CenSoc: Public Linked Administrative Mortality Records for Indvidual-Level Research

Max Planck Institute for Demographic Research

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May 22, 2025

Motivation for CenSoc

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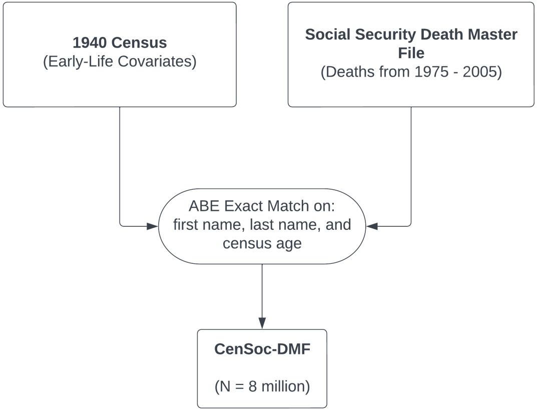
- Mortality research is often hampered by **data limitations**
  - U.S. has no population-level registry like Scandinavian countries
- Social scientists are increasingly turning to administrative datasets (Ruggles, 2014; Chetty et al., 2016; Card et al., 2010)

CenSoc: Linked IPUMS 1940 Census and Mortality Records



1940 Census
(Early-Life Covariates)

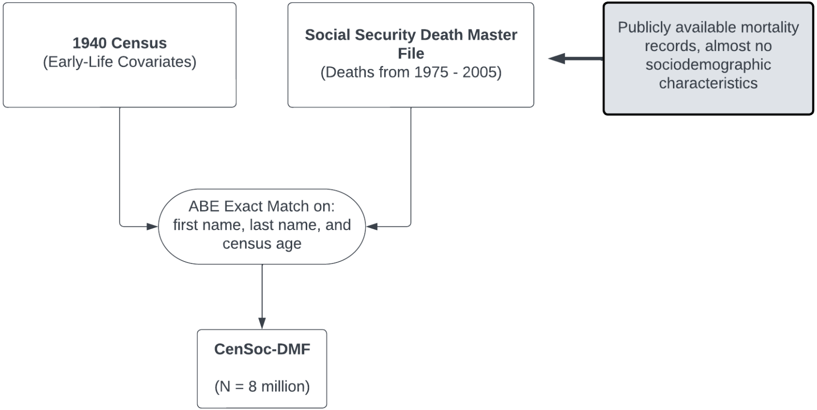
Social Security Death Master File
(Deaths from 1975 - 2005)

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

CenSoc-DMF

(N = 8 million)

CenSoc: Linked IPUMS 1940 Census and mortality records



1940 Census
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Publicly available mortality records, almost no sociodemographic characteristics

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Social Security Mortality Records – Numident

A monthly check to you –
FOR THE REST OF YOUR LIFE • • BEGINNING WHEN YOU ARE 65
GET YOUR SOCIAL SECURITY ACCOUNT NUMBER promptly
APPLICATIONS ARE BEING DISTRIBUTED AT ALL WORK PLACES
Your monthly Social Security check
NEWMAN
SOCIAL SECURITY BOARD

WHO IS ELIGIBLE • • • EVERYBODY WORKING FOR SALARY OR WAGES (WITH ONLY A FEW EXCEPTIONS, SUCH AS AGRICULTURE, DOMESTIC SERVICE, AND GOVERNMENT WORK). APPLICATIONS FOR SOCIAL SECURITY ACCOUNTS ARE AVAILABLE THROUGH EMPLOYERS. IF YOU DO NOT GET ONE FROM YOUR EMPLOYER, ASK FOR ONE AT THE POST OFFICE.

HOW TO RETURN APPLICATION

1. HAND IT BACK TO YOUR EMPLOYER, *or*
2. HAND IT TO ANY LABOR ORGANIZATION OF WHICH YOU ARE A MEMBER, *or*
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DO IT NOW. NO POSTAGE NEEDED.

–Social Security Board

INFORMATION MAY BE OBTAINED AT ANY POST OFFICE

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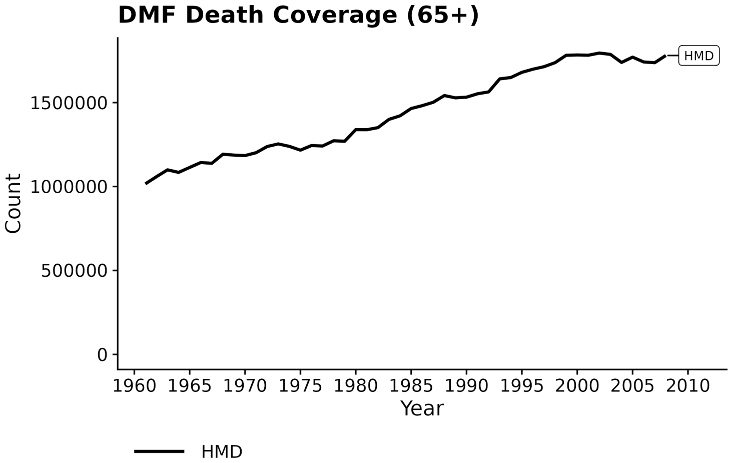
- Internal restricted version used for research by SSA researchers and collaborators (Mehta et al., 2016; Elo et al., 2004; Waldron, 2007)

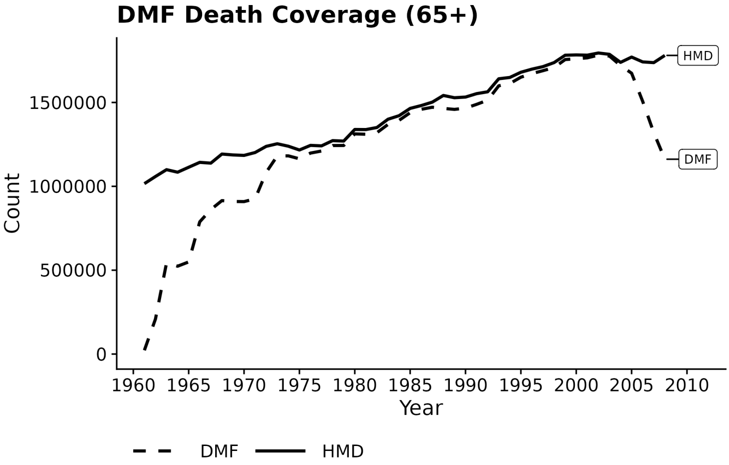
Social Security Mortality Records – Death Master File

- Social Security Death Master File (DMF) is an extract of Numident, plus misc. deaths
- **Limited info**: Name, date of birth, date of death

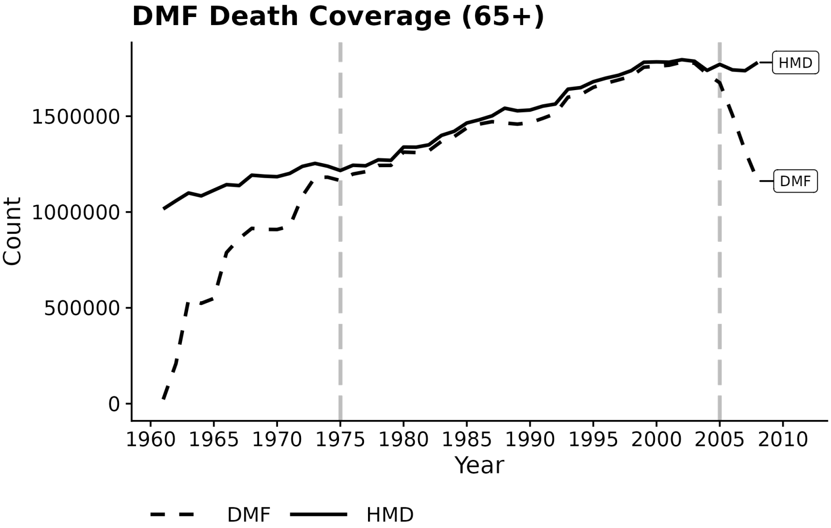
Coverage DMF (Public)



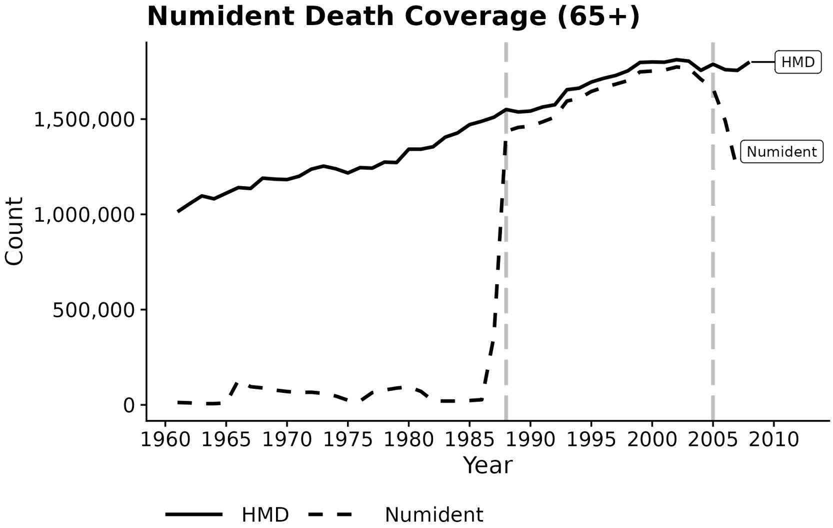
Coverage DMF (Public)



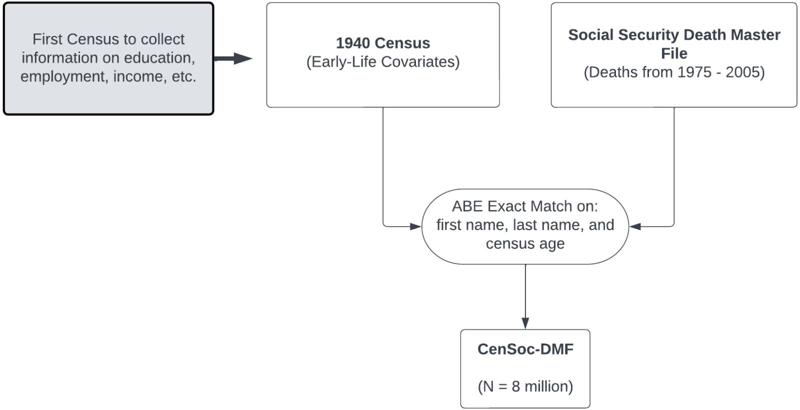
Public DMF —95% death coverage 1975-2005



Public Numident: 95%+ mortality coverage between 1988-2005



Linked IPUMS 1940 Census and mortality records



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

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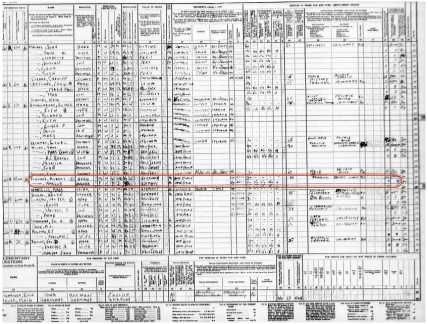
CenSoc-DMF

(N = 8 million)

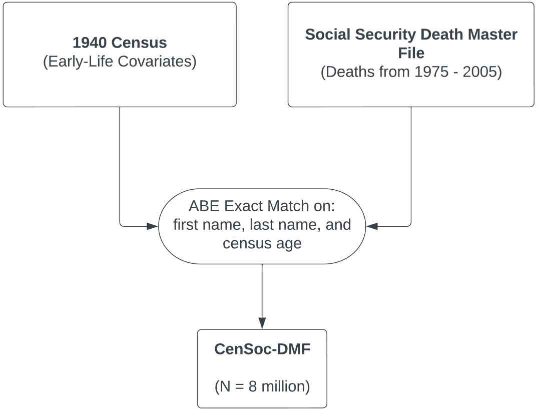
1940 Census

- 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
- Question on homeownership status (rent vs. own) and estimate of home value for owners



1940 Census Form

ABE Conservative Algorithm for Record Linkage



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Match rate (mortality adjusted)

$$M_{adjusted} = \underbrace{\left(\frac{\text{Number Established Matches}}{\text{Number of Records in 1940 Census}}\right)}_{\text{Raw match rate}} \times \underbrace{\left(\frac{1}{P(\text{Dying in window})}\right)}_{\text{Adjustment factor for mortality}},$$

- CenSoc-Numident: 22%
- CenSoc-DMF: 17%

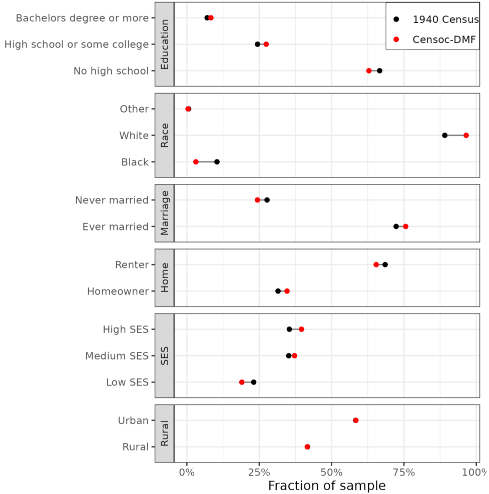
Summary of datasets

	CenSoc-DMF	CenSoc-Numident
Gender	Men-Only	Men and Women
1940 Census Covariates	Yes	Yes
Death Coverage	1975-2005	1988-2005
Size	4.7 Million	7.0 Million

Characteristics of CenSoc Datasets

Mostly representative of general population

- Compared to the general population, CenSoc is:
  - Slightly higher socioeconomic status
  - Slightly more white

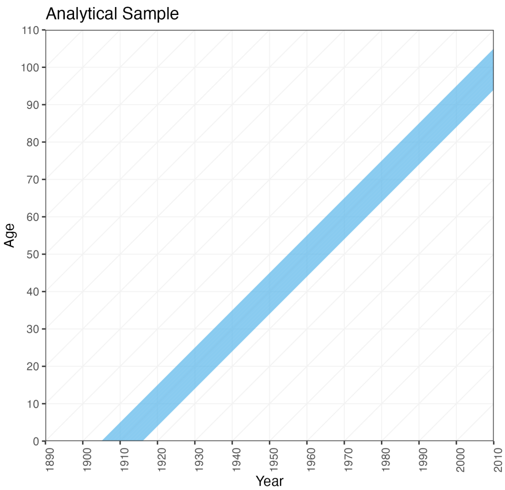


Statistical Person-level Weights

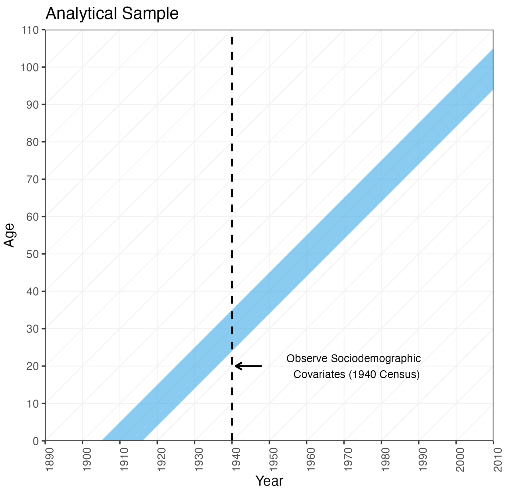
- **Post-stratification weights:** Use population totals from the Multiple Cause-of-Death (MCOD) mortality data from National Center for Health Statistics (NCHS)
- Individuals are split into cells cross-classified by year of death (y), age at death (a), sex (s), race (r), and birth state (b)

$$W_{yasrb} = \frac{\text{number of deaths in NCHS cell } yasrb}{\text{number of deaths in CenSoc cell } yasrb}$$

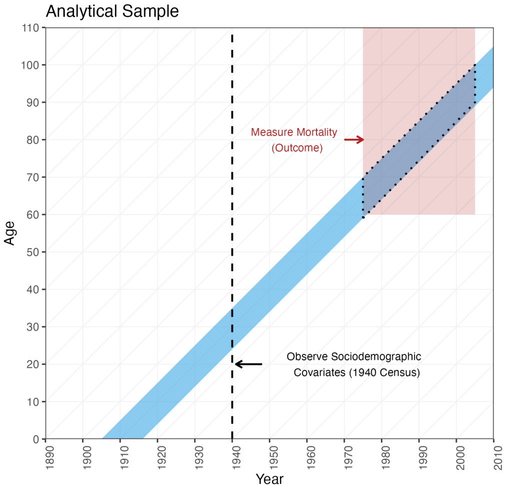
Cohort perspective



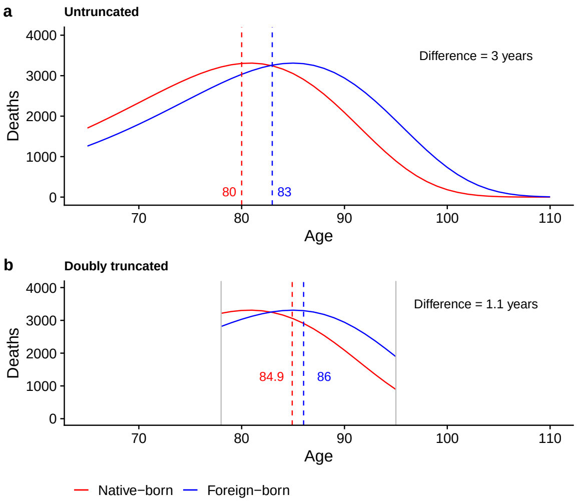
Cohort perspective



Cohort perspective



Double truncation presents challenges for mortality estimation



Method 1: OLS regression on age of death (attenuated)

$$\text{Age of Death} = \beta_0 + \lambda_t t + X\beta + \epsilon$$

where

1. β_0 is the intercept

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where

1. β_0 is the intercept
2. $\lambda_t t$ **are birth year fixed effects**
3. $\mathbf{X}$ **is a matrix of covariates and** β **is the coefficient vector**

Method 2: Gompertz parametric MLE approach (no attenuation)

$$h_i(x|\beta) = a_0 e^{b_0 x} e^{\beta Z_i}$$

where

- $h_i(x|\beta)$ is the hazard at age x conditional on parameters

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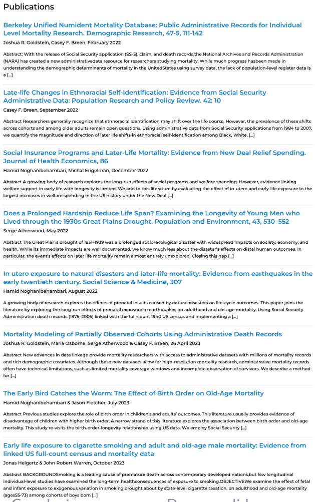
- a_0 **is some baseline level of mortality**
- b_0 **gives rate of increase of mortality over time**
- Z_i are the covariates for person i (e.g., years of education, place of birth)
- β is the set of coefficients

What can you do with the data?

- Mortality disparities by education, national origin, and race
- Early life conditions and later-life mortality + geographic variation and the neighborhood determinants of mortality
- Natural experiments from local policies and chance events such as natural disasters.



Publications

Berkeley Unified Numident Mortality Database: Public Administrative Records for Individual Level Mortality Research. Demographic Research, 47-5, 111-142

Joshua R. Goldstein, Casey F. Breen, February 2022

Abstract: With the release of Social Security application (SS-5), claim, and death records,the National Archives and Records Administration (NARA) has created a new administrativedata resource for researchers studying mortality. While much progress hasbeen made in understanding the demographic determinants of mortality in the UnitedStates using survey data, the lack of population-level register data is a [...]

Late-life Changes in Ethnoracial Self-Identification: Evidence from Social Security Administrative Data: Population Research and Policy Review. 42: 10

Casey F. Breen, September 2022

Abstract Researchers generally recognize that ethnoracial identification may shift over the life course. However, the prevalence of these shifts across cohorts and among older adults remain open questions. Using administrative data from Social Security applications from 1984 to 2007, we quantify the magnitude and direction of later life shifts in ethnoracial self-identification among Black, White, [...]

Social Insurance Programs and Later-Life Mortality: Evidence from New Deal Relief Spending. Journal of Health Economics, 86

Hamid Noghanibehambari, Michal Engelman, December 2022

Abstract A growing body of research explores the long-run effects of social programs and welfare spending. However, evidence linking welfare support in early life with longevity is limited. We add to this literature by evaluating the effect of in-utero and early-life exposure to the largest increases in welfare spending in the US history under the New Deal [...]

Does a Prolonged Hardship Reduce Life Span? Examining the Longevity of Young Men who Lived through the 1930s Great Plains Drought. Population and Environment, 43, 530–552

Serge Atherwood, May 2022

Abstract The Great Plains drought of 1931–1939 was a prolonged socio-ecological disaster with widespread impacts on society, economy, and health. While its immediate impacts are well documented, we know much less about the disaster's effects on distal human outcomes. In particular, the event's effects on later life mortality remain almost entirely unexplored. Closing this gap [...]

In utero exposure to natural disasters and later-life mortality: Evidence from earthquakes in the early twentieth century. Social Science & Medicine, 307

Hamid Noghanibehambari, August 2022

A growing body of research explores the effects of prenatal insults caused by natural disasters on life-cycle outcomes. This paper joins the literature by exploring the long-run effects of prenatal exposure to earthquakes on adulthood and old-age mortality. Using Social Security Administration death records (1975–2005) linked with the full-count 1940 US census and implementing a [...]

Mortality Modeling of Partially Observed Cohorts Using Administrative Death Records

Joshua R. Goldstein, Maria Osborne, Serge Atherwood & Casey F. Breen, 26 April 2023

Abstract New advances in data linkage provide mortality researchers with access to administrative datasets with millions of mortality records and rich demographic covariates. Although these new datasets allow for high-resolution mortality research, administrative mortality records often have technical limitations, such as limited mortality coverage windows and incomplete observation of survivors. We describe a method for [...]

The Early Bird Catches the Worm: The Effect of Birth Order on Old-Age Mortality

Hamid Noghanibehambari & Jason Fletcher, July 2023

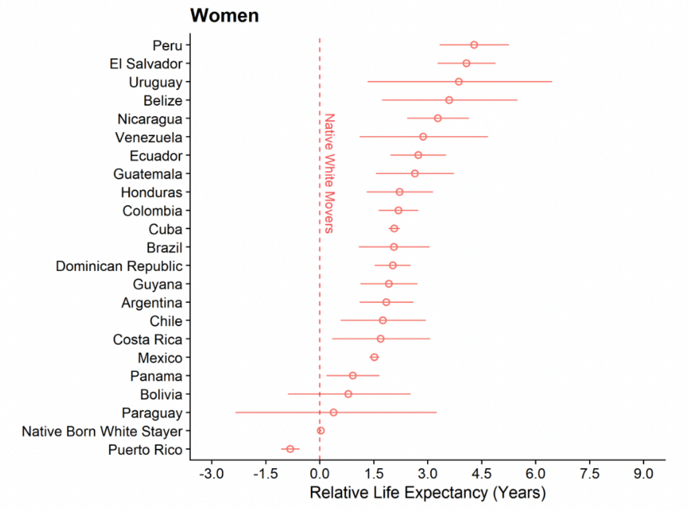
Abstract Previous studies explore the role of birth order in children's and adults' outcomes. This literature usually provides evidence of disadvantage of children with higher birth order. A narrow strand of this literature explores the association between birth order and old-age mortality. This study re-visits the birth-order-longevity relationship using US data. We employ Social Security [...]

Early life exposure to cigarette smoking and adult and old-age male mortality: Evidence from linked US full-count census and mortality data

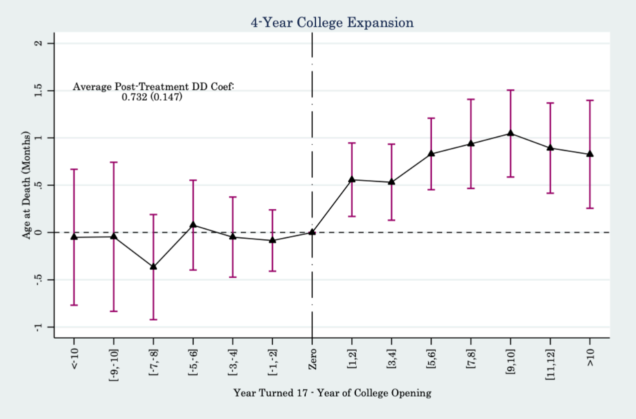
Jonas Helgertz & John Robert Warren, October 2023

Abstract BACKGROUNDSmoking is a leading cause of premature death across contemporary developed nations,but few longitudinal individual-level studies have examined the long-term healthconsequences of exposure to smoking.OBJECTIVEWe examine the effect of fetal and infant exposure to exogenous variation in smoking,brought about by state-level cigarette taxation, on adulthood and old-age mortality (ages55-73) among cohorts of boys born [...]

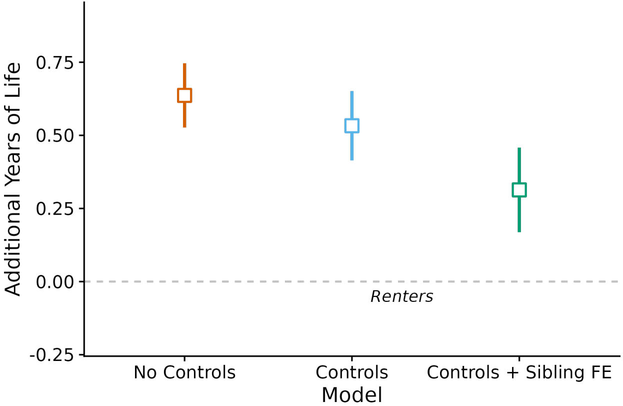
González et al. — Hispanic mortality paradox



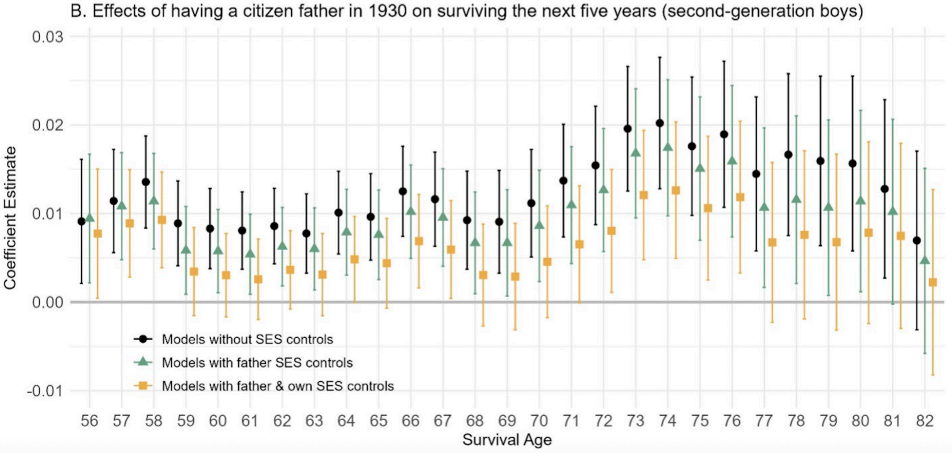
Education Expansion and Mortality (Fletcher et al. 2022, Health Economics)



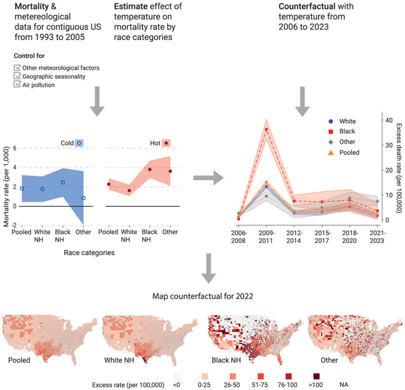
Longevity Benefits of Homeownership (Breen 2024, Demography)



Citizen Mortality Advantage (Shi and Fletcher 2025, Demography)



Racial disparities in deaths related to extreme temperatures (Conte Keivabu, Basellini, and Zagehni 2022)



Mortality & metereological data for contiguous US from 1993 to 2005

Estimate effect of temperature on mortality rate by race categories

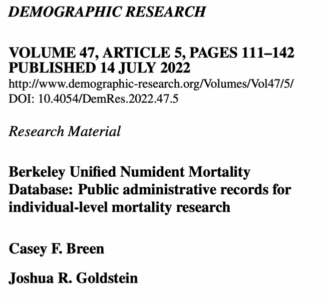
Counterfactual with temperature from 2006 to 2023

Control for

☑ Other meteorological factors
☑ Geographic seasonality
☑ Air pollution

Map counterfactual for 2022

Other Data Products



DEMOGRAPHIC RESEARCH

VOLUME 47, ARTICLE 5, PAGES 111–142
PUBLISHED 14 JULY 2022
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DOI: 10.4054/DemRes.2022.47.5

Research Material

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- Berkeley Unified Numident Mortality Database (BUNMD)

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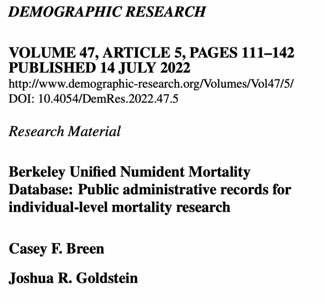

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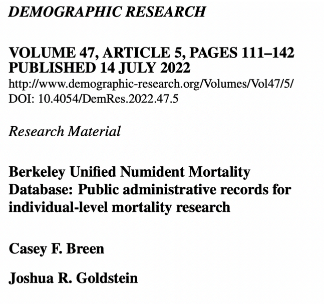

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  - 9 million records, height + weight
  - Link to: 1940 Census, mortality records

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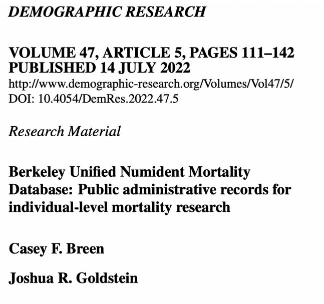

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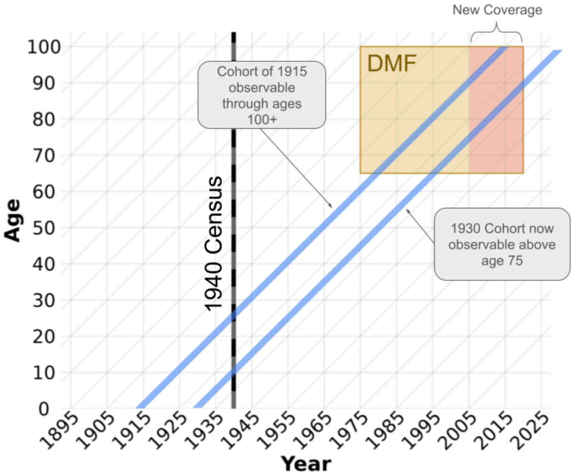
Recent release: more recent death records



How to get started...

- **https://censoc.berkeley.edu/**
  - Data + tutorials + publications
- Annual users conference
- Reach out if you have data questions / requests: **censoc@berkeley.edu**

Thank You

Download: CenSoc.Berkeley.edu

Funding: R01AG058940, R01AG076830

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

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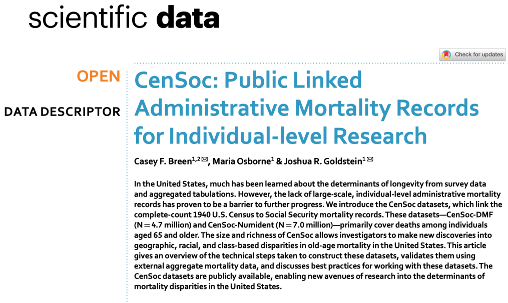

scientific **data**

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.

Reserve Slides

References

Card, David E., Raj Chetty, Martin S. Feldstein and Emmanuel Saez. 2010. "Expanding Access to Administrative Data for Research in the United States." *American Economic Association, Ten Years and Beyond: Economists Answer NSF's Call for Long-Term Research Agendas.* .

Chetty, Raj, Michael Stepner, Sarah Abraham, Shelby Lin, Benjamin Scuderi, Nicholas Turner, Augustin Bergeron and David Cutler. 2016. "The Association Between Income and Life Expectancy in the United States, 2001-2014." *JAMA* 315(16):1750.

Elo, Irma T., Cassio M. Turra, Bert Kestenbaum and B. Reneé Ferguson. 2004. "Mortality Among Elderly Hispanics in the United States: Past Evidence and New Results." *Demography* 41(1):109–128.

Mehta, Neil K., Irma T. Elo, Michal Engelman, Diane S. Lauderdale and Bert M. Kestenbaum. 2016. "Life Expectancy Among U.S.-Born and Foreign-born Older Adults in the United States: Estimates From Linked Social Security and Medicare Data." *Demography* 53(4):1109–1134.

Ruggles, Steven. 2014. "Big Microdata for Population Research." *Demography* 51(1):287–297.

Waldron, Hilary. 2007. "Trends in Mortality Differentials and Life Expectancy for Male Social Security-Covered Workers, by Socioeconomic Status." *Social Security Bulletin* 67(3):28.