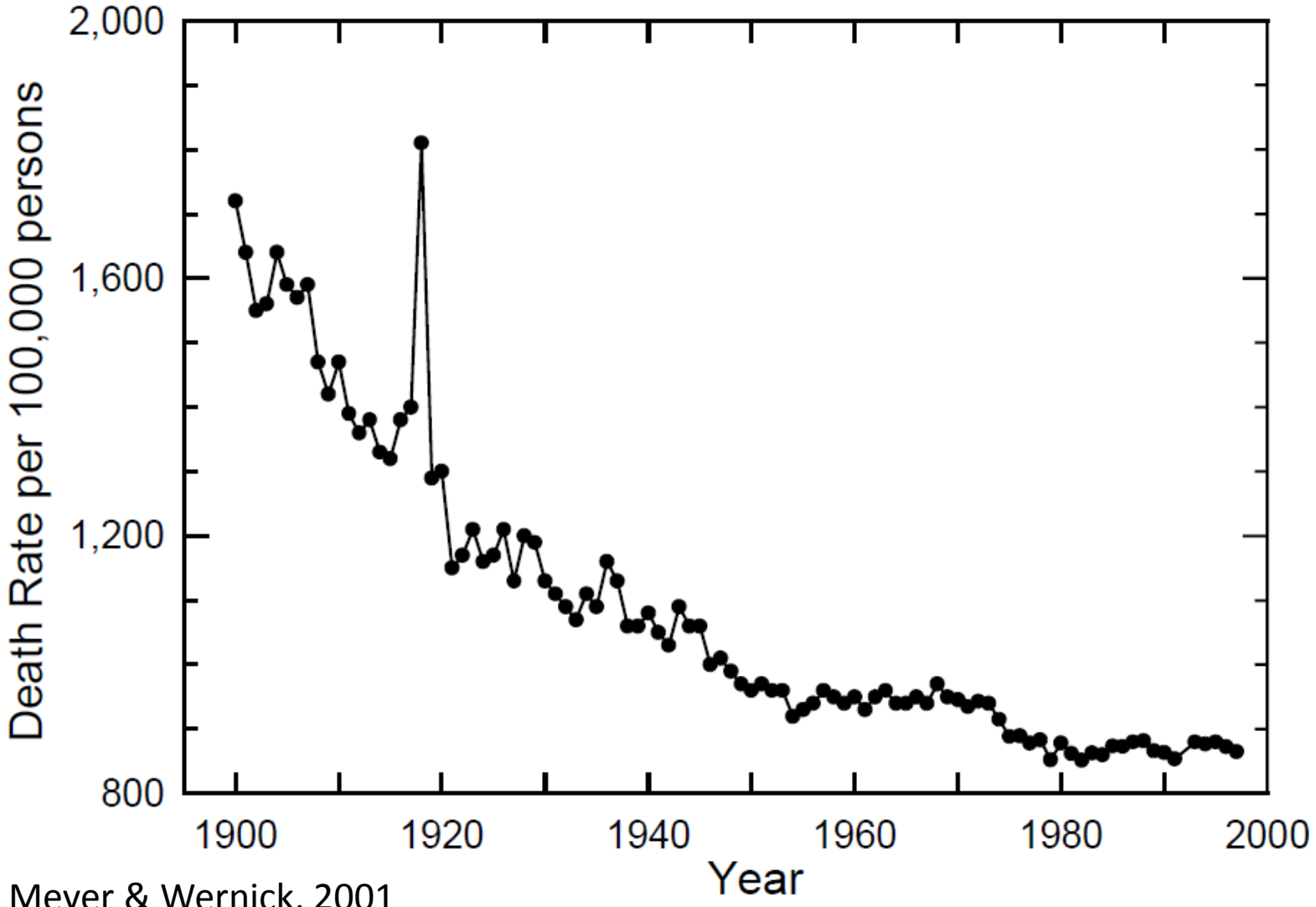
Long-term changes and transitions in population health

Long-term / secular trends

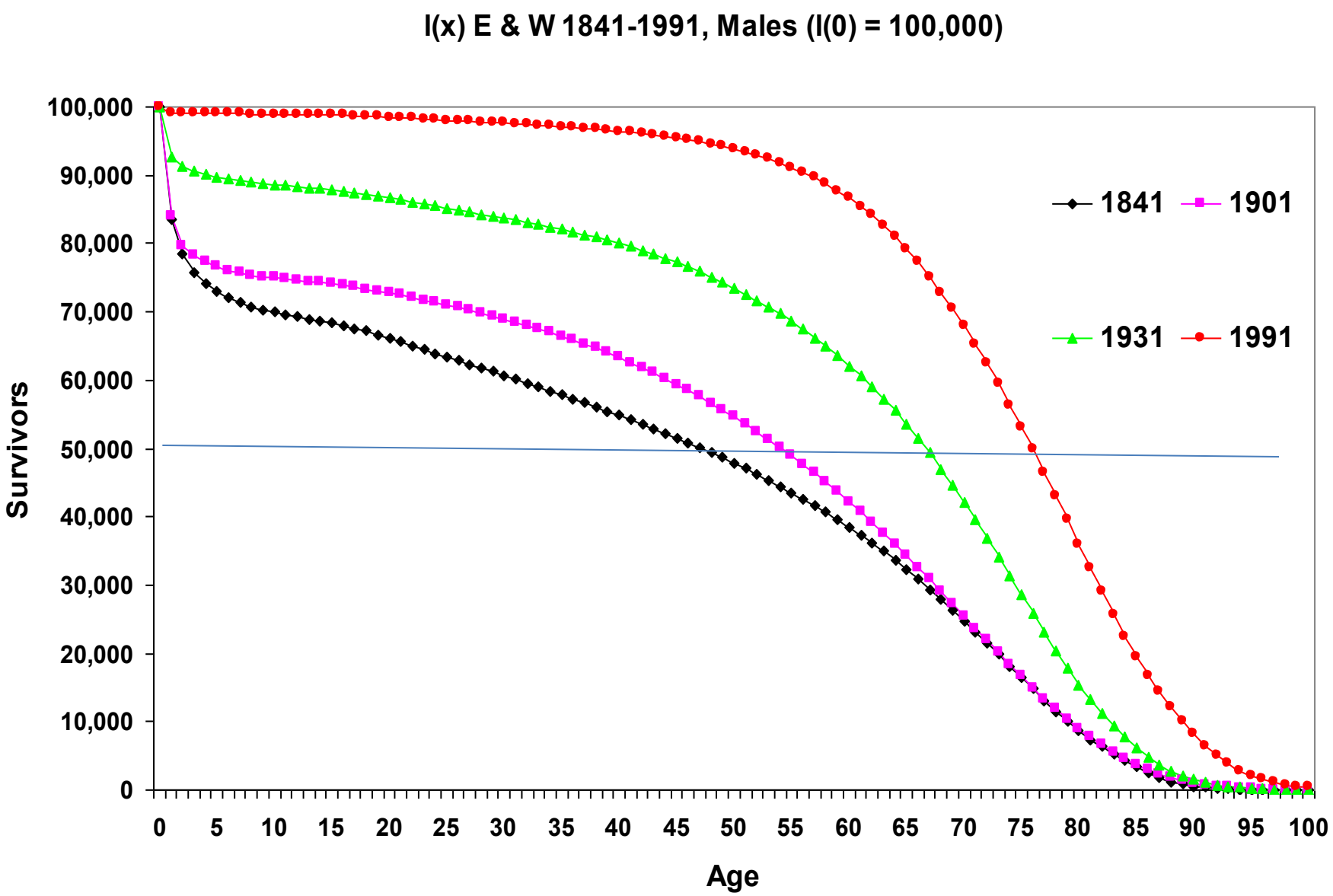
- Very long or dramatic changes are often call “transition”
  - Demographic transition
  - Mortality transition
  - Epidemiological transition
  - Health transition
  - Nutrition transition
  - Societal transitions
  - …
- Often over-simplifications but important concepts

Crude death rates, US, 1900-1997

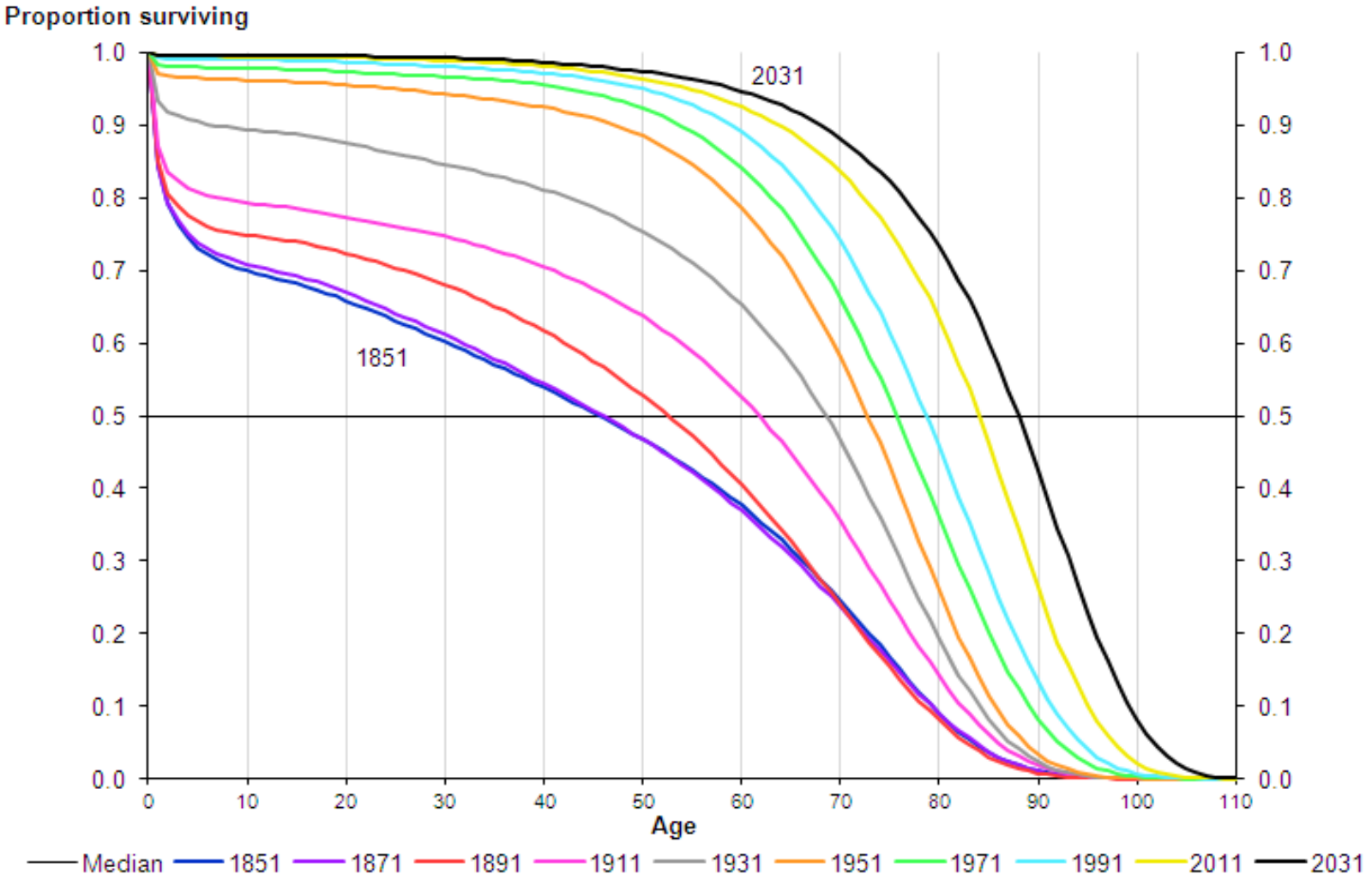


Ausubel, Meyer & Wernick, 2001

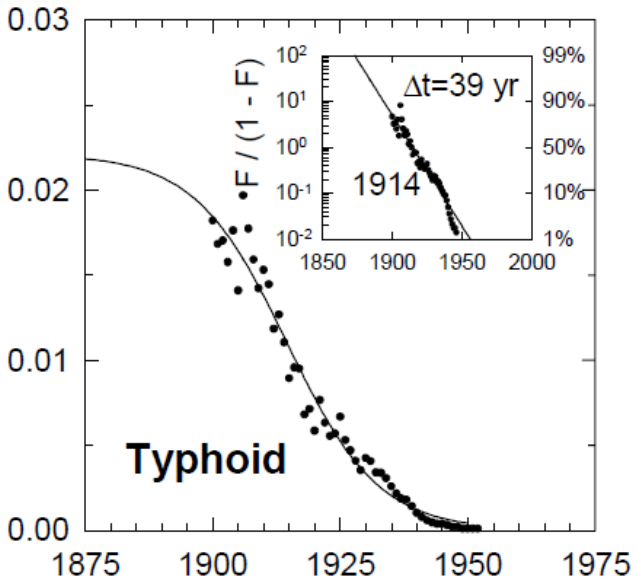
Mortality transition (England & Wales)

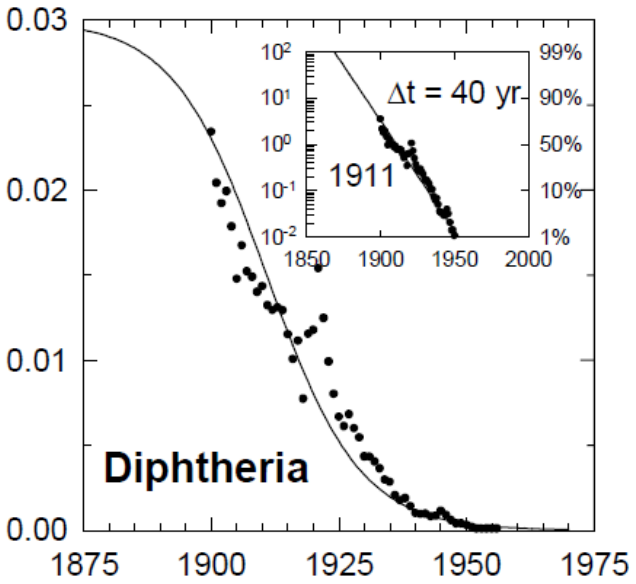


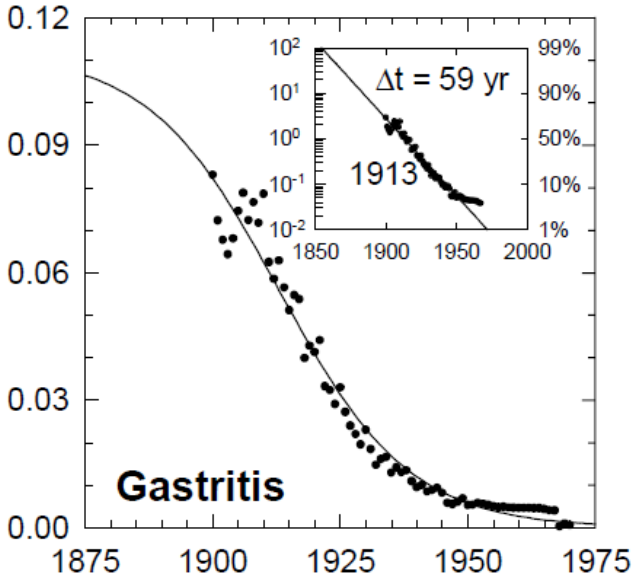
National population projections, UK, 2014

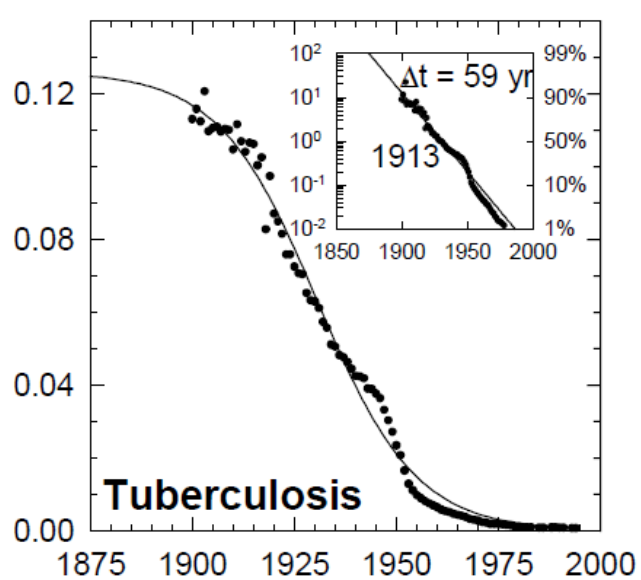


Selected diseases as fraction of all deaths









Ausubel, Meyer & Wernick, 2001

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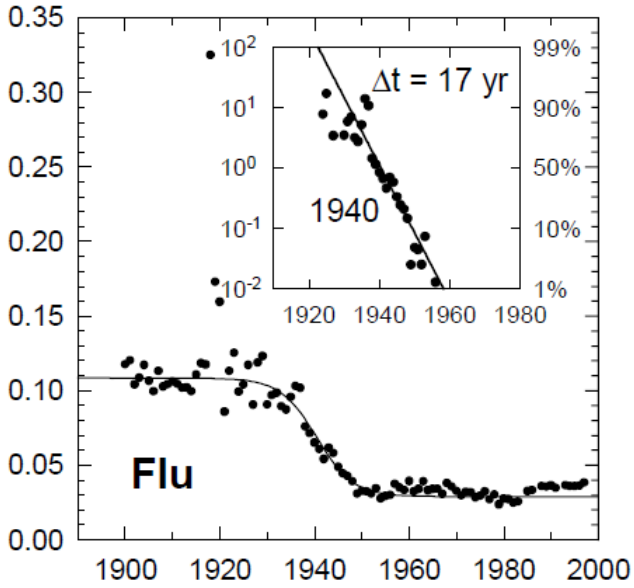
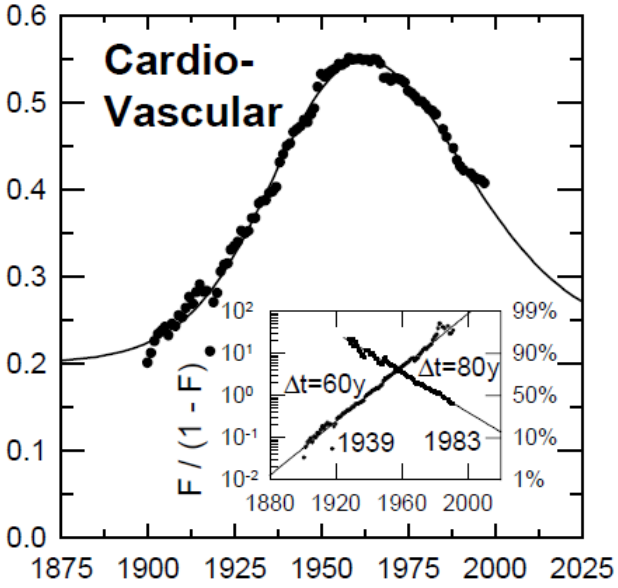
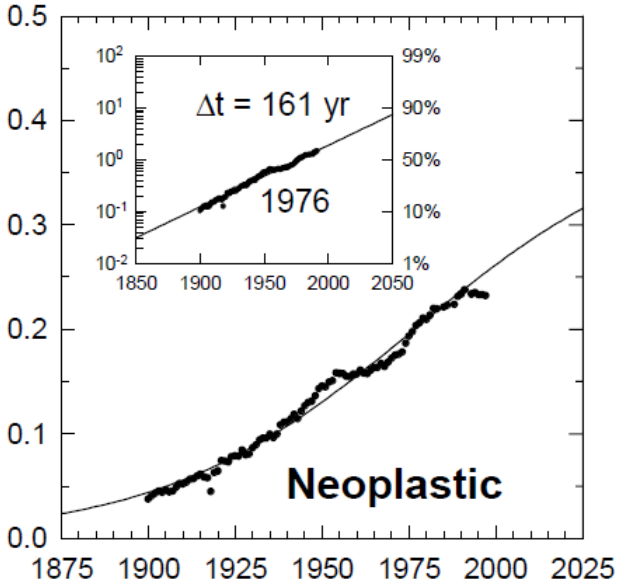
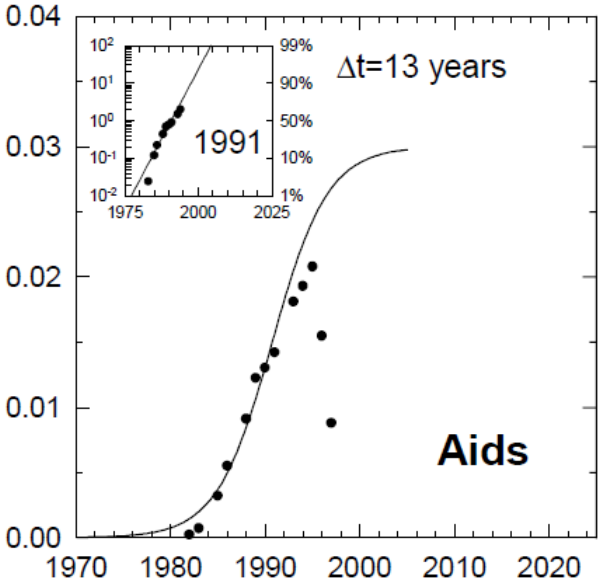


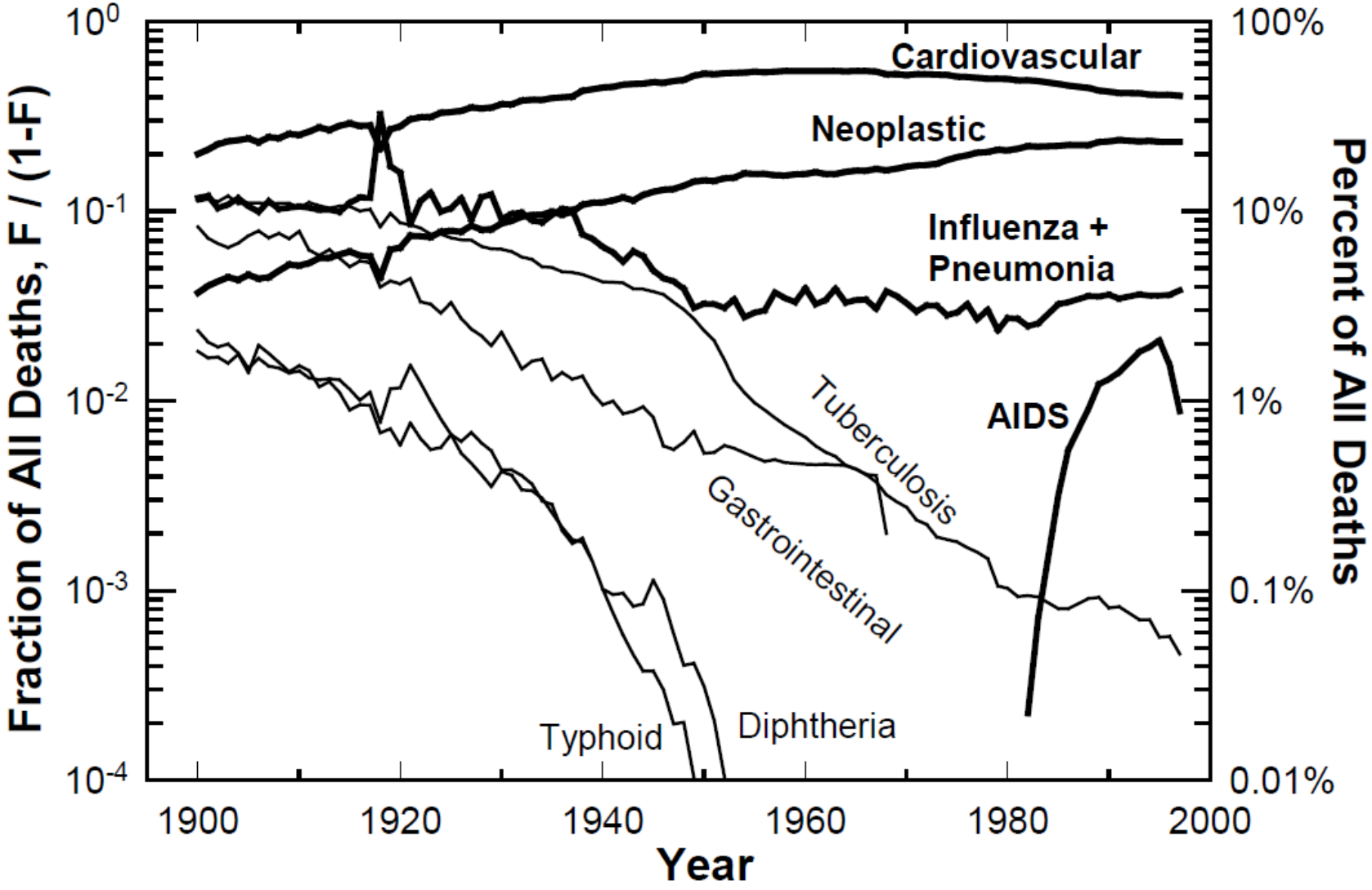






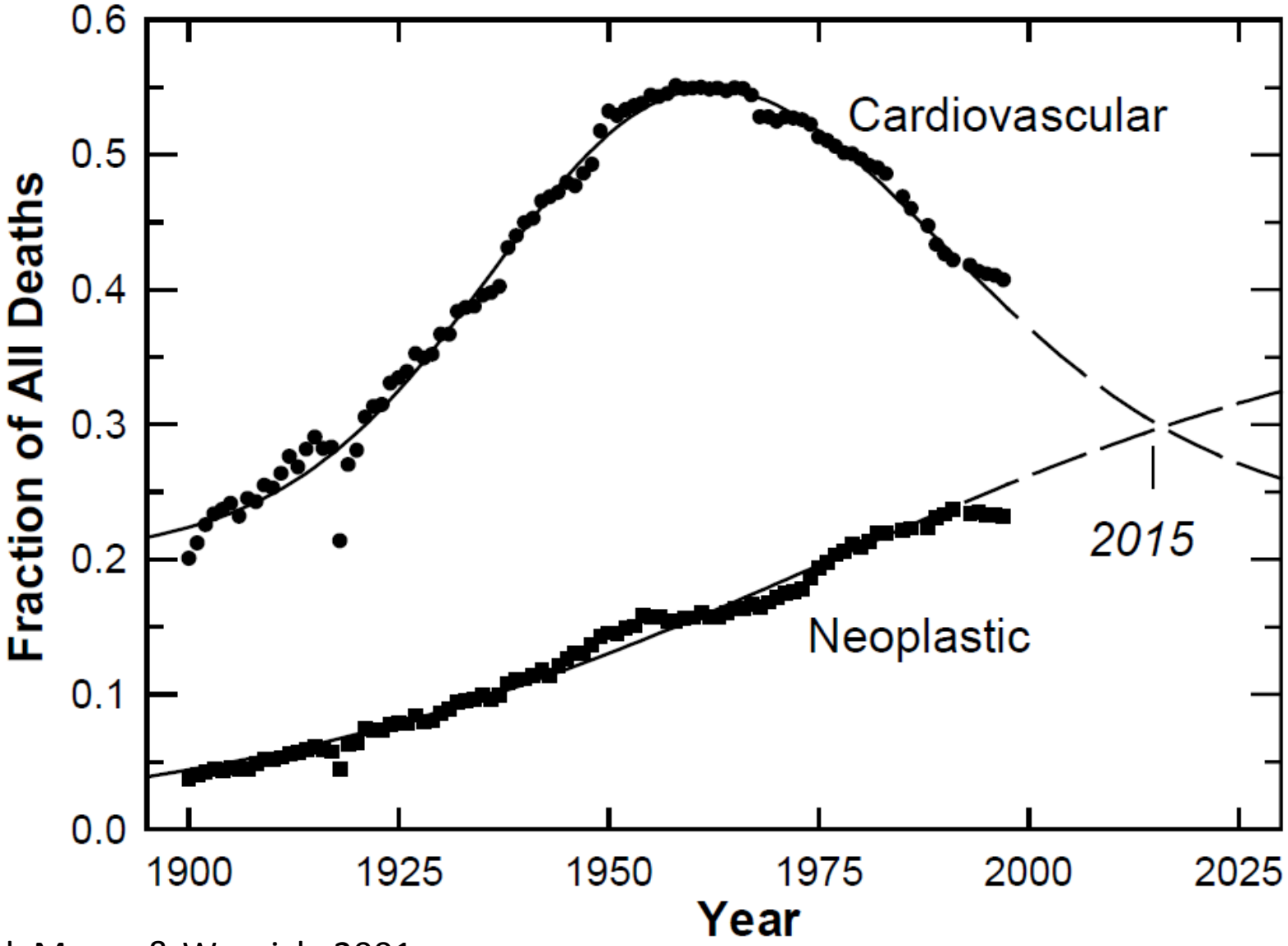
Ausubel, Meyer & Wernick, 2001

Eight killers (% of all deaths)



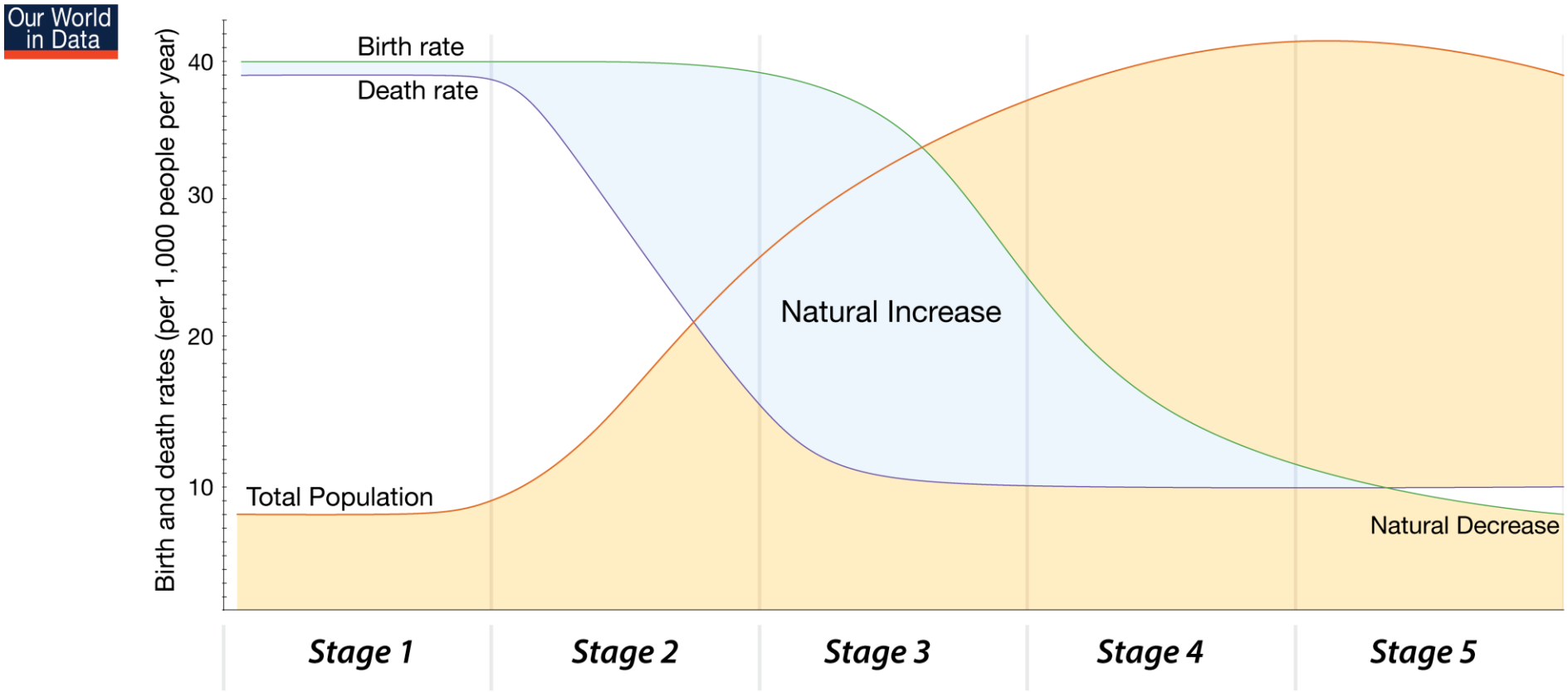
Ausubel, Meyer & Wernick, 2001

Cardiovascular diseases and cancers (% of all deaths)



Ausubel, Meyer & Wernick, 2001

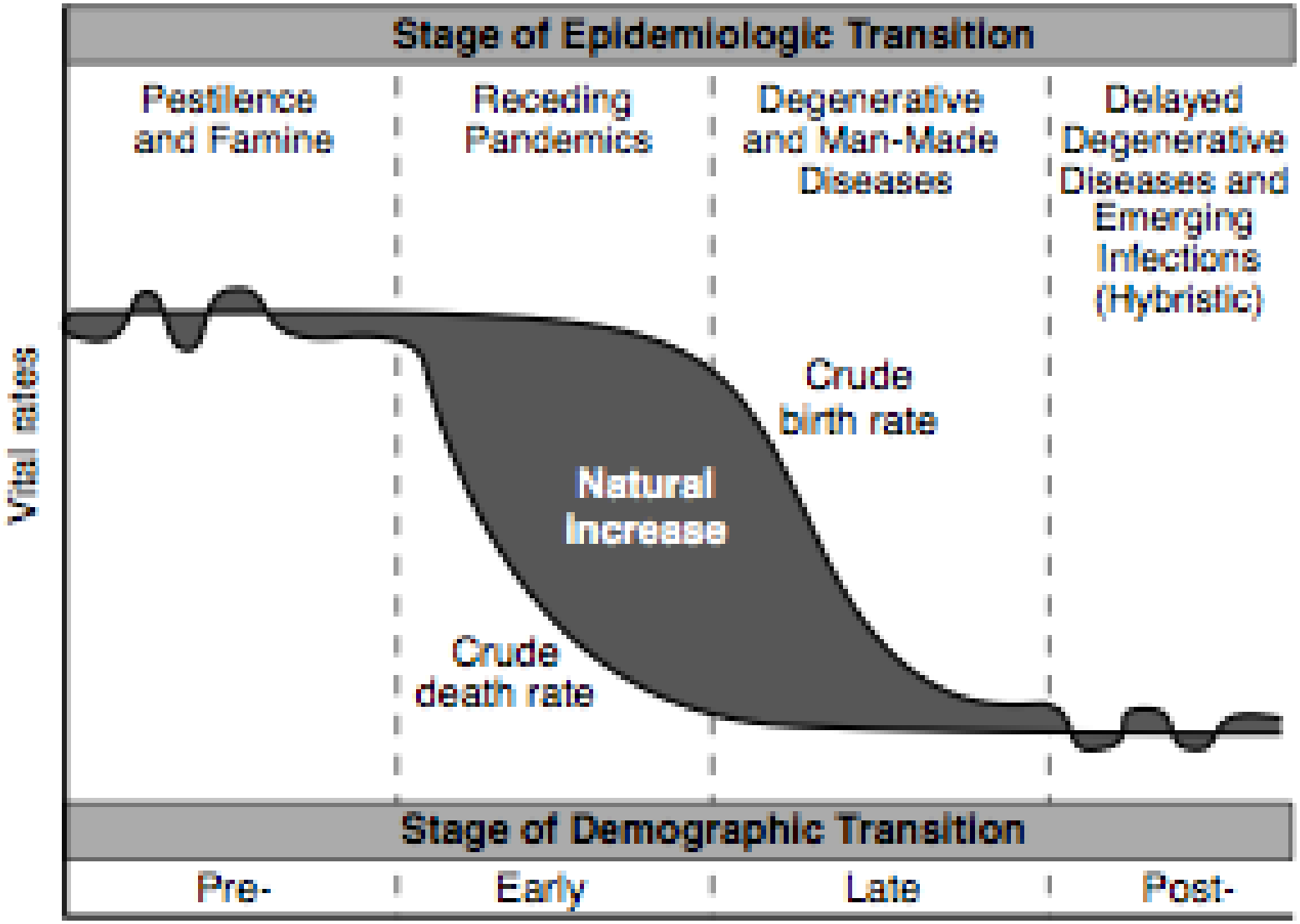
Demographic transition



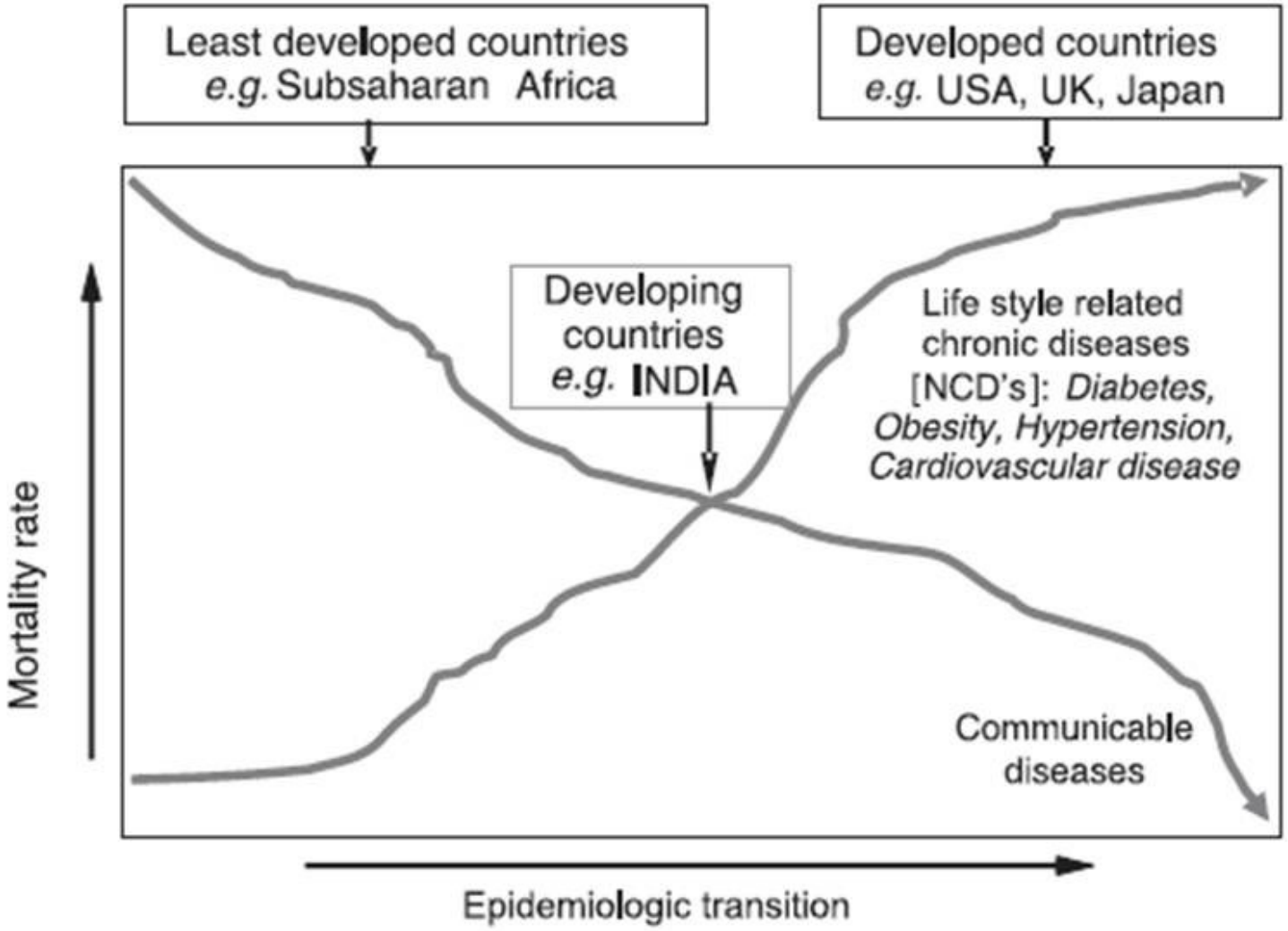
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Birth rate	*High*	*High*	*Falling*	*Low*	*Very low*
Death rate	*High*	*Falls rapidly*	*Falls more slowly*	*Low*	*Low*
Natural increase	*Stable or slow increase*	*Very rapid increase*	*Increase slows down*	*Stable or slow increase*	*Stable or slow decrease*

Figure 2

Demographic/Epidemiologic Transition Framework



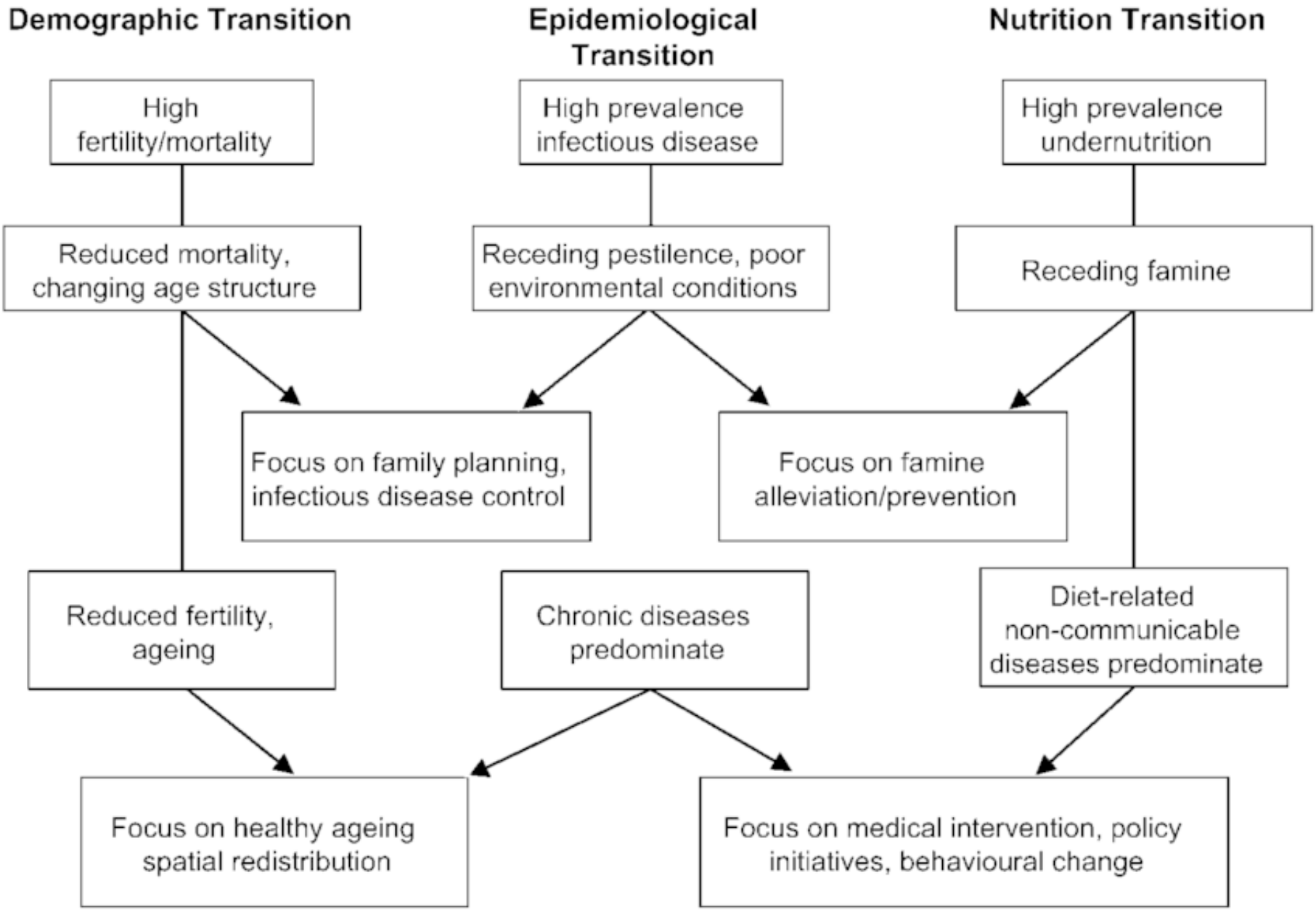
Epidemiologic transition of communicable vs noncommunicable disease



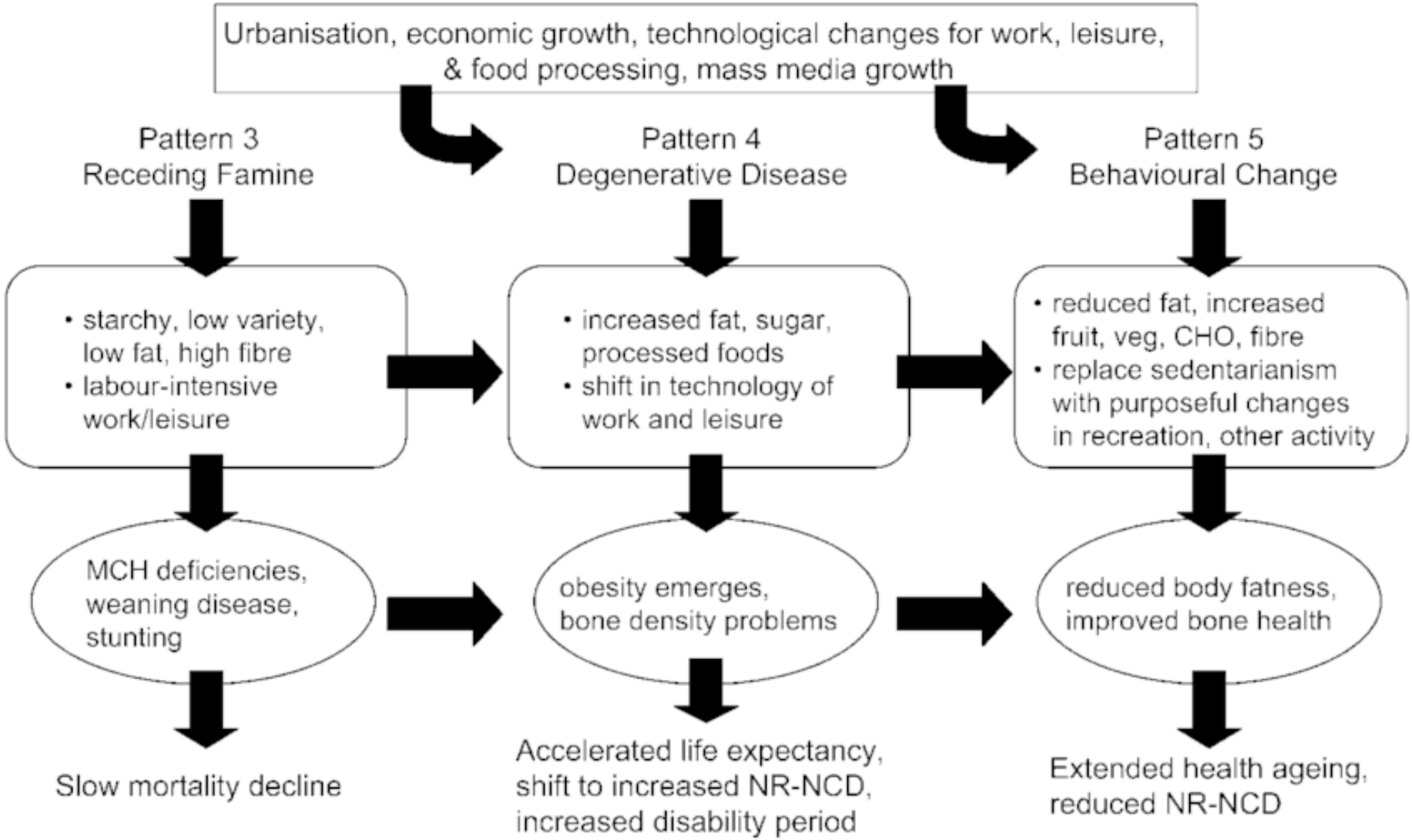
SANOFI DIABETES

INDIAN J MED RES, APRIL 2011

Stages of demographic, health and nutrition change



Stages of the nutrition transition



Popkin, PHN 2002

Question:

Does longer / better life make people happier?

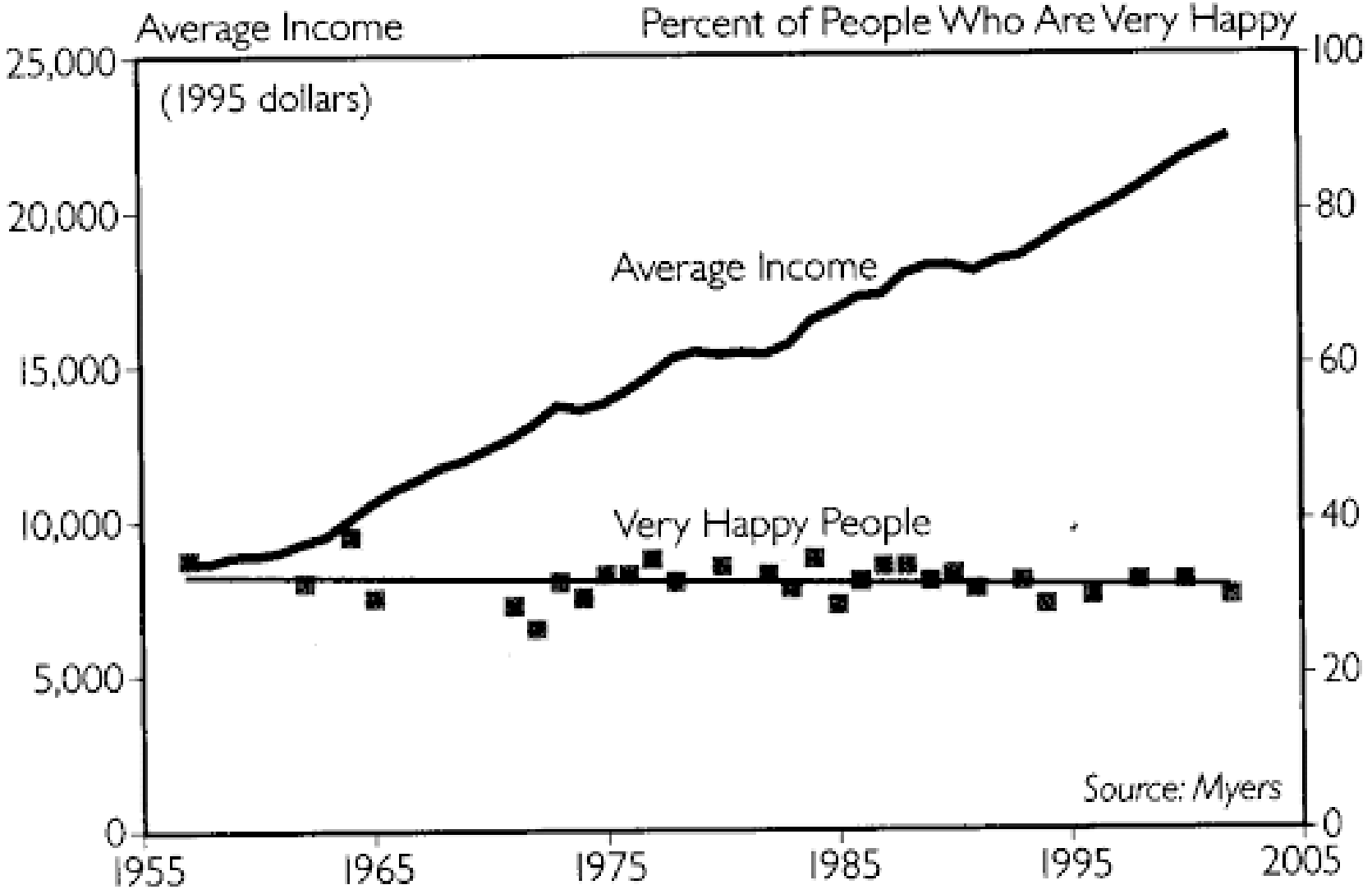


Figure 8–1. Average Income and Happiness in the United States, 1957–2002

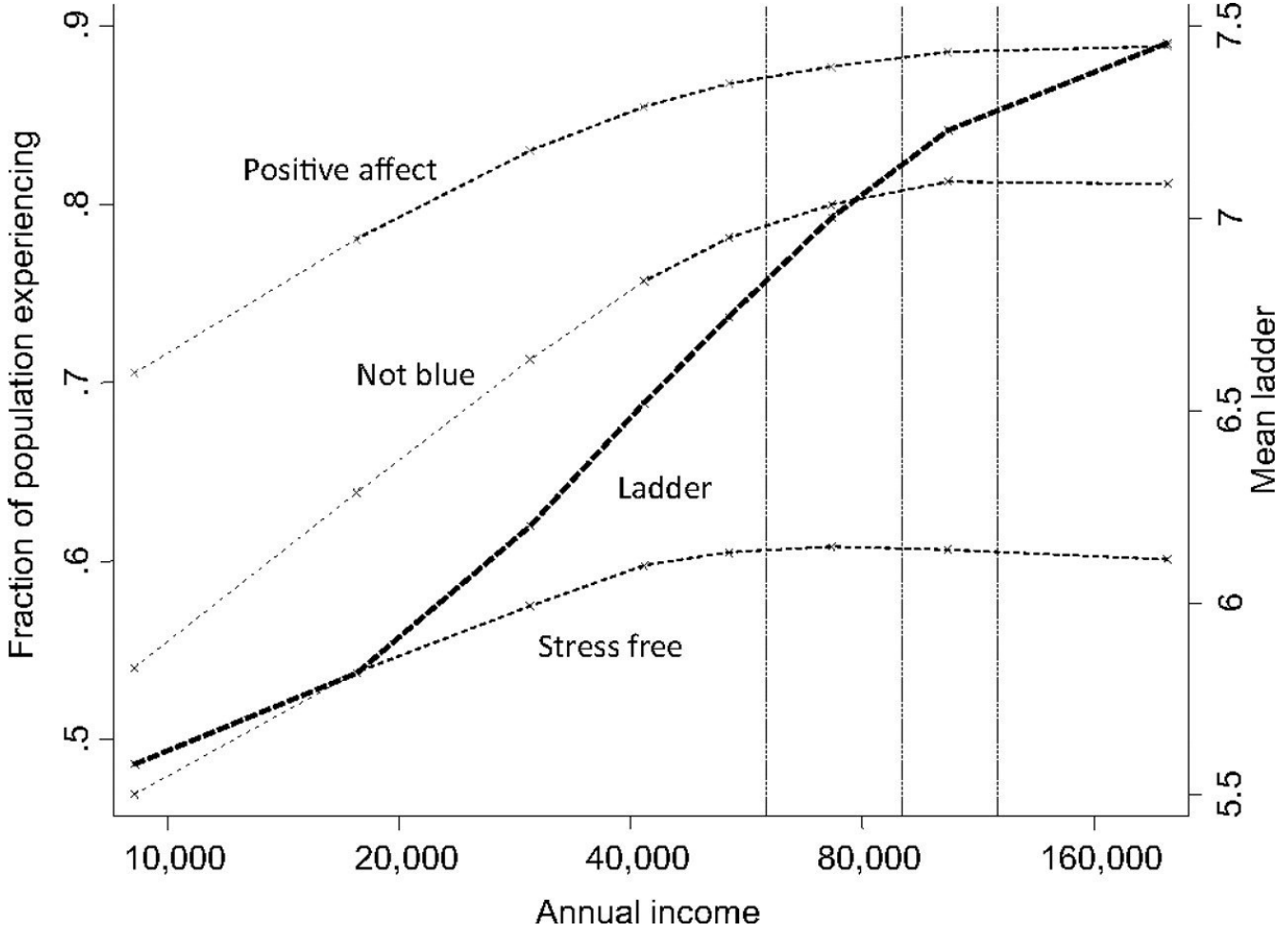
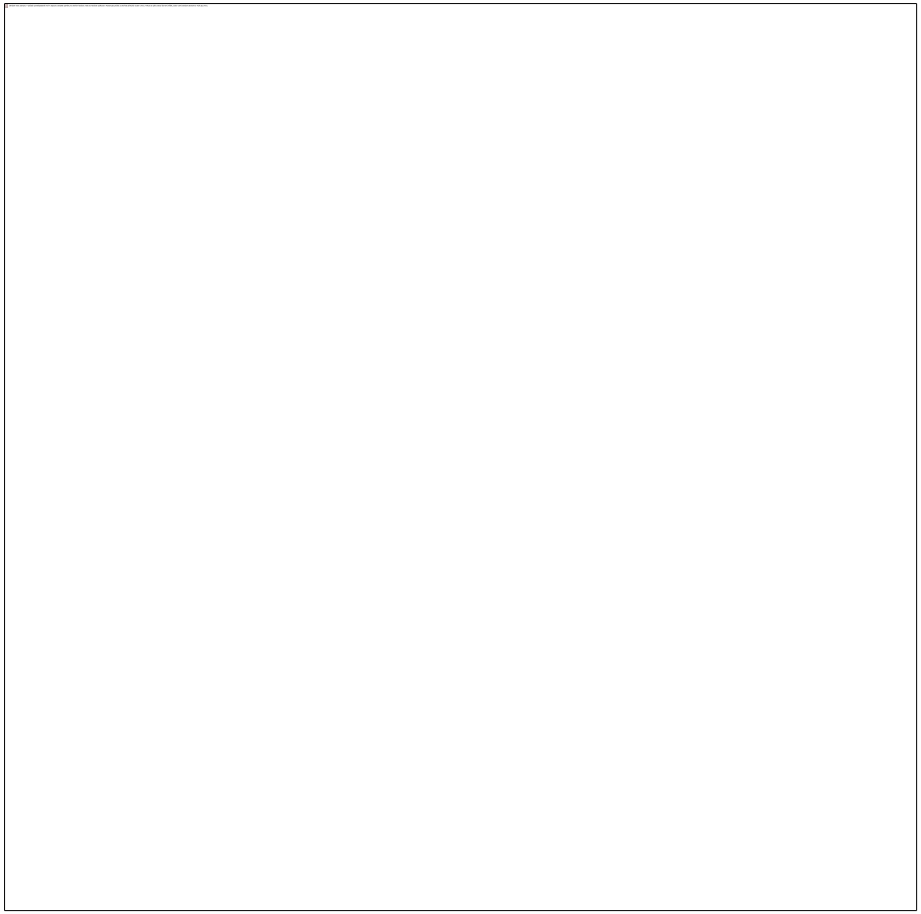


Figure 1 from Kahneman, D., & Deaton, A. (2010). High income improves evaluation of life but not emotional well-being. *Proceedings of the National Academy of Sciences*, *107*(38), 16489-16493.



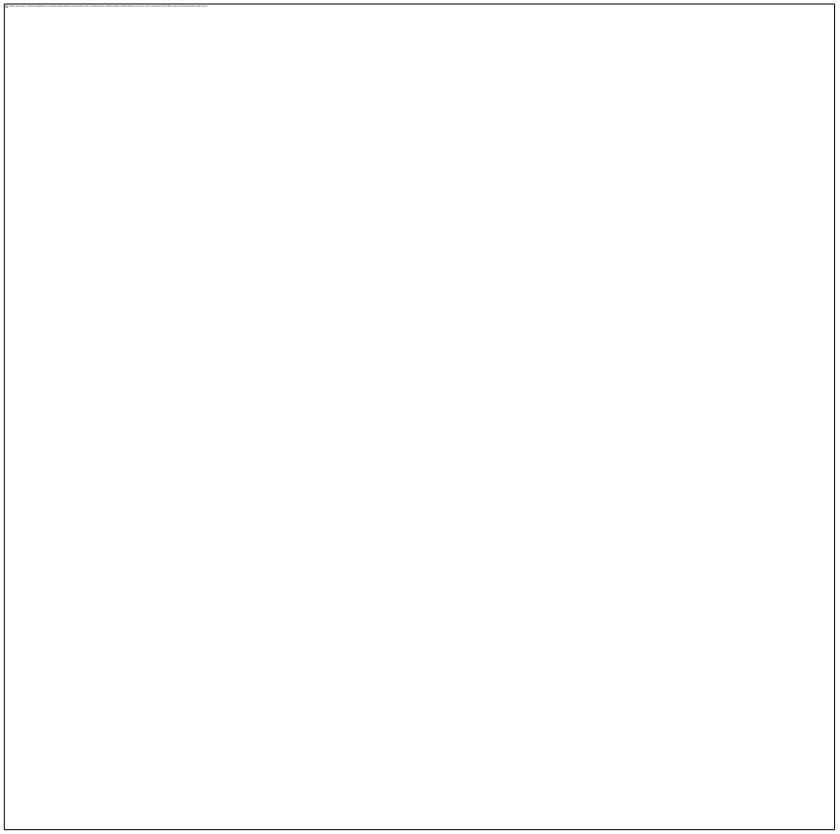


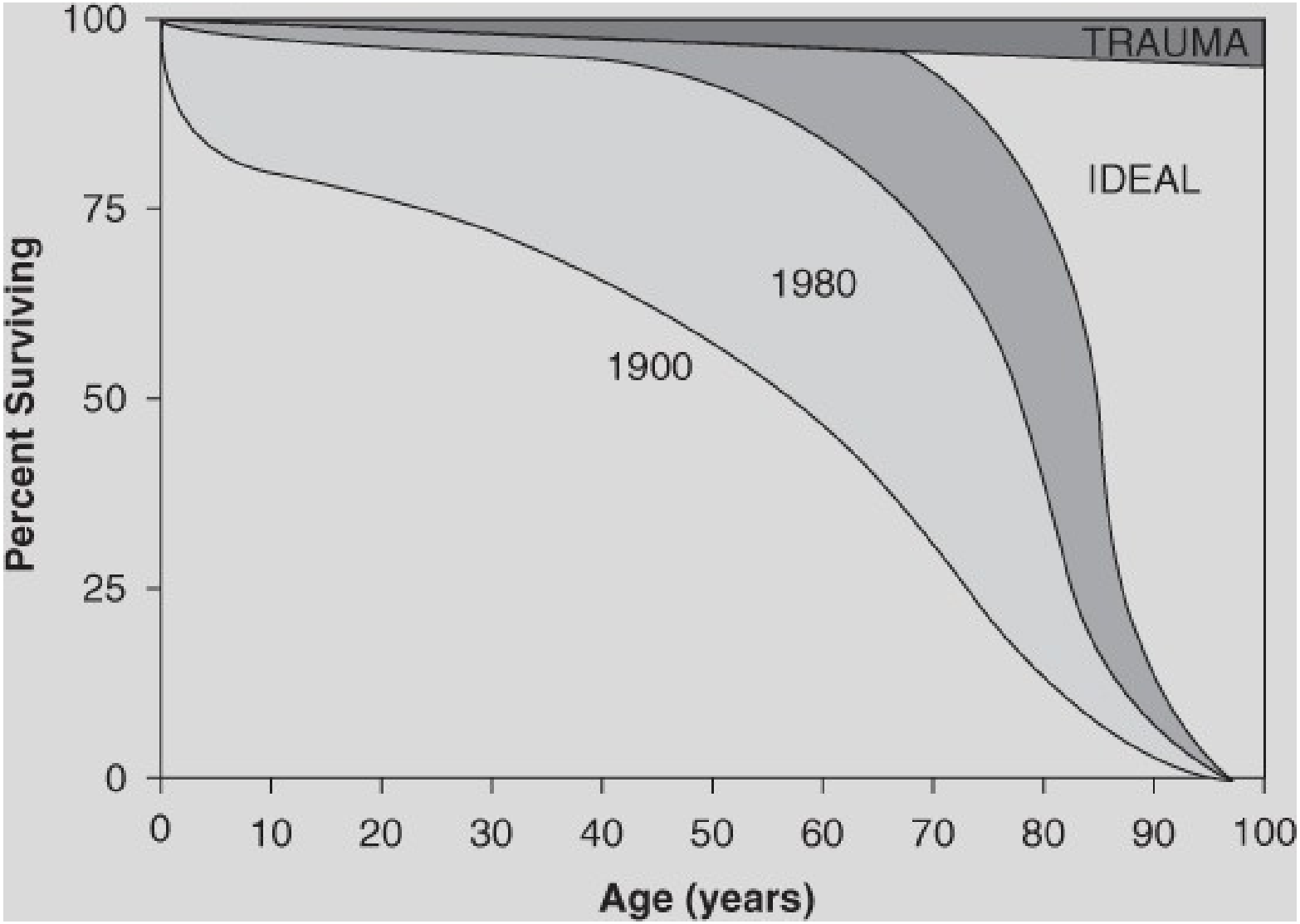
Figure 1 and 2 from Killingsworth, M. A. (2021). Experienced well-being rises with income, even above $75,000 per year. *Proceedings of the National Academy of Sciences*, *118*(4).

Mortality & morbidity compression

Mortality / morbidity compression

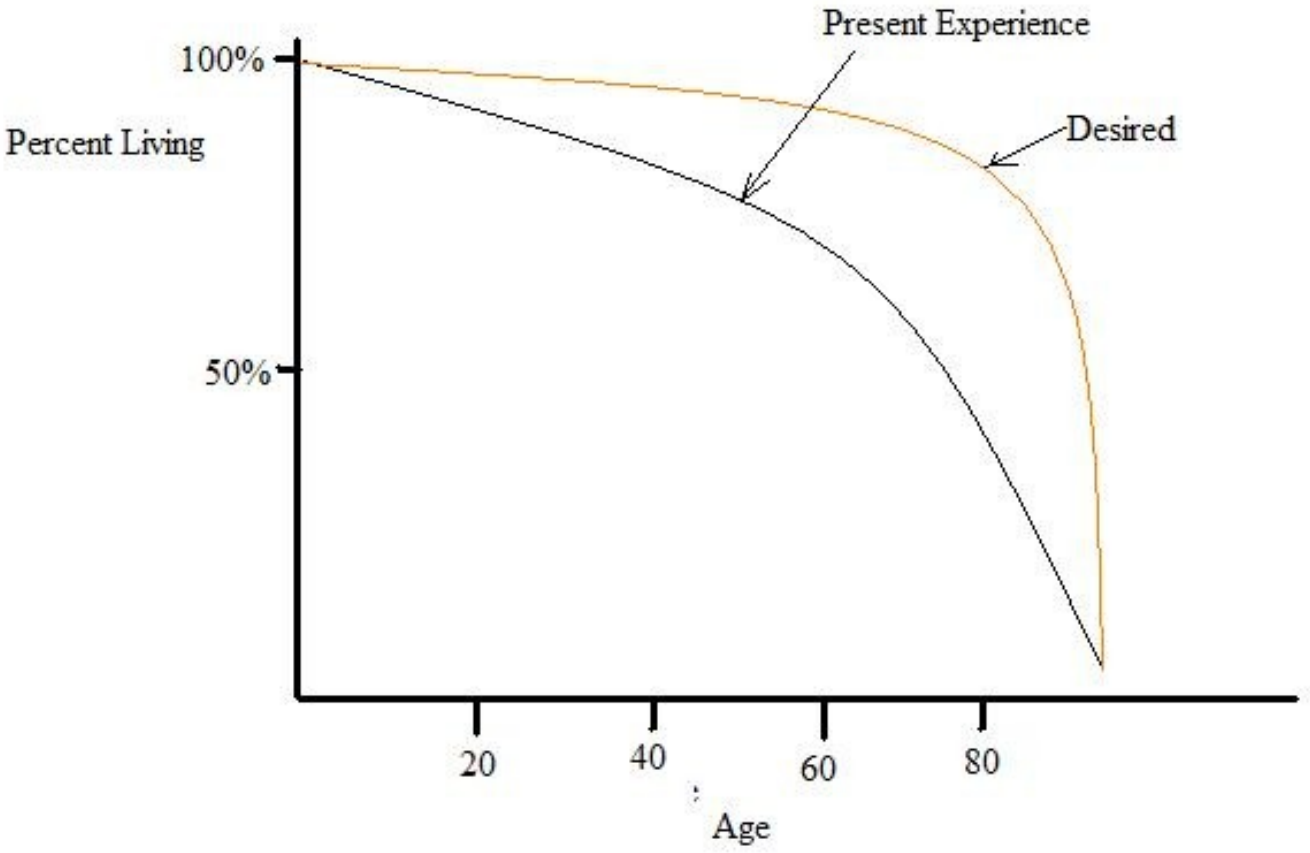
- Concepts closely related to demographic and epidemiological transitions
- Also related to population ageing
- Mortality compression ("rectangularisation")
  - It is important how long people live (assuming a maximum biological limit to life span)
- Morbidity compression
  - As people age, they develop a range of illnesses and disabilities
  - It is important how long people live in good health

Long term changes in survival



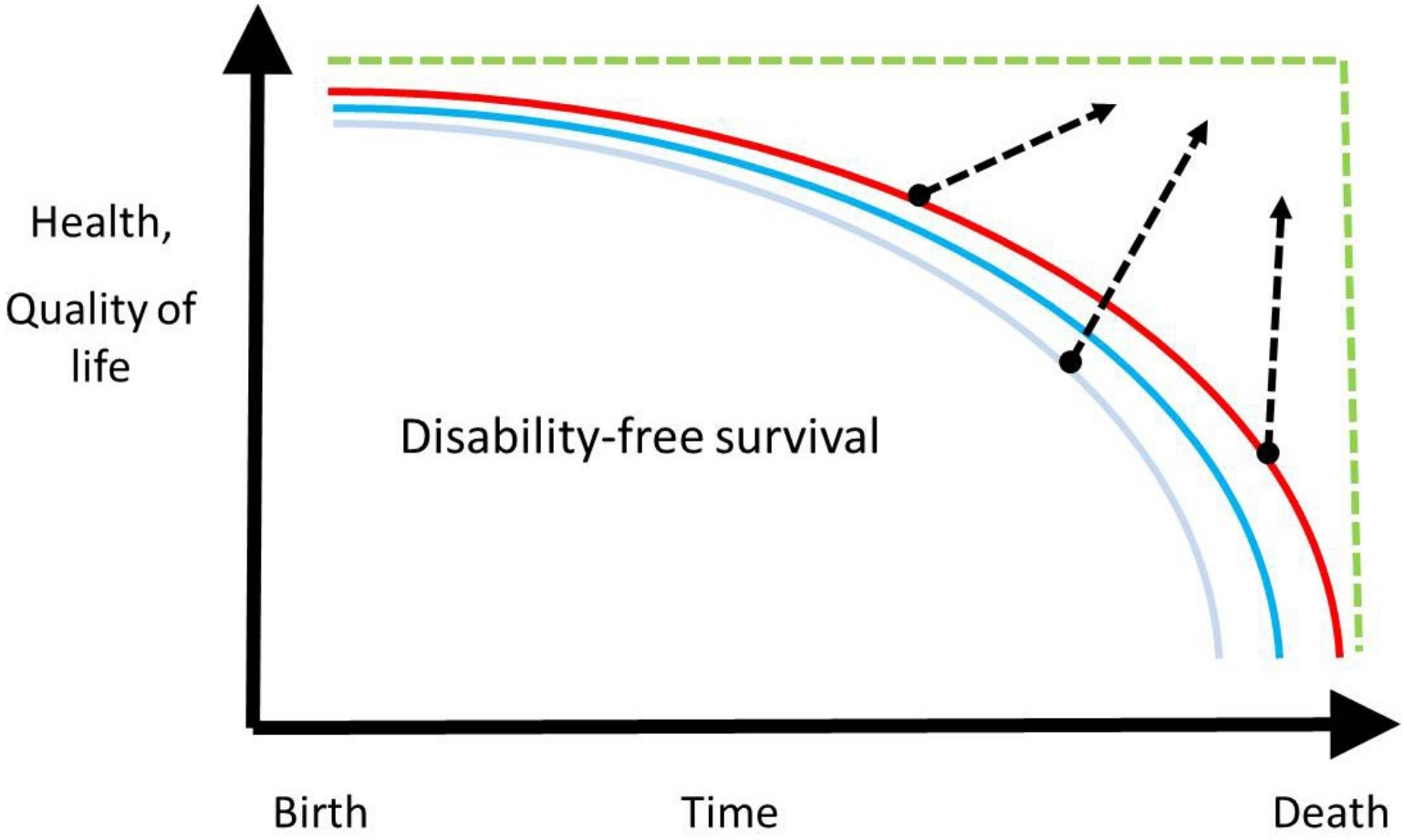
Rectangularisation

(pulling the survival curve to the upper right corner)

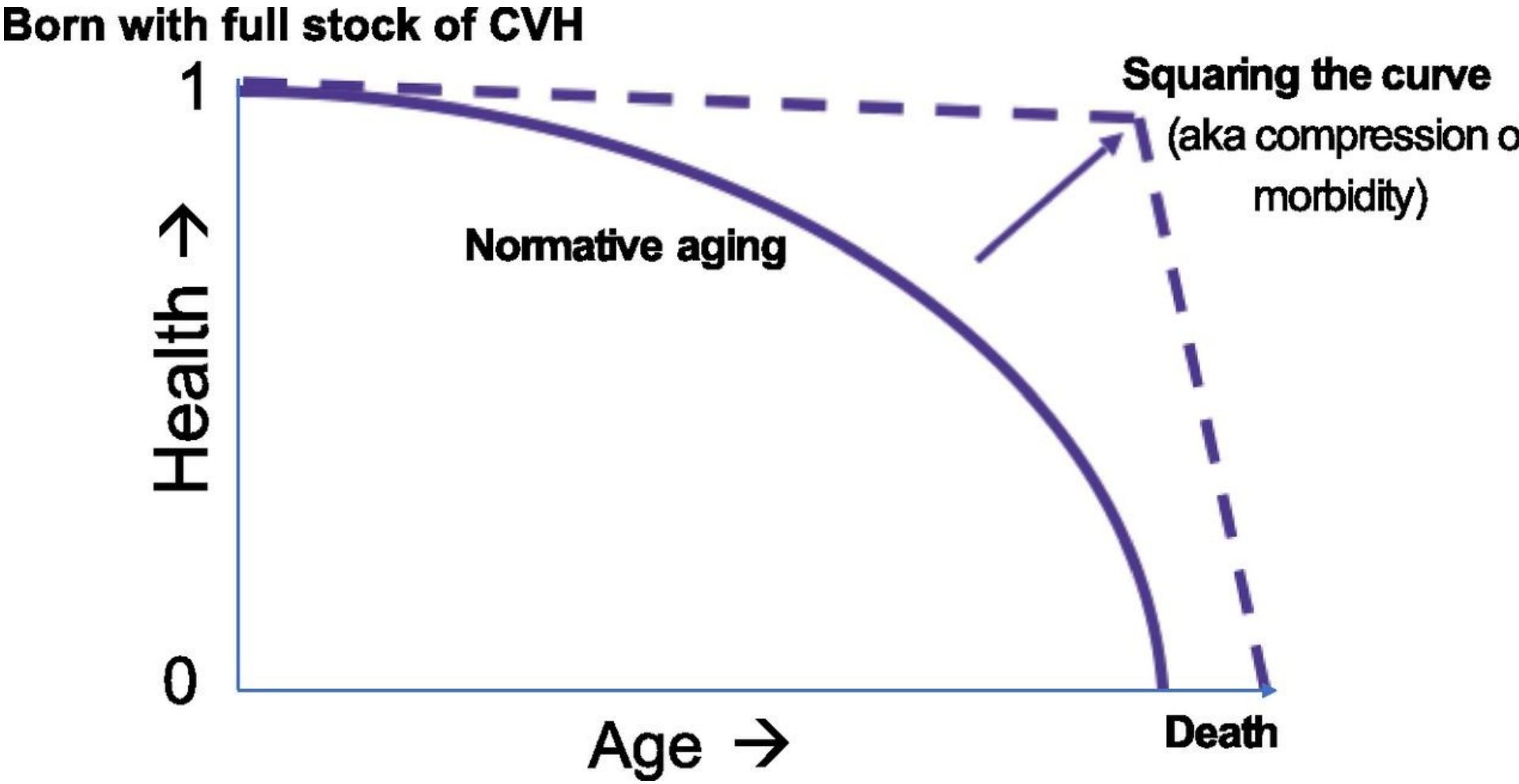


Morbidity compresson

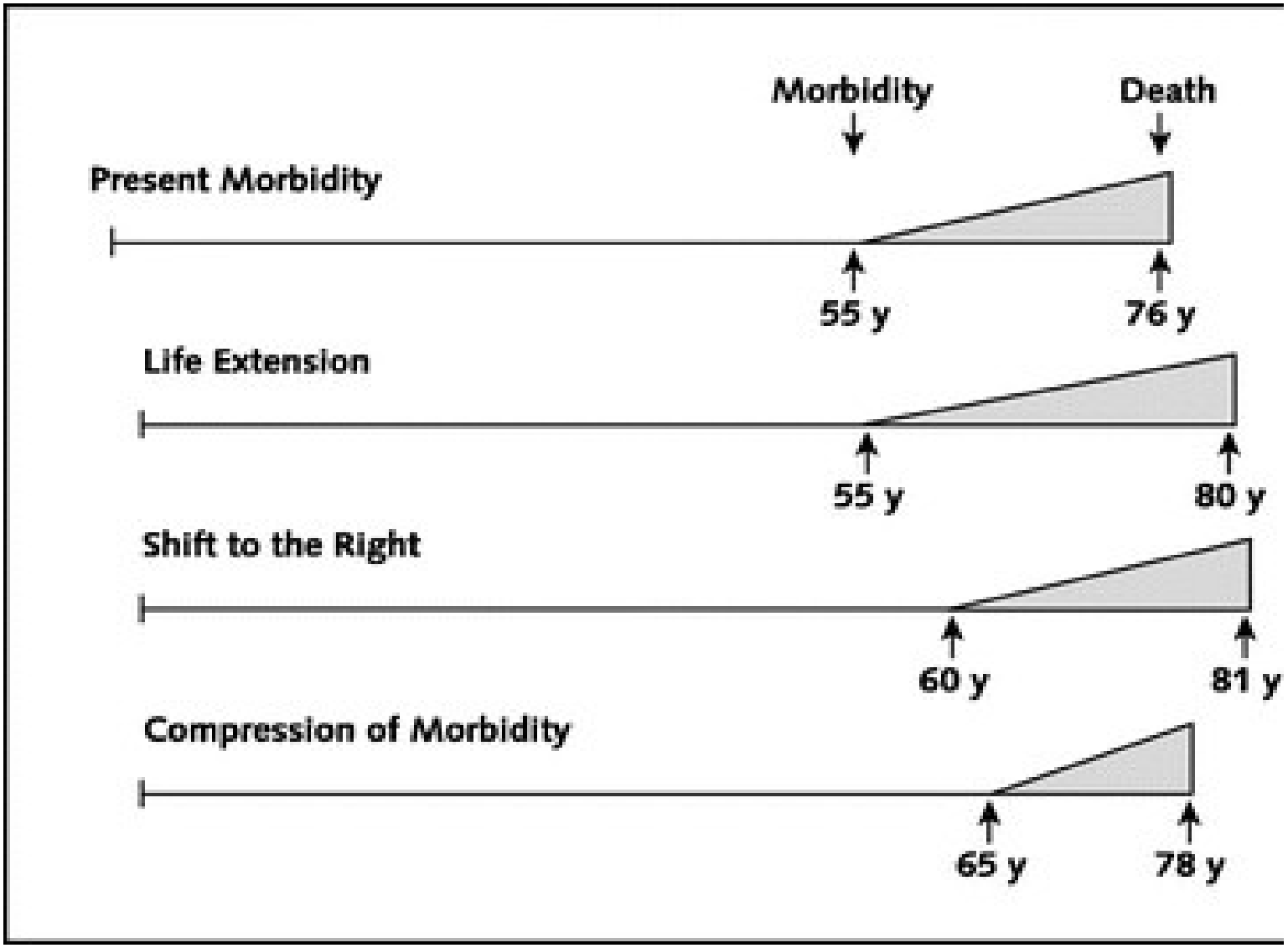
Pulling the *disability-free* survival to the upper right corner



The red line represents a survival curve for a population. The blue lines represent varying levels of disability among survivors. Squaring the curve implies shifting these lines up and to the right, towards the green line, which represents the hypothetical population health limit.


Born with full stock of CVH
1
Health →
0
Squaring the curve
(aka compression o
morbidity)
Normative aging
Age →
Death

Compression of morbidity scenarios



Morbidity compression

- Is it happening?
- Evidence is inconsistent
  - Some studies suggest life extension but no morbidity compression (living longer but also longer with disability)
  - Some studies suggest relative compression (shift to the right)
  - Some studies suggest absolute compression
  - Depending on definition of “morbidity” / “disability”

Summary

- Secular trends = long-term changes
- Demographic transition (centuries)
  - Mortality & fertility changes
- Epidemiological transition
  - Reflects risk factors, different types of diseases
- Morbidity compression
  - Related to population ageing, improvements in health, clinical care, technology