

Life expectancy

E-dagger





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Detailed description



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The research group "Mathematical and Actuarial Demography" aims to understand, model, and forecast mortality better, addressing the following question: What are the main drivers of mortality change? The researchers will approach the question from two perspectives: a macro perspective to investigate, for instance, the interaction of period and cohort factors; and a micro perspective to define determinants still unknown affecting mortality.

Global inequalities in age at death

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Two types of mortality inequalities

• Between groups – gets most of the attention

Difference in life expectancy at age 25 between highest and lowest income quintile, Finland 1988-2007



Martikainen, Peltonen, Mäkelä, Myrskylä 2014

Fraction deaths attributable to alcohol consumption and smoking, MEN





AGE

Difference in life expectancy at age 25 between highest and lowest income quintile, Finland 1988-2007



Two types of mortality inequalities

• Between groups – gets most of the attention

• Within groups

FIGURE 1 Distributions of ages at death in Sweden and the United States, 1999



Edwards and Tuljapurkar 2005

FIGURE 4 Unconditional standard deviations in the age at death, S₀, in seven high-income countries since 1960



Edwards and Tuljapurkar 2005

Lifespan variation, COHORTS vs. PERIODS. Swedish females, 1751-2014, 2015+ forecasted.



Year/Cohort(-30)



Average age at death conditional upon survival to age 35 years

Van Raalte et al. 2011



Life expectancy difference from 5 to 7.2

Total population lifespan variation from 11.3 to 10.5 (e-dagger)



Life expectancy difference from 5 to 7.2

Total population lifespan variation from 11.3 to 10.5 (e-dagger)



Inequalities in age at death

- Useful for summarizing within-population inqualities
- Often larger than between-group inequalities
- Should be monitored alongside between group inequalities
- Can be used to validate and inform demographic forecasts (Schmertmann et al. 2014 for fertility; Bohk-Ewald et al. 2017 for mortality)

Global inequalities in age at death

- How much inequality?
- What are the trends?
- What can we expect in the future
- What ages/causes of death should be targeted in order to reduce inequalities?
- What are actually being targeted?

Measures of lifespan disparity



- E-dagger: remaining lifetime lost at death, averaged
- Gini: Declines if life expectancy increases, even if the shape of the age at death distribution is constant
- ... lots of alternatives, from Keyfitz' entropy to SD, CV, ...
- Prefer e-dagger. Interpretation. Conclusions robust



Life expectancy

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Some of the challenges

- Need mortality by 1 year of age. Available in 5y groups, often with 80+ category
 - Solution: de-grouping as in Rizzi et al. (2018)
- Need probabilistic forecasts, e.g. the UN forecasts.
 We were not able to access them.
 - Solution: implement the Sevcikova-Raftery et al. model to reproduce UN-type forecasts
- The forecasts are e0! Need forecasted mx
 - Solution: Use inverse Lee-Carter to map e0 \rightarrow mx
- Need mx by cause. WHO data spotty.
 - Solution: Use GBD data. And Rizzi et al. (2018)
- Need elasticity of inequality wrt changes by age and cause of death. Mathematically tedious.
 - Solution: numerical (=simulation)



Ungroup_1D_0_to_110 : WORLD 1950-1955



Age

Global lifespan inequality measured with e_{30}^{\dagger}



- Overall positive trends
- Surprising gender cross-over: Until 1970s, men had a lower inequality
- Since 1970s, no progress among men (!)
- Increase in inequality in 1990s-2000s – why?

Past and the future



Decomposition: stability a balancing act between young and old age mortality contributions

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Future: According to UN type forecasts, future may be positive

Sensitivity: Future progress in mortality at ages 75+ will increase inequalities

Large differences at any level of life expectancy Latin America, Africa high also conditional on life exp



Life expectancy

E-dagger

Life expectancy

MEN

WOMEN



MEN: Forecasts



WOMEN: Forecasts



Global inequalities in age at death

- How much inequality?
 - Men have 12, women 11y life expectancy at death
 - Range from close to 14 (Africa) to < 10 (Eur Women)
- Past trends
 - Inequalities in Africa in 2015 much higher than in Europe, NA in 1950
 - Gender cross-over ~1975, since then women have lower inequality
 - Men: Stagnation and increase (Global, Africa, Europe)
 - Women: Declines, except Africa
- Future: UN-type forecasts suggest that
 - regional differences persist
 - within regions inequalities decline
 - global inequality will not budge much
- What ages and causes of death should be targeted?

• Goal: reduce lifespan inequalities

 Can reduce mortality by X% in some age+cause of death group, what to target? Figure 2: Contributions to and sensitivities of global lifespan inequality in terms of changes in mortality by age and cause-of-death



B.2 - CVD = Cardiovascular diseases

- B.3 CRD = Chronic Resp Dis
- C.1 TI = Transport injuries
- B.6 ND = Neurological disorders

Table 5: 2014. Sensitivity of in global e_{30}^{\dagger} to changes in mortality by causes of death

Cause of death	Women	Men
B.2 - Cardiovascular diseases	0.6(1)	0.57(1)
B.1 - Neoplasms	-0.46(2)	-0.06 (11)
B.6 - Neurological disorders	0.45(3)	0.3(2)
A.1.2 - HIV/AIDS	-0.2(4)	-0.19(4)
A.1.1 - Tuberculosis	-0.09(5)	-0.11 (9)
C.3 - Self-harm and interpersonal violence	-0.08 (6)	-0.16 (6)
A.4 - Maternal disorders	-0.08(7)	0(22)
C.1 - Transport injuries	-0.07 (8)	-0.19 (5)

Table 1: Rank top 5 cause of death & age–combos that would most decrease global lifespan inequality

Rank Cause of death (Ages)

Women

- B.2 Cardiovascular diseases (63–67)
- 2 B.1 Neoplasms (57–61)
- 3 A.1.2 HIV/AIDS (30–34)
- 4 B.8 Diabetes (61–65)
- 5 B.3 Chronic respiratory diseases (64–68)

Men

- 1 B.2 Cardiovascular diseases (55–59)
- 2 B.1 Neoplasms (57–61)
- 3 C.1 Transport injuries (30–34)
- 4 A.1.2 HIV/AIDS (34–38)
- 5 C.3 Self-harm and interpersonal violence (30–34)

Regional variation

• In all regions, and for women & men, CVD and neoplasms are among top 5 causes to target

- Regional/gender specific patterns in top 5:
 - Africa: HIV/Aids, Maternal mortality, TB
 - Men everywhere: External causes
 - Women everywhere: Diabetes, except Africa
 - Cirrhosis in Europe
 - Mental and substance use disorders in America

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 - Gender cross-over ~1975, since then women have lower inequality
 - Men: Stagnation/increase; Women: Decline, exception Africa
- Future: UN-type forecasts suggest that
 - Within regions inequalities decline, regional differences persist
 - Global inequiity will not budge much
- What ages and causes of death should be targeted
 - Global: Neoplasms, HIV/AIDS, External causes
 - Regional: HIV/Aids (Africa); External (LA); diabetes, transport (EUR, NA, Asia)



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