Socio-Economic Differences in Mortality by Cause of Death

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Joint work with C. Redondo, D. Blake, K. Dowd, M. Kallestrup-Lamb, C. Rosenskjold, A.S. Macdonald

ARC Workshop, April 2018

Outline

- Danish data by:
  - affluence
  - education
- US by education group
- Comparison: Denmark vs US
- English data: early stages

Purpose of looking at cause of death data

- What are the key drivers of all-cause mortality?
- How are the key drivers changing over time?
- Which causes of death have high levels of inequality?
- Can we point to specific causes of death as responsible for *growing inequality*?
- Beware of
  - changes in ICD classification of deaths (1998-99)
  - drift in how deaths are classified
  - changing education levels (grade inflation)
- Insight into mortality underpinning life insurance and pensions

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Danish Data: Cairns et al. (2017)

- Statistics Denmark National Register Database

- Key data (amongst others) for each individual:
  - Date of birth ($\Rightarrow$ age)
  - Date of death
  - Wealth
  - Income
  - Affluence=Wealth+15$\times$Income
  - Education
  - Cause of Death

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Education and Affluence Levels

Education (Denmark)	
Low education	Primary and lower secondary education
Medium education	Upper secondary education
High education	Tertiary education

(No education data for cohorts born before 1922.)

Affluence	
Level 1	Low affluence *decile*
⋮	⋮
Level 10	High affluence *decile*

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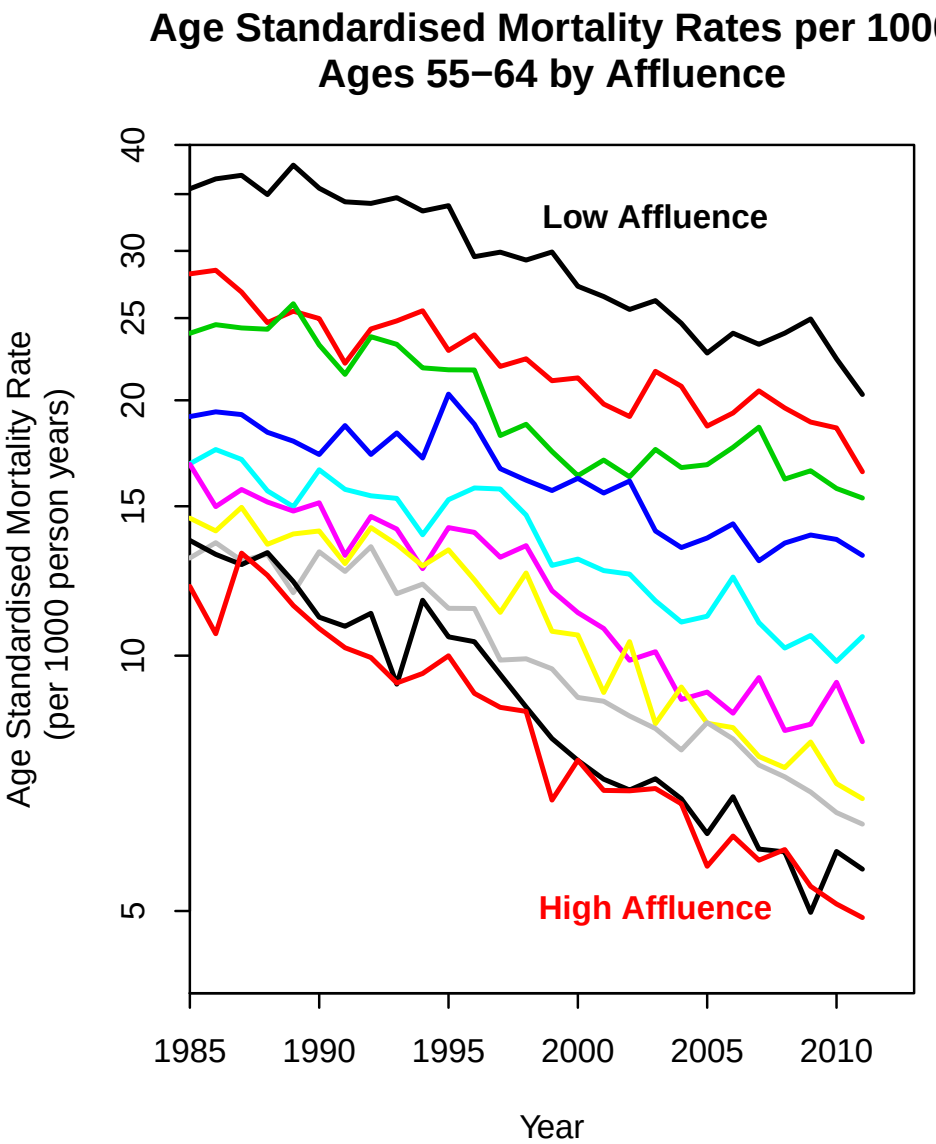
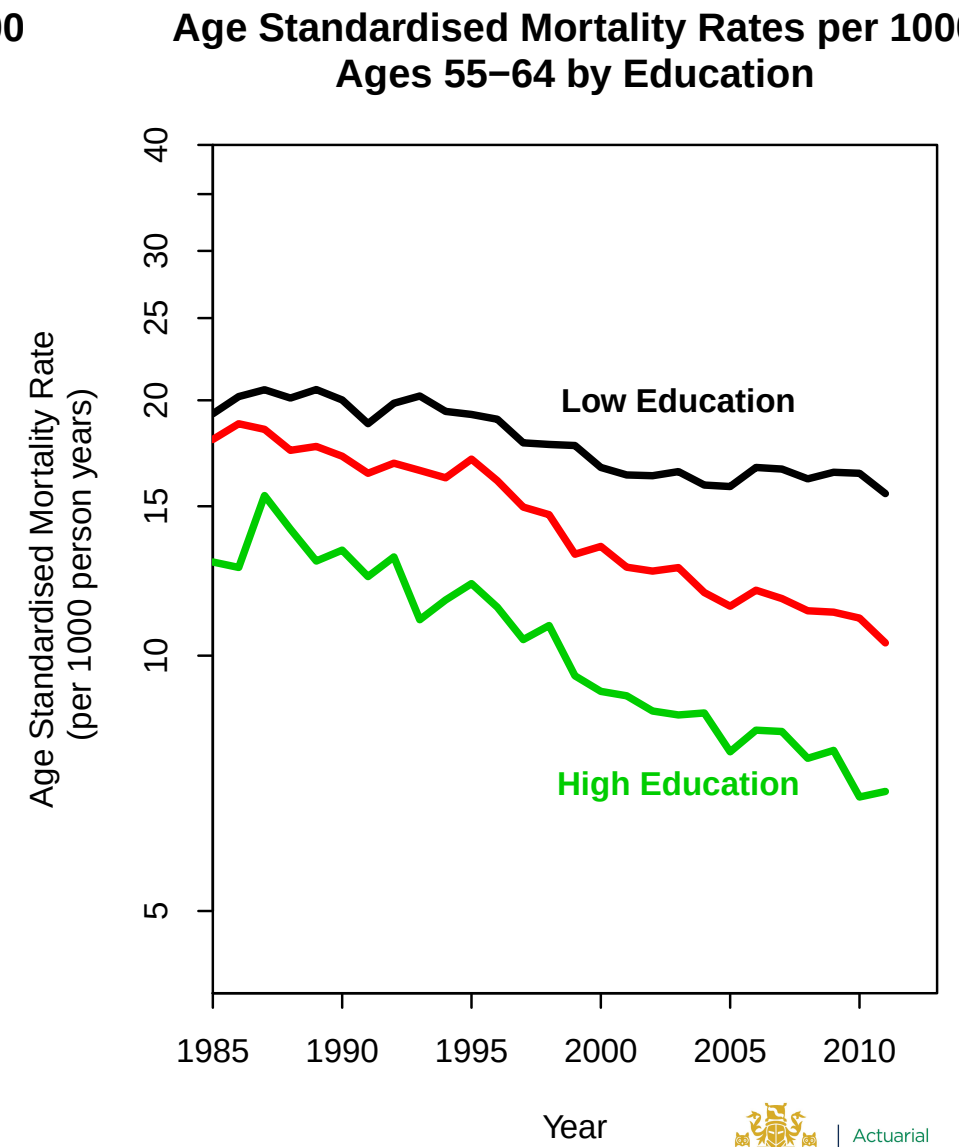
Age Standardised Death Rates, Age Group 55-64





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Cause of Death Data – Health Inequalities

- Deaths subdivided into 29 CoD groups
- Age groups 31-35, 36-40, ..., 91-95
- Year groups 1985-89, 1990-94, 1995-99, 2000-2004, 2005-2009
- Compare affluence groups
- Compare education groups

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Cause of Death Data – Health Inequalities

1	Infectious diseases incl. tuberculosis	2	Cancer: mouth, gullet, stomach
3	Cancer: gut, rectum	4	Cancer: lung, larynx, ..
5	Cancer: breast	6	Cancer: uterus, cervix
7	Cancer: prostate, testicular	8	Cancer: bones, skin
9	Cancer: lymphatic, blood-forming tissue	10	Benign tumours
11	Diseases: blood	12	Diabetes
13	Mental illness	14	Meningitis + nervous system (Alzh.)
15	Blood pressure + rheumatic fever	16	Ischaemic heart diseases
17	Other heart diseases	18	Diseases: cerebrovascular
19	Diseases: circulatory	20	Diseases: lungs, breathing
21	Diseases: digestive	22	Diseases: urine, kidney,...
23	Diseases: skin, bone, tissue	24	Senility without mental illness
25	Road/other accidents	26	Other causes
27	Alcohol $\rightarrow$ liver disease	28	Suicide
29	Accidental Poisonings		

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Denmark – Affluence – Top 10 CoD

Ages 71-75; Years 2005-2009

Rank	Least Affluent	Most Affluent
1	Ischaemic heart	Skin/bone cancer
2	Respiratory	Ischaemic heart
3	Lung cancer etc.	Prostate cancer
4	Skin/bone cancer	Respiratory
5	Other	Lung cancer etc.
6	Cerebrovascular	Cerebrovascular
7	Other heart	Other
8	Diabetes	Gut cancer
9	Gut cancer	Other heart
10	Prostate cancer	Alzheimers etc.

Prostate: almost no inequality

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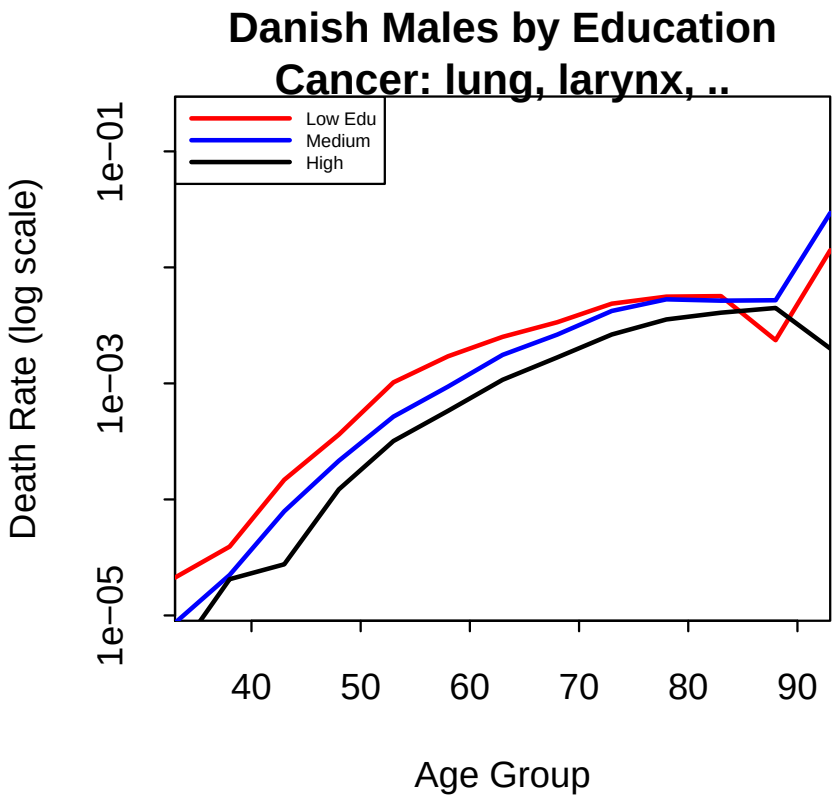
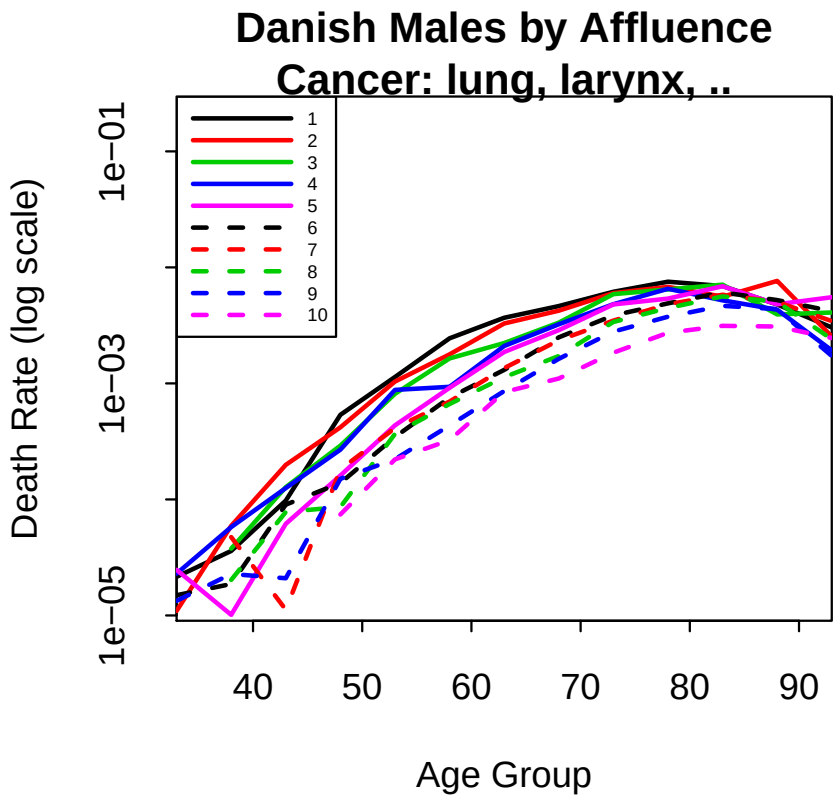
Denmark: Cause of Death Data 2005-2009





High levels of mortality inequality

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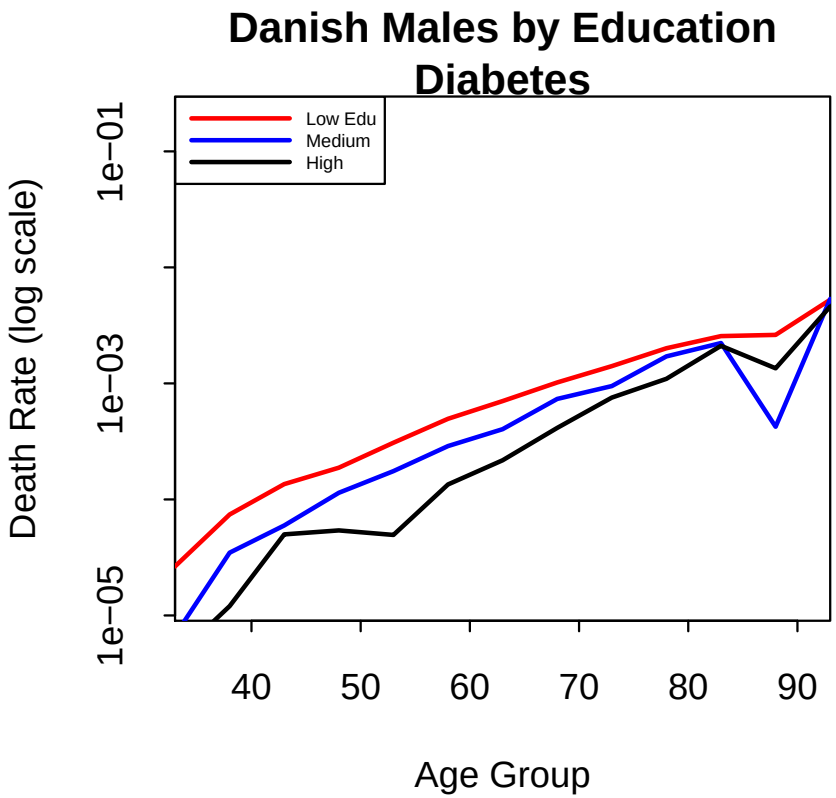
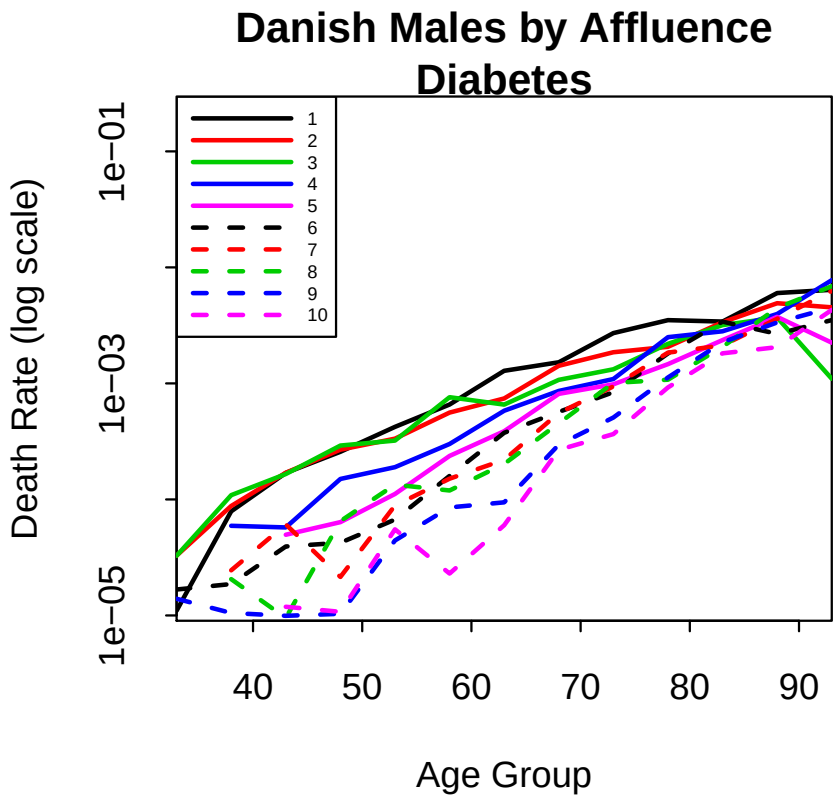
Denmark: Cause of Death Data 2005-2009





Affluence $\Rightarrow$ much wider

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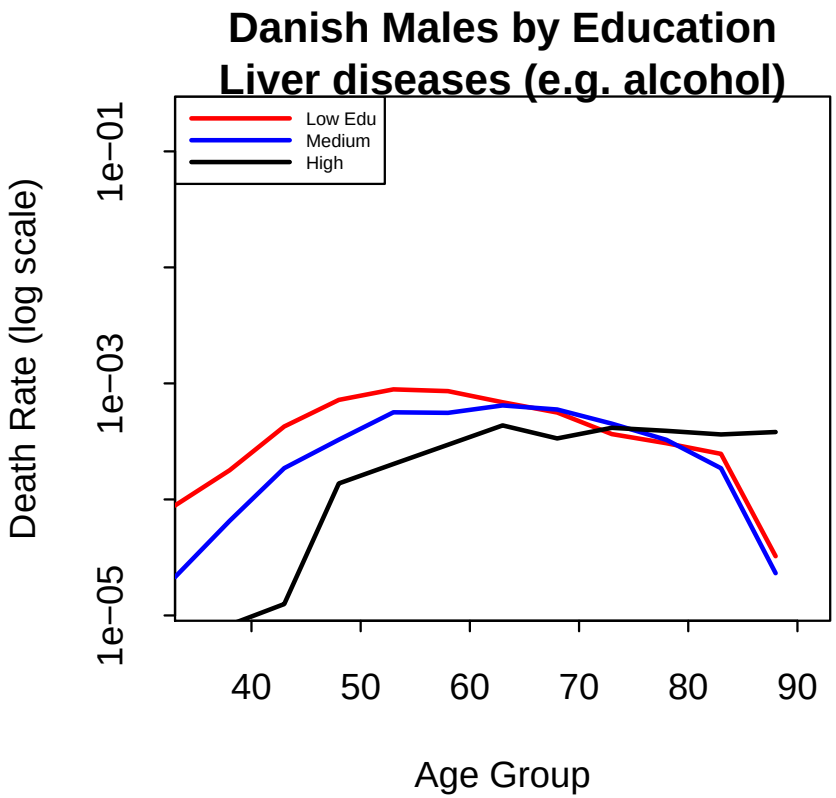
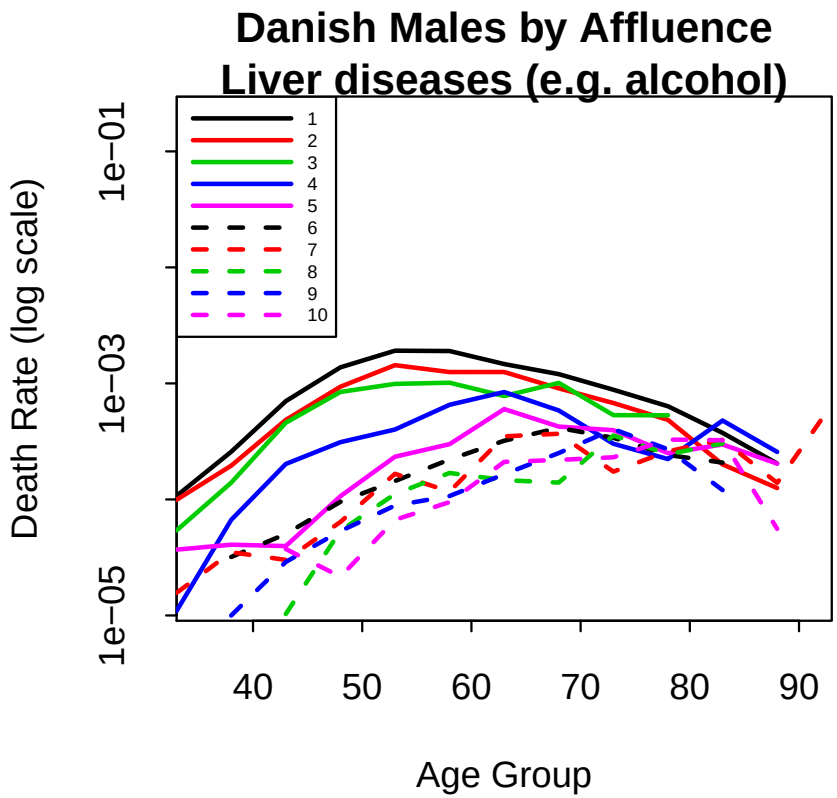
Denmark: Cause of Death Data 2005-2009





Very large differences in middle ages.

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Denmark: Cause of Death Data 2005-2009

- Many causes of death have known risk factors or drivers

  e.g. smoking, diet, healthy lifestyle etc.

  $\Rightarrow$ clear socio-economic differences
- Biggest differences at ages < 60
- Affluence $\Rightarrow$ stronger predictor than education (sometimes very much stronger)
- Other diseases do not have strong differences:

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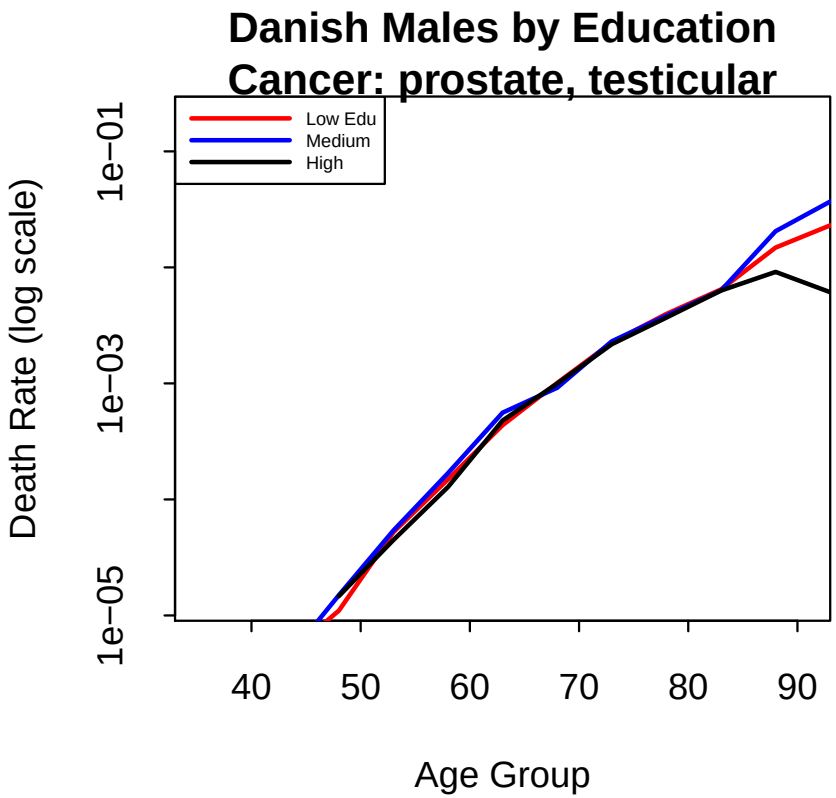
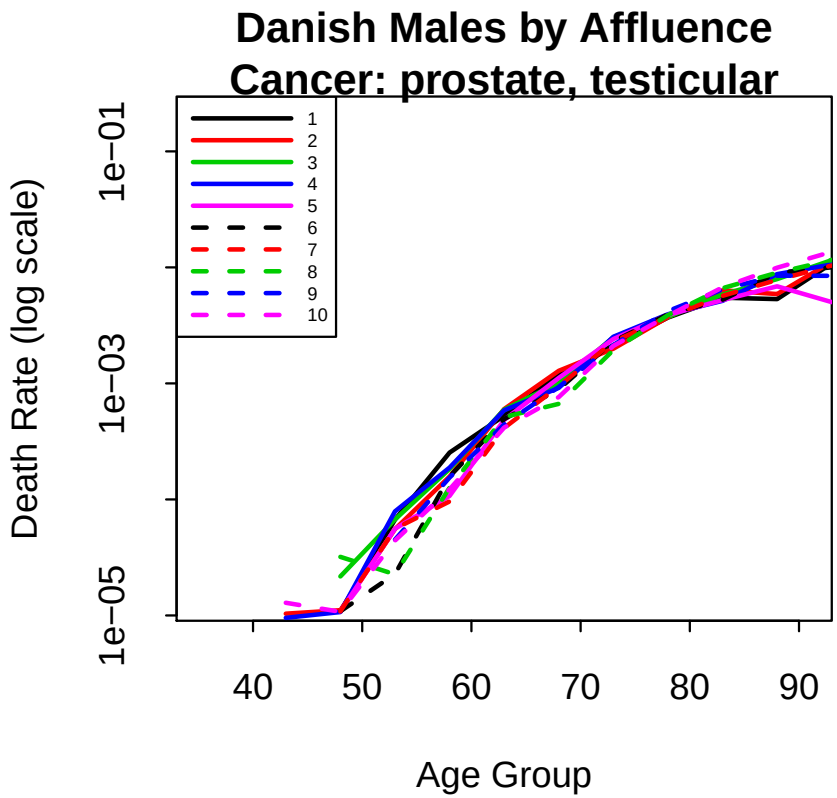
Denmark: Cause of Death Data 2005-2009





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Denmark: Cause of Death Data – Health Inequalities

- Some causes of death have no obvious link to lifestyle/affluence/education
  e.g. Prostate Cancer
  CancerUK: *Prostate cancer is not clearly linked to any preventable risk factors.*
  Possible unavoidable risk factors: genetic; race
- But Affluence $\Rightarrow$ inequalities
- Possible explanations (a very non-expert view)
  - *onset* is not dependent on lifestyle/affluence/education
  - BUT less affluent/educated $\Rightarrow$
    ??? later diagnosis
    ??? engage less well with treatment process
    ??? unhelpful environment
    ??? genetic/racial

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US Education Data

Data sources:

- Human Mortality Database (aggregate exposures)
- CDC individual deaths records
- Current Population Survey (CPS)
  $\Rightarrow$ population education levels

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US Education Data

- Males and Females (2)
- Single ages 40-89 (50)
- Single years 1989-2015 (27)
- Causes of death (30) (Danish 29 + HIV/AIDS)
- Low ($\leq$ high school) & high ($\geq$ some college) education level (2)

Note 1: further separation of high into (a) $<$ bachelors degree and (b) $\geq$ bachelors degree was found to be unreliable.
Note 2: HMD's Human Cause of Death Database $\Rightarrow$
All ages (5's), 1999-2013 BUT no education subdivision

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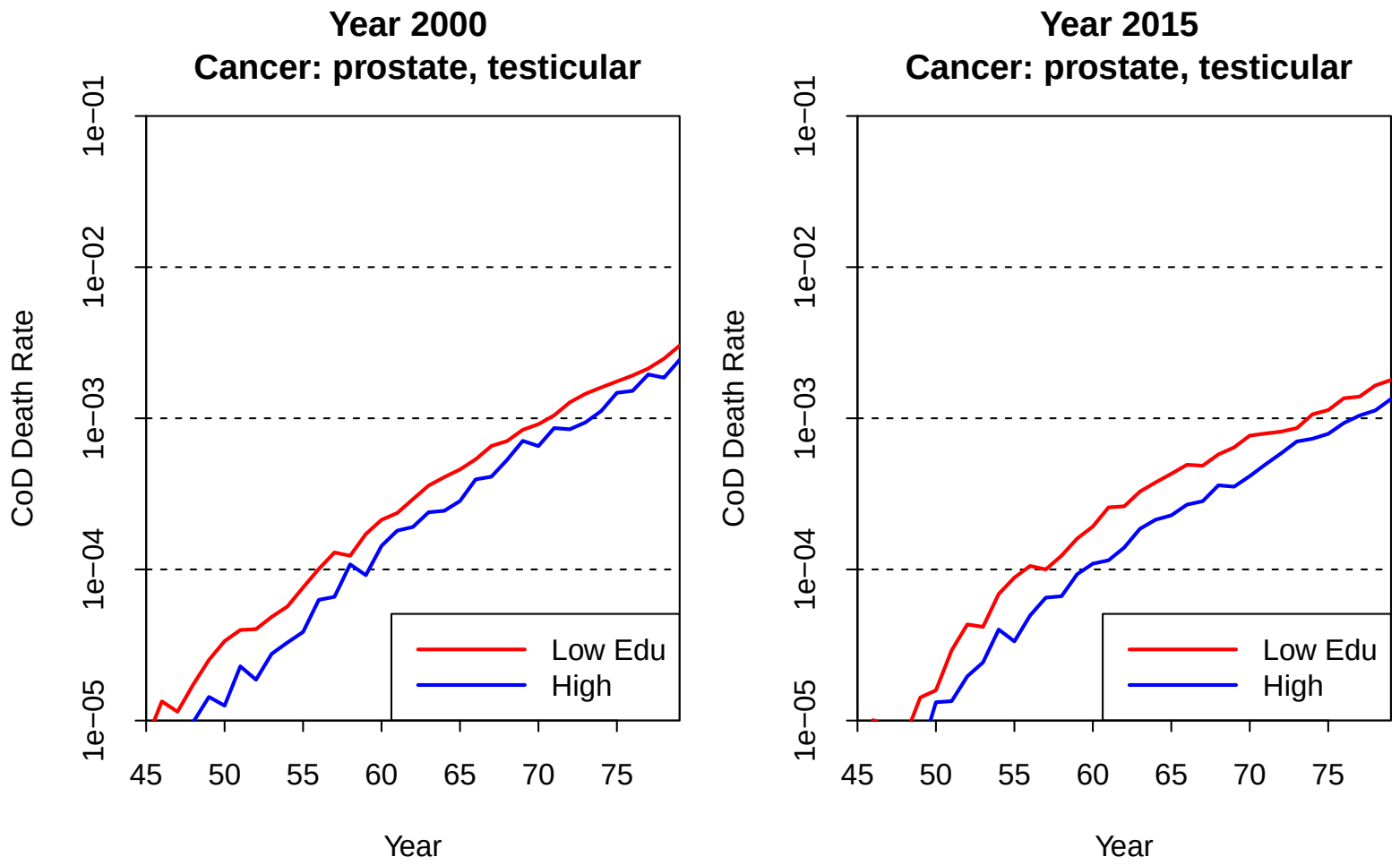
US Education Data: 2000 and 2015



Note 1: some improvements above age 60

Note 2: widening gap

Recall: Denmark $\Rightarrow$ very narrow gap

US wider gap: health insurance inequalities; genetic/racial

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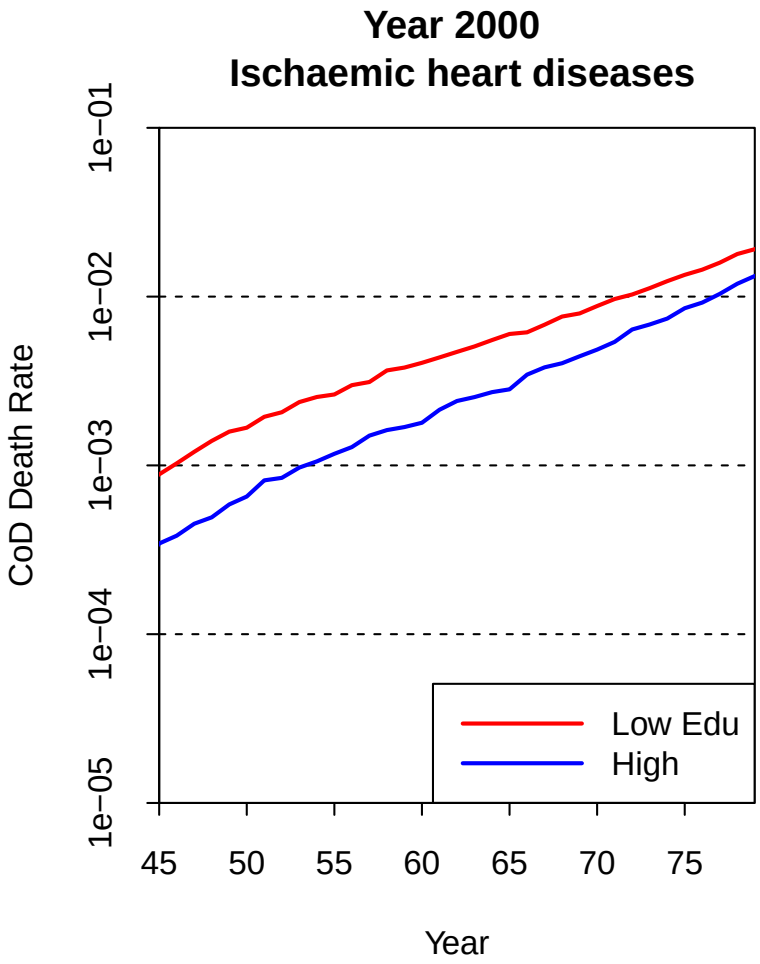
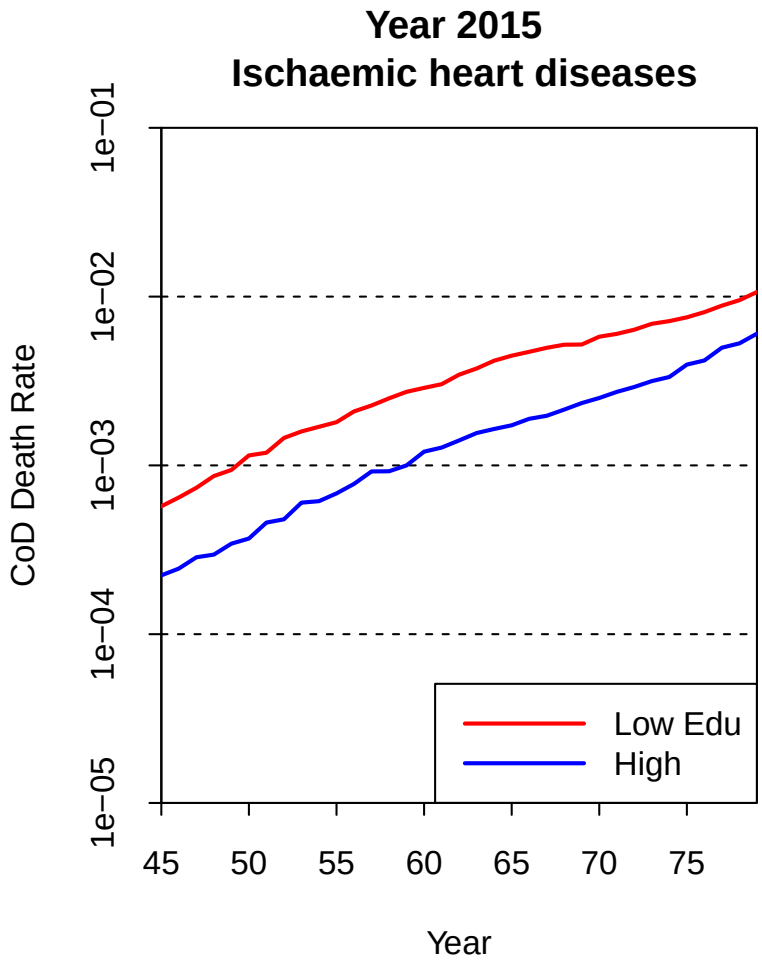
US Education Data: Males Age 55 – Top Causes





Improvements
Widening gap

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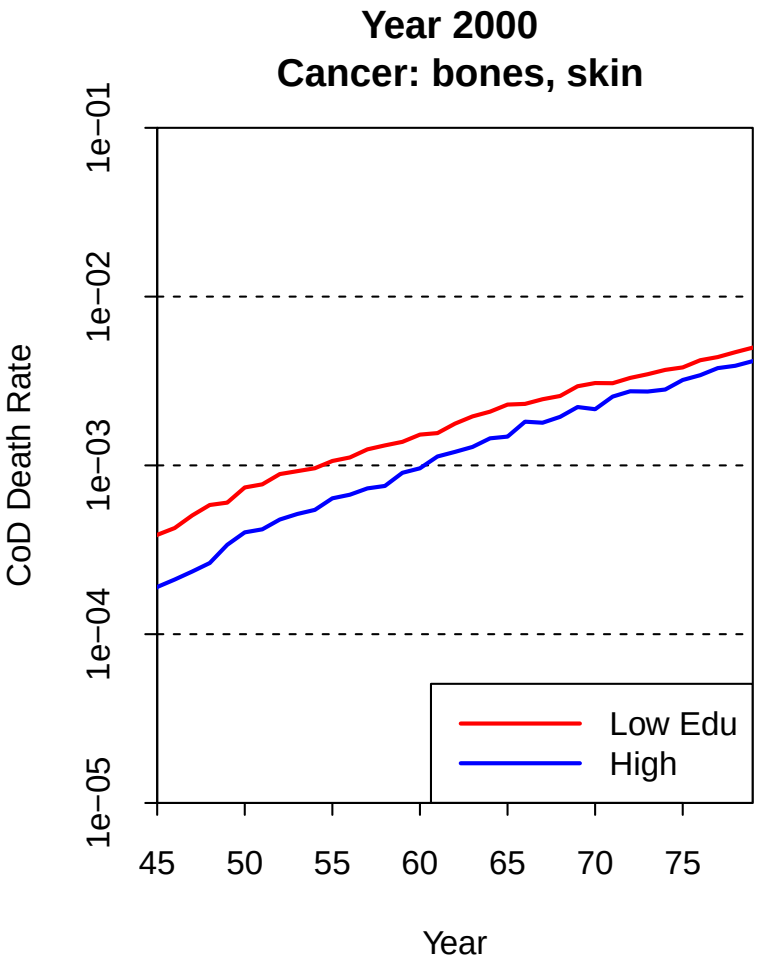
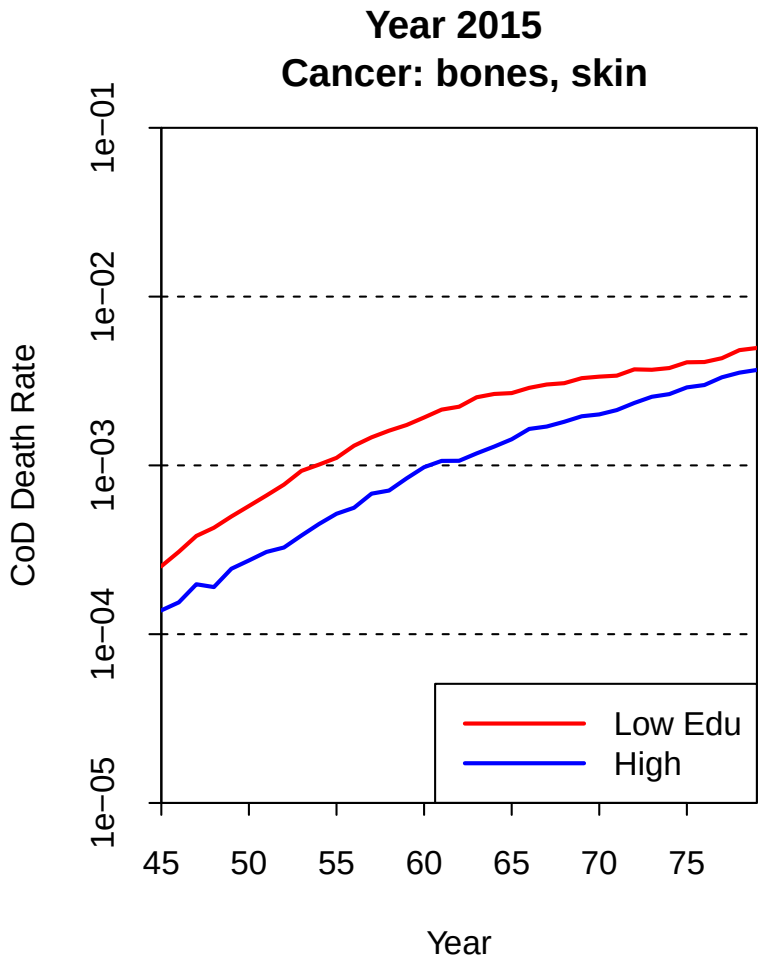
US Education Data





Widening gap

Some worsening, some improving

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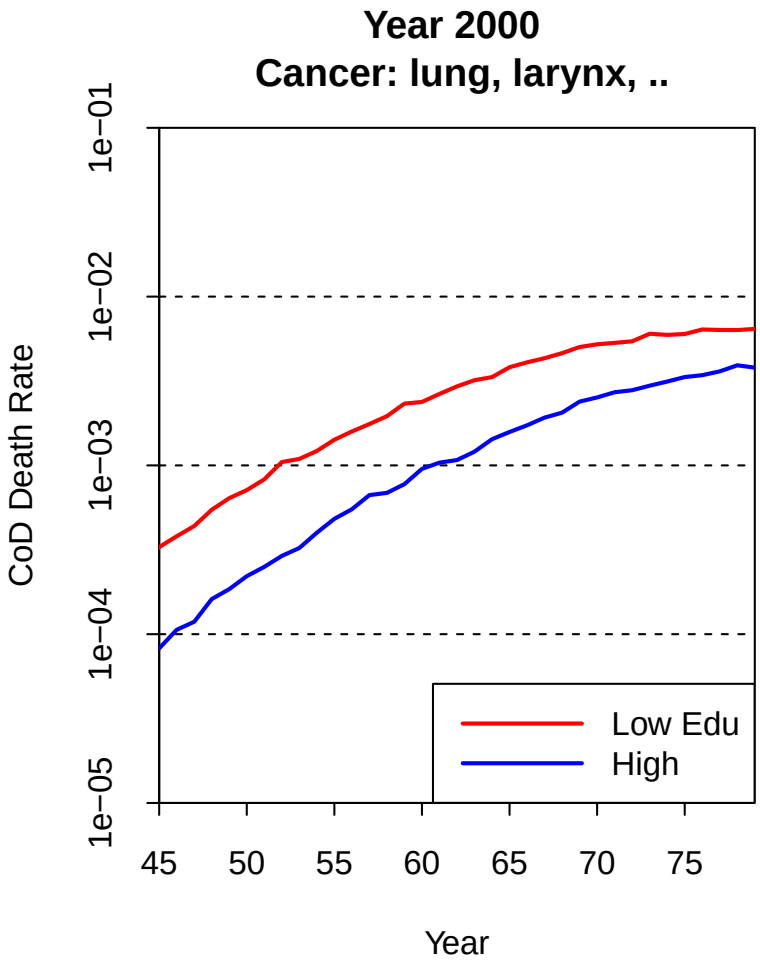
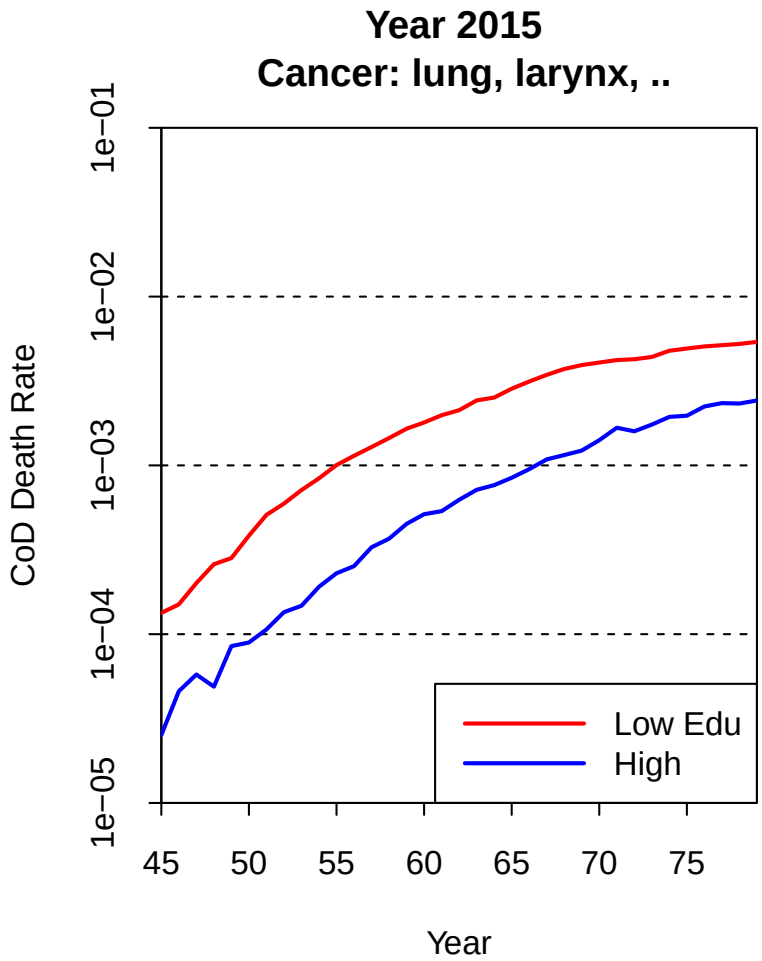
US Education Data





Widening gap, some improvements

Improvements possibly linked to smoking prevalence

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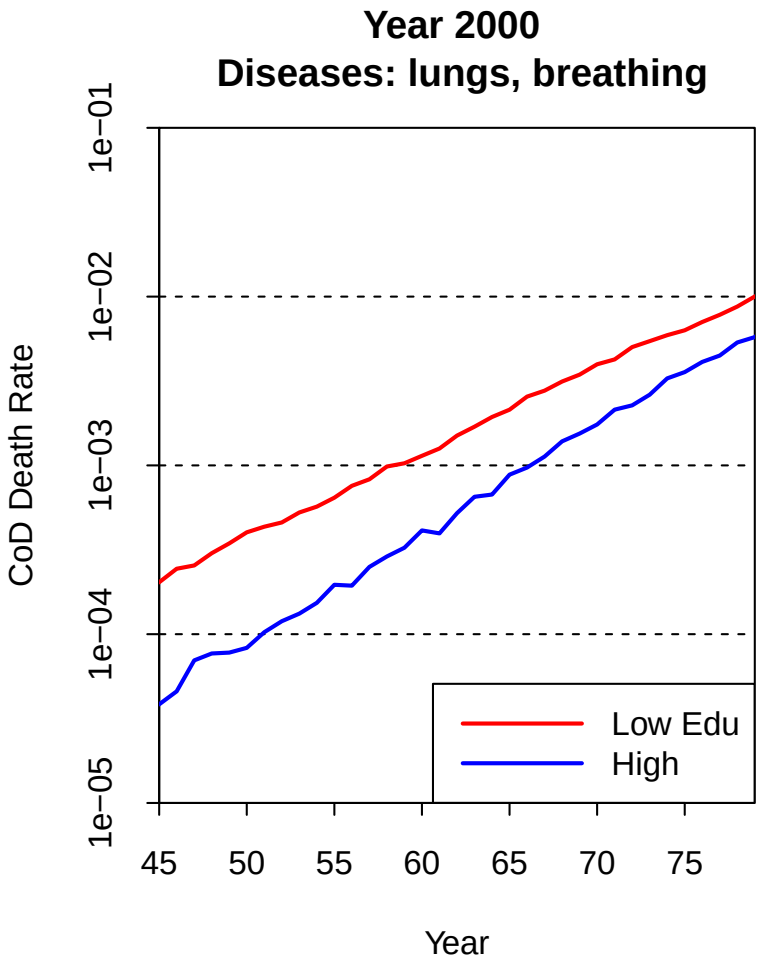
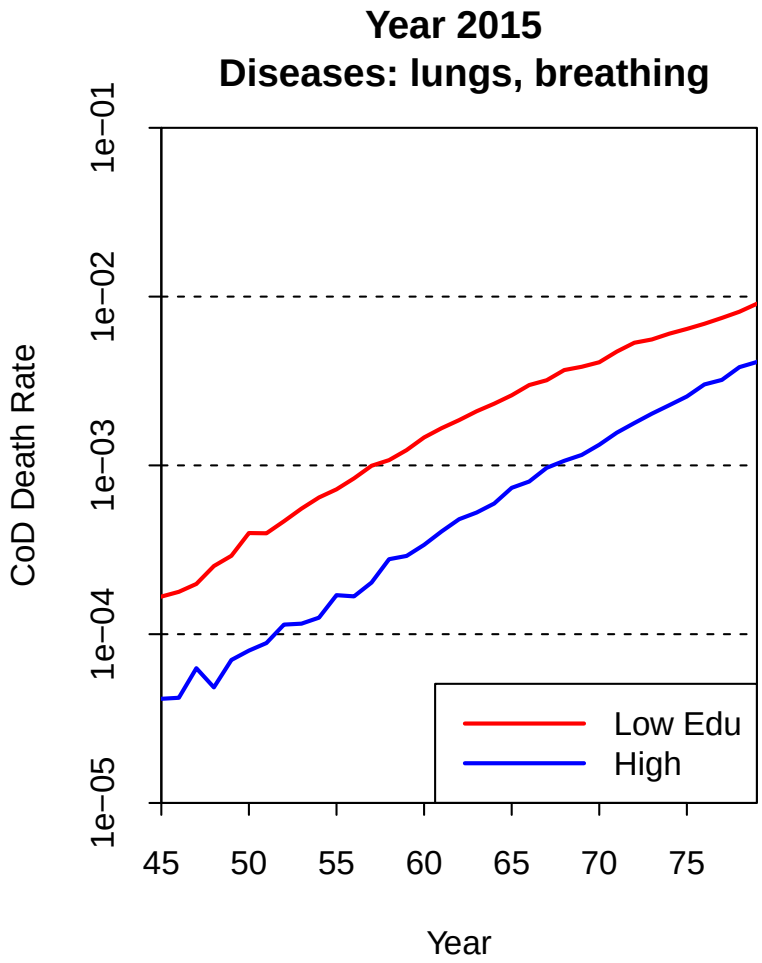
US Education Data





Widening gap

Modest improvements

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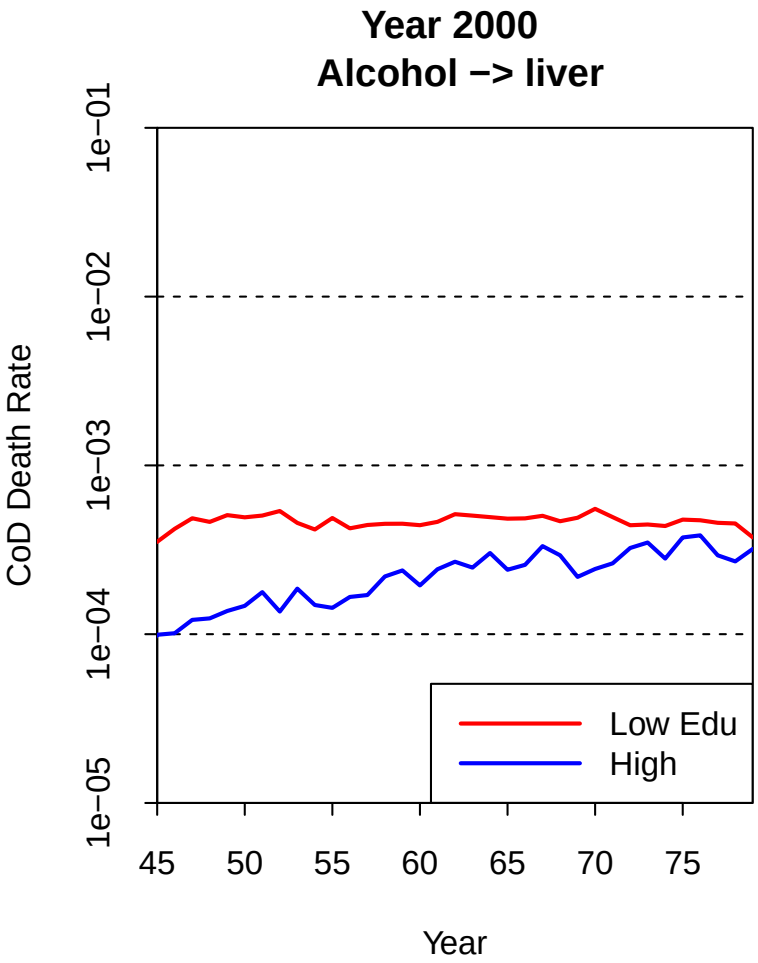
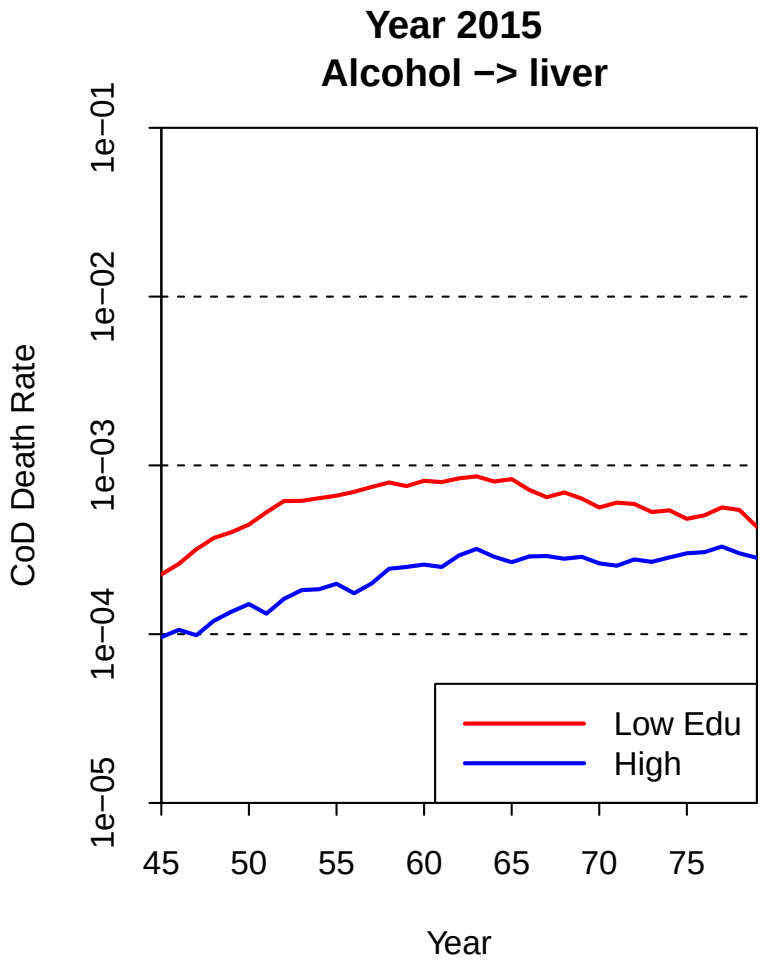
US Education Data





Case & Deaton (2015) $\Rightarrow$ Deaths of Despair $\nearrow$

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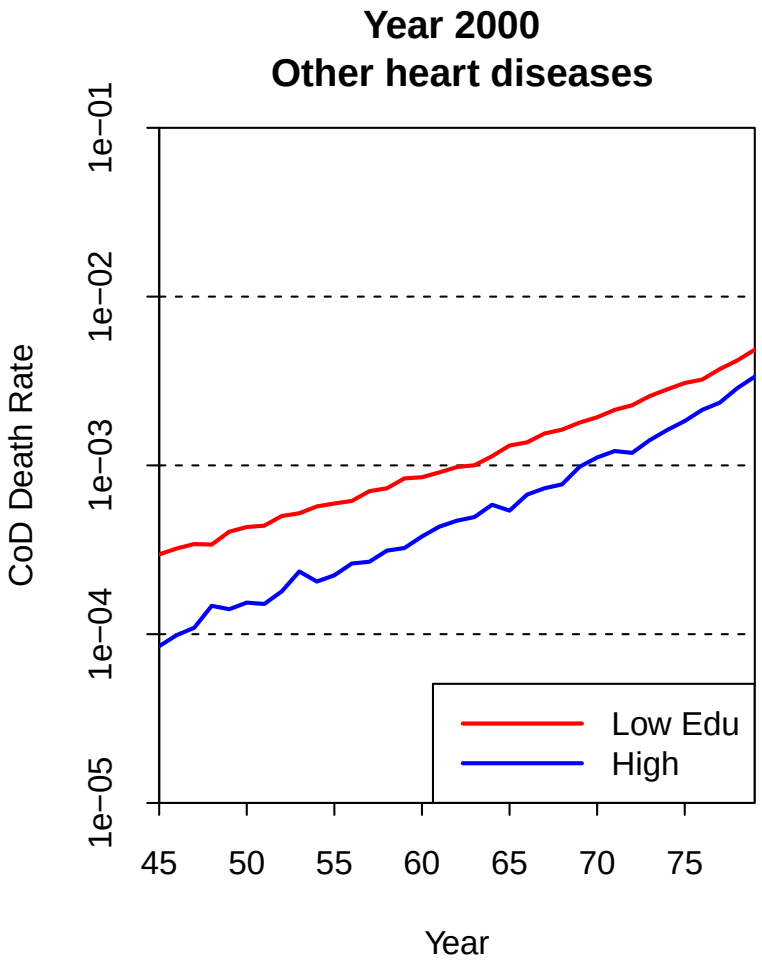
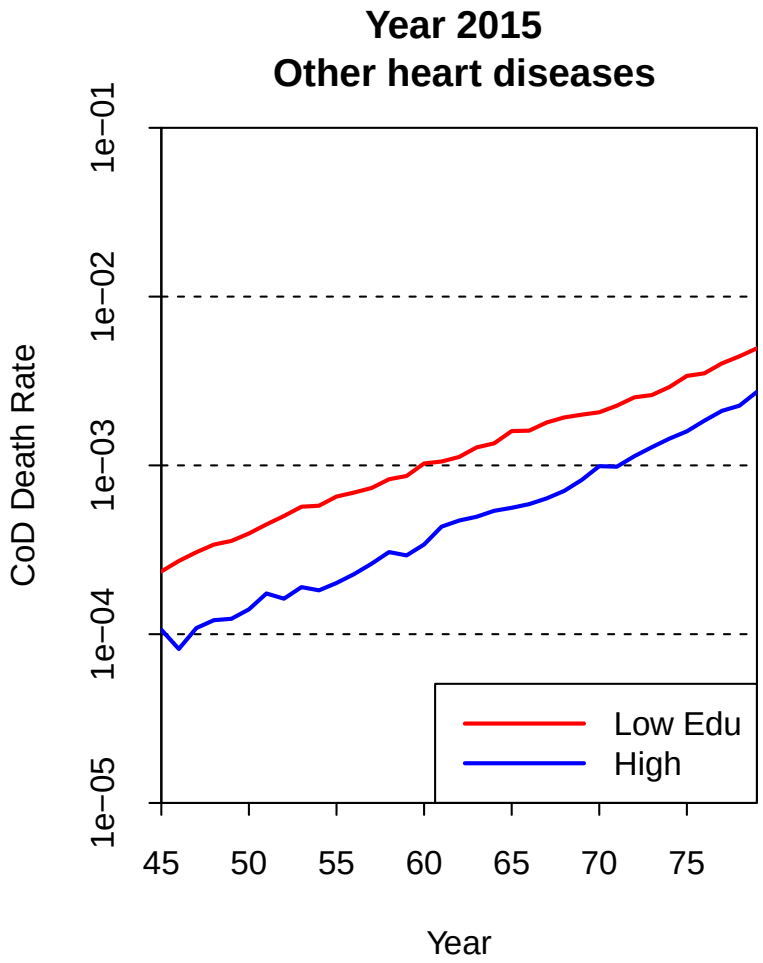
US Education Data





Widening gap

Modest improvements for high education

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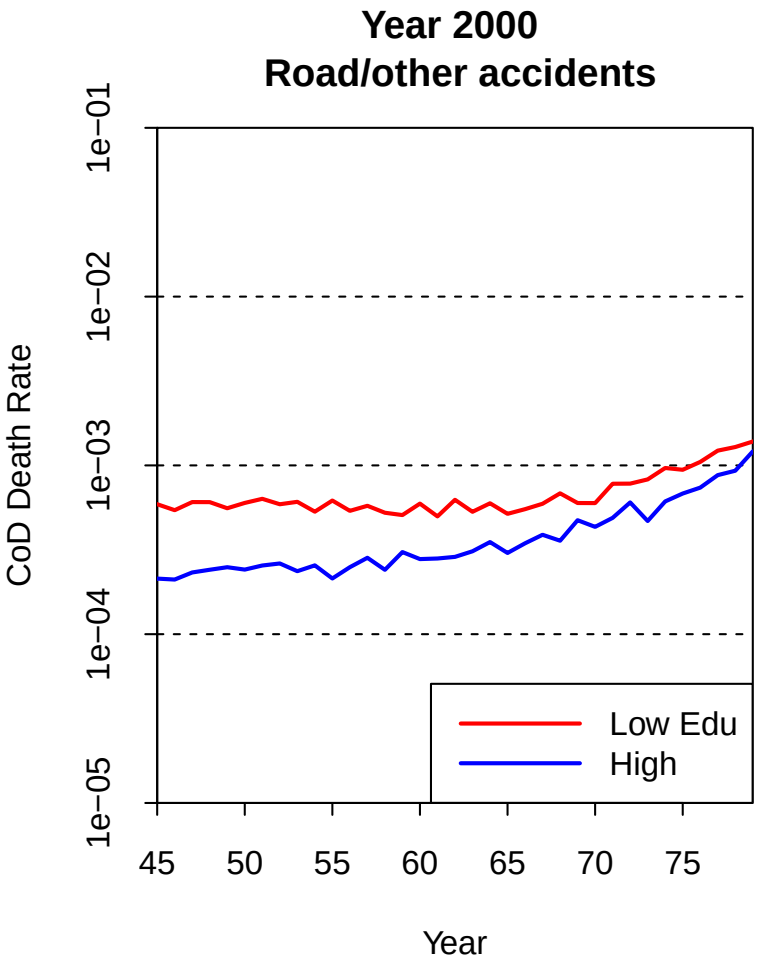
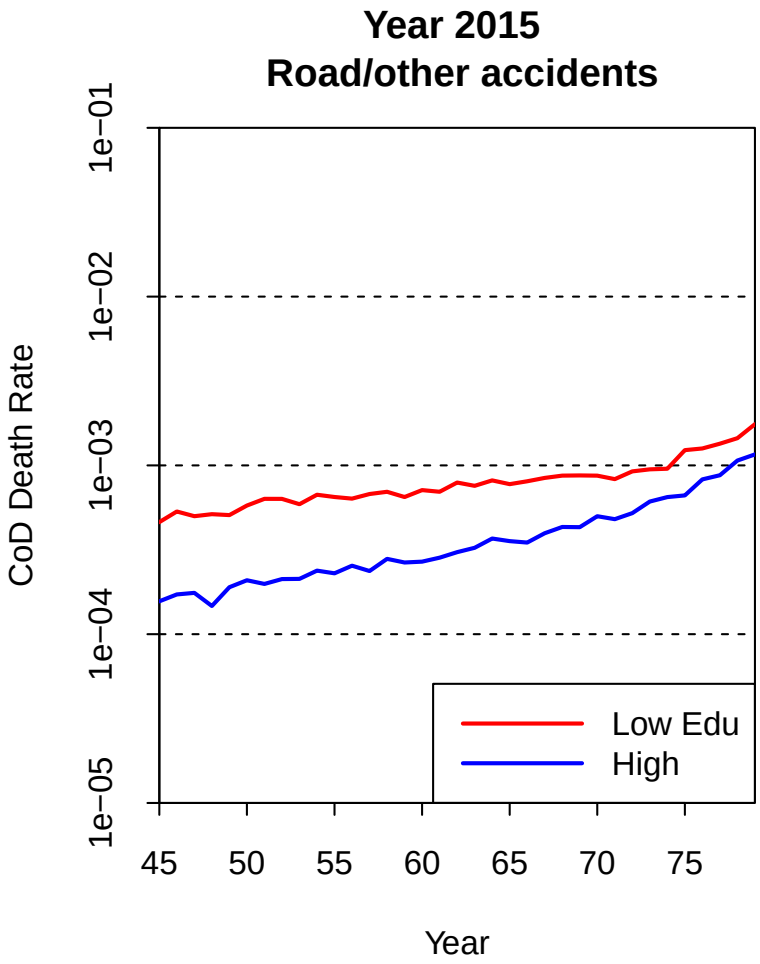
US Education Data





Mixed picture

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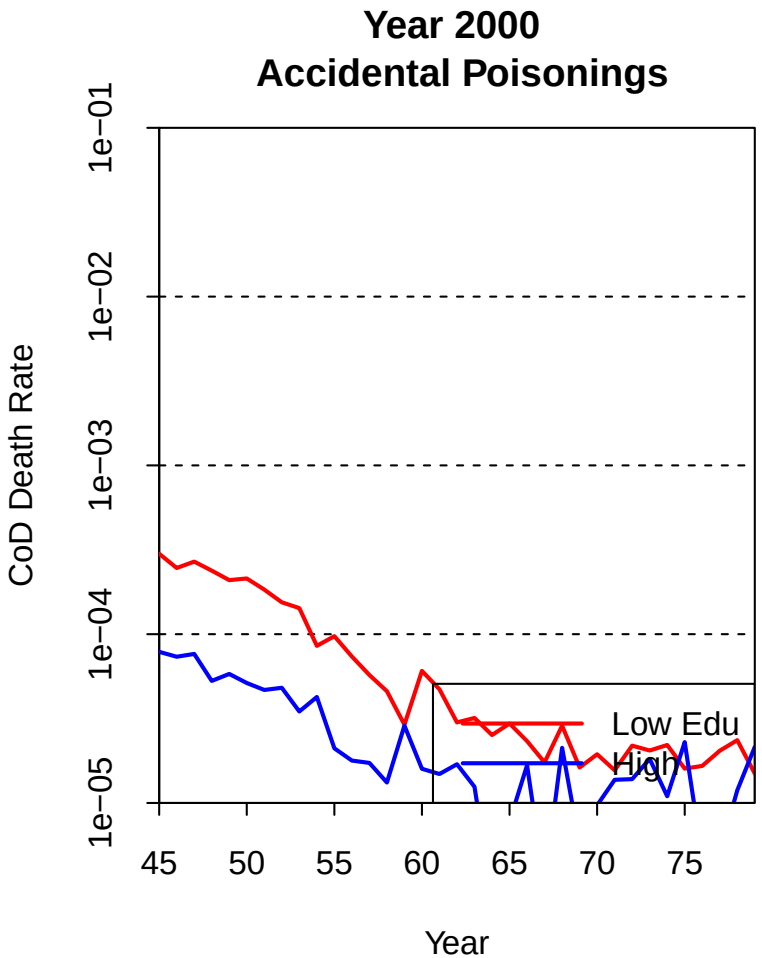
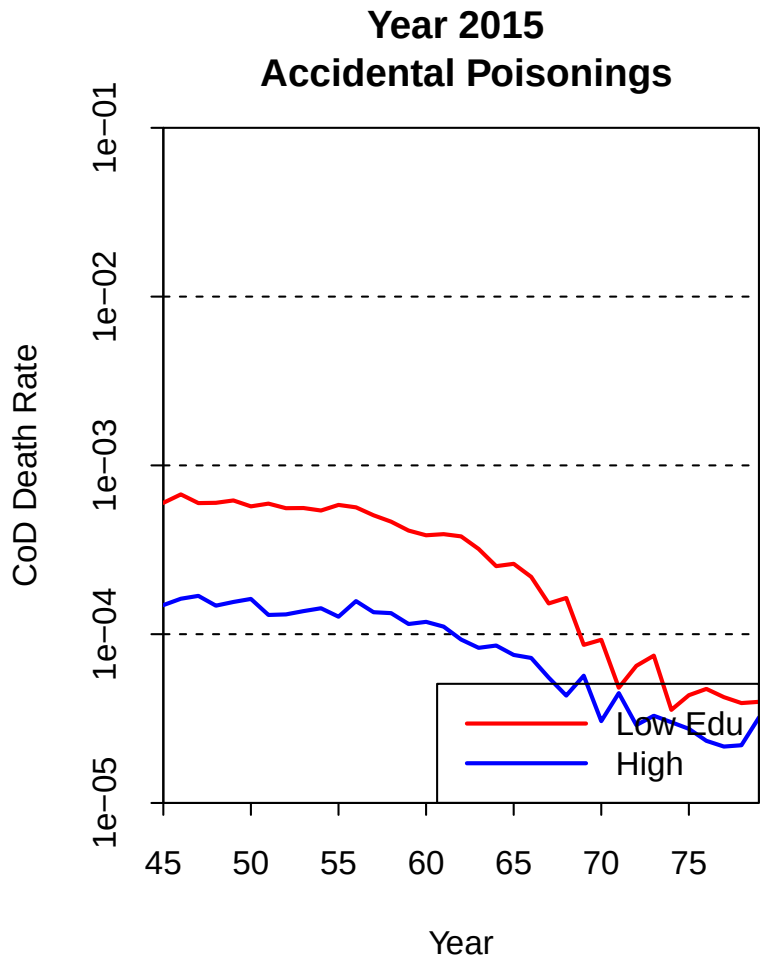
US Education Data





Case & Deaton (2015) $\Rightarrow$ Deaths of Despair $\nearrow$

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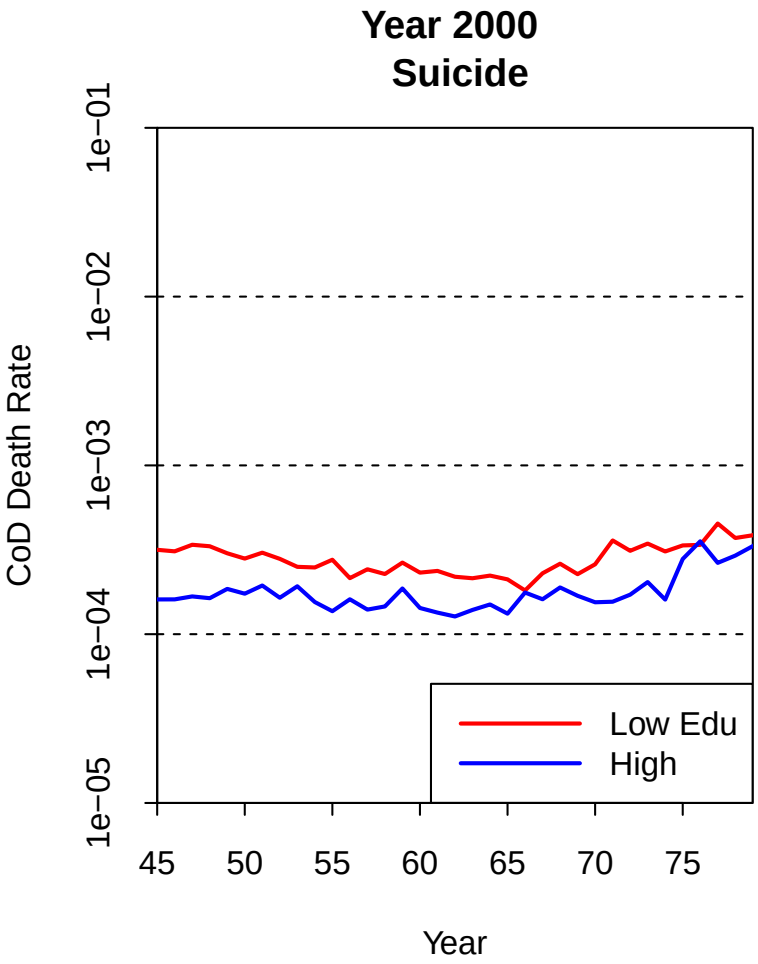
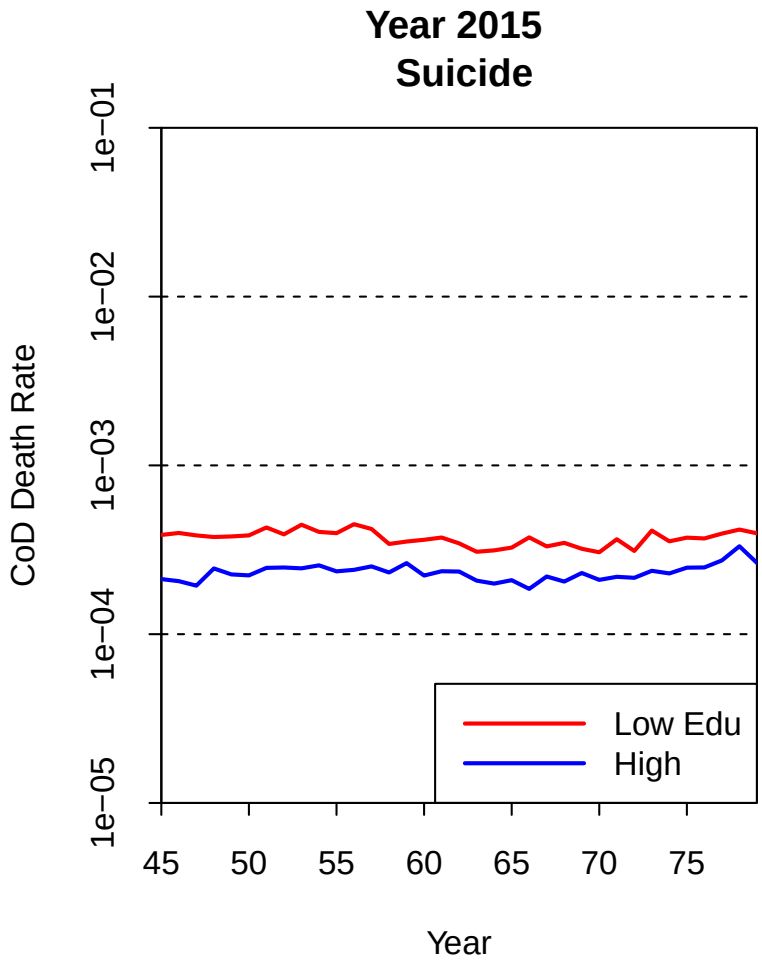
US Education Data





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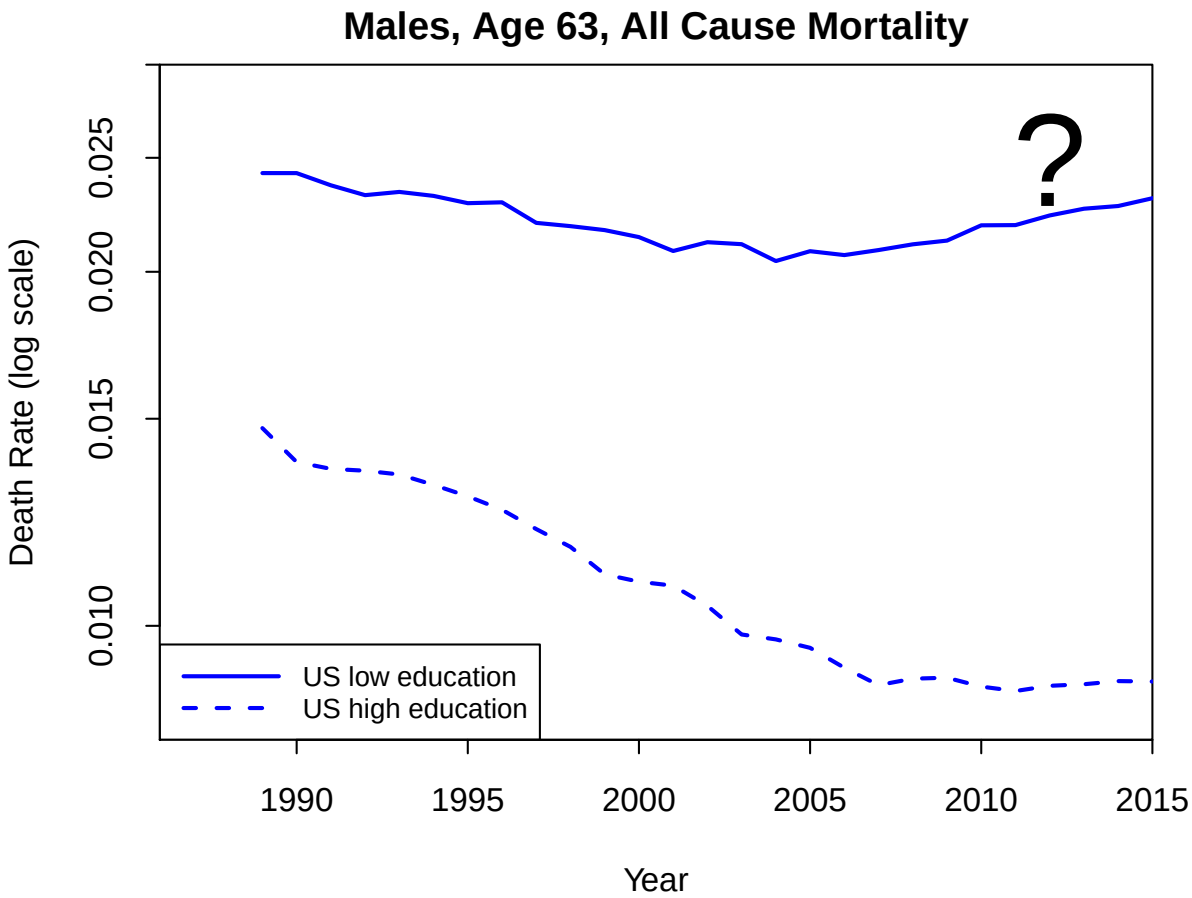
US Drivers of Change 1991-2013, Males Age 63



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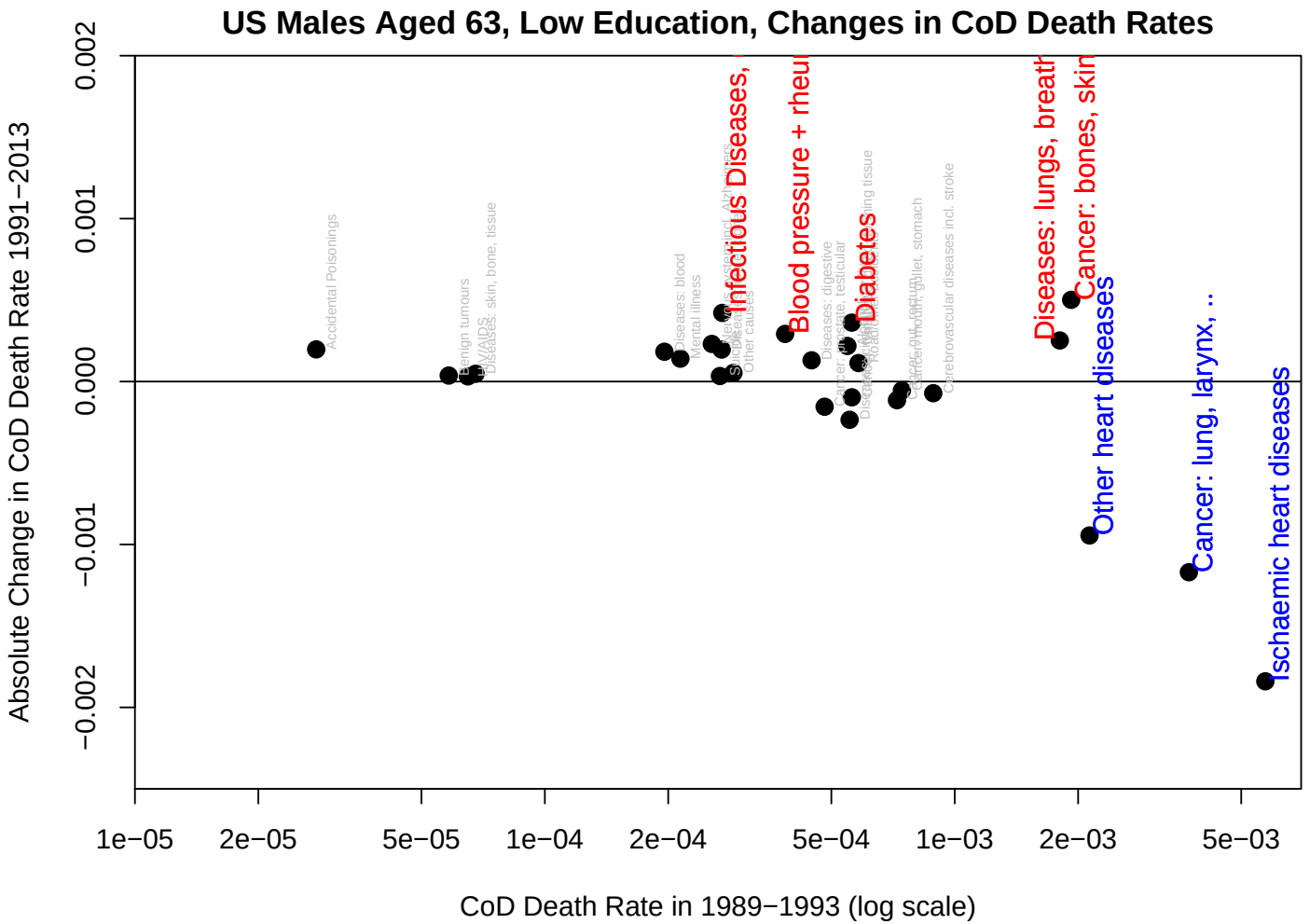

- Big gains in three causes
- Offset by modest deterioration in many causes

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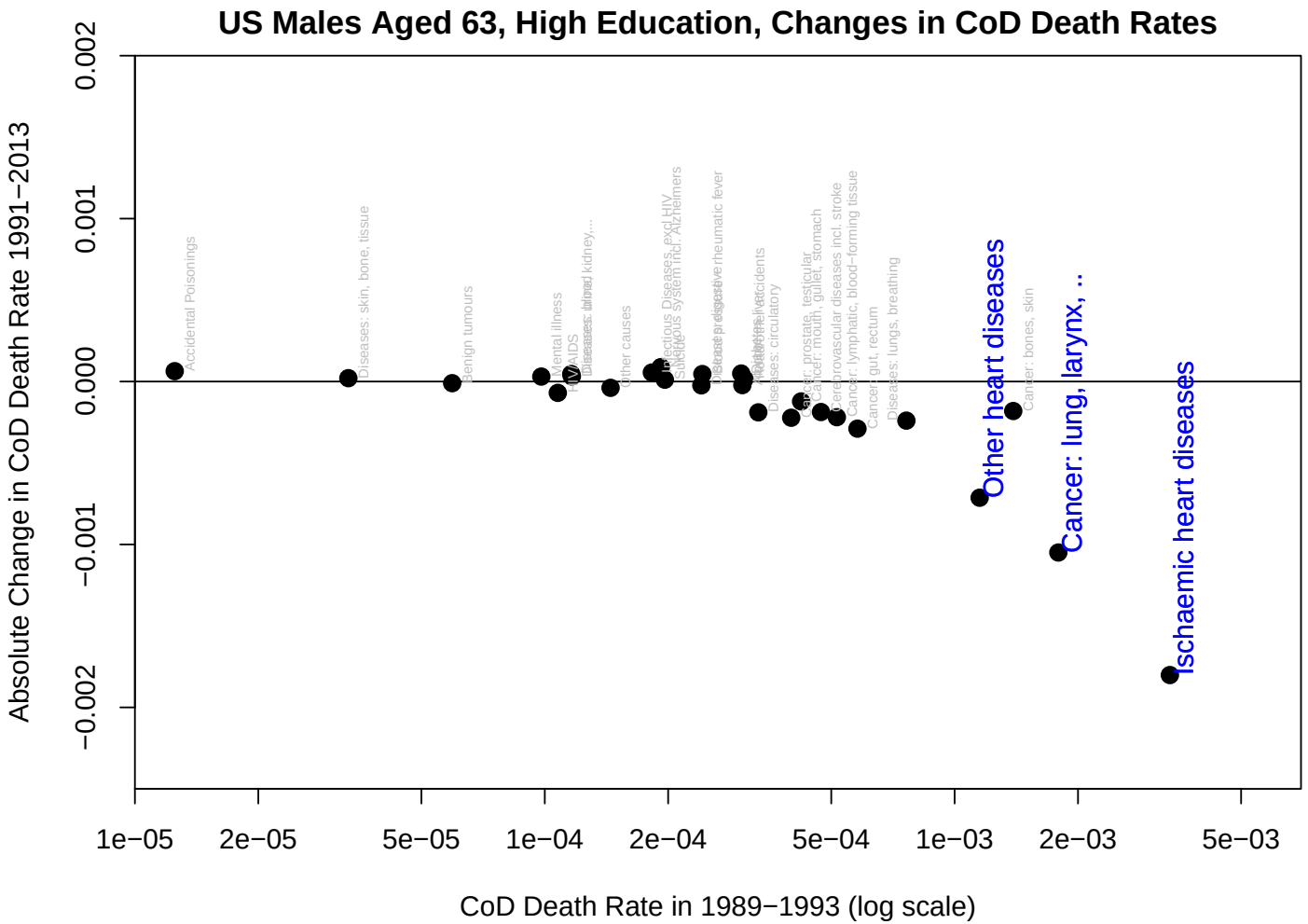

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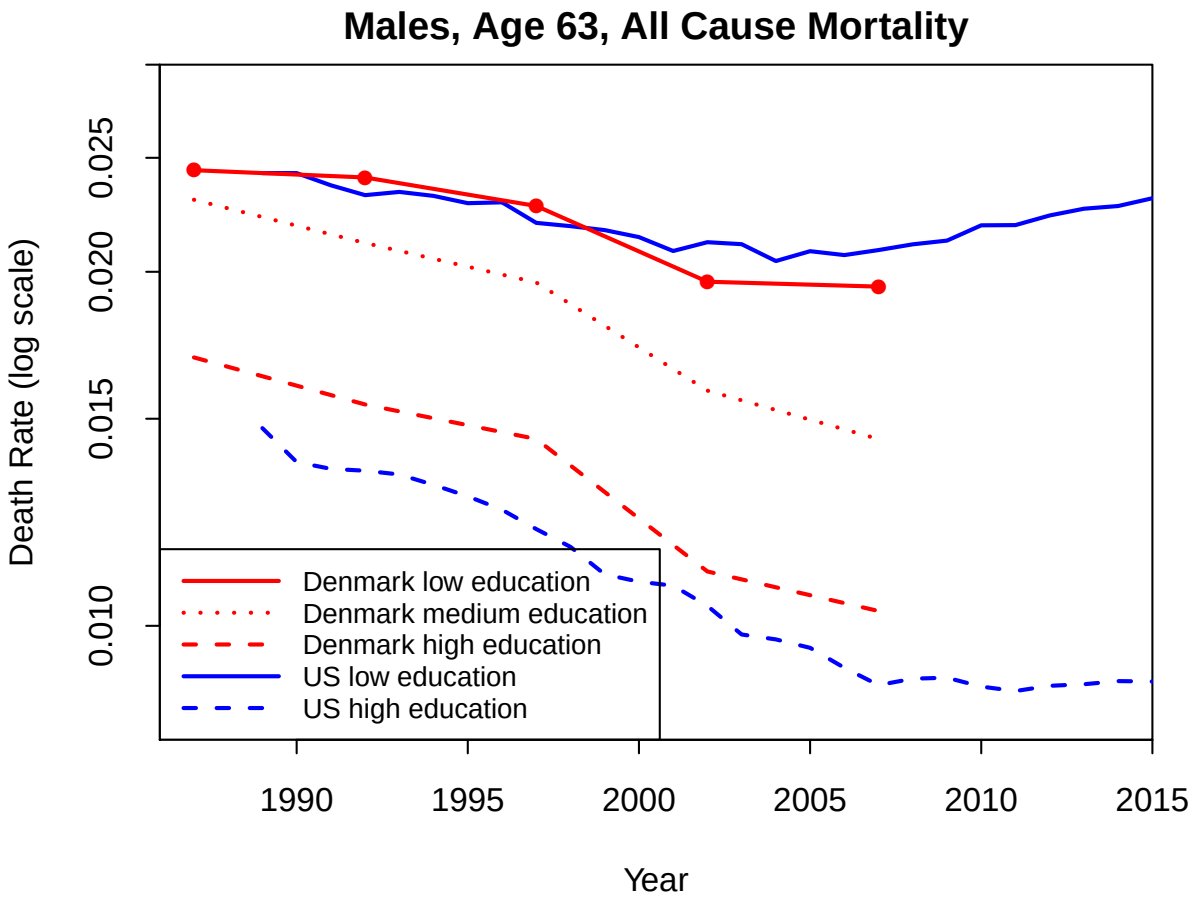
US versus Denmark, Males Age 63 / 61-65



- US: wider inequality gap
- But can't point to one or two big drivers

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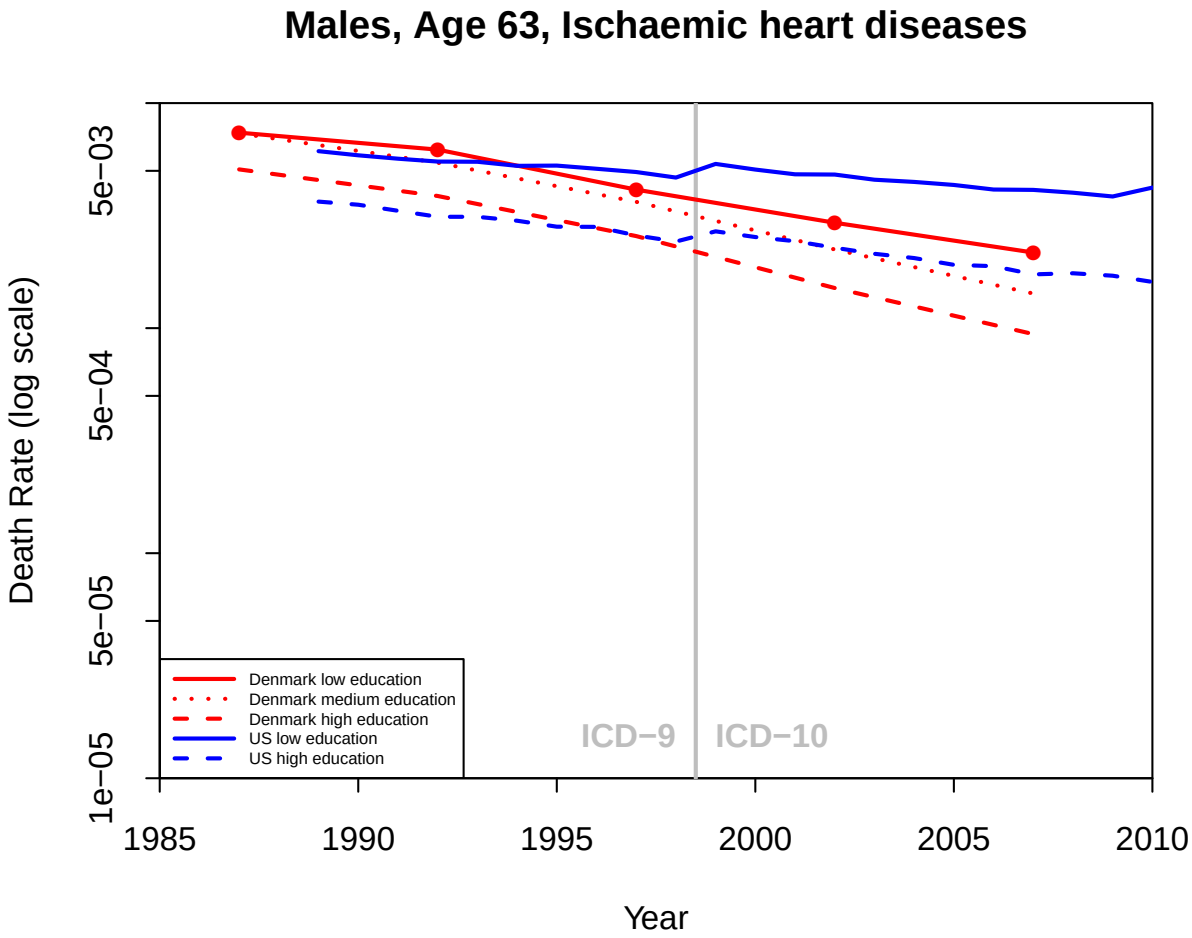
US versus Denmark, Males Age 63 / 61-65



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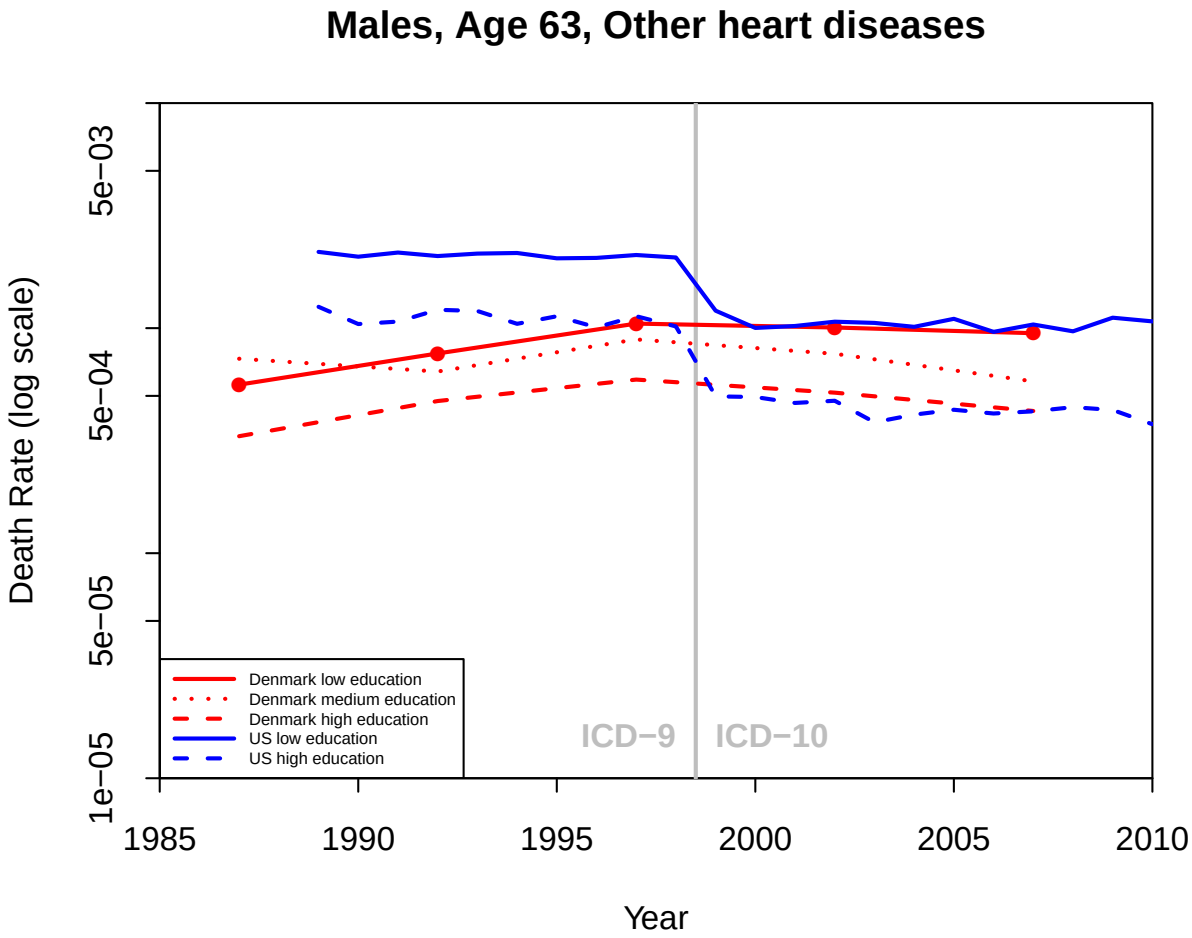

Denmark not impacted by IMD change???

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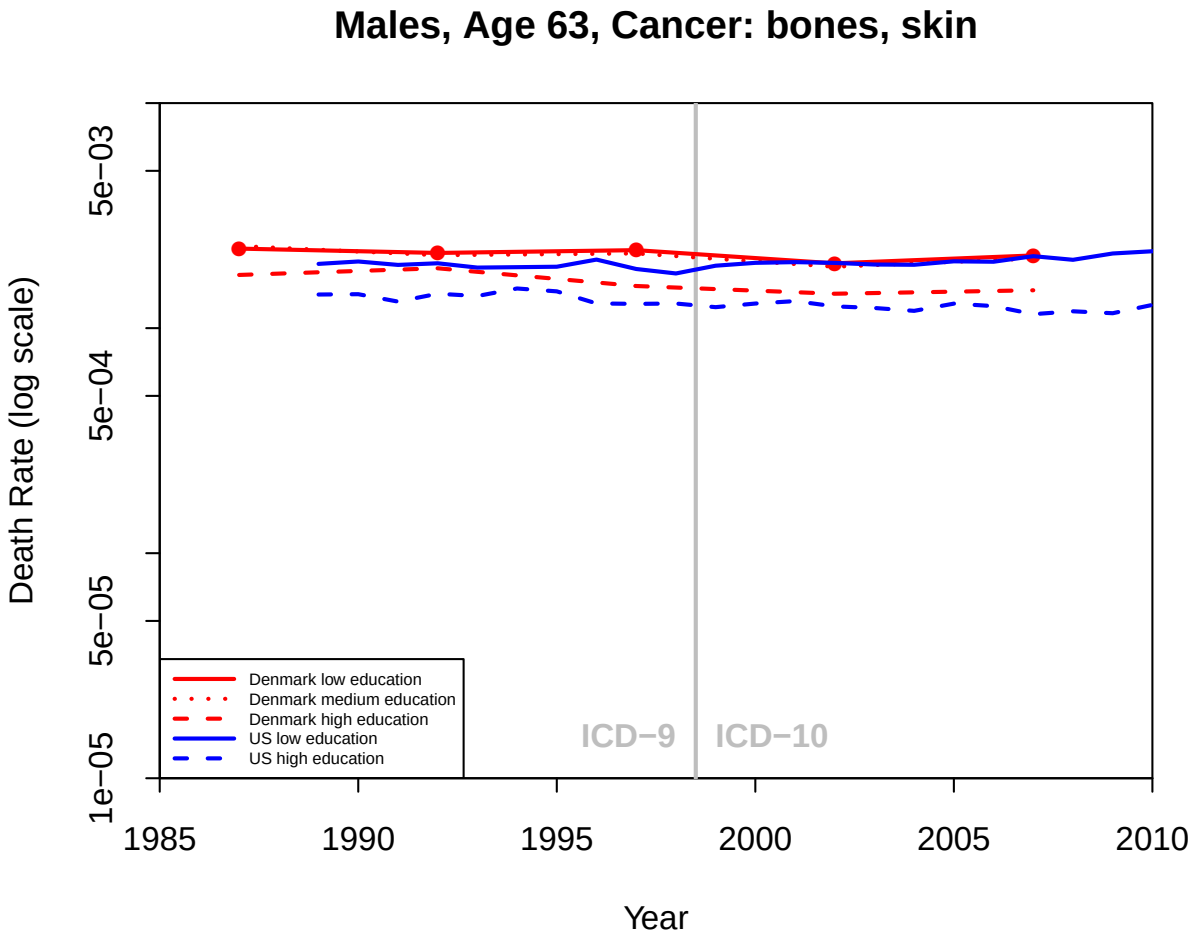

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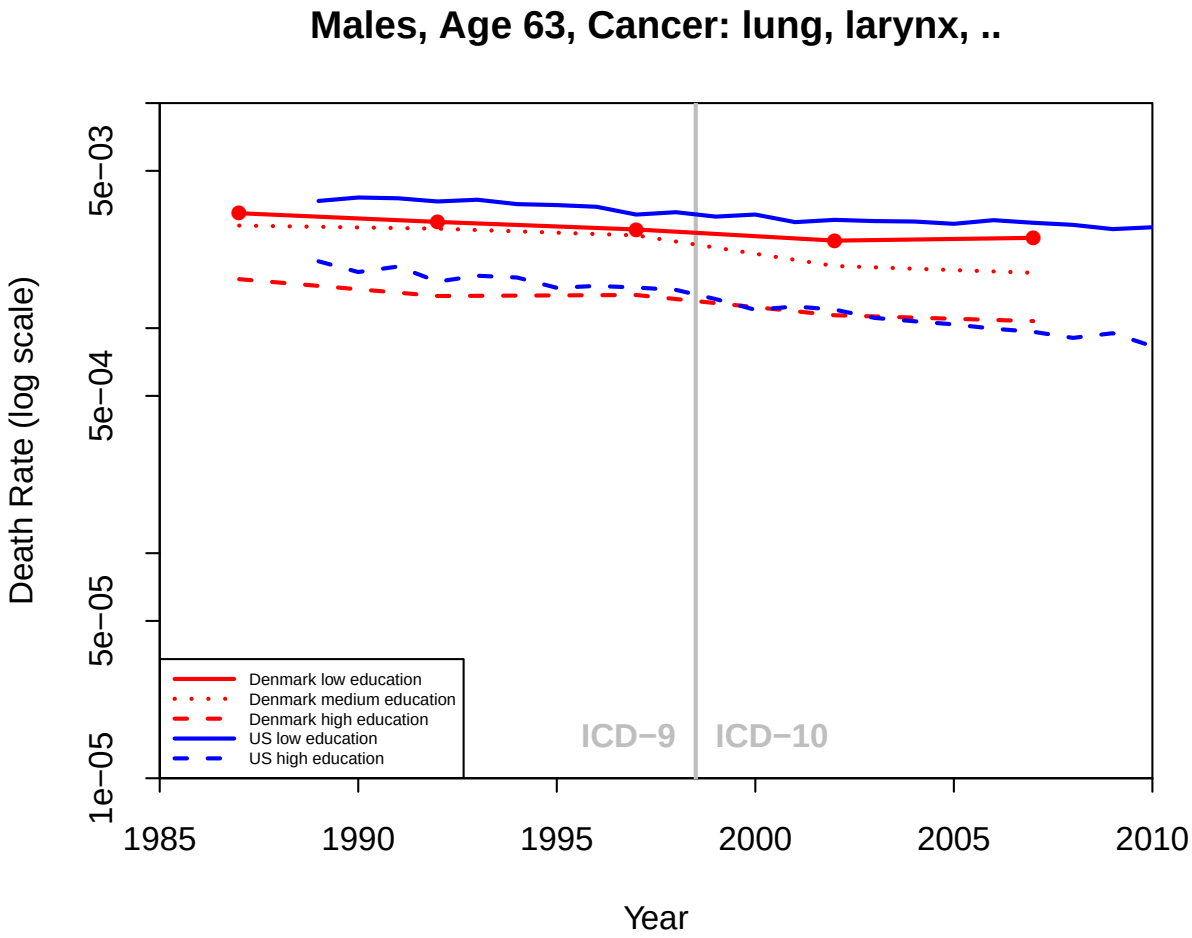

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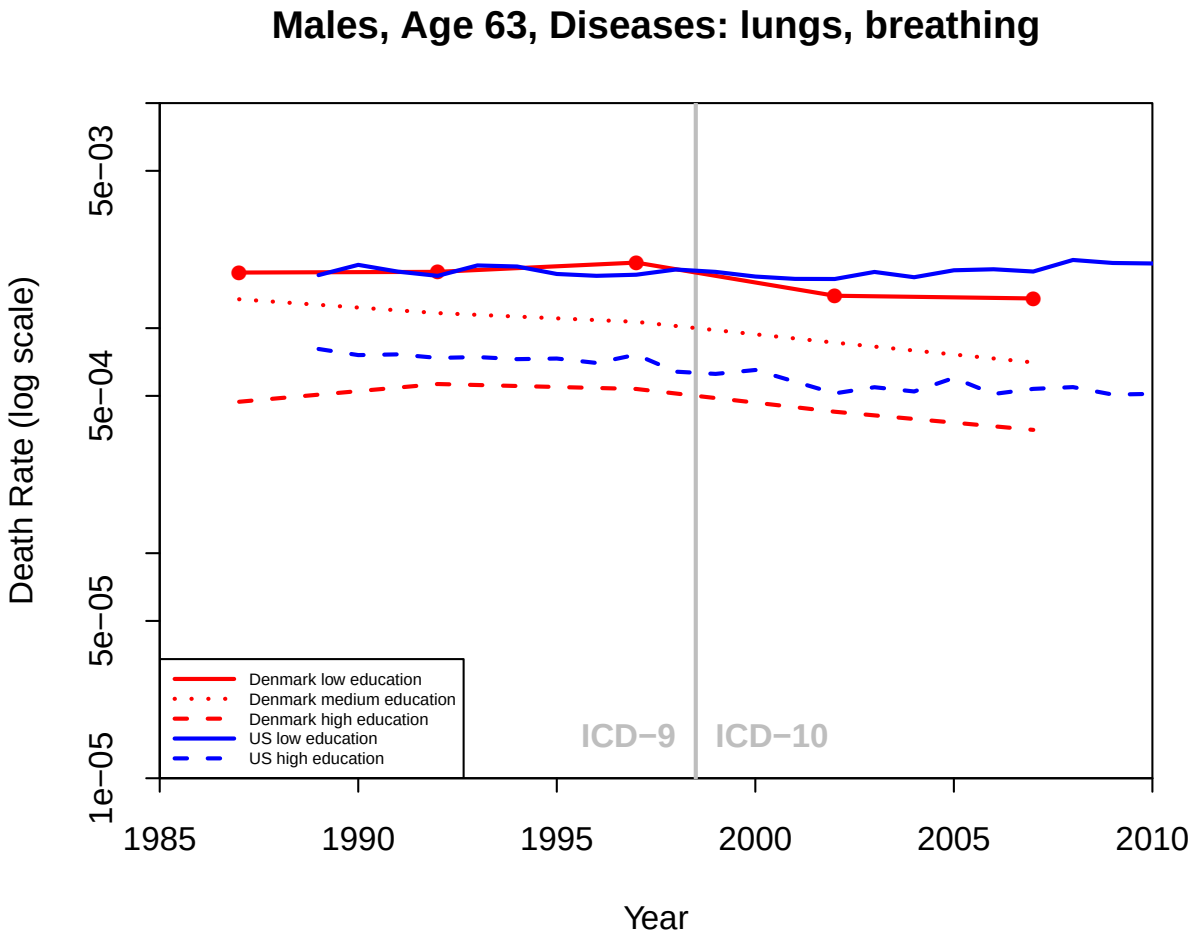

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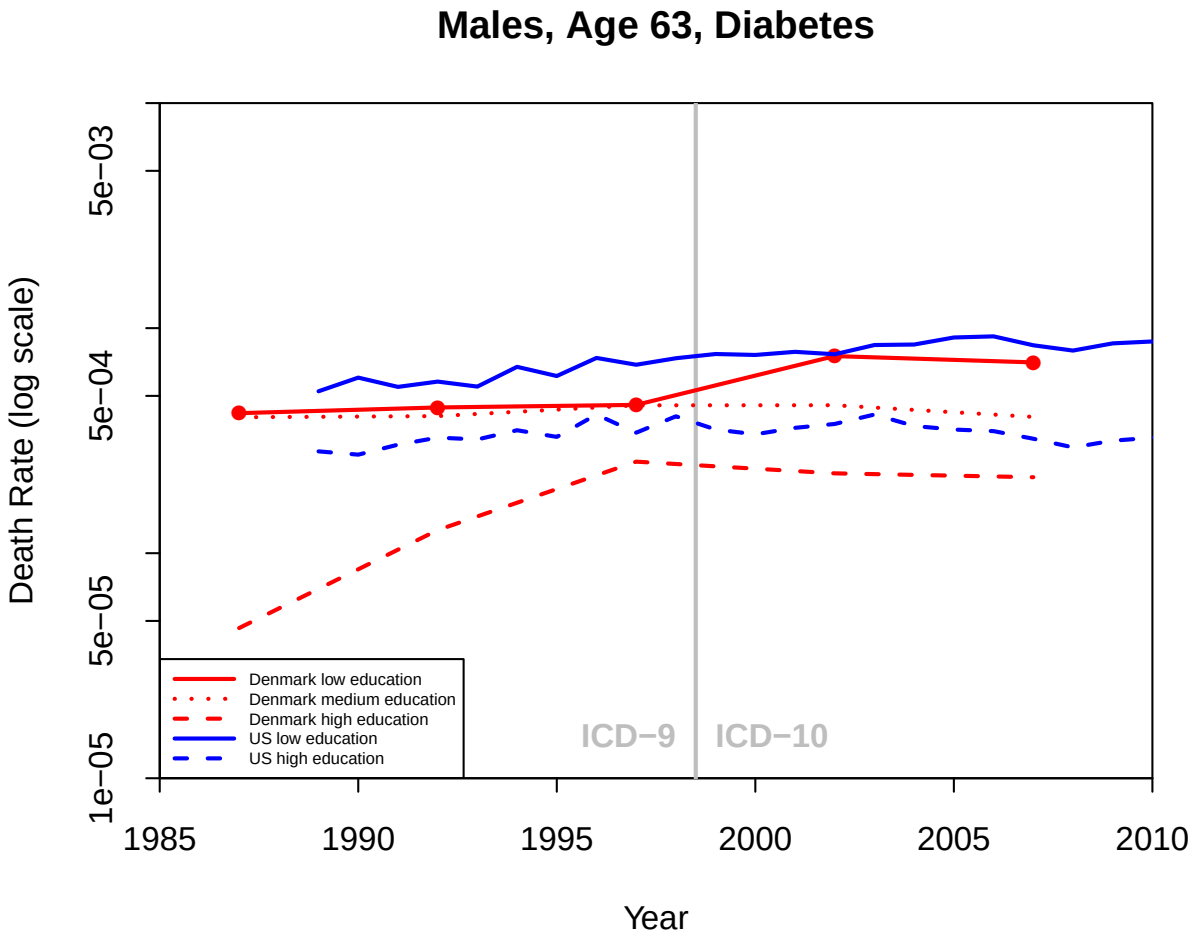

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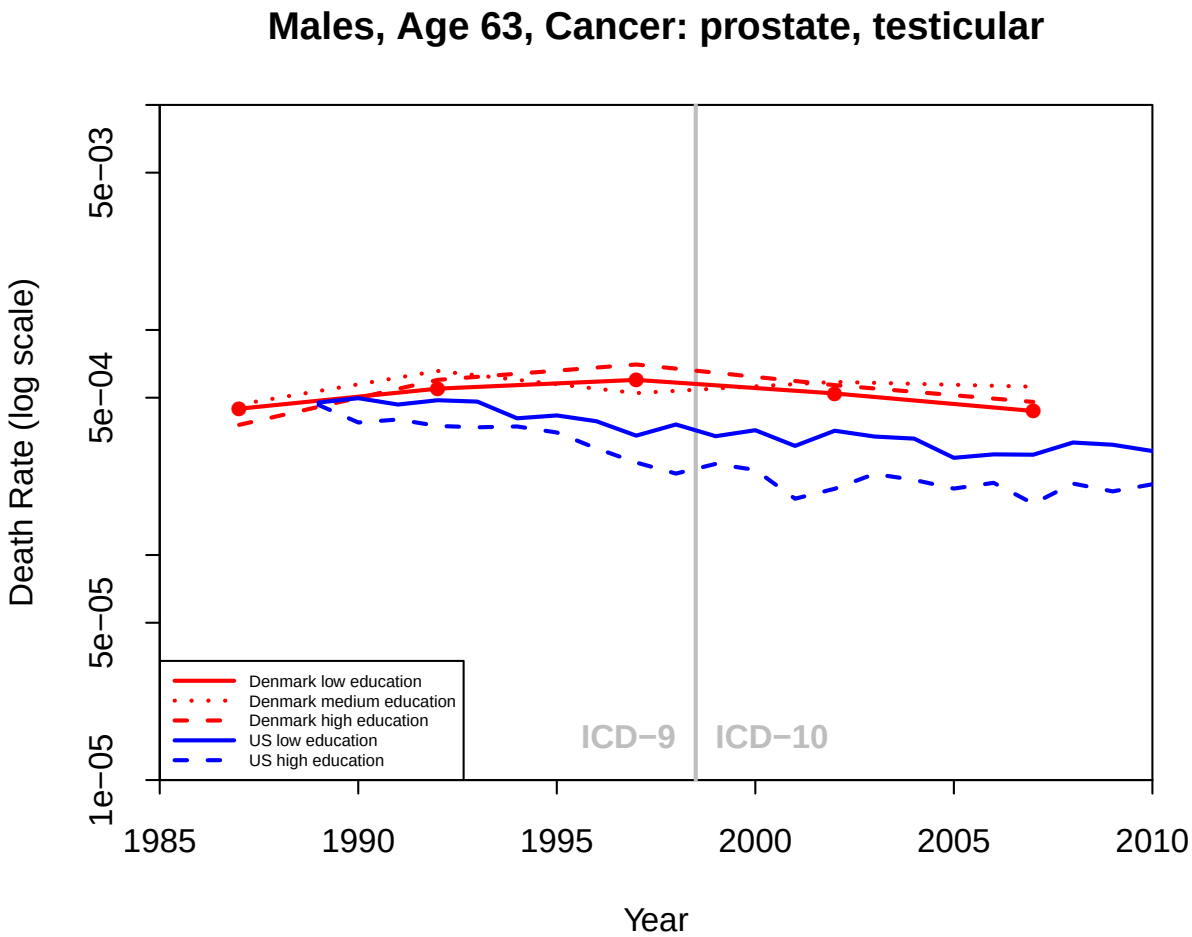
US versus Denmark, Males Age 63 / 61-65



- Wider US gap: access to healthcare post-diagnosis + genetic/racial???
- No preventable risk factors, but Denmark much higher??? Potentially genetic/racial???

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Further remarks

- Need to factor in changing levels of educational attainment
- Can we link smoking prevalence to e.g. lung cancer mortality?
- Working on obtaining English data by socio-economic $\times$ geographic groups and cause of death
- Built from small geographical areas rather than individual records.

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Summary

- Affluence better than education for all CoD if you have the data
- Impact of affluence/education varies with CoD
- Significant levels of inequality for most of the big CoD's
- Impact of education varies between countries (e.g. different health systems)
- Work in progress!

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Thank You!

Questions?

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The 'Modelling, Measurement and Management of Longevity and Morbidity Risk' research programme is being funded by the ARC, the SoA and the CIA.

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