Evaluating the Role of Geographical Location and Lifestyle Factors in Estimating Mortality by Causes of Death

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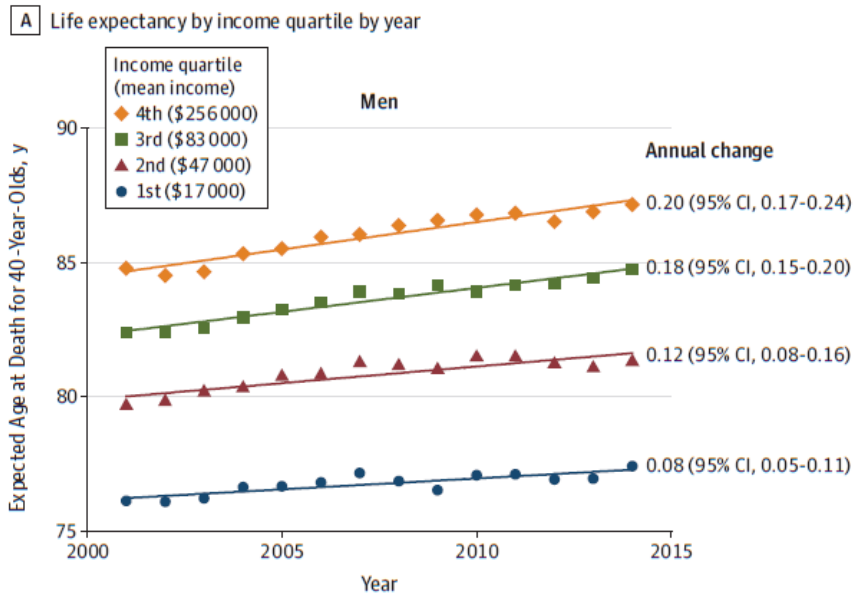
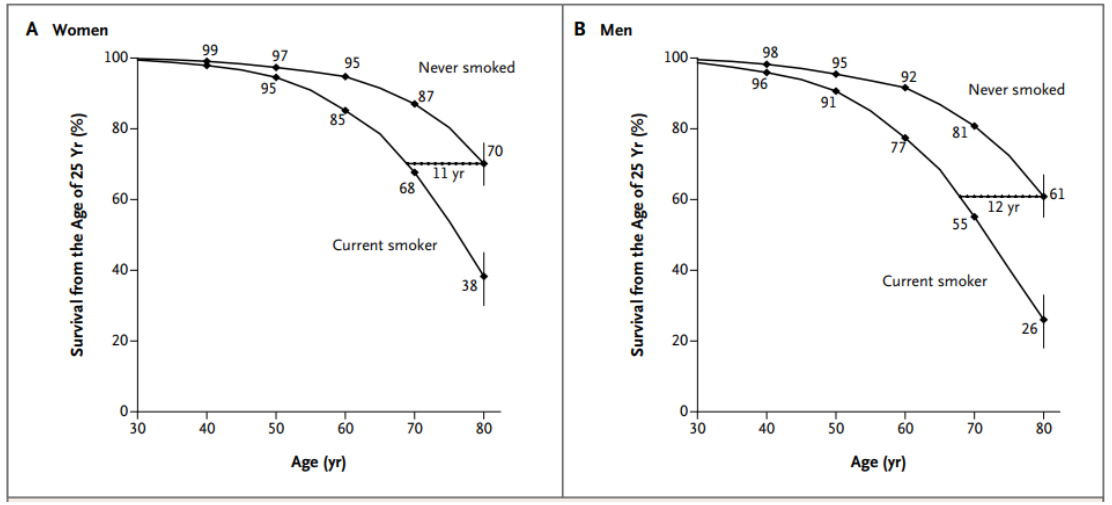
Agenda

- Observations and facts on mortality rates and risk factors
- Verisk's mortality model
  - Using individual attributes to estimate the mortality risk
  - Enhanced mortality improvement for individuals
  - Impact of variation of individuals' characteristics on life expectancy
  - Stochastic modeling to project mortality
- Closing notes

Key Drivers of Mortality Trends: Lifestyle and Socioeconomic Status





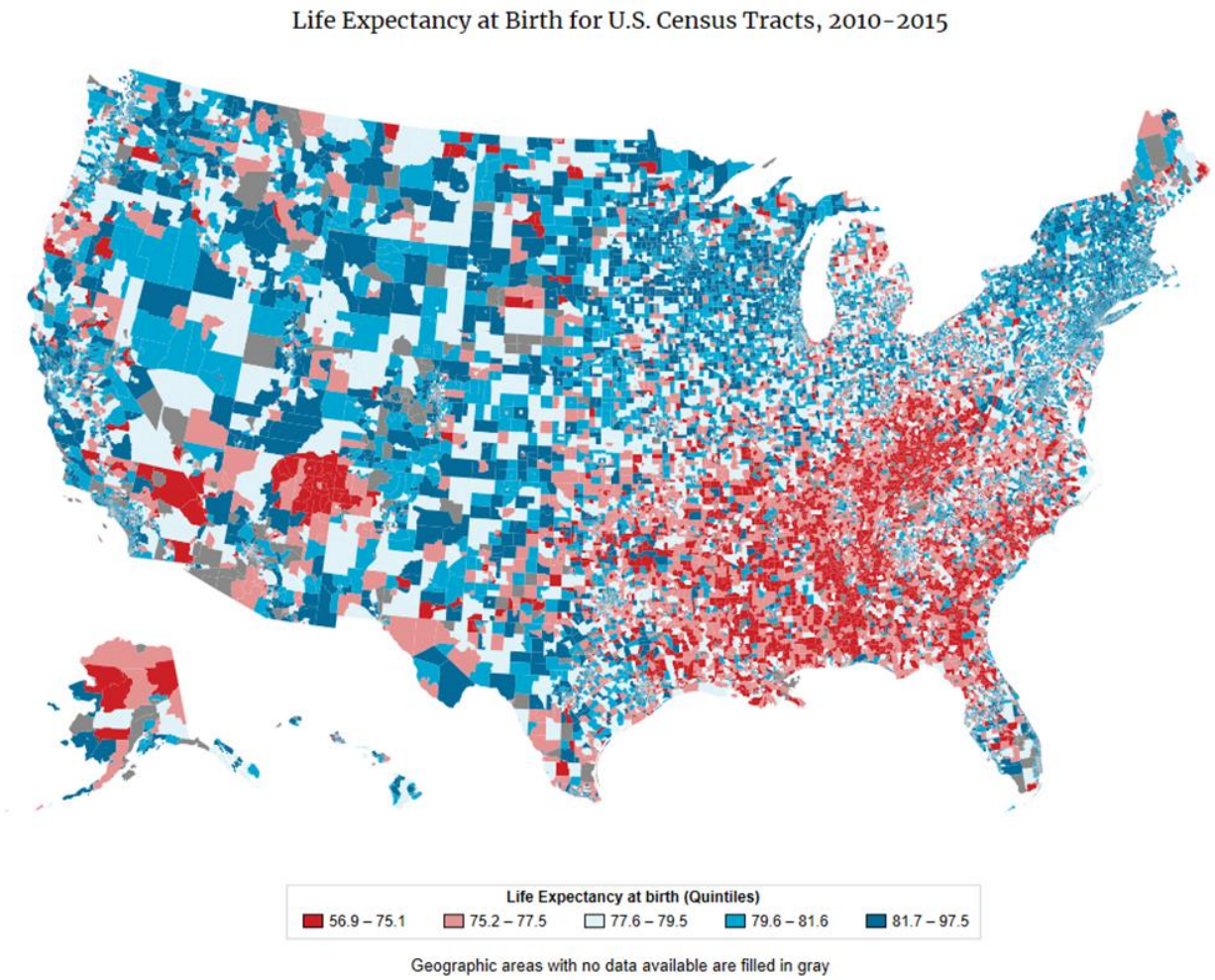
"Higher income was associated with **greater longevity**, and differences in life expectancy across income groups **increased over time**."[1]

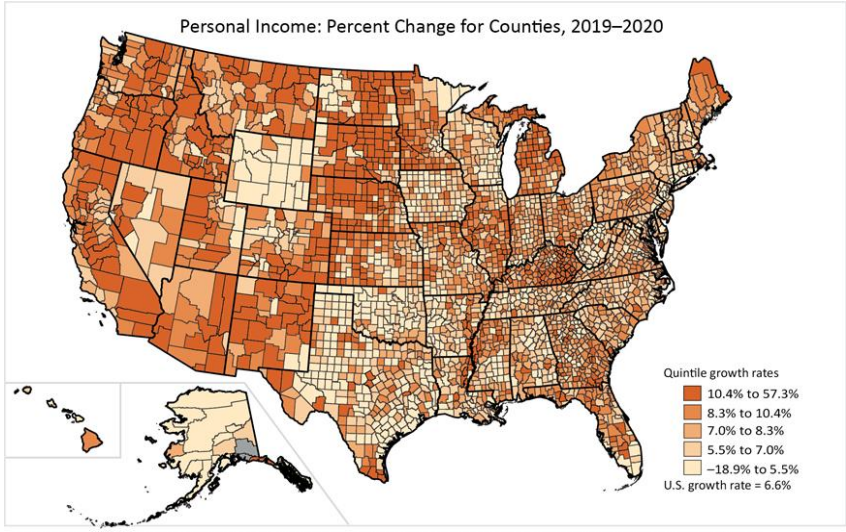
"Smokers **lose at least one decade** of life expectancy, as compared with those who have never smoked."[2]

1. Chetty, Raj, et al. "The association between income and life expectancy in the United States, 2001-2014." *Jama* 315.16 (2016): 1750-1766.

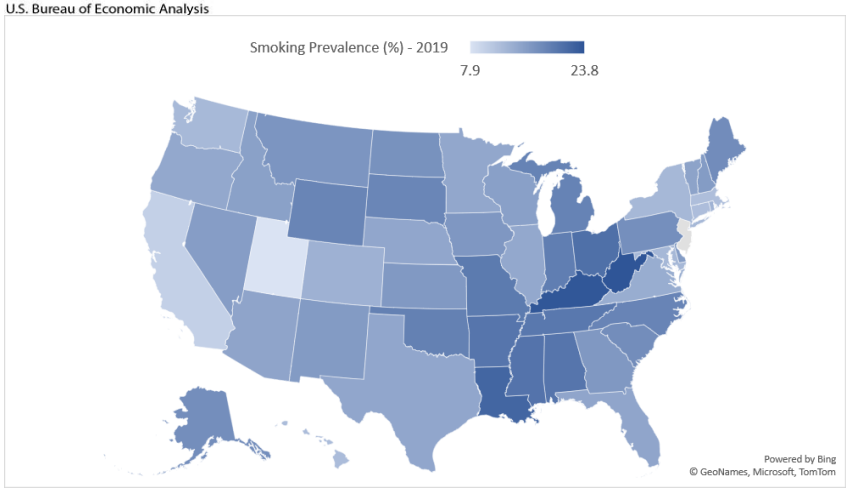
2. Jha, Prabhat, et al. "21st-century hazards of smoking and benefits of cessation in the United States." *New England Journal of Medicine* 368.4 (2013): 341-350.

Location as a Proxy





Note. Chugach Census Area, AK, and Copper River Census Area, AK, estimates begin in 2020; personal income growth rates for 2019–2020 are not available for these areas.
U.S. Bureau of Economic Analysis



1. Centers for Disease Control and Prevention, Deputy Director for Public Health Science and Surveillance (DDPHSS)
2. U.S. Bureau of Economic Analysis
3. Hu SS, Homa DM, Wang T, Gomez Y, Walton K, Lu H, et al. State-Specific Patterns of Cigarette Smoking, Smokeless Tobacco Use, and E-Cigarette Use Among Adults — United States, 2016. Prev Chronic Dis 2019;16:180362. DOI: http://dx.doi.org/10.5888/pcd16.180362

Refining the Mortality Estimation

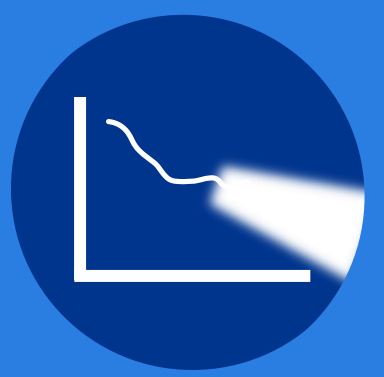
US - Male
65-years-old

Dallas, TX

Non-smoker
Non-obese
$100K income

John Doe

Verisk Mortality Projection Model



Mortality estimation at a high, granular level

- Underlying health factors
- Individual lifestyles

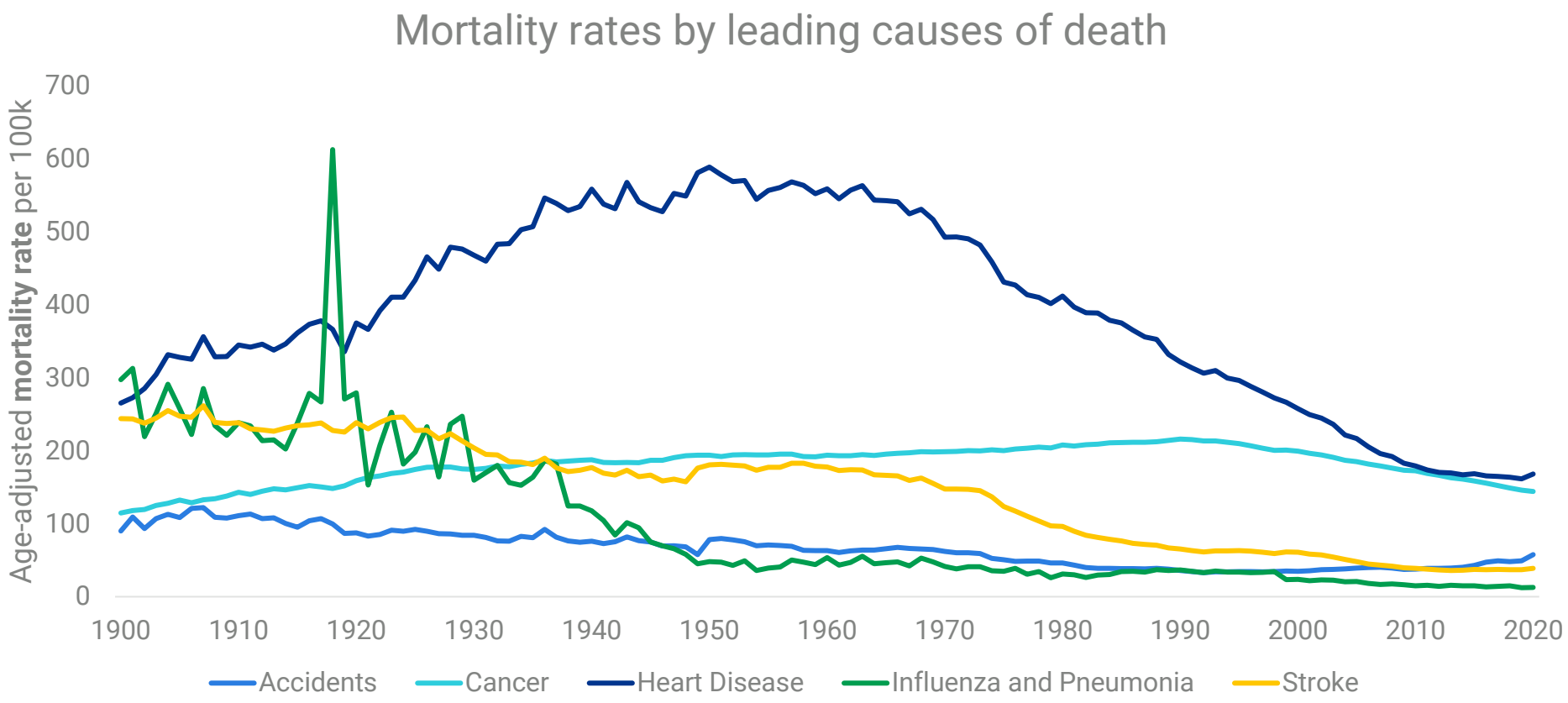
Differential mortality improvement rate

- Socioeconomic factors
- Lifestyle factors

Distribution of plausible values

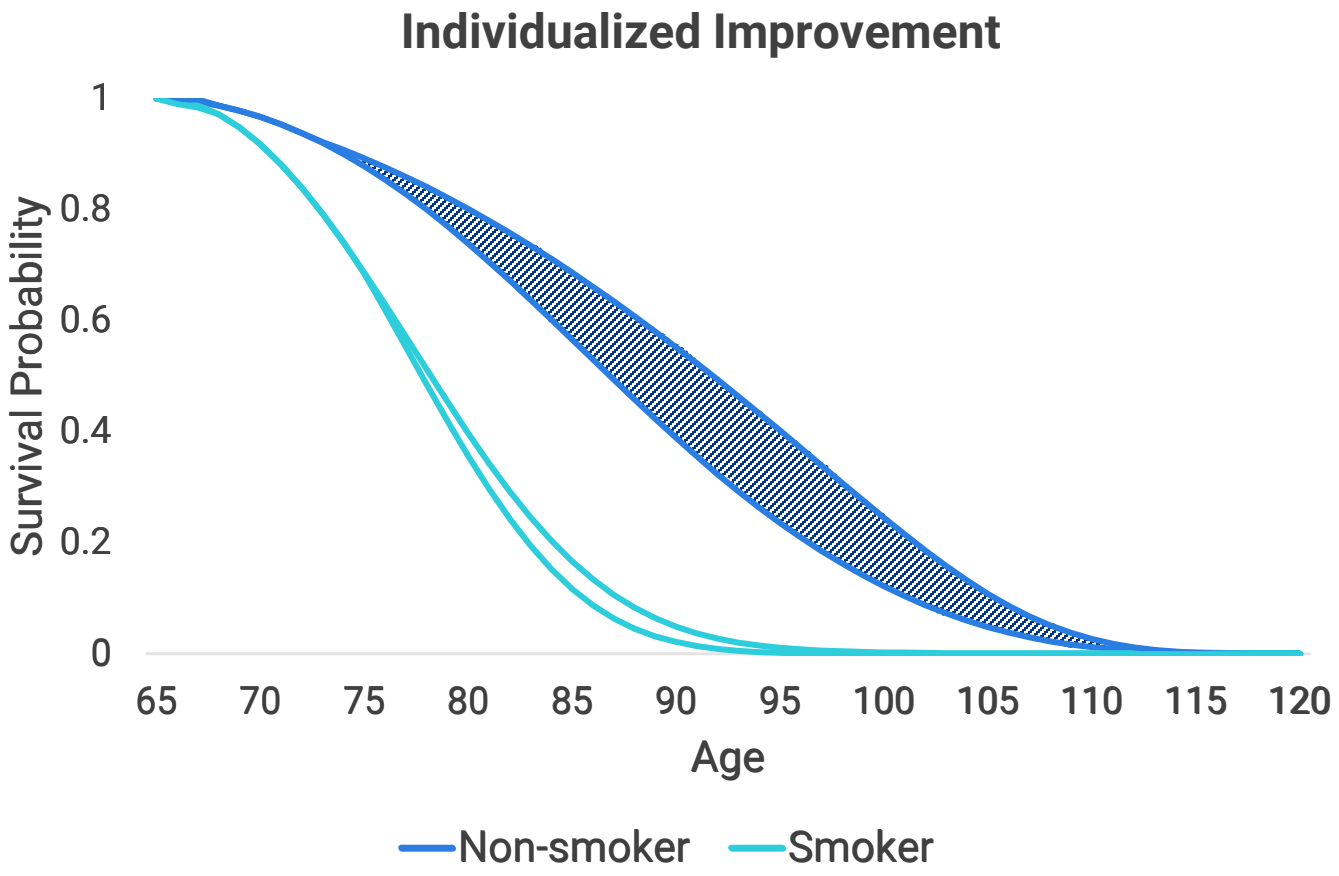
- Full distribution of outcomes
- Mortality/longevity offset

Different Causes of Death Experienced Different Trends of Improvement



National Center for Health Statistics. NCHS - Age-adjusted Death Rates for Selected Major Causes of Death. Date accessed [Last accessed date]. Available from https://data.cdc.gov/d/6rkc-nb2q.

Impact of Smoking Status on Mortality Improvement



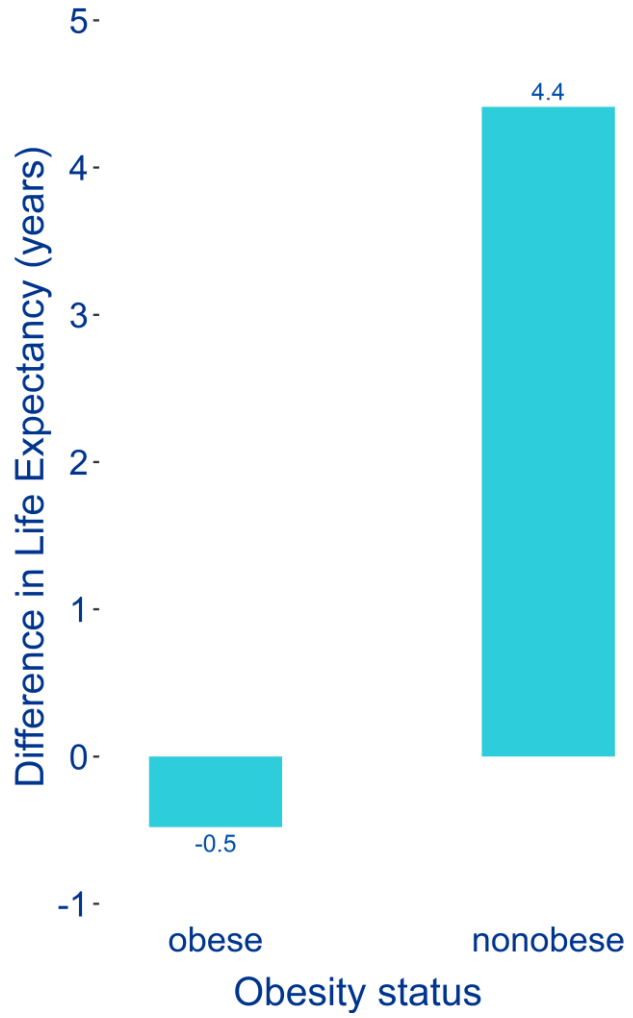
Non-smoker gains

3.6 years

due to individualized improvements

* All values are estimated for a 65 years old male in Alameda county in the CA

Impact of Obesity on Mortality Improvement



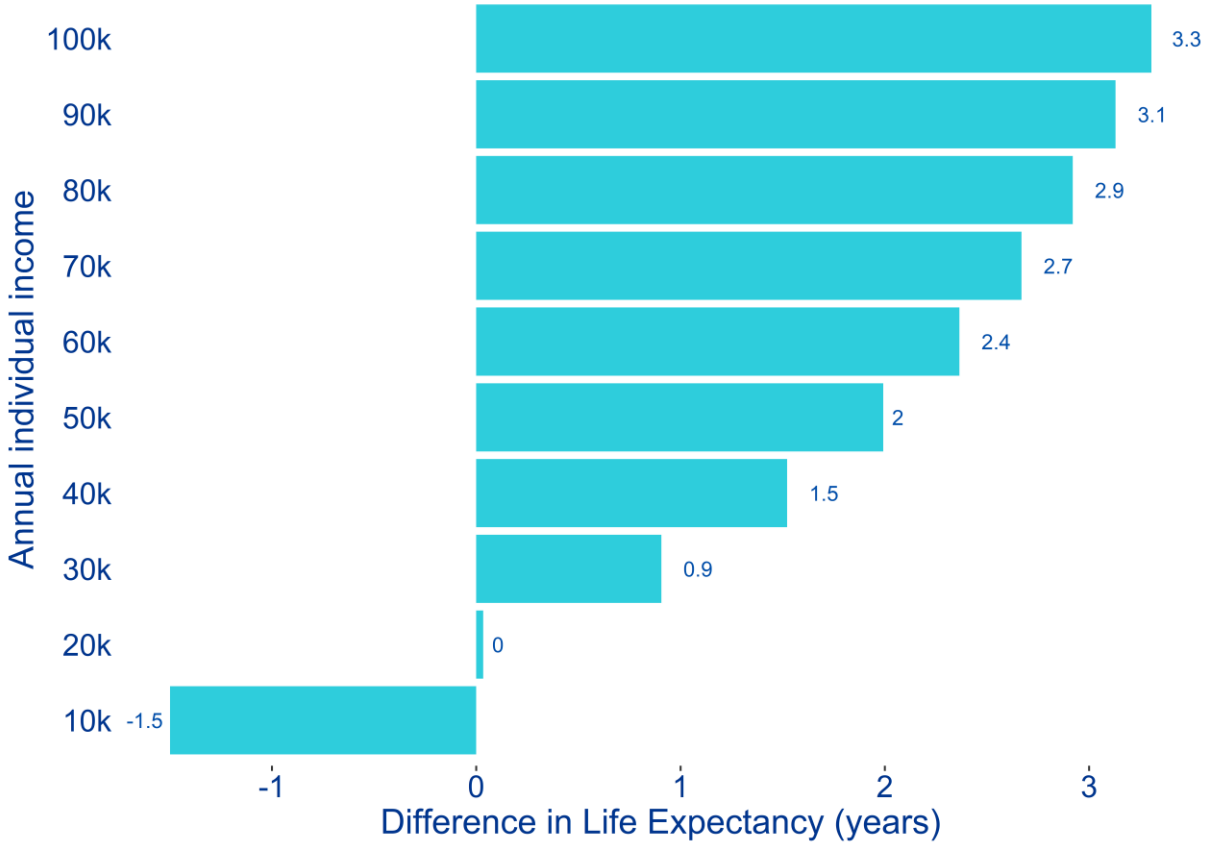
Healthy weight gains

5 years

additional life expectancy

* All values are estimated for a 65 years old male in Alameda county in the CA

Impact of Income on Mortality Improvement



Higher income can drive up to

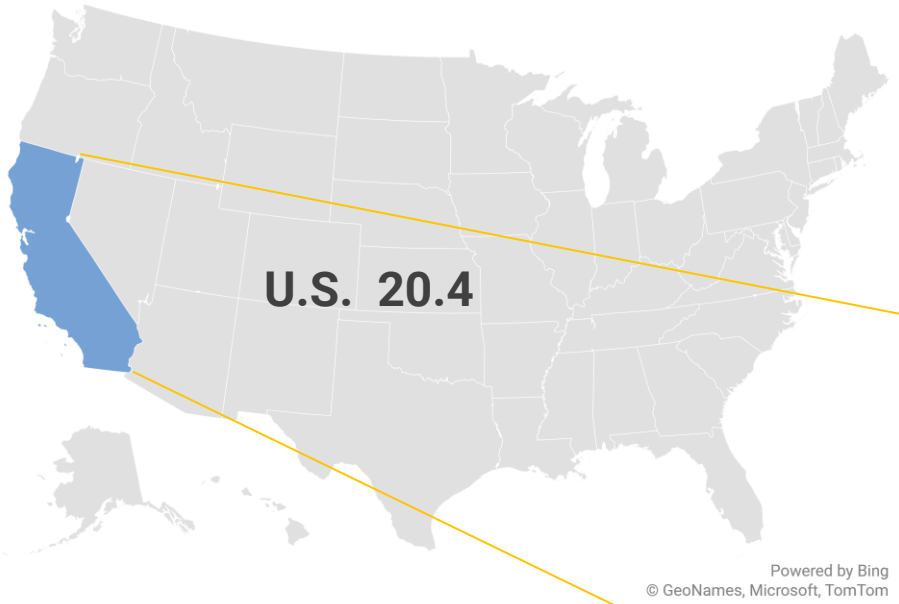
4.8 years

additional life expectancy

* All values are estimated for a 65 years old male in Alameda county in the CA

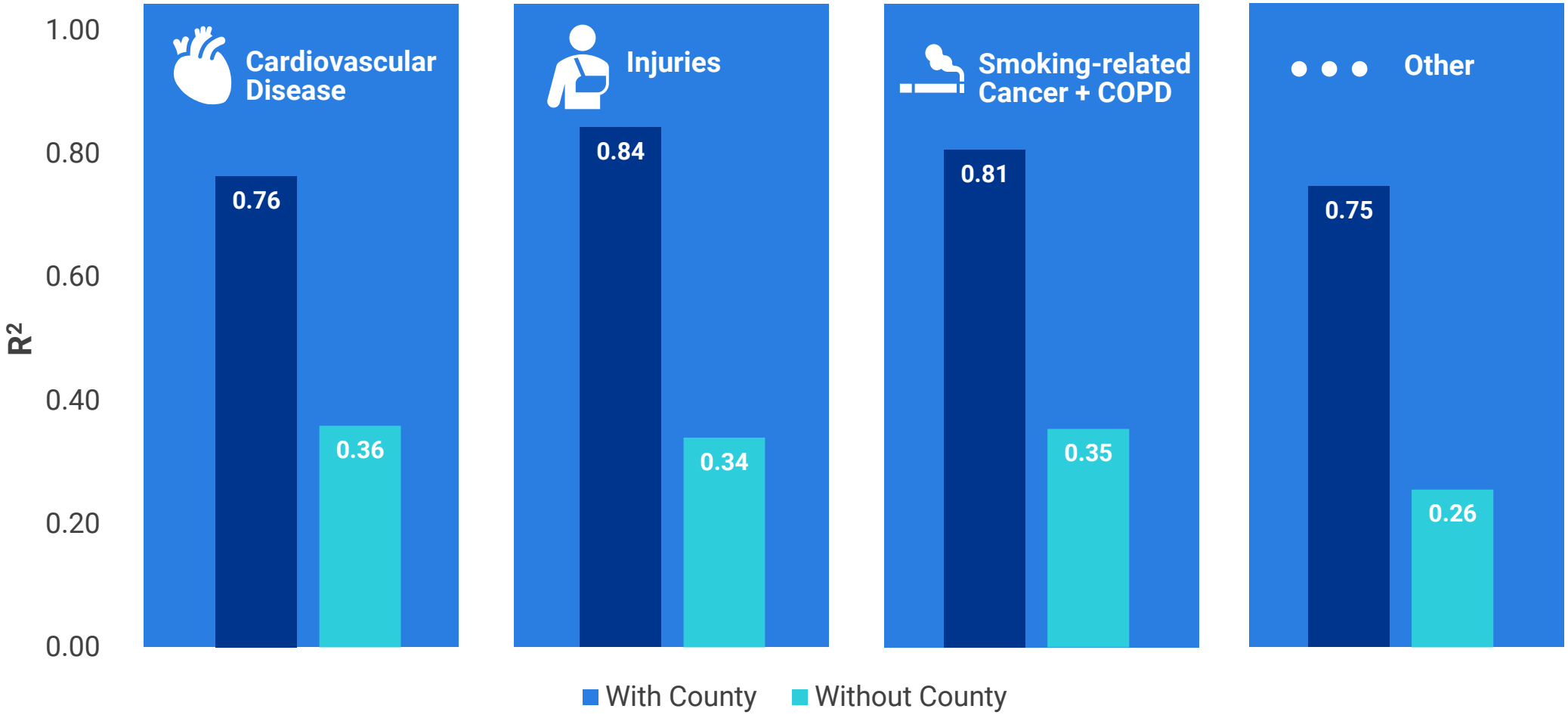
Impact of Location on Life Expectancy

Male, 65-years-old



Location Matters

Regardless of cause of death, location matters…



Same Lifestyles, Different Location

Location	Lincoln, WV
Age	65
Sex	Male
Smoking Status	Non-smoker
Obesity Status	Non-obese
Income	$100k
Life expectancy: 28.6 years	

Difference of
4.2 years
in life expectancy

Location	Alameda, CA
Age	65
Sex	Male
Smoking Status	Non-smoker
Obesity Status	Non-obese
Income	$100k
Life expectancy: 32.8 years	

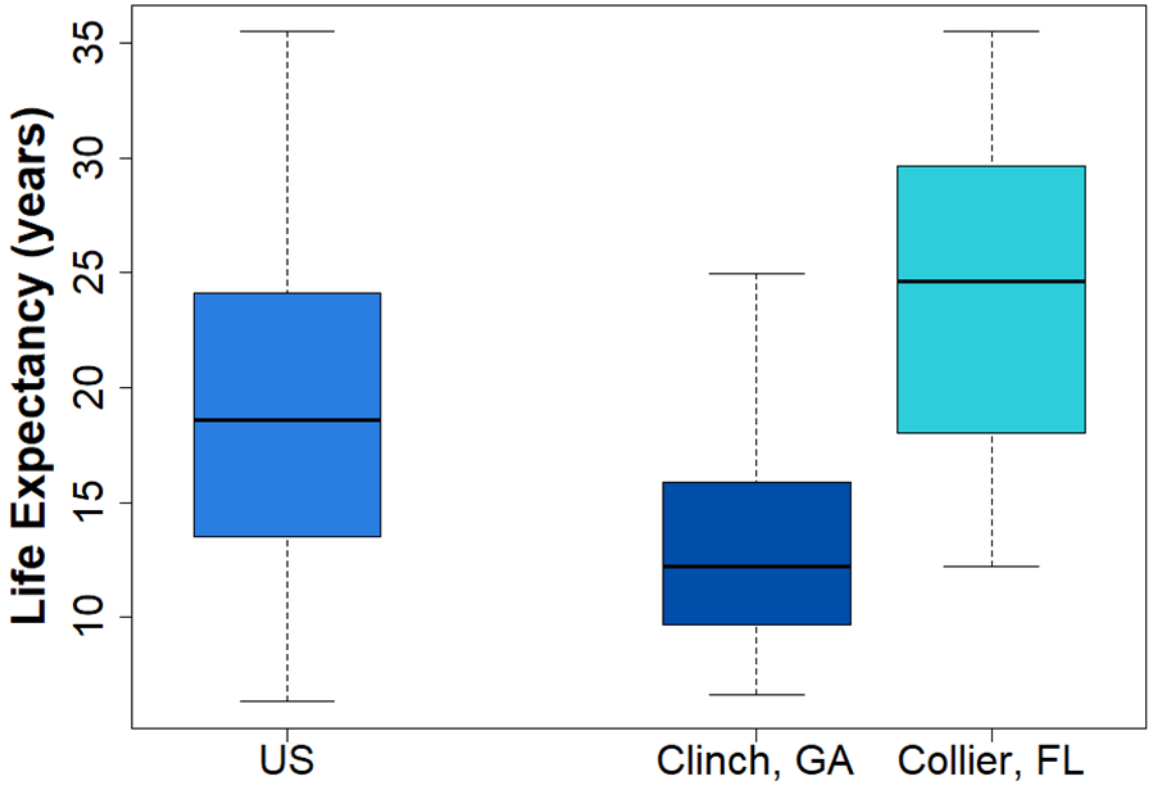
Same Location, Different Lifestyle

Age	65
Sex	Male
Smoking Status	**Smoker**
Obesity Status	**Obese**
Income	**$45K**
Location	Alameda, CA
Life expectancy: 13.1 years	

Difference of
19.7 years
in life expectancy

Age	65
Sex	Male
Smoking Status	**Non-smoker**
Obesity Status	**Non-obese**
Income	**$100K**
Location	Alameda, CA
Life expectancy: 32.8 years	

Possible Variation from Enhancement



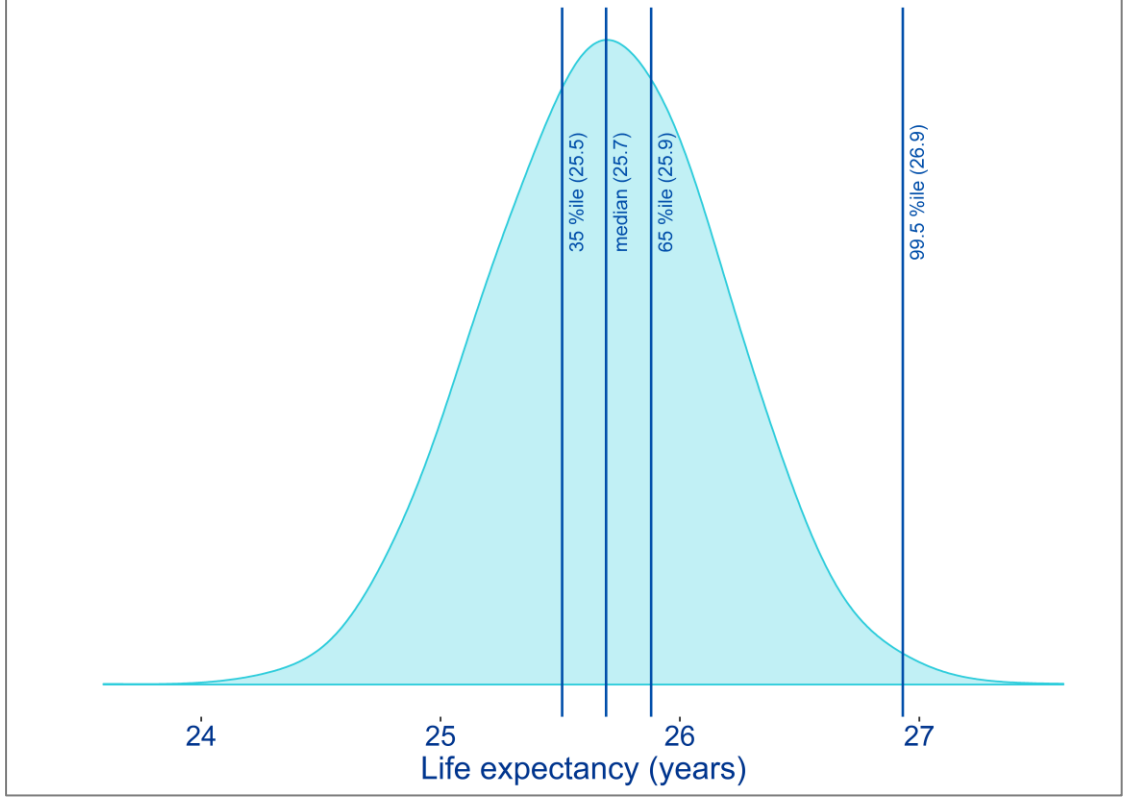
- For 65-year-old male, the possible range of life expectancy is between 6.3–35.5 years
- Different locations do not experience the same impact of lifestyle factors and income

Possible Variation from Stochastic Results

Instead of the deterministic, single point estimates traditional actuarial models provide, a **full distribution** of outcomes enables:

- Flexible, non-linear estimates of pricing
- Accurate quantification of marginal mortality/longevity offset
- Robust full portfolio risk analyses for any capital threshold

Stochastic results: Average 65-year-old male, Dallas TX



Why Granularity Matters?

A robust solution on estimating mortality requires a more granular approach:

Differentiating by mortality risk categories at the individual level

Accurate and granular longevity projection

Instant, flow-like pricing in a fast-paced pension market

Comprehensive portfolio risk analysis

THANK YOU

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