Age, Sex, and Racial/Ethnic Disparities and Temporal-Spatial Variation in Excess All-Cause Mortality During the COVID-19 Pandemic:
Evidence from Linked Administrative and Census Bureau Data

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Motivation

- In February 2022, the United States surpassed 1 million excess deaths since the start of the pandemic (National Center for Health Statistics [NCHS])

- Pandemic impacts are not distributed evenly across the population, but more heavily concentrated among:
    - Males
    - Older Americans
    - Hispanic, Non-Hispanic (NH) Black, and NH American Indian/Alaskan Native (AIAN) individuals

- Though consensus on racial/ethnic disparities is beyond dispute, estimates of the relative impacts of the pandemic vary…
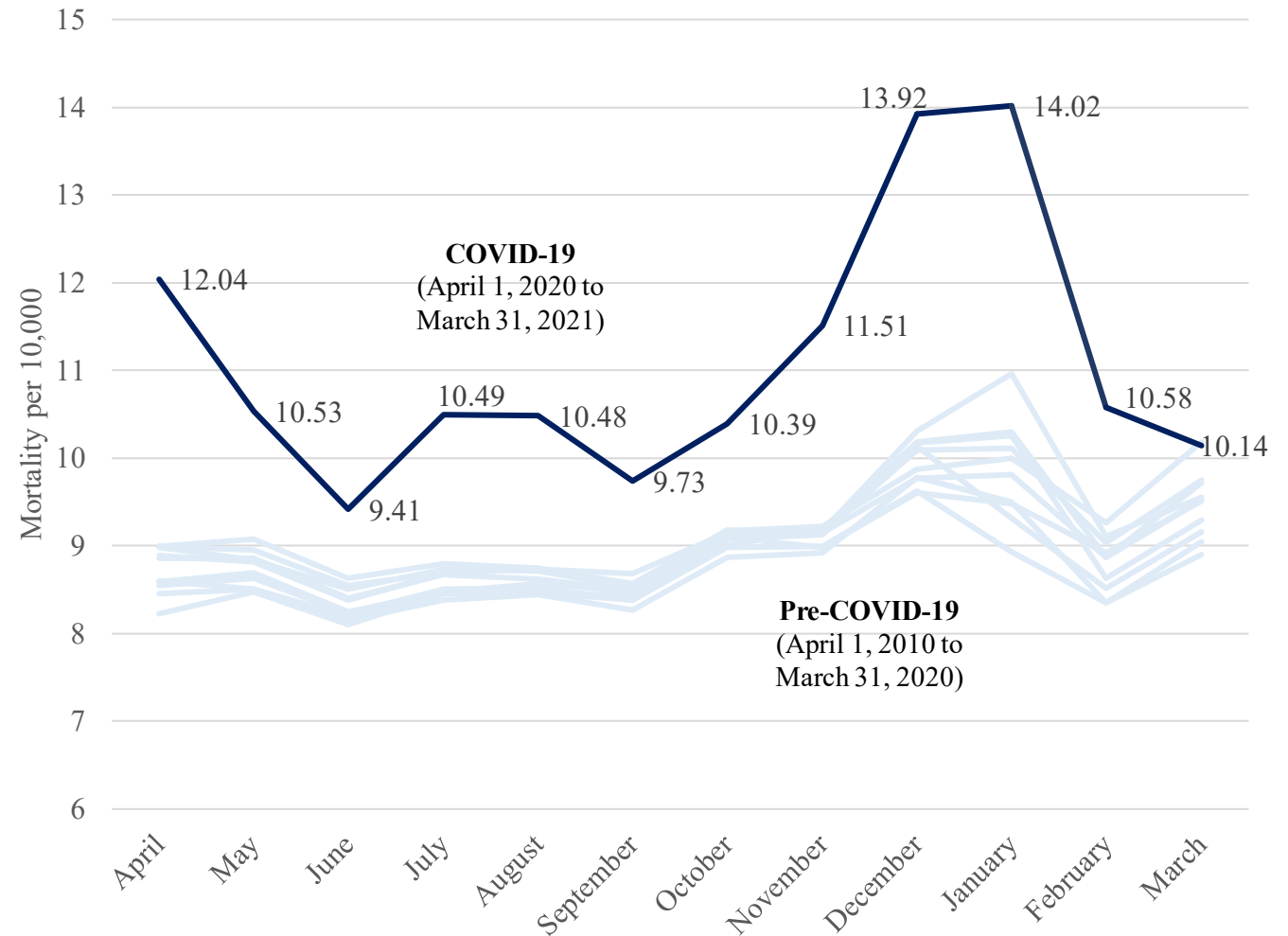
Motivation

- For example:
  - Polyakova et al. (2021) estimate age-adjusted excess mortality for Non-Hispanic (NH) Blacks is **4.2 times greater** than that of NH Whites
  - Luck et al. (2021) estimate age-adjusted increases in death rates are only **2.5 times higher** for NH Blacks than NH Whites
- Variation in estimates of racial/ethnic disparities stems from differences in:
  - Measurement of race/ethnicity
    - Most of the literature relies on race/ethnicity as listed on death certificates
      - Next-of-kin reports or coroner assessments
    - Particularly poor for American Indian/Alaskan Natives (AIAN)*
    - Unreliable for Hispanics, Asians, and Native Hawaiian/Pacific Islanders (NHPI)*
  - Time period studied
    - Trade-offs between timeliness and comprehensiveness

*Source: Arias et al. (2008, 2016).

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Goals

- Provide circumspect estimates of excess mortality in the first full year of the pandemic, while also examining granular variation in mortality for population subgroups
  - Estimate age-, sex-, and race/ethnicity-specific excess *all-cause* mortality
  - Examine racial/ethnic gaps in excess all-cause mortality over the course of the pandemic and across the United States
- Inform ongoing research on the determinants of pandemic-era disparities

Measuring Mortality

- Census Numident (Q3 2021)

- Universe of individuals ever issued a Social Security Number (SSN)

- Reliable date of death information through March 31, 2021*
  - Death counts and trends virtually identical to those reported by NCHS

Chart: Mortality per 10,000

COVID-19
(April 1, 2020 to March 31, 2021)

12.04, 10.53, 9.41, 10.49, 10.48, 9.73, 10.39, 11.51, 13.92, 14.02, 10.58, 10.14

Pre-COVID-19
(April 1, 2010 to March 31, 2020)

Months: April, May, June, July, August, September, October, November, December, January, February, March

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Measuring Demographic and Geographic Characteristics

- Age and Sex are also drawn from the Census Numident (Q3 2021)
- We use the most recent self-reported or household-proxy race/ethnicity response for each individual from the decennial census (2000, 2010) and the American Community Survey (ACS, 2001-2019)
  - Eight race/ethnicity categories following OMB (1997) standards:
    - Hispanic, NH White alone, NH Black alone, NH AIAN alone, NH Asian alone, NH Native-Hawaiian/Pacific Islander (NHPI) alone, NH Some Other Race (SOR) alone, and NH Multiple Race
- State of last known residence:
  - Decennial census (2010); ACS (2010-2019); Composite administrative record files (MAF-ARF, 2010-2020); and Third-party administrative data (2015-2020)
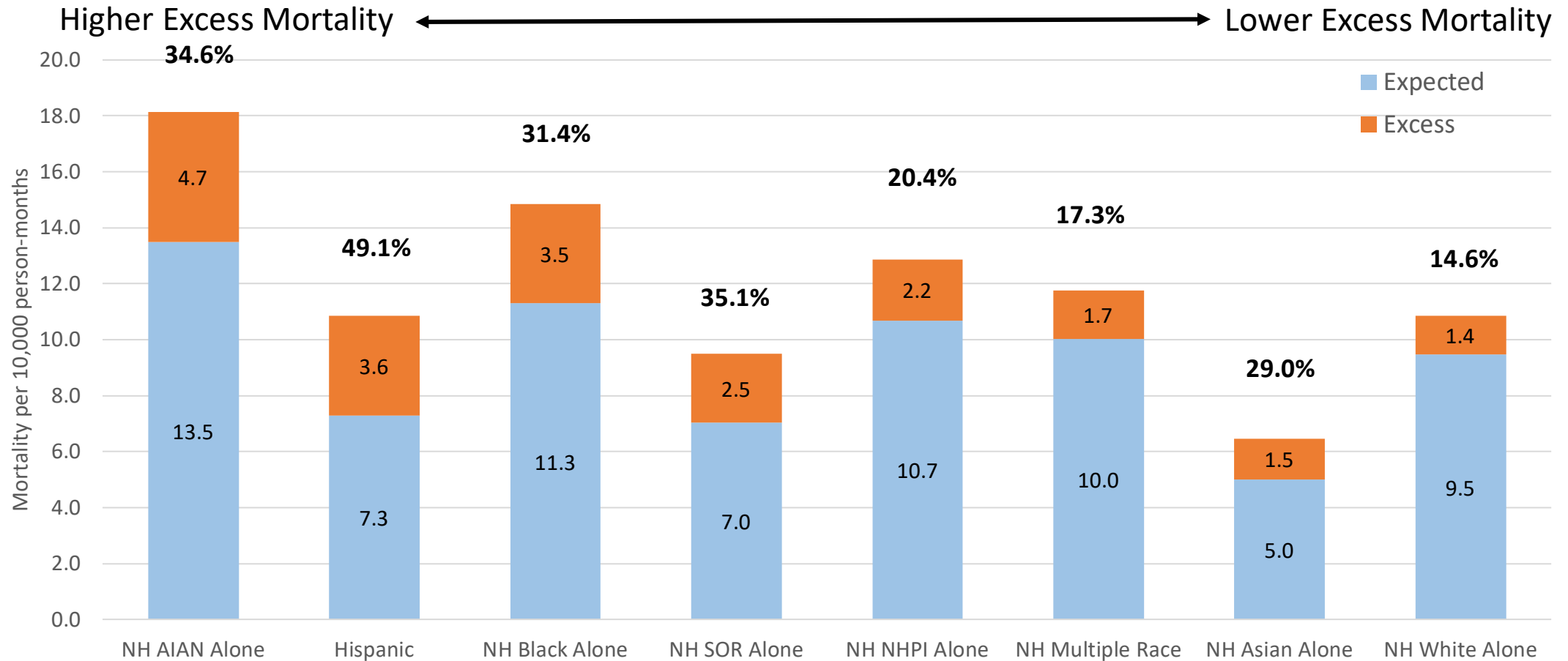
Linkage and Universe Restrictions

- We link individuals across datasets using anonymous Protected Identification Keys (PIKs) assigned by the Person Identification Validation System (PVS) software*

- The universe of all SSN-holders is restricted to those:
  - Alive as of April 1, 2010
  - With non-missing date of birth, sex, and race/ethnicity
  - Ages 15 to 99 (inclusive) at the start of a given month

- Analytical universe includes
  - 2.4 billion person-month observations in the April 1, 2010 to March 31, 2020 reference period
  - 248 million person-month observations in the April 1, 2020 to March 31, 2021 COVID period

*Source: Wagner and Layne (2014).

Estimating Excess Mortality
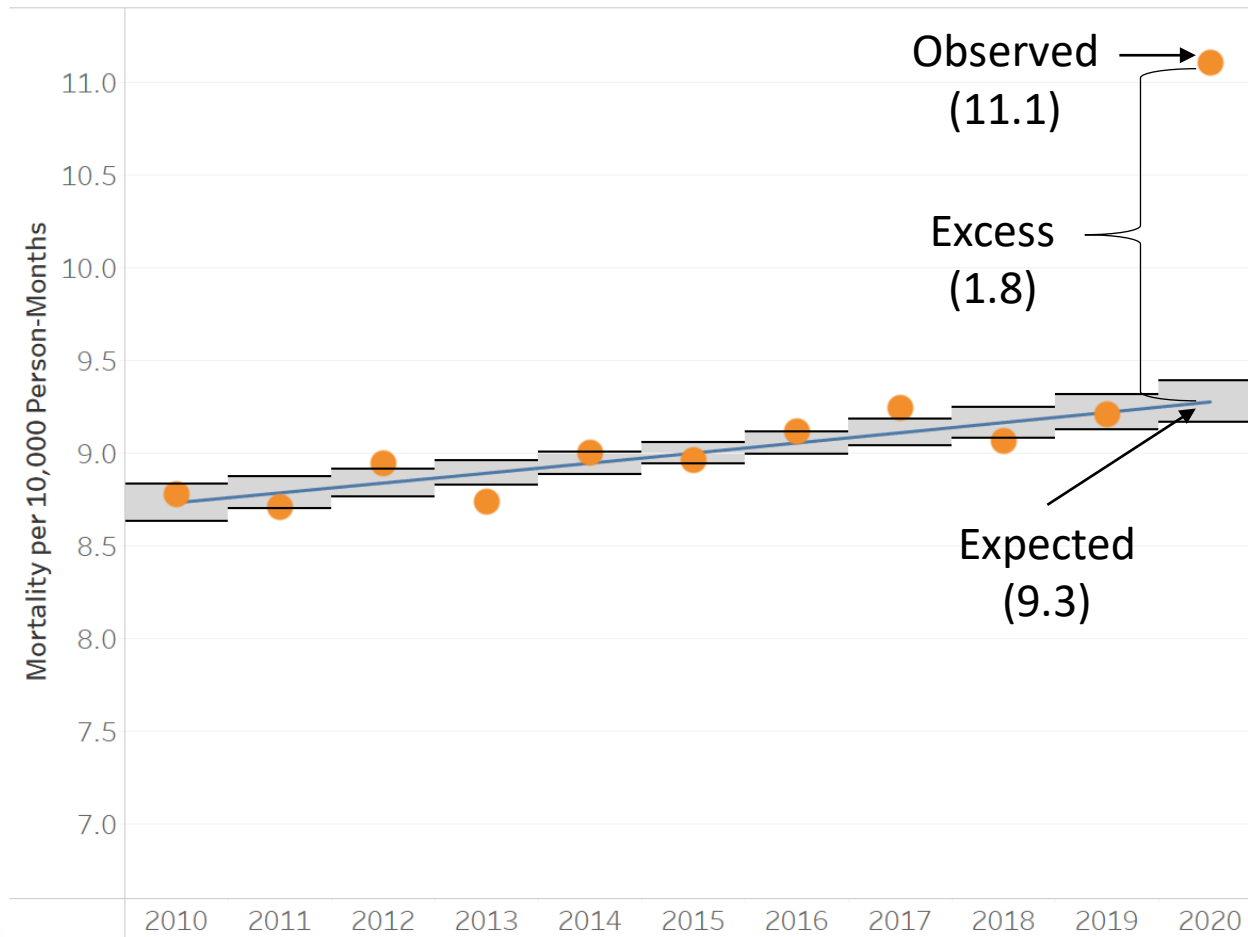
- *Excess Mortality = Observed Mortality – Expected Mortality*

- *Expected Mortality* is the mortality rate expected in the hypothetical absence of the pandemic
  - Use negative binomial regression (with a population offset term) to predict expected death counts for the April 1, 2020 to March 31, 2021 period as a function of death counts from April 1, 2010 to March 31, 2020
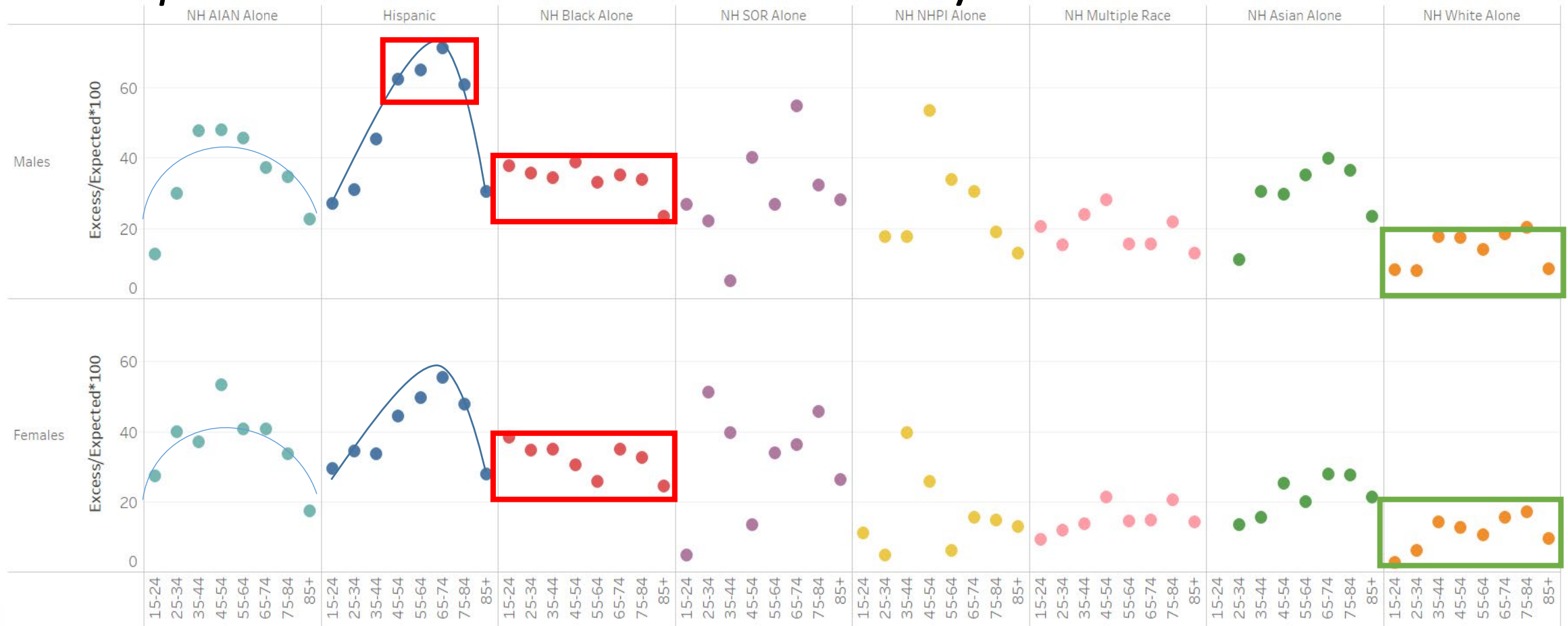 - Express these expected counts as deaths per 10,000 person-months

Age- and Sex-Adjusted Mortality

Higher Excess Mortality ← → Lower Excess Mortality

Mortality per 10,000 person-months

Legend: Expected, Excess

Group	Expected	Excess	Percent
NH AIAN Alone	13.5	4.7	34.6%
Hispanic	7.3	3.6	49.1%
NH Black Alone	11.3	3.5	31.4%
NH SOR Alone	7.0	2.5	35.1%
NH NHPI Alone	10.7	2.2	20.4%
NH Multiple Race	10.0	1.7	17.3%
NH Asian Alone	5.0	1.5	29.0%
NH White Alone	9.5	1.4	14.6%

Note: National age and sex distributions are used for adjustments. Source: Census Numident (Q3, 2021); Decennial Census (2000, 2010); and ACS (2001-2019). Restricted to individuals ages 15 to 99 at the start of any given month with a non-missing self-reported or household proxy race/ethnicity response.

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Age-, Sex-, and Race/Ethnicity-Specific Excess Mortality

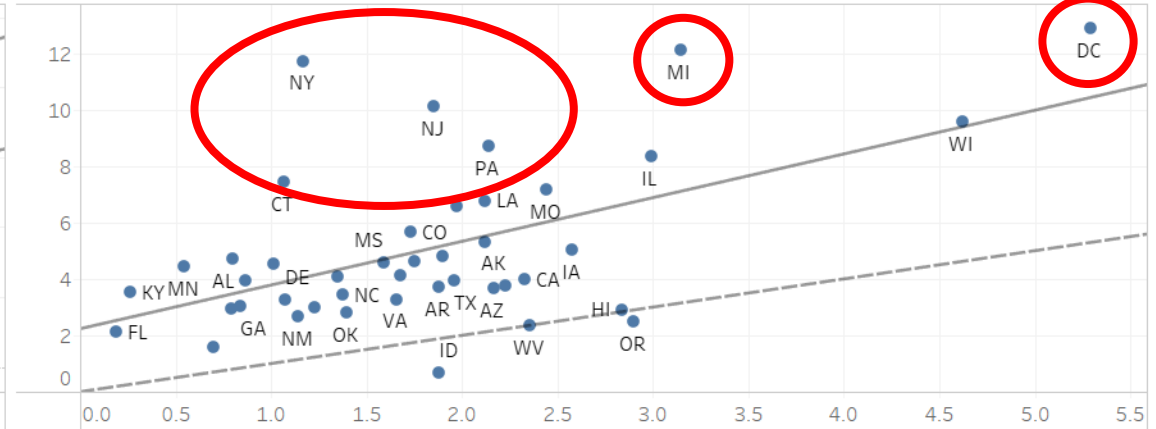# Age-, Sex-, and Race/Ethnicity-Specific *Proportional* Excess Mortality

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Temporal-Spatial Variation in Black-White Gap

Note: Black-White gaps are raw differences in observed and expected mortality. Source: Census Numident (Q3, 2021); Decennial Census (2000, 2010); and ACS (2001-2019). Restricted to individuals ages 15 to 99 at the start of any given month with a non-missing self-reported or household proxy race/ethnicity response.
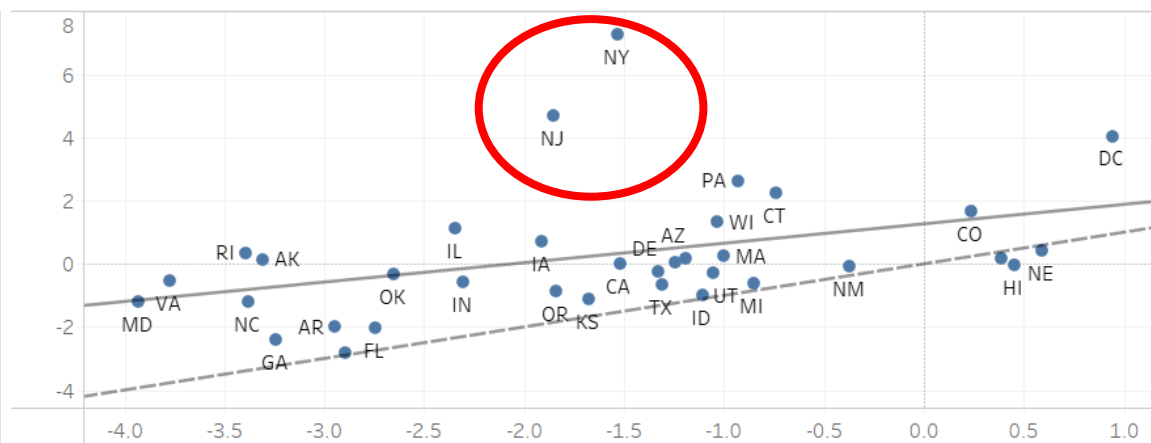
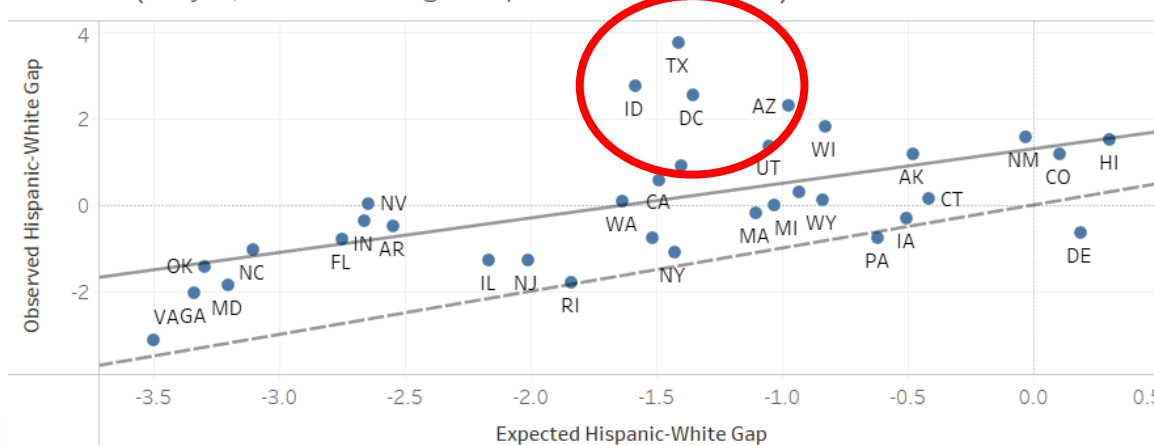# Temporal-Spatial Variation in Hispanic-White Gap

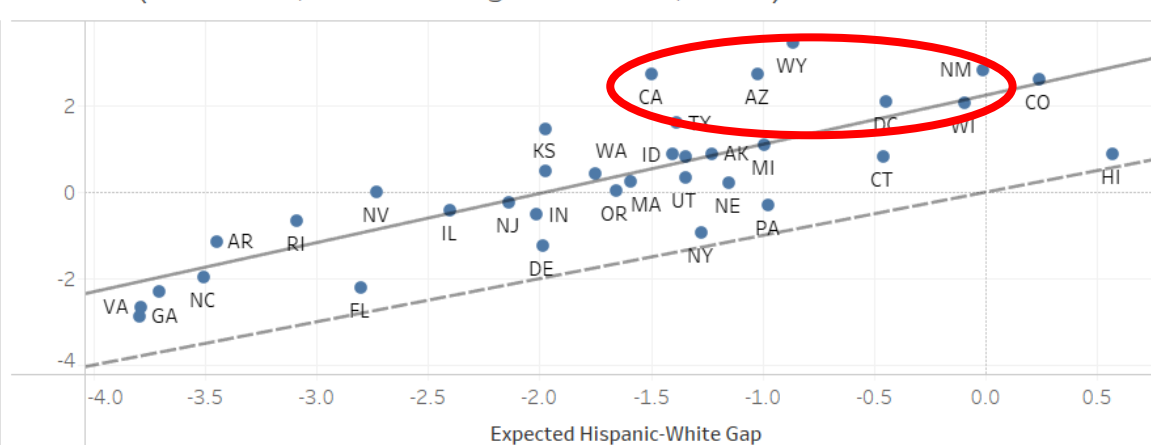**First Full Year (April 1, 2020 through March 31, 2021)**
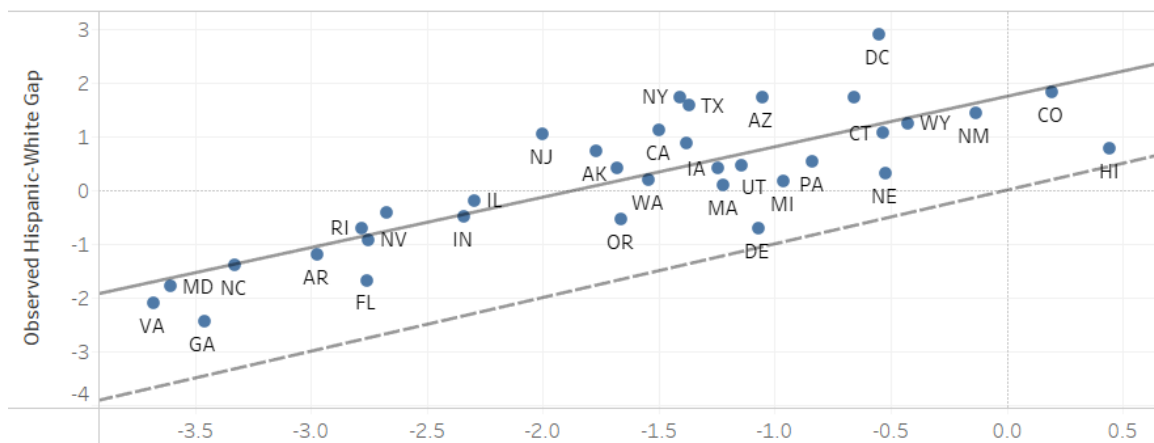
Wave 1 (April 1, 2020 through June 30, 2020)

Wave 2 (July 1, 2020 through September 30, 2020)

Wave 3 (October 1, 2020 through March 31, 2021)

Note: Hispanic-White gaps are raw differences in observed and expected mortality. Source: Census Numident (Q3, 2021); Decennial Census (2000, 2010); and ACS (2001-2019). Restricted to individuals ages 15 to 99 at the start of any given month with a non-missing self-reported or household proxy race/ethnicity response.

Discussion

- National excess mortality: 1.8 per 10,000 person-months (or 216 per 100,000 person-years)

- Adjusted excess mortality is lowest for NH Whites, but highest for NH AIAN, Hispanic, and NH Black individuals
  - Substantial racial/ethnic variation in excess mortality at younger ages

- Racial/ethnic disparities in excess mortality
  - Widened the Black-White mortality gap in virtually all states
  - Erased the Hispanic mortality advantage at the national level and, in many states, reversed the Hispanic-White mortality gap

Discussion

- Limitations
  - No cause of death information
  - Restricted to individuals ever issued an SSN
  - Substantial heterogeneity within the Hispanic racial/ethnic group
- Social and economic determinants of health as fundamental drivers of racial/ethnic disparities in excess mortality
- Properly understanding the origins of persistent racial/ethnic gaps requires accurate and detailed estimates of those gaps
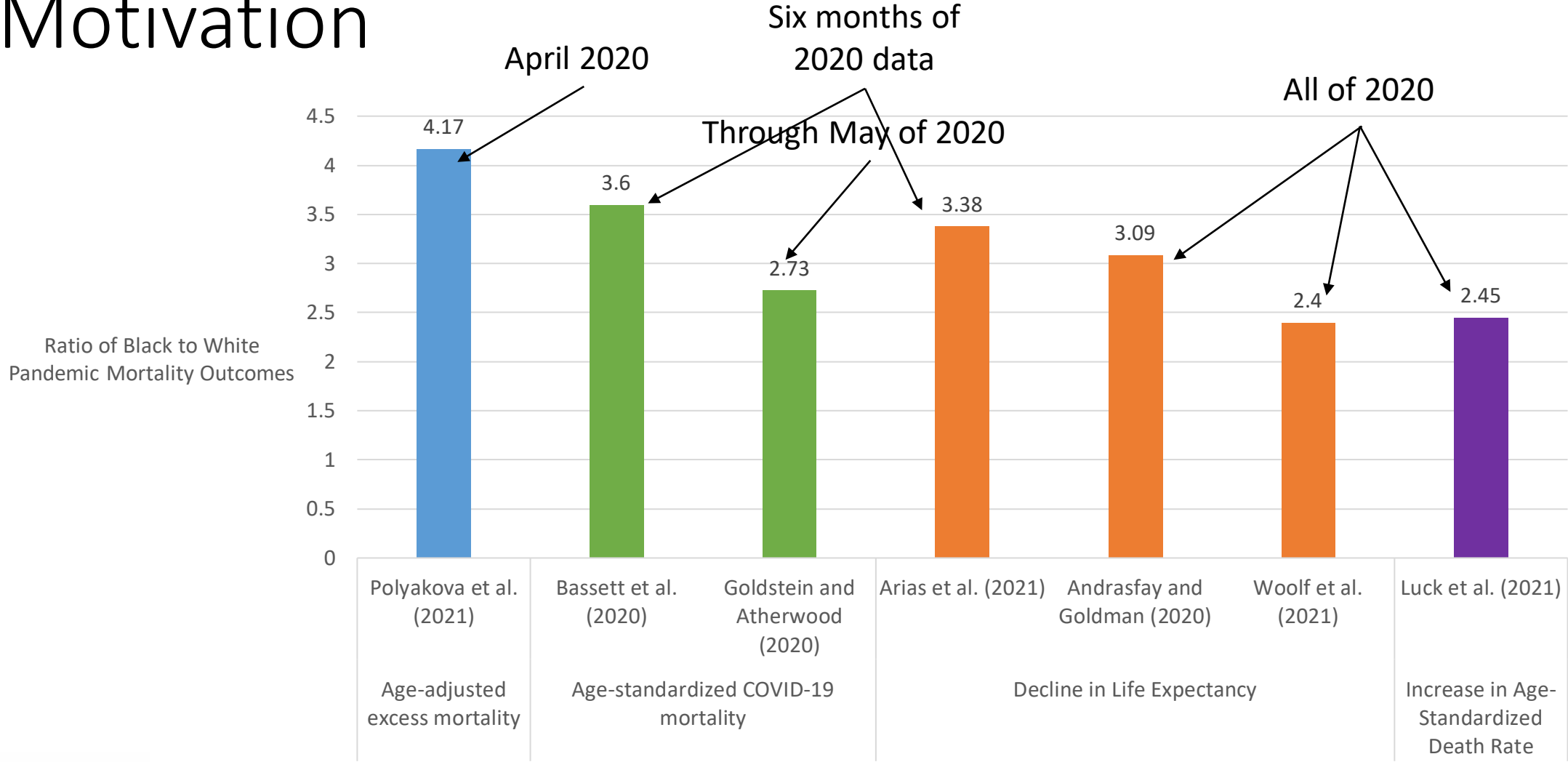
Thank you!

Contact Info:

Brad Foster

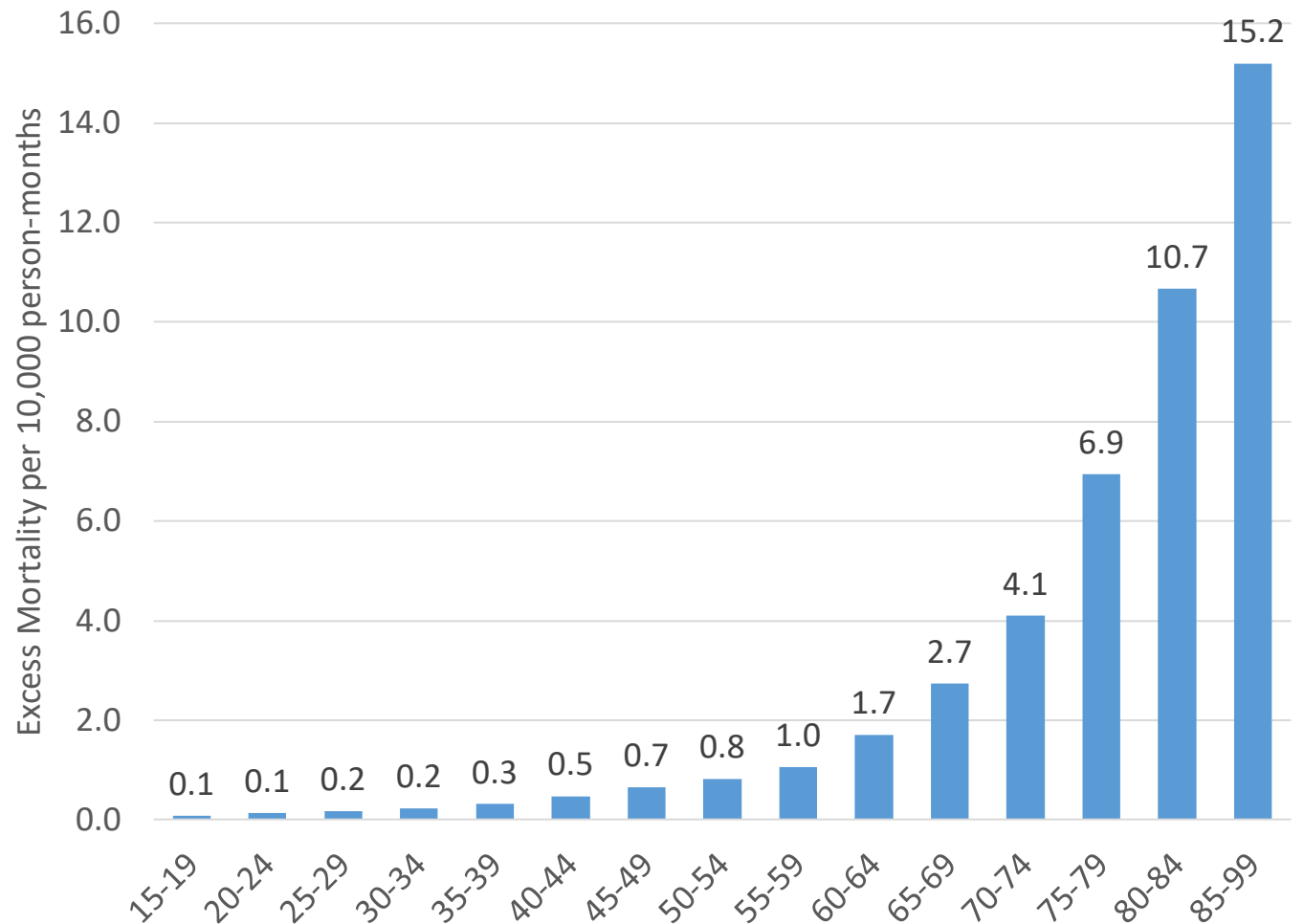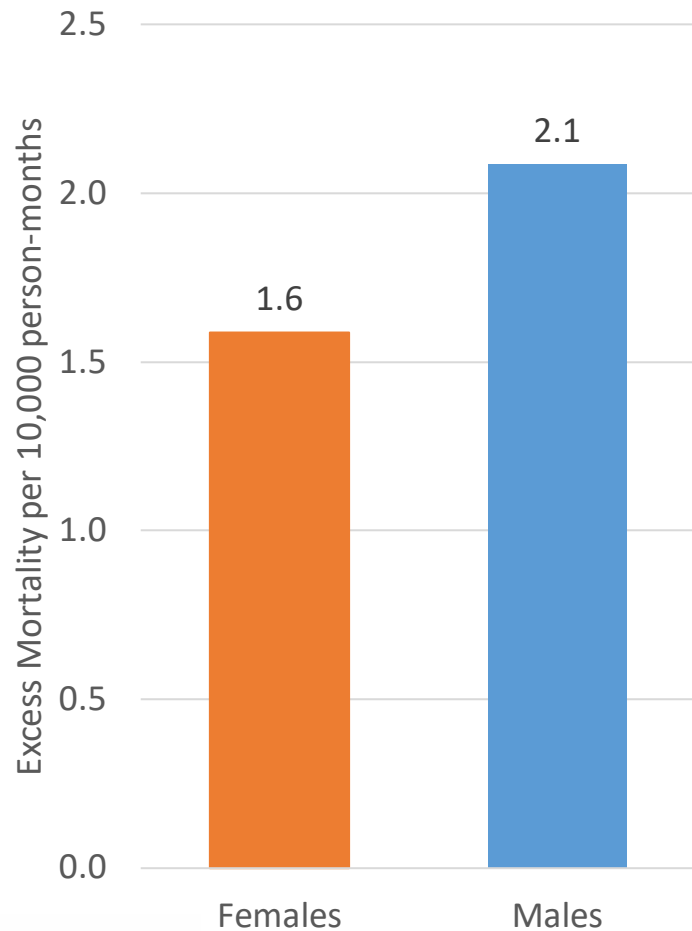Center for Economic Studies
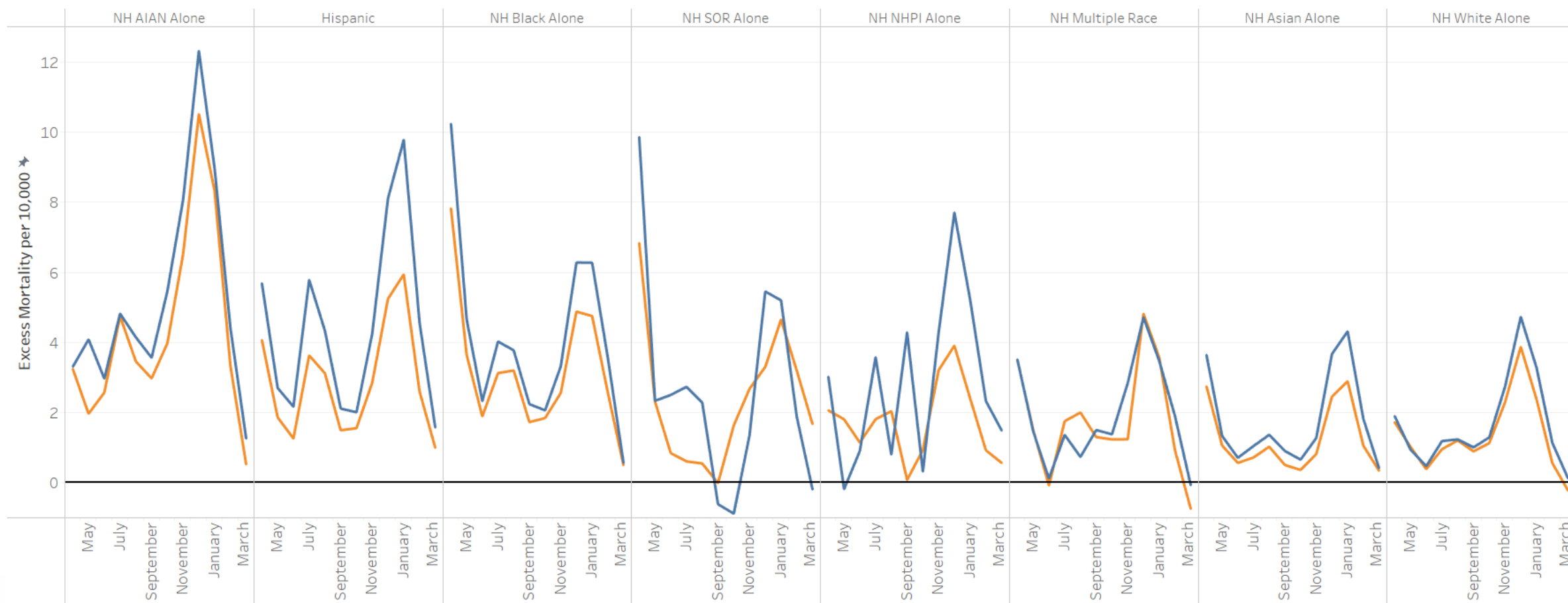
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Supplemental Slides

Motivation

Source: Author tabulations of findings reported by Polyakova et al. (2021), Basset et al. (2020), Goldstein and Atherwood (2020), Arias et al. (2021), Andrasfay and Goldman (2020) Woolf et al. (2021), and Luck et al. (2021). Our estimates come from Census Numident (Q3, 2021); Decennial Census (2000, 2010); and ACS (2001-2019). Restricted to individuals ages 15 to 99 at the start of any given month with a non-missing self-reported or household proxy race/ethnicity response -- DRB Approval Number: CBDRB-FY22-CES014-020.

Excess Mortality by Sex and Age

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Temporal Trends in Age-Adjusted Excess Mortality

Source: Census Numident (Q3, 2021); Decennial Census (2000, 2010); and ACS (2001-2019). Restricted to individuals ages 15 to 99 at the start of any given month with a non-missing self-reported or household proxy race/ethnicity response.
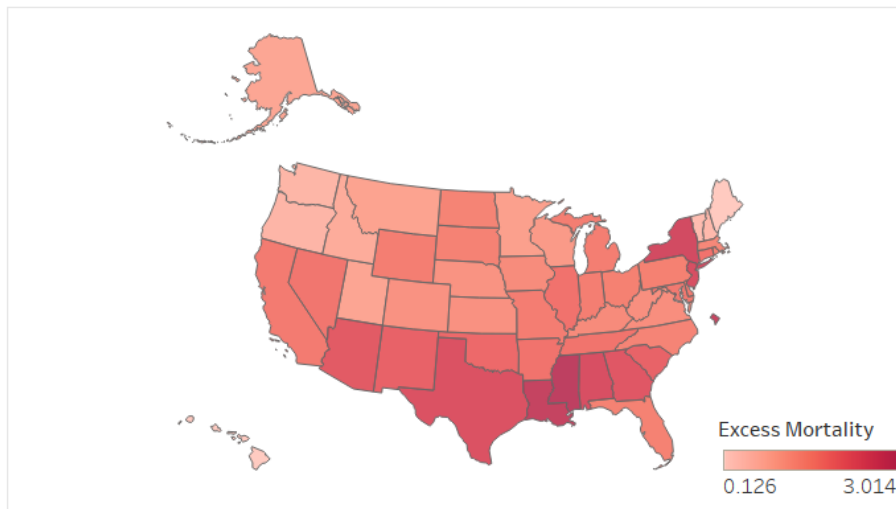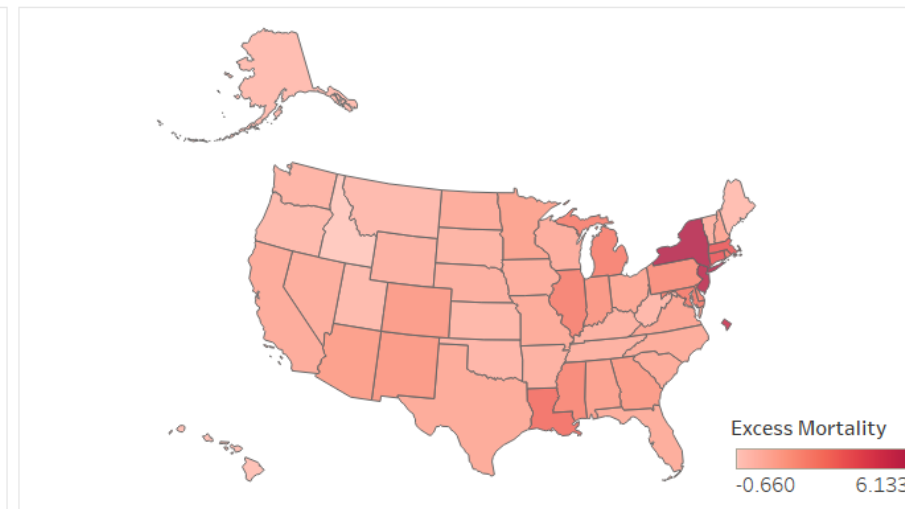
Racial/Ethnic Gaps in Excess Mortality by Month
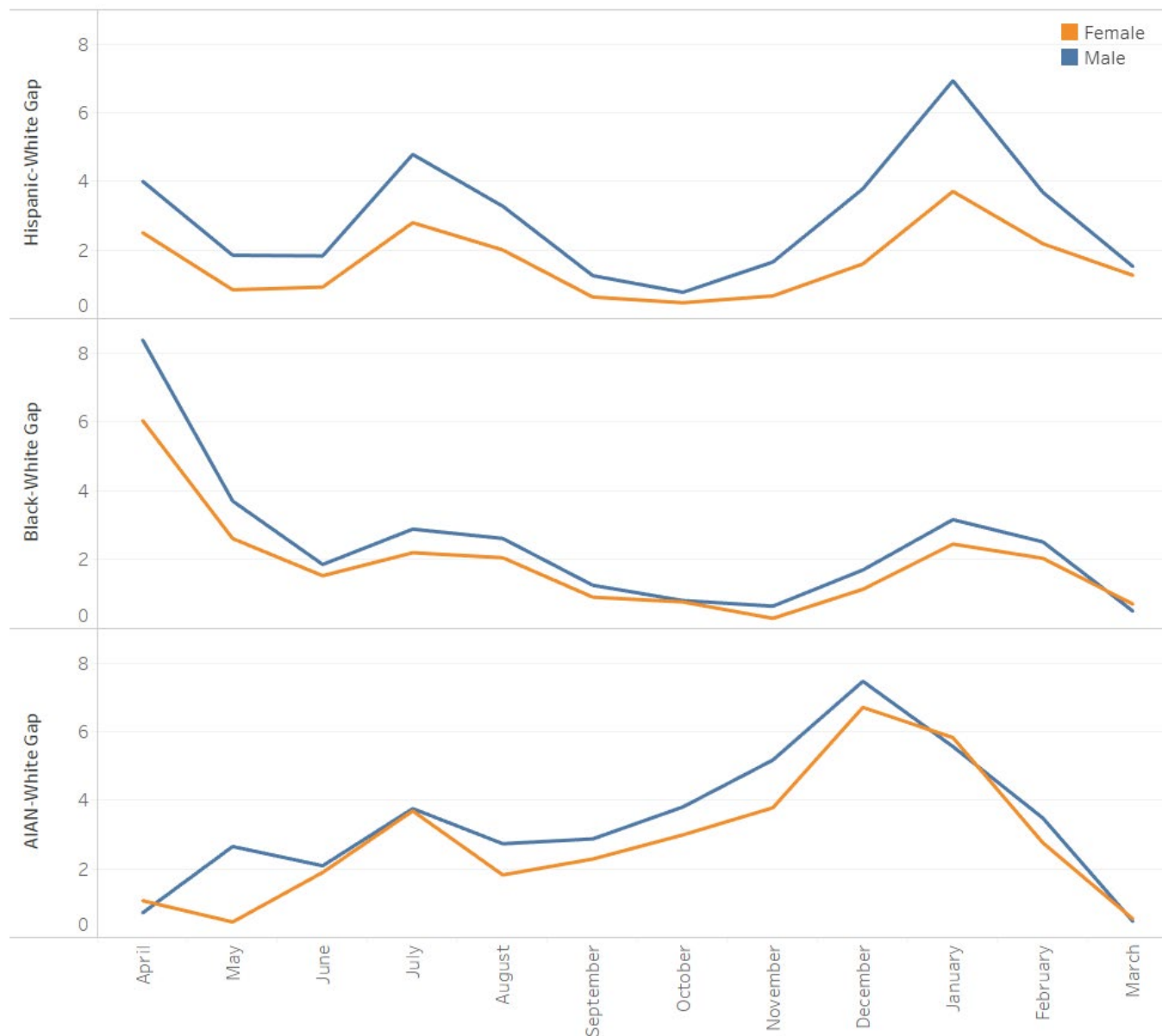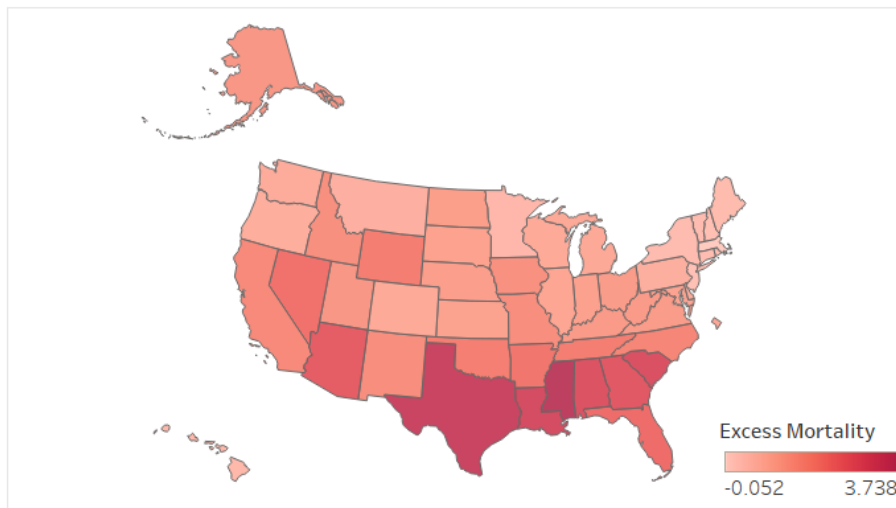
Temporal-Spatial Trends in Excess Mortality

First Full Year (April 1, 2020 through March 31, 2021)

Wave 1 (April 1, 2020 through June 30, 2020)

Wave 2 (July 1, 2020 through September 30, 2020)

Wave 3 (October 1, 2020 through March 31, 2021)

Excess Mortality
0.126   3.014

Excess Mortality
-0.660   6.133

Excess Mortality
-0.052   3.738

Excess Mortality
0.154   3.674