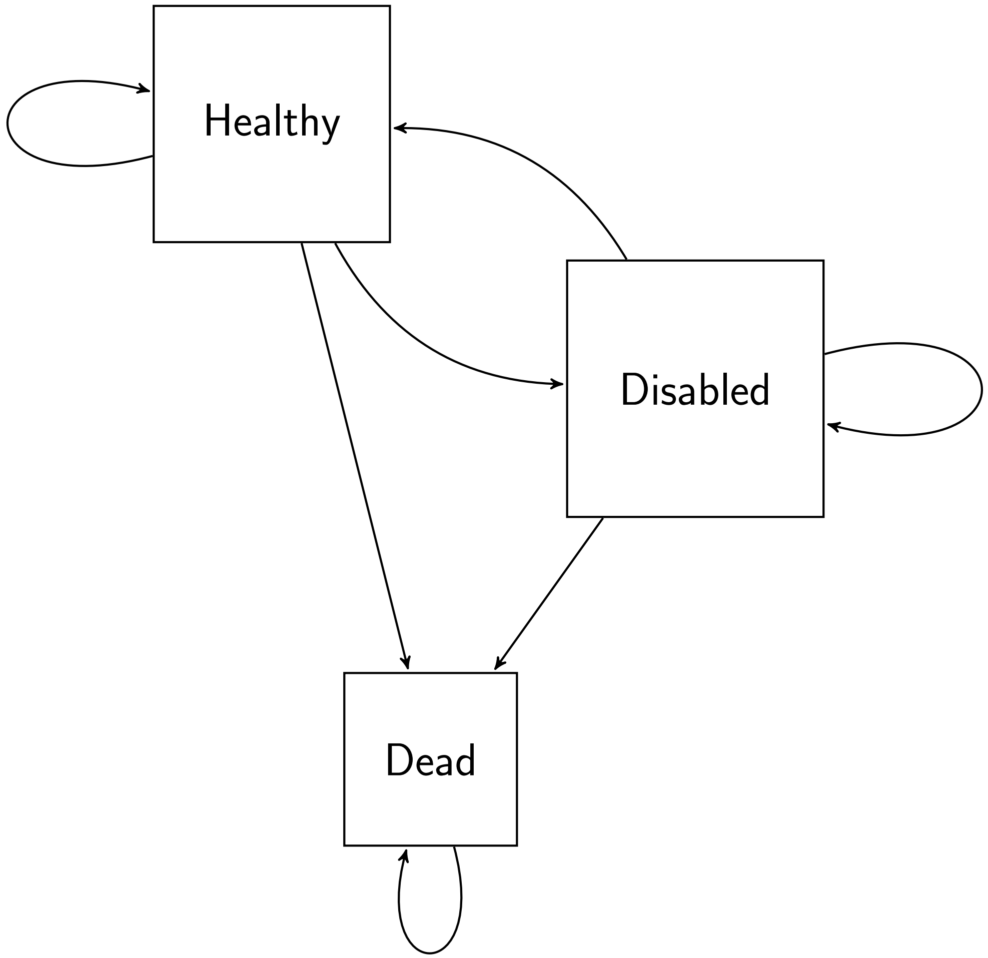
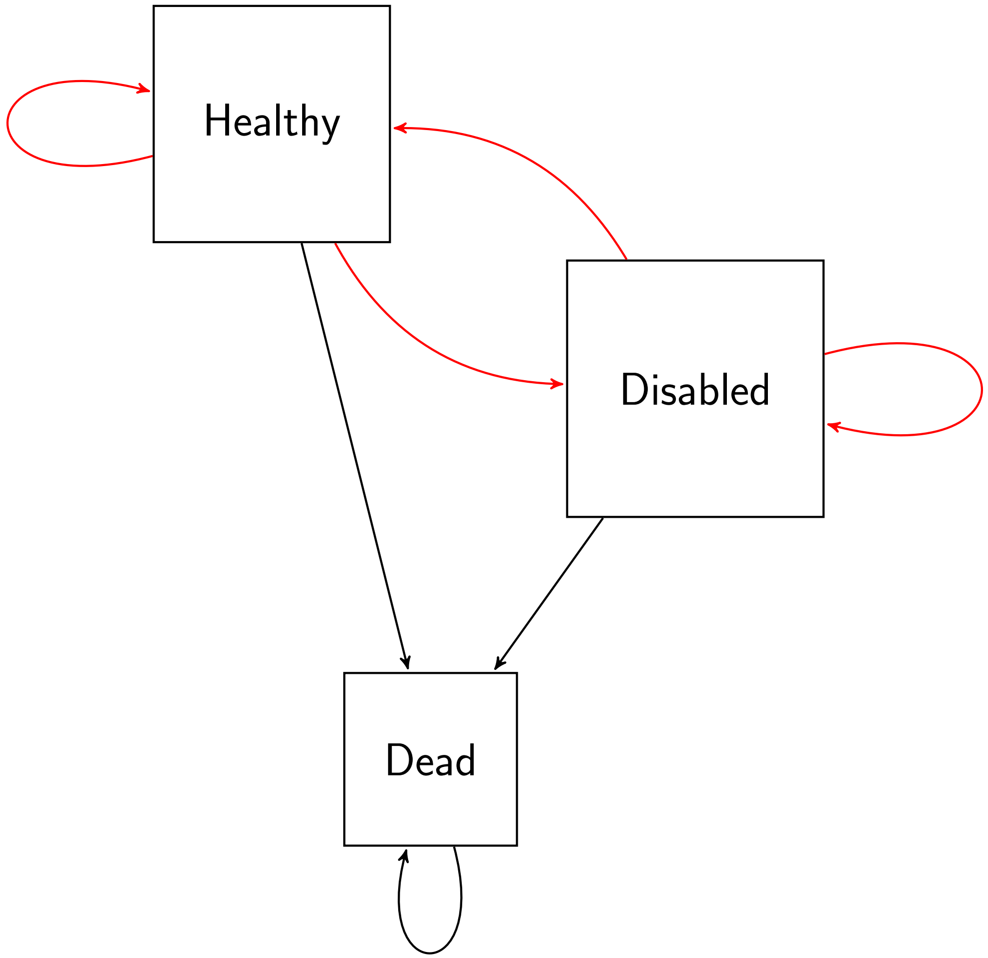
A typical multistate model



A typical multistate model



$$\xi = f(\theta)$$

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where ξ can be any synthetic quantity calculated with θ.
- often ξ is an expectancy

setup

$$\Delta\xi = \xi^2 - \xi^1$$

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$$= f(\theta^2) - f(\theta^1)$$

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$$\Delta\xi = \sum \mathbf{c}_i$$

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$$\Delta\xi = \xi^2 - \xi^1$$

$$= f(\theta^2) - f(\theta^1)$$

$$\Delta\xi = \sum \mathbf{c}_i$$

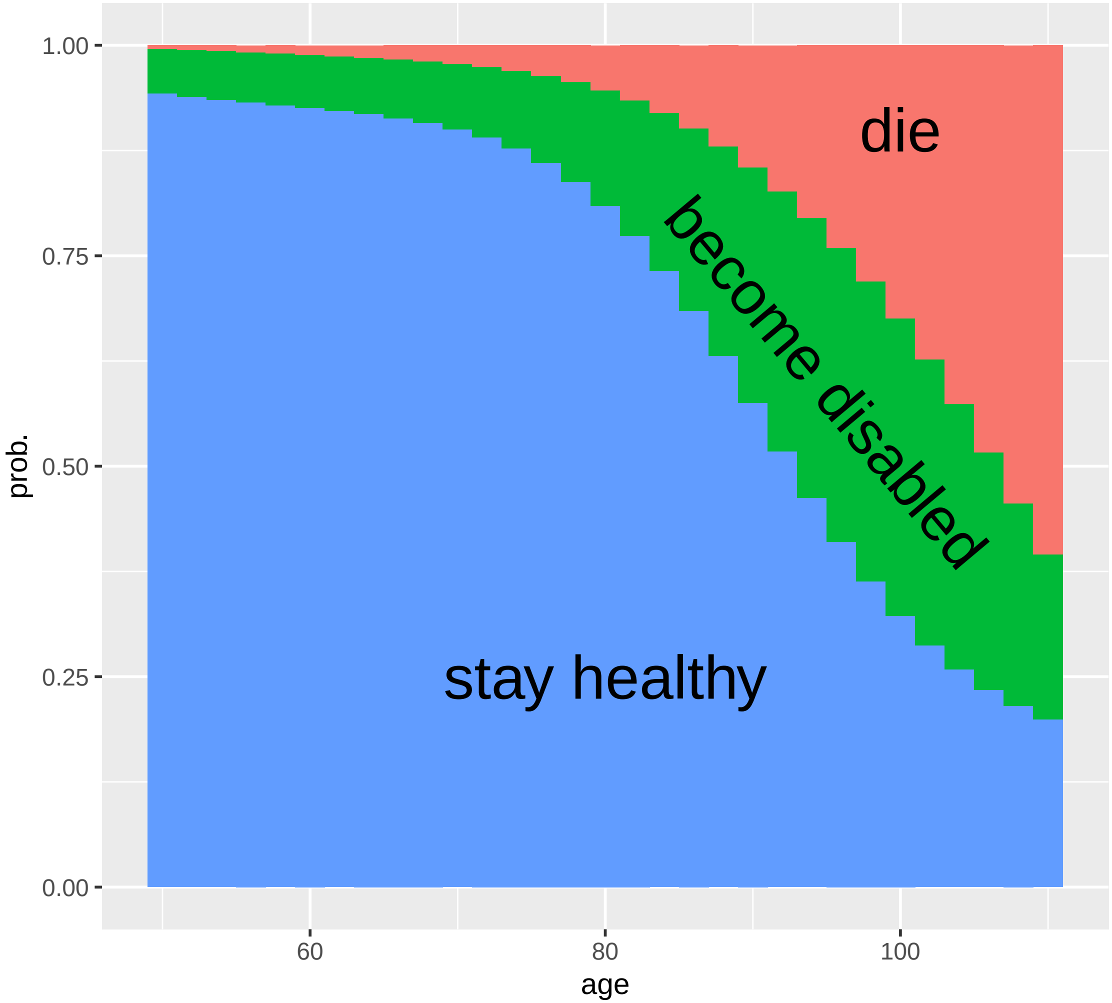
$$\mathbf{c} = \mathcal{D}(f, \theta^2, \theta^1)$$

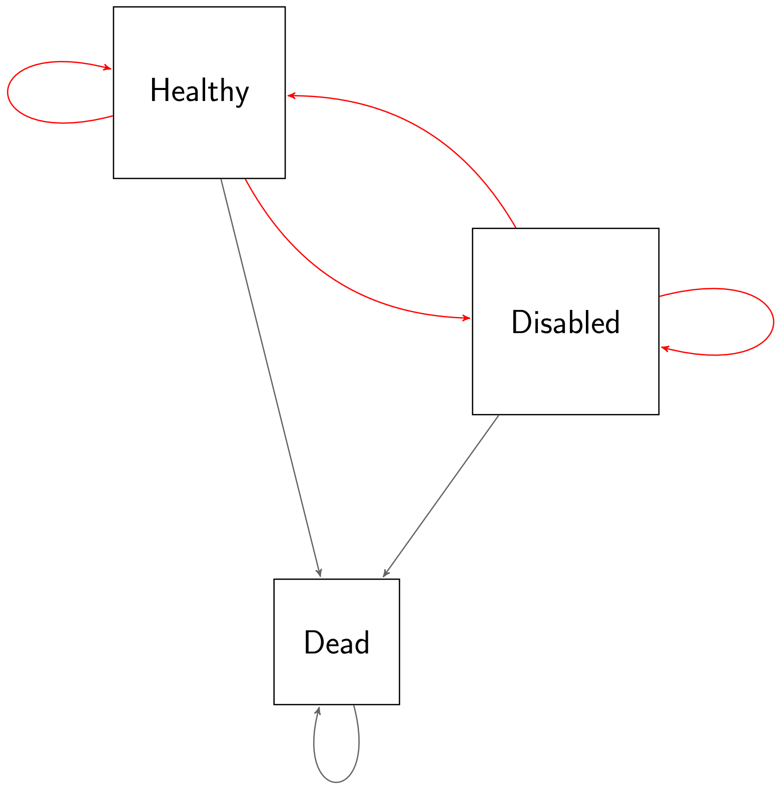
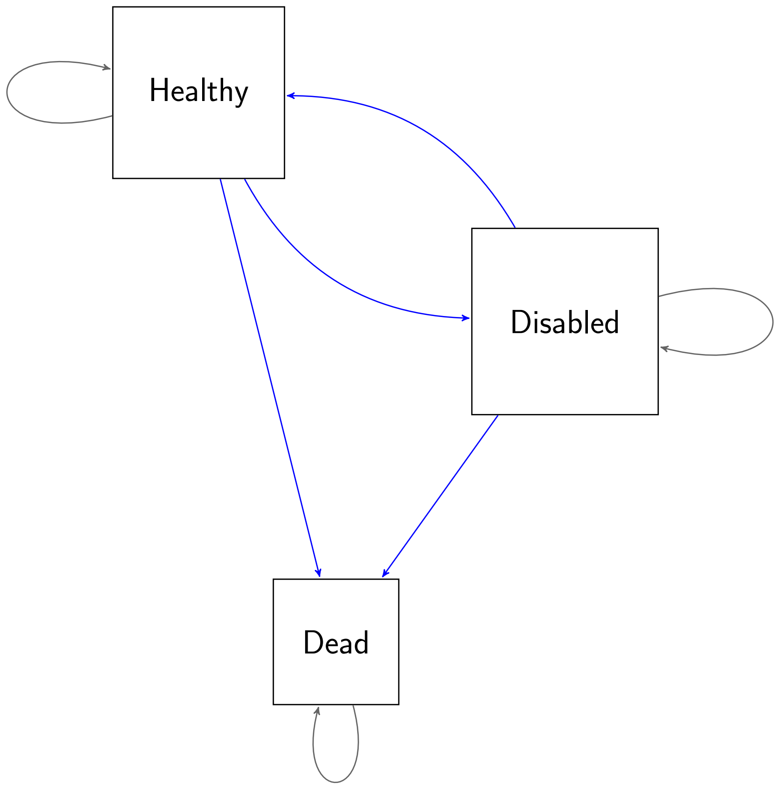
Decomposition, $\mathcal{D}()$

- LTRE (Caswell 1989)
- Stepwise (Andreev et al 2002)
- Pseudo continuous (Horiuchi et al 2008)

Let's talk about θ

Pick two colors to make θ




Healthy
Disabled
Dead

Healthy
Disabled
Dead

$$\xi = \color{red}{f(\theta)} = \color{blue}{f(\theta)}$$

$$\xi = f(\theta) = f(\theta)$$

$$\Delta\xi = \xi^2 - \xi^1 = \xi^2 - \xi^1$$

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$$\Delta\xi = \xi^2 - \xi^1 = \xi^2 - \xi^1$$

$$\mathcal{D}(f, \theta^2, \theta^1) \neq \mathcal{D}(f, \theta^2, \theta^1)$$

$$\sum \mathbf{c}^i = \sum \mathbf{c}^i$$

but

$$\mathbf{c}^i \neq \mathbf{c}^i$$

Example

DFLE increased from 30.75 in 2006 to 32.33 in 2014.
That's $\Delta\xi$ =1.58 years

(HRS, age 50 women with secondary education)

Example

Same result, ξ whether we omit:

- self-transitions
- mortality transitions
- health transitions

But very different stories if we decompose:

omits	Stay healthy	Get disabled	Die healthy	Recover	Stay disab.	Die disabled
self		-0.01	1.32	-0.28		0.54
mort	1.28	0.04		-1.86	2.13	
health	0.21		1.10		-0.41	0.67

"Thank you" intermission

We would like a solution that gives consistent interpretable results

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Solution

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Solution

Make θ consist in conditional probabilities

For standard calcs we use (two of)

$$\left[p^{stay}, p^{switch}, p^{die}\right]$$

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$$\left[p^{stay}, p^{switch}, p^{die}\right]$$

Transform this into two multiplicative probabilities

$$\left[p^{stay}|survive, p^{survive}\right]$$

Complementarity

DF mort	Dis. mort	DF$\rightarrow$ *Dis*	Dis$\rightarrow$ *Df*
1.29	0.58	0.02	-0.31

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Thanks