MAX PLANCK INSTITUTE
FOR DEMOGRAPHIC
RESEARCH

Healthy Life Expectancy, Mortality, and Age Prevalence of Morbidity

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HLE most often measured by Sullivan method

$$\mathrm{HLE} = \int \ell(x)\,(1 - \pi(x))\ \mathrm{d}x$$

Ergo *age* patterns

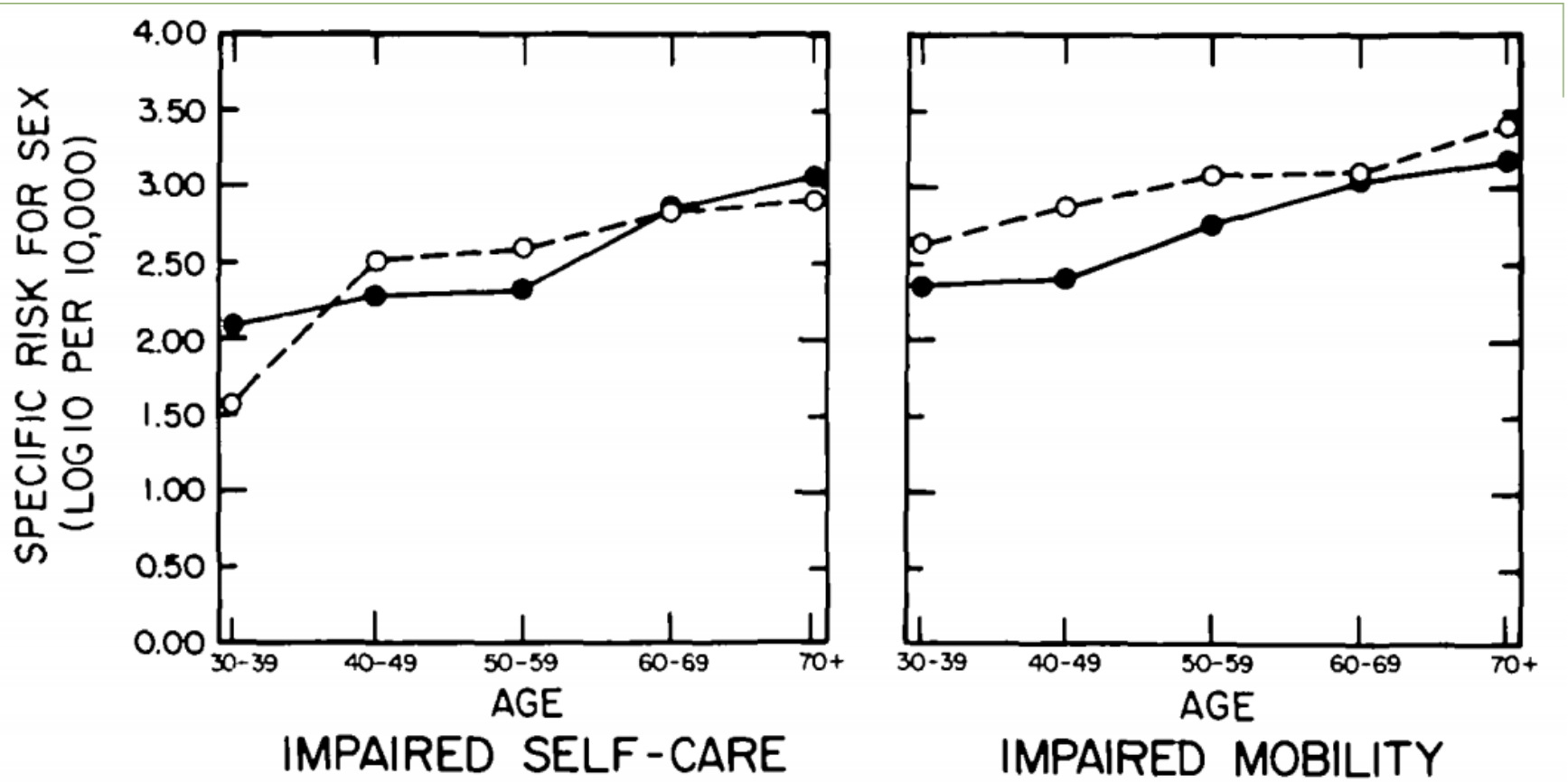

FIGURE 5. Sex-specific risks of 9-year functional disability (6 months or longer duration) by age, Alameda County, California, 1965–1974. ●, men; ○, women.

Wingard et. al. (1989)

- Stock variable, changes slowly (Barendregt et al. 1994)
- Prevalence can vary by age, time-to-death, lifespan, or combinations of these things.
- Complicates comparisons of period HLE (or ULE) across populations with different mortality.
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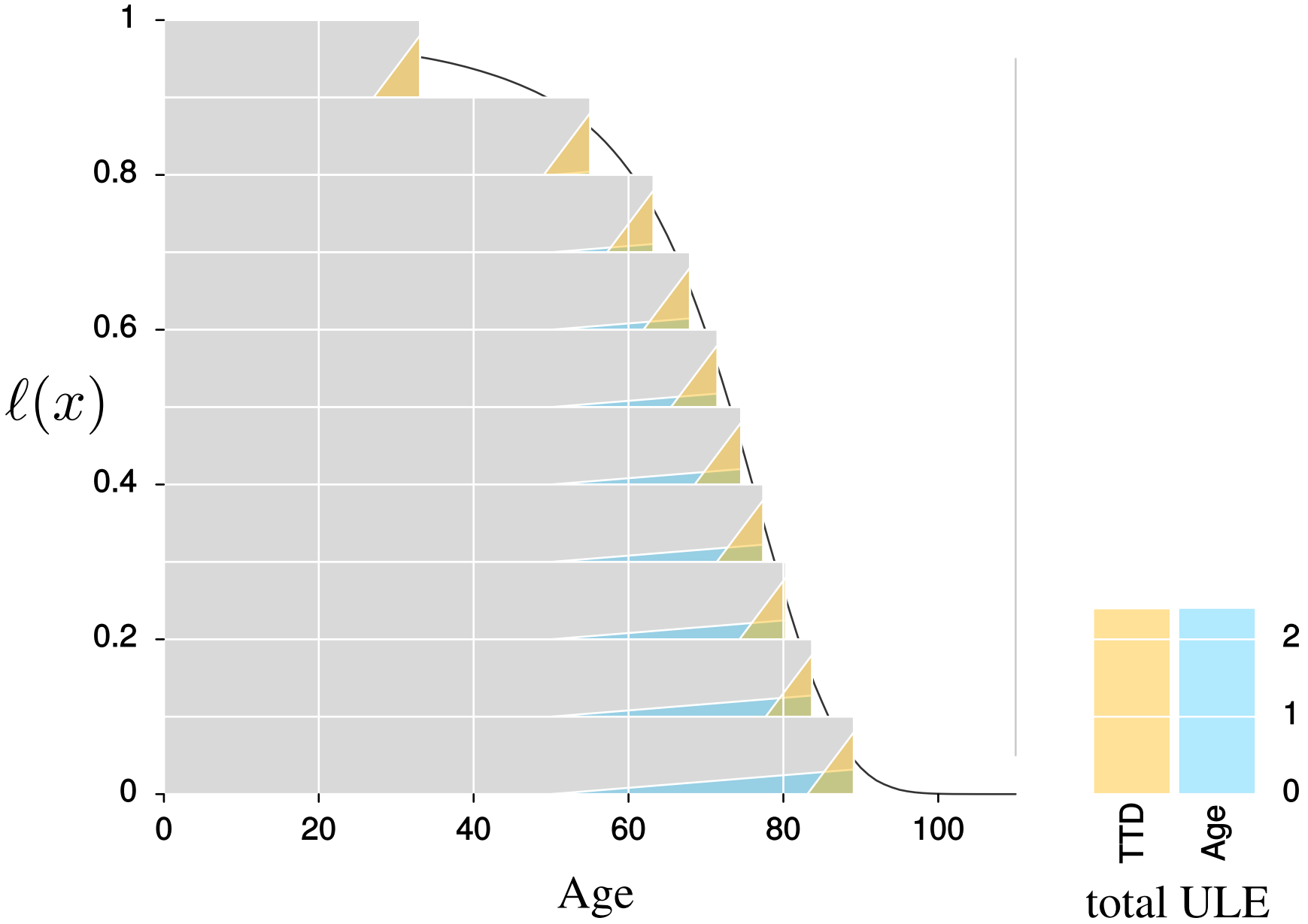
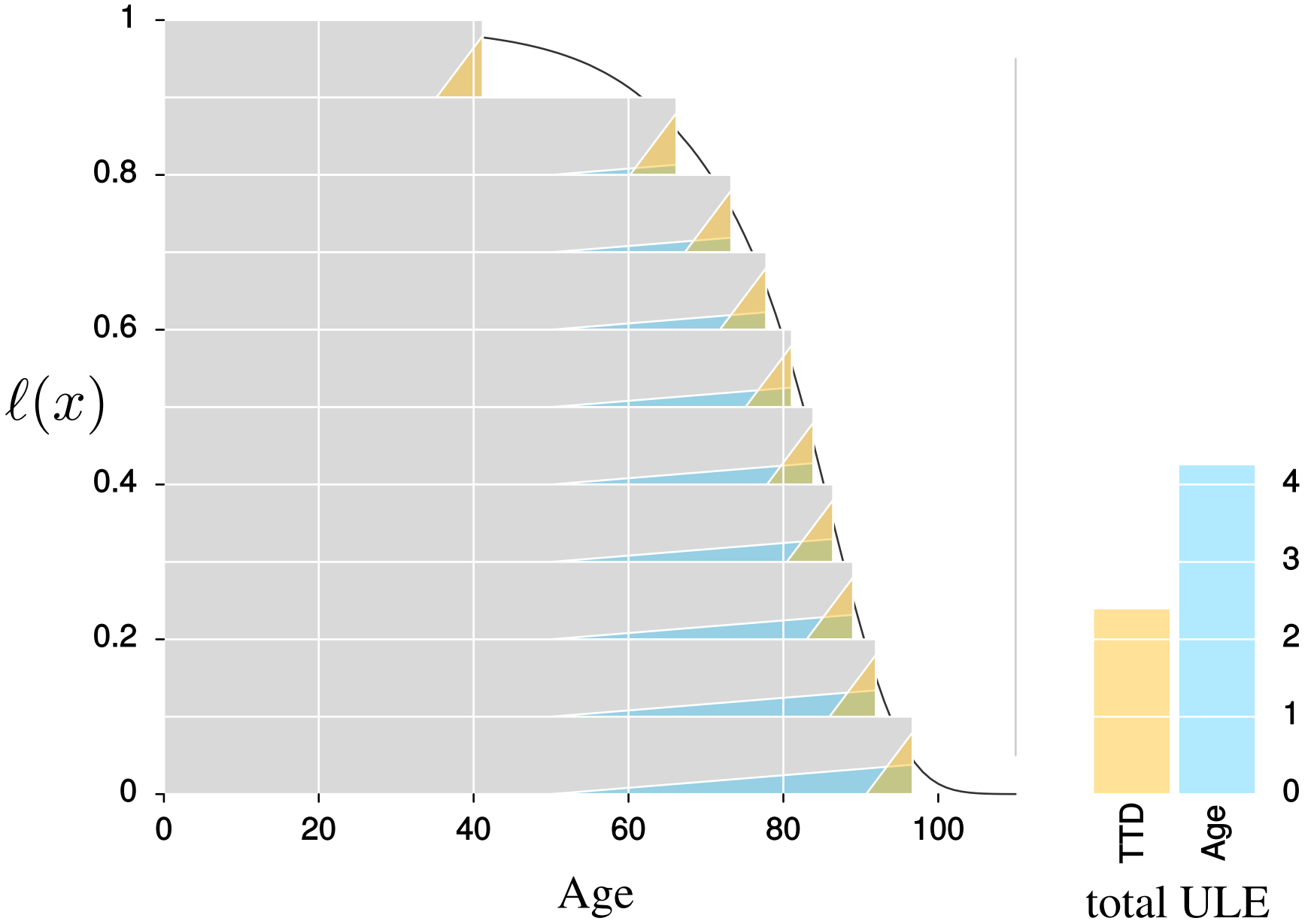
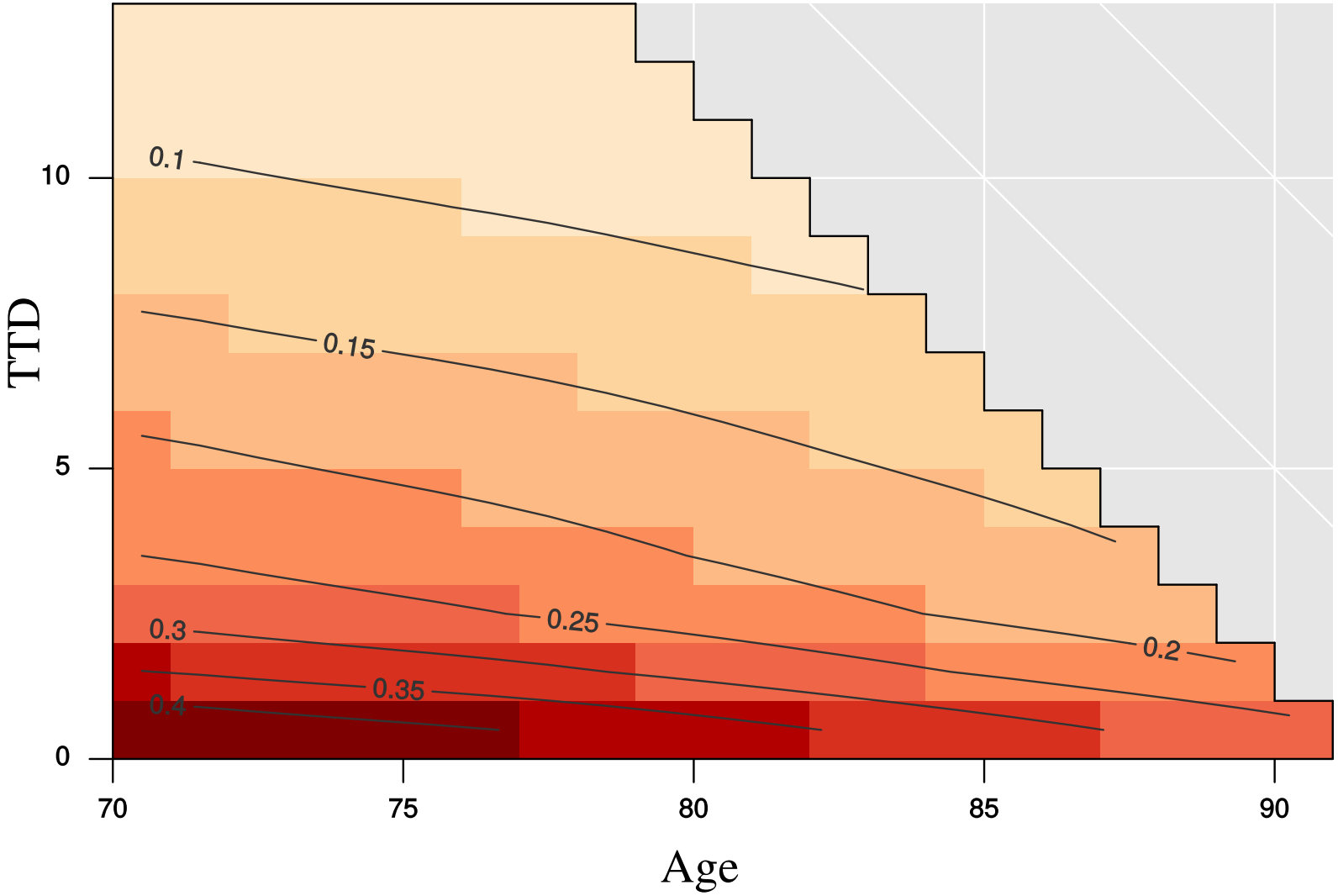
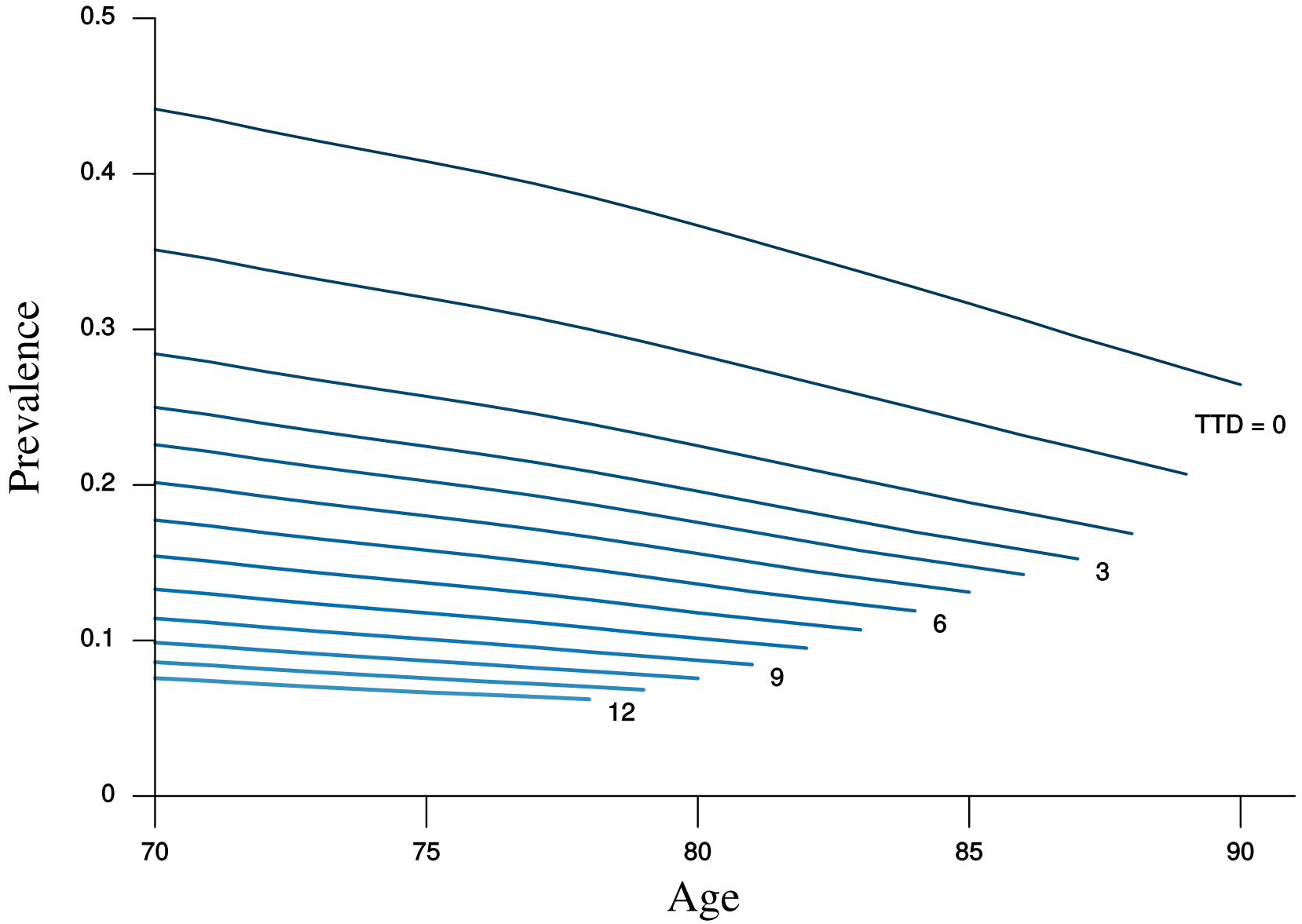
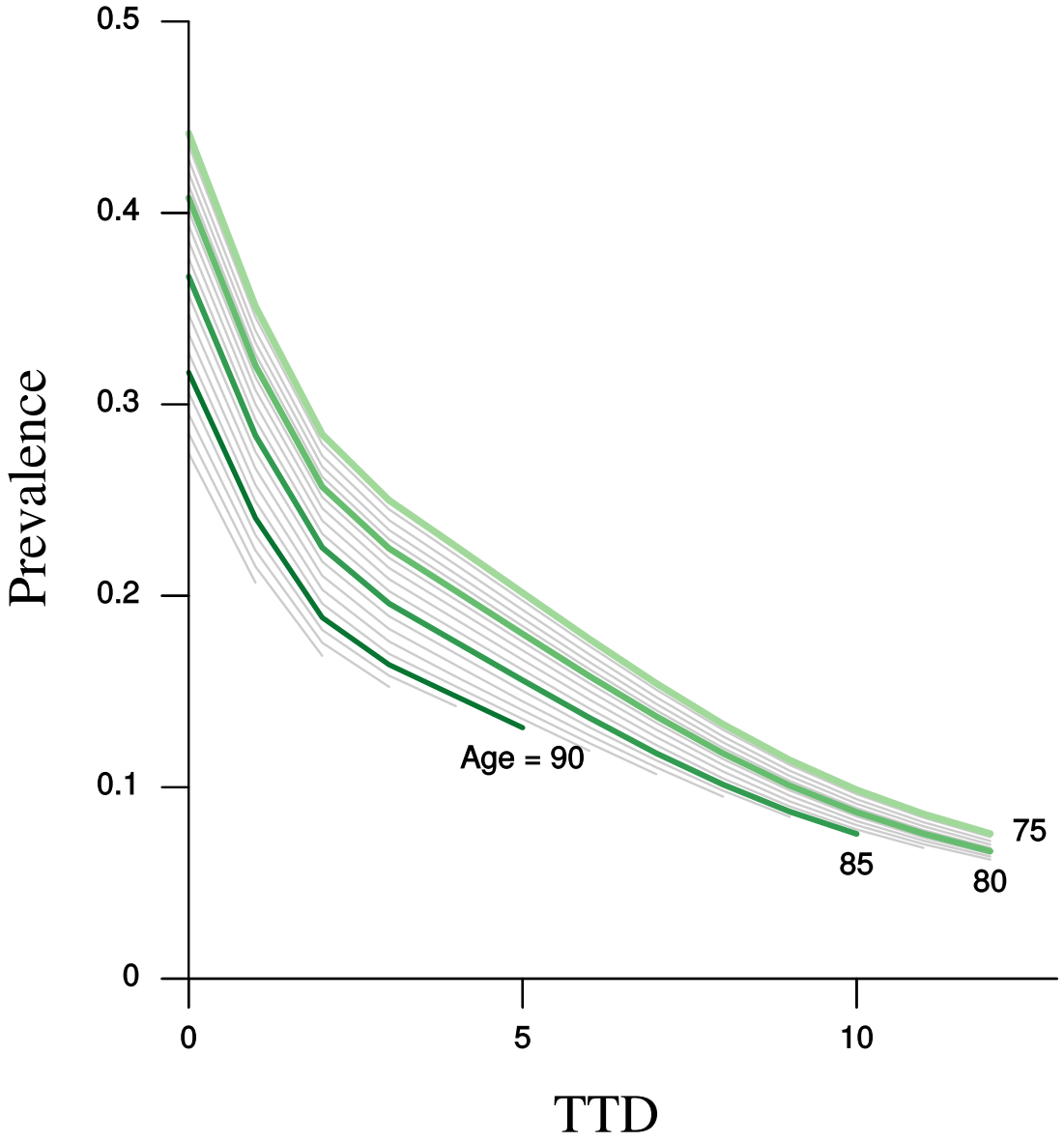

1
0.8
0.6
$\ell(x)$
0.4
0.2
0
0
20
40
60
80
100
Age
2
1
0
TTD
Age
total ULE

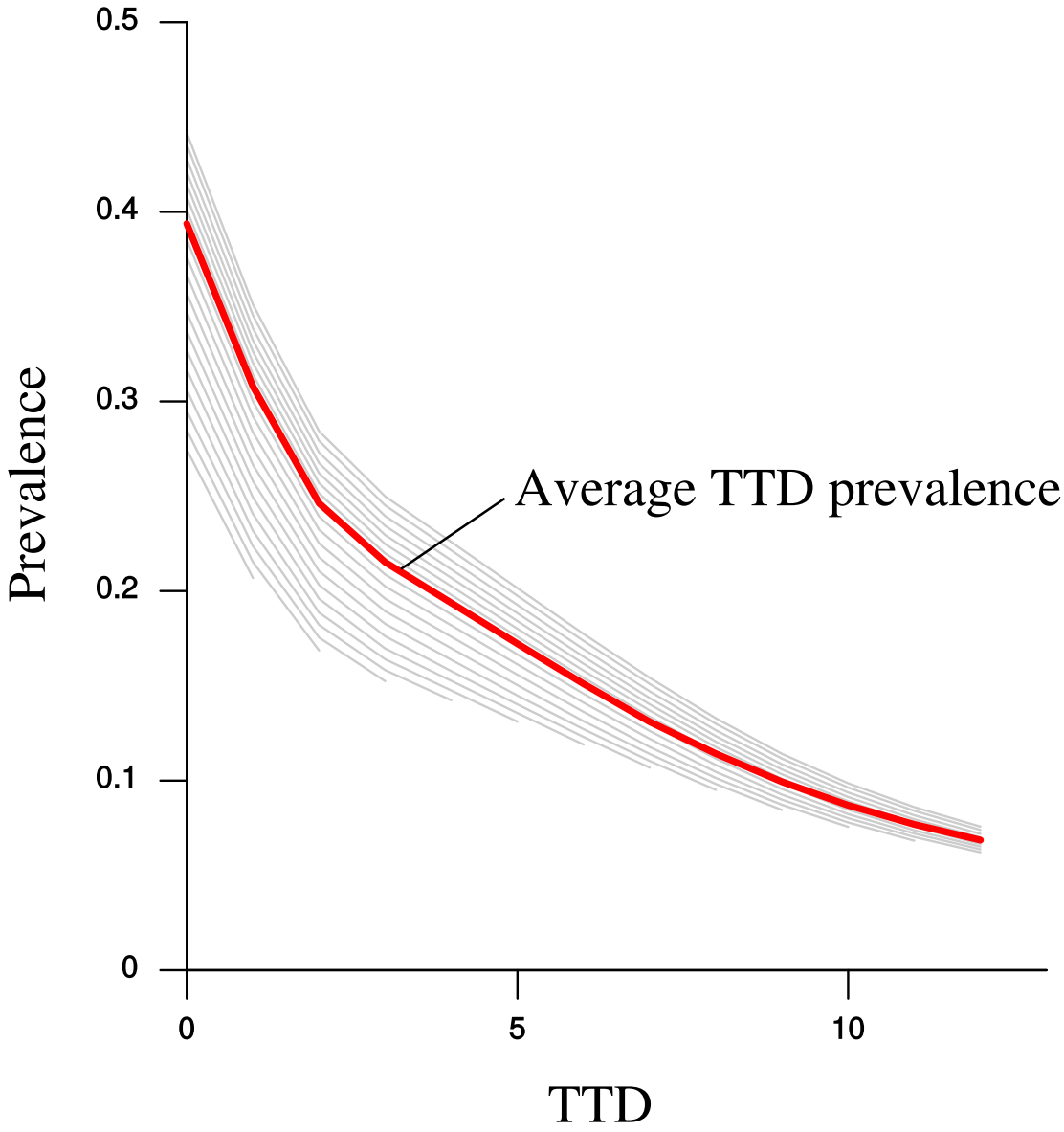

1
0.8
0.6
0.4
0.2
0
$\ell(x)$
0
20
40
60
80
100
Age
4
3
2
1
0
TTD
Age
total ULE

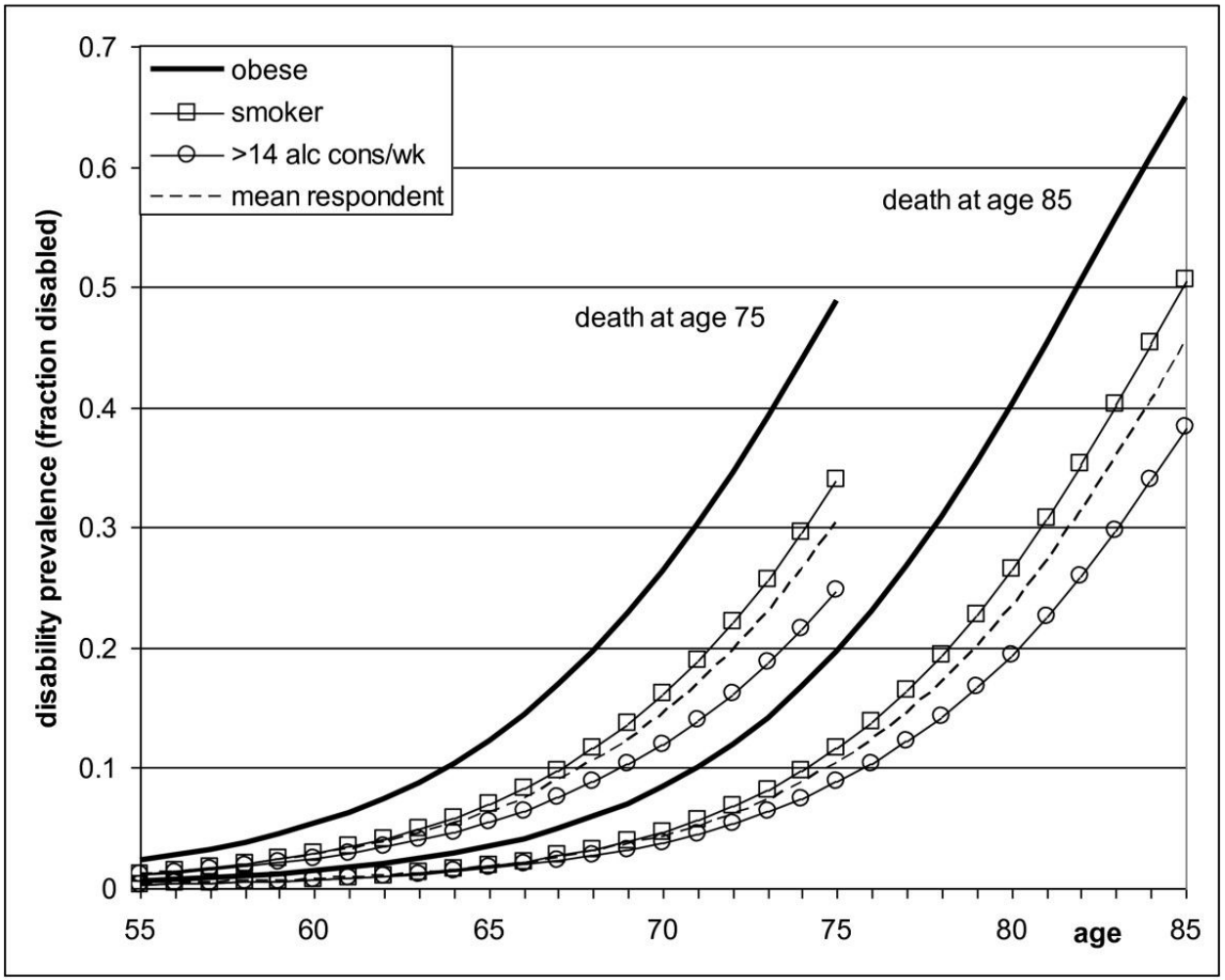


Proportion of USA females from the 1915-1919 self-reporting poor health

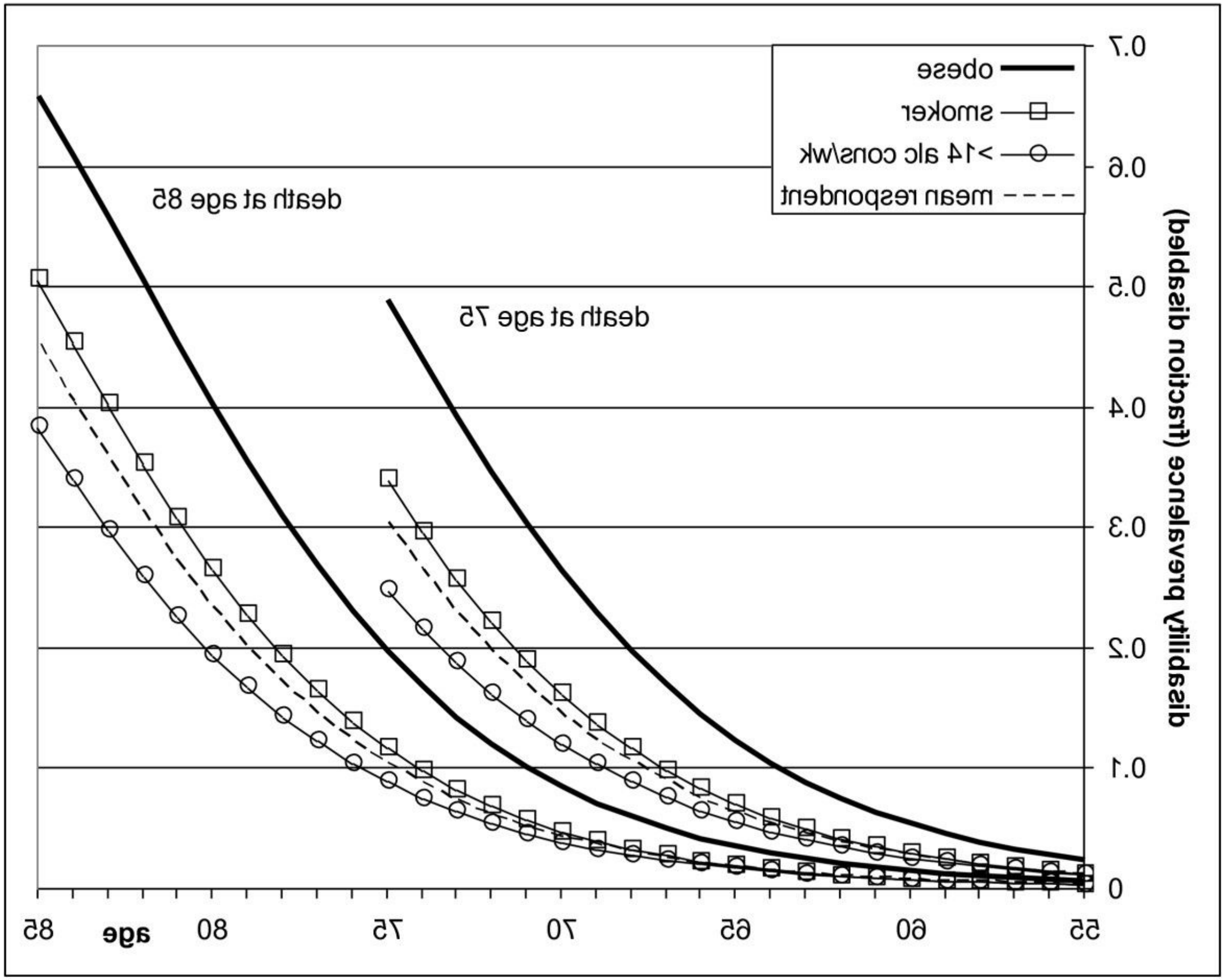

0.5
0.4
0.3
0.2
0.1
0
Prevalence
TTD = 0
3
6
9
12
70
75
80
85
90
Age


0.5
0.4
0.3
0.2
0.1
0
Prevalence
Age = 90
75
85
80
0
5
10
TTD


0.5
0.4
0.3
0.2
0.1
0
Prevalence
Average TTD prevalence
0
5
10
TTD

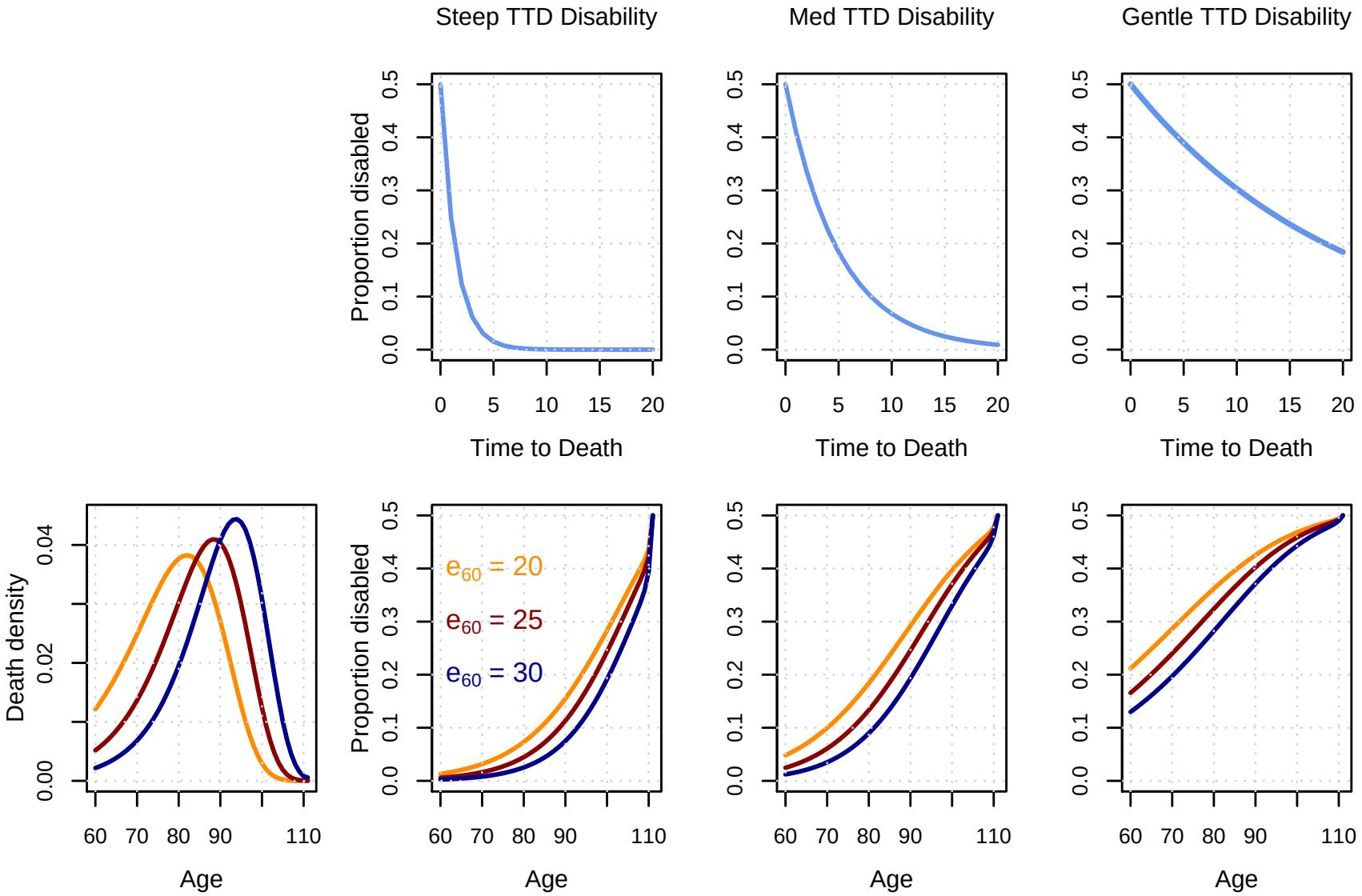


Klijs et. al. (2011)



Klijs et. al. (2011)

Held constant, time-to-death prevalence moves *with* longevity.


Steep TTD Disability
Med TTD Disability
Gentle TTD Disability
Proportion disabled
Time to Death
Death density
Age
e_{60} = 20
e_{60} = 25
e_{60} = 30

- Are differences in DLY from mortality or morbidity?

- Decomposition methods isolate the effects of changes in L_x and changes in π_x

- These are considered as *mortality* and *morbidity* effects (Nusselder and Looman 2004, Andreev et al. 2002)

- Interpretation problem: mortality can change π_x all by itself if disability is patterned by time-to-death

- Estimated average TTD profile for different disability types, based on USA HRS data, quinquennial cohorts 1905-1930

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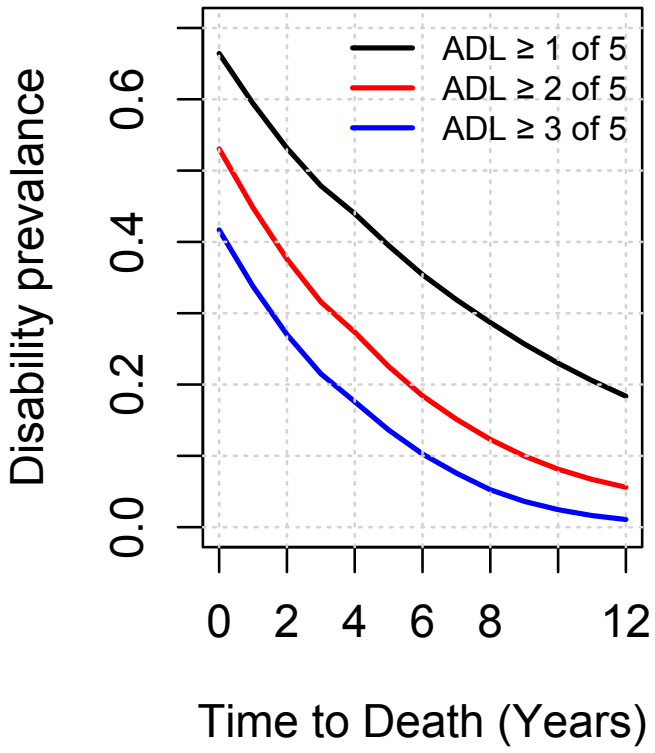
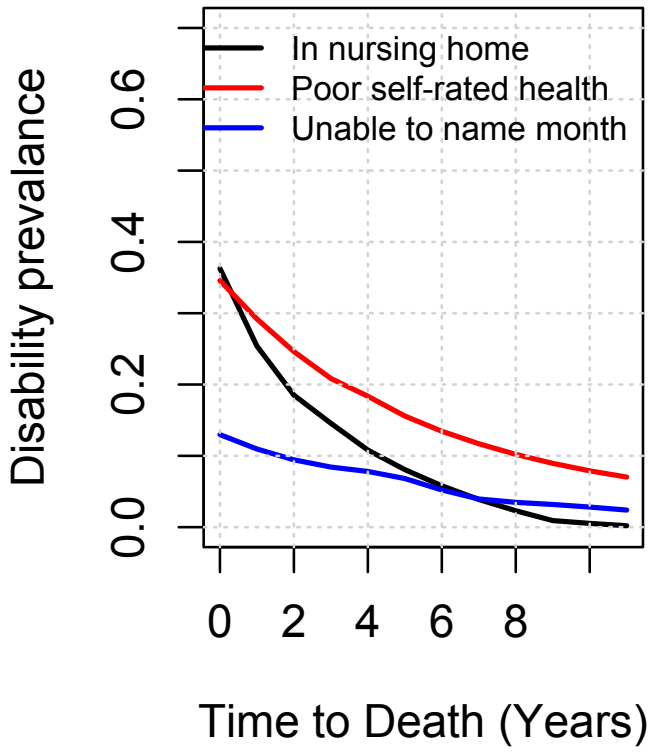
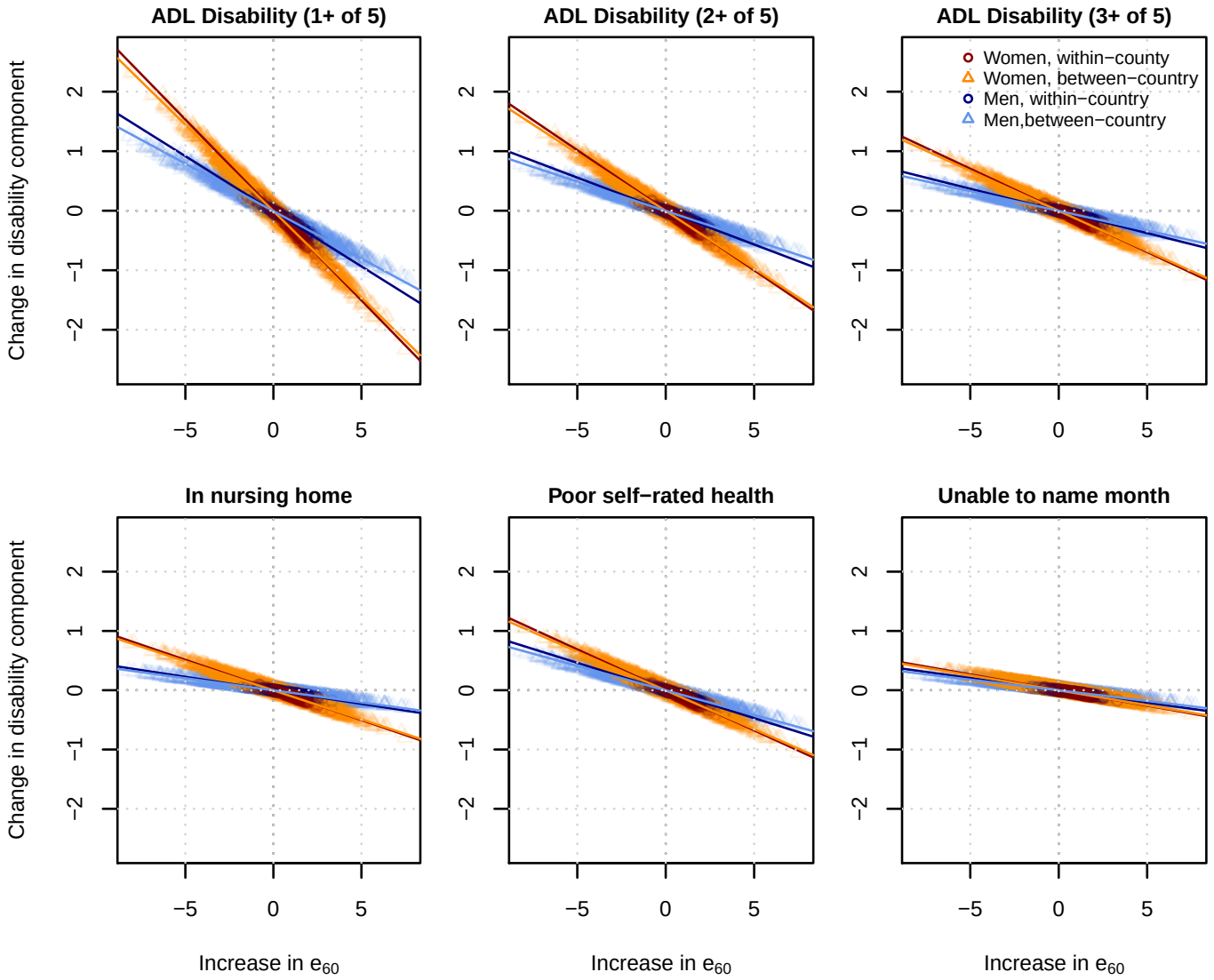
- Same for within-population changes over 10-year periods, 1950-2010


Disability prevalance
0.0
0.2
0.4
0.6
ADL ≥ 1 of 5
ADL ≥ 2 of 5
ADL ≥ 3 of 5
0
2
4
6
8
12
Time to Death (Years)


Disability prevalance
0.0
0.2
0.4
0.6
In nursing home
Poor self-rated health
Unable to name month
0
2
4
6
8
Time to Death (Years)


ADL Disability (1+ of 5)
ADL Disability (2+ of 5)
ADL Disability (3+ of 5)
In nursing home
Poor self−rated health
Unable to name month
Women, within−county
Women, between−country
Men, within−country
Men,between−country
Change in disability component
Increase in e60
−5
0
5
−2
−1
0
1
2

- True value of the change in disability component is zero by design

- Deviation is result of differences in mortality

- If e_{60} increases by 5 years, up to 1 year of decrease in DLY attributed to disability component could be from decrease in mortality (Female ADL 3 or more)

- Departure from upper bound depends on patterns of π_x, how well US pattern applies, departure from stationarity.

- Different slopes partly from differences in final π_x between disability types and the sexes

- Considering morbidity prevalence as a function of time to death does not imply that morbidity incidence is a time to death

- Modeling prevalence as TTD requires no specification of process

- In reality morbidity varies over both chronological age and time-to-death

- HLE or DLY provide an important snapshot of expected life years lived in good or poor health

- Difficulty in interpreting period differences in these quantities between populations

- Chronological age pattern of disability can change solely as a function of mortality change even when the underlying morbidity function is held constant

- Could partly explain why mortality levels and disability prevalence are related (Van Oyen et al. 2013, Luy and Minagawa 2014)

Thanks!