Mind the Gap: A Study of Causal Mortality by Socio-Economic Circumstances

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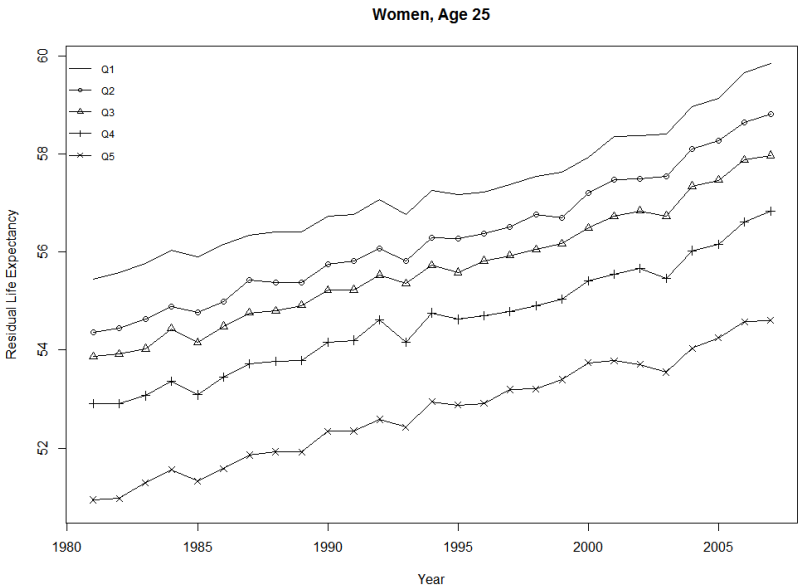
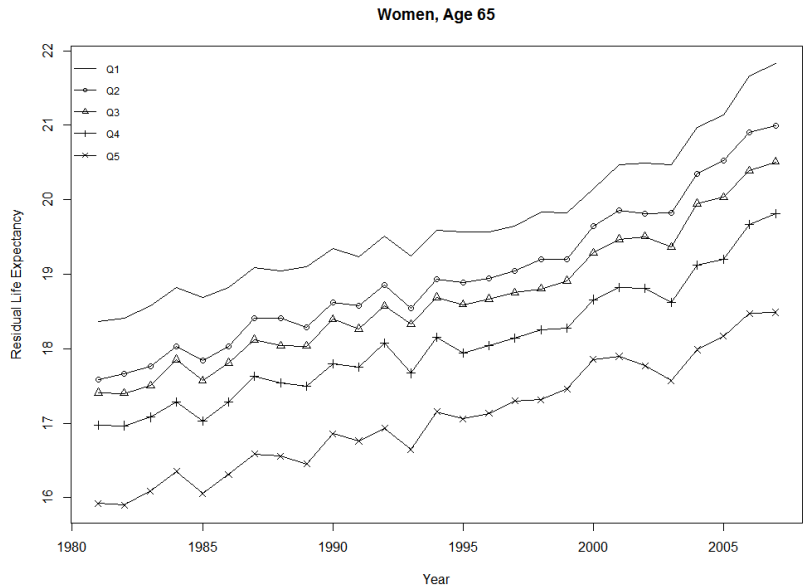
Recent observations

Differences in life expectancy between the lowest and the highest socioeconomic categories have widened over past decades in several countries (Brønnum-Hansen and Baadsgaard [2012]).

Recent observations



(a) Age 25

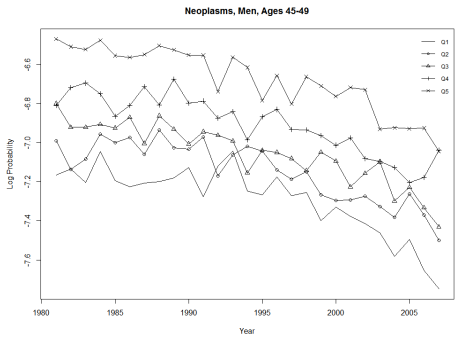


(b) Age 65

Figure: Life expectancy, England, females

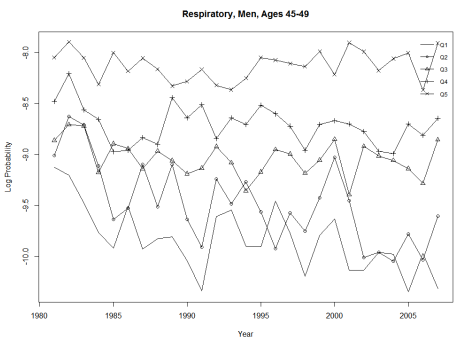
Recent observations

(a) Circulatory system

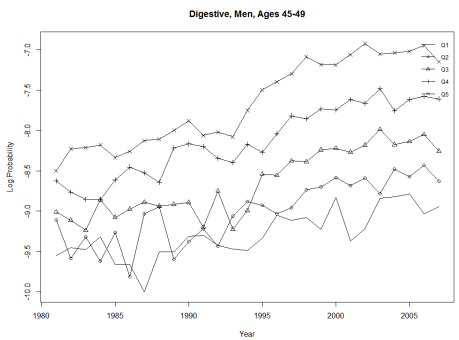


(b) Neoplasms

(c) External



(d) Respiratory



(e) Digestive

(f) Other

Figure: Log-mortality over time, England, males

Aim

What? Develop a tool that would help policy decisions aiming at reducing differences in life expectancy between socioeconomic categories.

How? By developing a model which takes into account the main causes of death for each socioeconomic category.

Key questions:

→ Which scenario of cause-elimination would help to reduce the gap?

→ Which scenario of cause-elimination would help to close the life expectancy gap while achieving the highest overall increase in life expectancy across the society?

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Data

- 1981-2007, England by socioeconomic circumstances (SEC) quintiles.
  → Mortality counts from ONS.
  → Population estimates from Dr Paul Norman, Leeds University.
- Inequalities by SEC: census areas grouped into quintiles by increasing deprivation (IMD 2007)
  → Q1 = least deprived.
  → Q5 = most deprived.
- Causes-of-Death (CoD) - adjusted for ICD change using ONS bridge coded dataset 1999: diseases of the circulatory system; neoplasms; diseases of the respiratory system; external causes; digestive causes; other.

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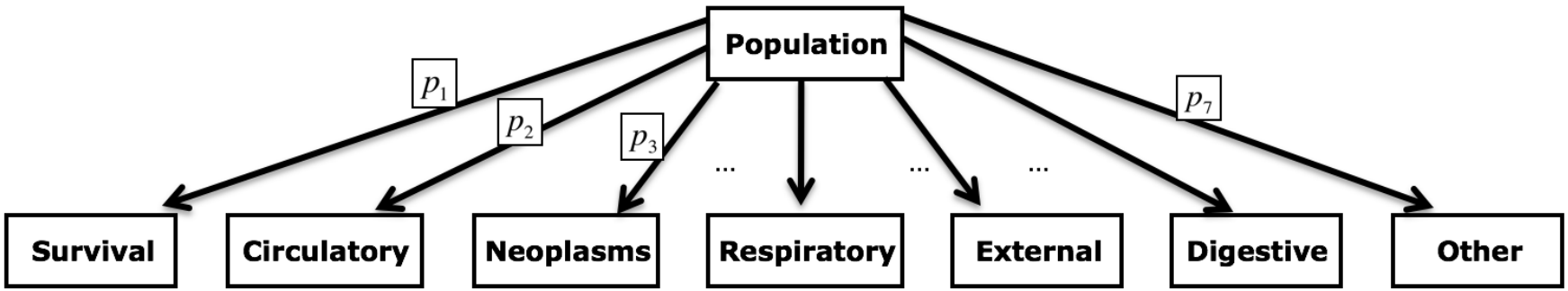
Multinomial logit models



- Typically used for a response with several unordered categories (Alai et al. [2015]).

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Which scenario of cause-elimination would help to reduce the gap?

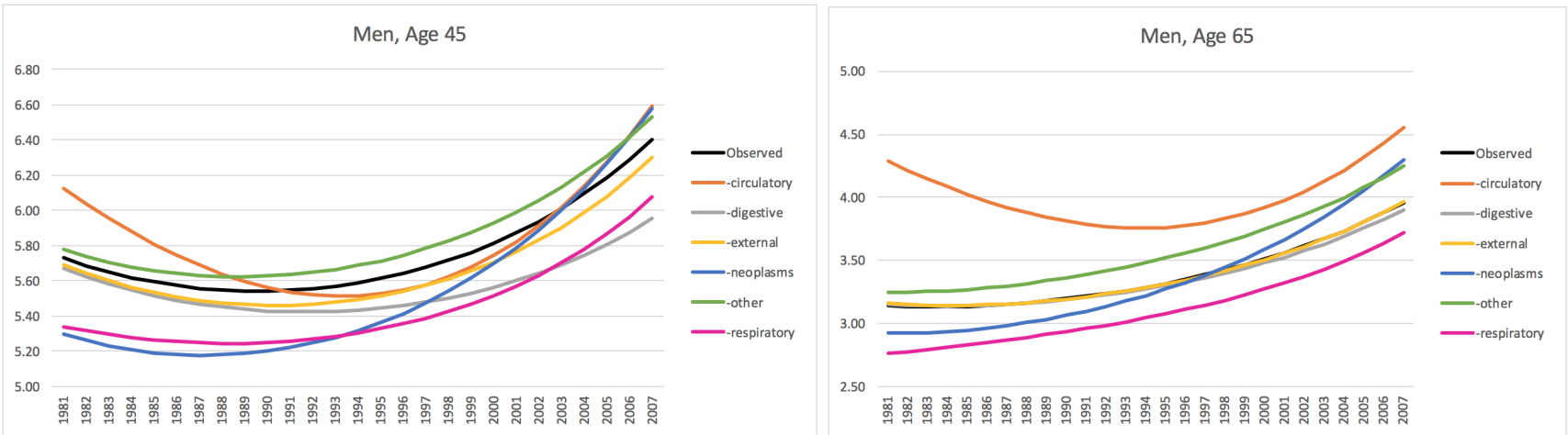

Figure: Gaps in life expectancy between the highest and lowest socio-economic categories, England, males, ages 45 and 65

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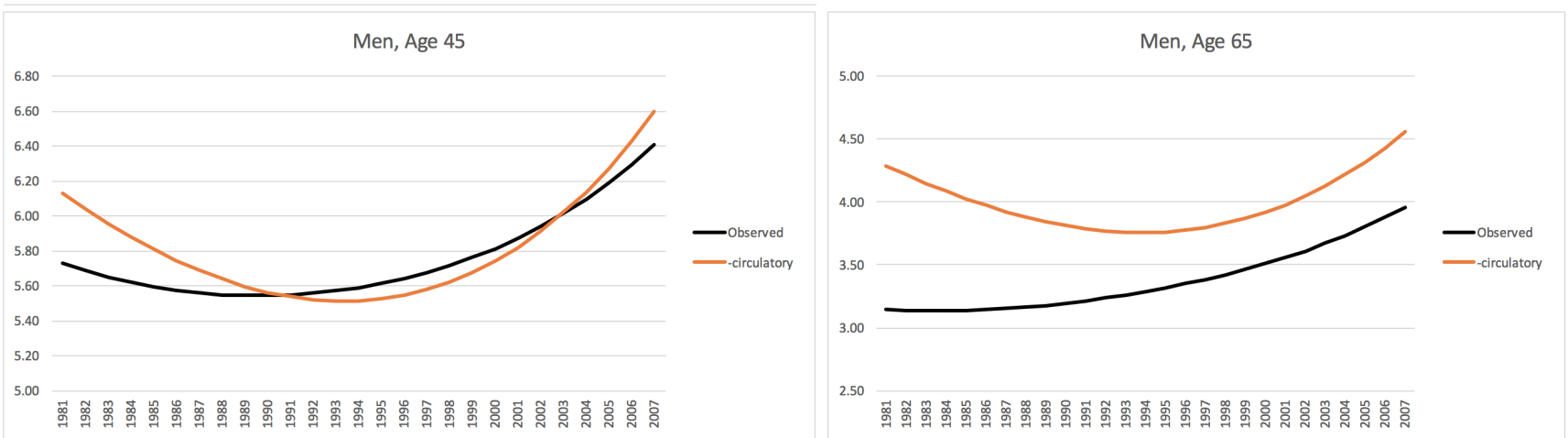

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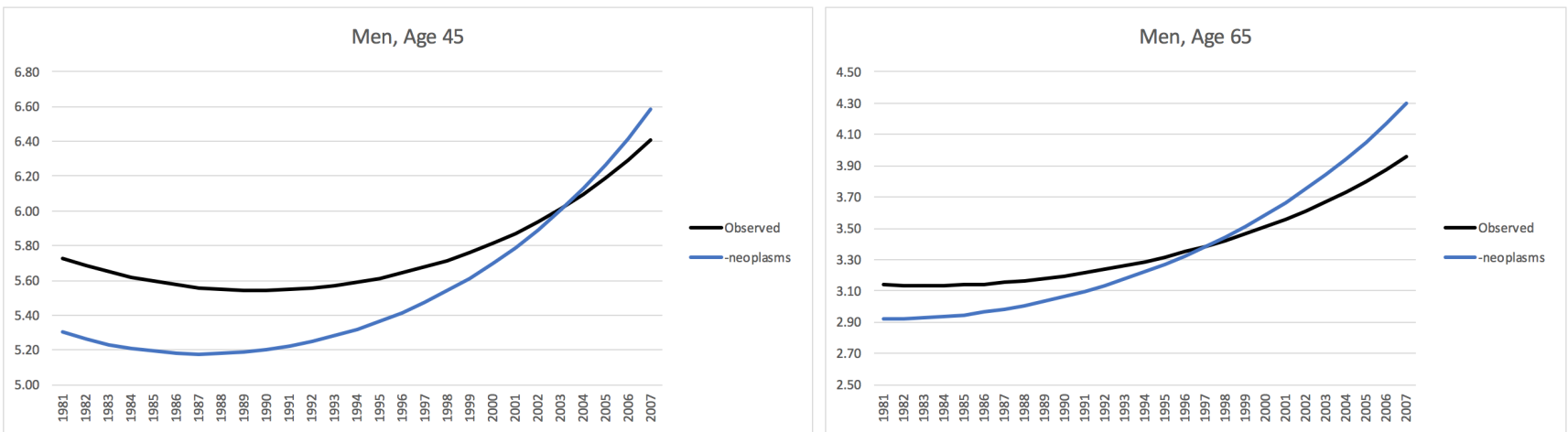

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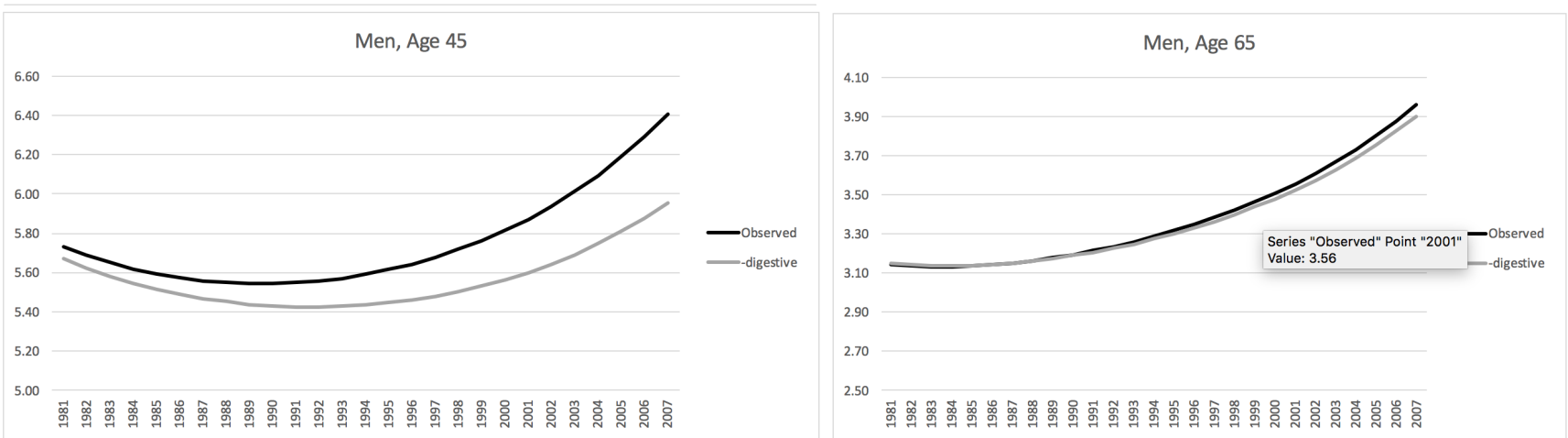

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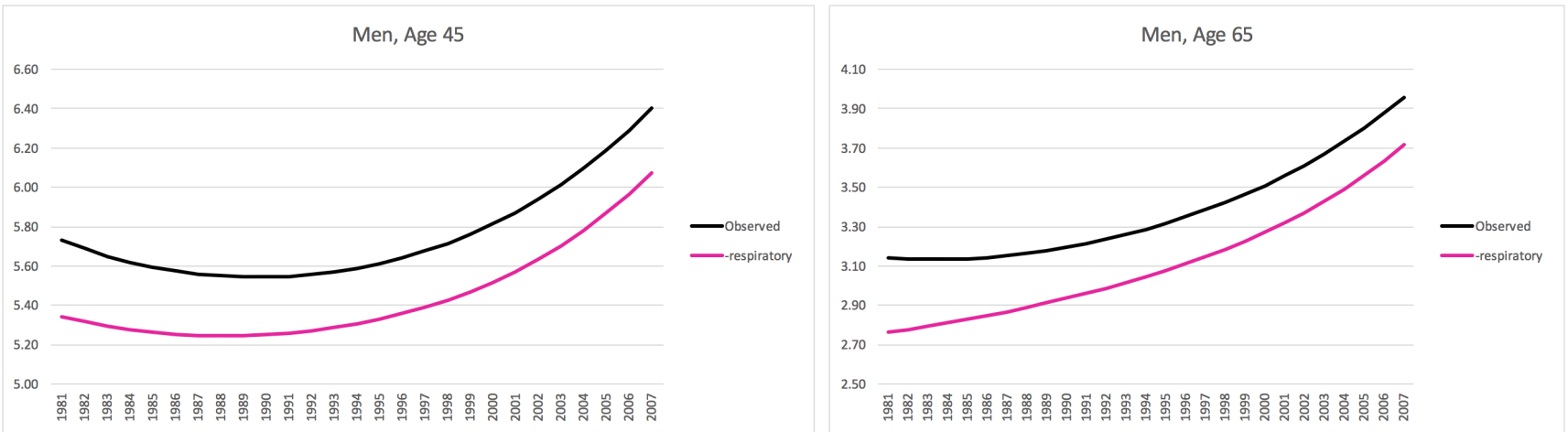

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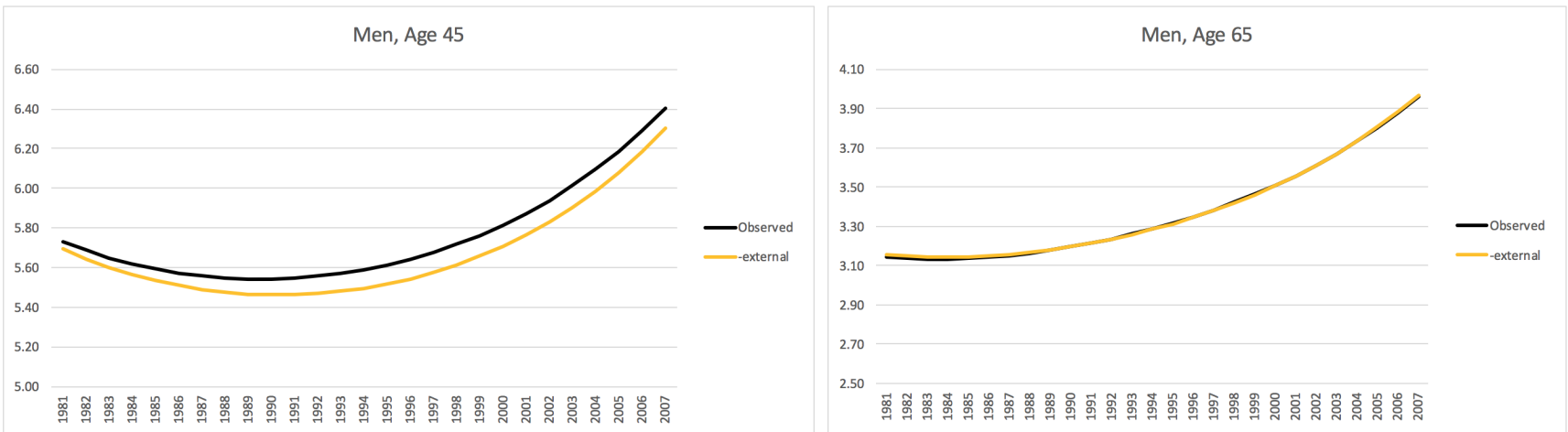

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Which scenario of cause-elimination would help to close the life expectancy gap while achieving the highest overall increase in life expectancy across the society?

WHO NCD Global Monitoring Framework 2025 target: Overall reduction in premature mortality by 25%, from cardiovascular disease, chronic respiratory disease, diabetes and neoplasms.

$\rightarrow$ Is it the optimal strategy?

$\rightarrow$ Multi-objective optimisation approach

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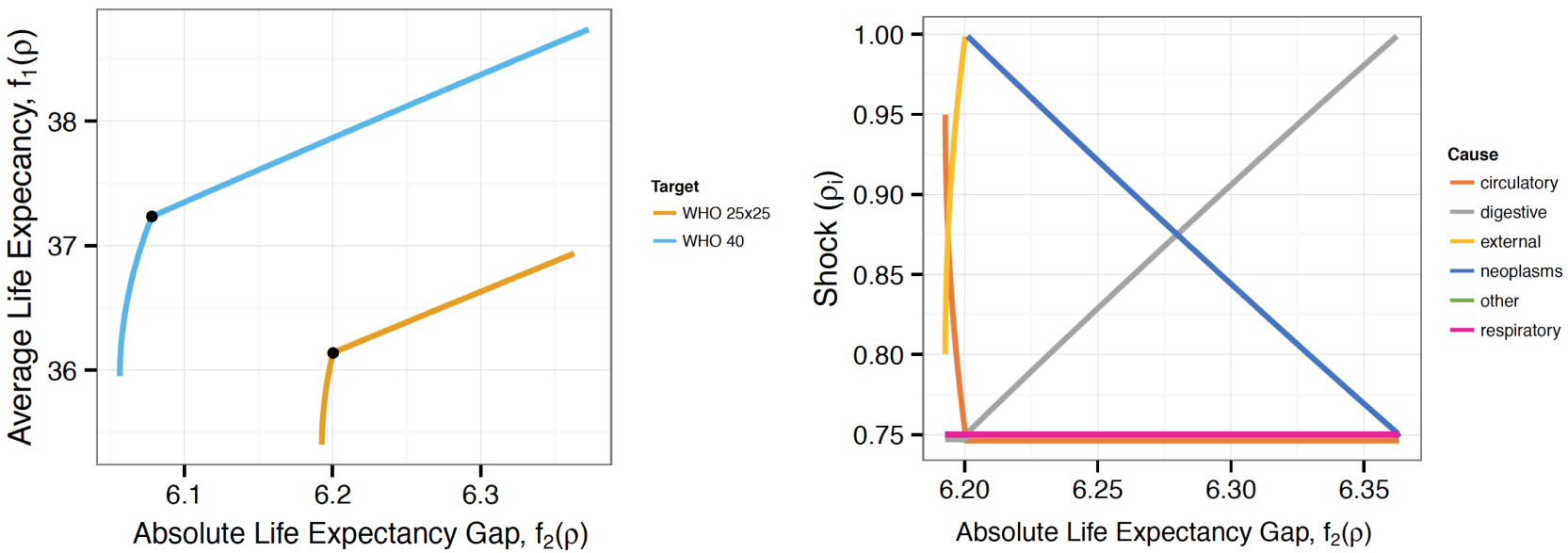

(a) Pareto Front

(b) Optimal policies WHO 25x25

Figure: Optimal strategies for males age 45

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Concluding remarks

- We provide a basis to assist government bodies in implementing well-informed strategies aimed at reducing social inequalities.

  $\rightarrow$ Use cause-specific mortality data by deprivation categories.

  $\rightarrow$ Use the multinomial logit model developed by Alai et al. [2015] $\rightarrow$ extend it to allow for socio-economic covariates. AND an optimisation procedure $\rightarrow$ simultaneously maximises overall gain in life expectancy whilst minimising social inequalities.

Concluding remarks

Key findings:

- Decline in heart disease mortality:
  → Major contributor to increases in life expectancy
  → BUT also increases inequalities.
- The optimal cause-of-death to target in order to reduce life expectancy gaps changes over time.
  → Crucial to take into account the latest time trends.
- To reduce inequalities, respiratory diseases need to be targeted as a priority.
- WHO target increases inequalities for men
  → A more optimal solution would be to target digestive diseases instead of neoplasms.

Next step: Include a budget constraint.

Bibliography

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