

PSA testing for prostate cancer: Depleting a limited pool of susceptible individuals?

IARC 50th year anniversary conference 2016, Lyon

Morten Valberg¹,

Tom Grotmol², Steinar Tretli², Marit B. Veierød¹, Tron A. Moger^{1,3}, Susan S. Devesa⁴, Odd O. Aalen¹

¹Oslo Center for Biostatistics and Epidemiology, Department of Biostatistics, University of Oslo

²Cancer Registry of Norway, Institute of Population-Based Cancer Research

³Department of Health Management and Health Economics, University of Oslo

⁴Division of Cancer Epidemiology and Genetics, National Cancer Institute, NIH



June 8, 2016



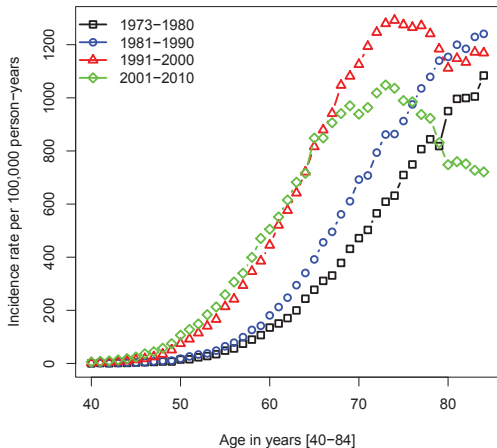
NORWEGIAN CANCER SOCIETY

Data

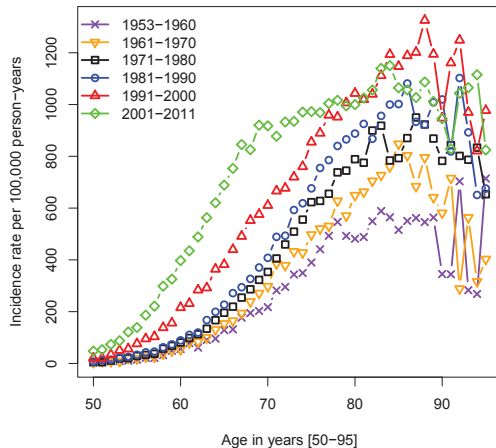
- US' Surveillance, Epidemiology and End Results (SEER) program.
 - 511,027 prostate cancers diagnosed in those 40 – 84 years in 1973-2010.
- Cancer Registry of Norway.
 - 113,837 prostate cancers diagnosed in those 50 – 95 years in 1953-2011.

Incidence rates wrt. age

SEER



Norway



Peaks in cancer age-incidence rates

Peak or leveling-off at very old age

- Cell senescence.
- Lack of diagnostic work-up in elderly people.

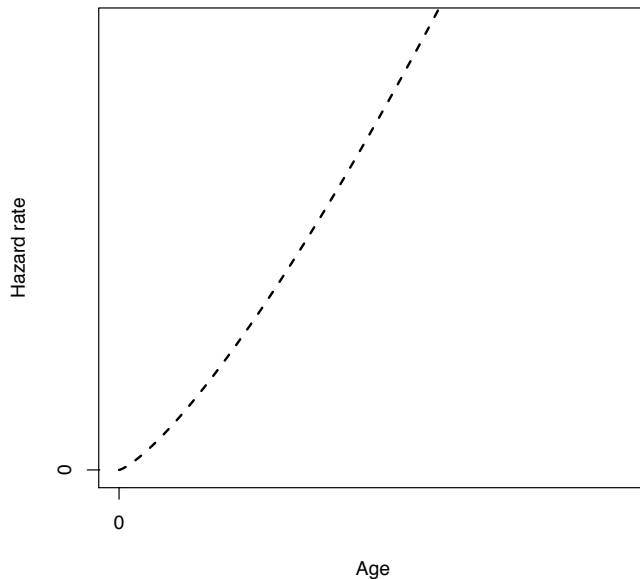
Alternative explanation

- Heterogeneity in risk.

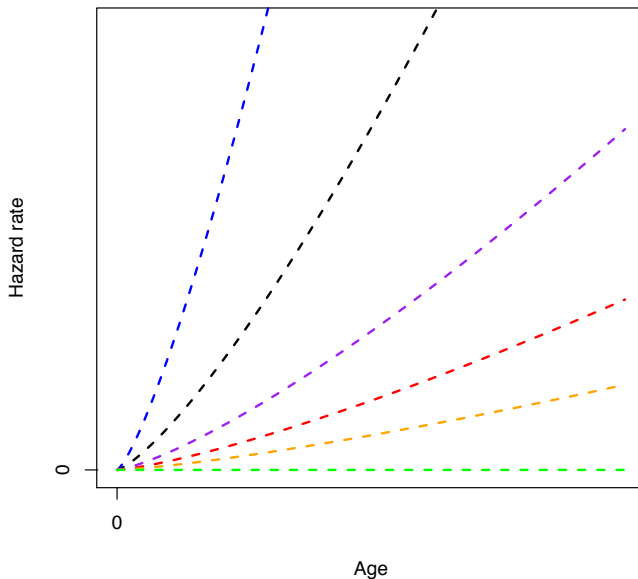
Aims

- To apply a statistical (frailty) model that assumes a heterogeneity in risk of prostate cancer.
 - Enables the estimation of the fraction of the population 'susceptible' to the cancer.
- To model the impact of PSA-testing in such a model.

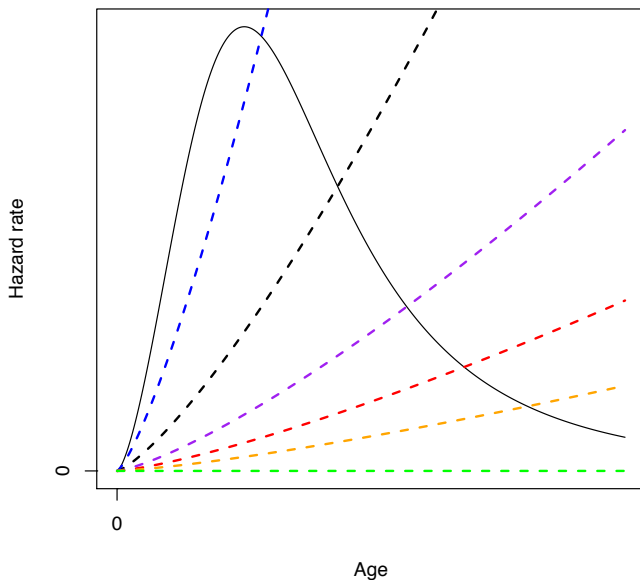
Shared risk pattern: Basic hazard rate



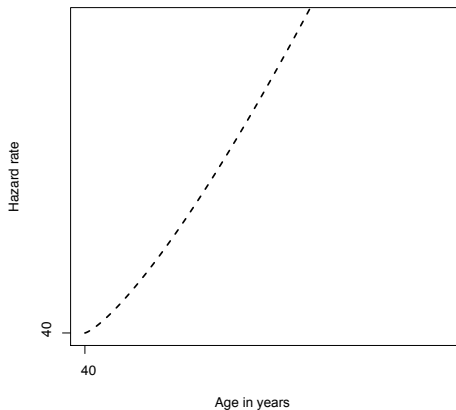
Individual risk pattern/hazard rate



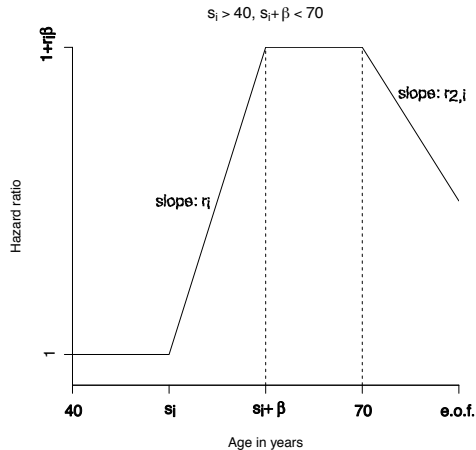
Frailty model: Individual risk pattern and population incidence rate



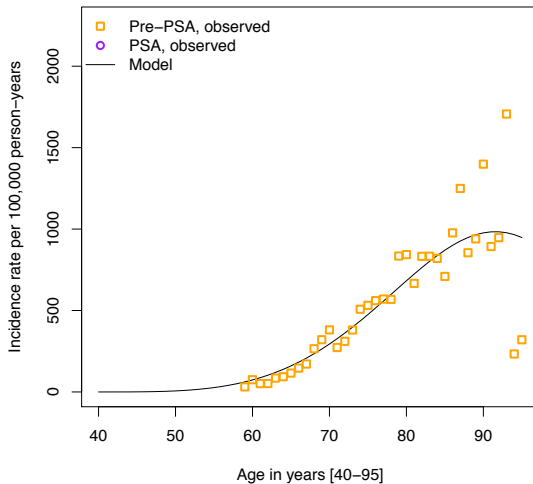
Modified frailty model



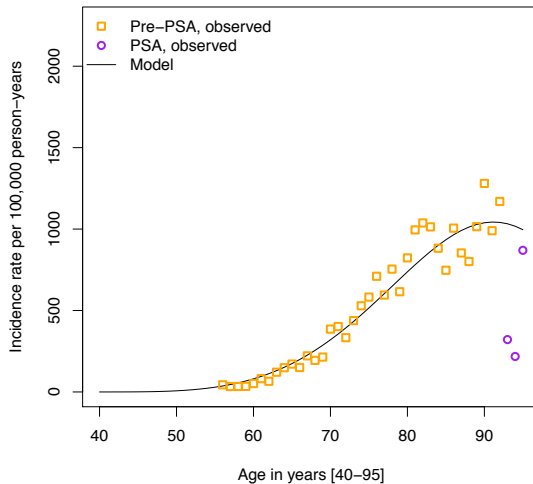
×

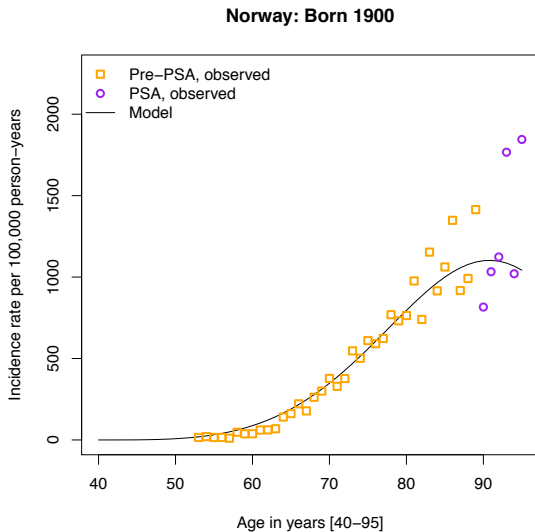


Norway: Born 1894

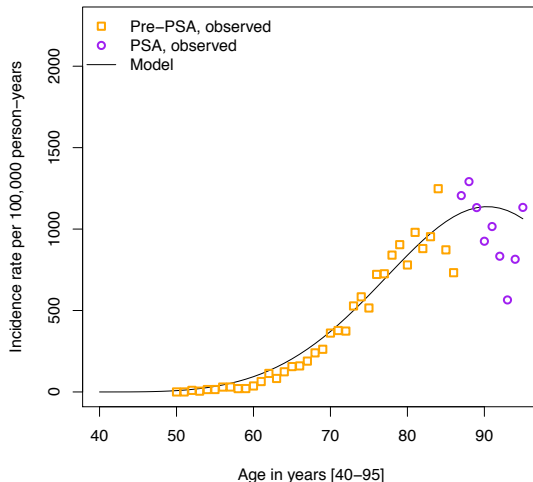


Norway: Born 1897

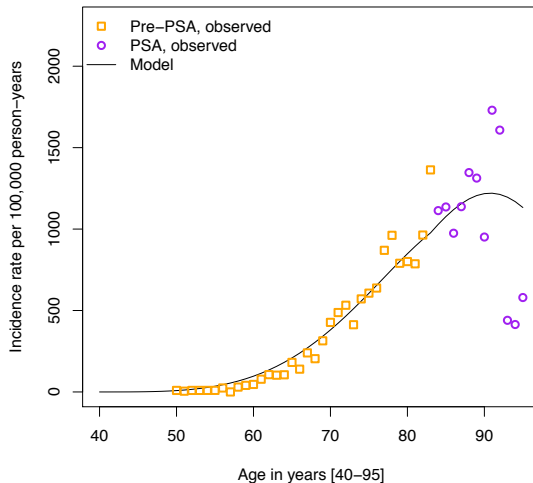




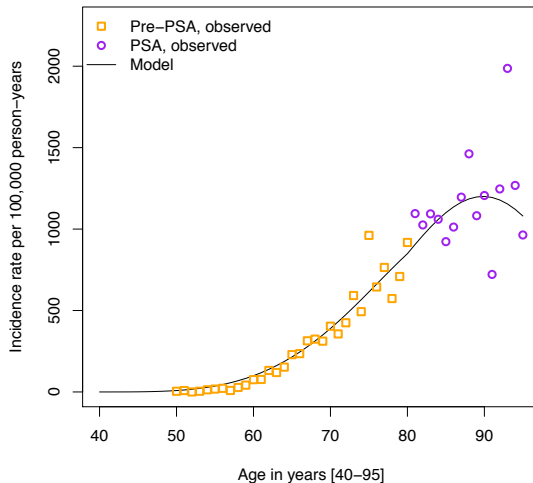
Norway: Born 1903



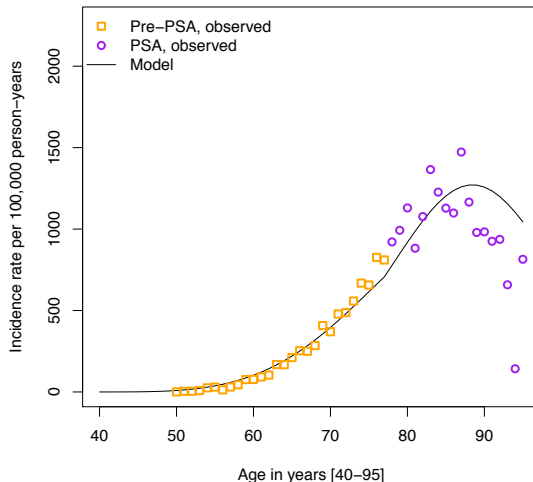
Norway: Born 1906



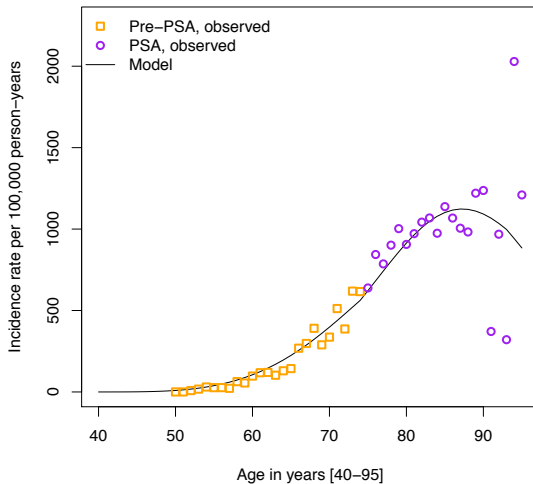
Norway: Born 1909



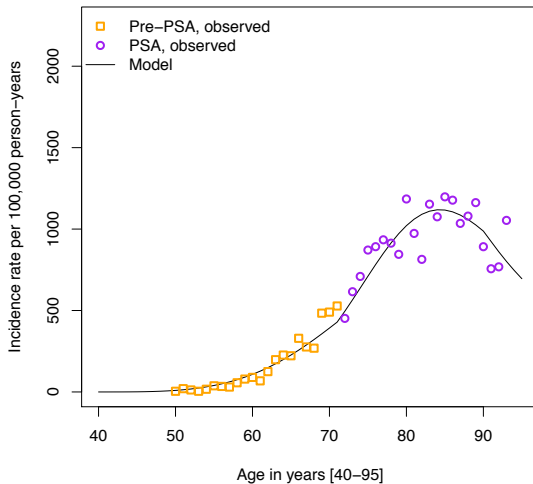
Norway: Born 1912



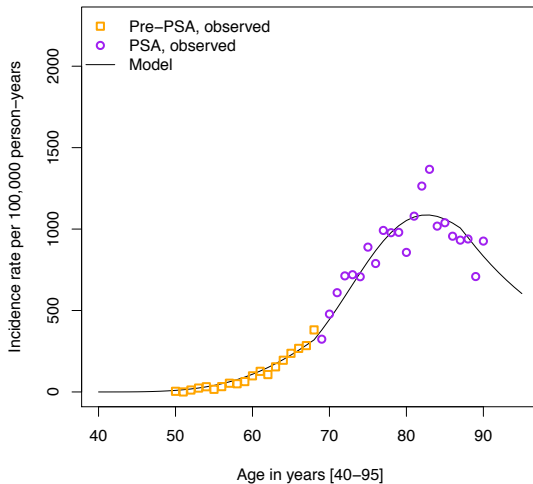
Norway: Born 1915



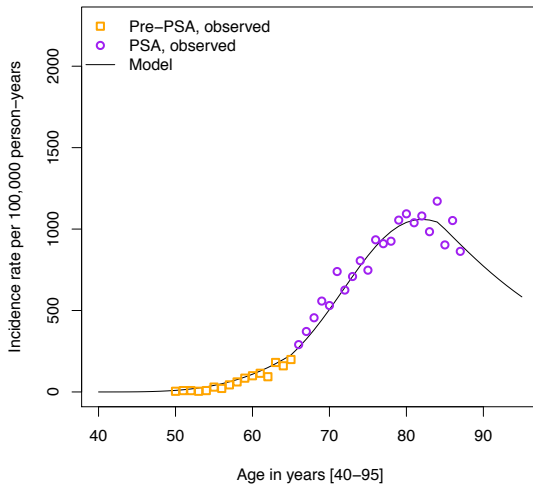
Norway: Born 1918



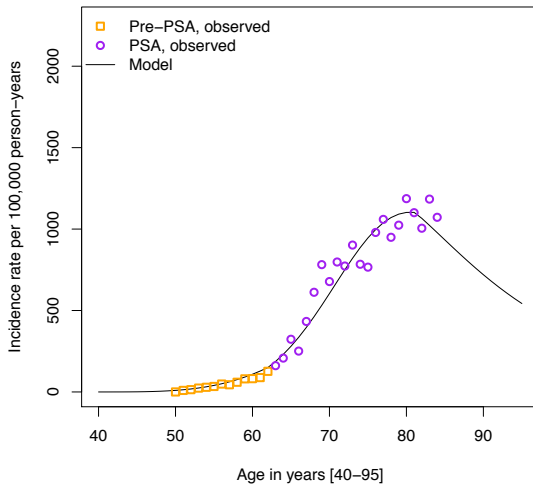
Norway: Born 1921



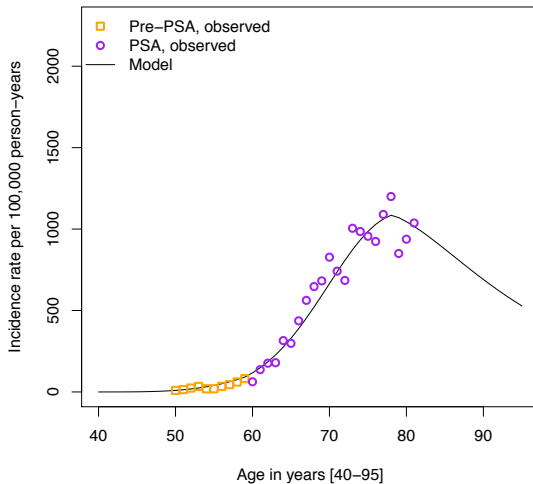
Norway: Born 1924



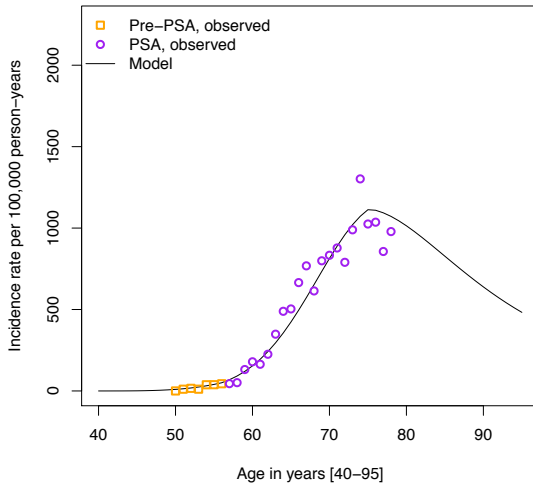
Norway: Born 1927



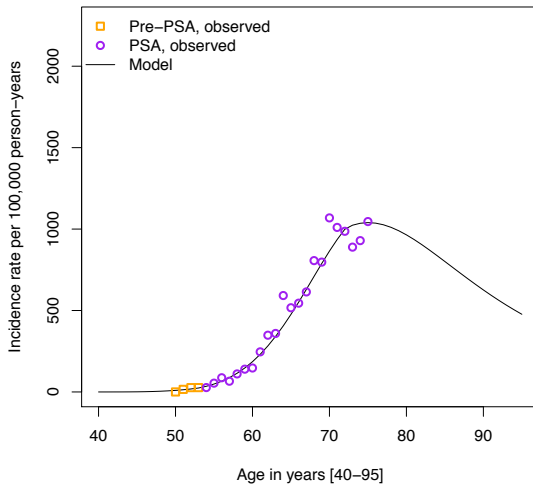
Norway: Born 1930



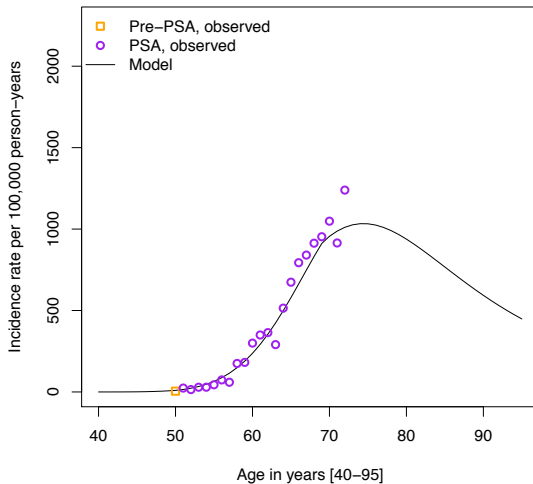
Norway: Born 1933

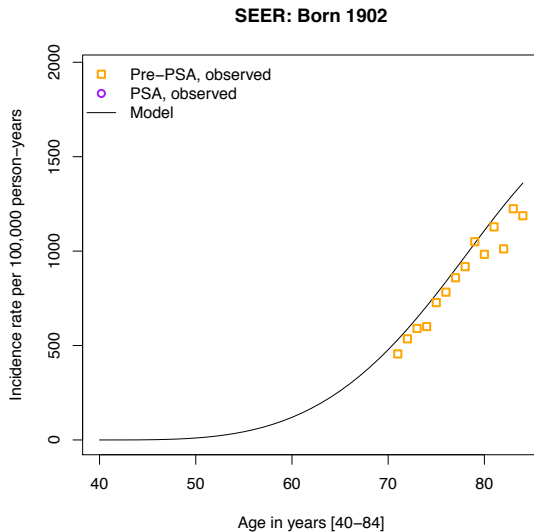


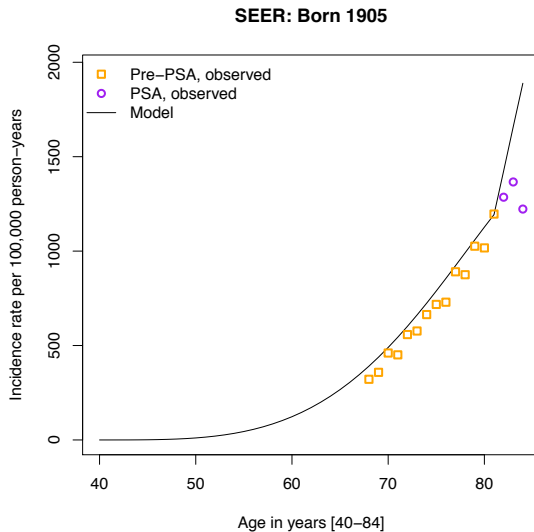
Norway: Born 1936

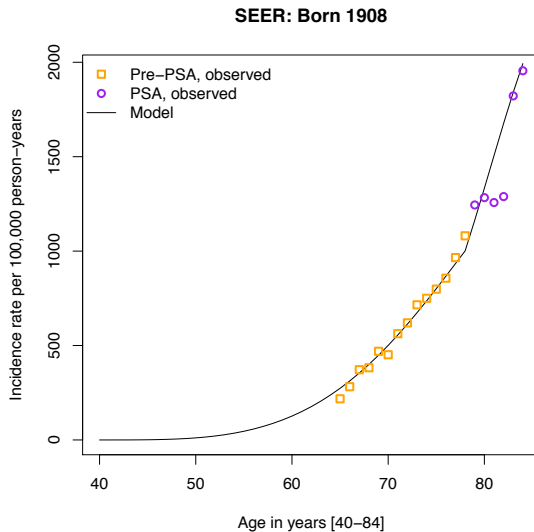


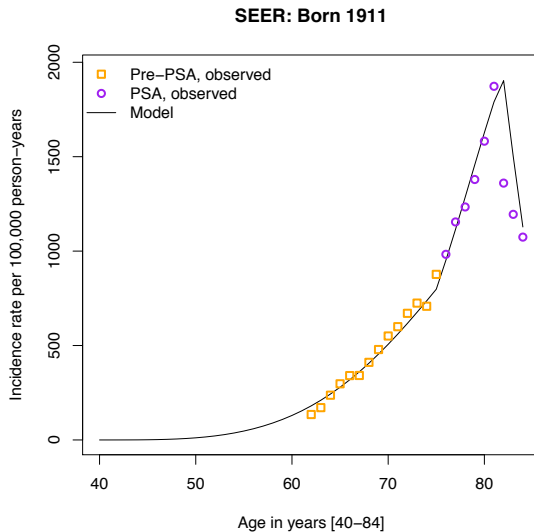
Norway: Born 1939

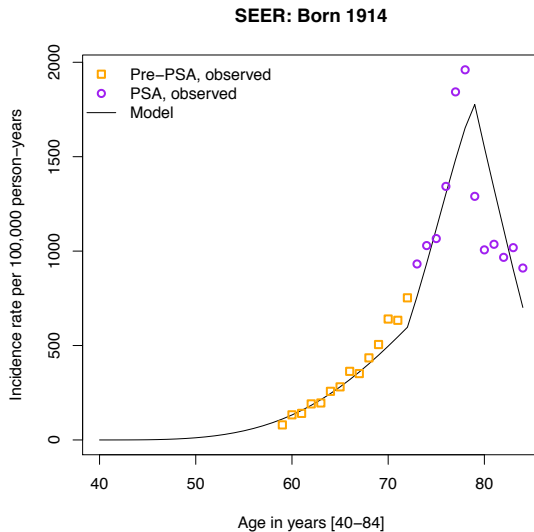


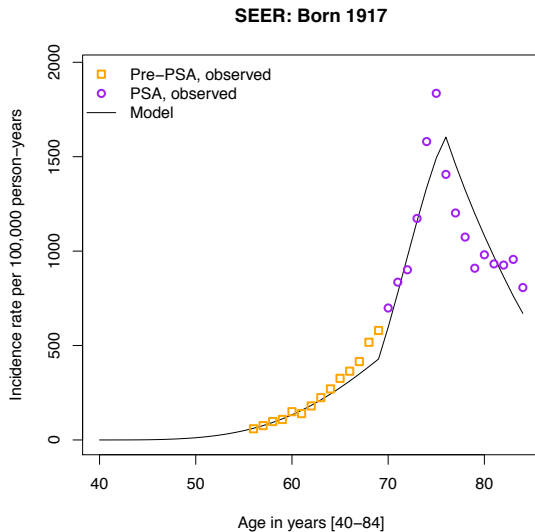


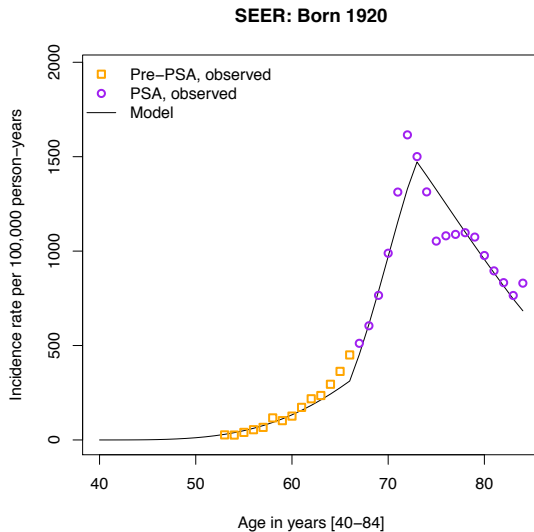


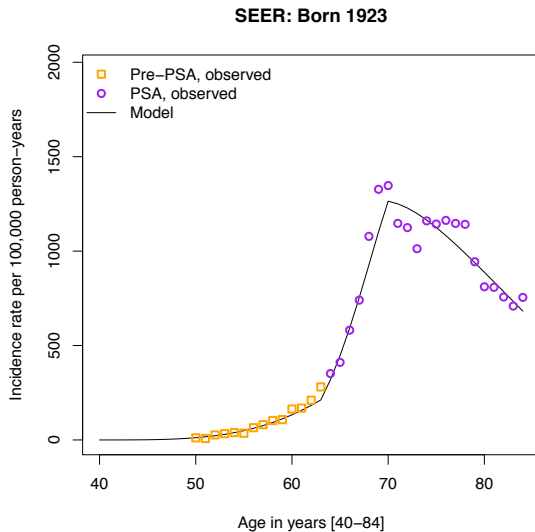


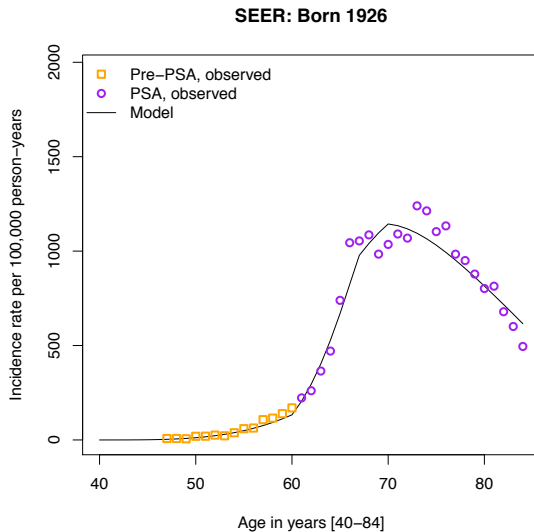


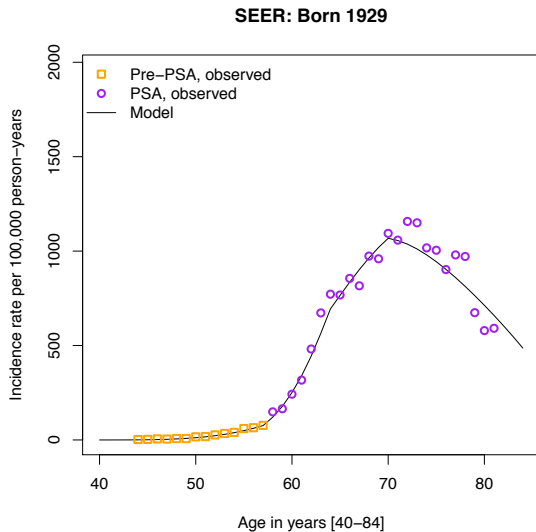


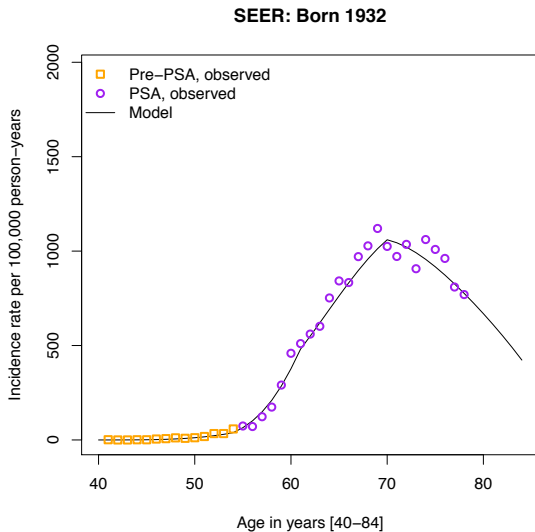


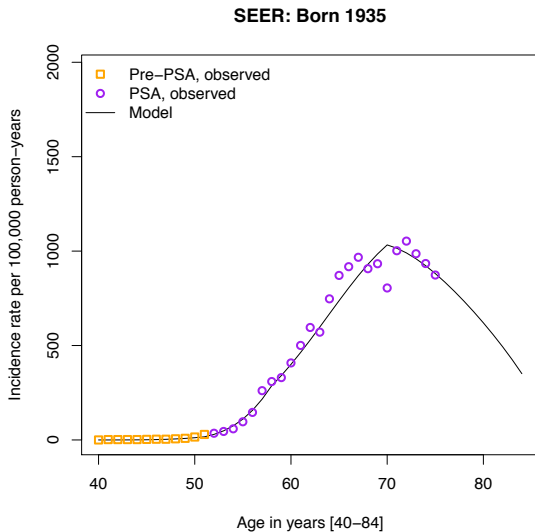


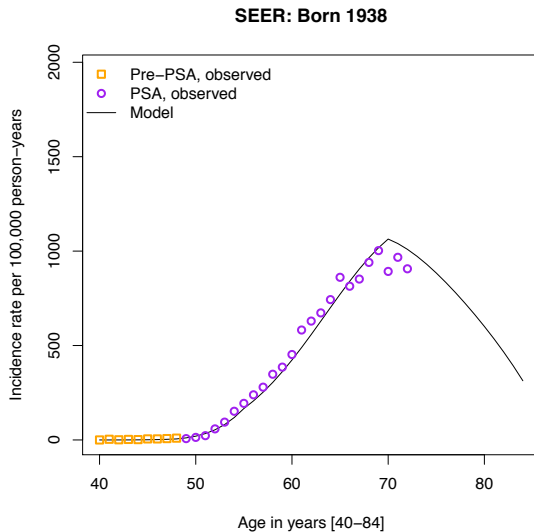












Estimated proportion susceptible

- Norway: 30.4% (95% CI: 28.9%, 32.0%).
- SEER: 39.9% (95% CI: 38.2%, 41.6%).

Heterogeneity in risk

- A plausible explanation for the peak in age-specific incidence.
 - Driven to younger ages by PSA testing.
 - Earlier depletion of a susceptible subgroup.

Otherwise

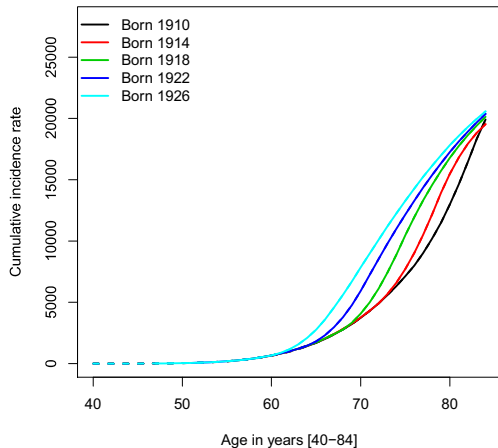
- If all men had similar risk.
 - Would not expect the drop in the age-specific incidence moving to younger ages.
 - Peak explained by factors relating to old age.

Thank you!

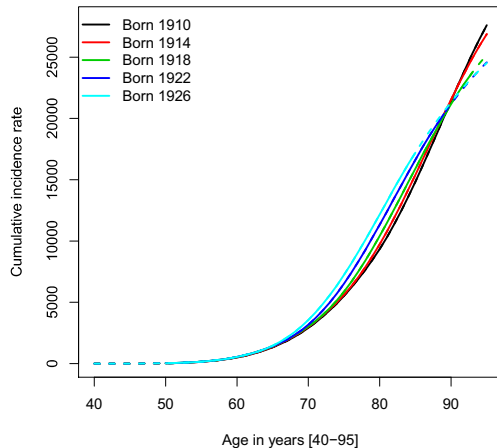
Thank You!

Cumulative incidence rates (model based)

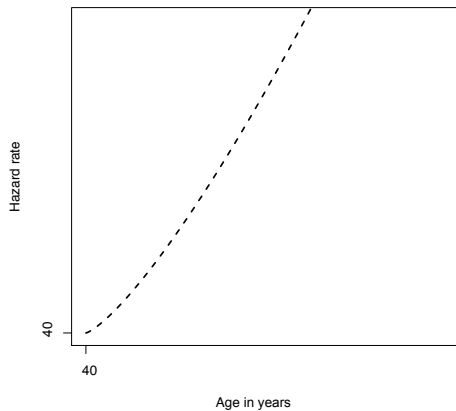
SEER: Model



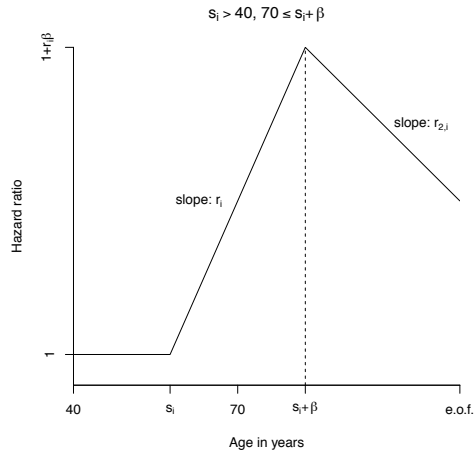
Norway: Model



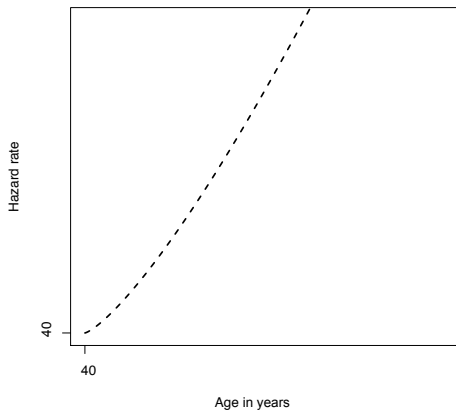
Modified frailty model



×



Modified frailty model



×

