Black-White Mortality Crossover Paradox: New Evidence from Social Security Mortality Records

Centre for Economic Demography | Lund University

Casey F. Breen

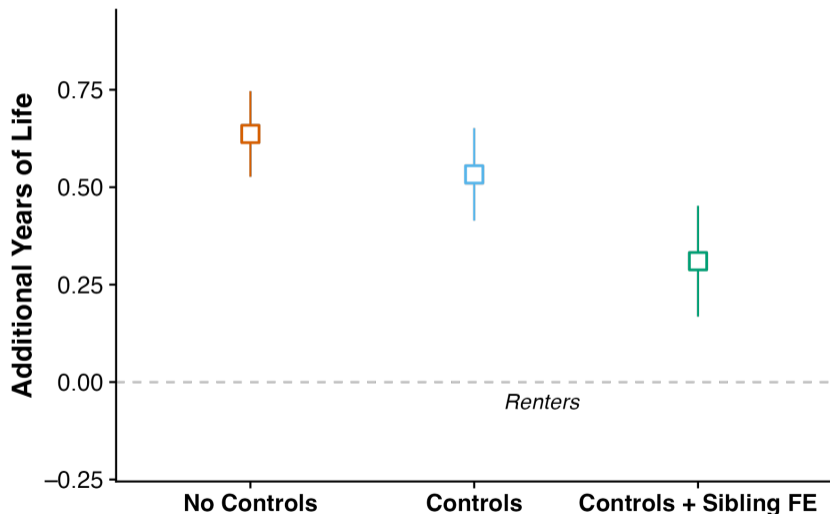University of Oxford | Nuffield College

December 3, 2024

My research

I combine formal demography and insights from the emerging field of computational data science to study questions in **population health**

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I combine formal demography and insights from the emerging field of computational data science to study questions in **population health**

Mortality dynamics and disparities

- ▶ Mortality estimation from admin data
- ▶ Causal effects of homeownership on longevity
- ▶ Racial disparities in mortality **(today)**

Introduction
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Data and methods
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Data artifact
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Frailty
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Empirical testing
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Homeownership benefits of longevity (Breen 2024, *Demography*)

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Empirical testing
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Discussion
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Today's talk

Black-White Mortality Crossover Paradox: New Evidence from Social Security Mortality Records

Black-White Mortality Crossover Paradox: New Evidence from Social Security Mortality Records [*]

Casey F. Breen [†]

Draft Version: November 18, 2024

Abstract

Since its original discovery in 1932, the Black-White mortality paradox has been repeatedly documented in the United States. Black Americans experience higher age-specific mortality rates than White Americans throughout most of the life course, but this trend reverses at advanced ages. The leading explanation centers on differential selective mortality. Black Americans who survive higher age-specific mortality risks are highly selected for robustness, resulting in lower mortality rates than White Americans in late life. Using large-scale linked administrative data (N = 2.3 million), we confirm a robust crossover at age 85. We document selective mortality dynamics with respect to sociodemographic characteristics as members of our cohort die off, finding modest selection effects that cannot explain the crossover. We conclude that selective mortality related to other unobserved covariates may still play a role, or that there are as-yet unidentified protective factors influencing racial mortality differences at older ages, distinct from those affecting younger ages.

Working paper...

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

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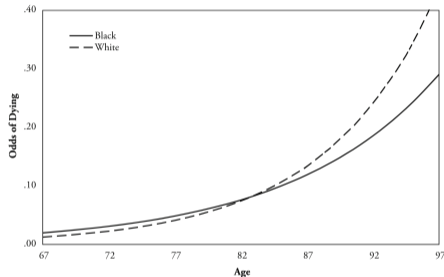
▶ Huge

▶ Historic

▶ Ongoing

PNAS. Wrigley-Field 2020.

Paradox: Black-White mortality crossover

▶ Among oldest-old, Black mortality
  is lower than White mortality

Paradox: Black-White mortality crossover

▶ 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 **inequality** over the life course

Why understanding Black-White crossover is important

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

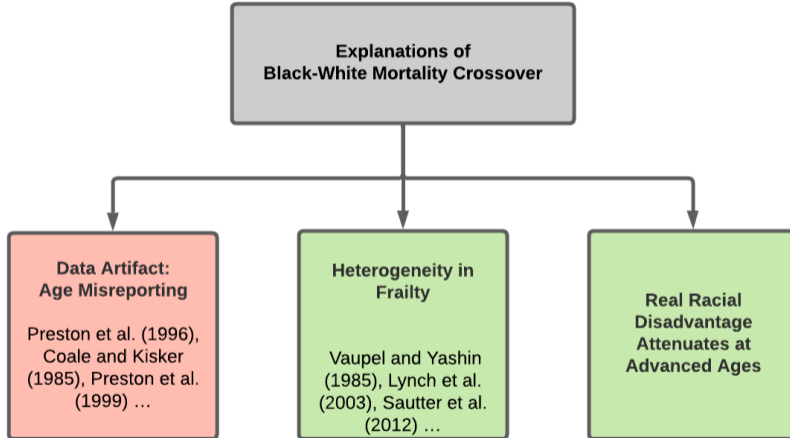2. Oldest-old is fastest growing age segment in the United States

Why understanding Black-White crossover is important

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

2. Oldest-old is fastest growing age segment in the United States

3. Implications for social policy

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)			Sautter et al. (2012)
NCHS Multiple Cause-of-Death public-use files	87	Education, Income		Fenelon (2013)
National Longitudinal Mortality Study	85			Şahin and Heiland (2017)

Still no consensus on explanation…

Explanations of Black-White Mortality Crossover

Data Artifact: Age Misreporting

Preston et al. (1996), Coale and Kisker (1985), Preston et al. (1999) …

Heterogeneity in Frailty

Vaupel and Yashin (1985), Lynch et al. (2003), Sautter et al. (2012) …

Real Racial Disadvantage Attenuates at Advanced Ages

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
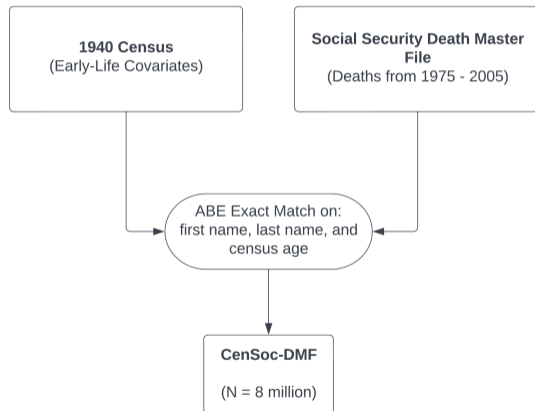 3. Covariates

scientific **data**

OPEN

DATA DESCRIPTOR

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

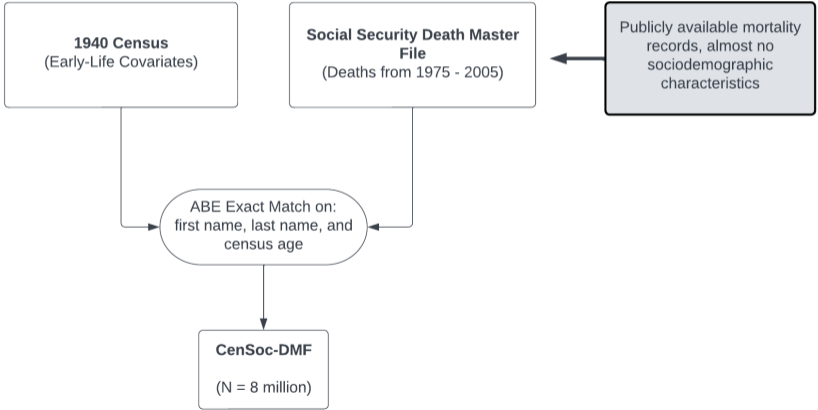Casey F. Breen[1,2,✉], Maria Osborne[1] & Joshua R. Goldstein[1,✉]

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.
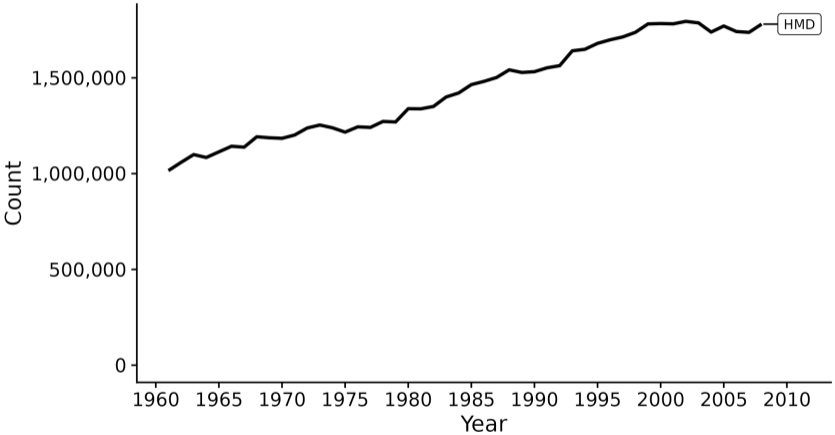
Breen, Osborne, Goldstein 2023

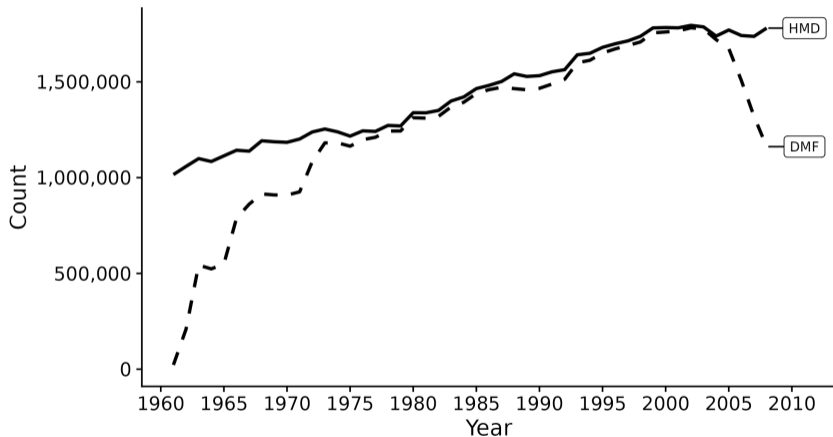# CenSoc-DMF: Linked IPUMS 1940 Census and mortality records

1940 Census
(Early-Life Covariates)

Social Security Death Master File
(Deaths from 1975 - 2005)

ABE Exact Match on:
first name, last name, and census age

CenSoc-DMF

(N = 8 million)

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References

CenSoc-DMF: Linked IPUMS 1940 Census and mortality records

1940 Census
(Early-Life Covariates)

Social Security Death Master File
(Deaths from 1975 - 2005)

Publicly available mortality records, almost no sociodemographic characteristics

ABE Exact Match on:
first name, last name, and census age

CenSoc-DMF

(N = 8 million)

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Death Master File (DMF) coverage (65+)

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Death Master File (DMF) coverage (65+)

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95% death coverage 1975-2005 (65+)
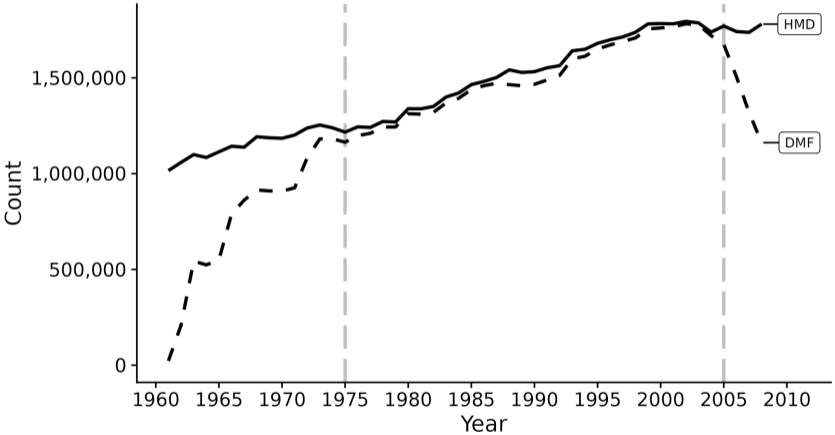
CenSoc-DMF: Linked 1940 Census and mortality records

First Census to collect information on education, employment, income, etc.

1940 Census
(Early-Life Covariates)

Social Security Death Master File
(Deaths from 1975 - 2005)

ABE Exact Match on: first name, last name, and census age

CenSoc-DMF

(N = 8 million)

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1940 Census

▶ 1940 Census reflected heightened
time of social awareness brought
about by Great Depression

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Empirical testing
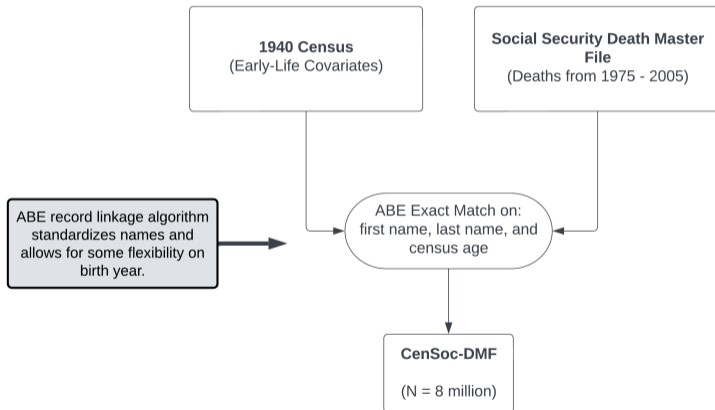○○○○○○○○○○○○○○

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References

1940 Census

▶ 1940 Census reflected heightened time of social awareness brought about by Great Depression

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

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References

1940 Census

- ▶ 1940 Census reflected heightened time of social awareness brought about by Great Depression

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

1940 Census Form

CenSoc-DMF: Linked census and mortality records

1940 Census
(Early-Life Covariates)

Social Security Death Master File
(Deaths from 1975 - 2005)

ABE record linkage algorithm standardizes names and allows for some flexibility on birth year.

ABE Exact Match on: first name, last name, and census age

CenSoc-DMF

(N = 8 million)

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Period vs. cohort perspective

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References
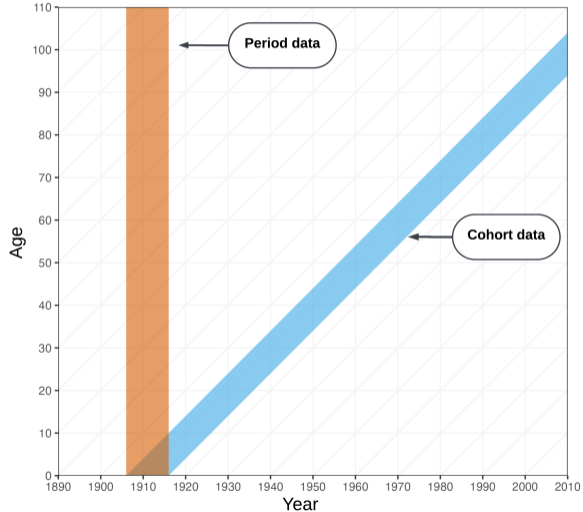
What we're generally restricted to…
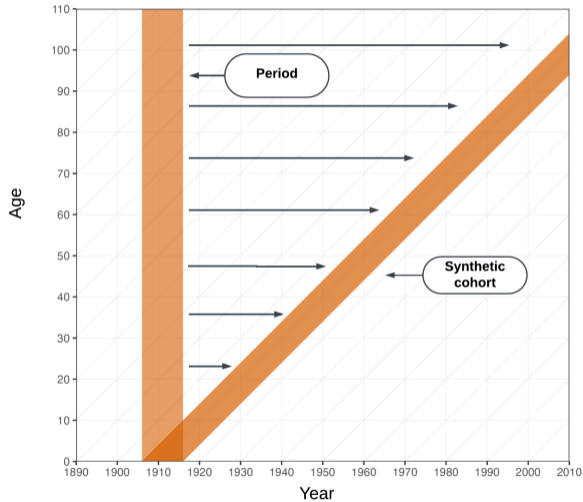
Introduction
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Data artifact
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Empirical testing
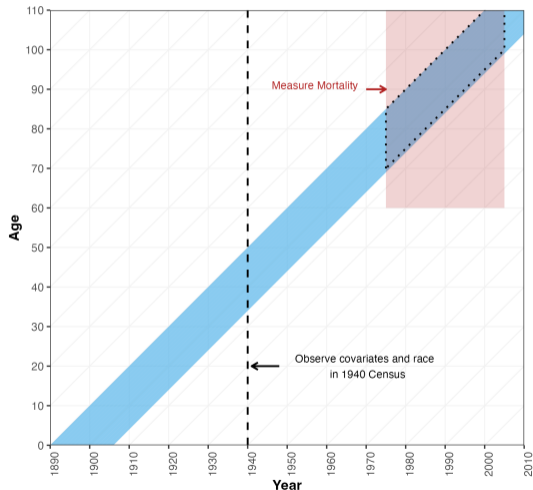○○○○○○○○○○○○○○○○

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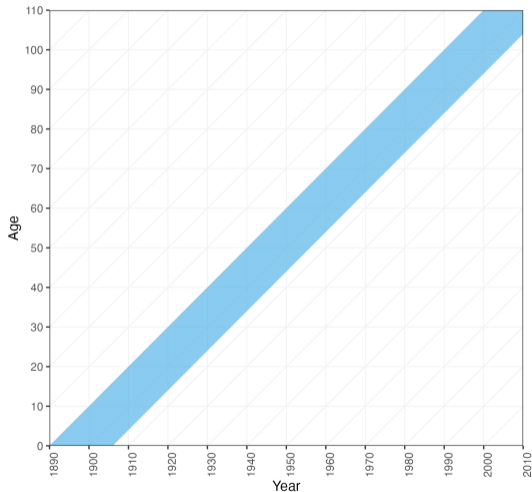
Analytic Sample

- Birth cohorts of 1890-1905
  - $N = 900,000$ deaths

- Sample restrictions
  - Men only

  - U.S. born

Analytic Sample

▶ Birth cohorts of 1890-1905
  ▶ $N = 900,000$ deaths

▶ Sample restrictions
  ▶ Men only

  ▶ U.S. born

Observe covariates and race
in 1940 Census

Analytic Sample

- Birth cohorts of 1890-1905
  - $N = 900,000$ deaths

- Sample restrictions
  - Men only
  - U.S. born

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Analytic Sample

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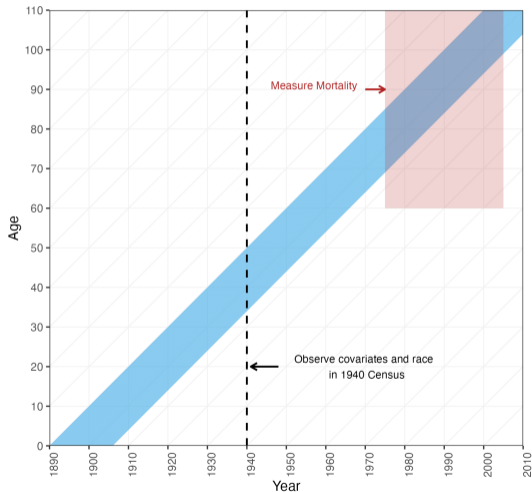
Birth cohorts of 1890-1905: extinct cohort method

▶ 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

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References

Question 1: Is the crossover a data artifact?

Explanations of
Black-White Mortality Crossover

Data Artifact:
Age Misreporting

Preston et al. (1996),
Coale and Kisker
(1985), Preston et al.
(1999) …

Heterogeneity in
Frailty

Vaupel and Yashin
(1985), Lynch et al.
(2003), Sautter et al.
(2012) …

Real Racial
Disadvantage
Attenuates at
Advanced Ages

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Black-White crossover (extinct cohort method)

Mortality Crossovers (Men)

Pooled cohorts of 1890 - 1905

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References

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
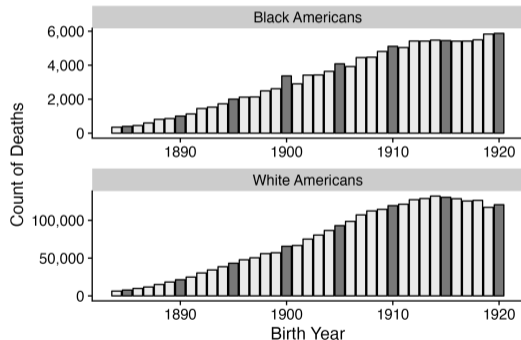
No age heaping in 1940 Census
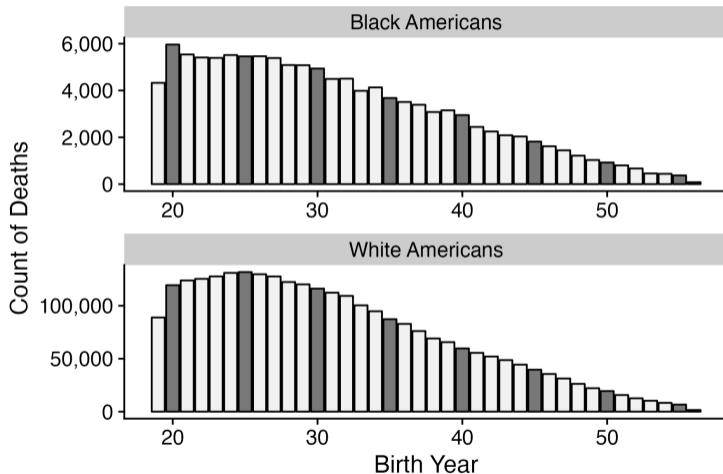
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References

Black-white crossover (extinct cohort method)

Mortality Crossovers (Men)

Pooled cohorts of 1891-1894, 1896-1899, 1901-1904

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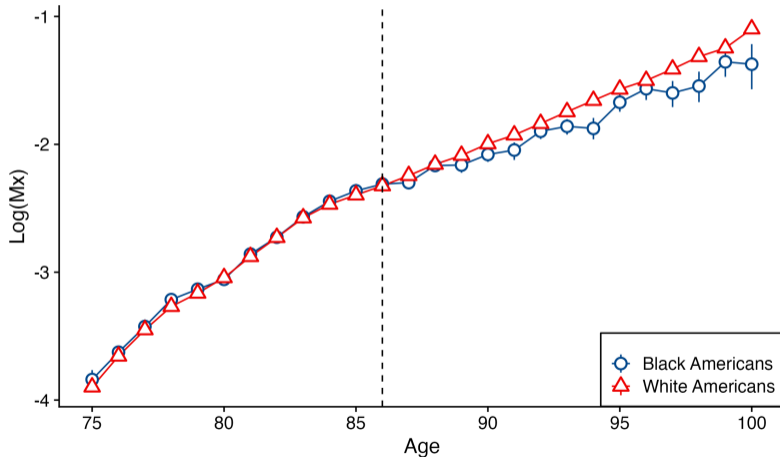
Question 2: Is the crossover driven by heterogeneity in frailty?
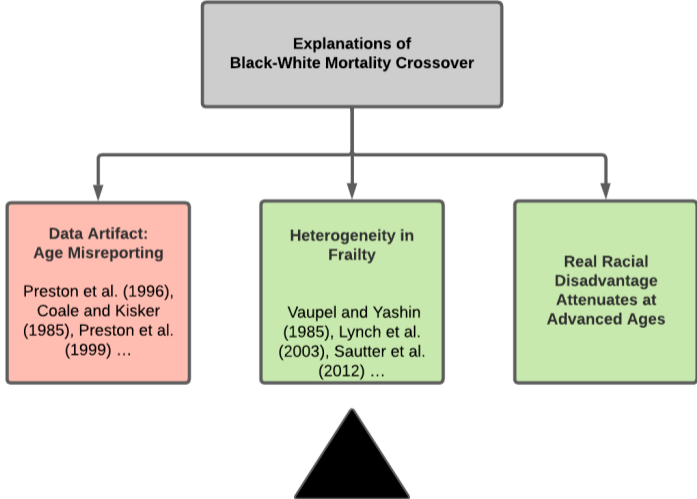
Heterogeneity in frailty – overview of approach

▶ First, how much **mortality selection** do we actually observe...?

▶ Second, does stratifying on heterogeneity uncross the crossover?

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...

- **Frailty:** an individual's susceptibility to death
  - Wealth, education, environmental, behavioral, etc.

- 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

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References

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
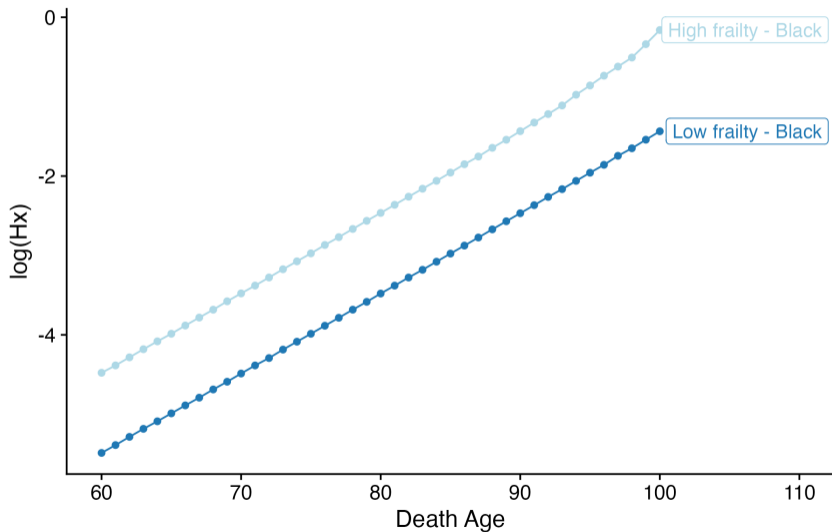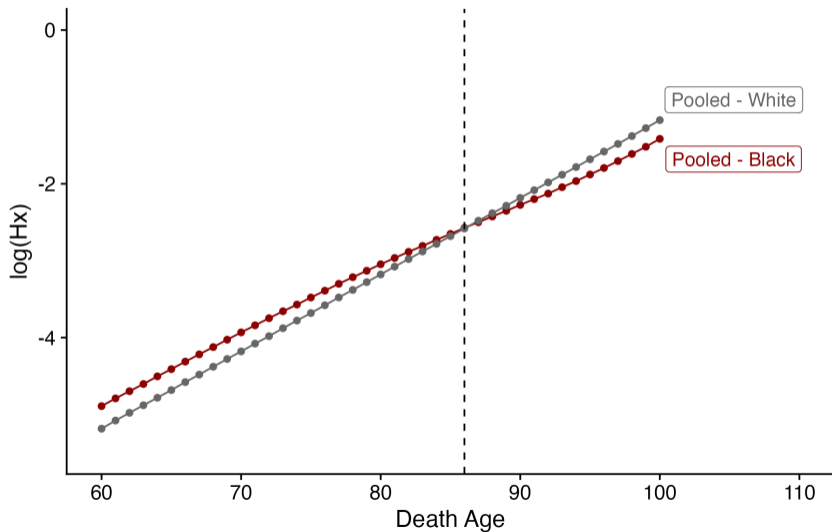
Heterogeneity in frailty (stylized example)

Heterogeneity in frailty (stylized example)

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References

Heterogeneity in frailty (stylized example)

Black (high heterogeneity)

High frailty - Black
Pooled - Black
Low frailty - Black

White (low heterogeneity)

High Frailty - White
Pooled - White
Low Frailty - White

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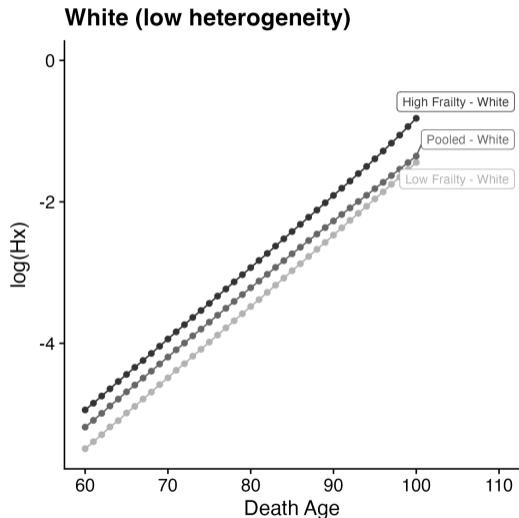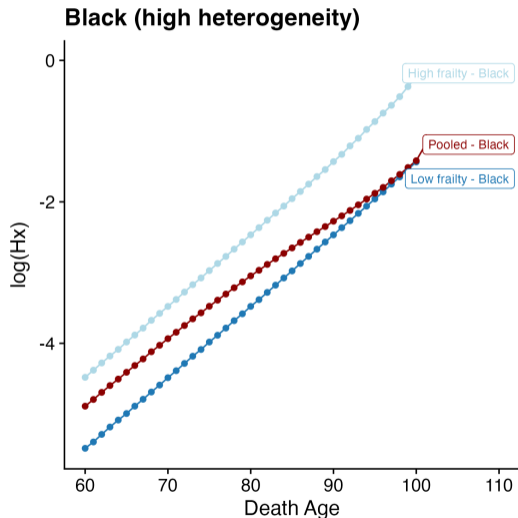
Heterogeneity in frailty (stylized example)

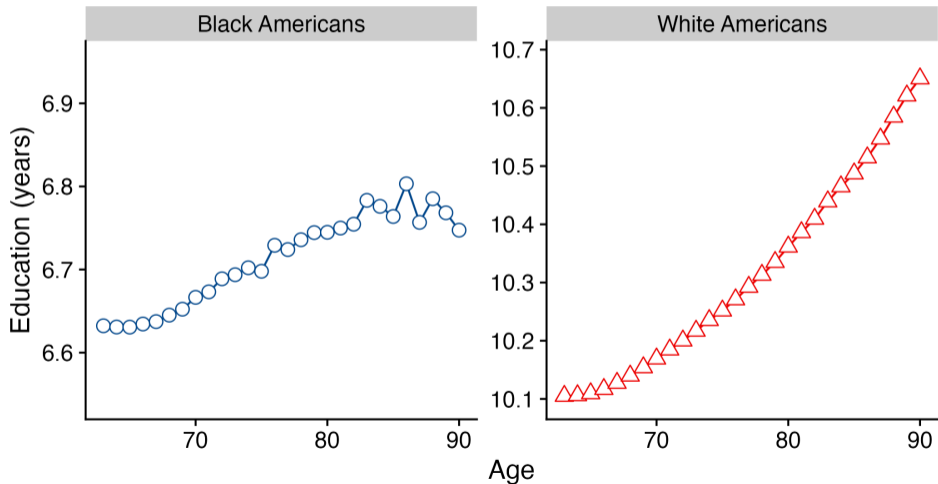# Very dramatic shift in composition of survivors...
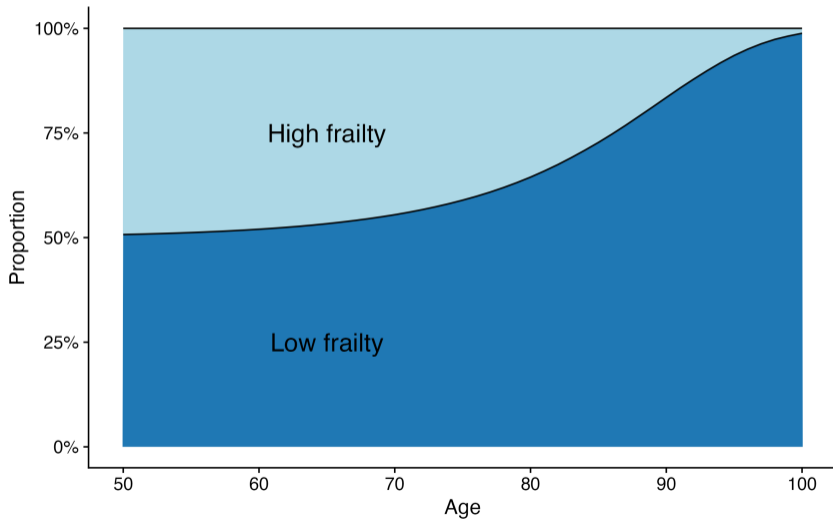
Empirical testing

▶ 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

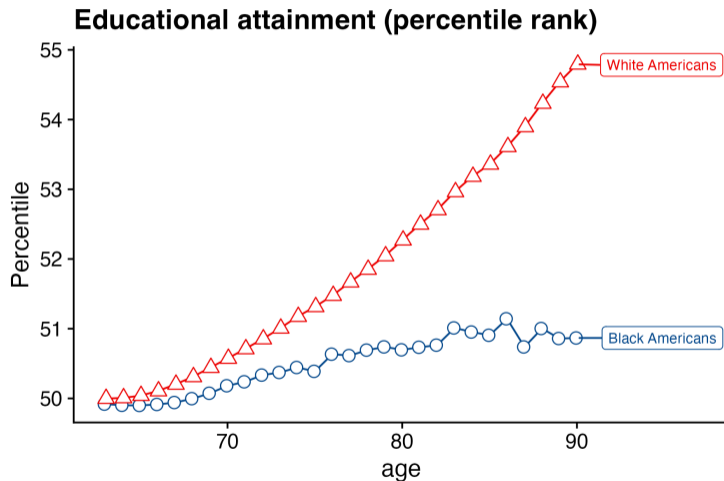# Changing educational composition of survivors

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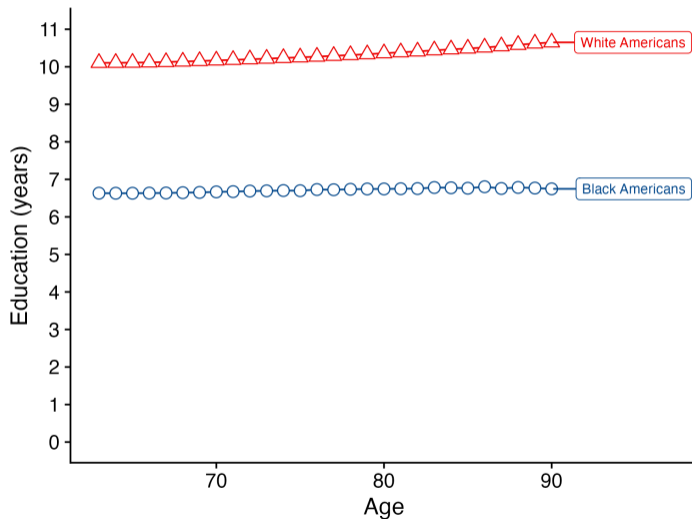
Changing composition of survivors

Educational Attainment

Changing educational composition of survivors (percentile)

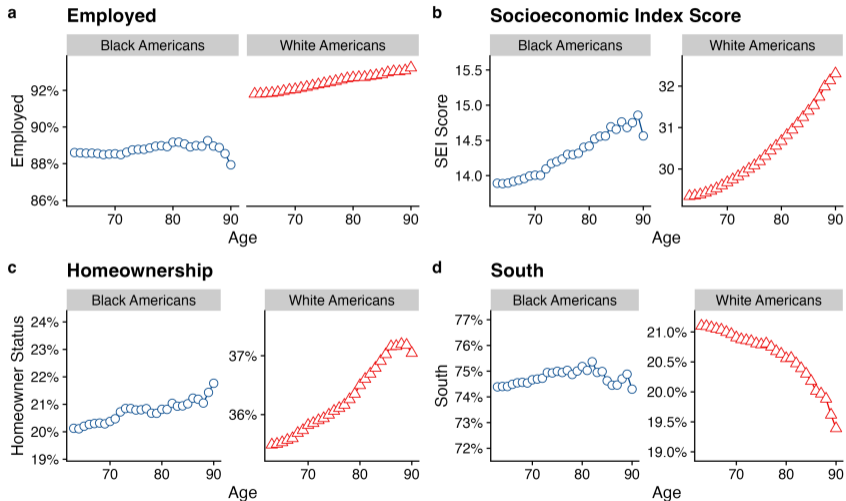**Educational attainment (percentile rank)**

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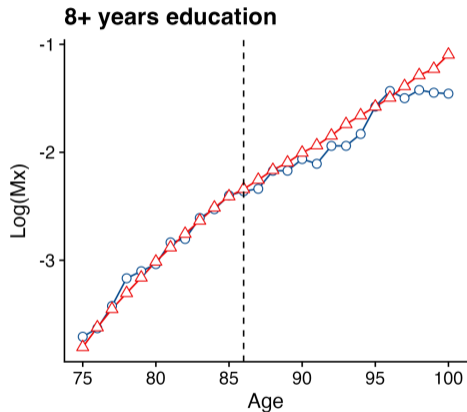Discussion
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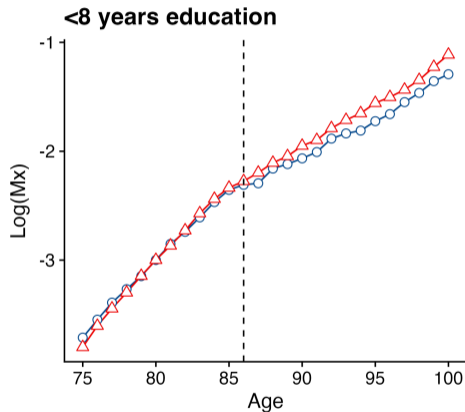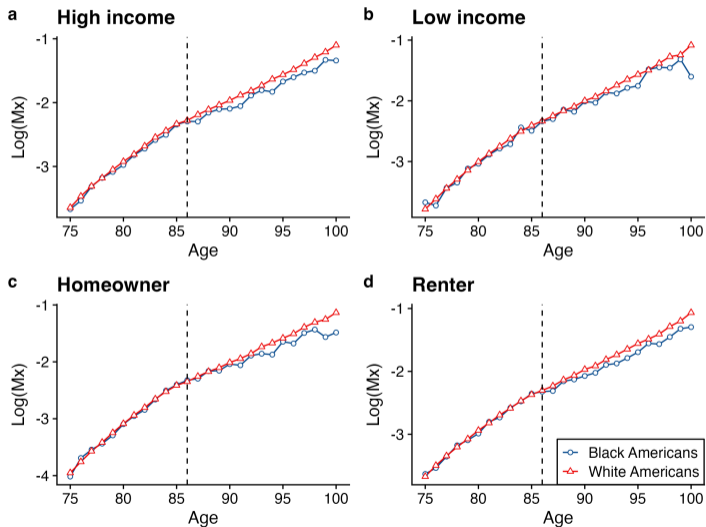# Changing composition of survivors

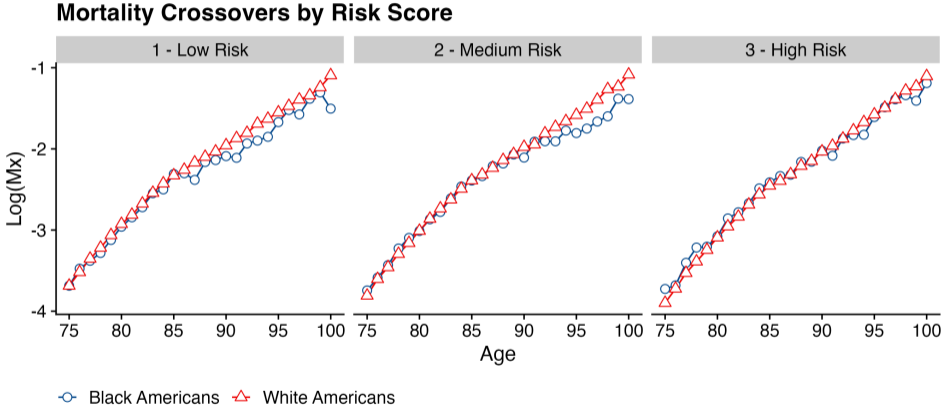**Wage and Salary Income**
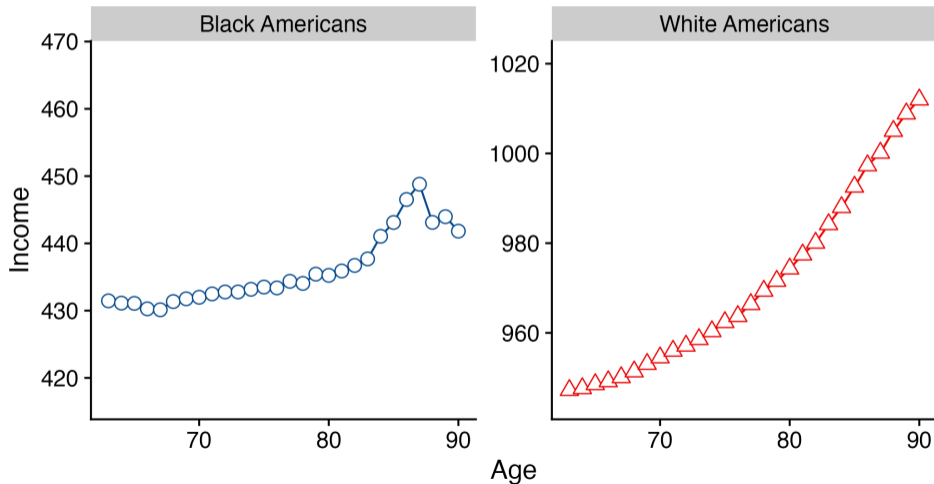
Changing composition of survivors

Stratifying by dimensions of frailty

<8 years education

8+ years education

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Stratifying by dimensions of frailty

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Stratifying on risk score

Mortality Crossovers by Risk Score
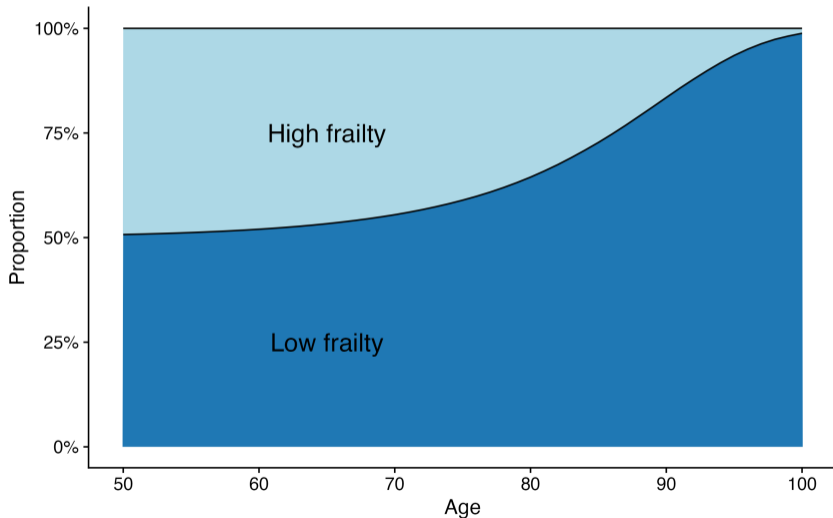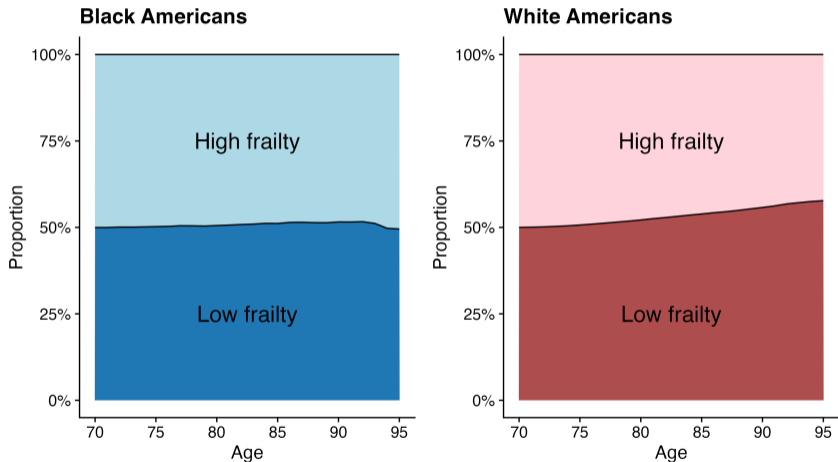
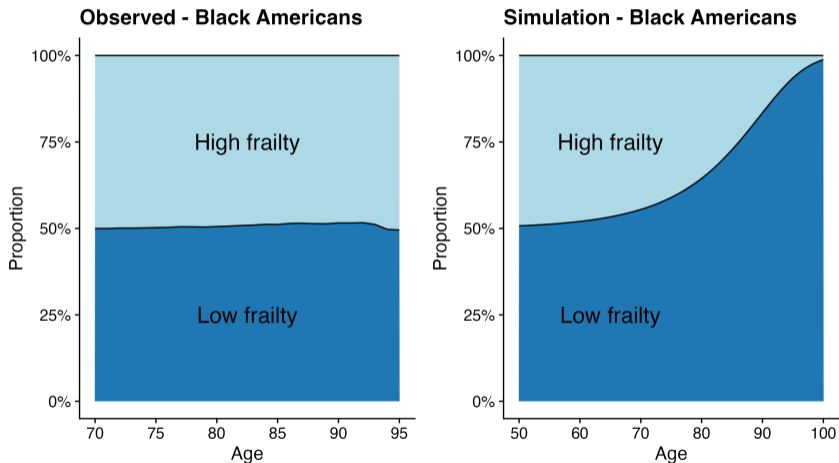# How much selection would we need? (Simulation)
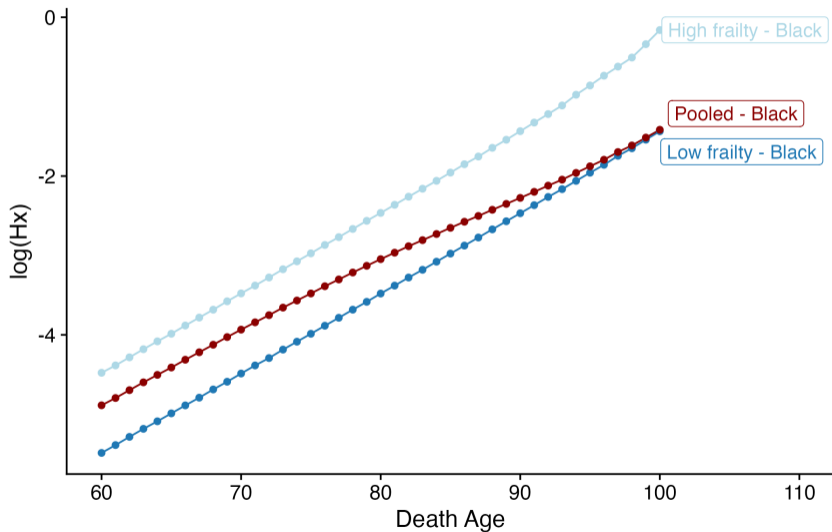
How much selection would we need for Blacks? (Simulation)

How much selection do we actually observe? Very little

Nowhere near enough for crossover...

Observed - Black Americans

Simulation - Black Americans

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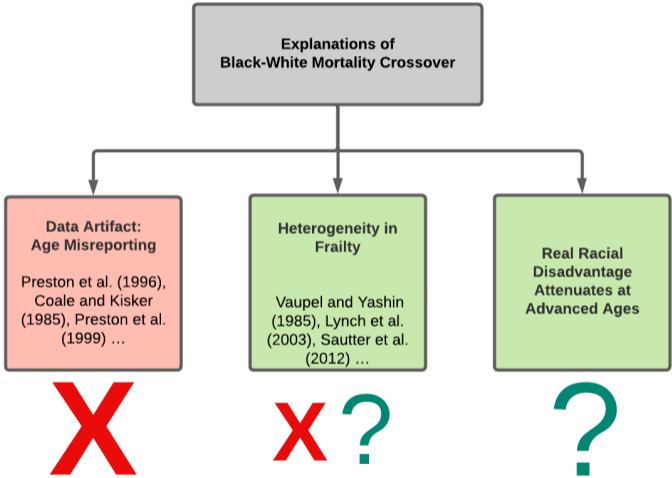
References

No support for heterogeneity in frailty explanation

1. Very little mortality selection
   - ▶ Based on simulation, nowhere near enough selection

2. Mortality selection stronger for White Americans than Black Americans
   - ▶ Cause a widening — not convergence/crossover — of mortality rates

Revisiting explanations...

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ooooooooooooooo

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ooooo

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ooooooooo

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References

Speculating on racial disadvantage at most advanced ages...

- ▶ Still backdrop of immense **racial discrimination**

- ▶ Black Americans have higher proximity to kin (**Spring, Crowder, et al. 2023**)

- ▶ Better mental health and strong coping resources for Black Americans

Do Racial Differences in Coping Resources Explain the Black–White Paradox in Mental Health? A Test of Multiple Mechanisms

Patricia Louie[1], **Laura Upenieks**[2], **Christy L. Erving**[3], **Courtney S. Thomas Tobin**[4]

[1]University of Washington, Seattle, WA, USA

[2]Baylor University, Waco, TX, USA

[3]Vanderbilt University, Nashville, TN, USA

[4]UCLA, Los Angeles, CA, USA

Abstract

A central paradox in the mental health literature is the tendency for black Americans to report similar or better mental health than white Americans despite experiencing greater stress exposure. However, black Americans' higher levels of certain coping resources may explain this finding. Using data from the Nashville Stress and Health Study (n = 1,186), we examine whether black Americans have higher levels of self-esteem, social support, religious attendance, and divine control than white Americans and whether these resources, in turn, explain the black–white paradox in mental health. In adjusted models, the black–white paradox holds for depressive symptoms and any *DSM-IV* disorder. Findings indicate that black Americans have higher levels of self-esteem, family social support, and religiosity than white Americans. Causal mediation techniques reveal that self-esteem has the largest effect in explaining black–white differences in depressive symptoms, whereas divine control has the largest effect in explaining differences in disorder.

Conclusions

▶ Black-White Crossover is real — *not **data artifact***

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 dimensions of heterogeneity might be responsible (biomarkers, self-rated health)

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 dimensions of heterogeneity might be responsible (biomarkers, self-rated health)

▶ Attenuation of disadvantage: **Intriguing**, but need more theoretical and empirical work

▶ New explanations are needed (!)

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References

What's next?

Racial **inequality** in health/mortality outcomes

▶ Are other health inequalities (i.e., morbidity, dementia) increasing or decreasing at most advanced ages? Gender differences?

▶ Investigating selection along other dimensions (height/weight, biomarkers)?

▶ More formal demography incorporating sociological theory (e.g., weathering / cumulative disadvantage, dynamic frailty)
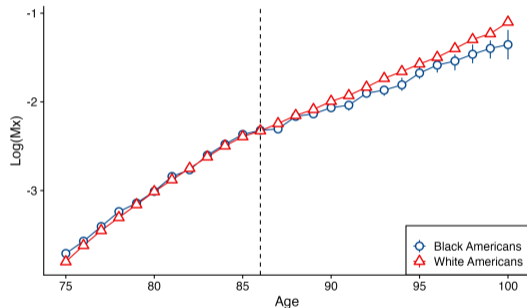
Thank you — questions?

Data: CenSoc.Berkeley.edu
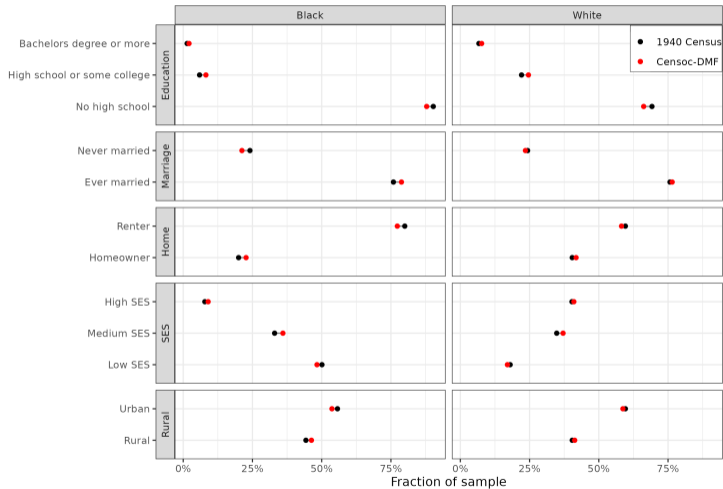
Funding: R01AG058940, R01AG076830

Contact: ✉ casey.breen@demography.ox.ac.uk
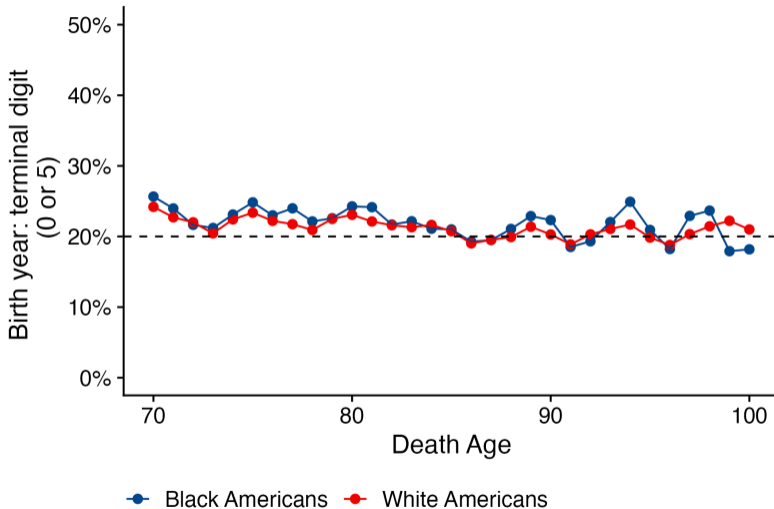

a **Mortality Crossovers (Men)**
Pooled cohorts of 1890 - 1905

Representativeness

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Age heaping

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"

Birth cohorts of 1906-1915: Gompertz Hazard Model

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

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

- **a is baseline mortality**

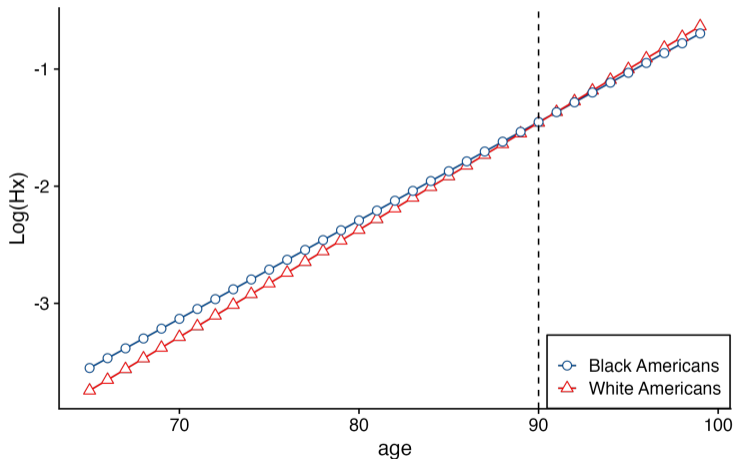# Birth cohorts of 1906-1915: Gompertz Hazard Model

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

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

▶ **a is baseline mortality**

▶ **b is rate of increase of mortality**

Black-white crossover (Gompertz Hazard Model)

Mortality Crossovers (Men)

Cohorts of 1906-1915

Stratifying on risk score

Difference in Log Hazards (White - Black)

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