Revisiting the Black-White Mortality Crossover Paradox: Evidence from Large-scale, Linked U.S. Administrative Cohort Data

Minnesota Demography and Aging Seminar Series

Casey F. Breen

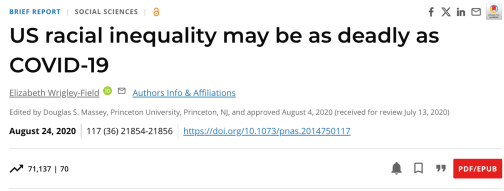
University of Texas at Austin

October 5, 2026

Black-White differences in mortality in the U.S.

Black-White differences in mortality in the United States are:

- Huge
- Historic
- Ongoing


BRIEF REPORT | SOCIAL SCIENCES

US racial inequality may be as deadly as COVID-19

Elizabeth Wrigley-Field | Authors Info & Affiliations

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August 24, 2020 | 117 (36) 21854-21856 | https://doi.org/10.1073/pnas.2014750117

71,137 | 70

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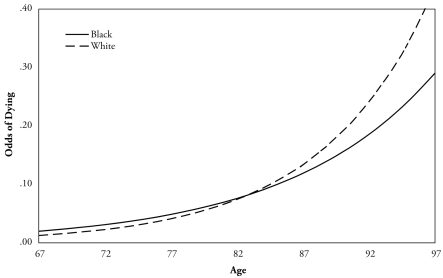
PNAS. Wrigley-Field 2020.

Paradox: Black-White mortality crossover

- Yet — among oldest-old, Black mortality is lower than White mortality (!)

Paradox: Black-White mortality crossover

- Yet — among oldest-old, Black mortality is lower than White mortality (!)
- Black-White mortality crossover is a well-studied demographic **paradox**



Dupre 2006. *Demography.*

Why understanding Black-White crossover is important

1. Fundamental to our understanding of mortality **inequality** over the life course

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1. Fundamental to our understanding of mortality **inequality** over the life course
2. Oldest-old is fastest growing age segment, potential social policy implications

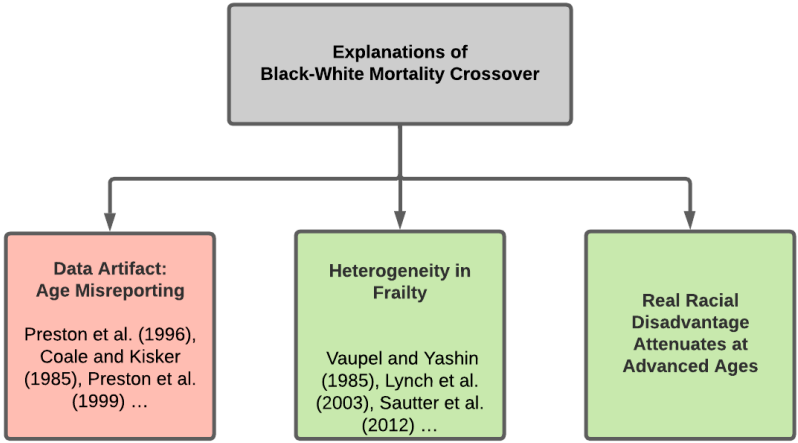
Why understanding Black-White crossover is important

1. Fundamental to our understanding of mortality **inequality** over the life course
2. Oldest-old is fastest growing age segment, potential social policy implications
3. Implications for theories of cumulative disadvantage and weathering (Diprete, 2006; Geronimus, 2023)

Black-White crossover repeatedly documented

Data Source	Age of Crossover	Covariates	Age Verification	Citation
Tennessee Vital Statistics	74			Sibley (1930)
Evans County Study	85 (f); 80 (m)			Wing et al. (1985)
Medicare Enrollment	88 (f); 86 (m)			Kestenbaum (1992)
U.S. Death Certificates	90 (f); 85 (m)		✓	Preston (1996)
Medicare Enrollment	85–86			Parnell and Owens (1999)
Survey on Asset and Health Dynamics Among the Oldest Old	81			Johnson (2000)
Berkeley Mortality Database	79–87		✓	Lynch, Brown and Harmsen (2003)
Medicare Enrollment	80–85			Arias (2006)
Established Populations for Epidemiologic Studies of the Elderly	83 (f); 79 (m)	Religious Attendance		Dupre, Franzese and Parrado (2006)
Americans' Changing Lives study	80	Education, Income, Neighborhoods		Yao and Robert (2011)
National Health Interview Survey-Linked Mortality Files	85			Masters (2012)
Established Populations for Epidemiologic Studies of the Elderly	83 (f); 79 (m)	Education, Income		Sautter et al. (2012)
NCHS Multiple Cause-of-Death public-use files	87			Fenelon (2013)
National Longitudinal Mortality Study	85			Şahin and Heiland (2017)

Still no consensus on explanation...

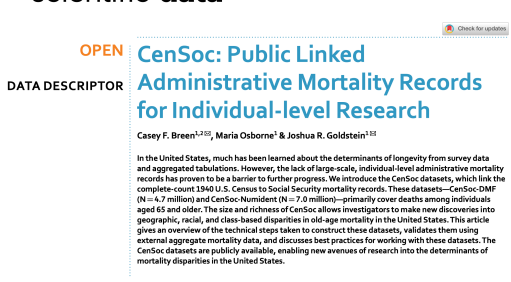


Research questions

1. Is the Black-White mortality crossover a **data artifact**?
2. Does **heterogeneity in frailty** explain the Black-White crossover? Is there really observable late-life mortality selection?

New Data Allows Us to Make Progress

- Data limitations have hampered efforts to explain crossover
- Comparative advantage:
  1. Massive sample (1M deaths)
  2. Cohorts
  3. Covariates


scientific **data**

Check for updates

OPEN

DATA DESCRIPTOR

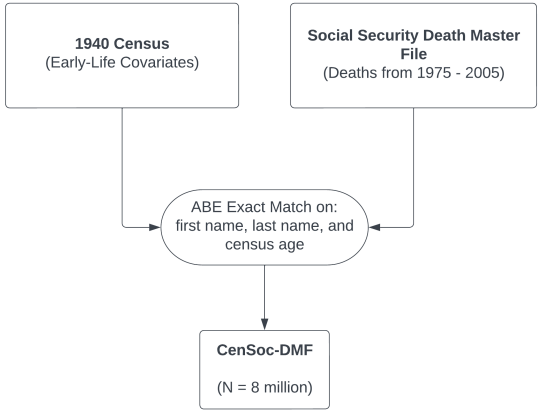
CenSoc: Public Linked Administrative Mortality Records for Individual-level Research

Casey F. Breen[1,2✉], Maria Osborne[1] & Joshua R. Goldstein[1✉]

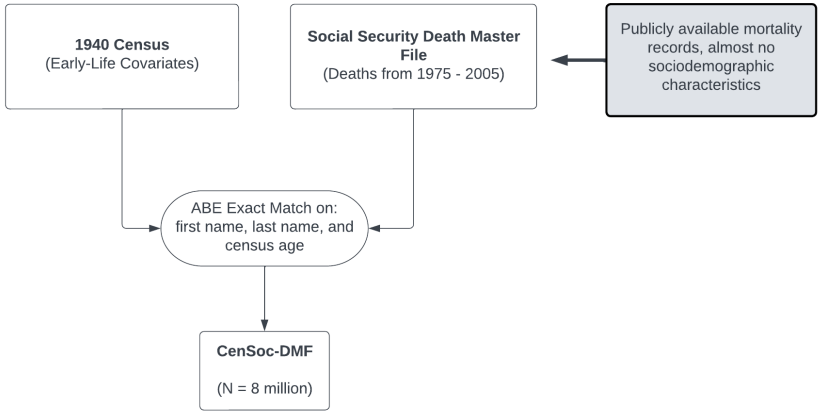
In the United States, much has been learned about the determinants of longevity from survey data and aggregated tabulations. However, the lack of large-scale, individual-level administrative mortality records has proven to be a barrier to further progress. We introduce the CenSoc datasets, which link the complete-count 1940 U.S. Census to Social Security mortality records. These datasets—CenSoc-DMF (N = 4.7 million) and CenSoc-Numident (N = 7.0 million)—primarily cover deaths among individuals aged 65 and older. The size and richness of CenSoc allows investigators to make new discoveries into geographic, racial, and class-based disparities in old-age mortality in the United States. This article gives an overview of the technical steps taken to construct these datasets, validates them using external aggregate mortality data, and discusses best practices for working with these datasets. The CenSoc datasets are publicly available, enabling new avenues of research into the determinants of mortality disparities in the United States.

Breen, Osborne, Goldstein 2023

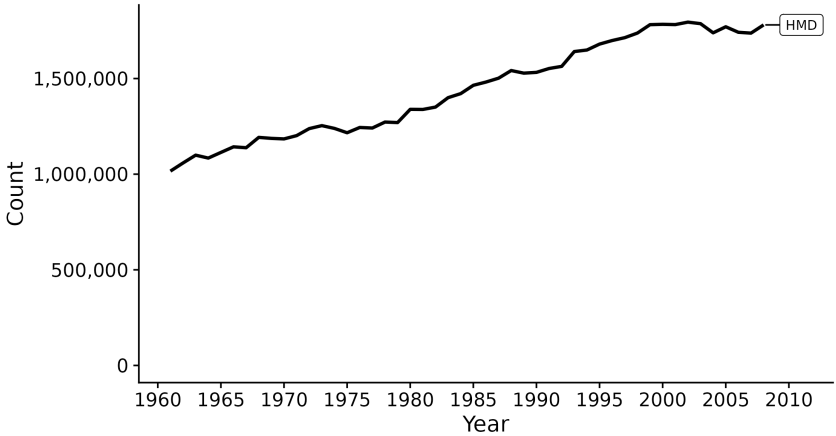
CenSoc-DMF: Linked IPUMS 1940 Census and mortality records



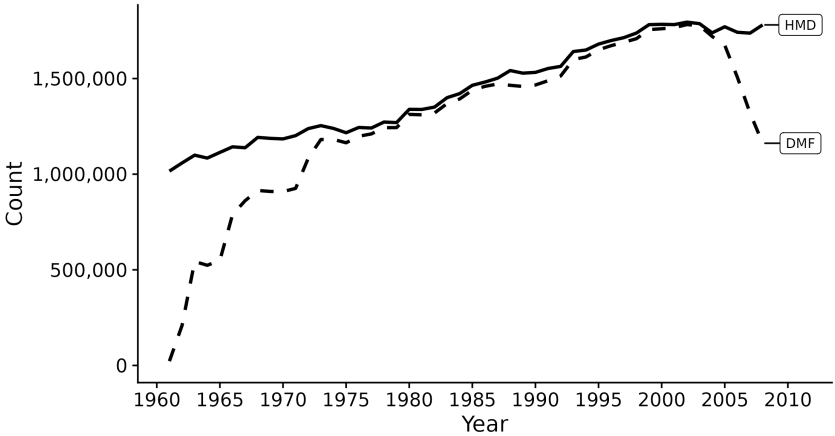
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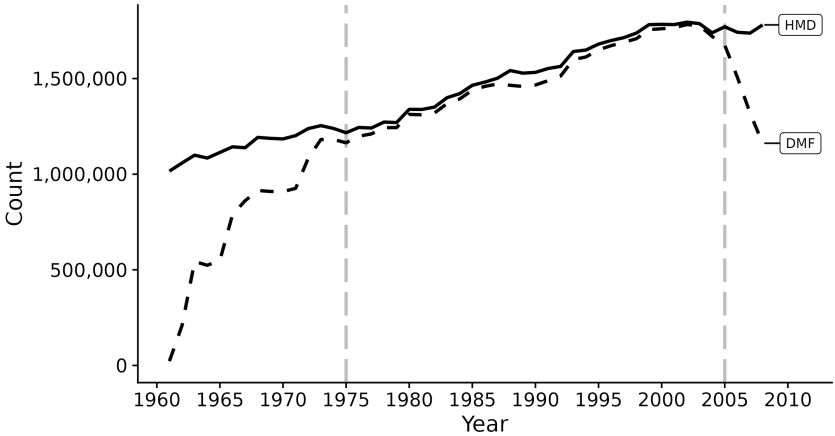
Death Master File (DMF) coverage (65+)



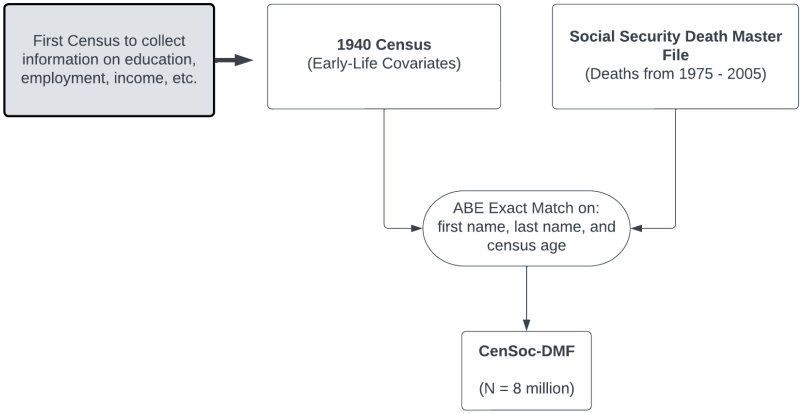
Death Master File (DMF) coverage (65+)



97% death coverage 1975-2005 (65+)



CenSoc-DMF: Linked IPUMS 1940 Census and mortality records



1940 Census

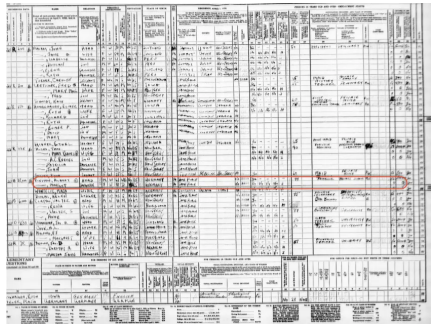
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- First decennial census to include question on educational attainment, wage and salary income, and detailed questions on employment

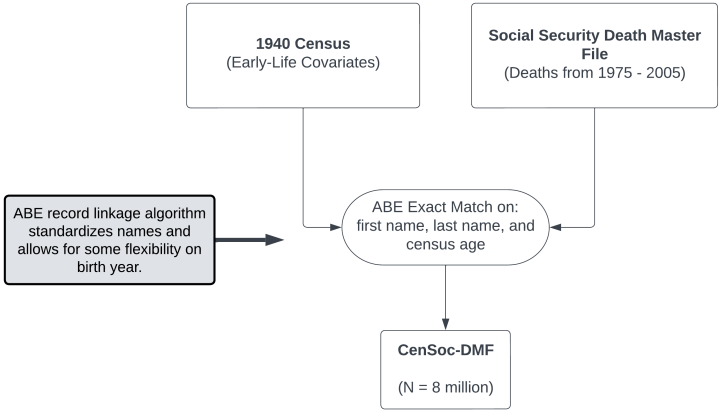
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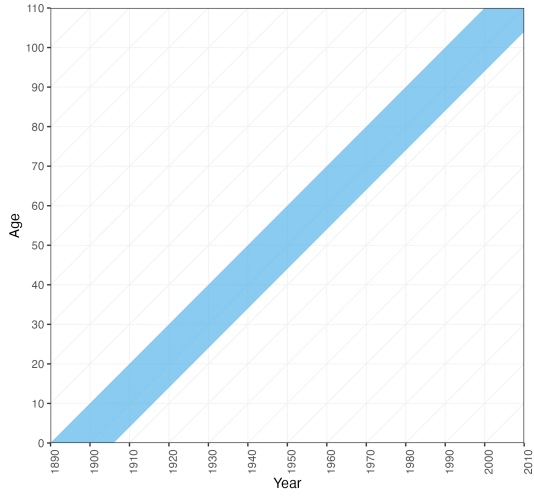
1940 Census Form

CenSoc-DMF: Linked census and mortality records



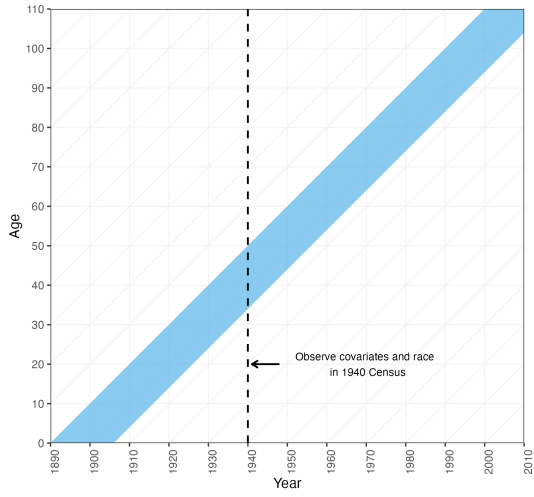
Analytic Sample

- Birth cohorts of 1890-1905
  - $N = 900,000$ deaths
- Sample restrictions
  - Men only
  - U.S. born



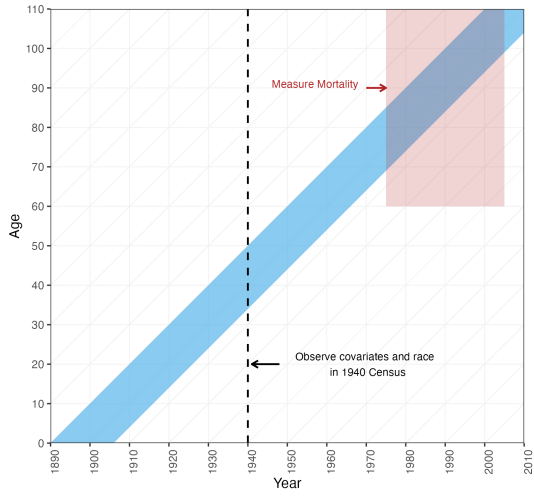
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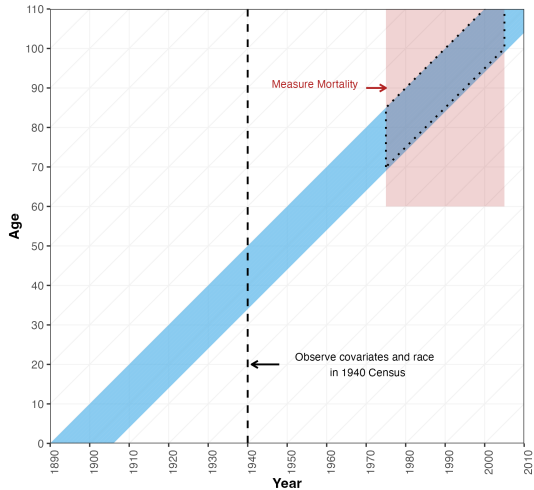
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Birth cohorts of 1890-1905: extinct cohort method

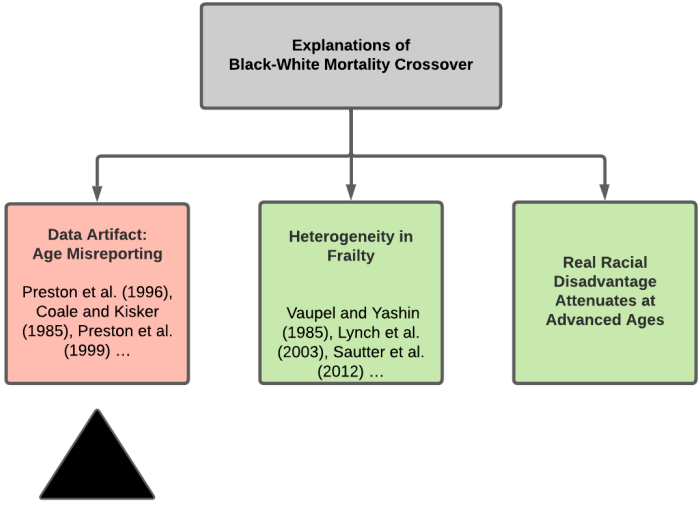
- Assumes that all members of the cohort have died by a certain year
- Uses recorded deaths over time to reconstruct the cohort's survival pattern

$$q_x = \frac{d_x}{\sum_x^\infty d_i} = \frac{d_x}{l_x} \tag{1}$$

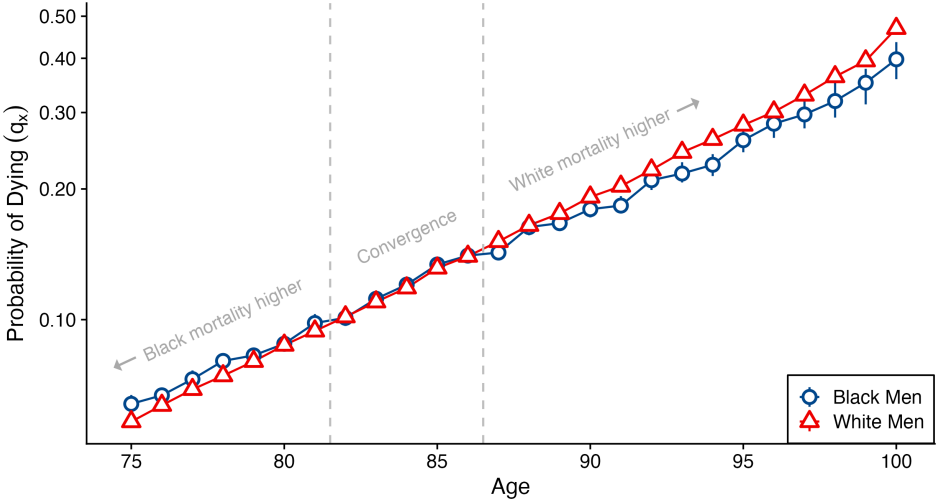
where:

- q_x is the probability of dying at age x.
- d_x is number of deaths at age x

Question 1: Is the crossover a data artifact?



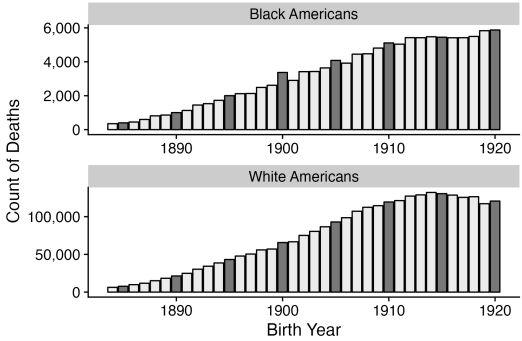
Black-White crossover (extinct cohort method)



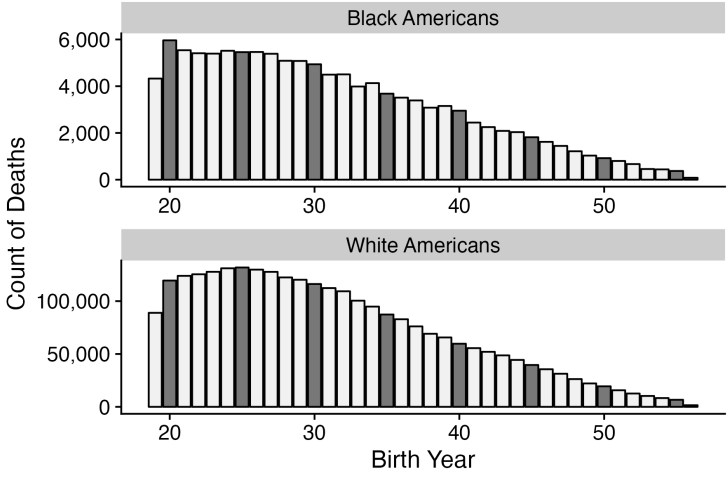
Question 1: Is the crossover a data artifact?

Background: Age of death calculated from date of birth and date of death

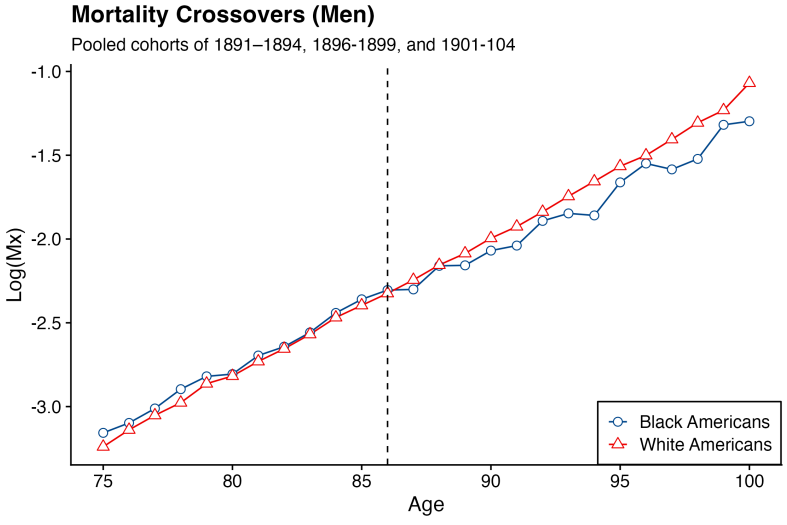
1. Minimal age heaping on birth year...
2. Date of death gets reported immediately (no heaping)
3. Institutional incentive: Social Security wants to accurately track birth date
4. Linkage requires close match on year of birth and Census age



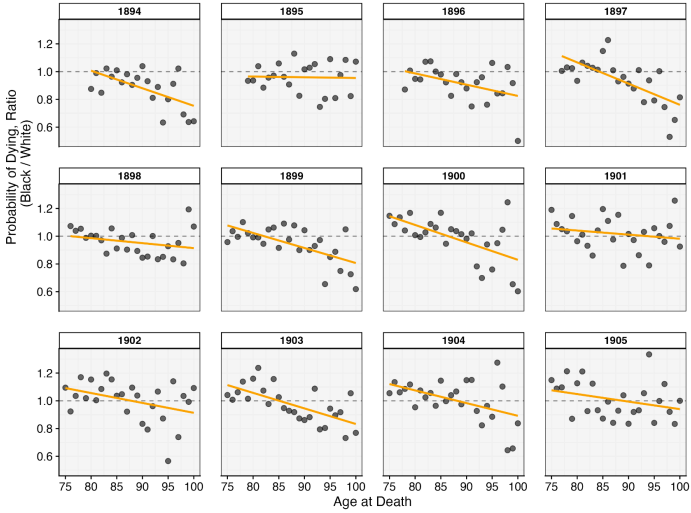
No age heaping in 1940 Census



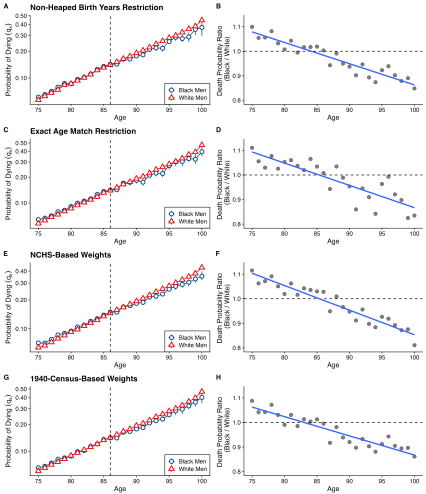
Black-white crossover (extinct cohort method)



Black-white crossover (extinct cohort method)



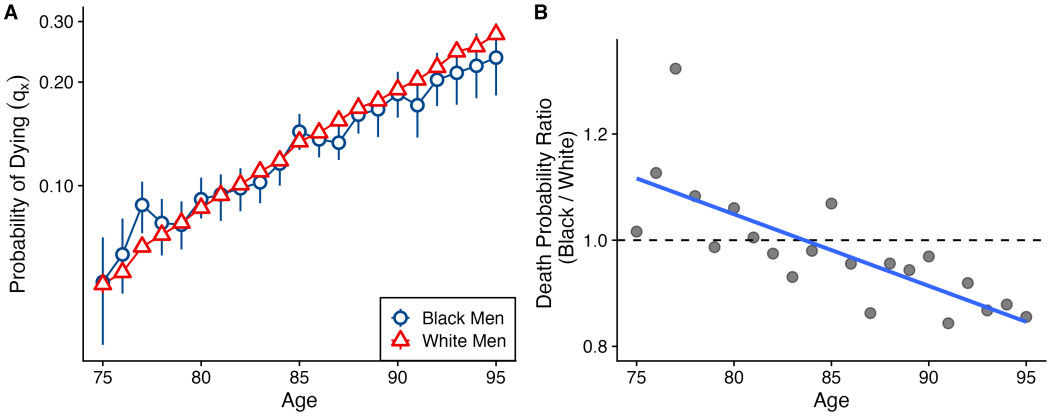
Black-white crossover robustness (extinct cohort method)



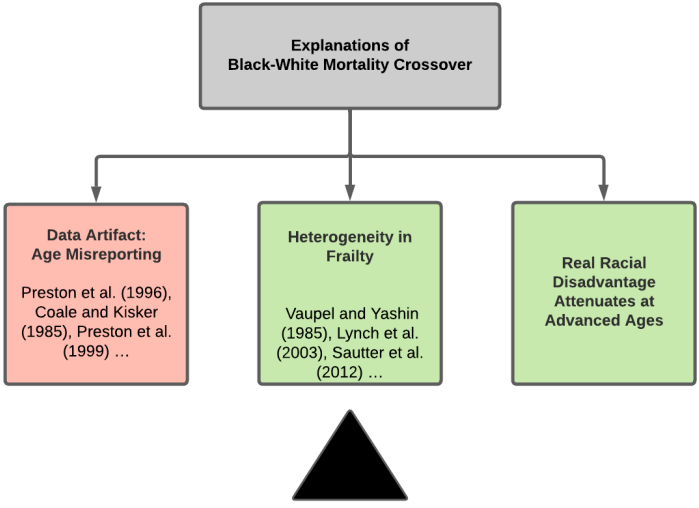
Robustness checks

- Drop heaped years
- Exact match on birth year
- Re-weight on 1940 Census characteristics
- Alternative mortality estimation methods

Linkage to 1900 Census (MLP, Ruggles et al. 2025)

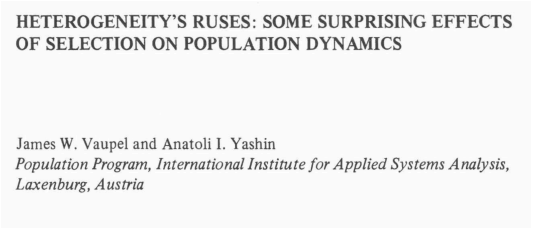


Question 2: Is the crossover driven by heterogeneity in frailty?



Heterogeneity in frailty – overview of approach

- First, how much **mortality selection** do we actually observe...?
- Second, does stratifying on heterogeneity uncross the crossover?
- **Frailty:** an individual's susceptibility to death
  - (Lack of) Wealth, education, environmental, behavioral, biological, etc.



HETEROGENEITY'S RUSES: SOME SURPRISING EFFECTS OF SELECTION ON POPULATION DYNAMICS

James W. Vaupel and Anatoli I. Yashin
Population Program, International Institute for Applied Systems Analysis, Laxenburg, Austria

Unpacking the black box of frailty...

- Lots of theorizing on frailty — but less empirical evidence due to data limitations
- Data-driven investigation of components of frailty that we can observe: sociodemographic characteristics

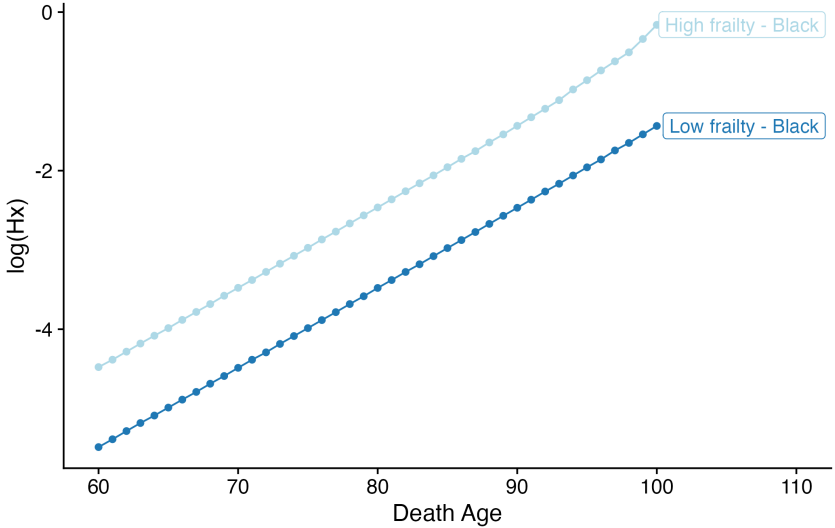
The theory of heterogeneity in frailty

- To get a crossover, higher initial mortality population must have **higher variance** in frailty

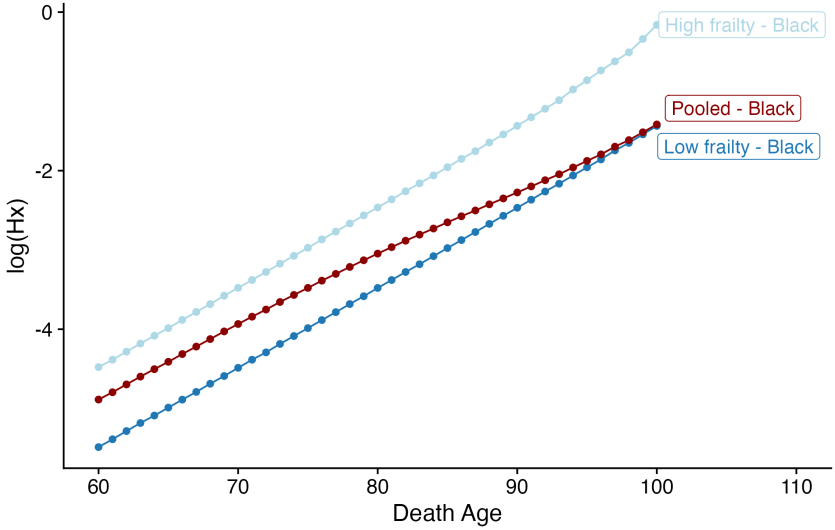
The theory of heterogeneity in frailty

- To get a crossover, higher initial mortality population must have **higher variance** in frailty
- As the cohorts age, mortality selection is much stronger for the high mortality, high variance group
- So much stronger, that eventually the frailty of survivors actually crosses

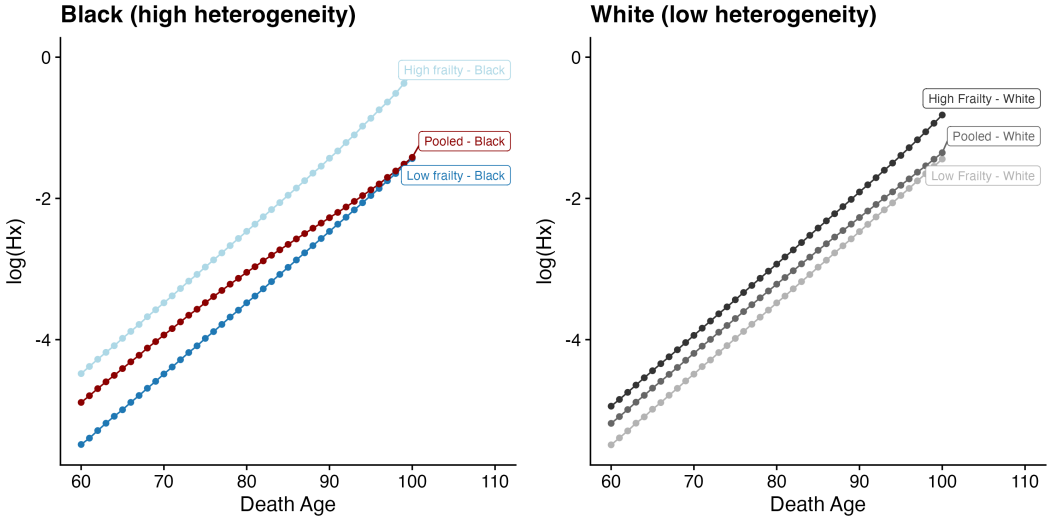
Heterogeneity in frailty (stylized example)



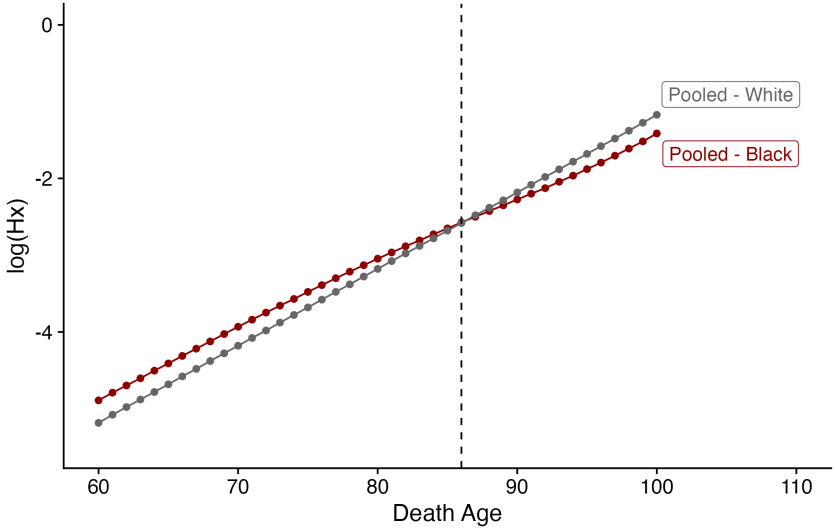
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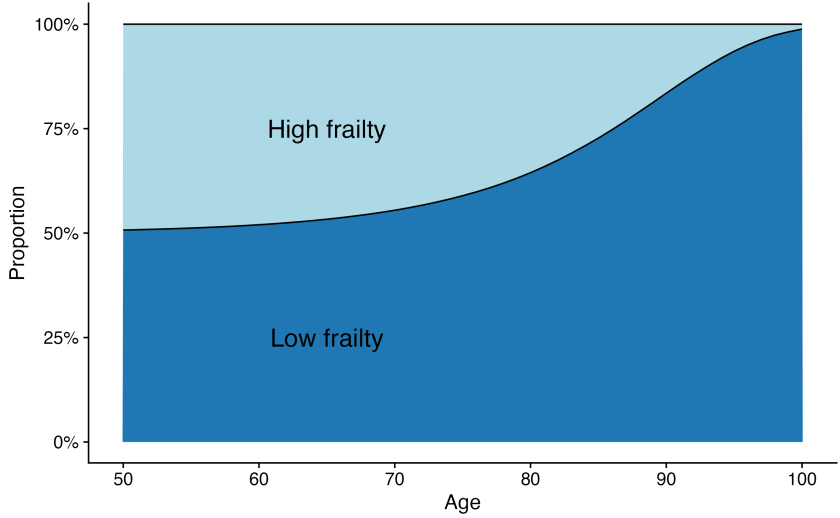
Heterogeneity in frailty (stylized example)



Heterogeneity in frailty (stylized example)



Very dramatic shift in composition of survivors...



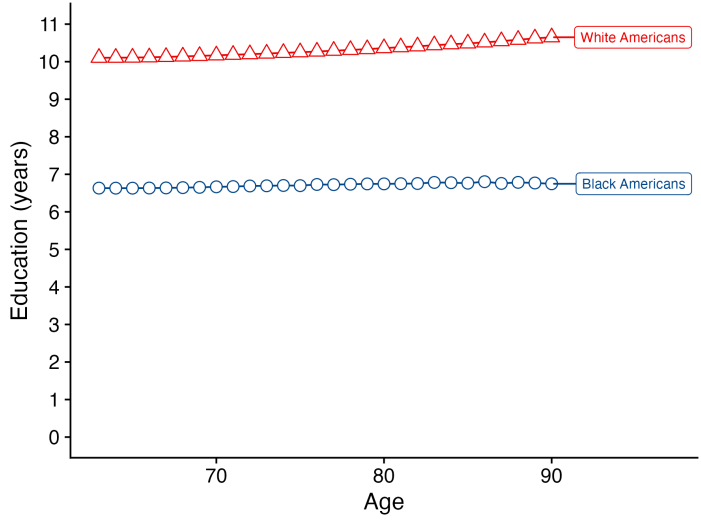
Empirical testing

- In order for the theory of frailty to explain the Black-White crossover, there must be stronger frailty selection over the life course for Black Americans than for White Americans

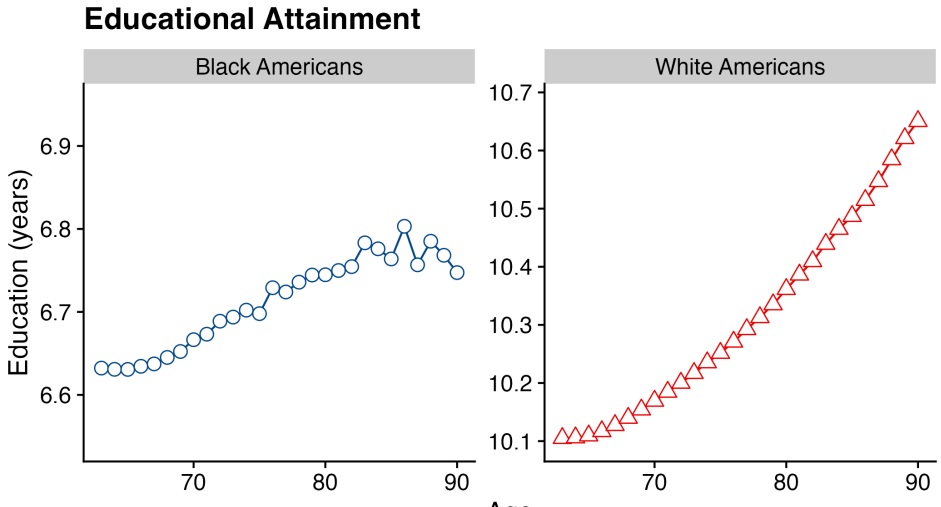
Empirical testing

- In order for the theory of frailty to explain the Black-White crossover, there must be stronger frailty selection over the life course for Black Americans than for White Americans
- We don't observe frailty but we observe characteristics that comprise part of frailty
  - Educational attainment
  - Occupation and income
  - Wealth

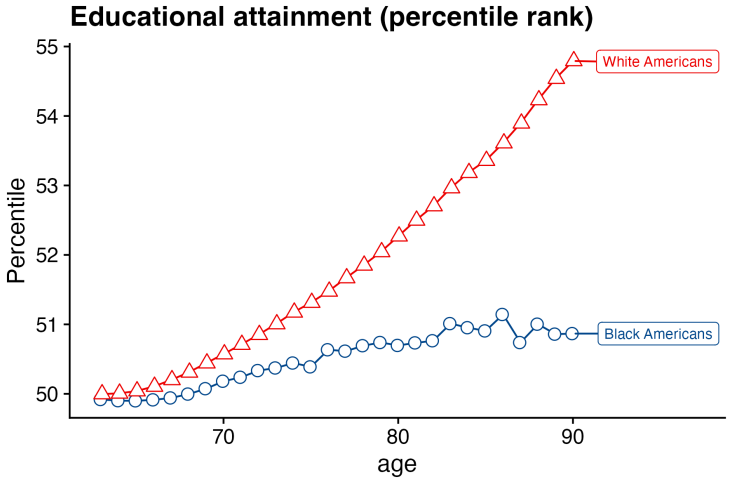
Changing educational composition of survivors



Changing composition of survivors



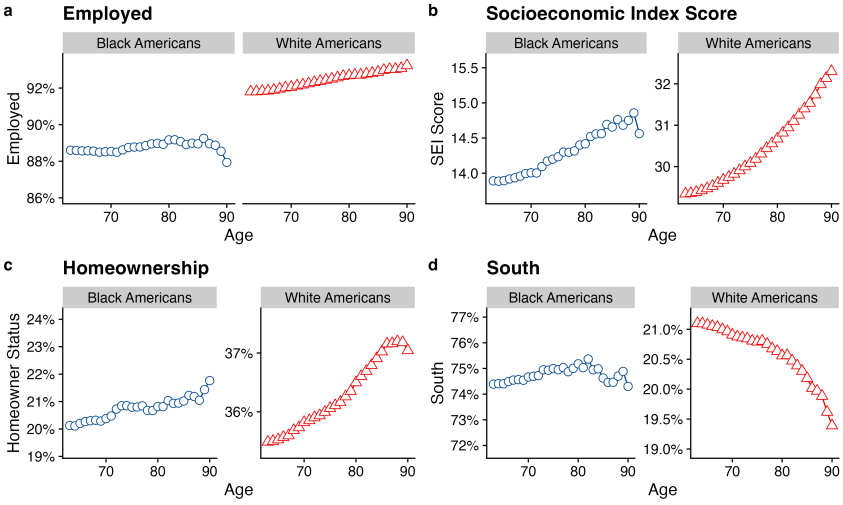
Changing educational composition of survivors (percentile)



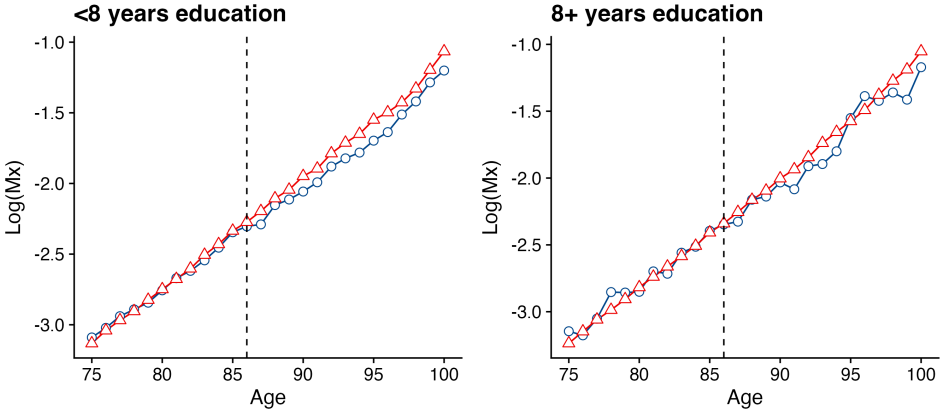
Changing composition of survivors



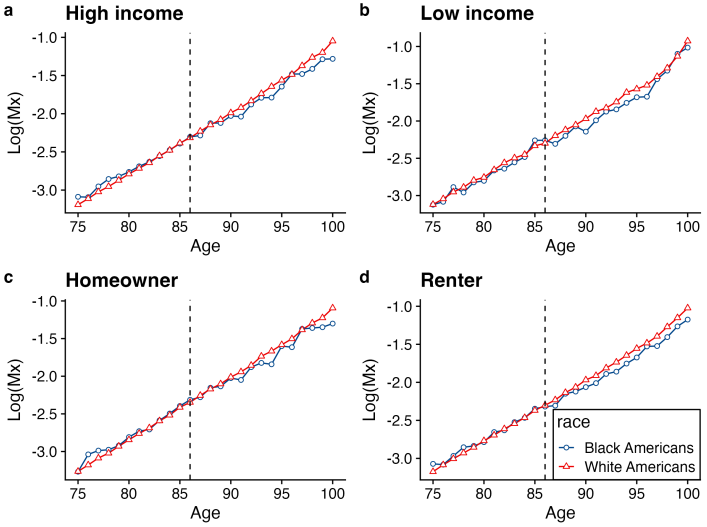
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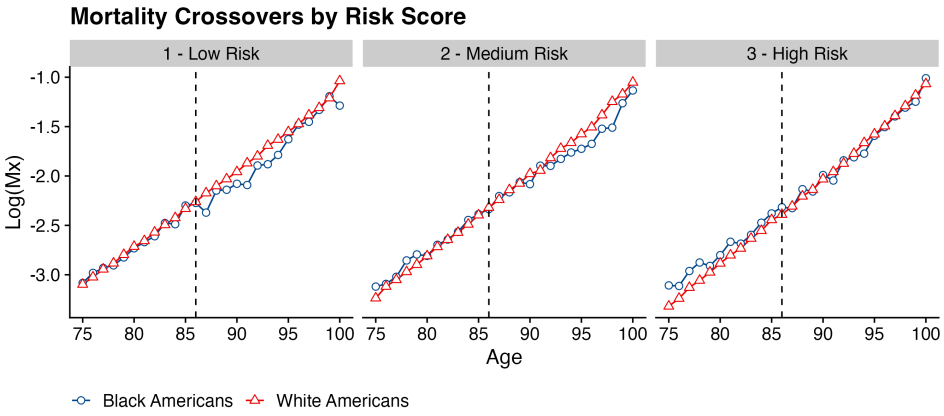
Stratifying by dimensions of frailty



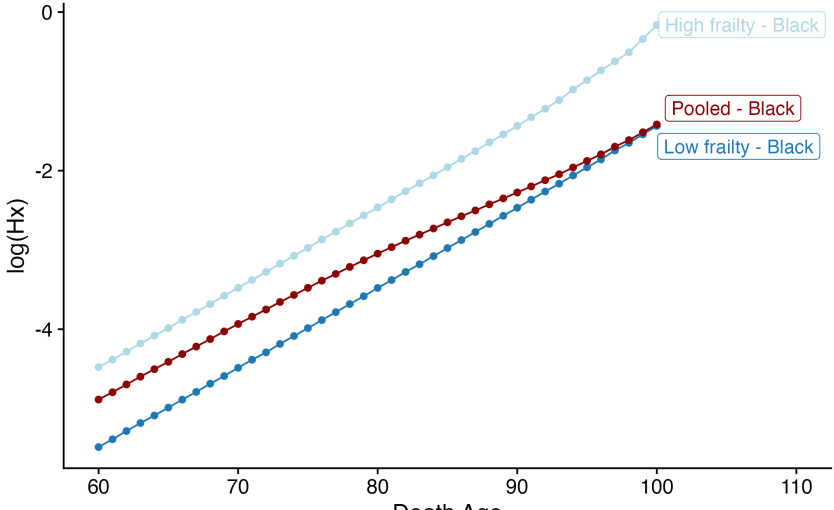
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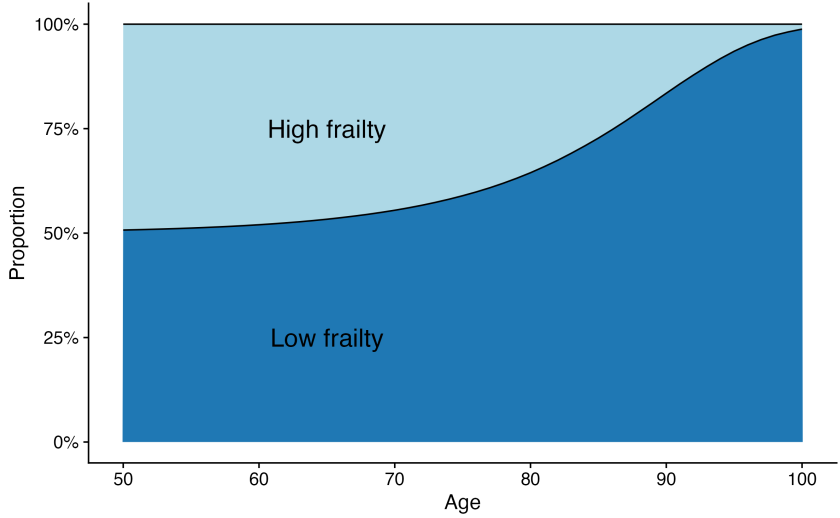
Stratifying on risk score



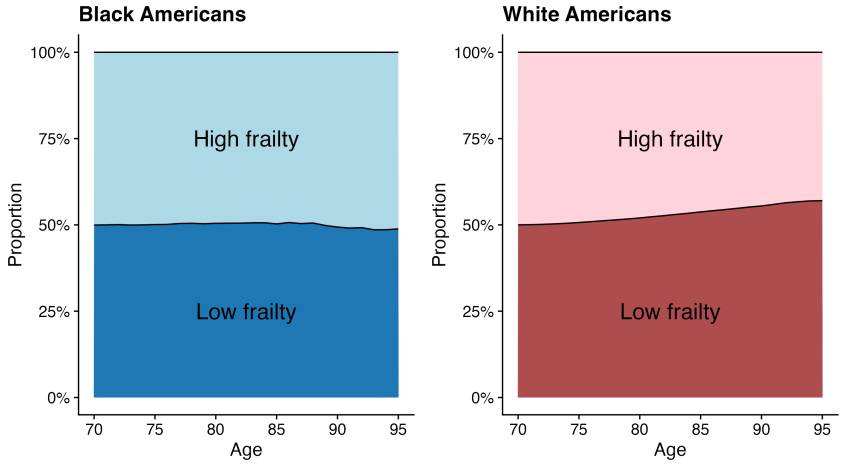
How much selection would we need? (Simulation)



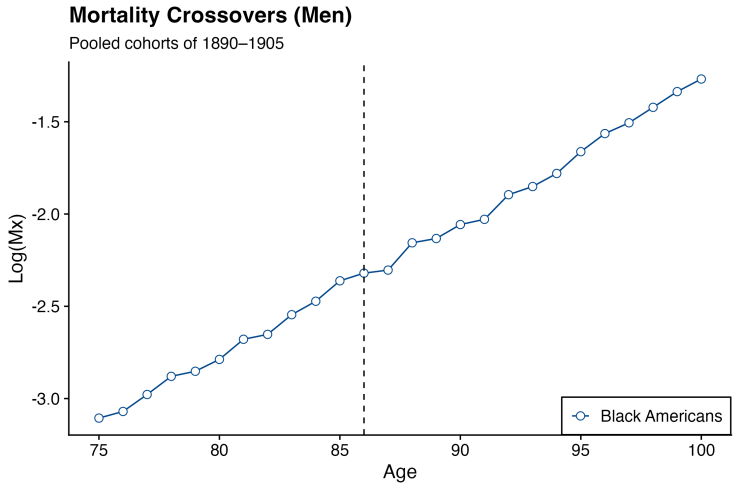
How much selection would we need for Black Americans?



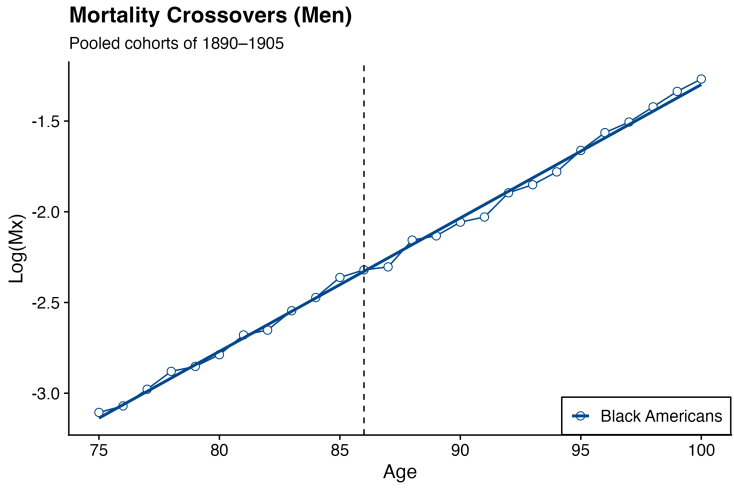
How much selection do we actually observe? Very little



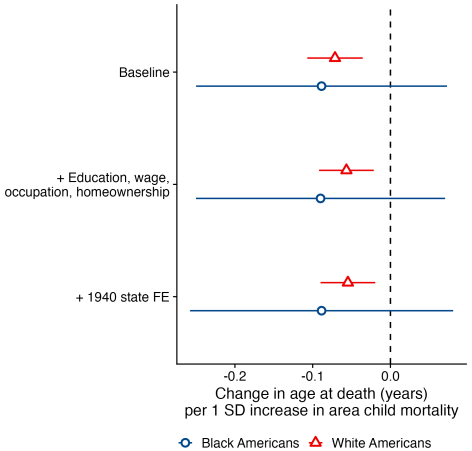
Visible mortality deceleration from selection? (Bend in curve?)



No evidence of deceleration...



What about early life mortality conditions?



- Childhood mortality rates from linked census data (**Hacker and Helgertz, 2025**)
- Exposure: child mortality ($_5q_0$) of own race in 1900 state economic area of residence
- **Selection** predicts survivors of harsh environments live *longer*; Evidence instead for **scarring**

No support for heterogeneity in frailty explanation

1. Very little observable mortality selection on SES

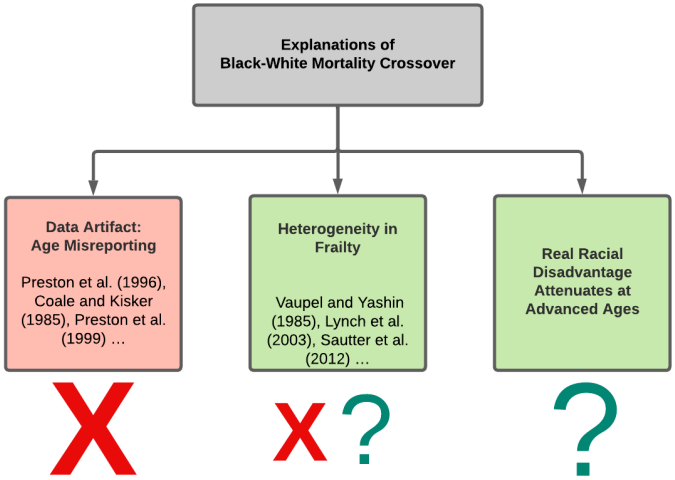
No support for heterogeneity in frailty explanation

1. Very little observable mortality selection on SES
2. Mortality selection stronger for White Americans than Black Americans

No support for heterogeneity in frailty explanation

1. Very little observable mortality selection on SES
2. Mortality selection stronger for White Americans than Black Americans
   - Cause a widening — not convergence/crossover — of mortality rates
3. No observable mortality deceleration

Revisiting explanations...



Perhaps adaptive resilience

- **Resilience**
  - Lifelong exposure to adversity (racism, economic hardship, discrimination) may cultivate adaptive coping mechanisms
  - Black Americans have higher levels of self-esteem and religiosity than white Americans (**Louie 2024**), better mental health (**Erving 2021**) and subjective survival expectations (**Bernstein and Sasson 2021**)
- **Supportive Social Structures**
  - Older Black adults are more deeply embedded in extended family systems + live closer to kin (**Springer, Crowder, et al. 2023**)
  - More embedded networks provide caregiving, daily help, companionship, protection from loneliness (**Durkheim 1897, Cornwell and Qu, 2024, Umberson et al. 2010**)

Conclusions

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Conclusions

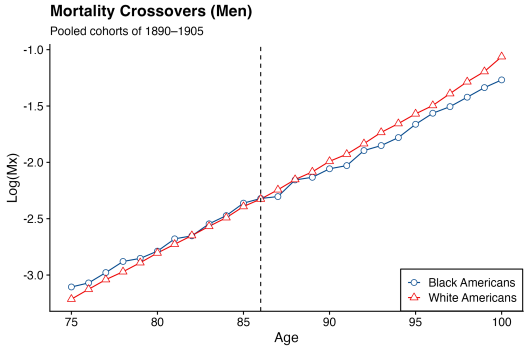
- Black-White Crossover is real — *not* ***data artifact***
- No support for **heterogeneity in frailty** explanation
  - Not educational attainment, not income, not wealth, not risk score
  - However, other unobserved dimensions of heterogeneity might be responsible (biomarkers, self-rated health)
- Attenuation of disadvantage from adaptive resilience: **Intriguing**, but need more theoretical and empirical work
- New explanations are needed (!)

Thank you — questions?

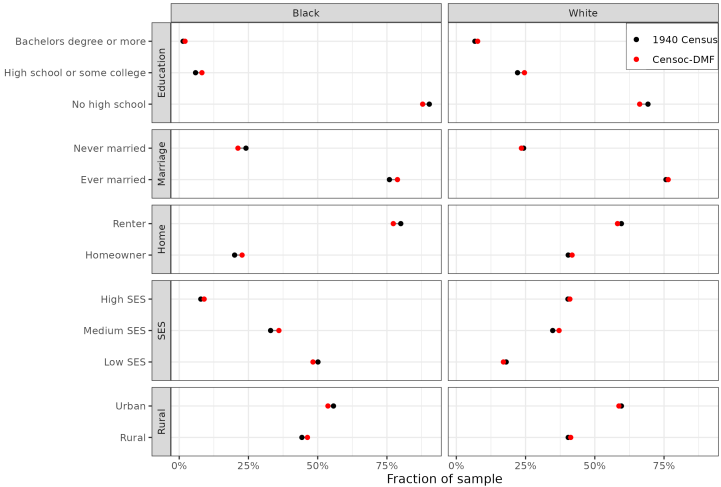
Data: CenSoc.Berkeley.edu

Funding: R01AG058940, R01AG076830

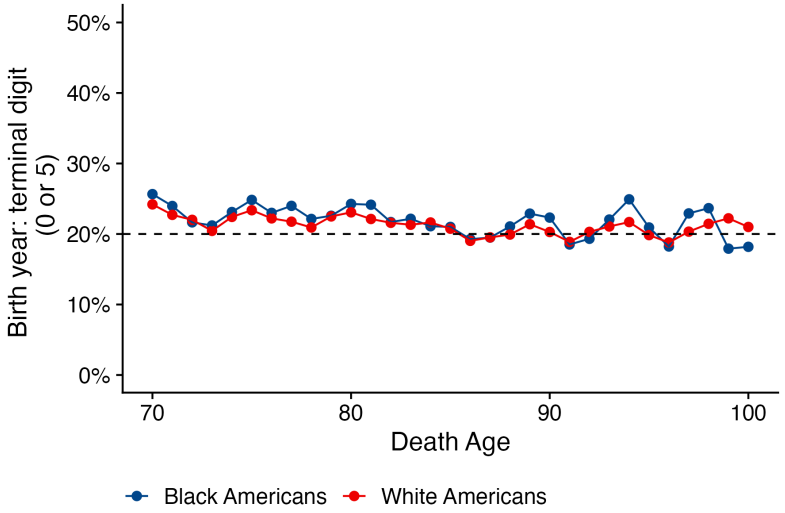
Contact: ✉ casey.breen@austin.utexas.edu



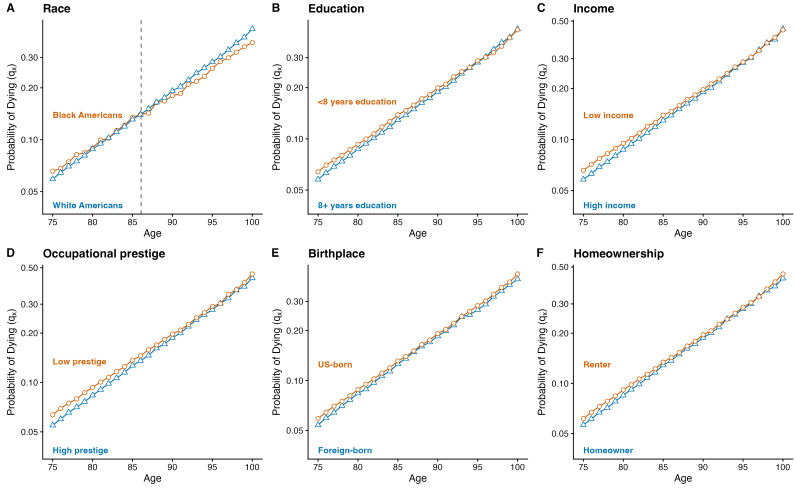
Representativeness



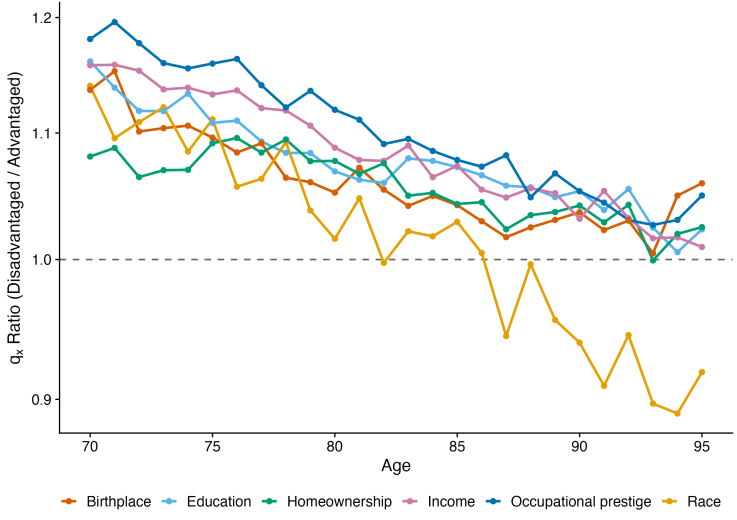
Age heaping


50%
40%
30%
20%
10%
0%
Birth year: terminal digit
(0 or 5)
70
80
90
100
Death Age
Black Americans
White Americans

Mortality crossovers: other dimensions



Uniqueness of Black-White Crossover



Birth cohorts of 1906-1915: Gompertz Hazard Model

$$h(x) = \mathbf{a}e^{\mathbf{b}.x} \tag{2}$$

- $h(x)$ = hazard at age x. "Force of mortality"

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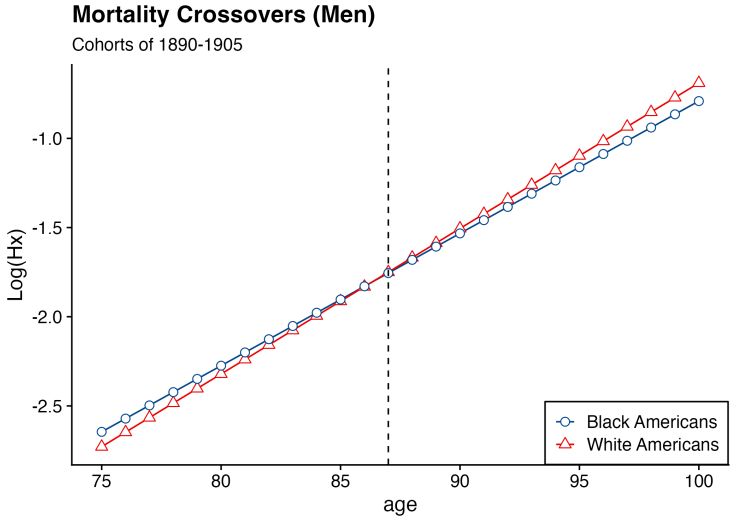
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Birth cohorts of 1906-1915: Gompertz Hazard Model

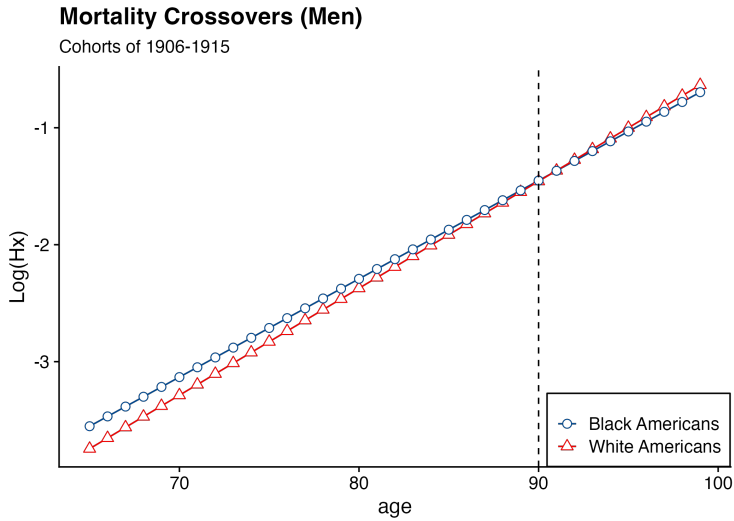
$$h(x) = \mathbf{a}e^{\mathbf{b}x} \tag{2}$$

- $h(x)$ = hazard at age x. "Force of mortality"
- **a is baseline mortality**
- **b is rate of increase of mortality**

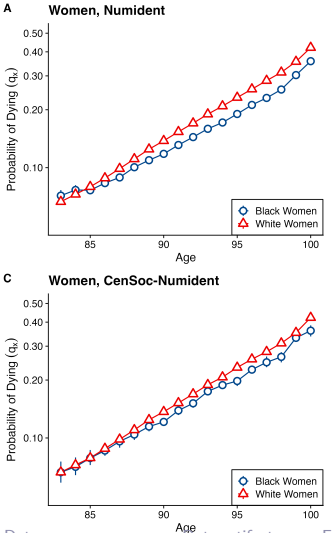
Black-white crossover (Gompertz Hazard Model)



Black-white crossover (Gompertz Hazard Model)

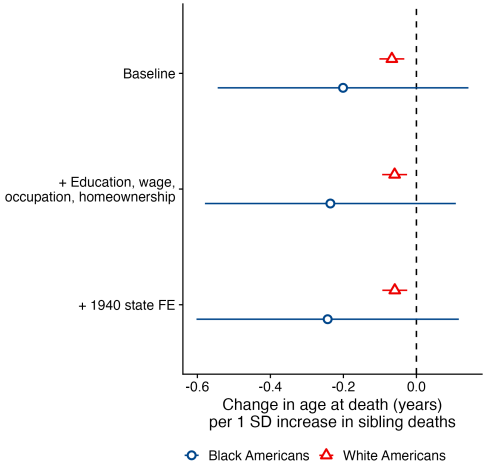


Crossover for women (Numident, 1988–2005)



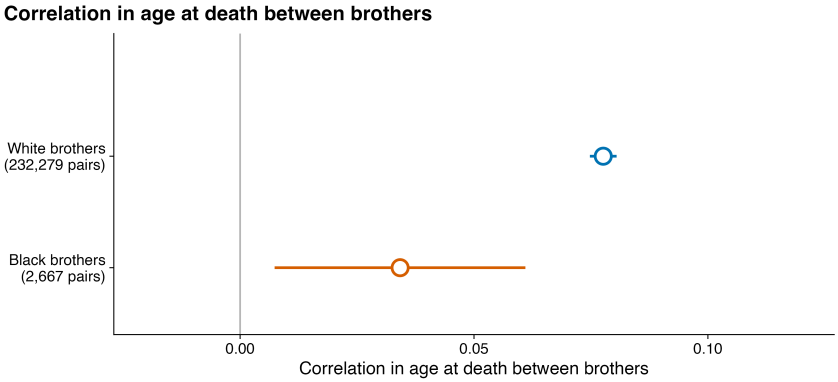
- Numident has a more narrow mortality estimation window
- However, women can be linked because we have parents' names
- Crossover for women around age 85

Early life conditions? Within the family

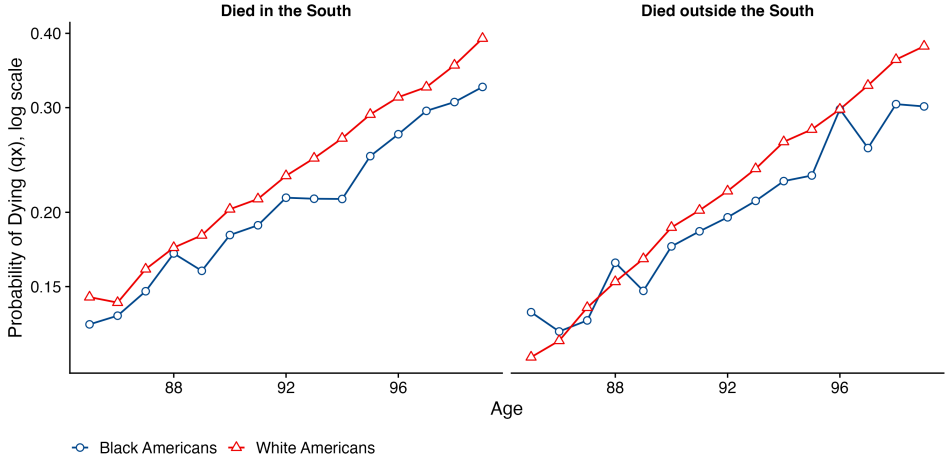


- 1900 Census asked mothers: children ever born, children surviving
- Exposure: share of a man's own siblings who had died by 1900

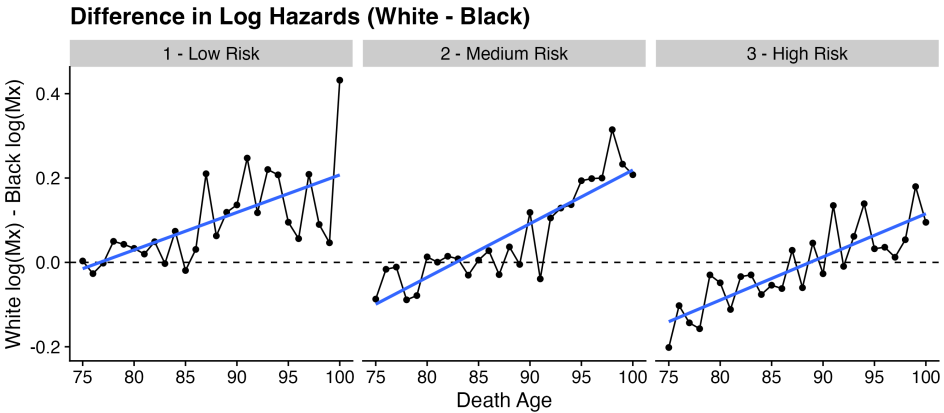
Brother correlation in lifespan



Great migration



Stratifying on risk score



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