

Mortality by Socioeconomic Category in the United States

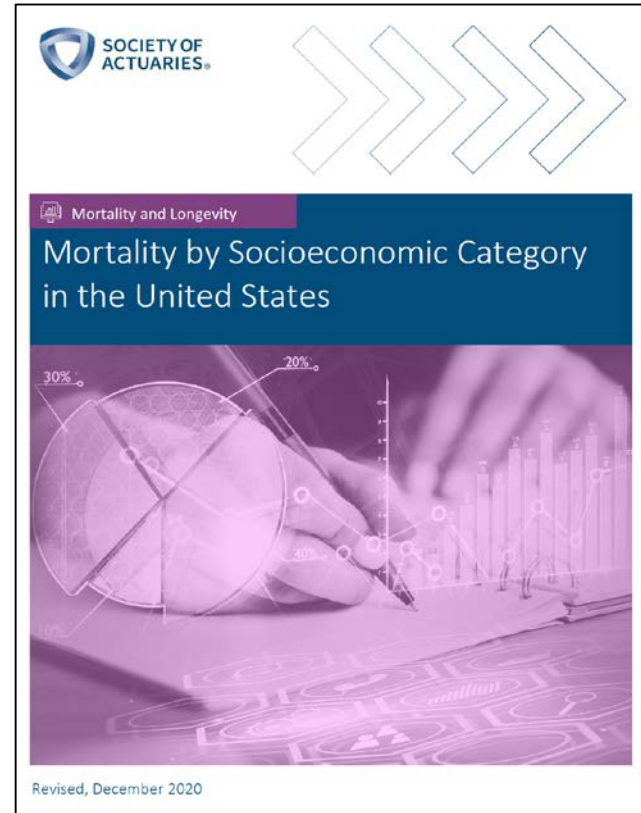
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Sr. Practice Research Actuary

Longevity 16
August 14, 2021



Study

- Dr. Magali Barbieri, UC-Berkeley
- Mortality And Longevity Strategic Research Program
- <https://www.soa.org/resources/research-reports/2020/us-mort-rate-socioeconomic/>

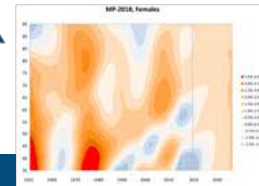
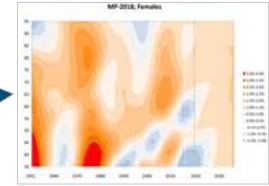
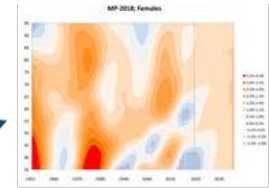
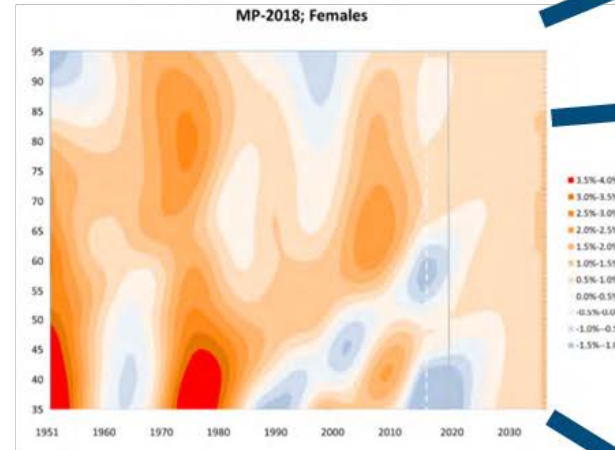


Background



Mortality Improvement

- Consistent Mortality Improvement Framework
- Decomposition of US Population into Socioeconomic Categories



Study Objective

- Stratify U.S. population into quintiles and deciles based on county level socioeconomic data
- Produce a set of detailed life tables by quintile and decile and year
- Produce a set of detailed life tables by quintile and decile and year
- Update Annually

Data

1. Socioeconomic variables (by county)

- 1980, 1990 and 2000 Census
- American Community Survey (5-year ACS)
2005-1009 through 2014-2018 (most recent)

2. Mortality (1982-2018)

- Individual death records (NCHS)
with sex, age at death and county/State of residence
- July 1st population estimates(Census Bureau)
By sex, age and county/State

Methods

- Construction of a county-level Socioeconomic Index Score (SIS) using Principal Component Analysis
- Distribution of all U.S. counties in 5 and 10 groups (quintiles and deciles) based on their SIS
- Calculation of lifetables for each county grouping using the Human Mortality Database methods

Socioeconomic Index Score

- Education
- Income
- Occupation
- Employment Status
- Home/rental value
- Housing quality

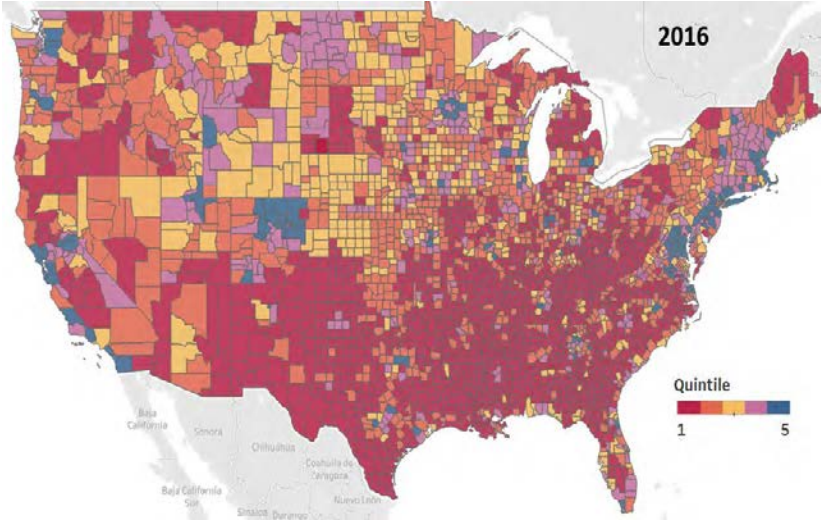
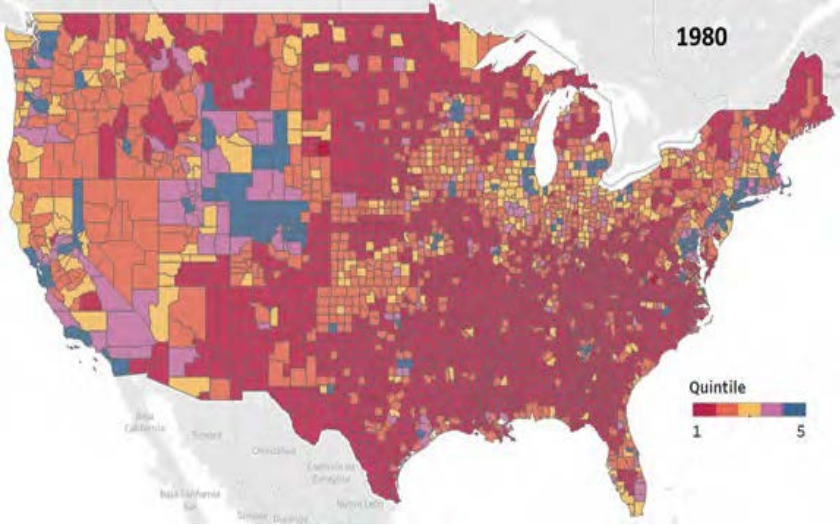
THE 11 VARIABLES USED IN OUR ANALYSIS

Socioeconomic variables
1. Percentage of the population aged 25 and over with less than 9 years of education
2. Percentage of the population aged 25 and over with at least a high school education
3. Percentage of the population aged 16 and over employed in a white collar occupation
4. Unemployment rate for the population 16 years and over
5. Median household income
6. Ratio of the average household income in the lowest quintile to the average household income in the highest quintile
7. Percentage of the population below the federal poverty threshold
8. Median home value for owner occupied units
9. Median gross rent for rental units
10. Percentage of housing without a telephone
11. Percentage of housing without complete plumbing

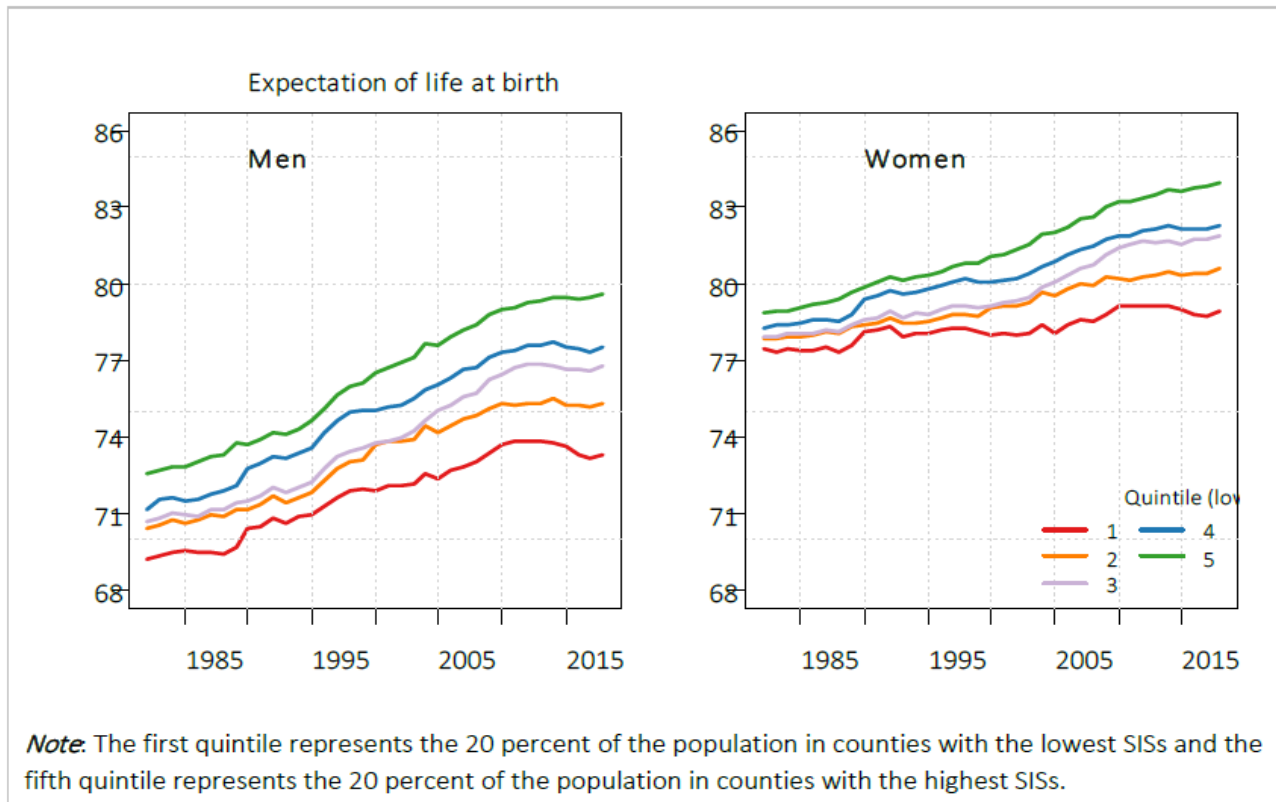
Results



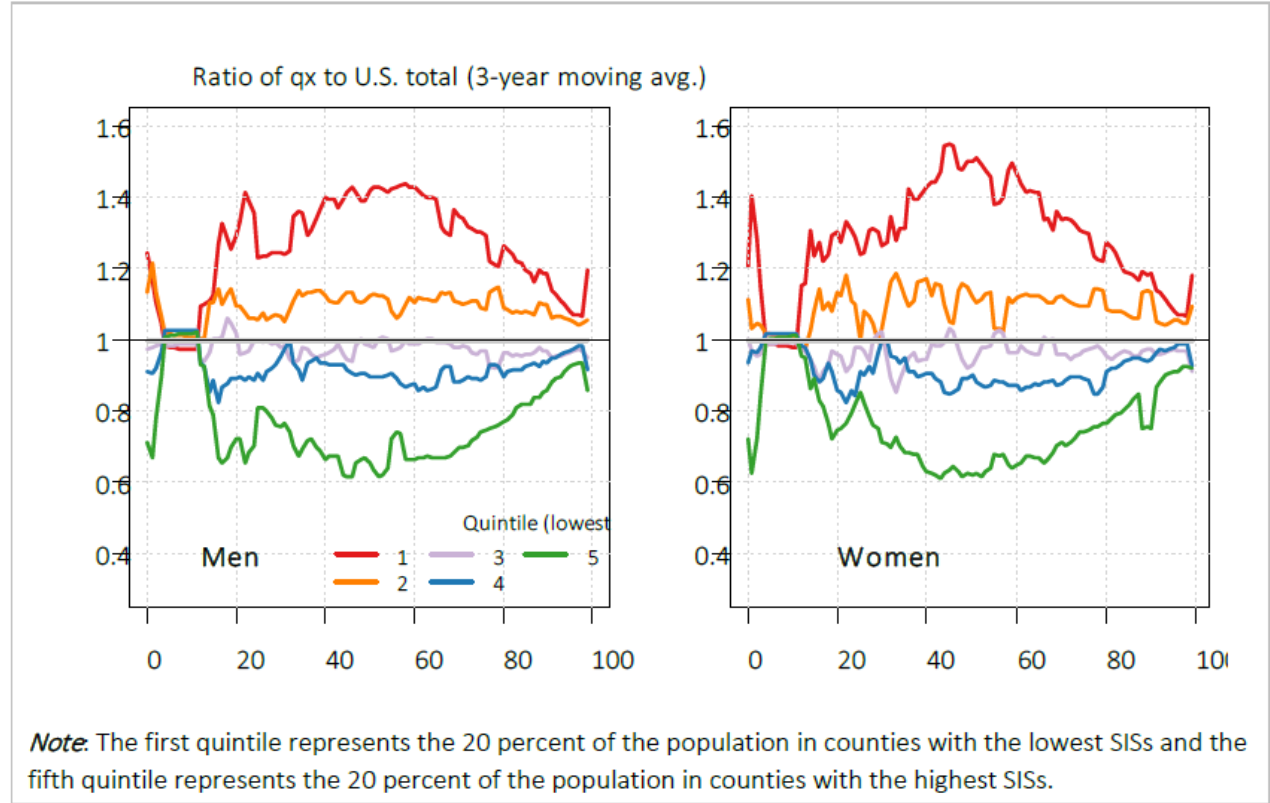
Socioeconomic Quintiles



- Growing Socioeconomic Inequalities in Mortality
- Gap larger for men than women

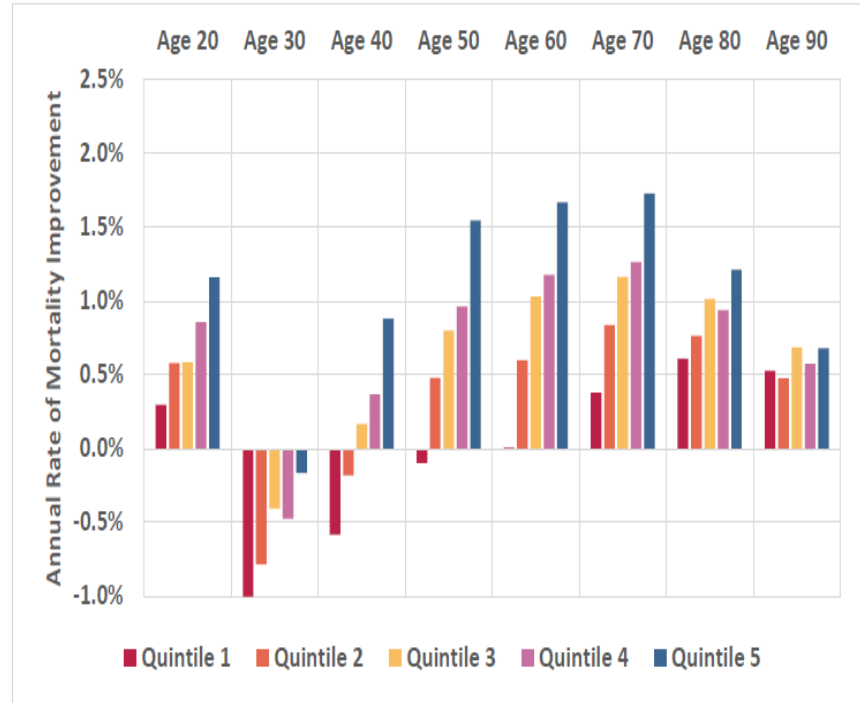
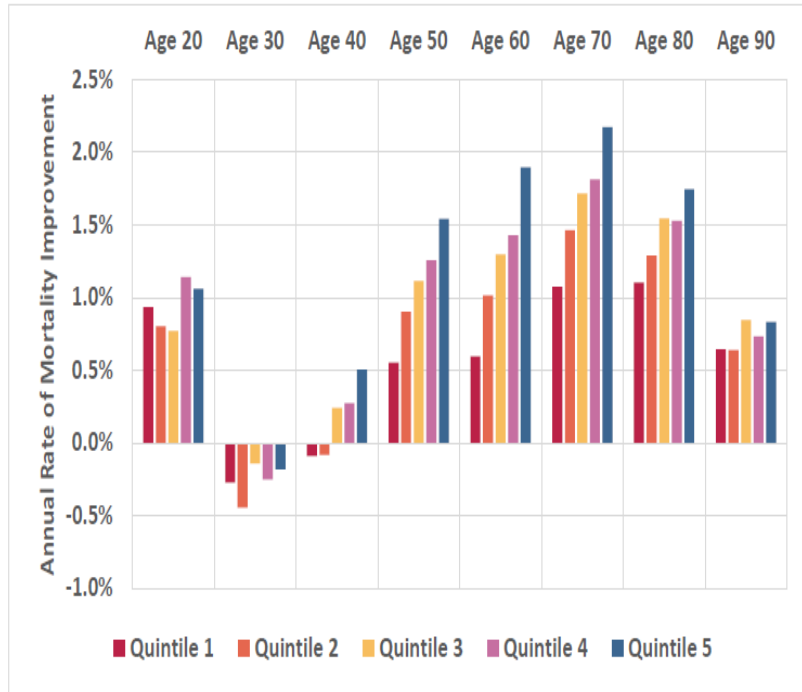


- Largest Disparities are Adults 40-60 and Young
- Older Ages - Disparities Narrow



Correlation between socioeconomic status and mortality improvement

GEOMETRIC AVERAGE ANNUAL RATE OF MORTALITY IMPROVEMENT FROM 1982 TO 2018: MALES GEOMETRIC AVERAGE ANNUAL RATE OF MORTALITY IMPROVEMENT FROM 1982 TO 2018: FEMALES

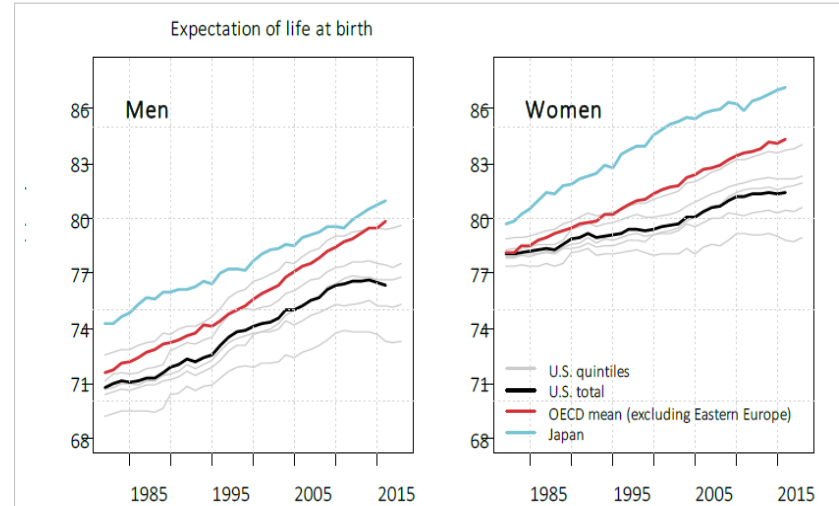


Other Findings

- A deterioration of recent trends for all
 - Life expectancy at birth
 - 2010 – 2014 – stabilized
 - 2014 – 2017 – declined
 - 2018 – slight uptick in survival
 - Lowest 20% no increase in length of life over period 2008 – 2018 for both men and women
 - Highest 20% continued decline but at much lower rate than before 2010

- Increasing Mortality Gap with Other High Income Countries

Figure D.5
TRENDS IN LIFE EXPECTANCY AT BIRTH IN U.S. QUINTILES, THE U.S. AS A WHOLE, THE OECD* AND JAPAN, EACH SEX, 1982–2018



*Excluding Eastern European countries as well as Mexico and Turkey.

Note: The first quintile represents the 20 percent of the population in counties with the lowest SISs and the fifth quintile represents the 20 percent of the population in counties with the highest SISs.

Future



What Comes Next

- Continue to analyze data – Tools developed to help
- More tools/research for applying trends to insured population
- Tweak scoring
 - Stationary SIS over period
 - Variables
- Research into factors for gaps
 - Cause of Death mortality by socioeconomic category underway

Data Analysis Tools



Excel Data Files



United States Mortality Database Lifetables by Age, Sex and Socioeconomic Index Decile

The attached life tables were computed using death and population data from CDC-Wonder by Magali Barbieri, August 22, 2020

The confidence intervals for the mortality rates were computed following the UK Office of National Statistics (<https://fingertips.phe.org.uk/documents/PHE%20Life%20Expectancy%20Calculator.xlsm>)

Note: see Berkeley/HMD/HMD-funding/Actuaries/SOA-deprivation/Ryan/CDC-Wonder-1999-2018/lifetables-deciles.r

The life table columns are described below.

Decile	One of the 10 deciles of US counties ranked on their multidimensional socioeconomic score, plus the US as a whole
Year	Year to which the life table values correspond (1999-2018)
Sex	Sex (Male, Female, Both sexes combined)
Age	Age x at last birthday in single year (0...85+ years)
Mx.lower	Lower 95% confidence bound for the mortality rate at age x
Mx	Mortality rate at age x
Mx.upper	Upper 95% confidence bound for the mortality rate at age x
ax	Years lived in the age interval x to x+n by those who died in the interval
qx.lower	Lower 95% confidence bound for the probability of dying between age x and x+n
qx	Probability of dying between the ages of x and x+n
qx.upper	Upper 95% confidence bound for the probability of dying between age x and x+n
lx	Survivors at age x
dx	Deaths in the age interval x to x+n
Lx	Person-years lived in the age interval x to x+n
Tx	Cumulative number of person-years lived by those who survived to age x
ex.lower	Lower 95% confidence bound for the expectation of life at age x
ex	Expectation of life at age x
ex.upper	Upper 95% confidence bound for the expectation of life at age x

Tableau Exhibits

soa.org/resources/research-reports/2020/us-mort-rate-socioeconomic/

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These interactive dashboards are visualizations of key metrics found in the report. They provide filtering, drill-down, and other interactive capabilities that allow you to focus on specific subsets of the data.

[Map of County-Level Socioeconomic Index Quintiles](#)

[Map of County-Level Socioeconomic Index Deciles](#)

[Expected Lifetimes by Year, Sex, Age and Socioeconomic Index Quintile](#)

[Expected Lifetimes by Year, Sex, Age and Socioeconomic Index Decile](#)

[Mortality Rate Estimates by Year, Sex, Age Group and Socioeconomic Index Quintile](#)

[Mortality Rate Estimates by Year, Sex, Age Group and Socioeconomic Index Decile](#)

[Mortality Improvement Rate Estimates by Year, Sex, Age Group and Socioeconomic Index Quintile](#)

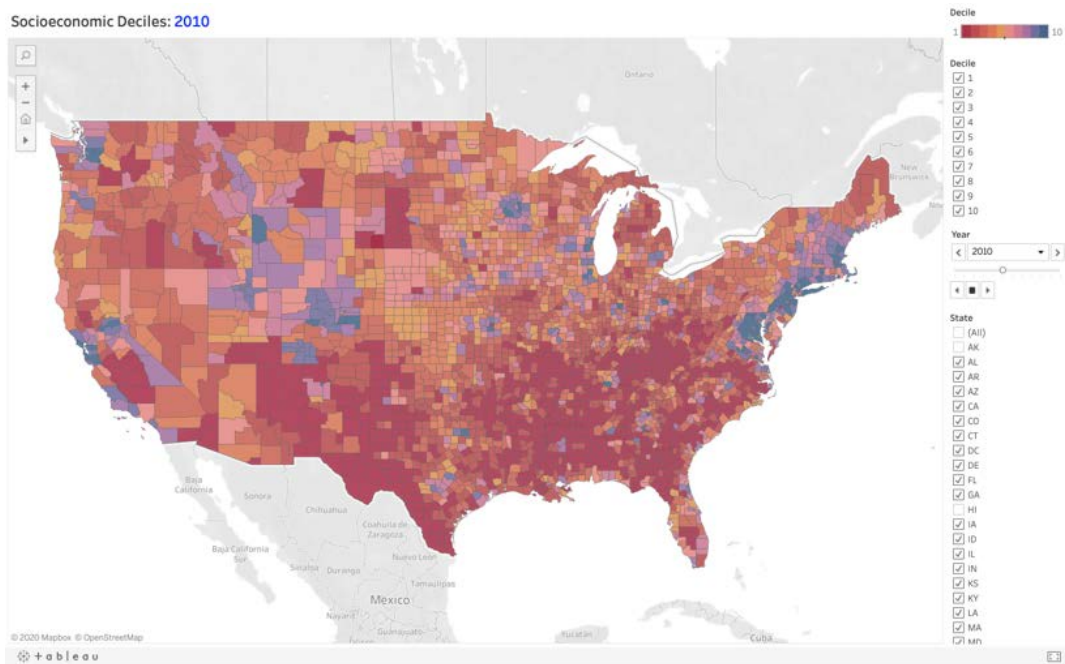
[Mortality Improvement Rate Estimates by Year, Sex, Age Group and Socioeconomic Index Decile](#)

[Survival Probabilities by Year, Sex and Socioeconomic Index Quintile](#)

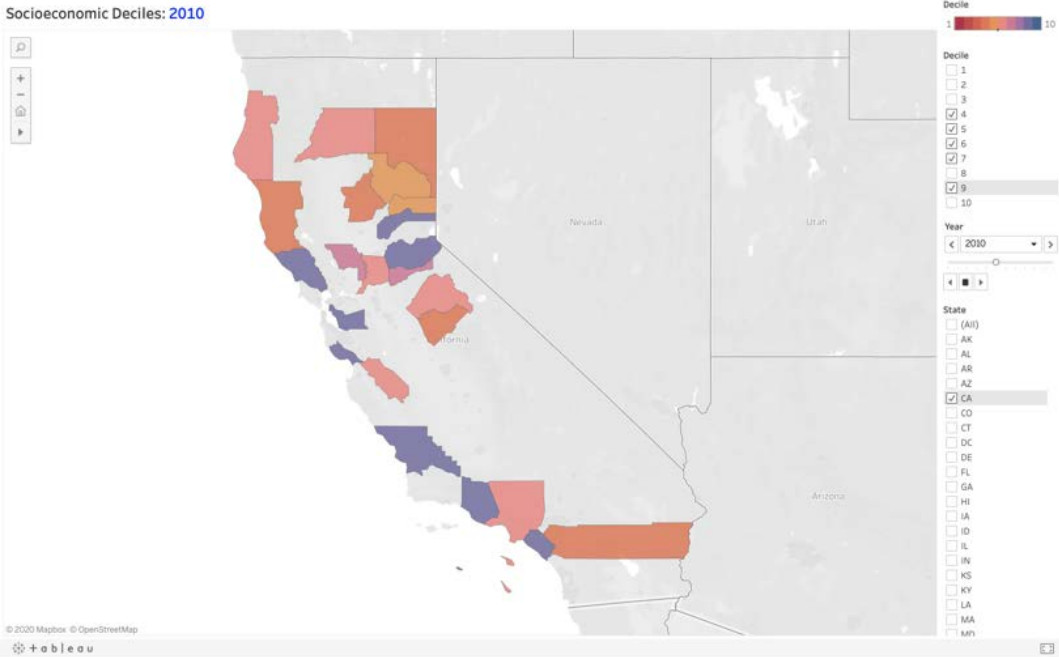
[Survival Probabilities by Year, Sex and Socioeconomic Index Decile](#)

[National-Level Mortality Rate Estimates: Comparison with SSA](#)

US Counties by Socioeconomic Decile 2010

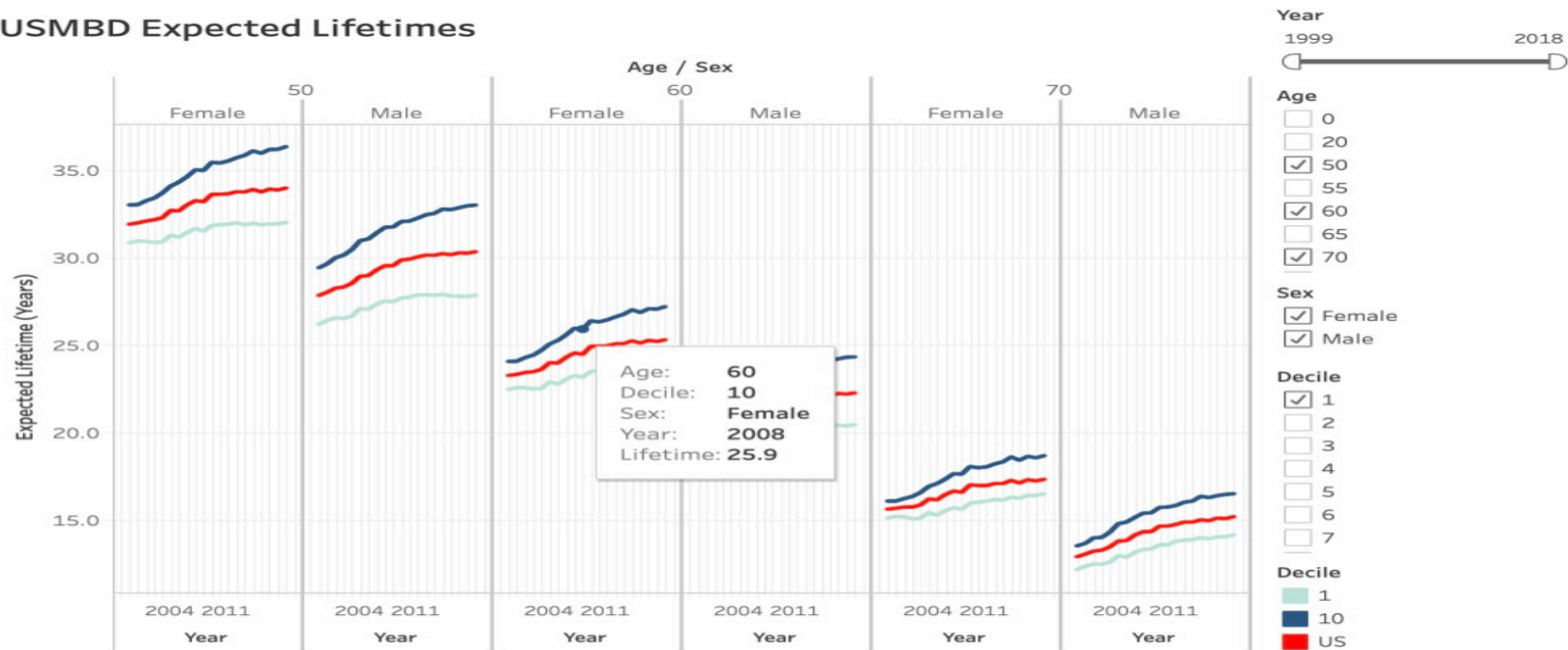


CA Counties by Socioeconomic Decile 2010



Expected Lifetimes

USMBD Expected Lifetimes



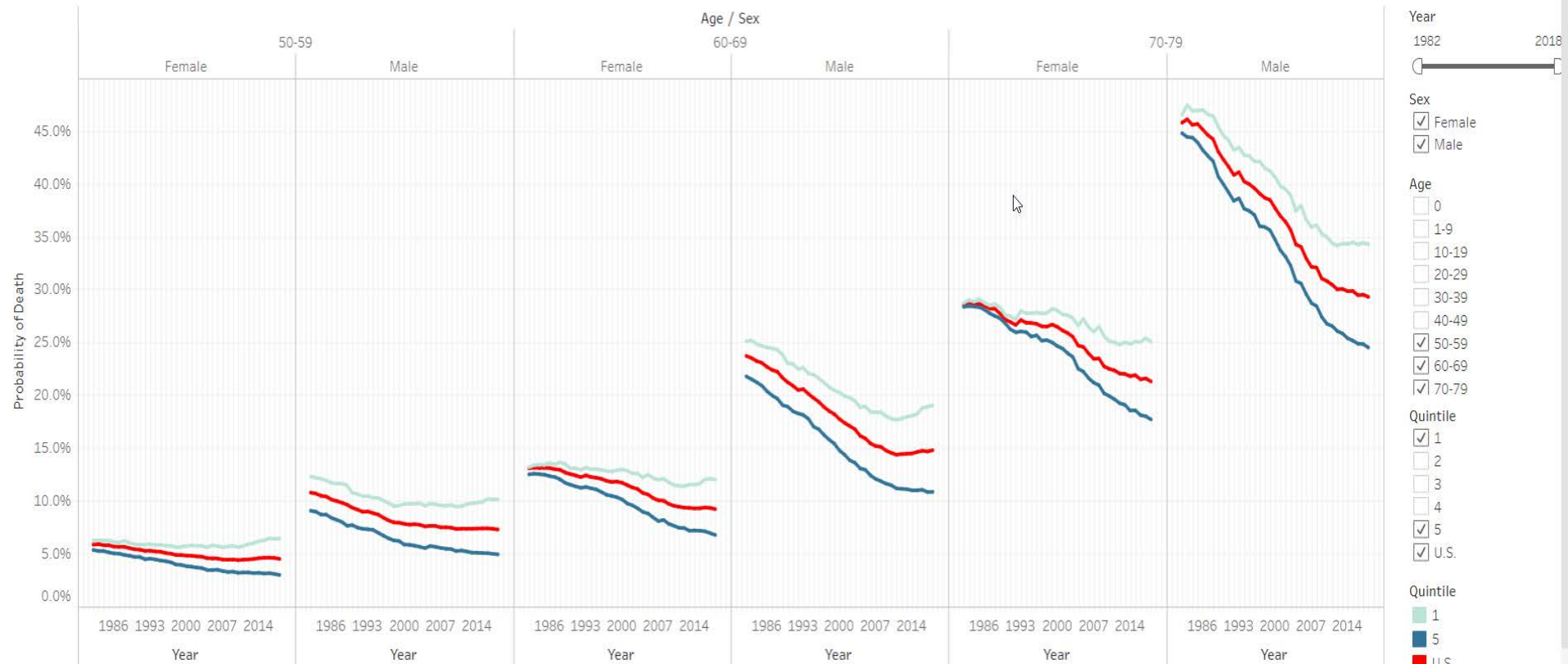
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Mortality by Socioeconomic Category in the United States: Quintiles

Conditional Probability of Death During Age Interval

- standard scale
- logarithmic scale



Year
1982 ————— 2018

Sex
 Female
 Male

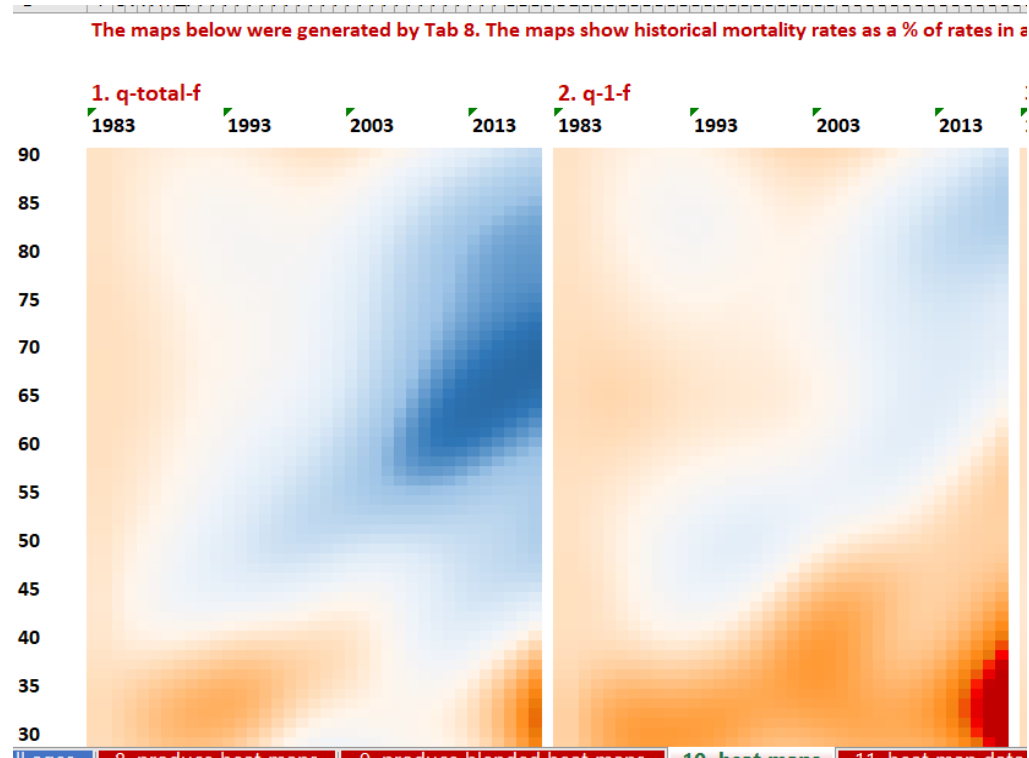
Age
 0
 1-9
 10-19
 20-29
 30-39
 40-49
 50-59
 60-69
 70-79

Quintile
 1
 2
 3
 4
 5
 U.S.

Quintile
1
5
U.S.

Heat Maps for Quintiles and Deciles

- MIM-2021 Data Analysis Tool Produces Heat Maps for each quintile and decile
- <https://www.soa.org/resources/research-reports/2021/mortality-improvement-model/>



Questions





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