

Period Analysis



HCC Journal Club

May 9, 2008

Relative Survival

- ❑ Becoming increasingly more common to see relative survival
- ❑ Competes with hazard ratios
- ❑ For large observational studies, relative survival generally better
- ❑ Interpretation:

$$\frac{\text{Probability of survival at time } t \text{ given cancer}}{\text{Probability of survival at time } t \text{ given no cancer}}$$

- ❑ Generally, use census data to find out the survival experience of people of same race, gender, age, etc.
- ❑ Example: relative survival at 5 years of 60% implies that patients with cancer have 60% of the chance of being alive as someone of same age, race, gender who does not have cancer.
- ❑ Note: this includes comorbidities

Period Analysis

- Fairly recent approach in cancer research
- Utility:
 - long-term survival rates are most commonly used outcome measures for pts with cancer
 - traditional approach uses “cohort” approach
 - reflects survival of patients diagnosed many years ago
 - these pts are not comparable to current pts
 - fails to account for ongoing improvements in survival over time
 - Period analysis accounts for newer information on survival
 - more accurately reflects what patients diagnosed today will experience

Some examples

- All cancers
 - current 20 yr survival using cohort approach: 40%
 - current 20 yr survival using period analysis: 51%
- Breast cancer
 - current 20 yr survival using cohort approach: 52%
 - current 20 yr survival using period analysis: 65%
- Ovarian cancer
 - current 20 yr survival using cohort approach: 35%
 - current 20 yr survival using period analysis: 50%

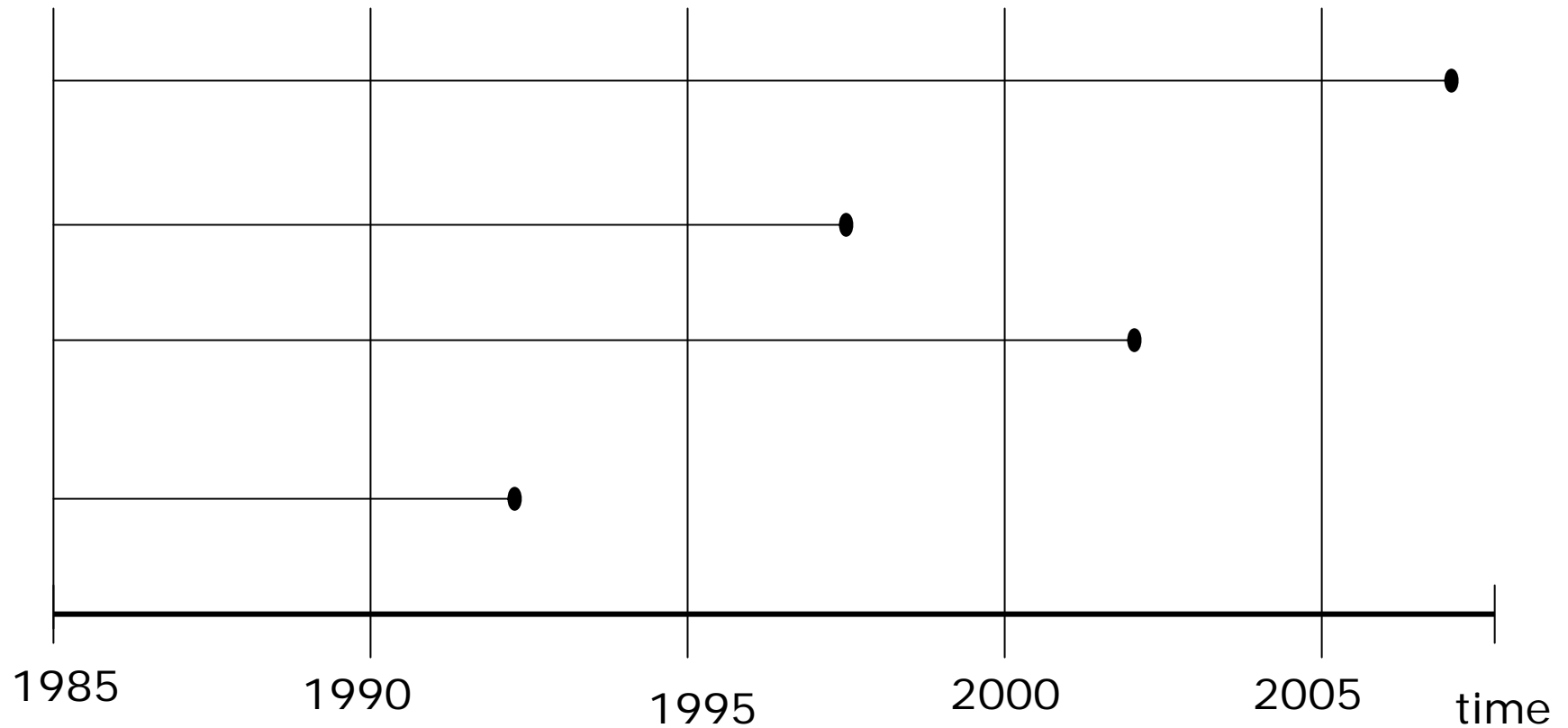
What's the difference?

- Assume we are interested in 20 year survival rate of cancer patients in 2005
- Cohort approach
 - look at patients diagnosed with cancer in 1985
 - estimate the fraction of them still alive in 2005
 - patients are all from the same 'cohort'
- Period analysis
 - combine information of patients throughout all years from 1985 through 2005
 - use 'survival analysis' approaches to determine how to combine

How it plays out

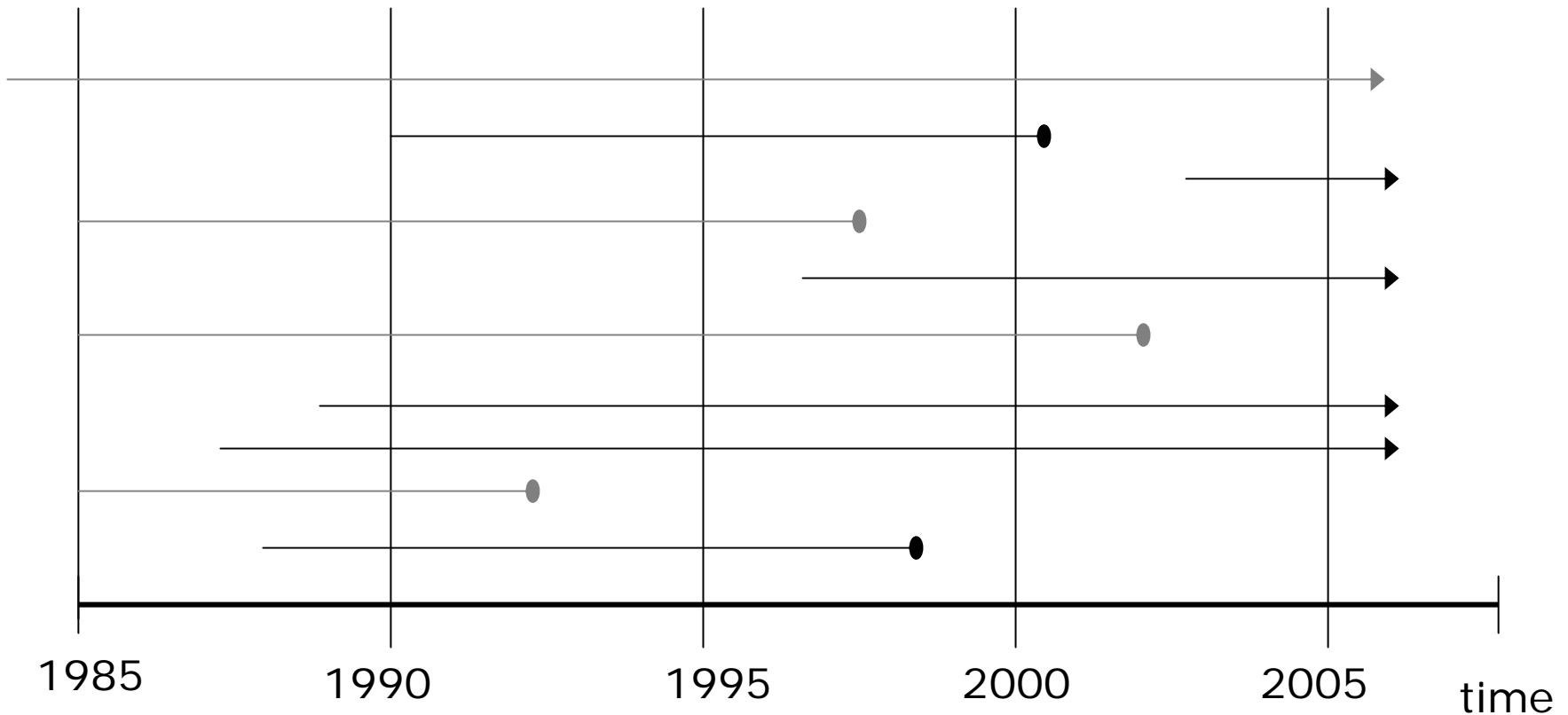
- ❑ Most cancer deaths occur during the first few years following diagnosis
- ❑ current estimates of 20 year survival should adjust for improvements made in first several years following diagnosis
- ❑ using patients diagnosed 20 years ago does not capture this
- ❑ replace the first few years of estimates with current estimates.
- ❑ and so on, for the most current info we have

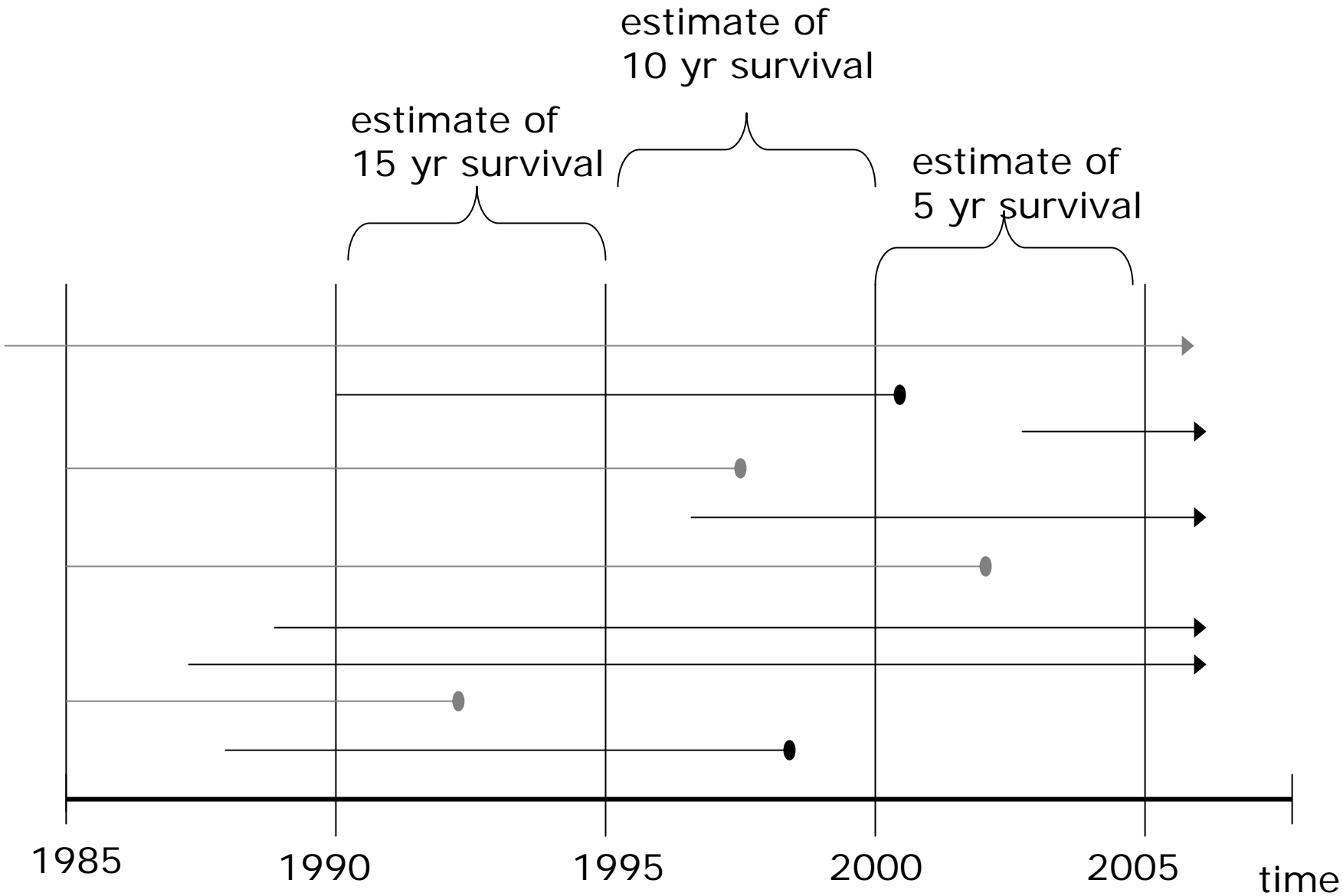
Cohort analysis



Period analysis

- right censoring
- left truncation





Period Analysis, technically

- Assume we are interested in 2001-2005 survival experience
- Calculate 'conditional survival probabilities'
 - 1 year survival: provided by patients diagnosed in 2000-2005
 - 2 year survival: provided by patients diagnosed in 1999-2004
 - ...
 - 20 year survival: provided by patients diagnosed in 1981 – 1986
- Multiply: conditional survival probabilities multiplied to get survival rates
 - probabilistic arguments
 - similar to those used to create kaplan-meier curves

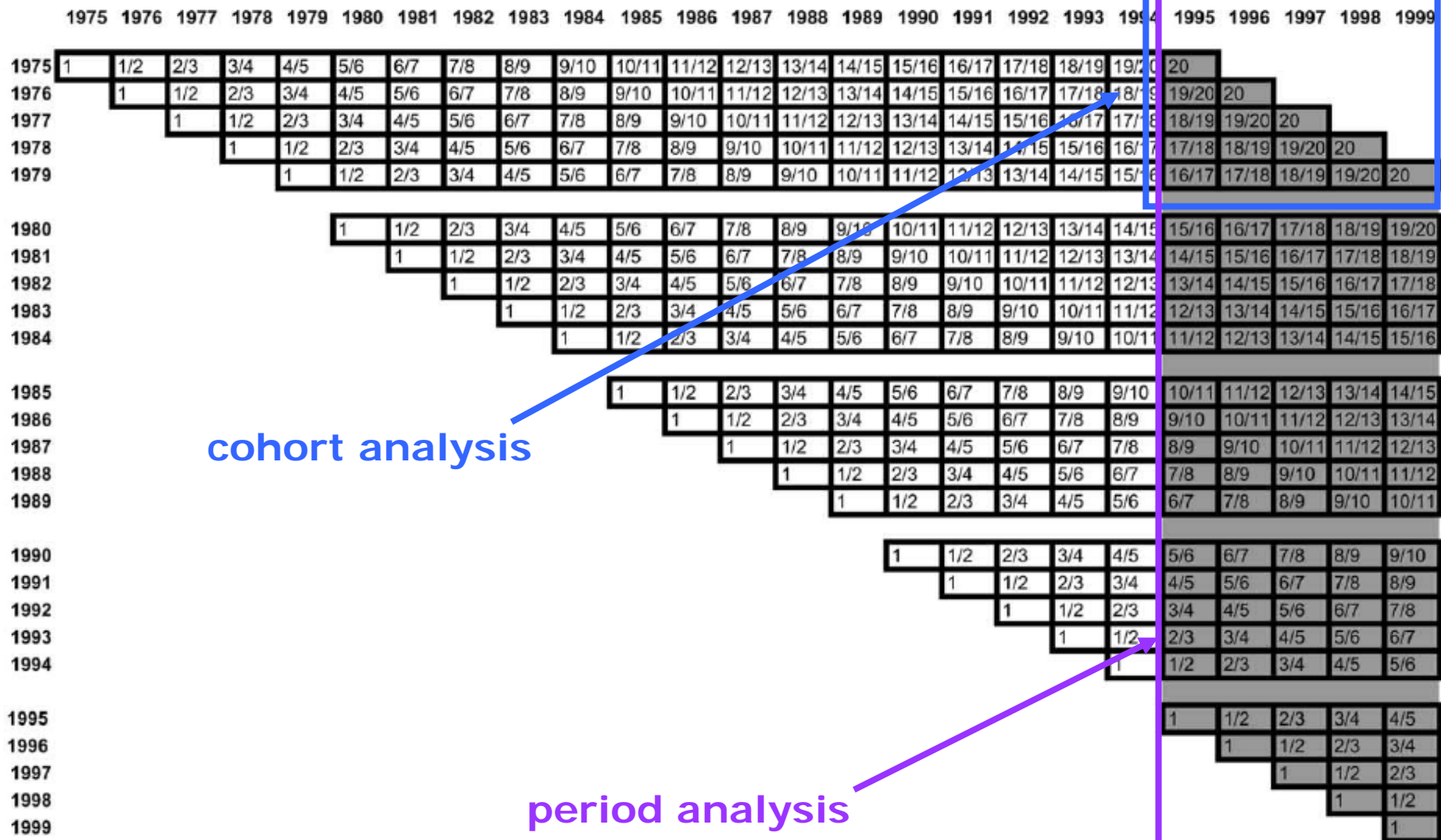
Example

- Finnish Cancer registry
- 1995-1999
- all cancer
- from Brenner et al., Eur J Cancer v. 40, 2004, p 326-335.

20 year rate estimates

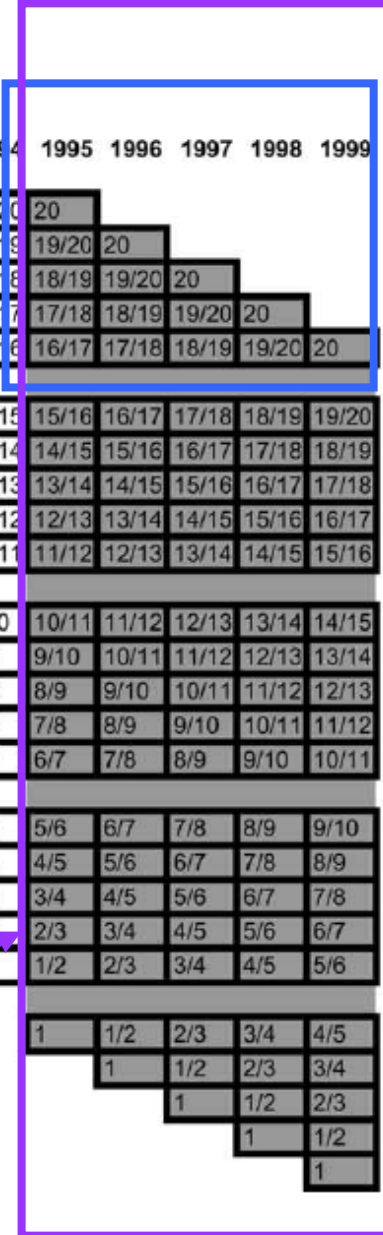
year of diagnosis

year of follow-up



cohort analysis

period analysis



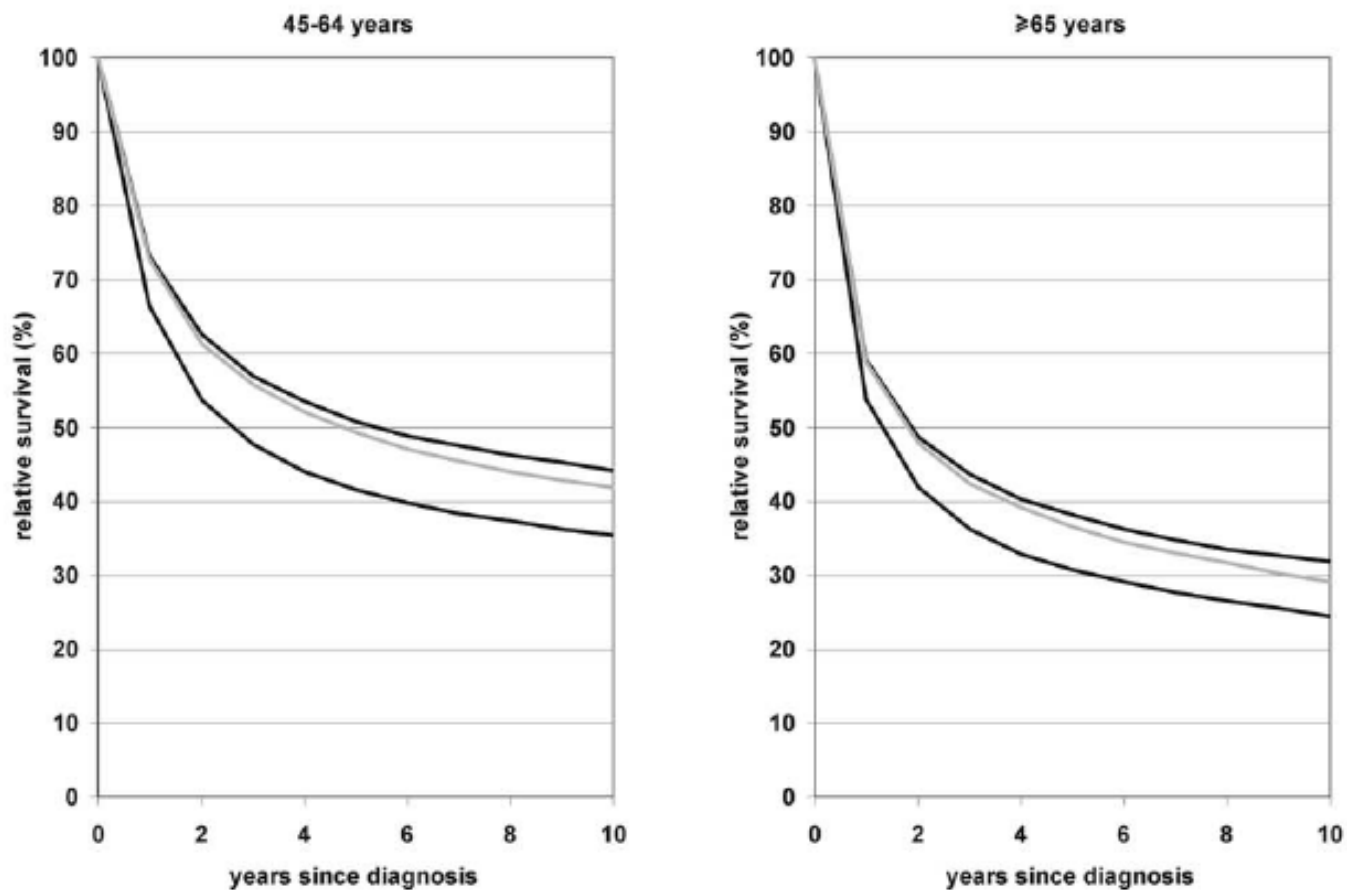
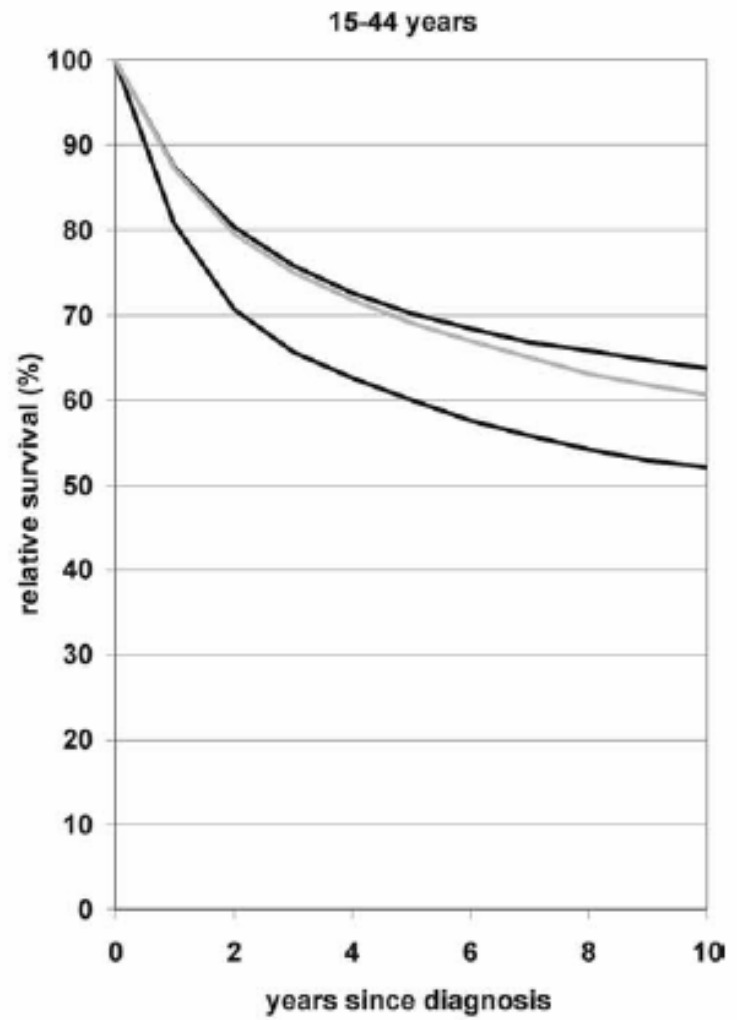
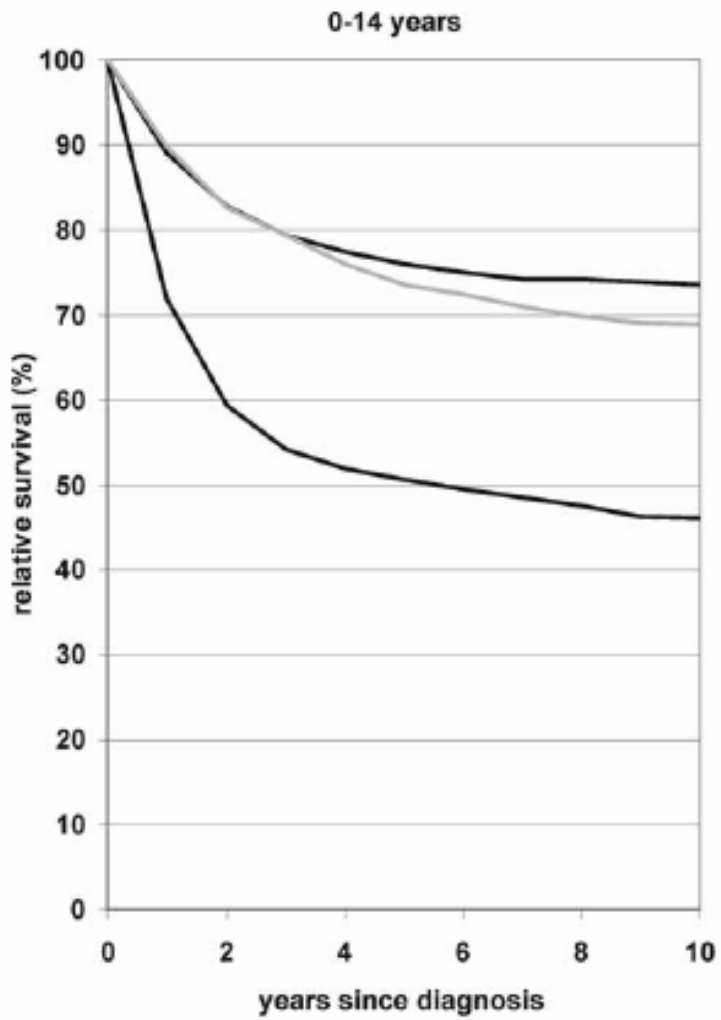


Fig. 3. Observed 10-year relative survival curves of patients diagnosed with cancer at various ages in 1985–1989 (upper black lines) compared with the most up-to-date survival curves available in 1985–1989 by period analysis (grey lines) and cohort analysis (lower black lines).



Pulte, Gondos, Brenner: NHL period analysis

- Period analysis appropriate
- some of analyses are 'overboard'
 - p-values when N is so large—meaningless
 - pay attention to differences in relative survivals (table 3)
 - comments about increases/decreases need to be taken with a grain of salt
 - some fluctuations are due to chance
 - observed decrease in survival could be a 'blip', or some other survival experience in the general population