

Decomposition of the US Black/White inequality in life expectancy

Quantifying the impact of deaths of despair



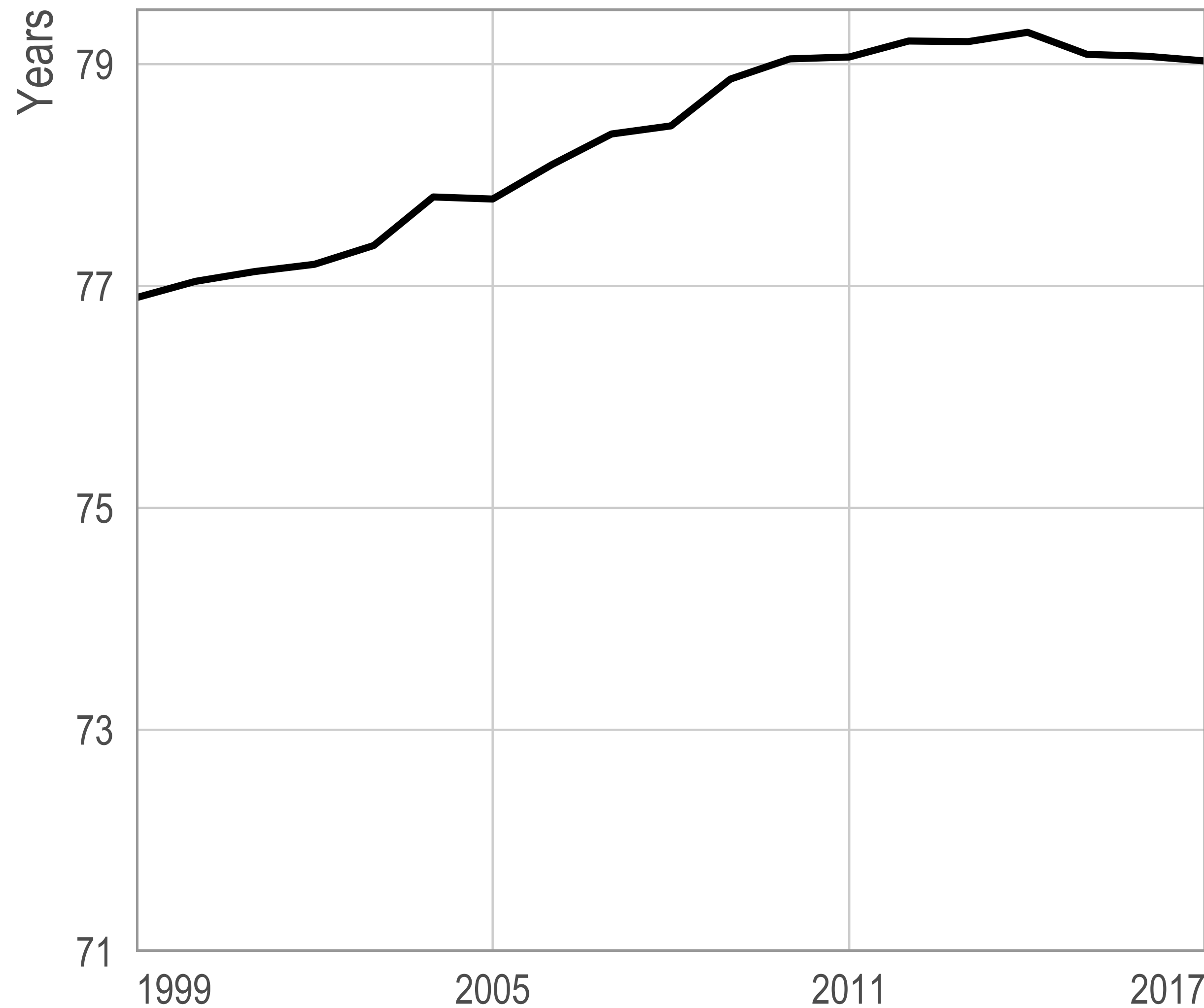
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http://bit.ly/ser_2019

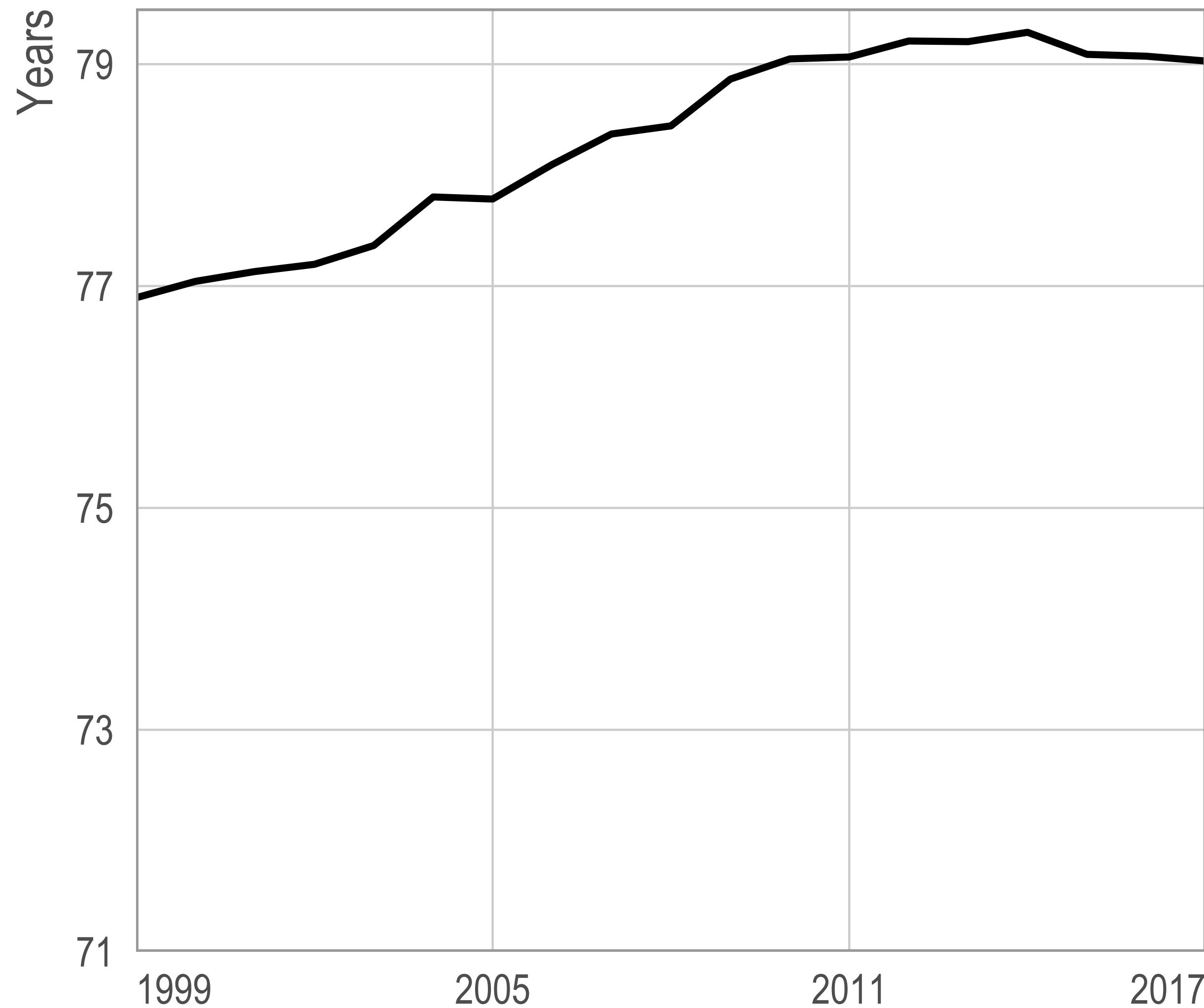
Life Expectancy in the US



- In 2017, US life expectancy declined for **3rd year in a row**¹

1. Murphy, Xu, Kochanek, and Arias. 2018. "Mortality in the United States, 2017." NCHS Data Brief.

Life Expectancy in the US

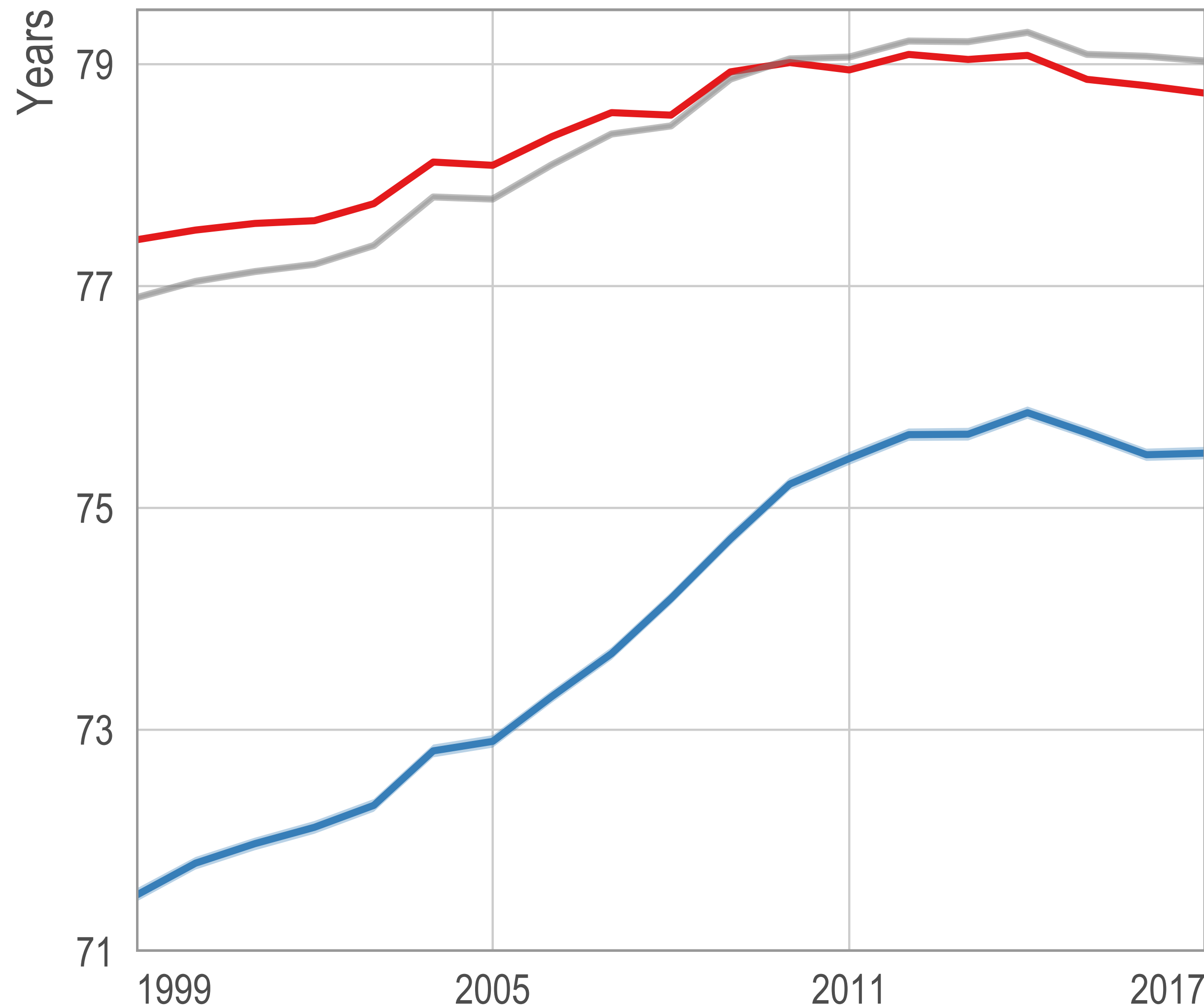


- In 2017, US life expectancy declined for **3rd year in a row**¹
- Has not happened **since 1918**²

1. Murphy, Xu, Kochanek, and Arias. 2018. "Mortality in the United States, 2017." NCHS Data Brief.

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Life Expectancy in the US



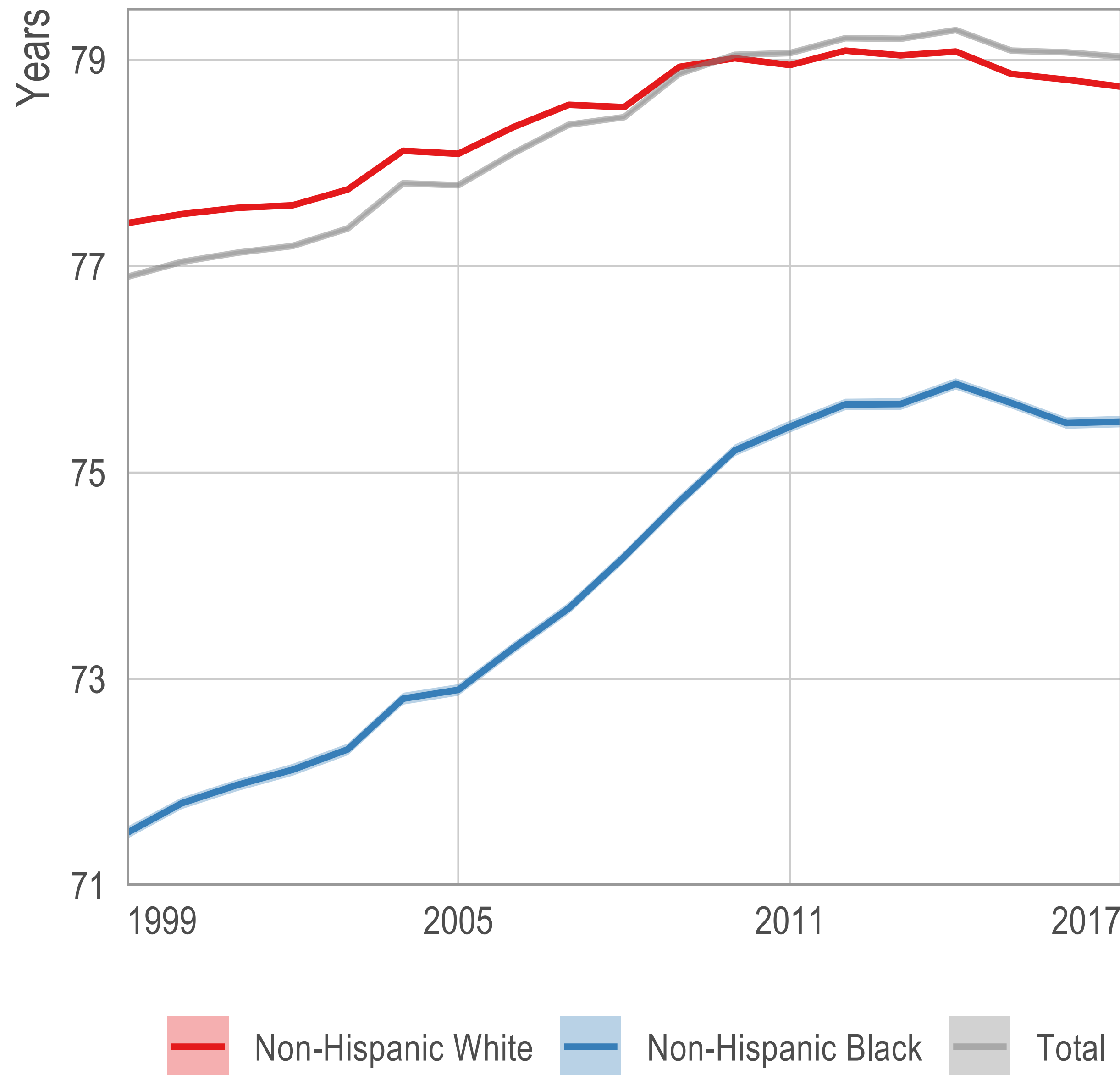
- In 2017, US life expectancy declined for **3rd year in a row**¹
- Has not happened **since 1918**²

— Non-Hispanic White — Non-Hispanic Black — Total

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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

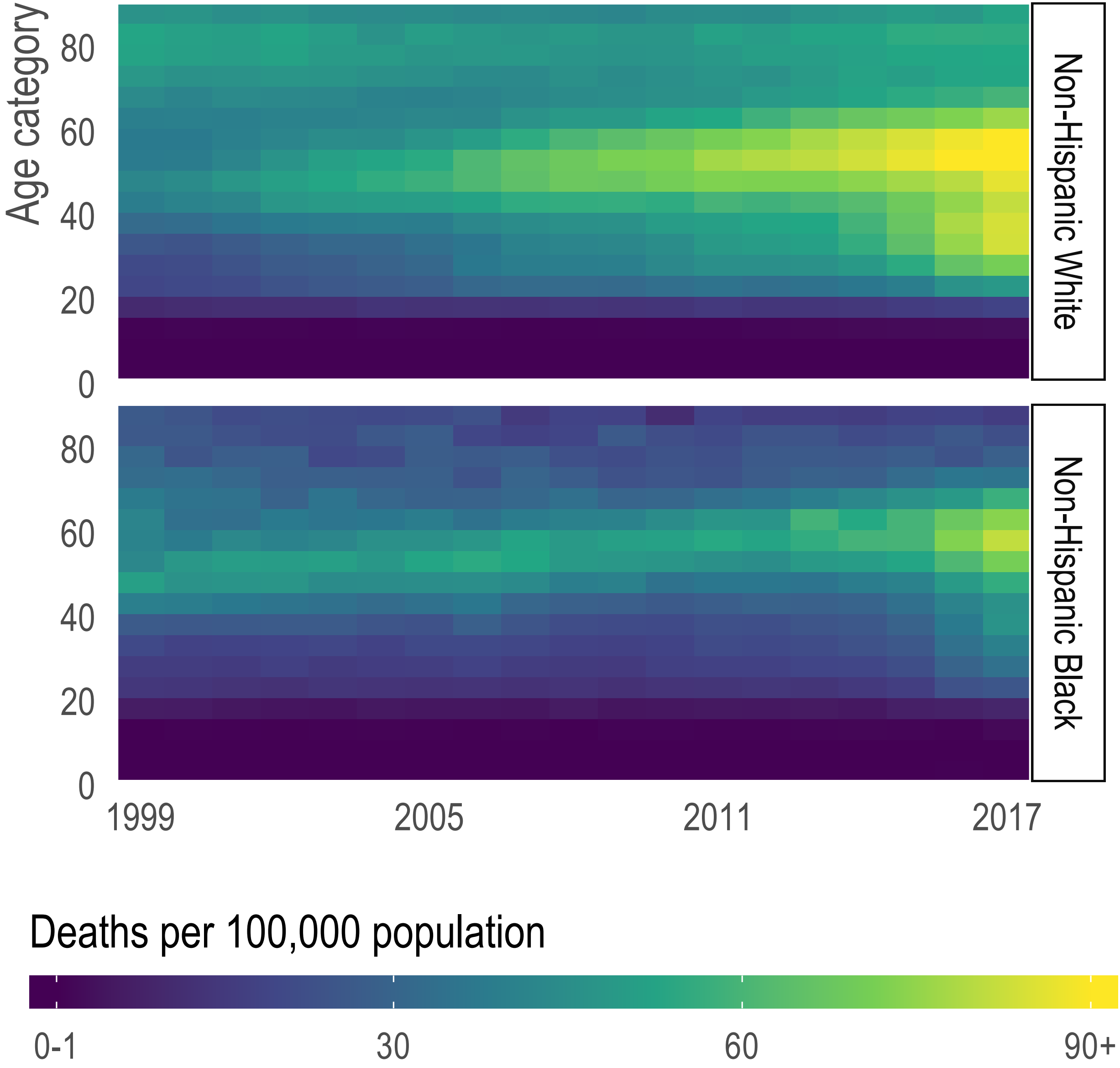
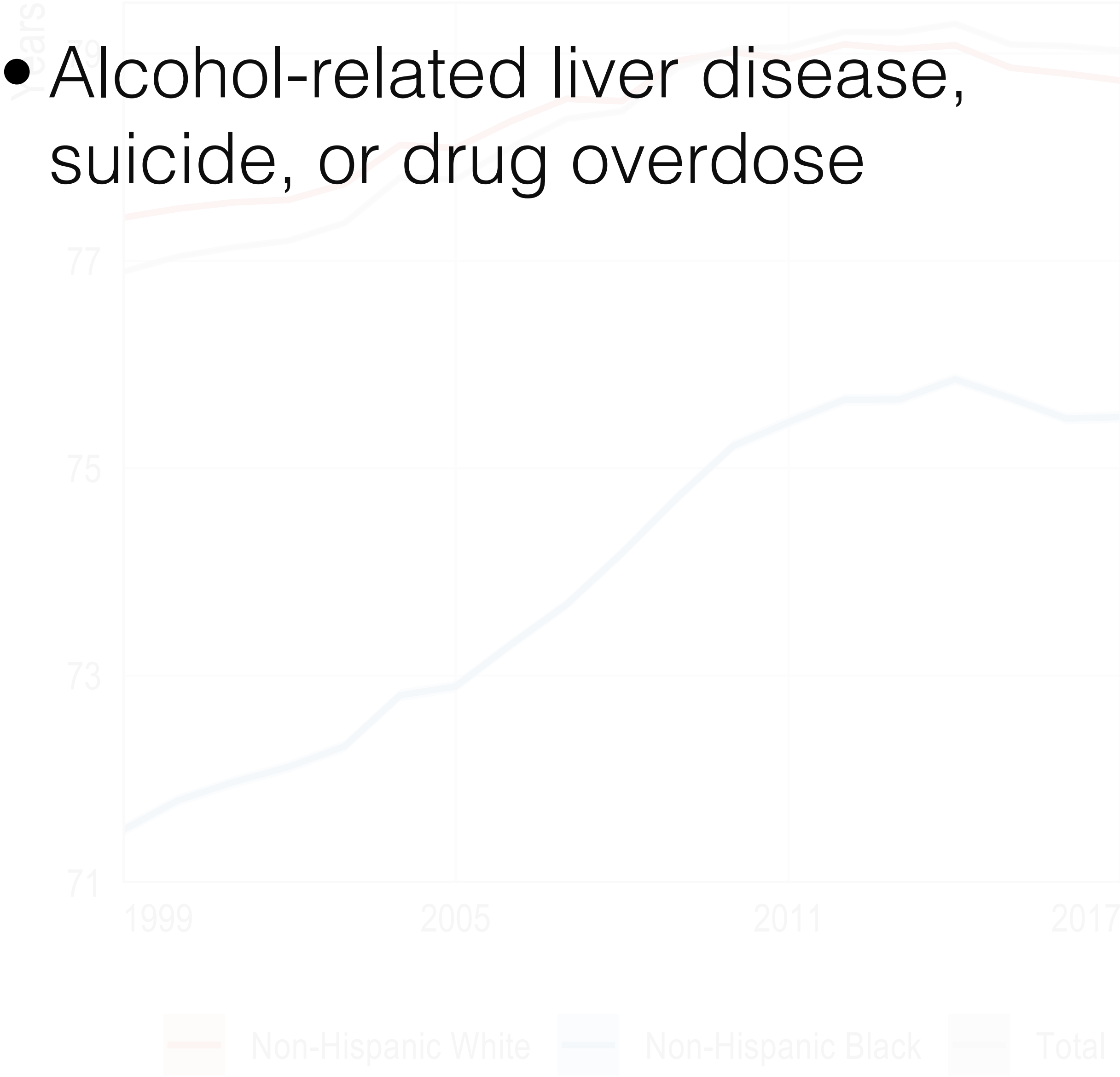
1. Murphy, Xu, Kochanek, and Arias. 2018. "Mortality in the United States, 2017." NCHS Data Brief.

2. Dyer. BMJ 2018. "US Life Expectancy Falls for Third Year in a Row."

3. Case and Deaton. PNAS 2015. "Rising Morbidity and Mortality in Midlife Among White Non-Hispanic Americans in the 21st Century."

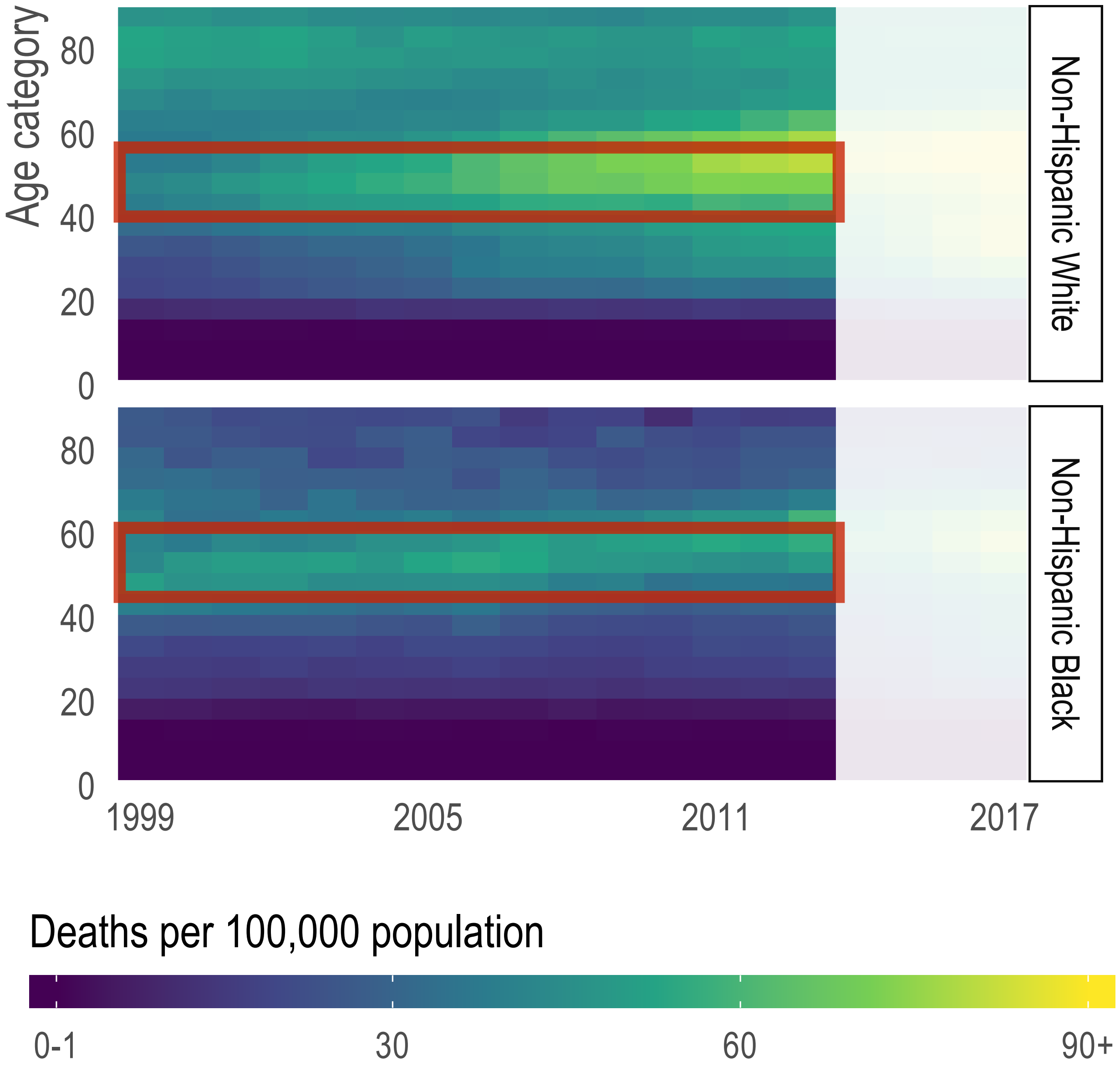
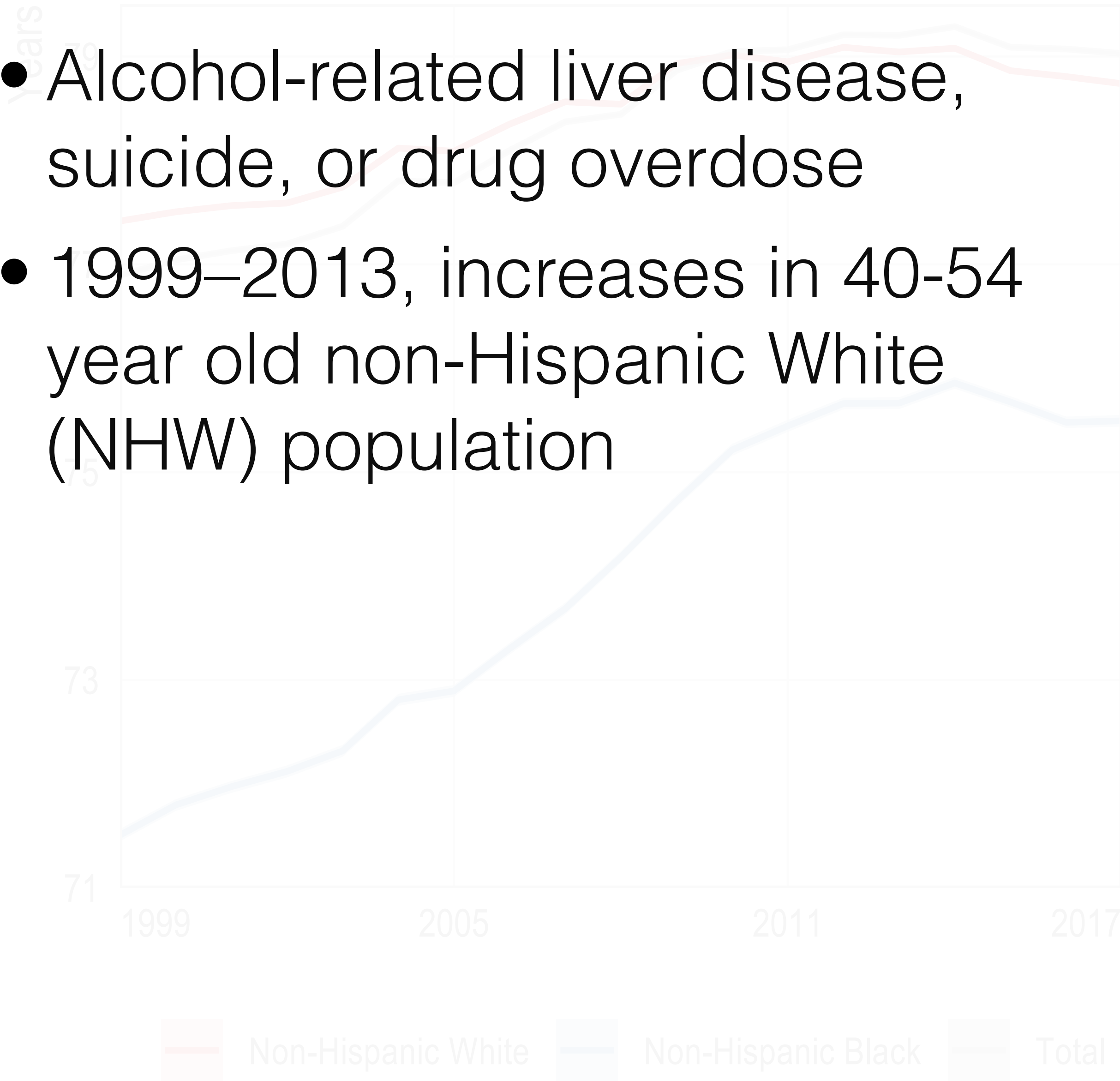
Deaths of Despair

- Alcohol-related liver disease, suicide, or drug overdose



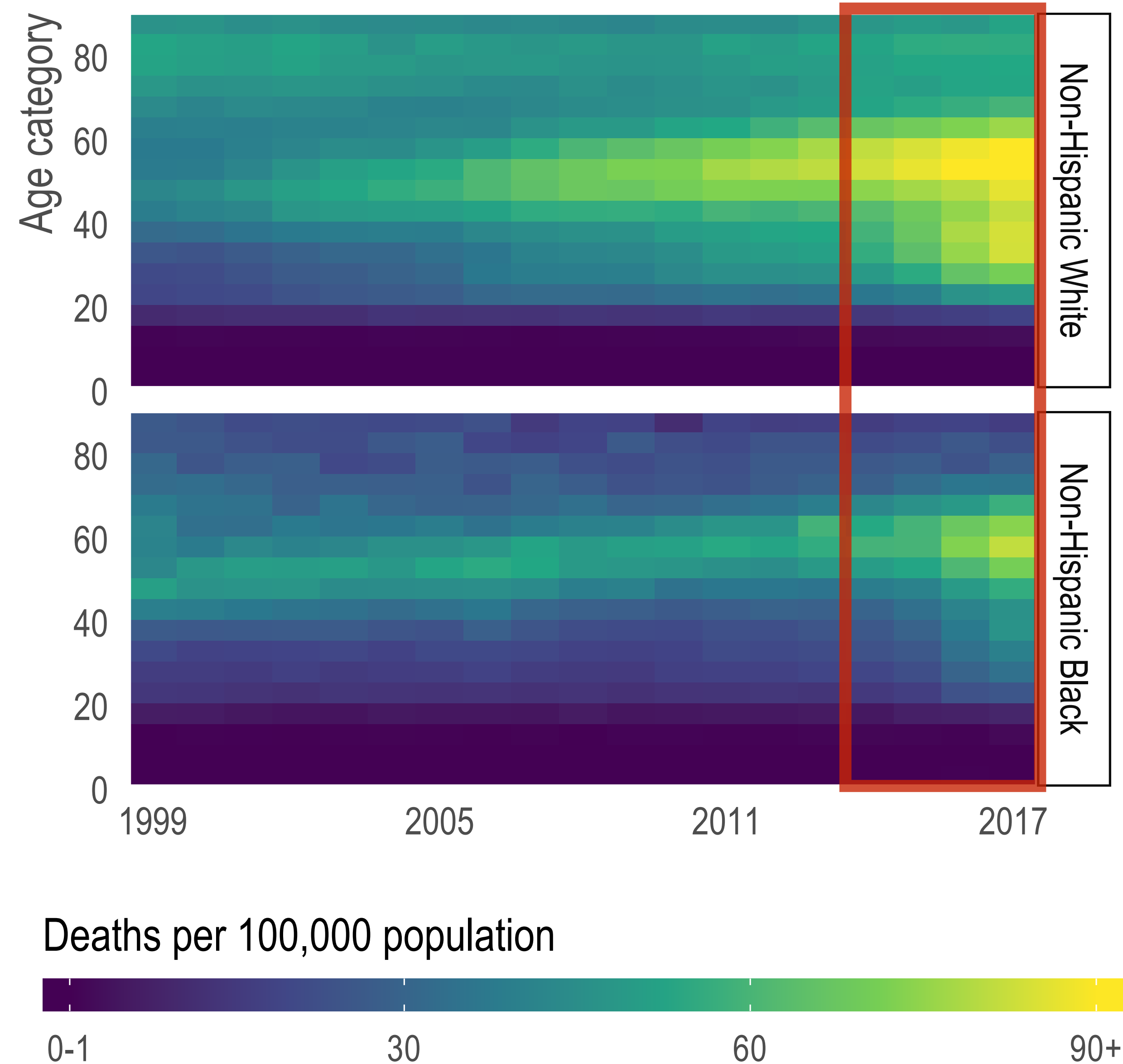
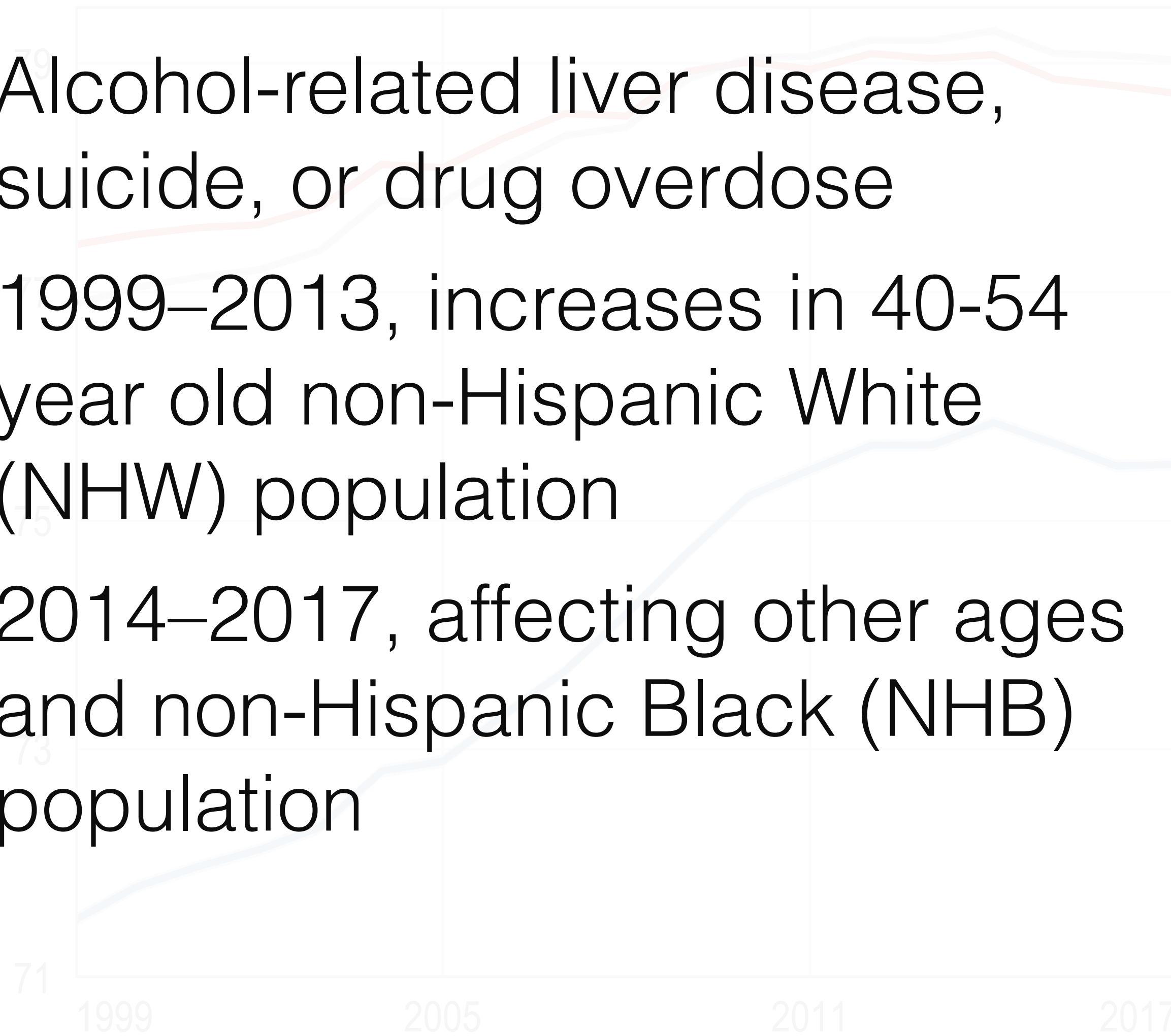
Deaths of Despair

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



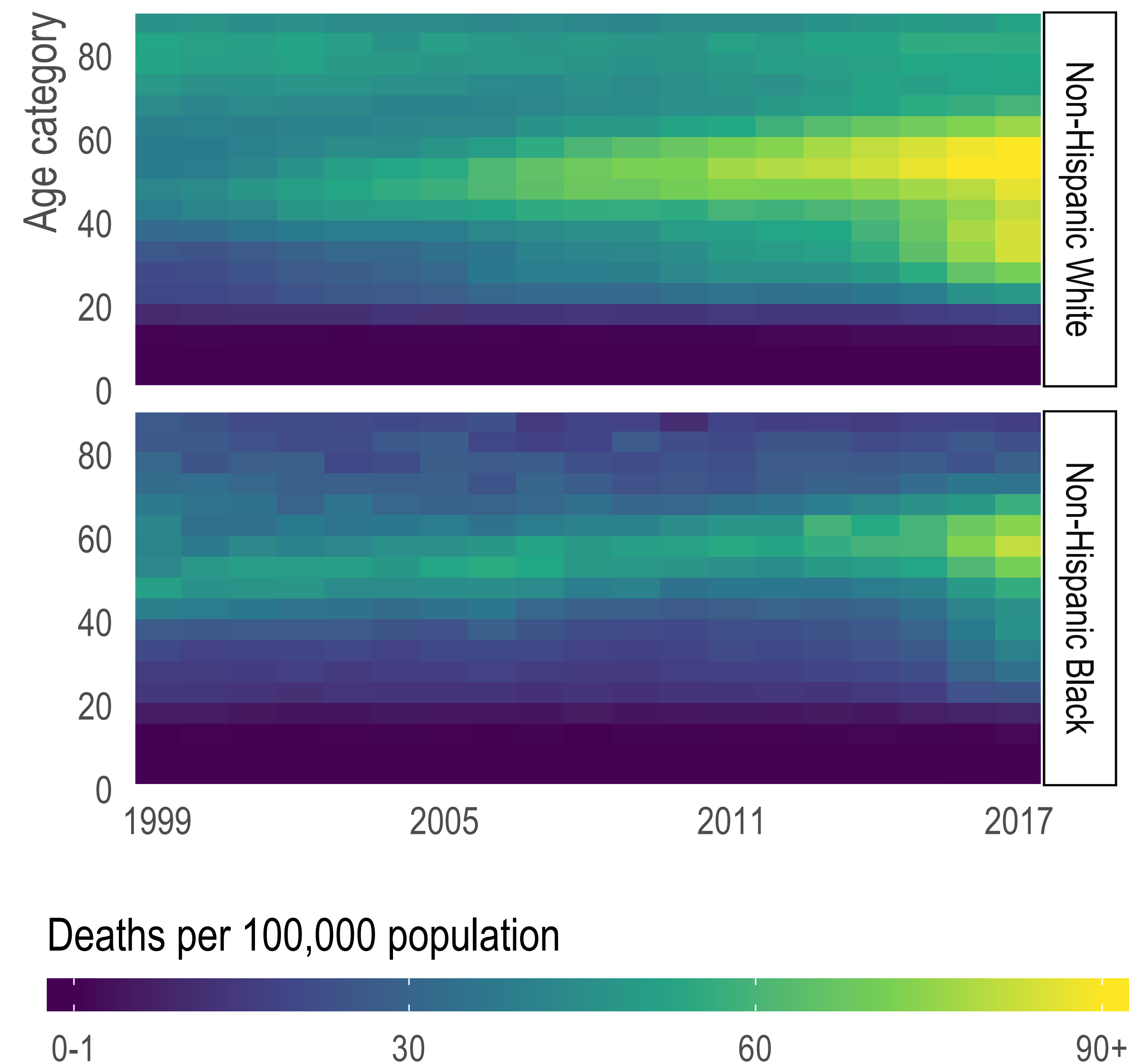
Deaths of Despair

- Alcohol-related liver disease, suicide, or drug overdose
- 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

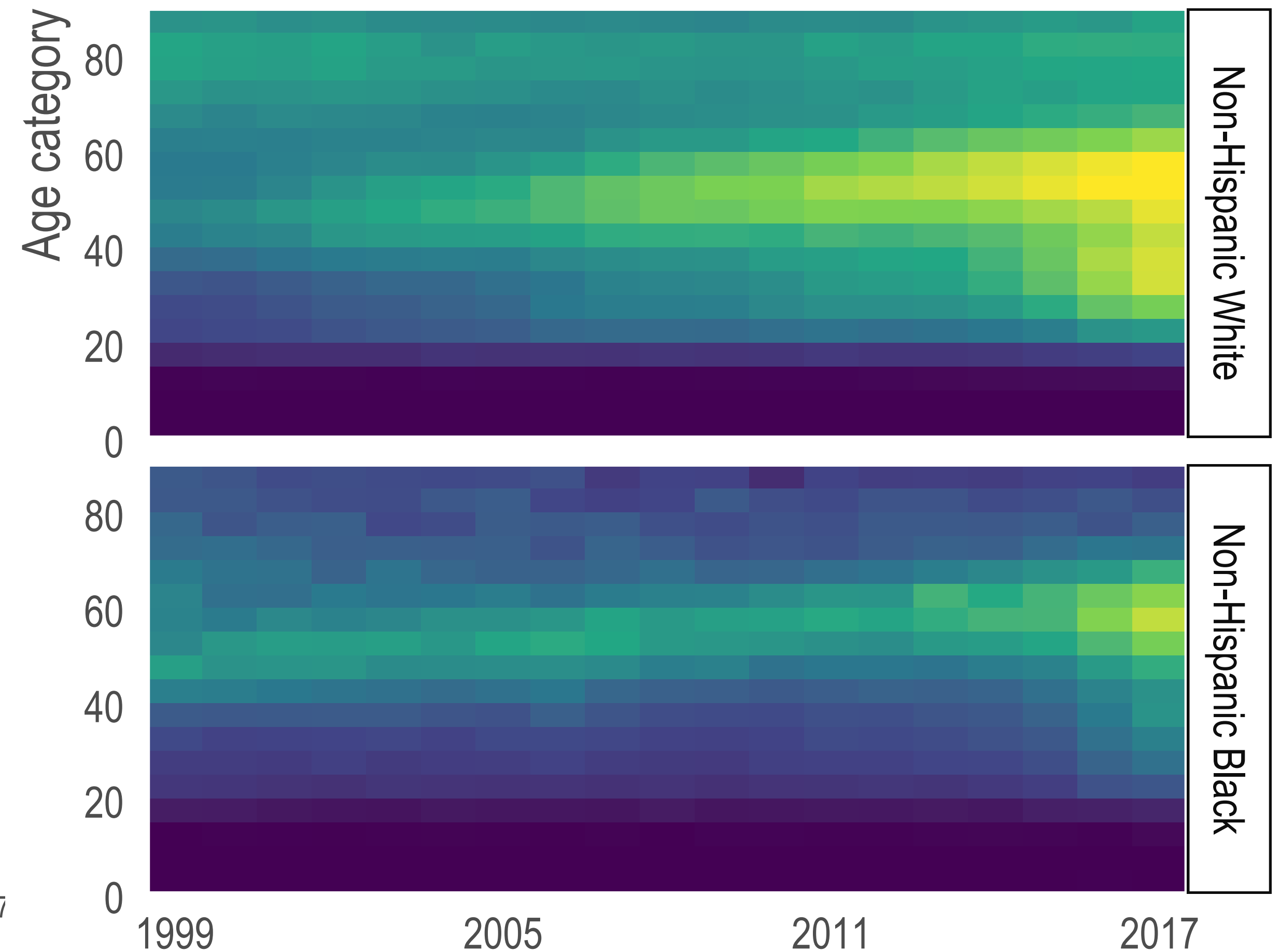
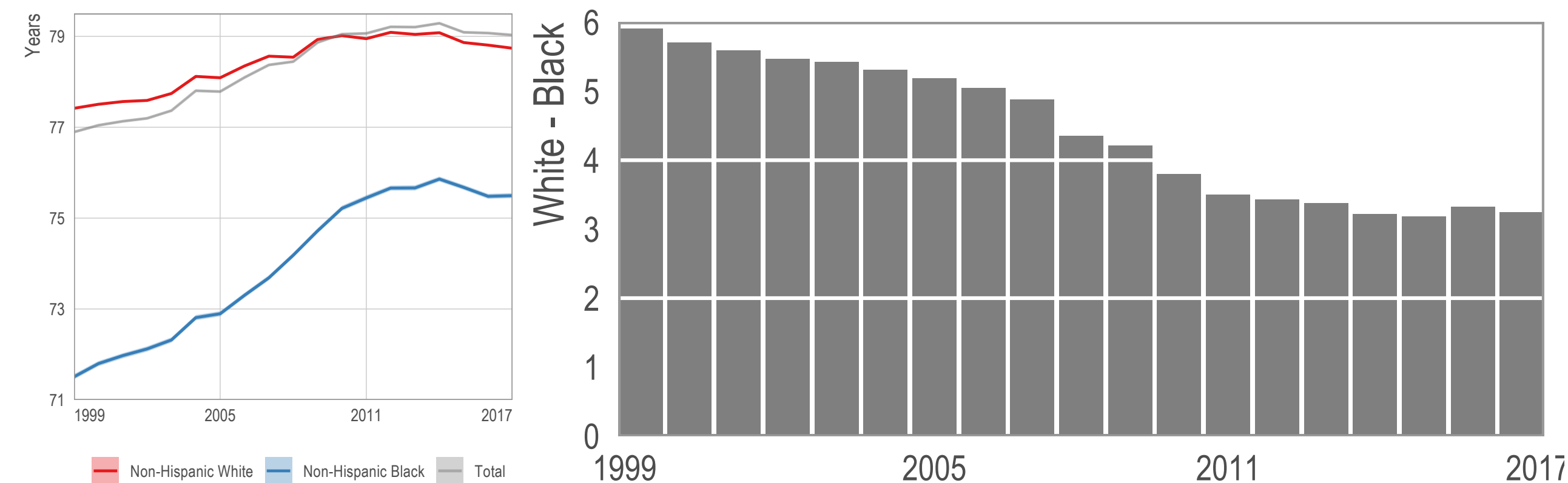
- But health inequalities aren't new¹



1. Williams, and Sternthal. 2010. "Understanding Racial-Ethnic Disparities in Health: Sociological Contributions." J Health Soc Behav 51

Racial/Ethnic Health Inequalities

- But health inequalities aren't new¹
- And grow and shrink over time^{2,3}



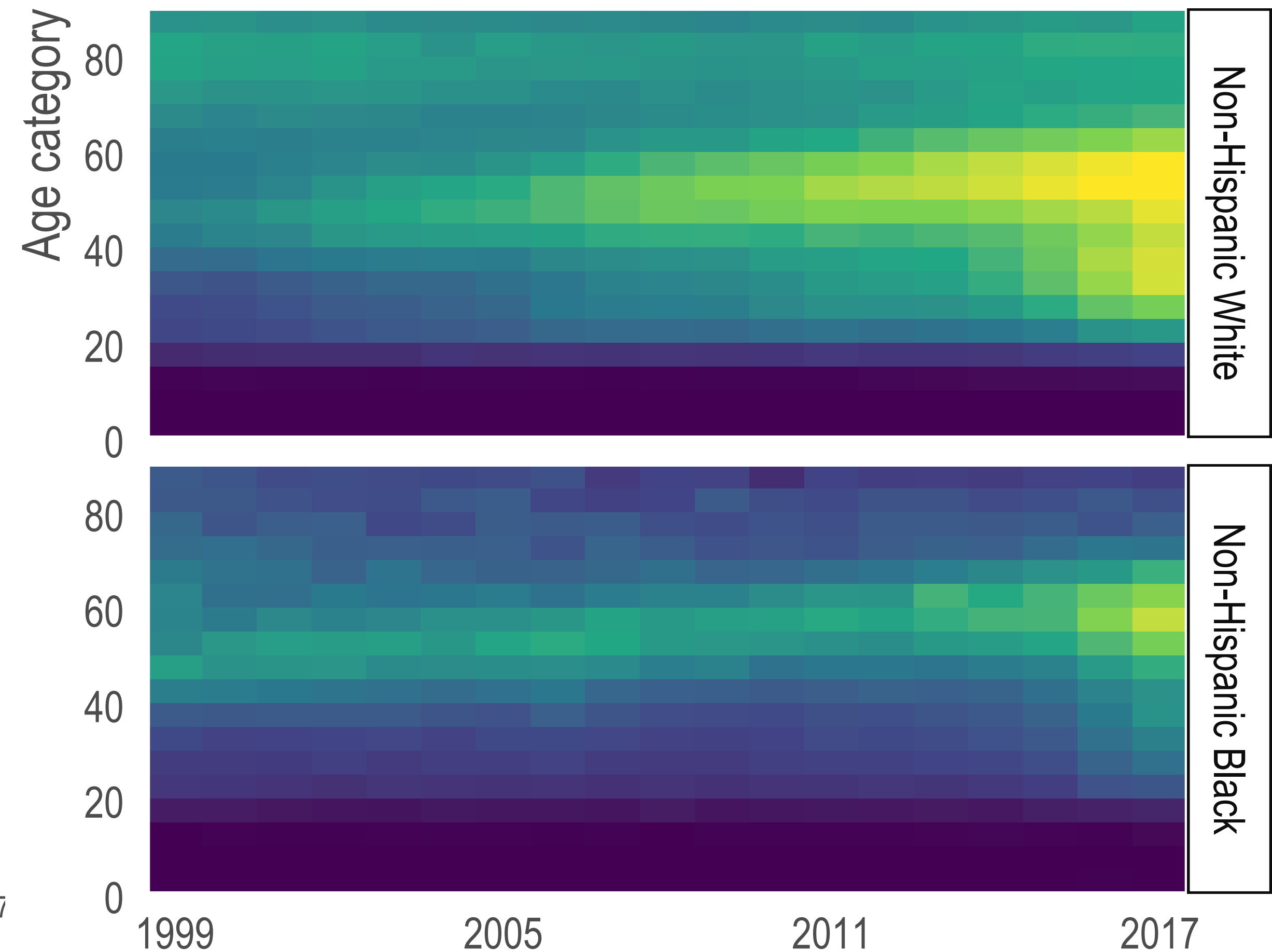
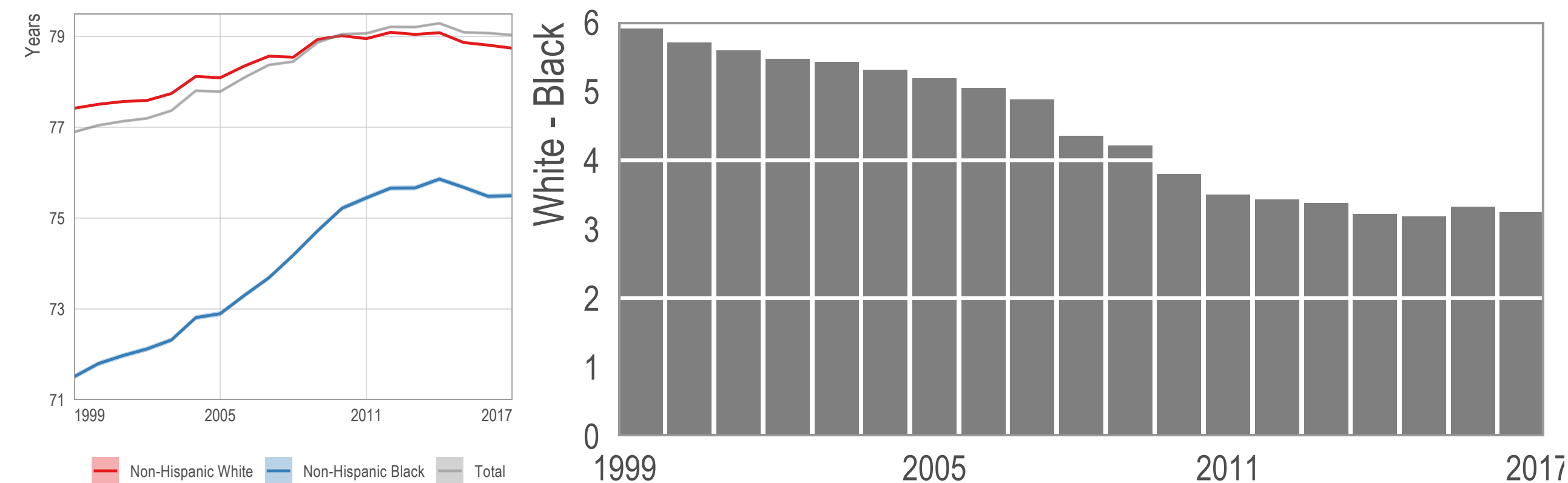
Deaths per 100,000 population



1. Williams, and Sternthal. 2010. "Understanding Racial-Ethnic Disparities in Health: Sociological Contributions." J Health Soc Behav 51
2. Krieger, Rehkopf, Chen, Waterman, Marcelli, and Kennedy. 2008. "The Fall and Rise of US Inequities in Premature Mortality: 1960–2002." PLOS Med.
3. Krieger, Kosheleva, Waterman, Chen, Beckfield, and Kiang. 2014. "50-Year Trends in US Socioeconomic Inequalities in Health: US-born Black and White Americans, 1959–2008." IJE

Racial/Ethnic Health Inequalities

- But health inequalities aren't new¹
- And grow and shrink over time^{2,3}
- Geographical variation yet spatially persistent⁴



Deaths per 100,000 population



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3. Krieger, Kosheleva, Waterman, Chen, Beckfield, and Kiang. 2014. "50-Year Trends in US Socioeconomic Inequalities in Health: US-born Black and White Americans, 1959–2008." IJE
4. Cossman, Cossman, Jackson, and Cosby. 2003. "Mapping High or Low Mortality Places Across Time in the United States: A Research Note on a Health Visualization and Analysis Project." Health Place

**Quantify impact of deaths of despair
on Black/White inequalities**

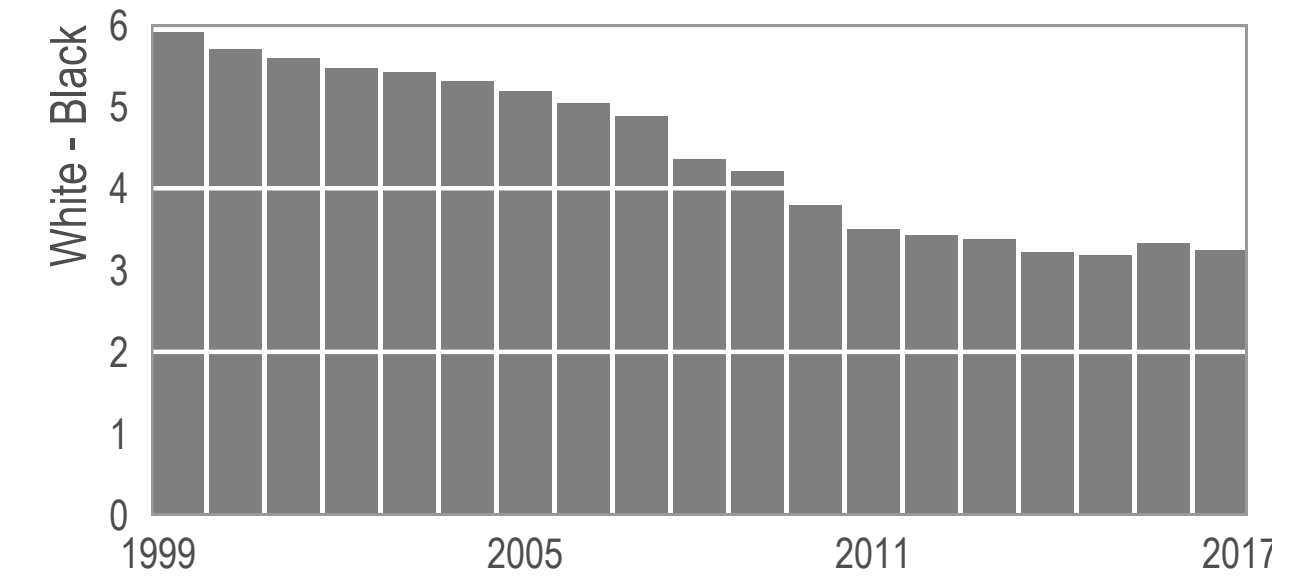
Data and Methods

- Restricted-access death and population data from the NCHS, 1999 to 2017 to create life tables
- Line integral model of decomposition from *Horiuchi, Wilmoth, and Pletcher. 2008. "A Decomposition Method Based on a Model of Continuous Change."* Demography 45 (4). doi:10.1353/dem.0.0033

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

Data and Methods

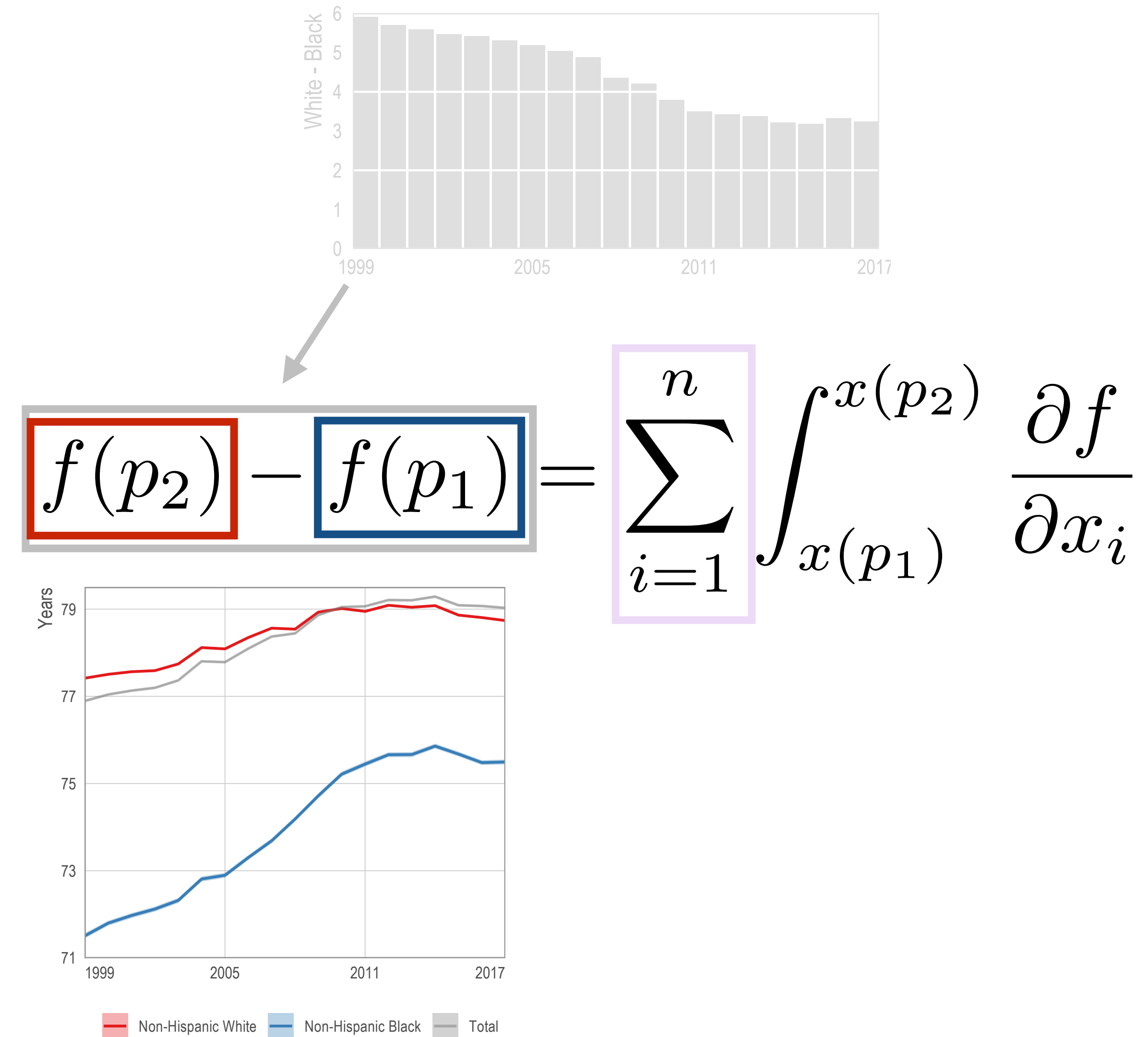
- Interested in **decomposing** the **difference in life expectancy** between two groups



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Data and Methods

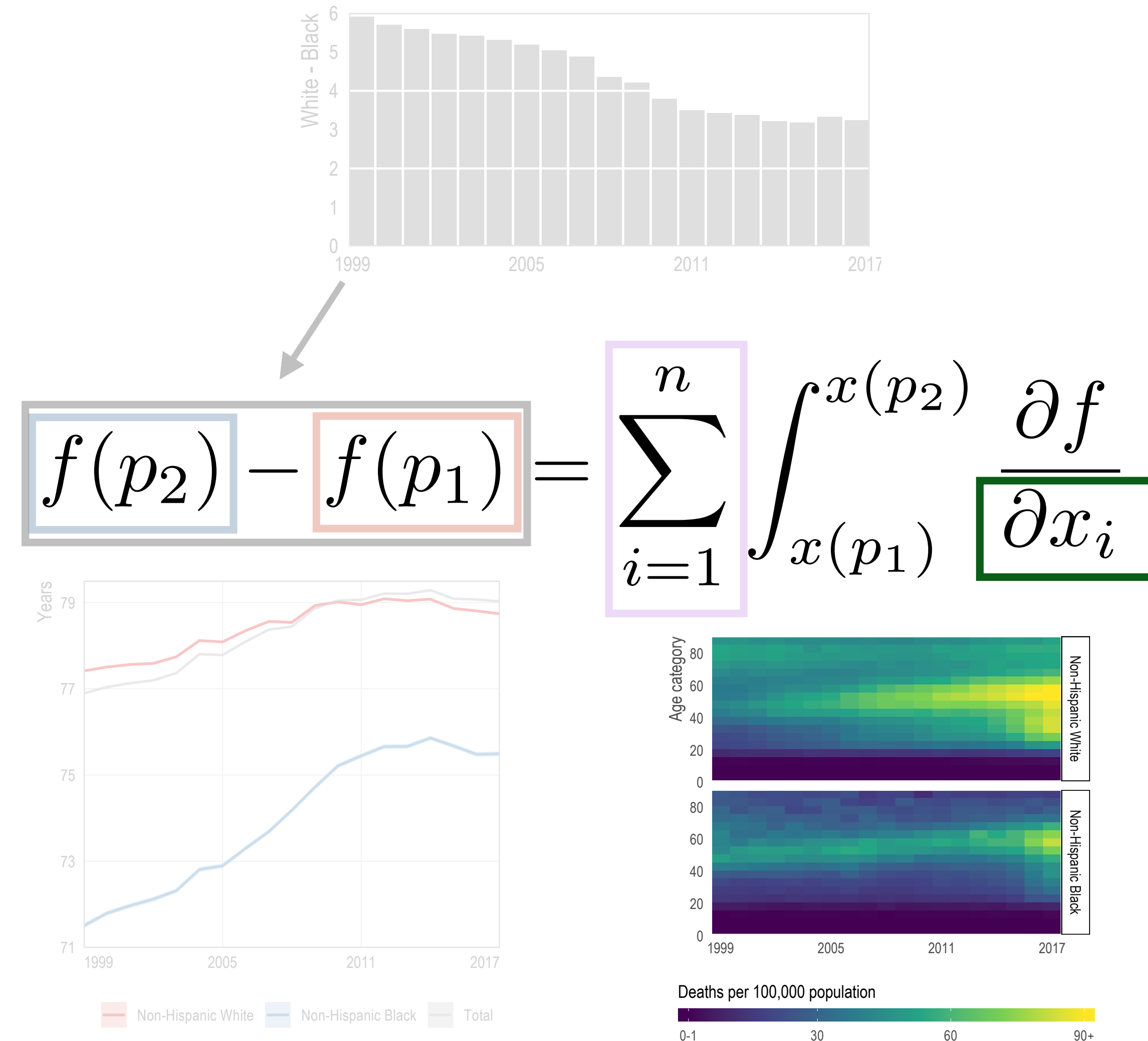
- Interested in **decomposing** the **difference in life expectancy** between two groups
- Express **White LE** and **Black LE** as a function f of n covariates denoted $\mathbf{x} = [x_1, \dots, x_n]$



Horiuchi, Wilmoth, and Pletcher. 2008. "A Decomposition Method Based on a Model of Continuous Change." *Demography* 45 (4). doi:10.1353/dem.0.0033

Data and Methods

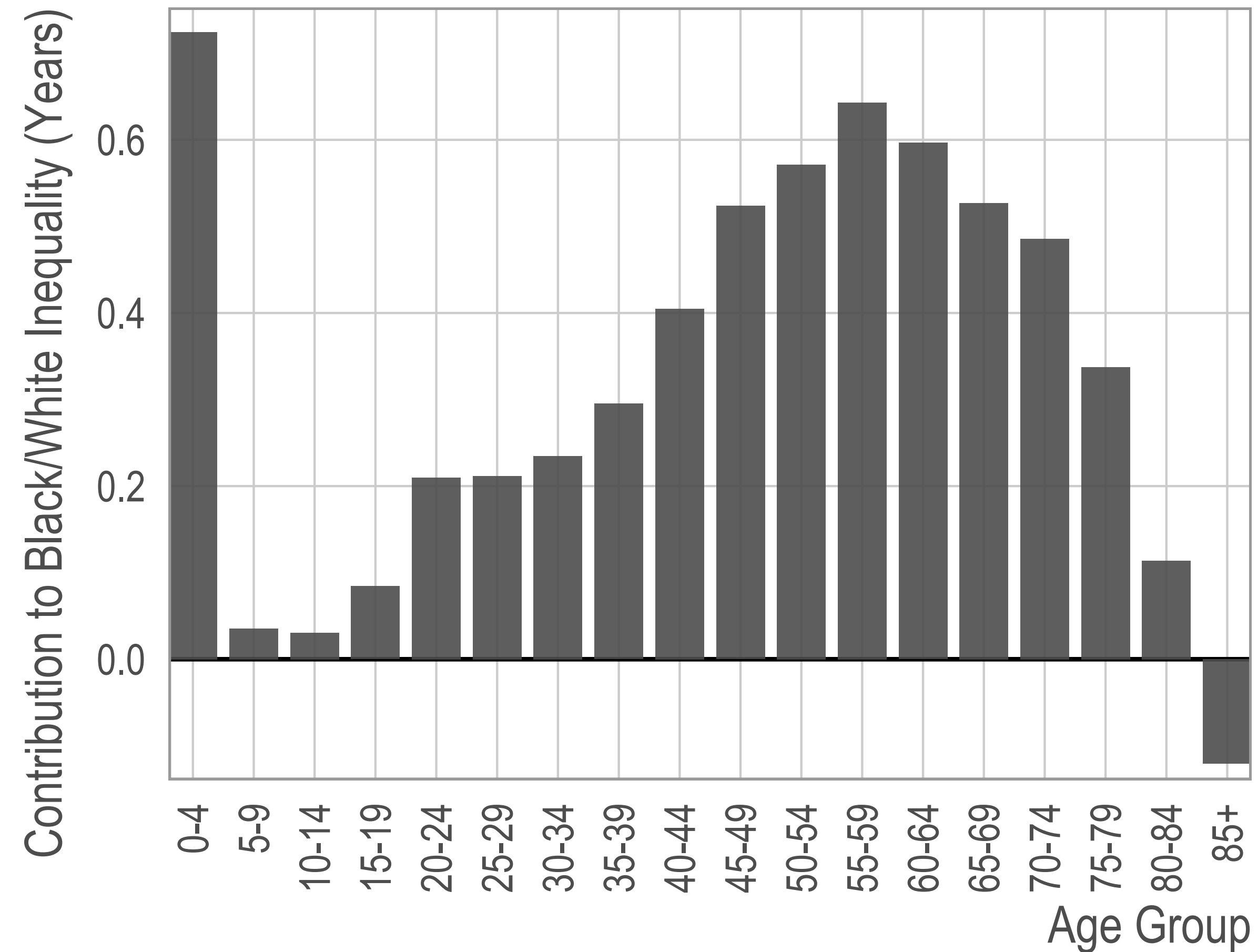
- Interested in **decomposing** the **difference in life expectancy** between two groups
- Express **White LE** and **Black LE** as a function f of n covariates denoted $\mathbf{x} = [x_1, \dots, x_n]$
- Here, life expectancy (f) is a function of **mortality rates by age** (x_1) and **type of death**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



Horiuchi, Wilmoth, and Pletcher. 2008. "A Decomposition Method Based on a Model of Continuous Change." *Demography* 45 (4). doi:10.1353/dem.0.0033

Decomposing Black/White Inequality

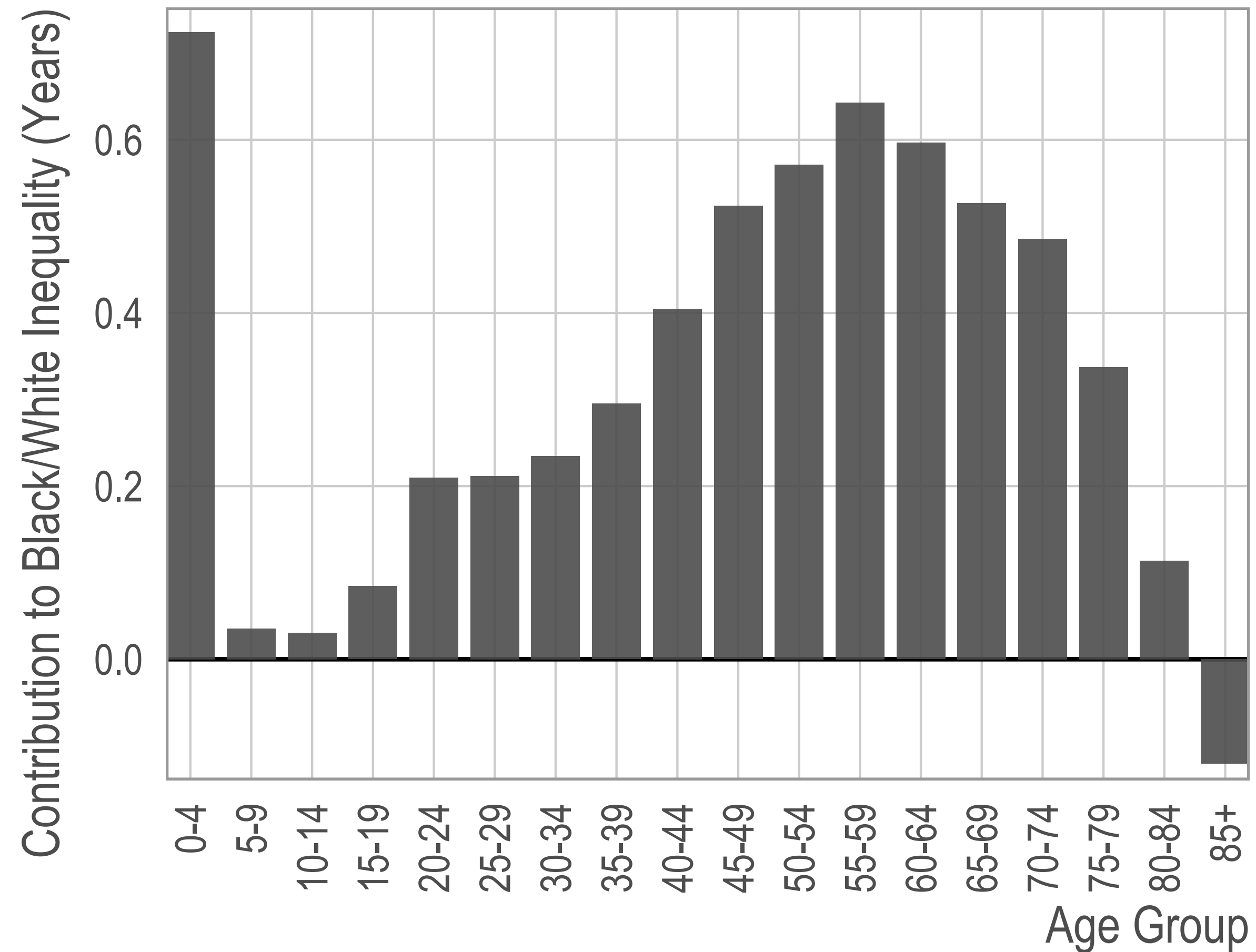
1999 (5.91 years)



- In 1999, NHW outlived NHB by ~6 years

Decomposing Black/White Inequality

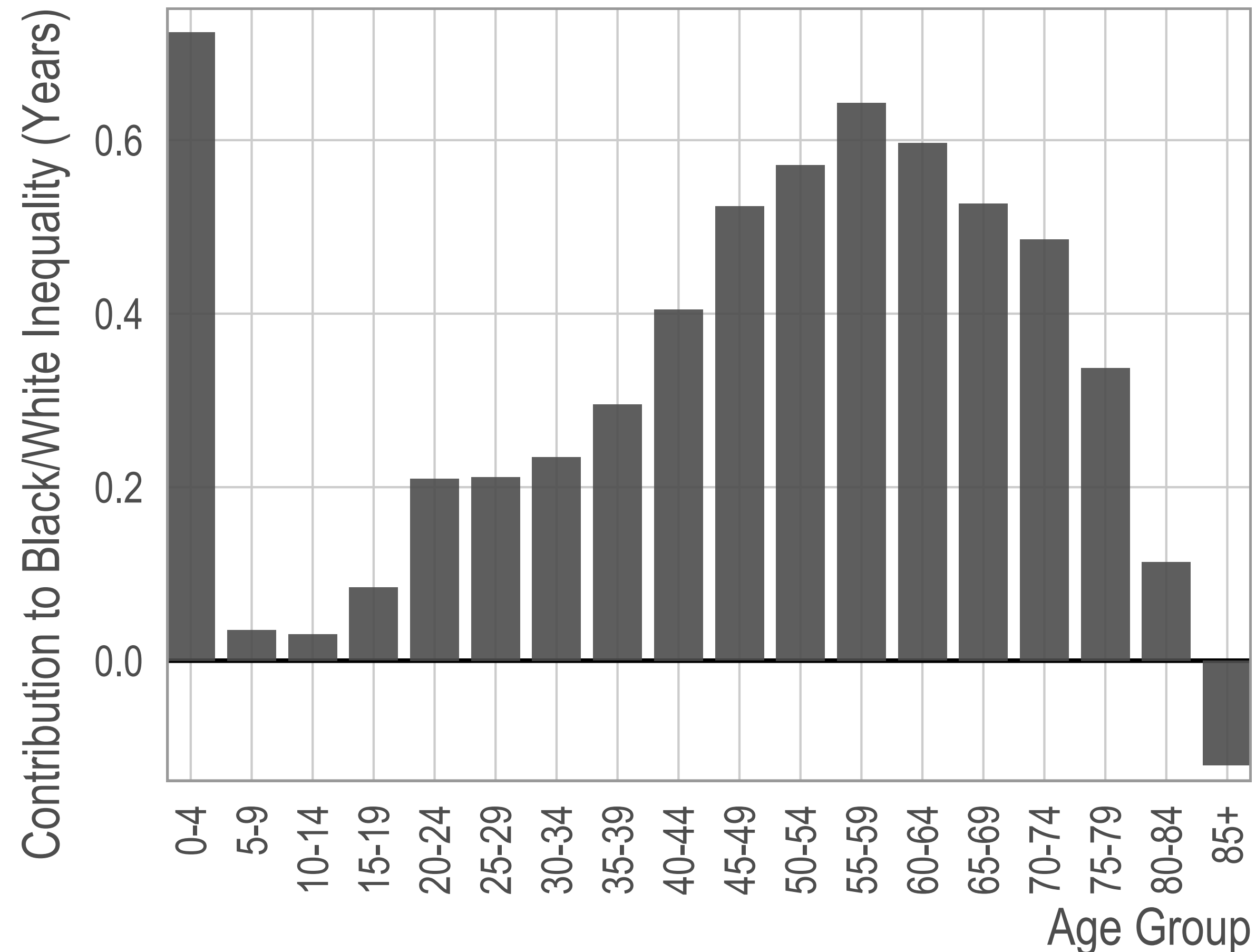
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- In 1999, NHW outlived NHB by ~6 years
- Negative values indicate NHB mortality rate is lower than NHW mortality rate *in that age group*

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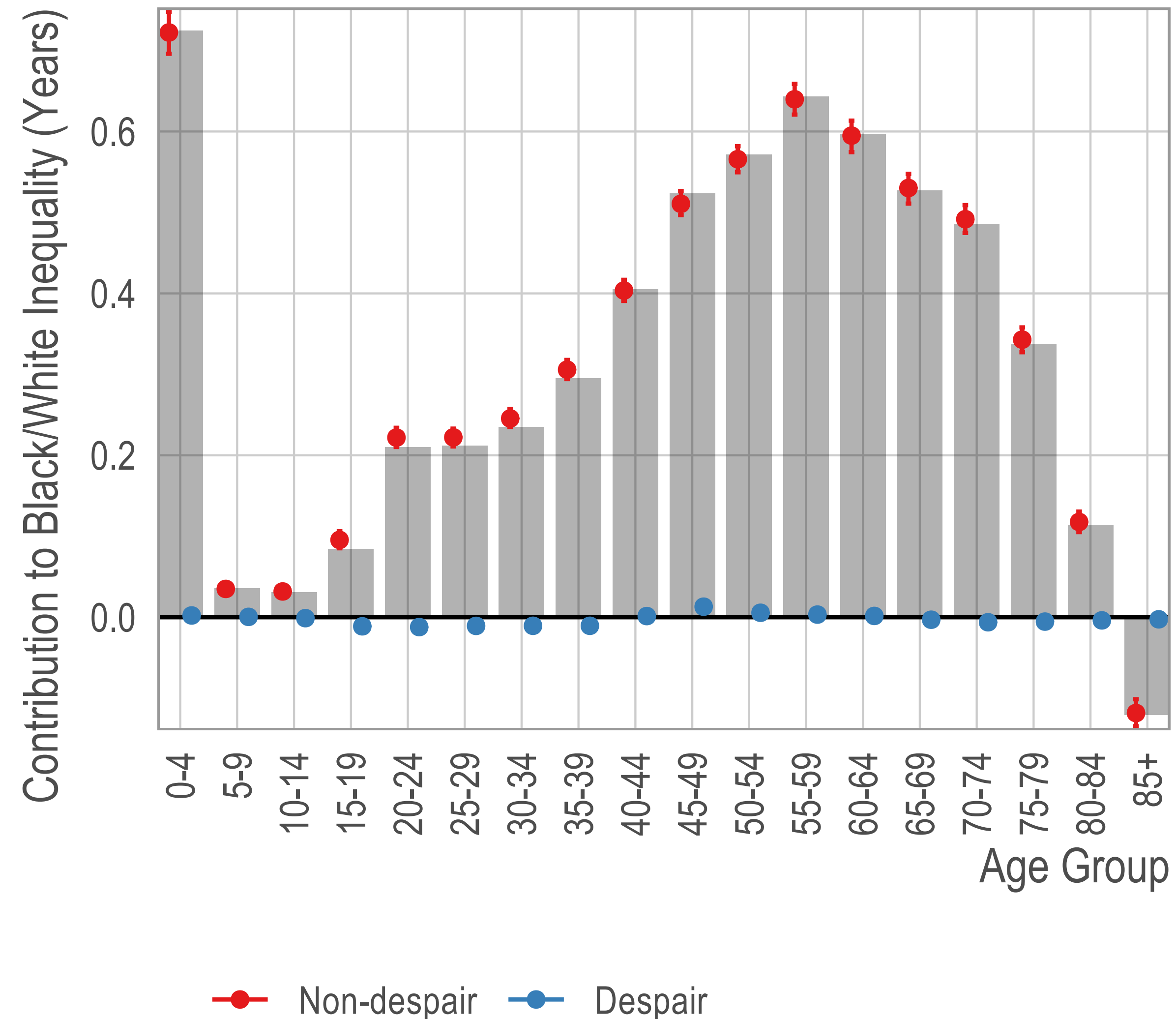
1999 (5.91 years)



- 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

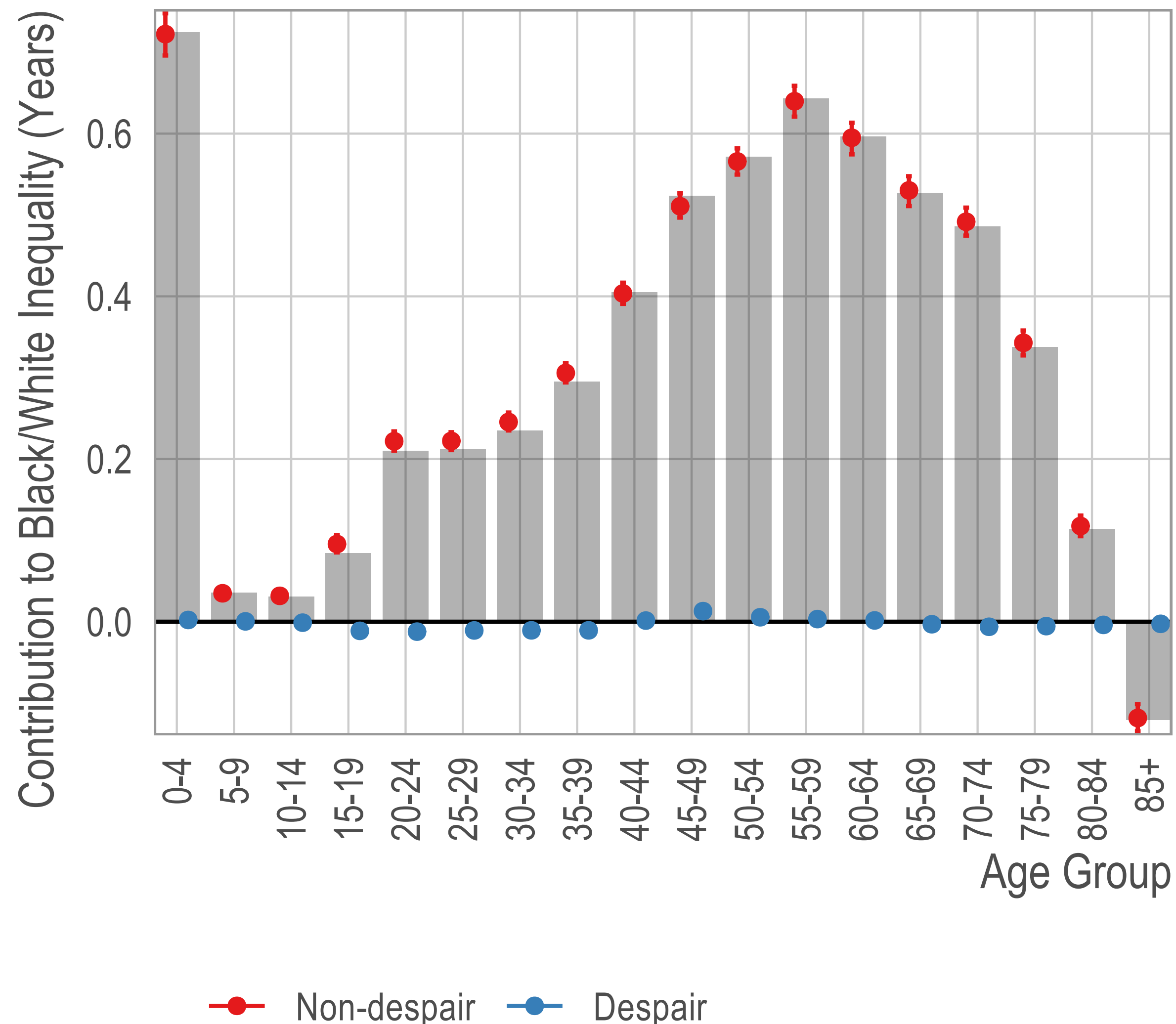
1999 (5.91 years)



- In 1999, deaths of despair accounted for less than **1%** of the Black/White inequality in life expectancy (-0.05 years)

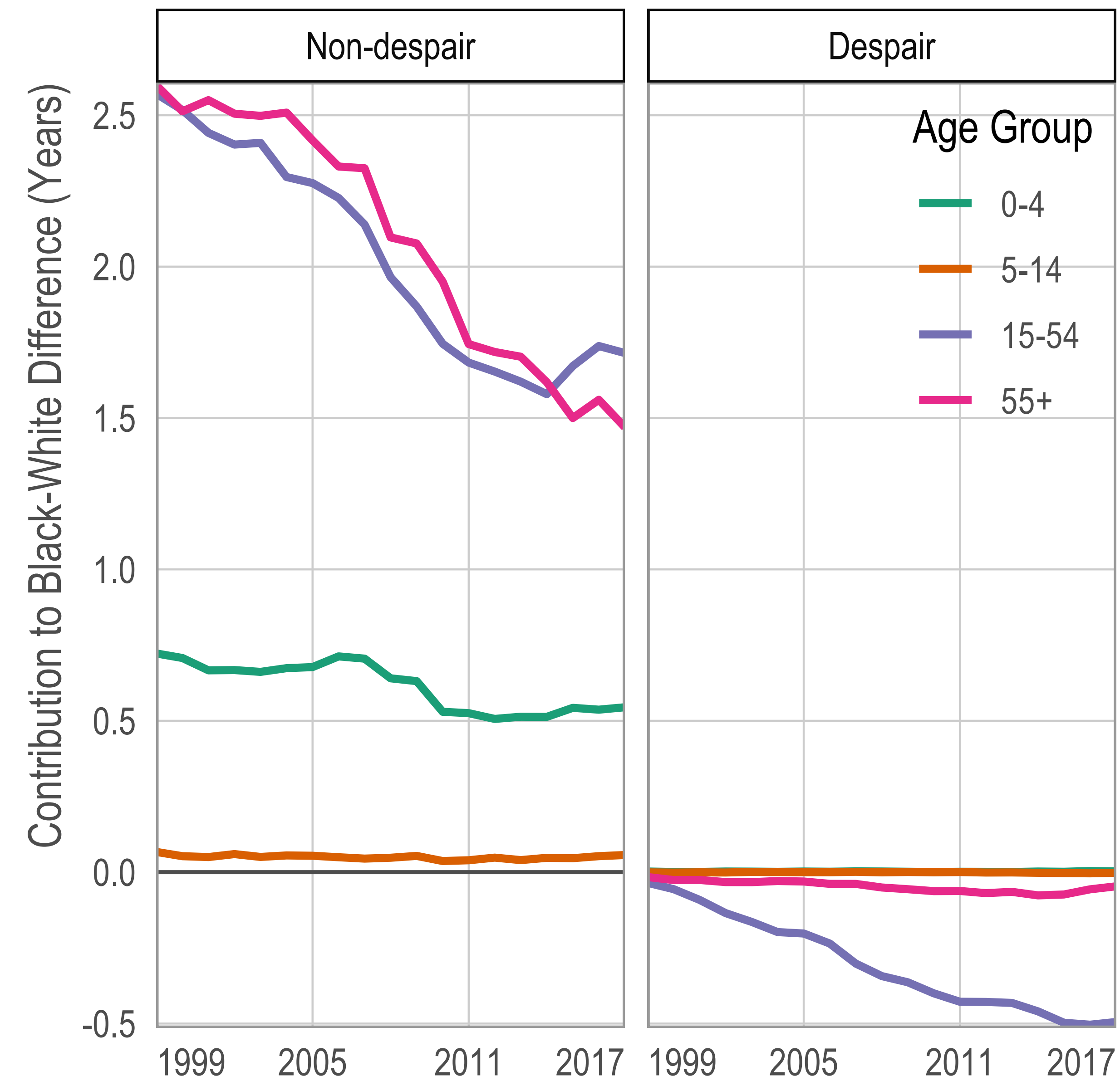
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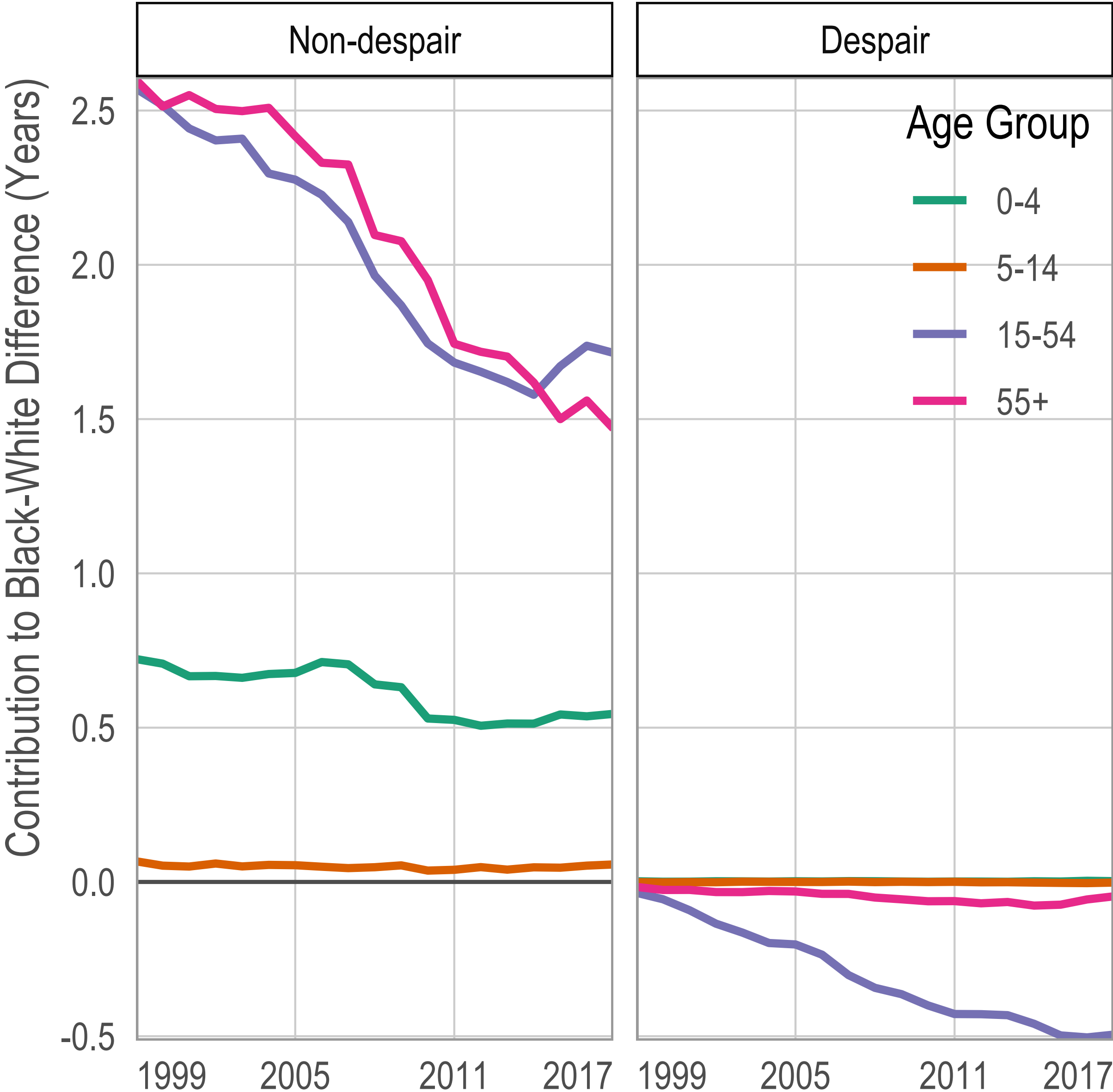


- In 1999, deaths of despair accounted for less than **1%** of the Black/White inequality in life expectancy (-0.05 years)
- Non-despair, under-5 mortality was the single largest contributor at **12%** (.72 years)

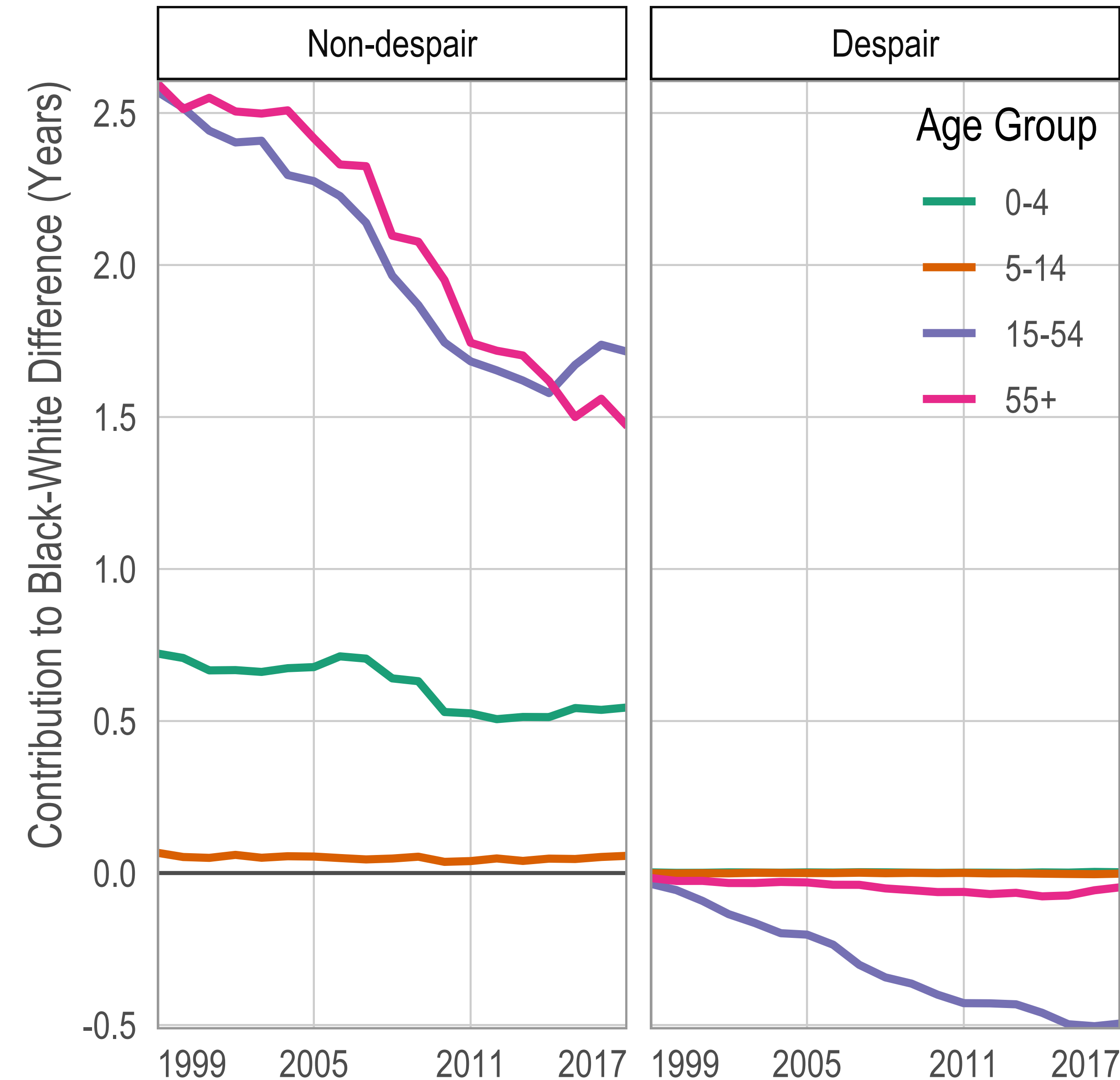
Two main results
(+ one bonus)



Convergence Mainly from Non-despair Deaths

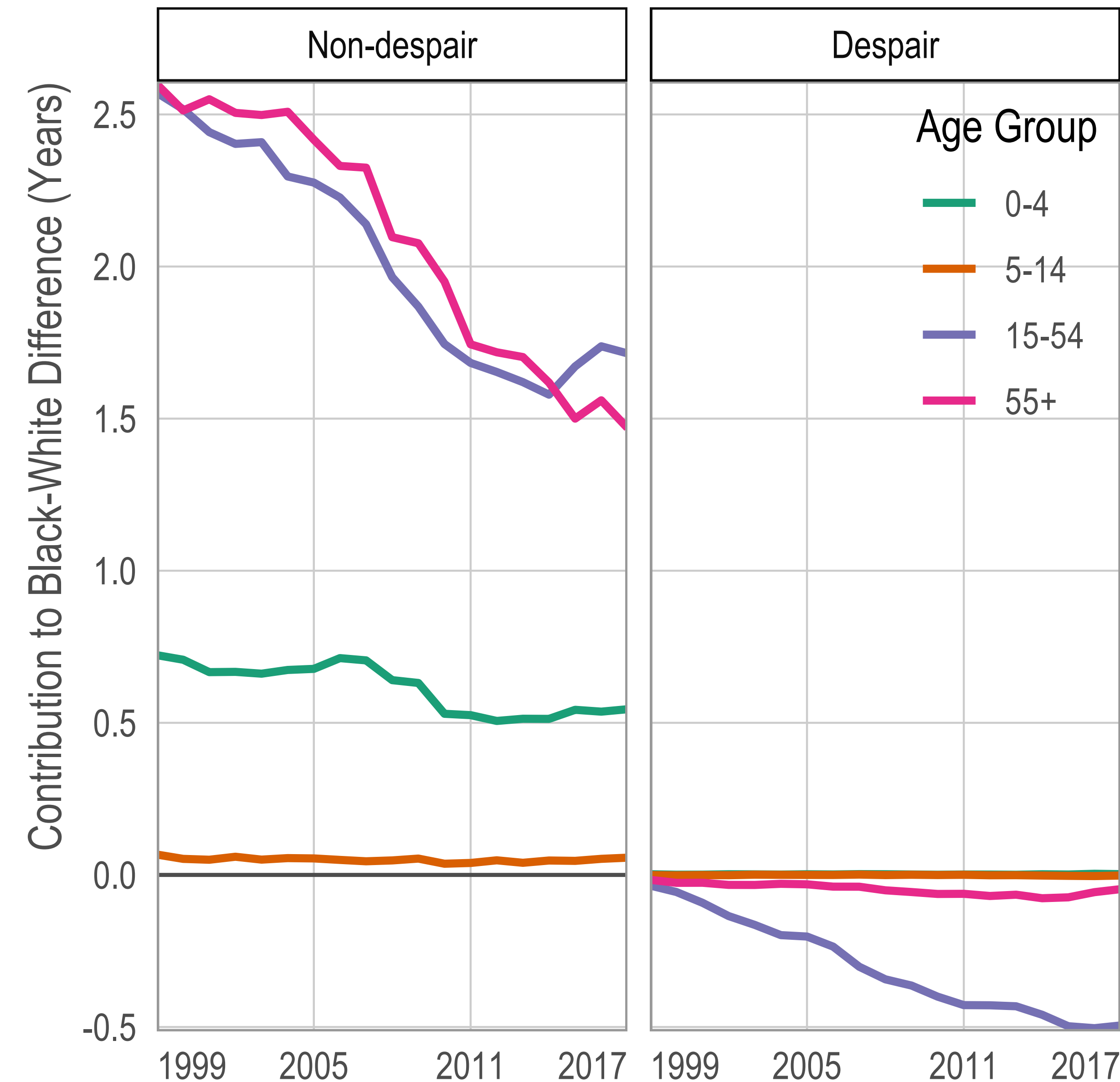


Convergence Mainly from Non-despair Deaths



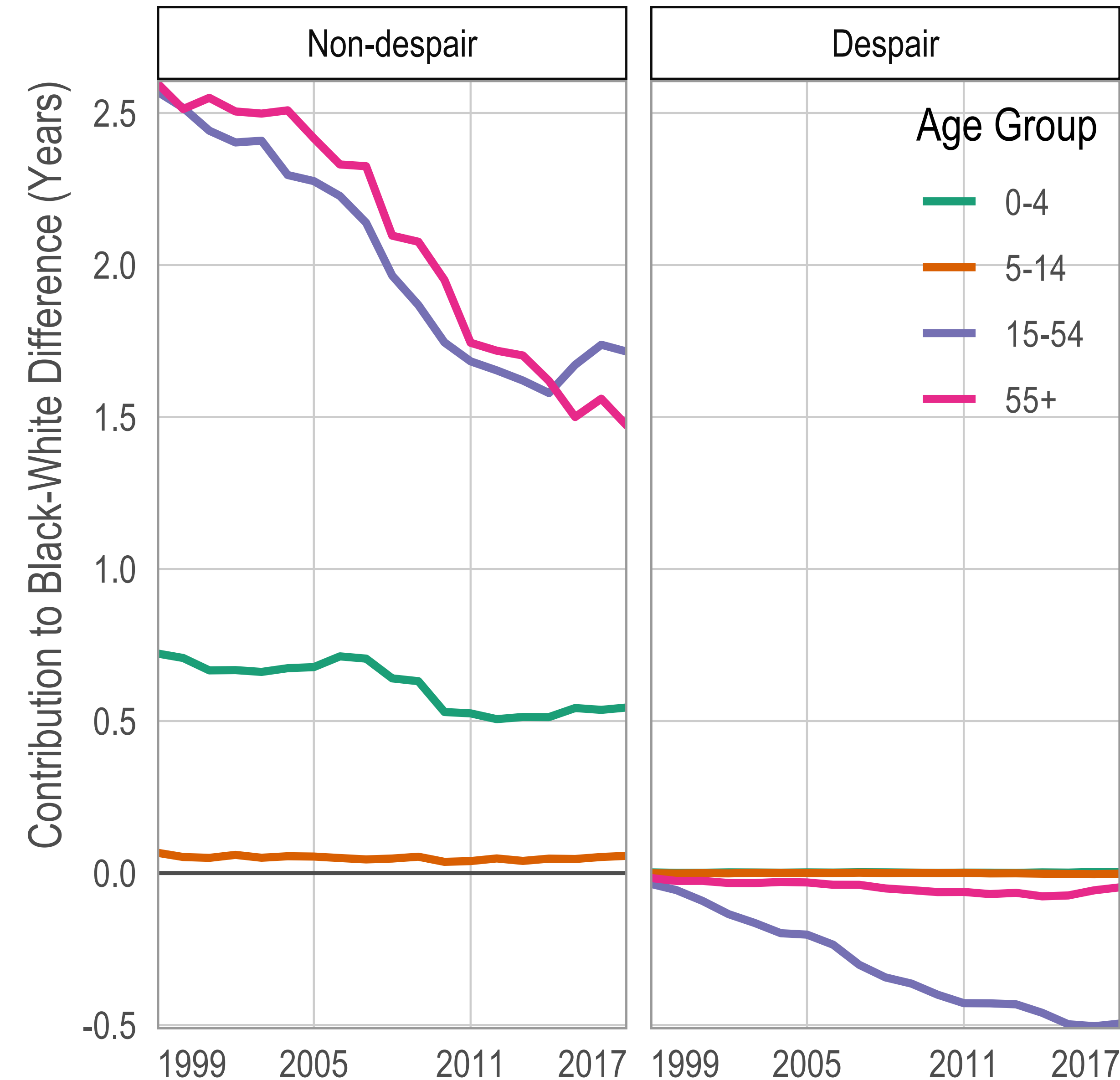
- **Majority** of the lower inequality is due to improvements in NHB **15-54** and **55+**, non-despair mortality (5.17 to 3.18 years)

Convergence Mainly from Non-despair Deaths



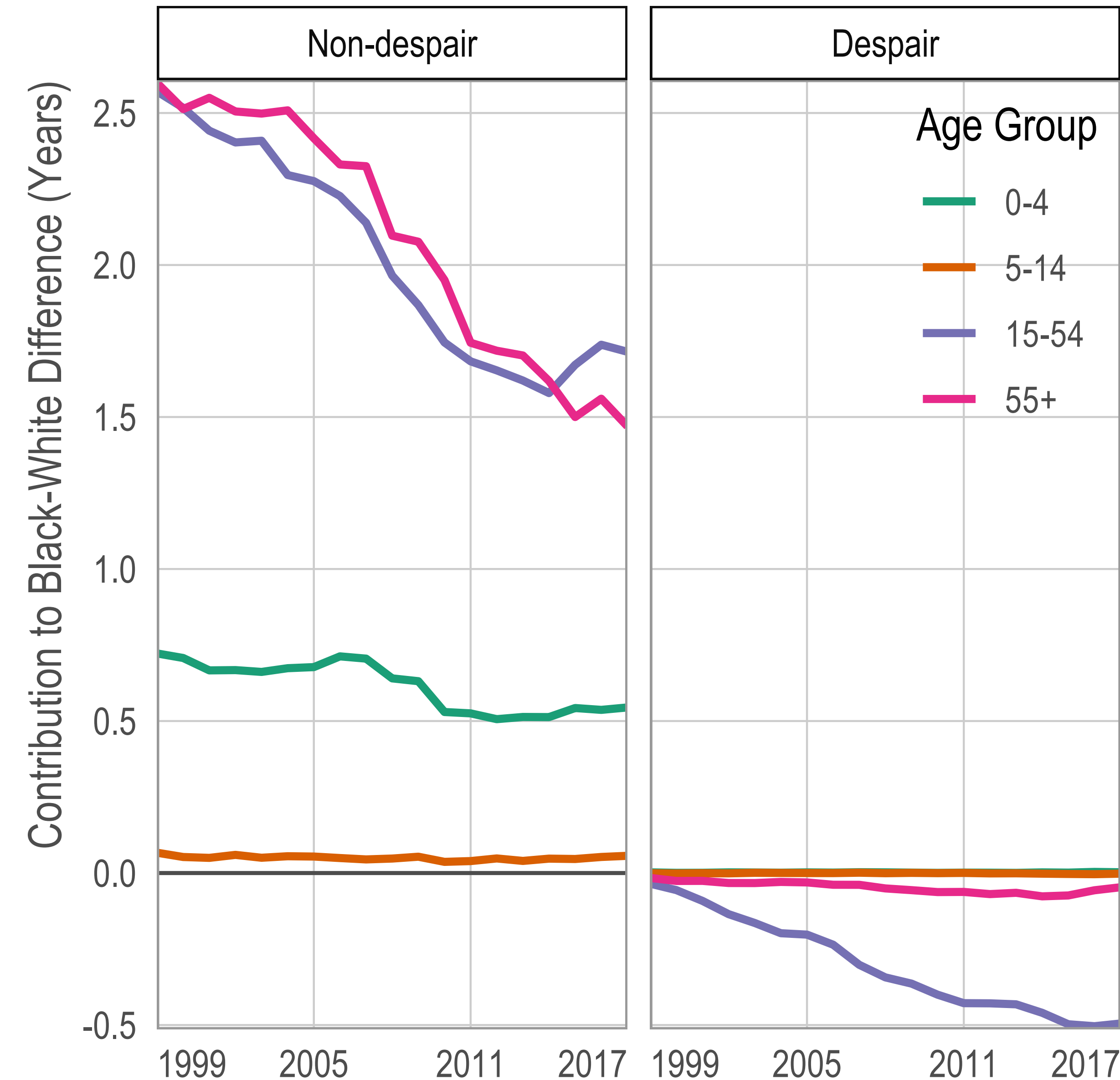
- **Majority** of the lower inequality is due improvements in NHB **15-54** and **55+**, non-despair mortality (5.17 to 3.18 years)
- **Small contribution** from **15-54** deaths of despair (albeit, growing: -0.04 to -0.49 years)

We Need to Reduce Under-5 Deaths



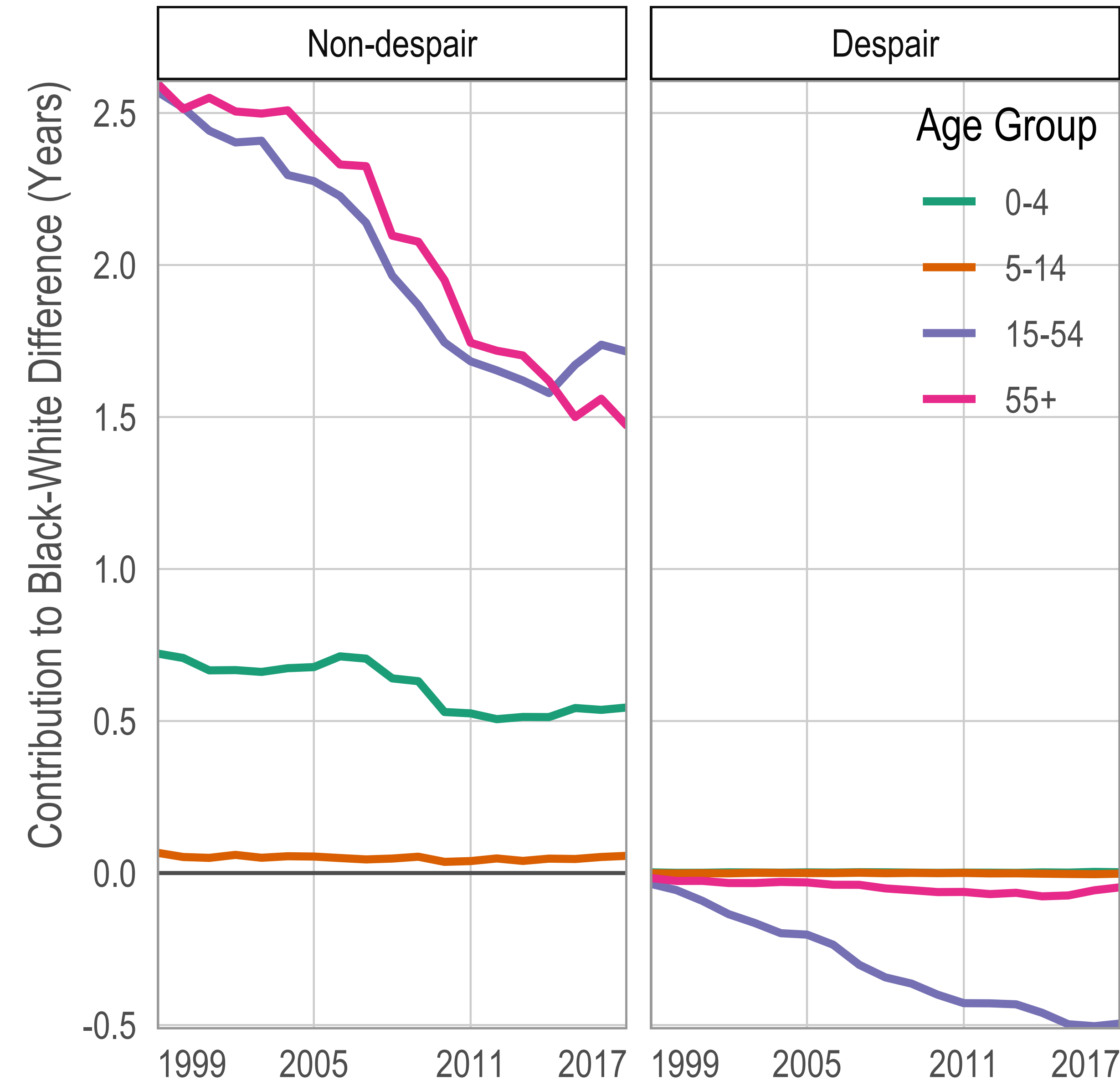
- **Under-5** inequality has not improved since 2010 (0.53 years)

We Need to Reduce Under-5 Deaths



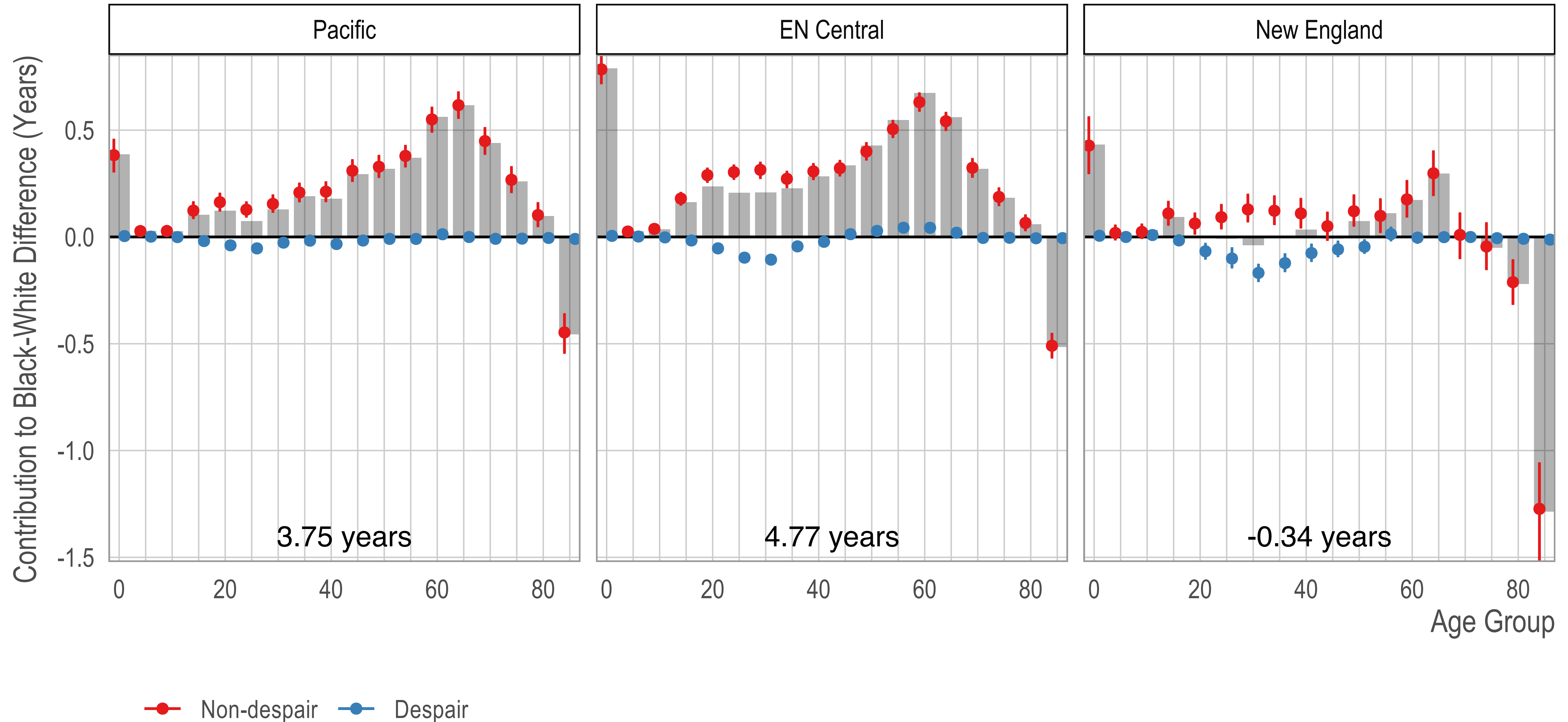
- **Under-5** inequality has not improved since 2010 (0.53 years)
- **Under-5** inequality has only modestly declined since 1999 (0.72 years)

We Need to Reduce Under-5 Deaths

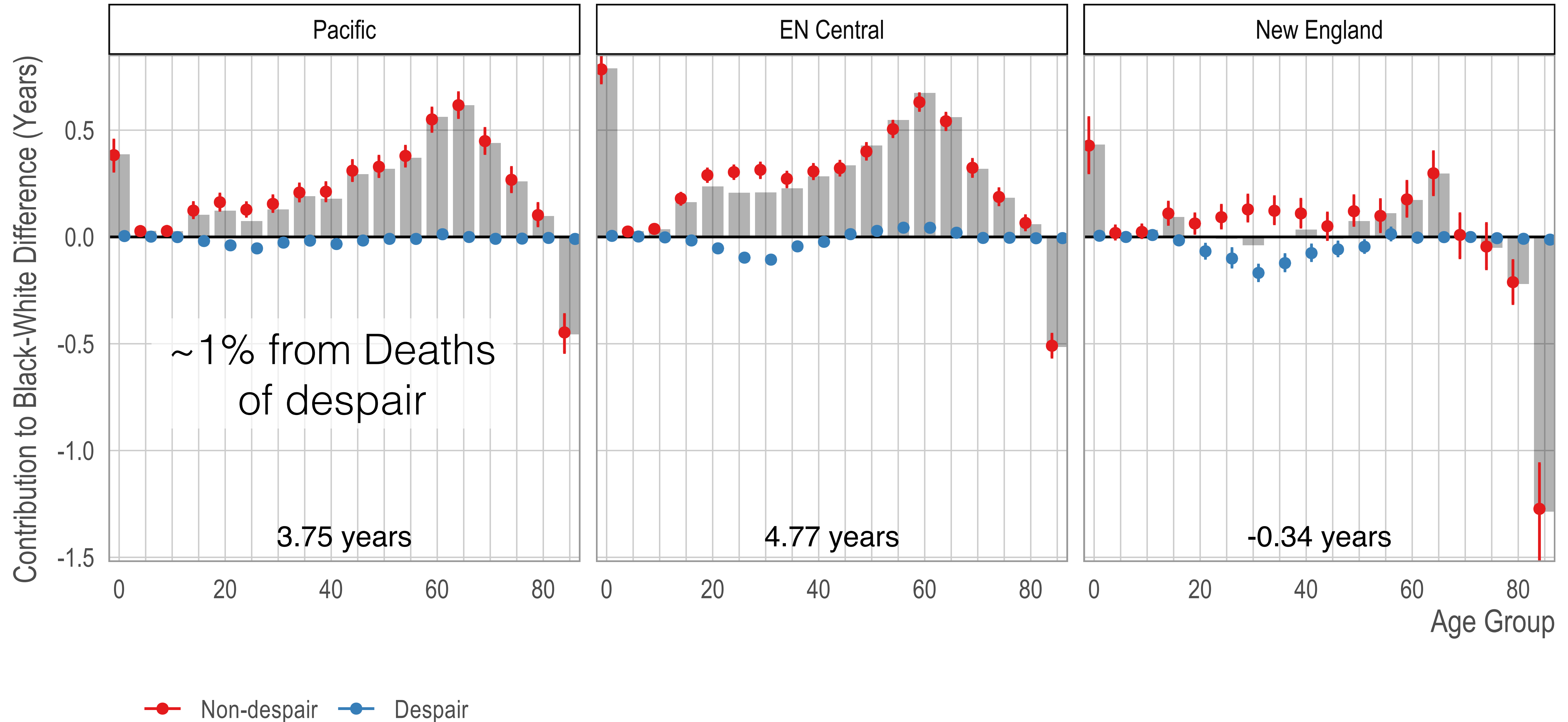


- **Under-5** inequality has not improved since 2010 (0.53 years)
- **Under-5** inequality has only modestly declined since 1999 (0.72 years)
- In every year, non-despair **under-5** mortality is single largest contributor

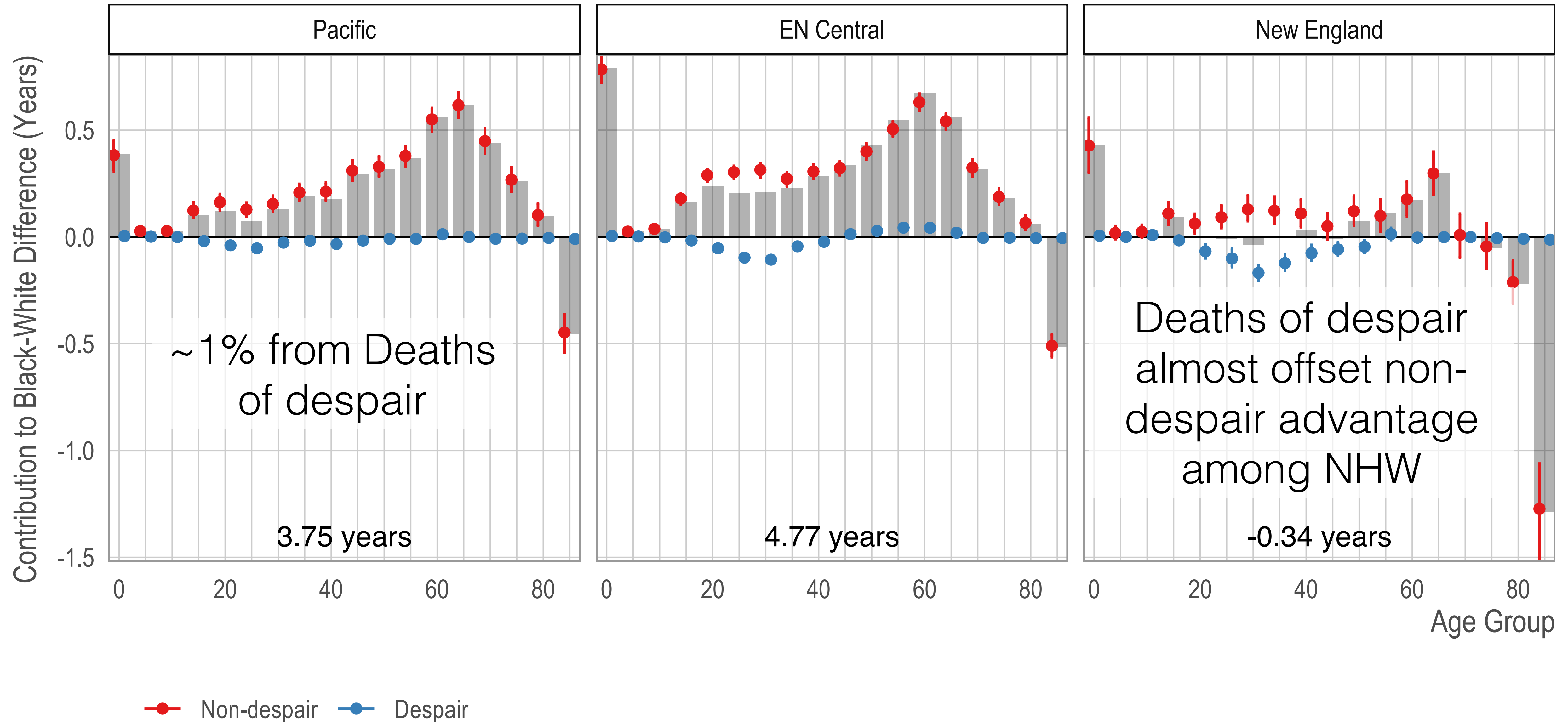
There is Substantial Geographic Variation



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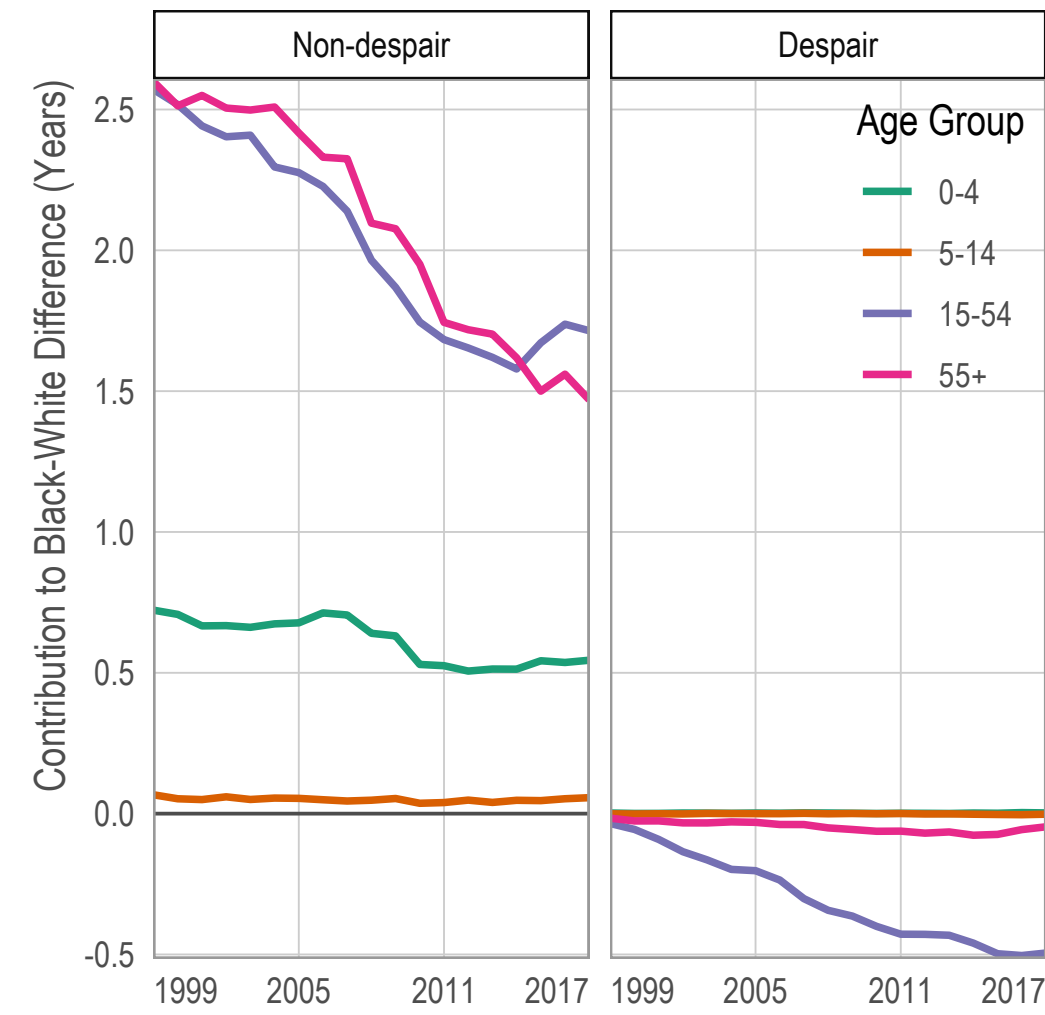


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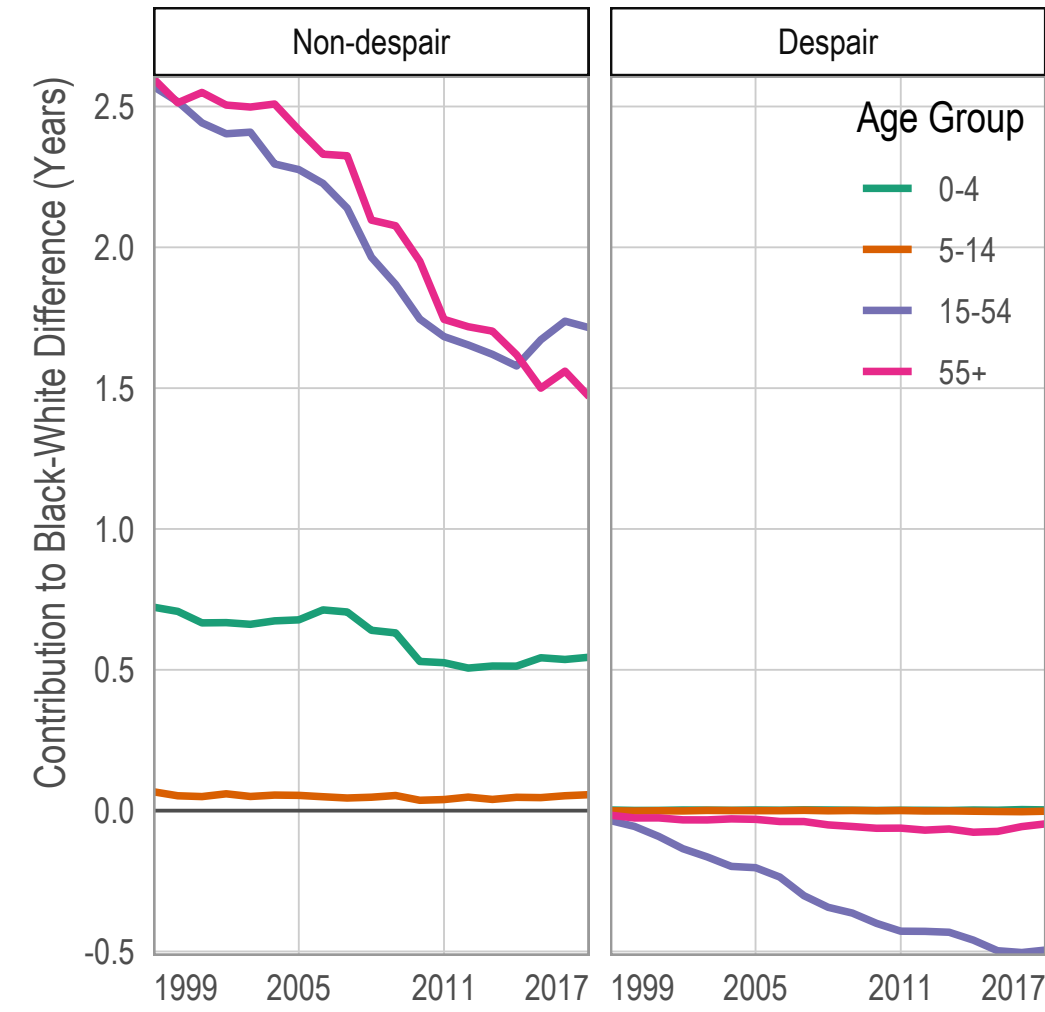
Conclusion

Conclusion



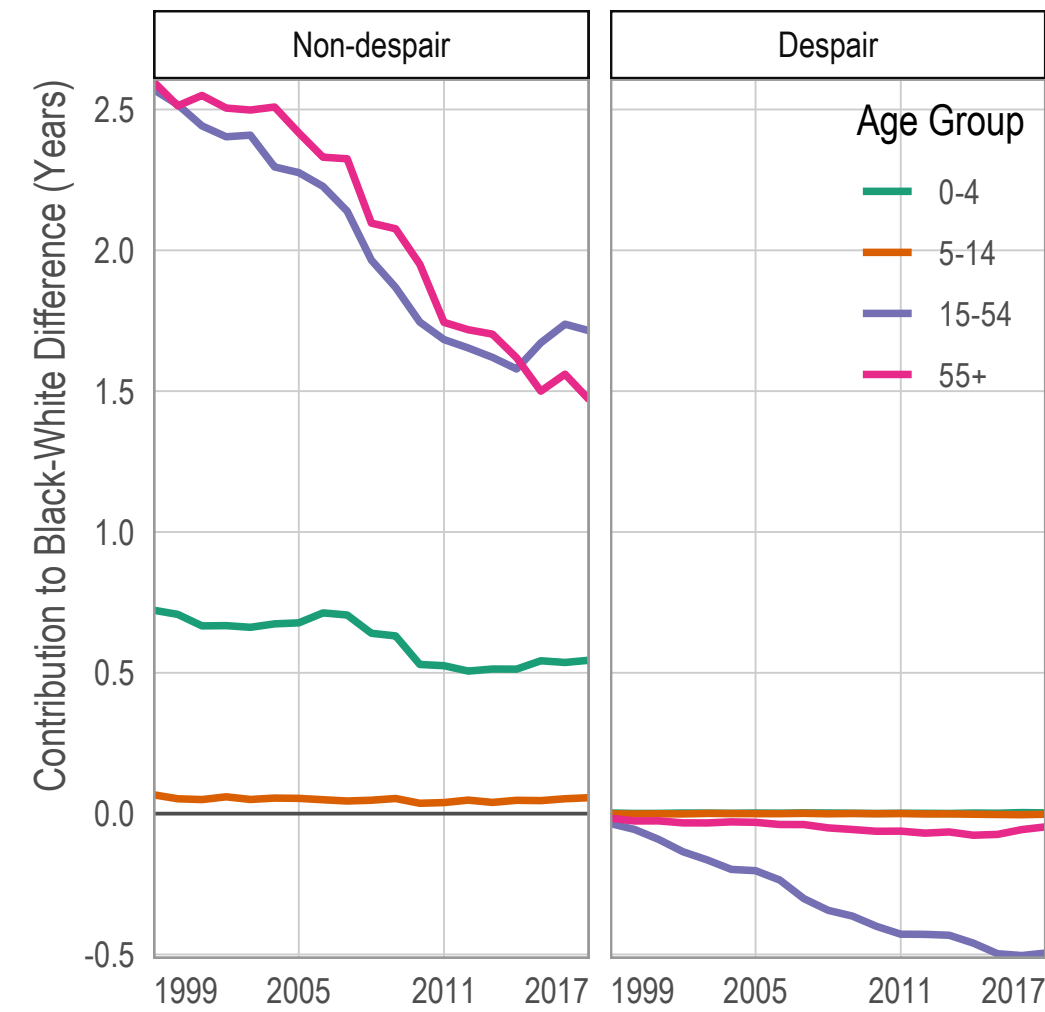
We need to address under-5 mortality.

Conclusion

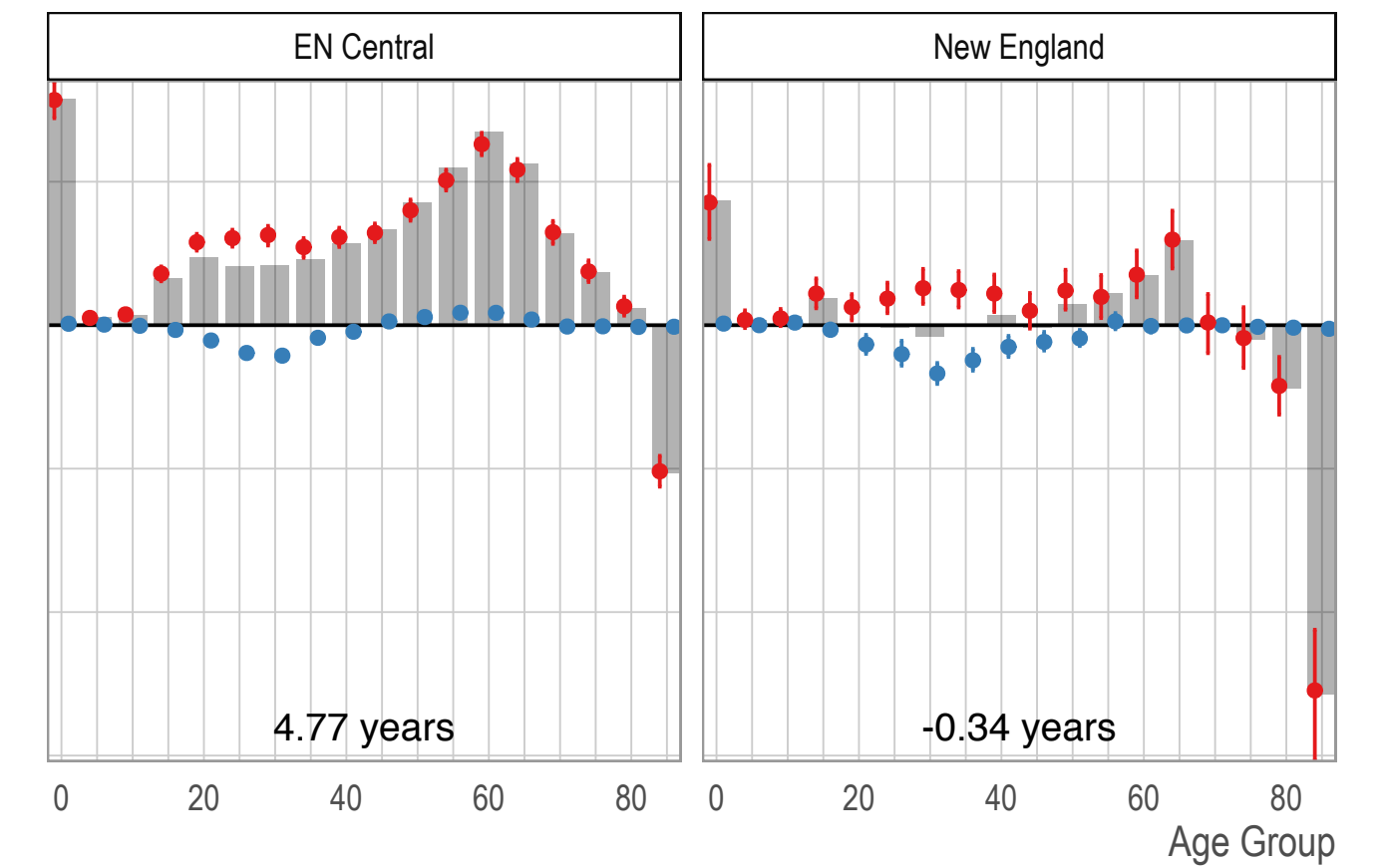


We need to address under-5 mortality. Deaths of despair minor relative to under-5.

Conclusion

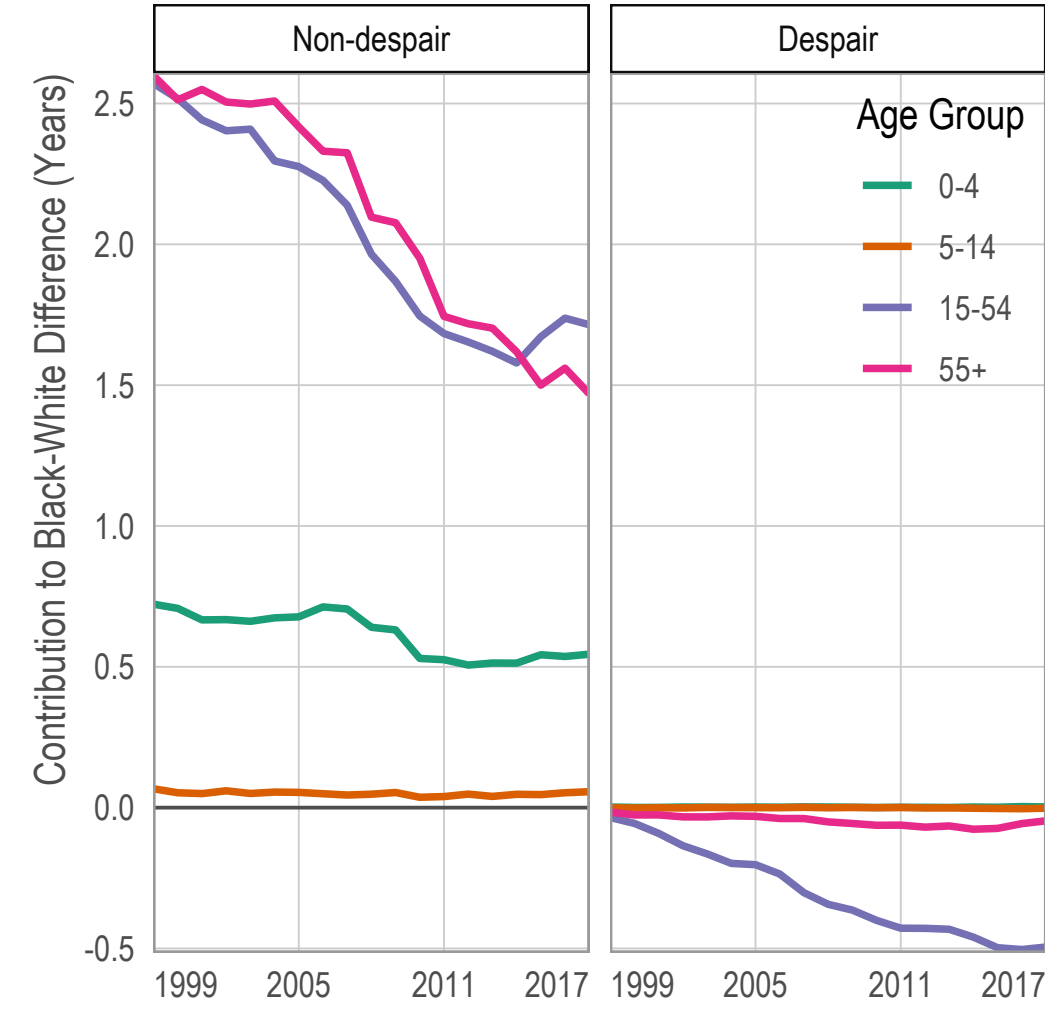


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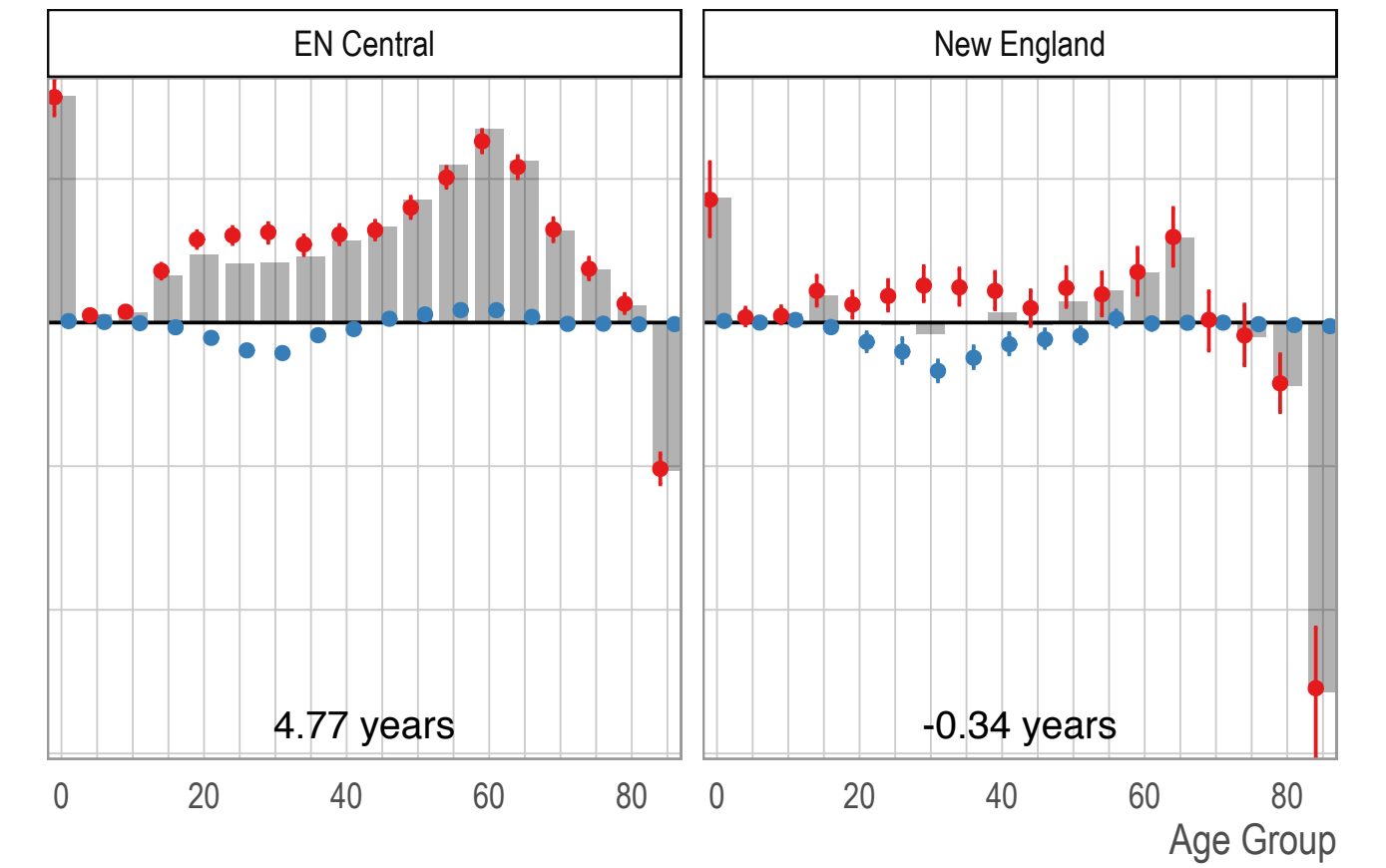


Geography cannot be ignored.

Conclusion

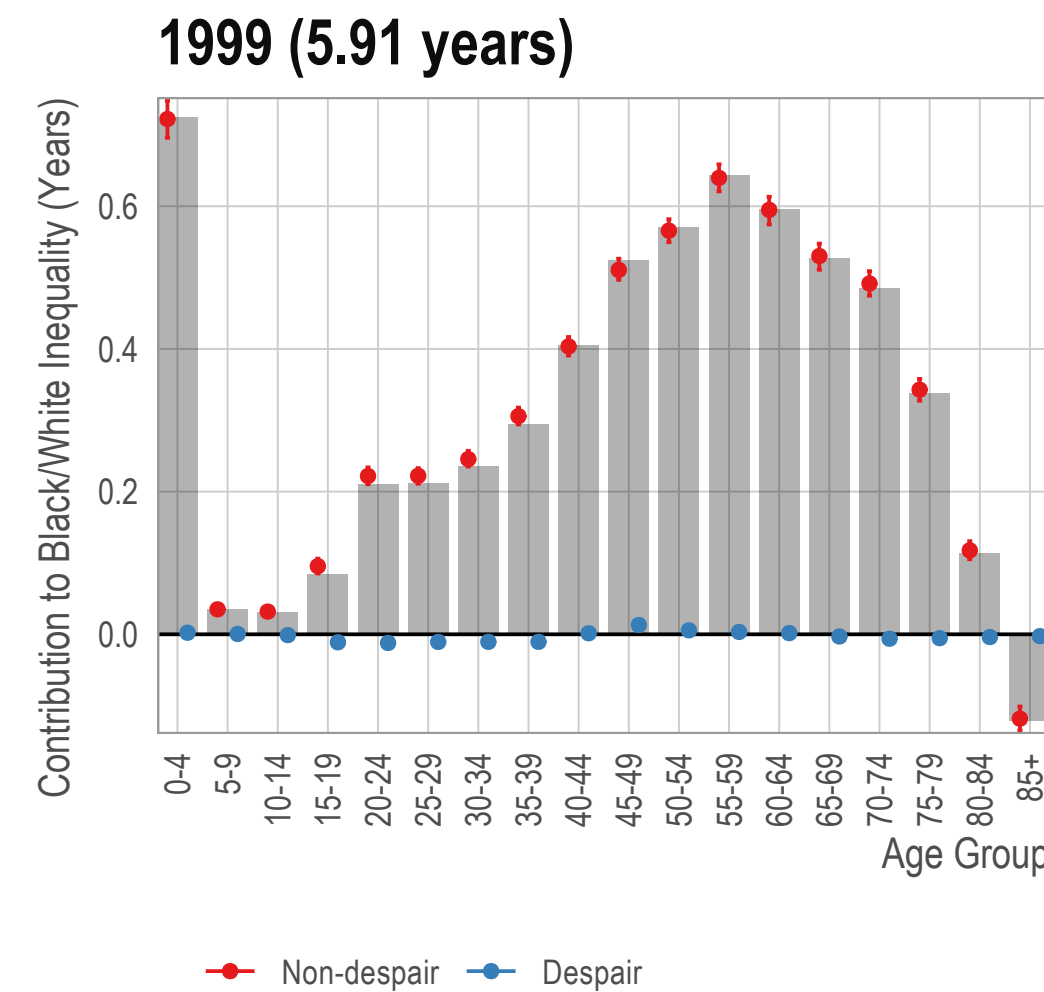


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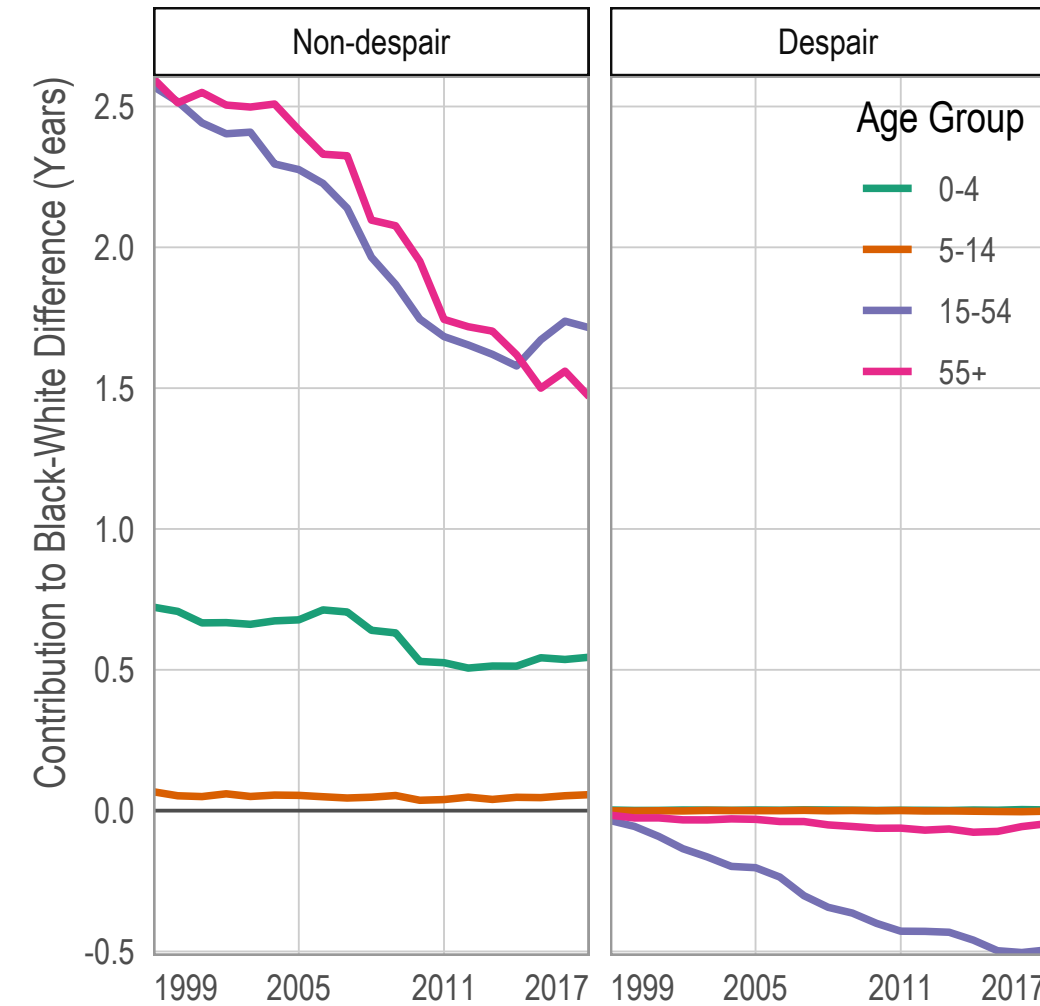


Geography cannot be ignored. **Interventions must be local.**

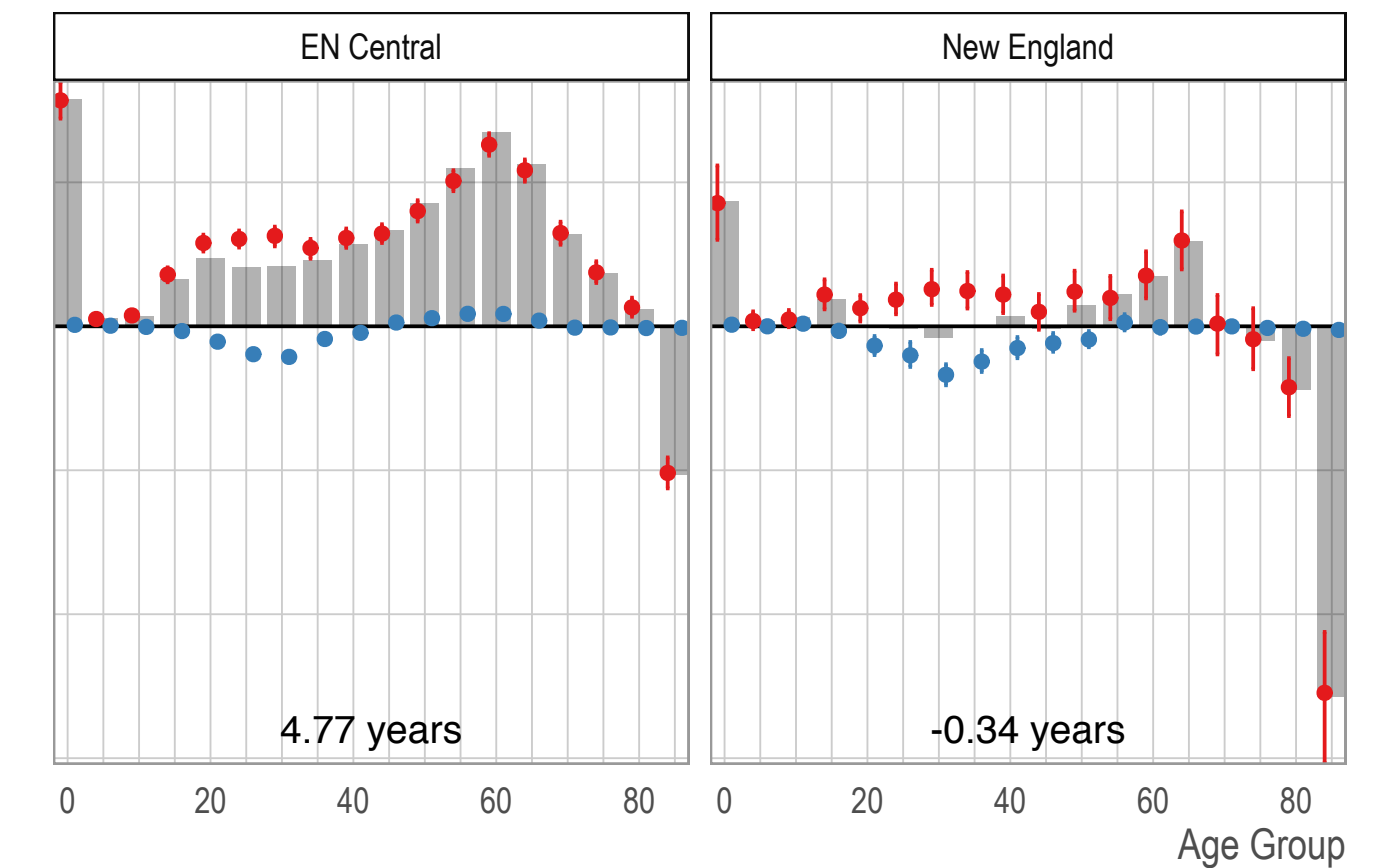
Conclusion



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

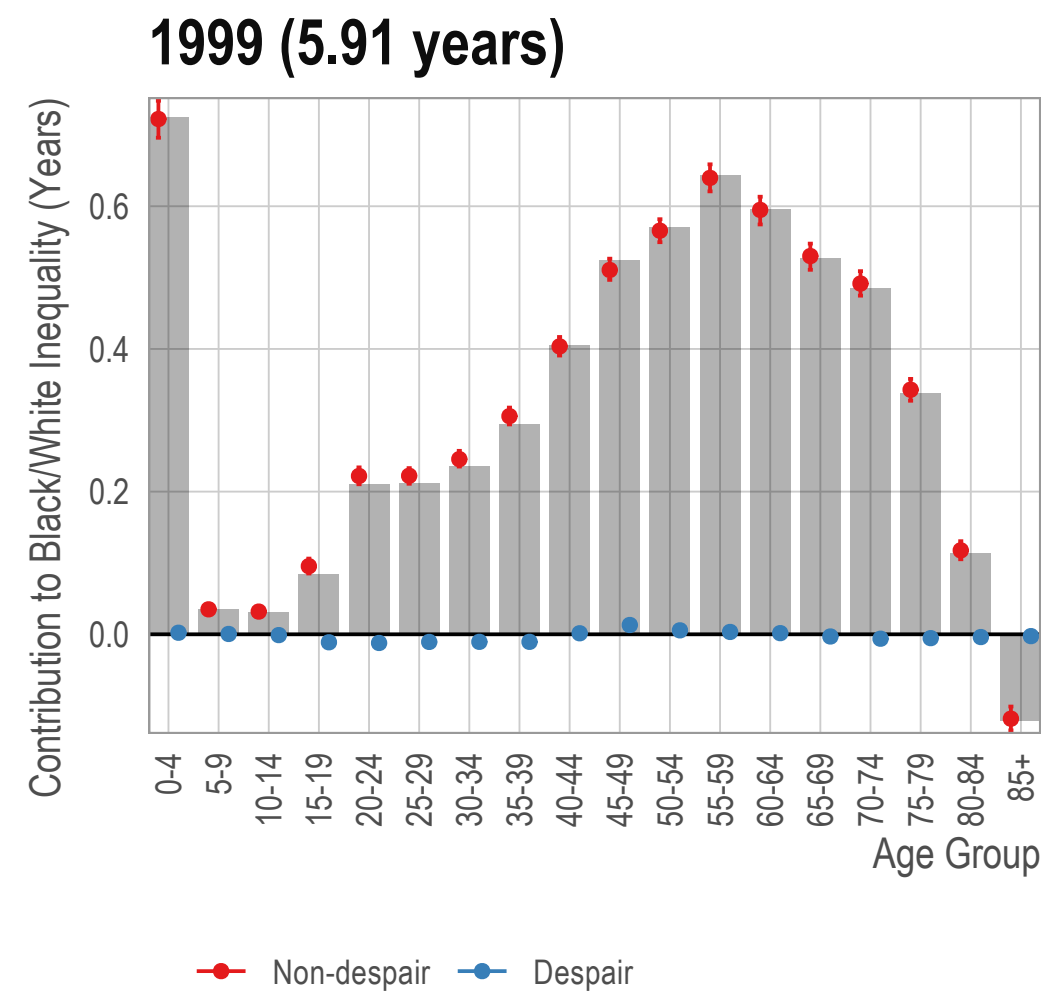


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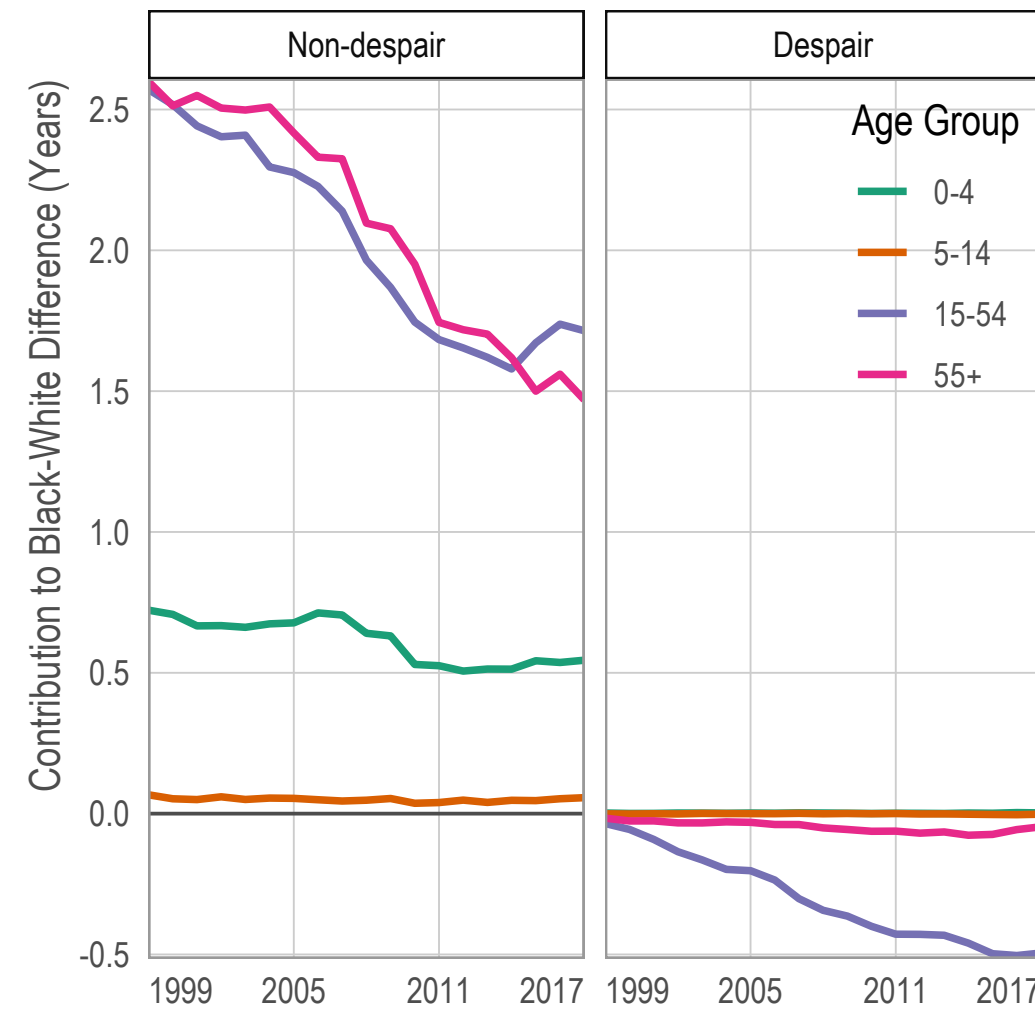


Geography cannot be
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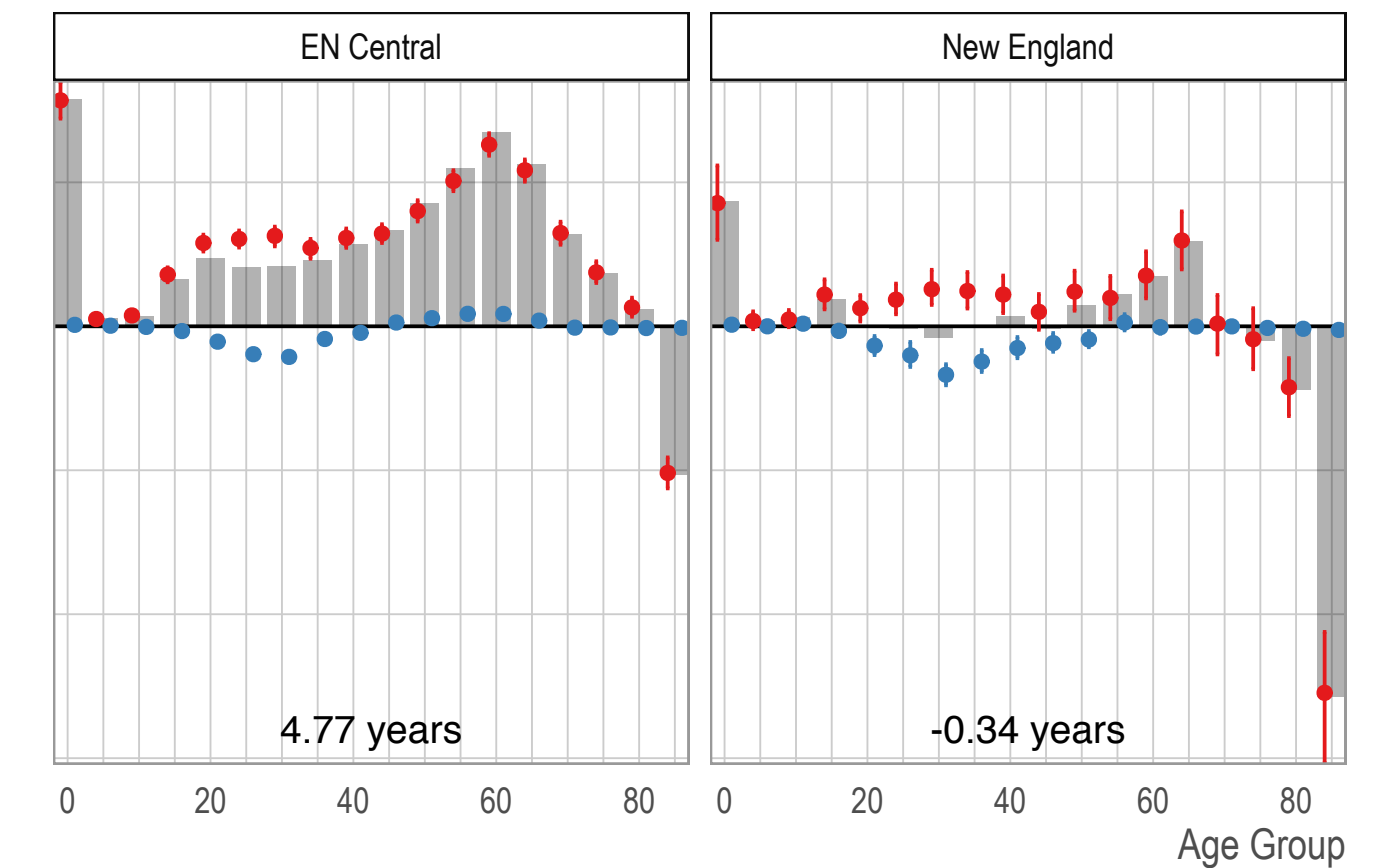
Thank you



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.

Slides available at: http://bit.ly/ser_2019

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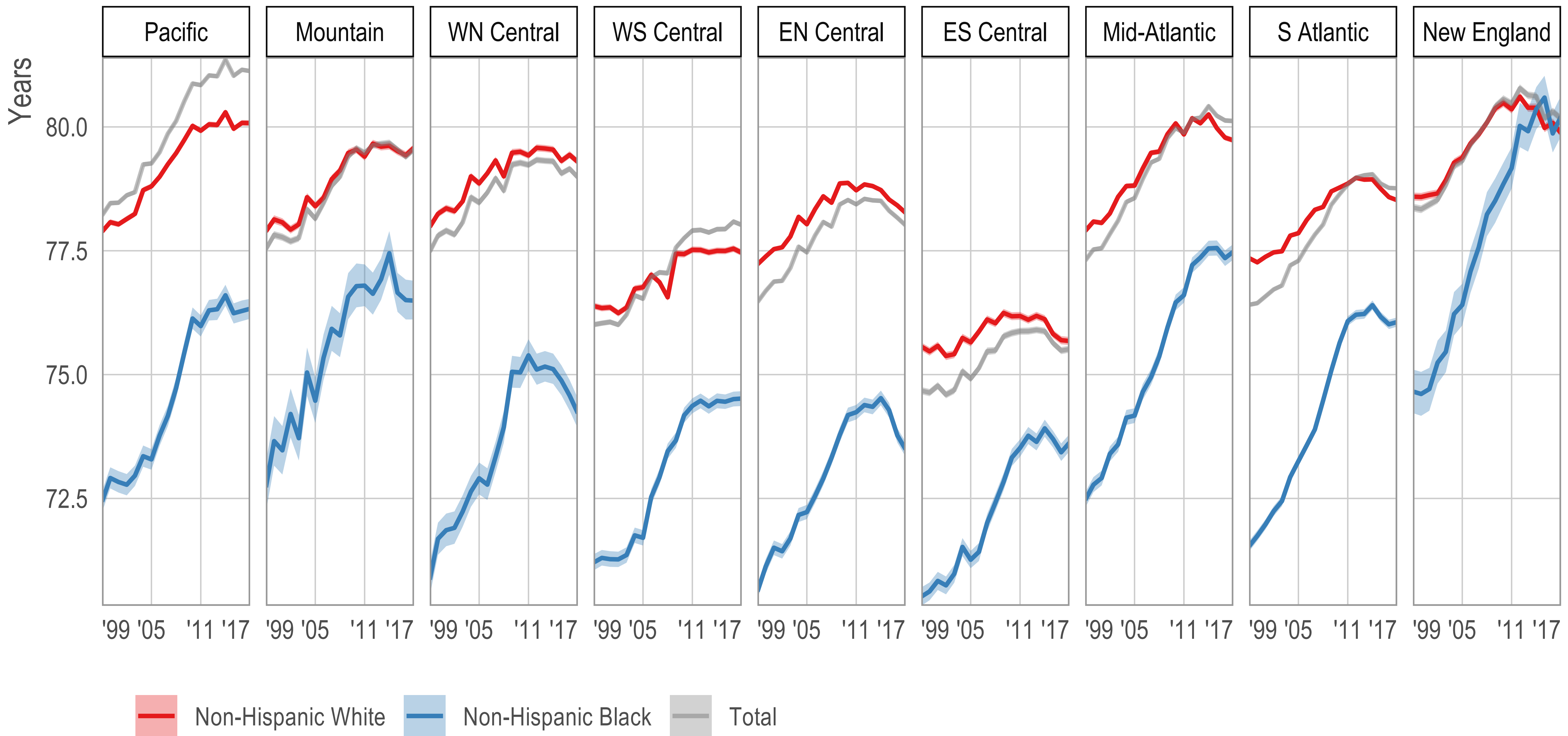
Stanford

Center for
Population
Health Sciences

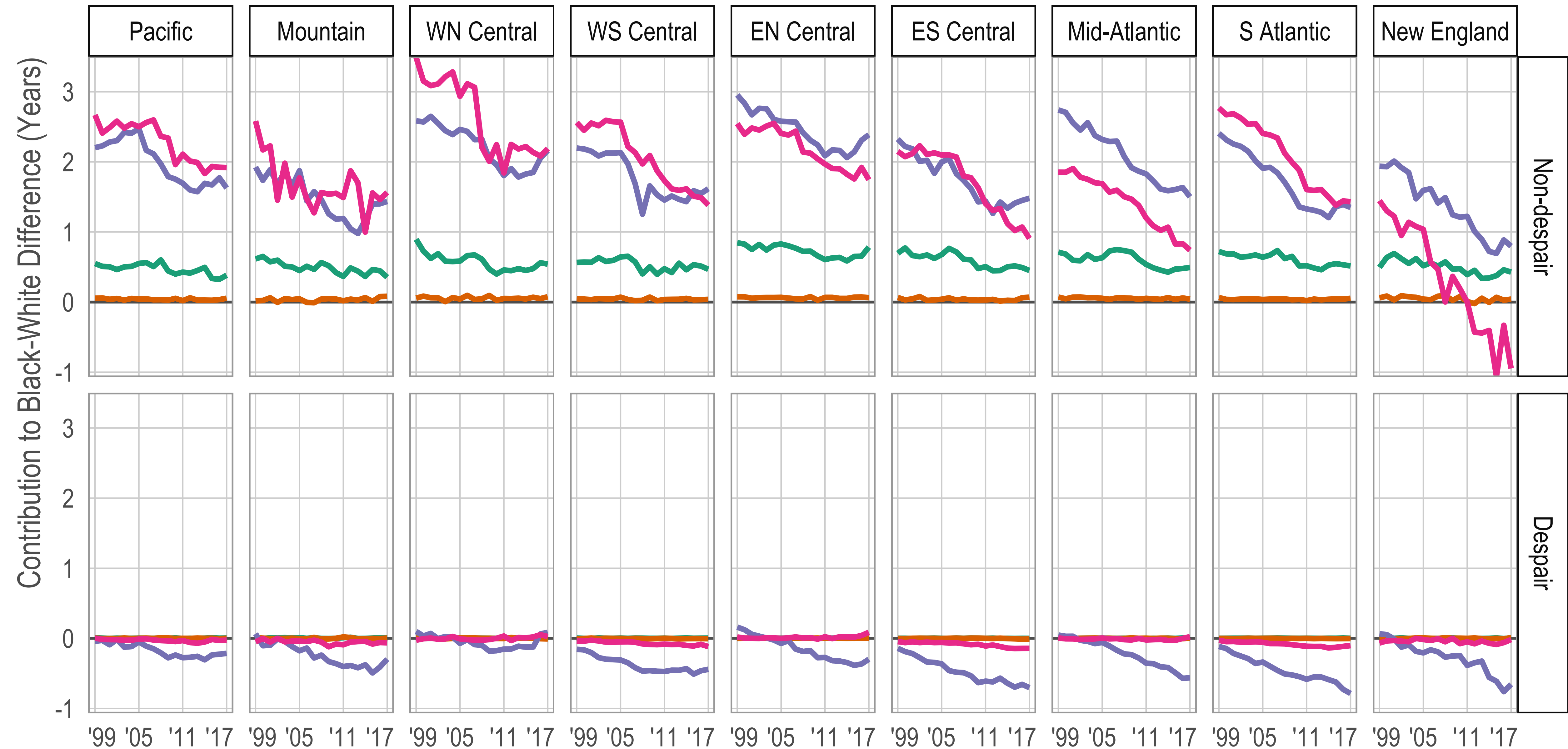
Support:
NIMHD (DP2MD010478)
NIDA (T32DA035165)
PHS DataCore and SRCC for
computational resources.

Additional slides

Life Expectancy by Division



Contributions by Division



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)

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

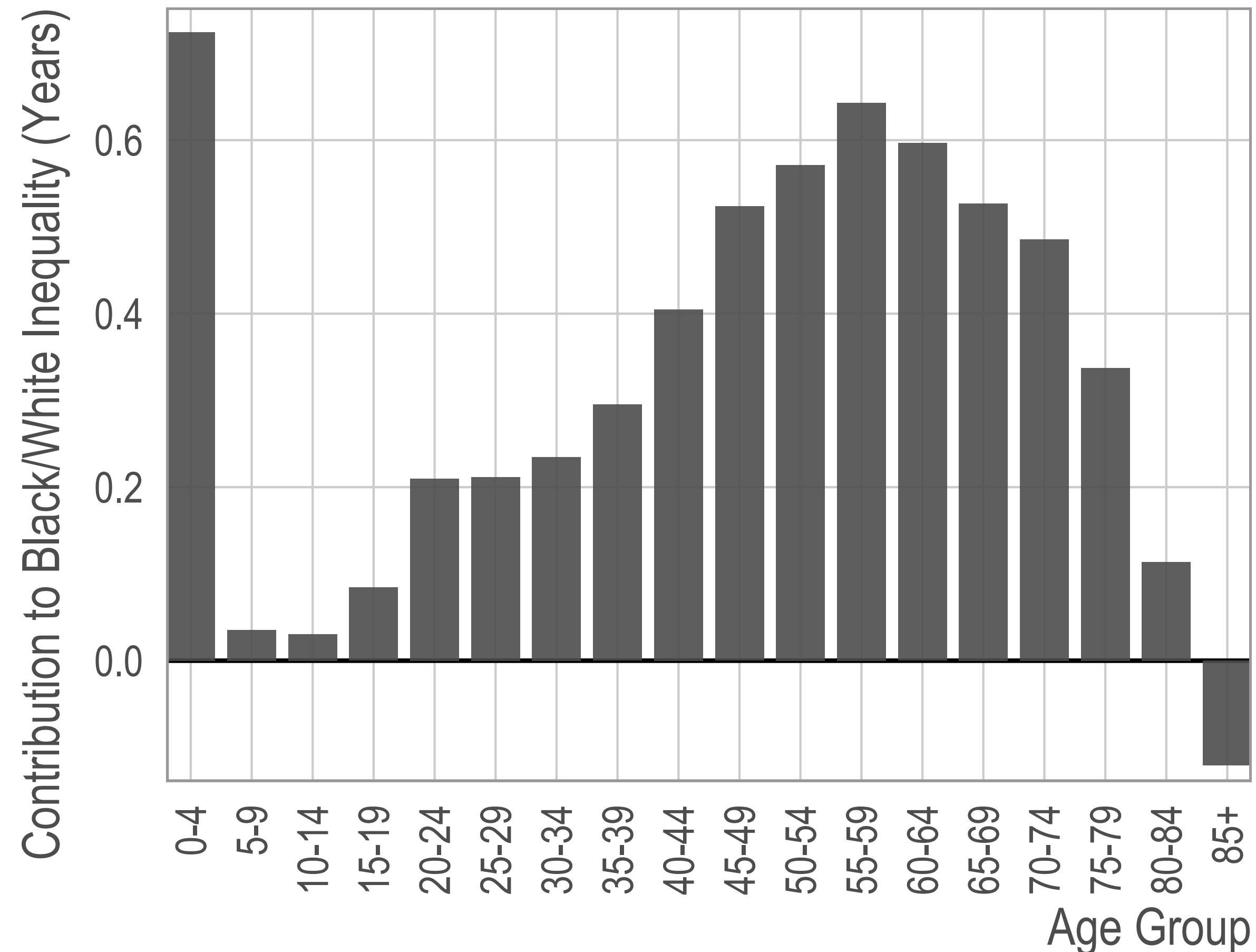
Data and Methods

- 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

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

Decomposing Black/White Inequality

1999 (5.91 years)



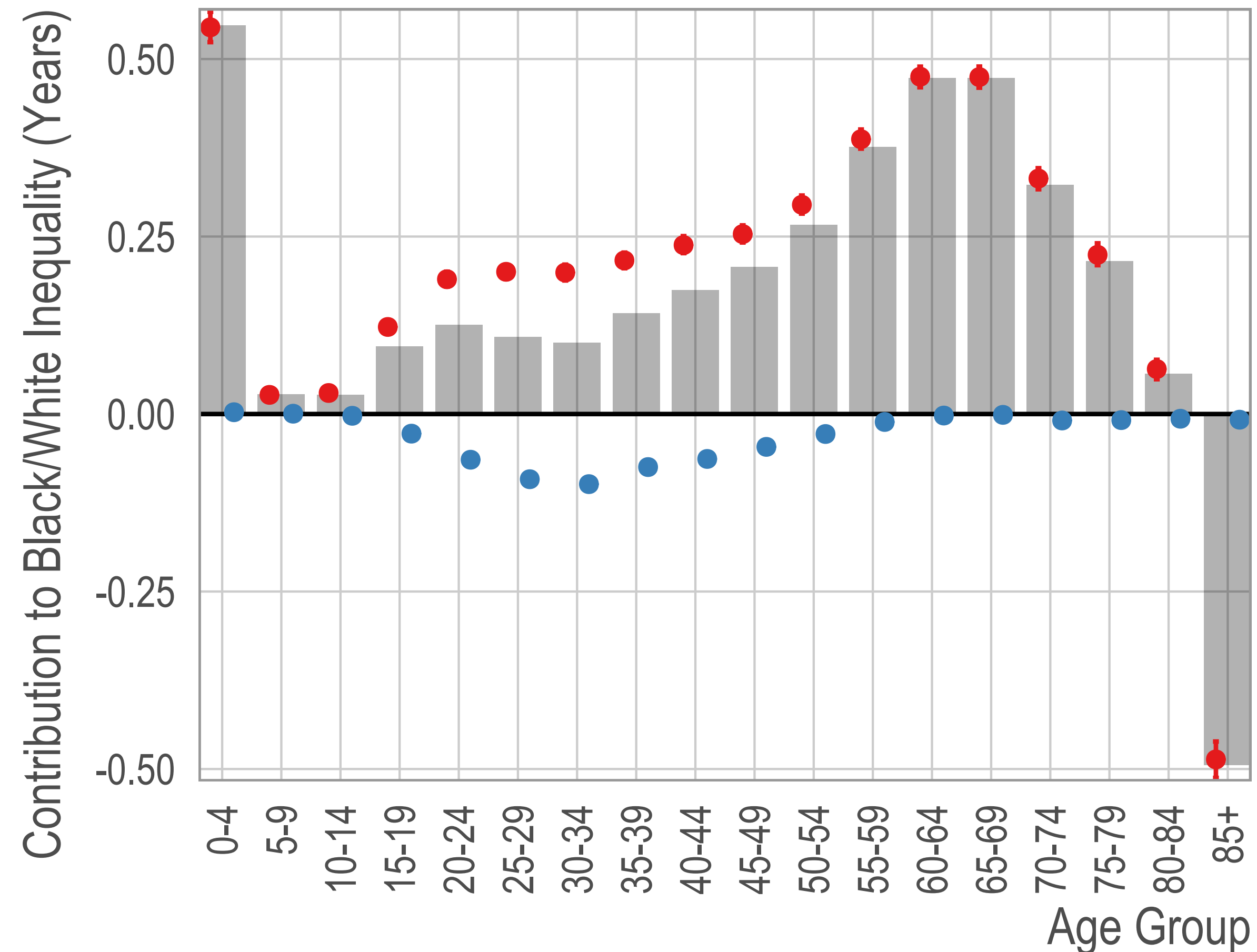
- In 1999, NHW outlived NHB by ~6 years
- Negative values indicate NHB mortality rate is lower than NHW mortality rate *in that age group*
- NHW lower mortality in nearly every age group except 85+*

*Not clear this is real.

See: Nam 1995 in *Social Biology* (doi: 10.1080/19485565.1995.998889)

Decomposing Black/White Inequality

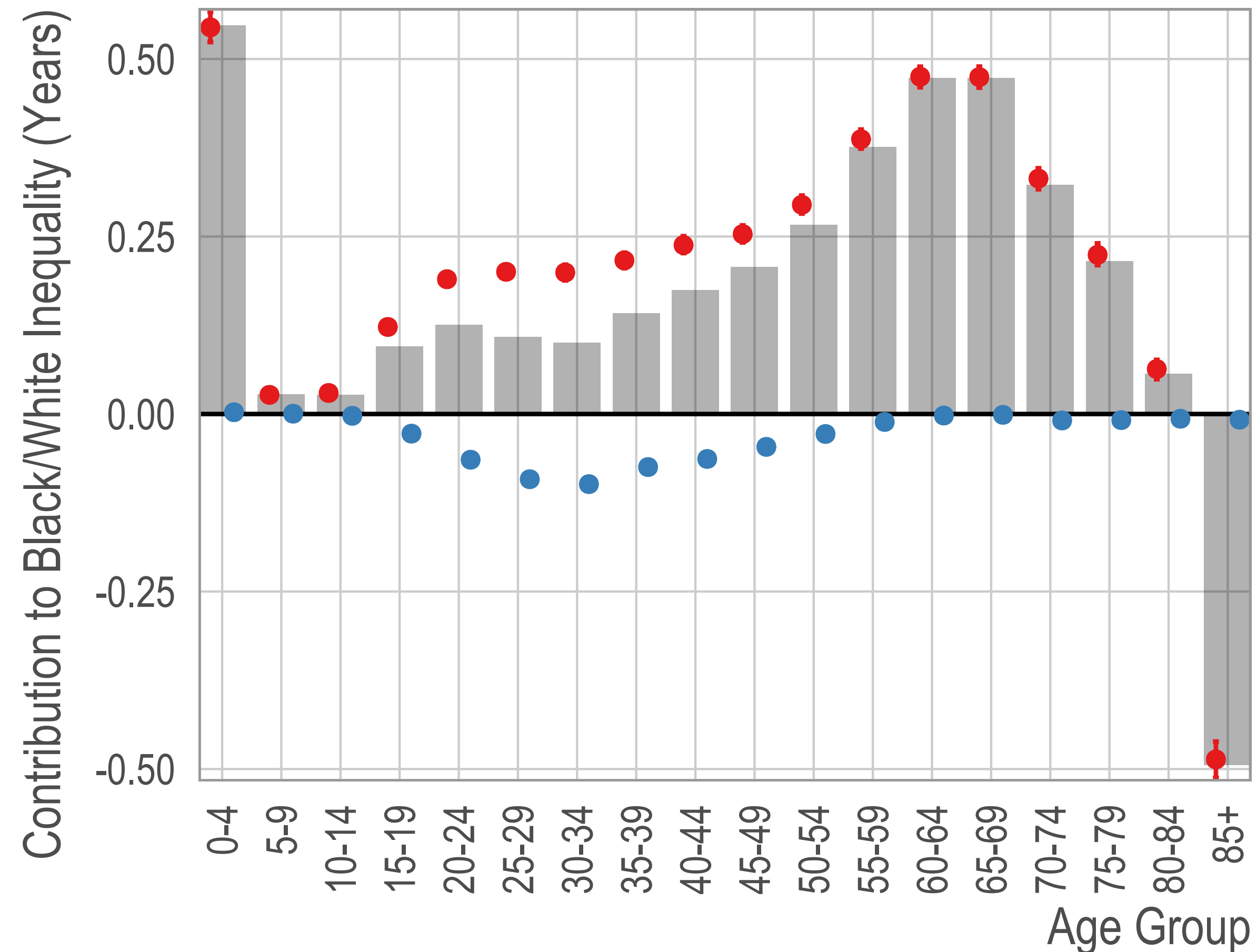
2017 (3.24 years)



- By 2017, Black/White inequality dropped to 3.24 years

Decomposing Black/White Inequality

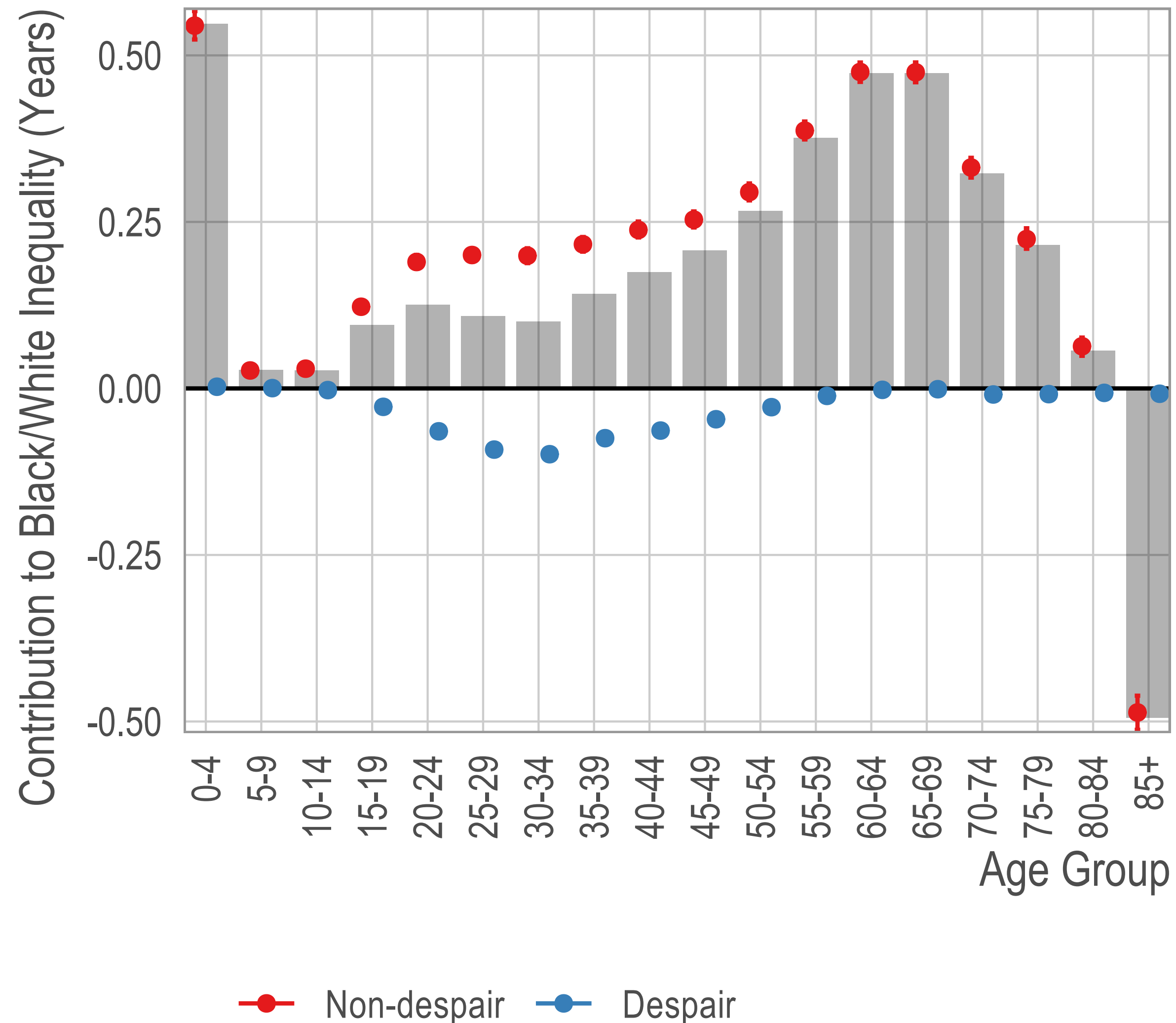
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- By 2017, Black/White inequality dropped to 3.24 years
- **17%** of gap is due to deaths of despair (-0.54 years)

Decomposing Black/White Inequality

2017 (3.24 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

