Decomposition of the US Black/White inequality in life expectancy

Quantifying the impact of deaths of despair

Mathew Kiang, ScD
@mathewkiang
Postdoctoral Research Fellow
Center for Population Health Sciences
Stanford University

Monica Alexander, PhD
@monjalexander
Assistant Professor
Department of Sociology
Department of Statistical Sciences
University of Toronto

Life Expectancy in the US

- In 2017, US life expectancy declined for 3rd year in a row\(^1\)
- Has not happened since 1918\(^2\)

Life Expectancy in the US

- In 2017, US life expectancy declined for **3rd year in a row**\(^1\)
- Has not happened **since 1918**\(^2\)
- Follows Case and Deaton 2015,\(^3\) which observed higher rates of *deaths of despair* in middle-age non-Hispanic Whites

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Deaths of Despair

- Alcohol-related liver disease, suicide, or drug overdose
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- 1999–2013, increases in 40-54 year old non-Hispanic White (NHW) population
Deaths of Despair

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- 1999–2013, increases in 40-54 year old non-Hispanic White (NHW) population
- 2014–2017, affecting other ages and non-Hispanic Black (NHB) population
Racial/Ethnic Health Inequalities

- But health inequalities aren’t new\(^1\)
- And grow and shrink over time\(^2,3\)
- Geographical variation yet spatially persistent\(^4\)

Quantify impact of deaths of despair on Black/White inequalities
Data and Methods

• Restricted-access death and population data from the NCHS, 1999 to 2017 to create life tables


\[ f(p_2) - f(p_1) = \sum_{i=1}^{n} \int_{x(p_1)}^{x(p_2)} \frac{\partial f}{\partial x_i} \]
Data and Methods

- Interested in **decomposing** the **difference in life expectancy** between two groups

\[
 f(p_2) - f(p_1) = \sum_{i=1}^{n} \int x(p_2) \frac{\partial f}{\partial x_i} x(p_1)
\]

Data and Methods

- Interested in decomposing the difference in life expectancy between two groups.
- Express White LE and Black LE as a function $f$ of $n$ covariates denoted $x = [x_1, \ldots, x_n]$.

$$f(p_2) - f(p_1) = \sum_{i=1}^{n} \int_{x(p_1)}^{x(p_2)} \frac{\partial f}{\partial x_i}$$
Data and Methods

- Interested in decomposing the difference in life expectancy between two groups.
- Express White LE and Black LE as a function $f$ of $n$ covariates denoted $\boldsymbol{x} = [x_1, \ldots, x_n]$
- Here, life expectancy ($f$) is a function of mortality rates by age ($x_1$) and type of death ($x_2$)

• In 1999, NHW outlived NHB by ~6 years
• Negative values indicate NHB mortality rate is lower than NHW mortality rate in that age group
• NHW lower mortality in nearly every age group except 85+
In 1999, deaths of despair accounted for less than 1% of the Black/White inequality in life expectancy (-0.05 years).

Non-despair, under-5 mortality was the single largest contributor at 12% (.72 years).
Two main results
(+ one bonus)
Convergence Mainly from Non-despair Deaths

- **Majority** of the lower inequality is due improvements in NHB 15-54 and 55+, non-despair mortality (5.17 to 3.18 years)

- **Small contribution** from 15-54 deaths of despair (albeit, growing: -0.04 to -0.49 years)
We Need to Reduce Under-5 Deaths

- **Under-5** inequality has *not* improved since 2010 (0.53 years)
- **Under-5** inequality has *only* modestly declined since 1999 (0.72 years)
- In every year, non-despair **under-5** mortality is single largest contributor
There is Substantial Geographic Variation

- Pacific: 3.75 years
- EN Central: 4.77 years
- New England: -0.34 years

~1% from Deaths of despair

Deaths of despair almost offset non-despair advantage among NHW
**Conclusion**

Decomposition methods are useful and flexible — nuanced view of inequalities.

We need to address under-5 mortality. Deaths of despair minor relative to under-5.

Geography cannot be ignored. Interventions must be local.
Thank you

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Mathew Kiang, ScD
T32 Postdoctoral Fellow
mathewkiang@mkiang@stanford.edu

Stanford Center for Population Health Sciences

Support:
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PHS DataCore and SRCC for computational resources.
Additional slides
Contributions by Division

Contribution to Black-White Difference (Years)
Data and Methods

- We can find the solution using numerical integration (i.e., calculating small steps between observations)

- This assumes a smooth continuous function (i.e., differentiable but not necessarily monotonic)

- While deaths are discrete events at the individual level, death rates at the population level are (generally) smooth

\[ f(p_2) - f(p_1) = \sum_{i=1}^{n} \int_{x(p_1)}^{x(p_2)} \frac{\partial f}{\partial x_i} \]
Data and Methods

• We performed numerical integration in R 3.6.0 using 20 integration steps as outlined in Horiuchi, Wilmoth, and Pletcher. 2008. “A Decomposition Method Based on a Model of Continuous Change.” *Demography* 45 (4)

\[
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\]
Data and Methods

- Used simulation to estimate uncertainty intervals
- Assume deaths are Poisson distributed and use observed age- and death-type-specific mortality rates as the mean of the distribution
- Create a simulated life table
- Estimate the quantity of interest
- Repeat 1,000 times and report 2.5th and 97.5th percentiles
In 1999, NHW outlived NHB by ~6 years

Negative values indicate NHB mortality rate is lower than NHW mortality rate in that age group

NHW lower mortality in nearly every age group except 85+*
Decomposing Black/White Inequality

By 2017, Black/White inequality dropped to 3.24 years.
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17% of gap is due to deaths of despair (-0.54 years)
• By 2017, Black/White inequality dropped to 3.24 years
• 17% of gap is due to deaths of despair (-0.54 years)
• Non-despair, under-5 mortality still the largest contributor 17% (0.55 years)
There is substantial geographic variation


- Pacific: 3.75 years
- EN Central: 4.77 years
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