

# Health Expectancy: Methods of Calculation

- Advances Made in the Last 20 Years -

# Before 1989

- Sullivan Method
- Double Decrement Life Table Method

# Sullivan Method

Daniel F. Sullivan

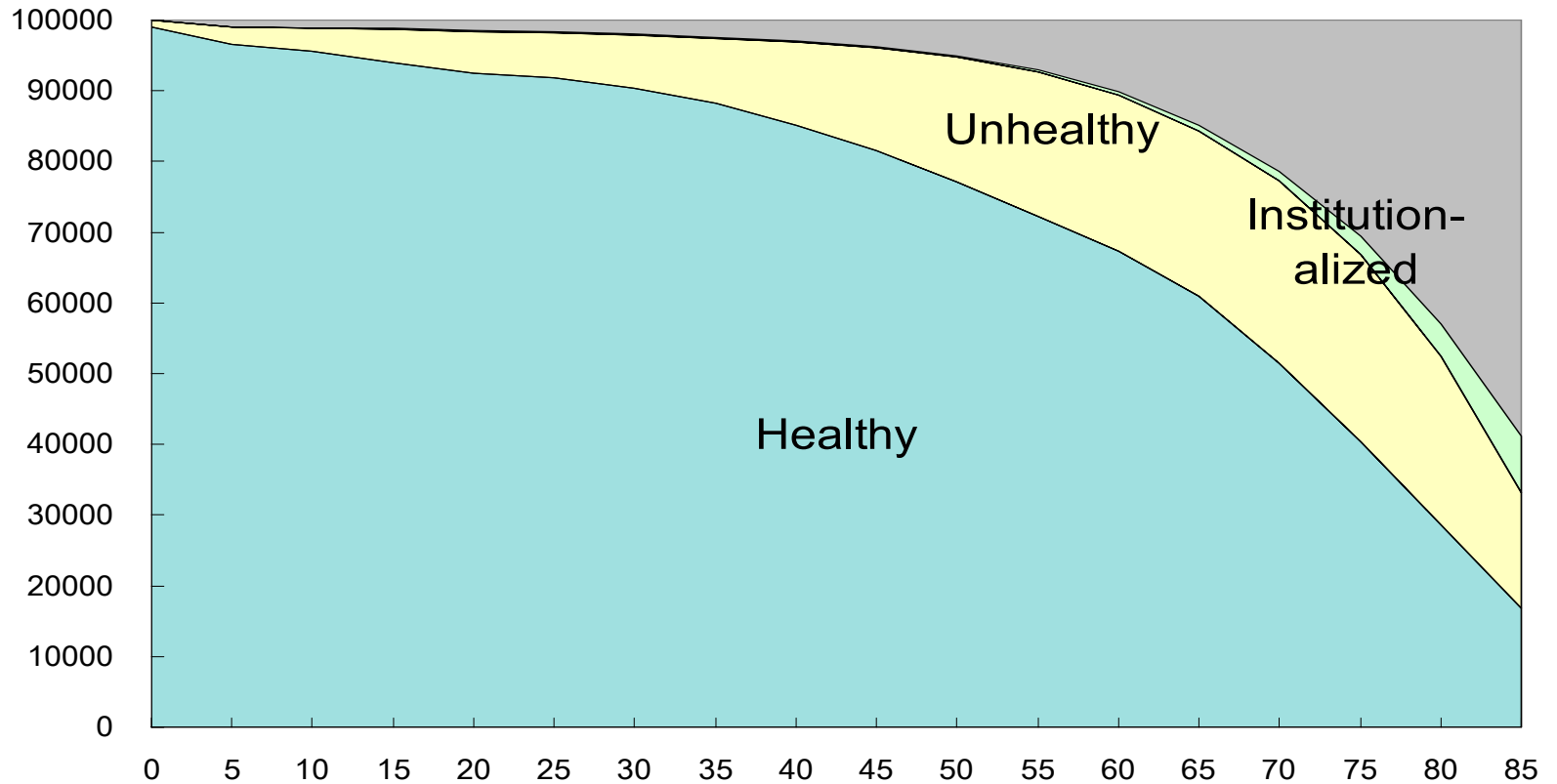
1966: “Conceptual Problems in Developing an Index of Health”

1971: “A Single Index of Mortality and Morbidity”

Data: Life Table, Prevalence Rates, Institutionalization Rates

- easy to calculate and collect data
- applied by many countries to compute health expectancy

# Depiction of Sullivan Method



# Sullivan Method

$$e_x (\text{healthy}) = T_x (\text{healthy}) / I_x$$

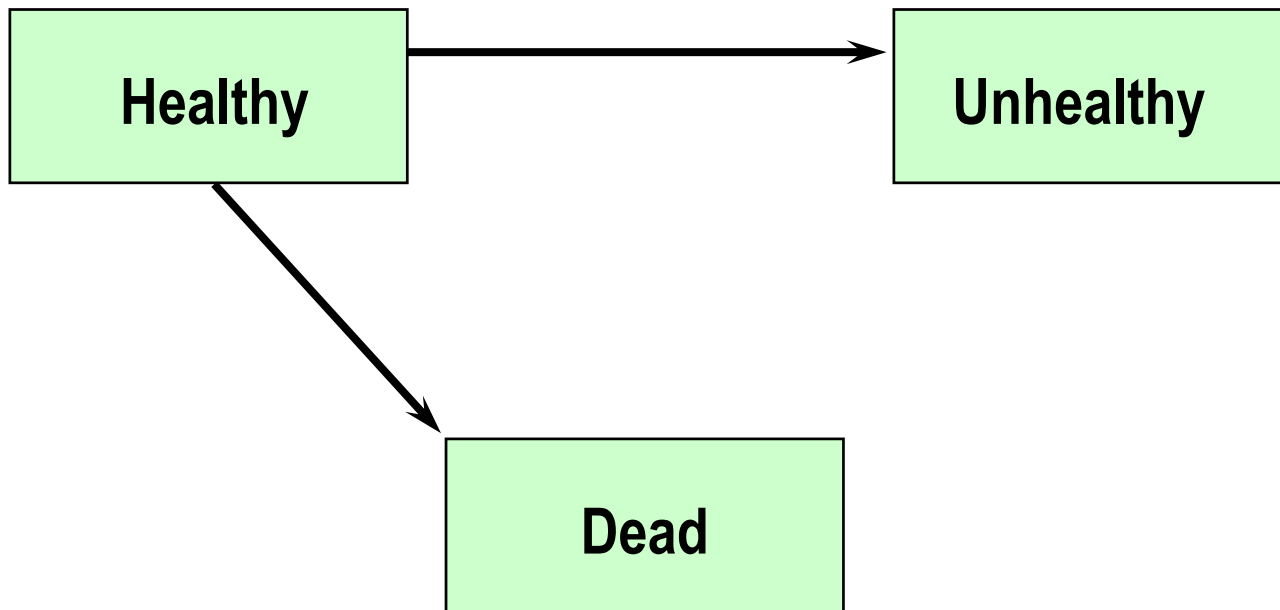
$$e_x (\text{institutionalized}) = T_x (\text{institutionalized}) / I_x$$

$$e_x (\text{unhealthy}) = T_x (\text{unhealthy}) / I_x$$

$$e_x = e_x (\text{healthy}) + e_x (\text{institutionalized}) + e_x (\text{unhealthy})$$

# Double Decrement Life Table Method

Katz et al. (1983) -- Active Life using ADL



# After 1989

- Multistate Life Table Method (1989)
- Bayesian Approach (around 2000)
- Microsimulation Method (1995)
- GoM Approach (1991)
- The Global Burden of Disease Approach (1992)
  - DALY
  - DALE
  - HALE

# Multistate Life Table Method

Method existed but applied to Health Expectancy  
Research by

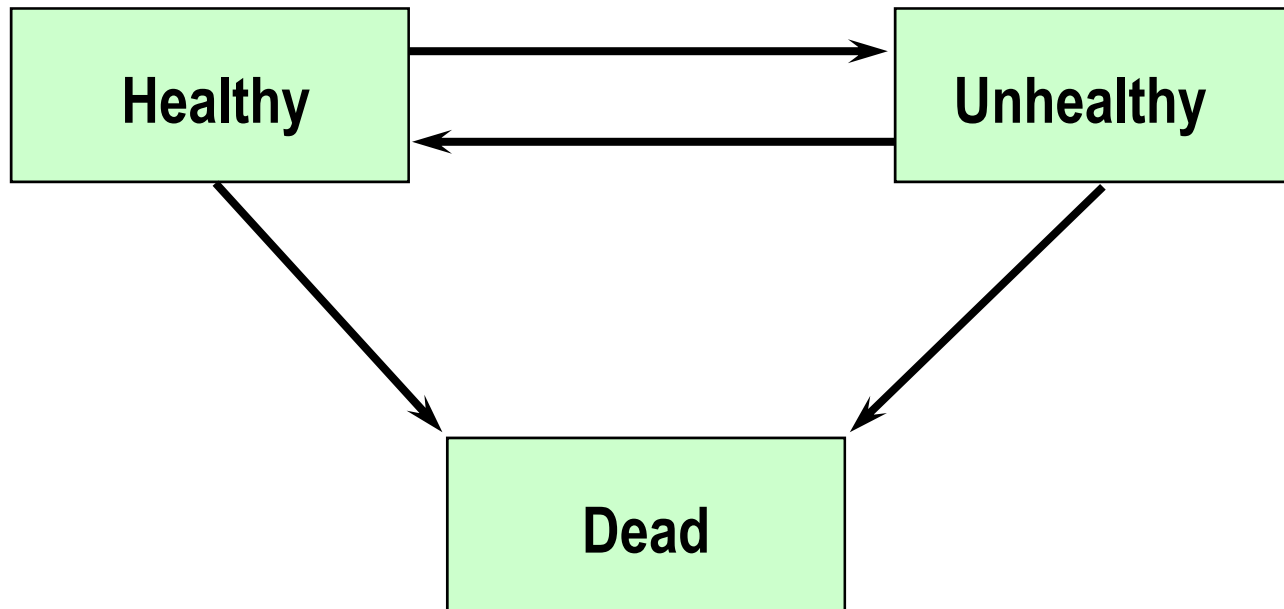
Rogers A., Rogers R., Branch (1989)

Rogers R., Rogers A., Belanger (1989)

Rogers A., Rogers R., Belanger (1990)



# Multistate Life Table Method



# Multistate Life Table Method

- Population-Based Method
  - only age is a variable
  - only one radix but need to distribute it by health states at the beginning of the age range
- Status-Based Method
  - age and health status are variables
  - can compute life table as many as the number of health states employed

# Beysian Approach

- Gibbs Sampler for Multistate Life Tables Software (GSMLT v.90): [www.reves.net](http://www.reves.net)
  - Scott M. Lynch and J. Scott Brown (2005)
- Lynch, Scott M. and J. Scott Brown. (in press). “A New Approach to Estimating Life Tables with Covariates and Constructing Interval Estimates of Life Table Quantities.” *Sociological Methodology*.

# Available Program to Compute Multistate Life Table

- IMaCh by Nicolas Bruard and Agnes Lievre at INED
- STATA Program by Margaret M. Weden
- SAS Program by Mark Hayward and his colleagues

# IMaCh

- Input:  $q$
- Available at:  
[reves.site.ined.fr/en/resources/computation\\_online/imach/](http://reves.site.ined.fr/en/resources/computation_online/imach/)
- IMaCh computes most of statistics we want.
- Estimation method of transition probabilities is based on the work by Laditka and Wolf presented in 1995 REVES meeting and published in 1998.

# STATA Program

- Input:  $q$
- Available at: [www.ssc.wisc.edu/~mweden/](http://www.ssc.wisc.edu/~mweden/)
- 3 programs
  - Create data set for analyses
  - Estimate transition probability based on multinomial logistic regression model
  - Construct multi-state life tables
- Status-based

# SAS Program

- Input:  $m$
- Available by request but will be available through internet soon
- Program only construct multi-state life tables—you need to compute transition RATES
- BUT!!! **SPACE** program will incorporate everything including estimation of SE

R?

- Input:



# Microsimulation Method

Laditka and Wolf (1995)

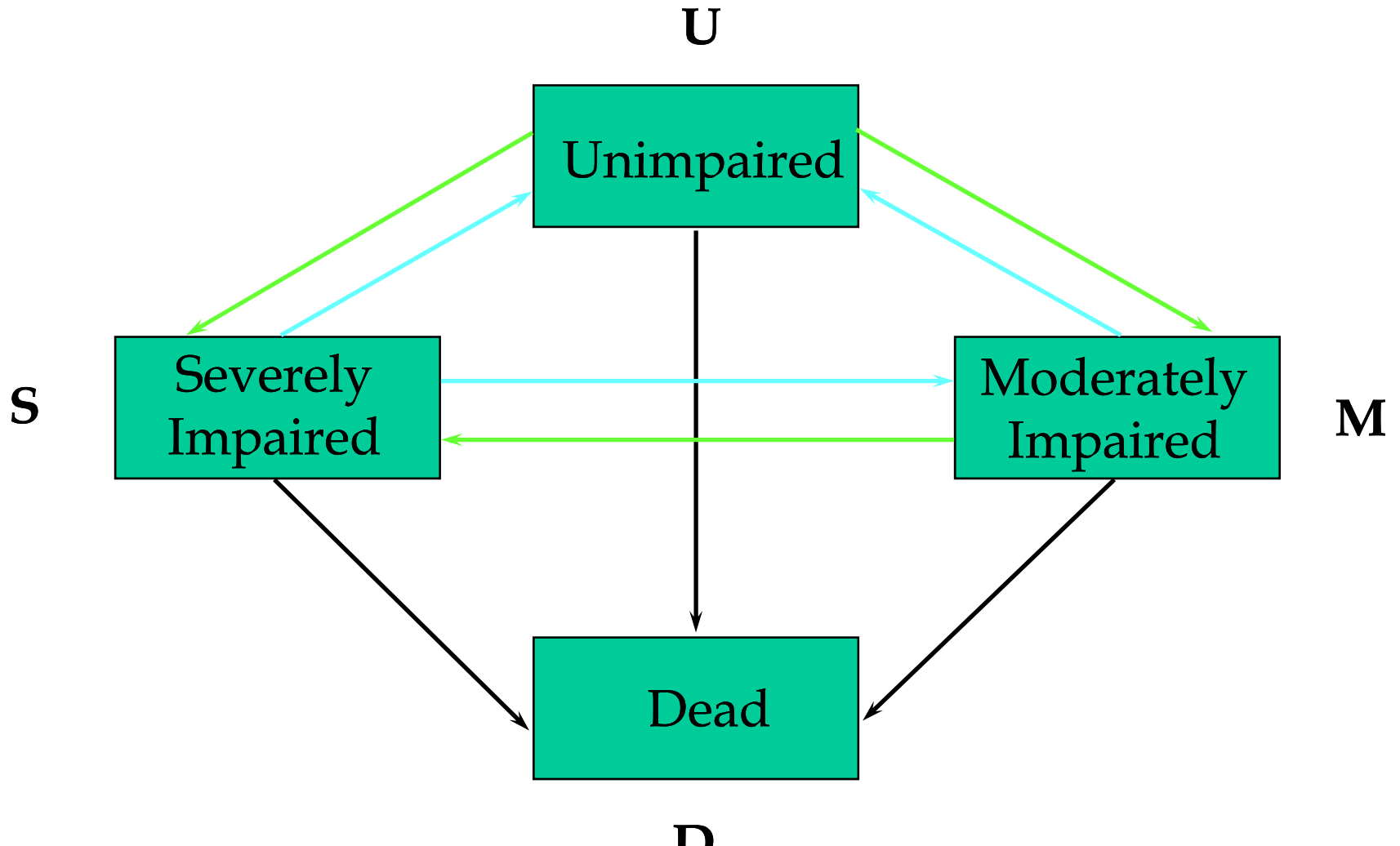
Wolf and Laditka (1996)

4 levels of health status by ADL

estimate monthly transition probabilities among health states

simulate life of 100,000 70 years or older by sex until they die

# Microsimulation Method

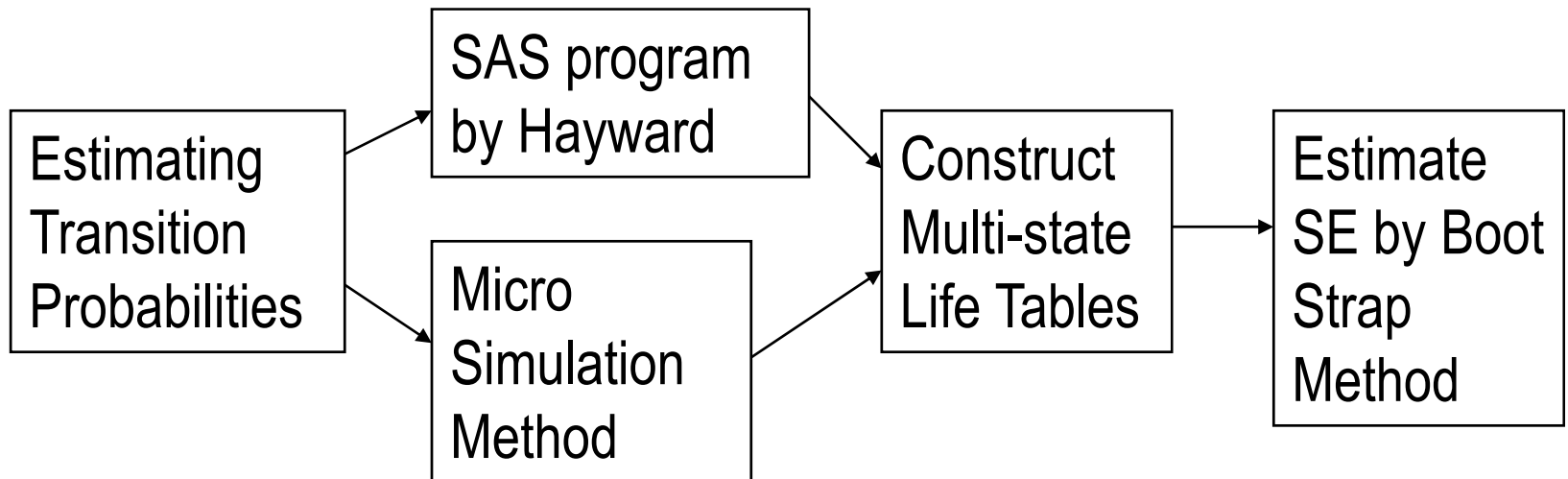


# Microsimulation Method

	70.0	70.1	70.2	70.3	----	----
1	U	U	U	U	U	U
2	U	U	U	M	M	S
3	S	S	S	D	-	-
4	M	M	M	M	U	S

# SAS program for Micro Simulation

- Input:  $q$
- **SPACE** program will incorporate everything including estimation of SE



# GoM Method

Grade of Membership (fuzzy reasoning)

K. G. Manton and E. Stallard (1991)

K. G. Manton, E. Stallard, and K. Liu (1993)

# Global Burden of Disease Approach

Global Burden of Disease Study: 1992

World Bank and World Health Organization

Christopher J.L. Murray and Alan D. Lopez

– ***Bull WHO.*** 72. 1994

– ***Science.*** 274. 1996

– ***The Global Burden of Disease: A Comprehensive Assessment of Mortality and Disability from Diseases, Injuries, and Risk Factors in 1990 and Projected to 2020.*** 1996

# Global Burden of Disease Approach

Concept of Disability-Adjusted Life-Year (DALY)

$$\text{DALY} = \text{YLL} + \text{YLD}$$

**YLL: Years of Life Lost**

**YLD: Years Lived with a Disability**

- DALY is computed for a certain population (country, region, or state) by disease
- 1 DALY = 1 person/year in perfect health

# Data Used to Calculated Health Expectancy

- Cross Section
  - Sullivan Method
- Longitudinal, Panel
  - Double Decrement Life Table Method
  - Multistate Life Table Method
  - GOM Method
  - Simulation Method