Constructing life tables for global surveillance of cancer survival: experience from CONCORD-2

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What are life tables?

Life tables are...
• Tables of age- and sex-specific death rates or probabilities, used to adjust for background mortality

They should...
• Match cancer patients as closely as possible (region, race, socioeconomic status, ...)
• Be by single year of age and single calendar year

However...
• Often only available at national level
• May only be available abridged
Data and methods

279 population-based cancer registries

Three categories of life table data obtained:

1. Death and population counts
   - 172 cancer registries; 57 North American
   - By race for United States

2. Mortality rates
   - Raw: 62
   - Smoothed: 21

3. No reliable data available
   - 24 cancer registries
279 population-based cancer registries

Three categories of data obtained for life tables:

1. Death and population counts
   → Multivariable Poisson model with restricted cubic splines
Poisson model

Mortality rate per 100,000 per year (log scale)

Age in years

# 1 - Counts
→ Poisson framework
Poisson model

Mortality rate per 100,000 per year (log scale)

Age in years

#1 - Counts
→ Poisson framework

#2 - Flexibility

Multivariable Poisson model with restricted cubic splines
Poisson model with restricted cubic splines

#1 - Counts
→ Poisson framework

#2 - Flexibility
→ Splines
A Poisson model with restricted cubic splines was used to analyze the mortality rate per 100,000 per year across different age groups. The mortality rate is presented on a log scale.

- **#1 - Counts**: Poisson framework
- **#2 - Flexibility**: Splines
- **#3 - Covariables**: Multivariable Poisson model

The graph shows the mortality rate increasing with age, with a notable decrease around the age of 10 years.
Multivariable Poisson model with restricted cubic splines

#1 - Counts
\rightarrow \text{Poisson framework}

#2 - Flexibility
\rightarrow \text{Splines}

#3 - Covariates
\rightarrow \text{Multivariable model}
Model performance

• Model performs well
• Across most life tables, 4 recurring patterns of knots
• Life tables by race for most US populations
• Not possible for Blacks (small numbers) for:
  – Hawaii
  – Idaho
  – Montana
  – New Hampshire
  – Wyoming
Variations in life expectancy

Life expectancy at birth (years): 2000

Males
- Nunavut: 67.6
- British Columbia: 77.0
- Mississippi: 69.9

Females
- Nunavut: 72.4
- British Columbia: 82.3

Legend:
- 80.0 - 82.5
- 77.5 - 80.0
- 75.0 - 77.5
- 72.5 - 75.0
- 70.0 - 72.5
- 67.5 - 70.0
- No data
Variations in life expectancy

Life expectancy at birth (years), by race in the US: 2000

White males

Black males

Legend:
- 75 - 78
- 72 - 75
- 69 - 72
- 66 - 69
Variations in life expectancy

Life expectancy at birth (years), by race in the US: 2000

White females

Black females

Legend:
- 79 - 81
- 77 - 79
- 75 - 77
- 73 - 75
What impact does using state- and race-specific versus national race-specific life tables have on estimates of net survival?
Impact on 5-year net survival (national – state)

Lung

Colon

Breast

Prostate

Legend:
- 2 to 3%
- 1 to 2%
- 0 to 1%
- 0 to -1%
- -1 to -2%
- -2 to -3%
- -3 to -4%
- No data

Note: The maps show the percentage impact on 5-year net survival for various cancers (Lung, Colon, Breast, Prostate) across different states.
Conclusions

• Flexible modelling approach captures state- and race-specific patterns of mortality, even when the death counts are small

• Regional variations in background mortality – important to use state- and race-specific life tables
Life table availability

• All CONCORD-2 life tables available online
  – Currently CONCORD Working Group members only
  – Publicly available soon
• Also available: detailed report for each registry’s life tables

http://csg.lshtm.ac.uk/life-tables/
Thank you!

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