Mortality and Longevity

SOA Mortality and Longevity Research

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Mortality & Longevity Program Steering Committee Member
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SOCIETY OF ACTUARIES®

SOA Research Overview

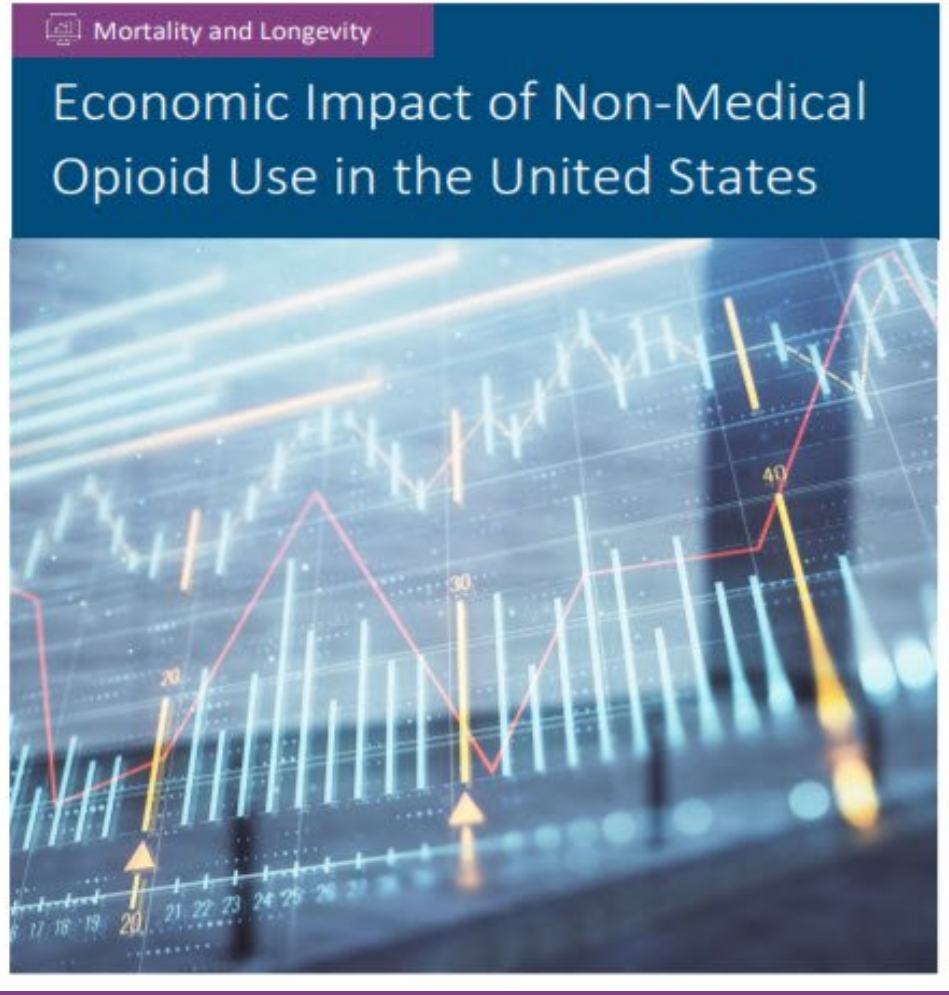
- History of SOA Research
- Broad across Actuarial Practice Research, Experience Studies and Academic Research Programs
- Strategic Initiative to increase focus on key Actuarial Research areas in to Strategic Research Programs

SOA Strategic Research Programs

Mortality and Longevity

Examines the factors impacting models and mortality predictions, and the analysis of longevity trends.

Inaugural Research Project



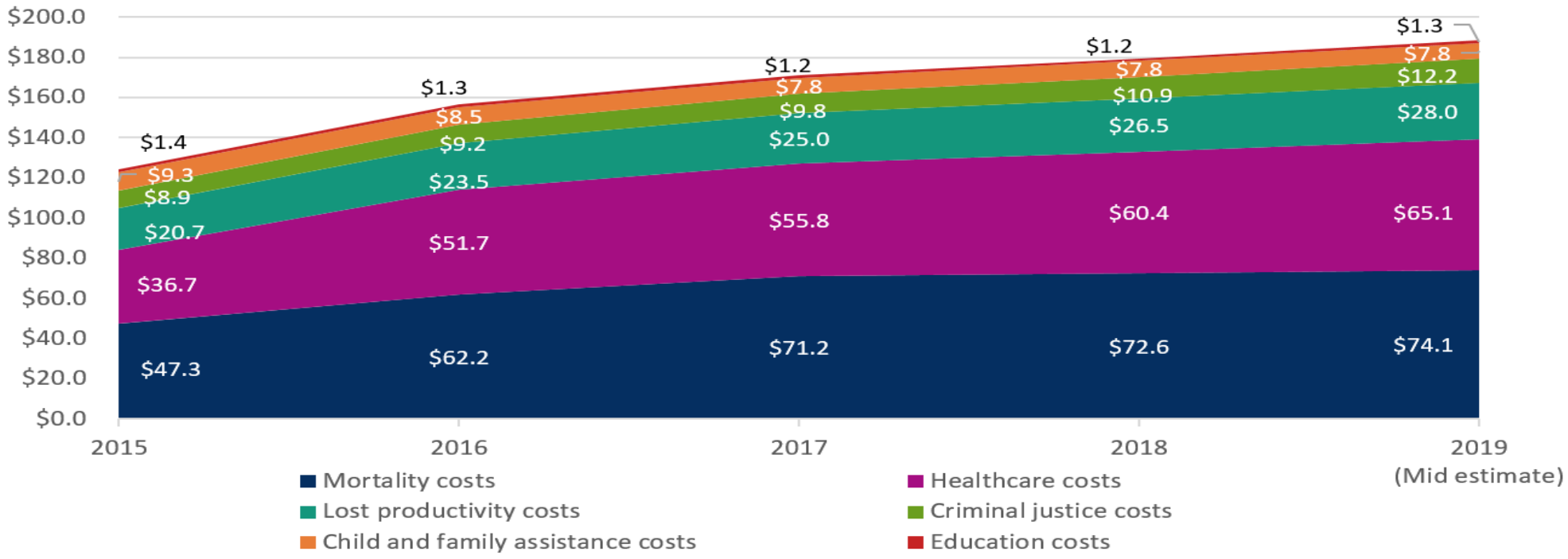
Opioid Report Media - Good Morning America

Economic Impact of Non-Medical Opioid Use

https://www.soa.org/resources/research-reports/2019/econ-impact-non-medical-opioid-use/	2015-2018	2019
Mortality Cost	253	74
HealthCare Cost	205	65
Loss Productivity Cost	96	28
Criminal Justice Costs	39	12
Child and Family Assistance Costs	33	8
Education Costs	5	1
Total	631	188

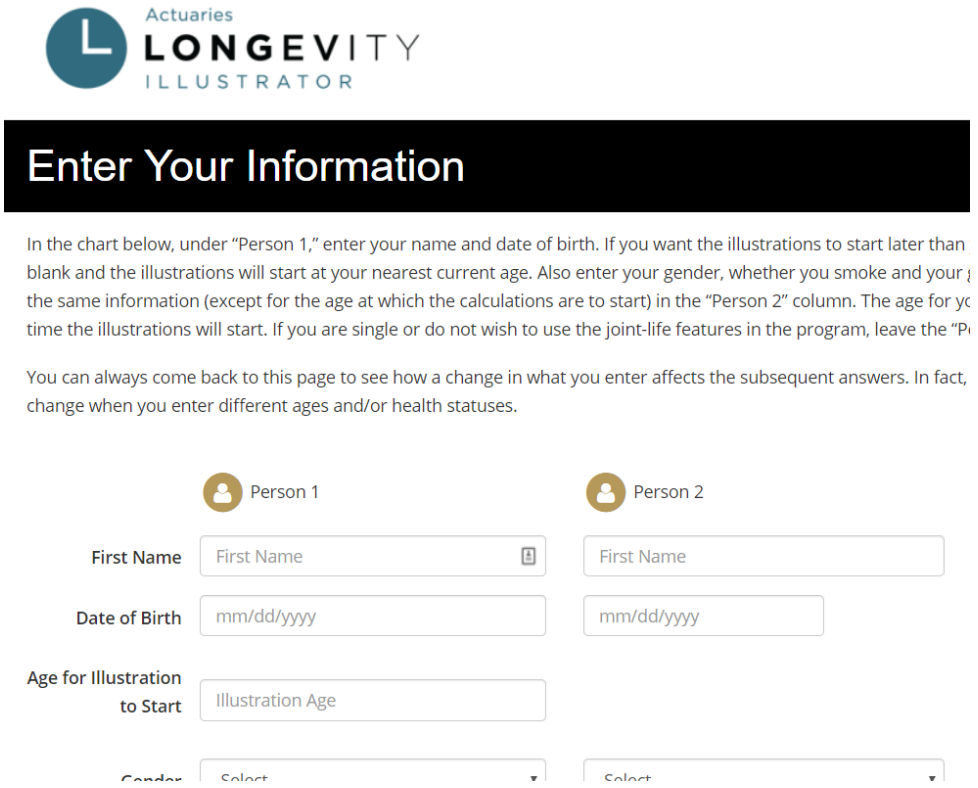
Economic Impact of Non-Medical Opioid Use

FIGURE 2: TRENDS IN TOTAL COSTS BY CATEGORY, 2015-2019 (BILLIONS)



Public Interest Mortality Research

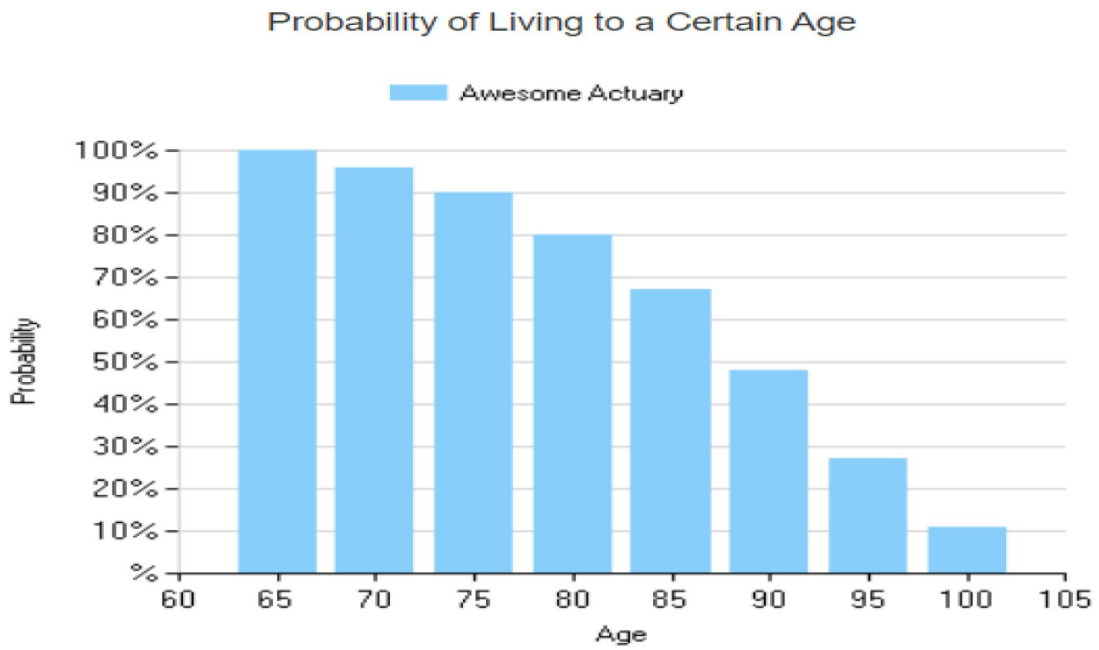
- Update to Actuaries Longevity Illustrator
- Joint project between AAA and SOA
- http://www.longevityillustrator.org/



Public Interest Mortality Research

- http://www.longevityillustrator.org/

Age	Awesome Actuary
65	100%
70	96%
75	90%
80	80%
85	67%
90	48%
95	27%
100	11%



Future Public Interest Research - 2019

- Public Perception of Longevity
  - Survey of pre and post retiree populations
  - Examines how realistic individuals are about their estimates
  - Examines variations in perception across socioeconomic and demographic categories
  - December 2019 release

Future Public Interest Research - 2020

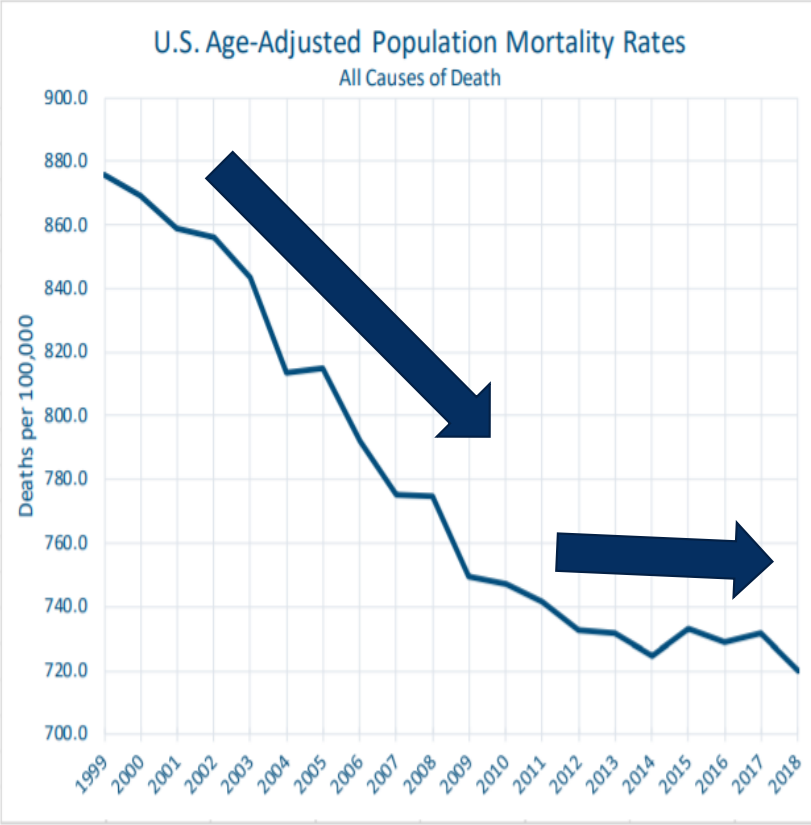
- Women's Longevity Trends
- Obesity Trends
- Contest - Workable Innovations for Living Longer (WILL)

Mortality Improvement Research

- U.S. Population Analysis
- Drivers of Mortality/Mortality Improvement
- Mortality Improvement Modeling Expansion

Mortality Improvement Research

- Recent U.S. Trends of slowing / declining mortality improvement
- August 2019:
  - *U.S. Population Mortality Observations - Preview of 2018 Experience*



Year	Deaths per 100,000	Year over Year % Change
1999	875.6	n/a
2000	869.0	***-0.8%***
2001	858.8	***-1.2%***
2002	855.9	***-0.3%***
2003	843.5	***-1.4%***
2004	813.7	***-3.5%***
2005	815.0	0.2%
2006	791.8	***-2.8%***
2007	775.3	***-2.1%***
2008	774.9	***-0.1%***
2009	749.6	***-3.3%***
2010	747.0	***-0.3%***
2011	741.3	***-0.8%***
2012	732.8	***-1.1%***
2013	731.9	***-0.1%***
2014	724.6	***-1.0%***
2015	733.1	1.2%
2016	728.8	***-0.6%***
2017	731.9	0.4%
2018	720.2	***-1.6%***

Mortality Improvement Research

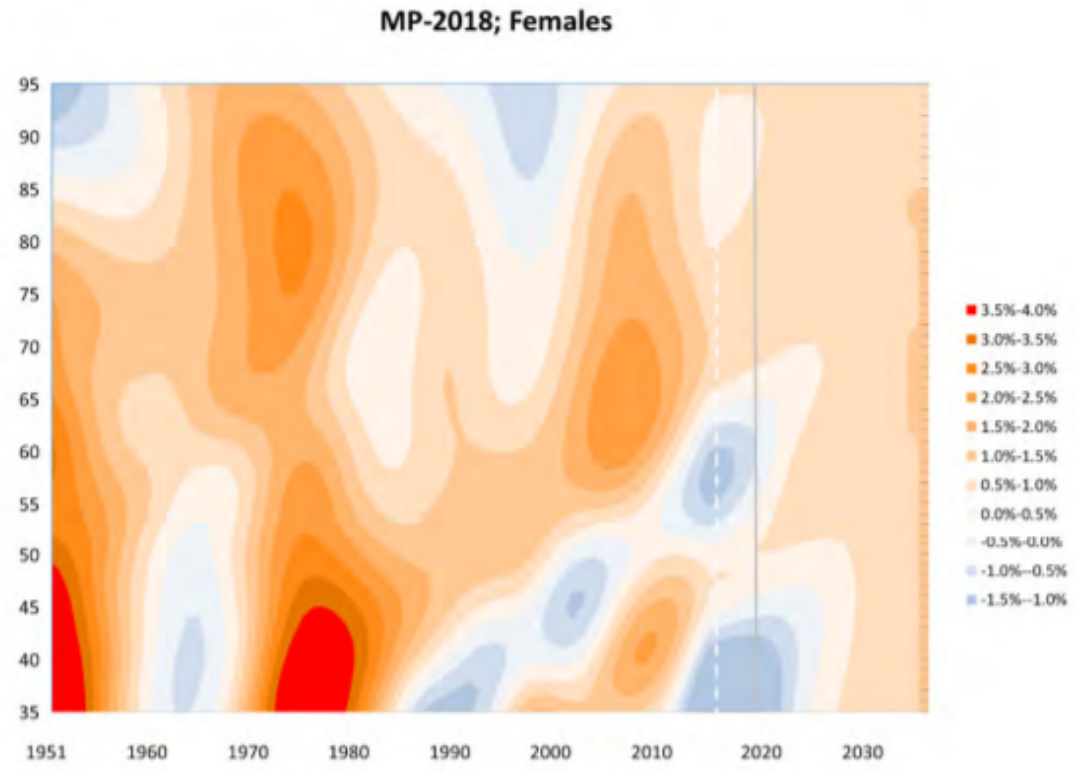
- Pulls on mortality improvement across many different causes of death
- January 2019:
  - *U.S. Population Mortality Observations - Updated with 2017 Experience*

2017 U.S. POPULATION MORTALITY BY COD

Cause of Death	Deaths	%	Age-Adjusted One Year Change	Attribution to All CODs*
Heart Disease	647,457	23.0%	0.2%	0.1%
Cancer	599,108	21.3%	2.1%	0.5%
Alzheimer's/Dementia	239,585	8.5%	-1.3%	-0.1%
Accidents	169,936	6.0%	-4.1%	-0.3%
Pulmonary	160,201	5.7%	-1.0%	-0.1%
Stroke	146,383	5.2%	-0.8%	0.0%
Diabetes	83,564	3.0%	-2.1%	-0.1%
Suicide	47,173	1.7%	-3.9%	-0.1%
Liver	41,743	1.5%	-1.4%	0.0%
Assault	19,510	0.7%	-0.2%	0.0%
Other	658,843	23.4%	-1.5%	-0.3%
All COD	**2,813,503**	**100%**	**-0.4%**	**-0.4%**

Mortality Improvement Research

- Moving from “just recording” to analyzing and using as a source of modeling and forecasting
- Look at Drivers of Mortality Improvement and expansion of Mortality Improvement Modeling



Mortality Improvement Research

- Differences in population and insured mortality improvement trends

Population

Cause of Death Category	2010	2011	2012	2013	2014	2015
Circulatory System Diseases	32.3%	31.6%	31.4%	31.3%	31.2%	31.3%
Neoplasms	24.2%	23.9%	23.8%	23.4%	23.4%	22.9%
Other	12.5%	13.1%	13.7%	13.8%	13.5%	12.9%
Respiratory System Diseases	7.7%	7.9%	7.8%	8.0%	7.8%	8.0%
Alzheimer's Disease	3.4%	3.4%	3.3%	3.3%	3.6%	4.1%
Endocrine Diseases	3.0%	3.1%	3.1%	3.1%	3.1%	3.2%
External Causes	2.9%	2.9%	2.9%	2.9%	3.0%	3.0%
Infectious Diseases	2.7%	2.8%	2.7%	2.7%	2.7%	2.7%
Influenza and Pneumonia	2.1%	2.2%	2.0%	2.2%	2.1%	2.1%

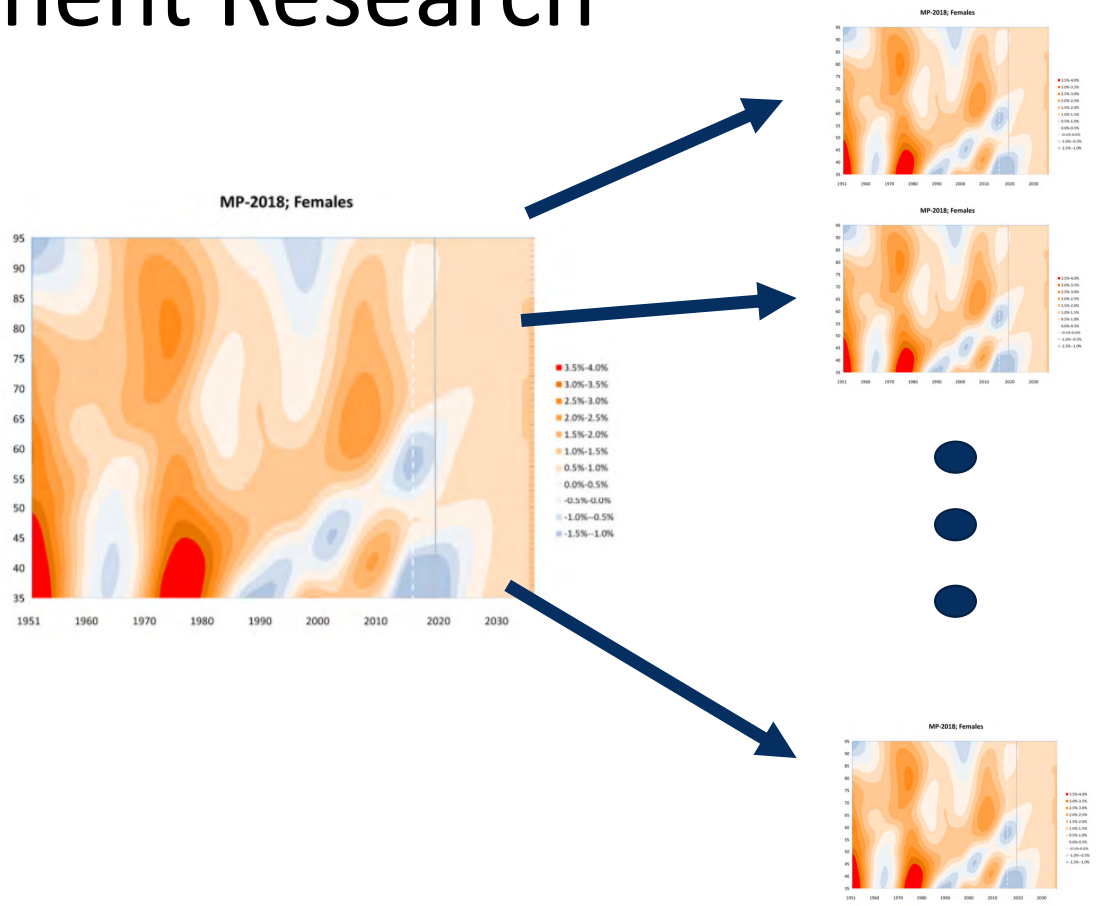
Individual Life

Cause of Death Category	2010	2011	2012	2013	2014	2015
Neoplasms	39.8%	40.9%	39.0%	38.7%	37.5%	37.4%
Circulatory System Diseases	23.6%	22.8%	23.0%	24.0%	23.0%	23.2%
External Causes	16.8%	14.5%	10.6%	10.0%	11.1%	10.3%
Respiratory System Diseases	3.1%	3.2%	4.1%	4.5%	4.9%	5.7%
Suicide	4.8%	4.4%	4.5%	4.2%	4.1%	4.1%
Motor Vehicle Accidents	3.4%	3.0%	2.9%	2.5%	2.2%	2.5%
Nervous System Diseases	1.1%	2.2%	2.8%	2.9%	3.0%	3.2%
Digestive System Diseases	2.2%	2.1%	2.7%	2.7%	2.7%	2.9%
Other	0.7%	1.4%	2.7%	2.6%	2.7%	2.7%

Recent Mortality Trends by Cause of Death; April 2017; SCOR Global Life Americas

Mortality Improvement Research

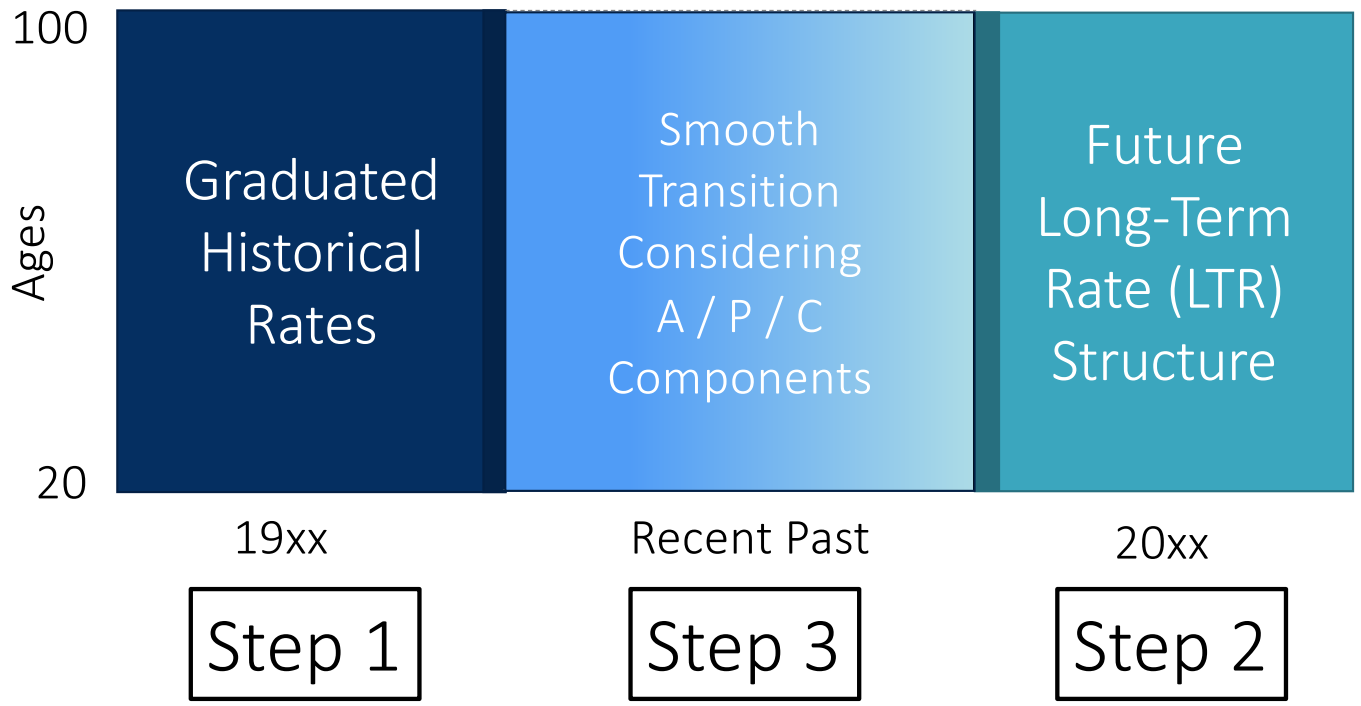
- Consistent Mortality Framework
- Decomposition of US Population into subcategories



Consistent Mortality Framework

- The purpose of this project is to develop a tool for practicing actuaries to model mortality improvement similar to the approaches used by RPEC and CMI
  - Life insurance
  - Annuities
  - Retirement

Consistent Framework…RPEC Methodology



Consistent Mortality Framework - Tool

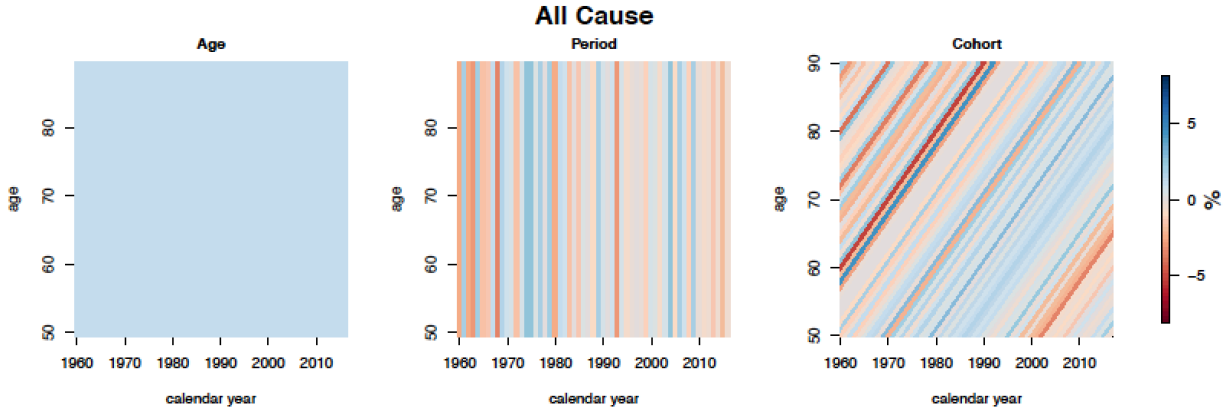
- The MP2018 calculation process uses historical Social Security mortality data to estimate the initial improvement rates
- For insured data, initial attempt was to use historical SOA mortality experience for NS and SM categories
  - Not enough data to achieve credible results
  - Has led to the project to decompose US population data into socioeconomic categories to “mimic” insured data

Decompose US Population Project

- Start with county-level mortality information
- Work to find ways to associate each county in each year with some form of socioeconomic score
- Use the score to group the counties into some form of deprivation/propensity/socioeconomic ranking
- Create mortality estimations for each year for each decile
- Ensure when aggregating back across deciles, result reasonably estimates the full population mortality

Additional SOA Mortality Improvement Research

- Analysis of Historical U.S. Population Mortality Improvement Drivers (Bajekal, Haberman, Villegas and Zhou)
- Determination as visualization of Age, Period and Cohort effects; All Cause and Cause of Death

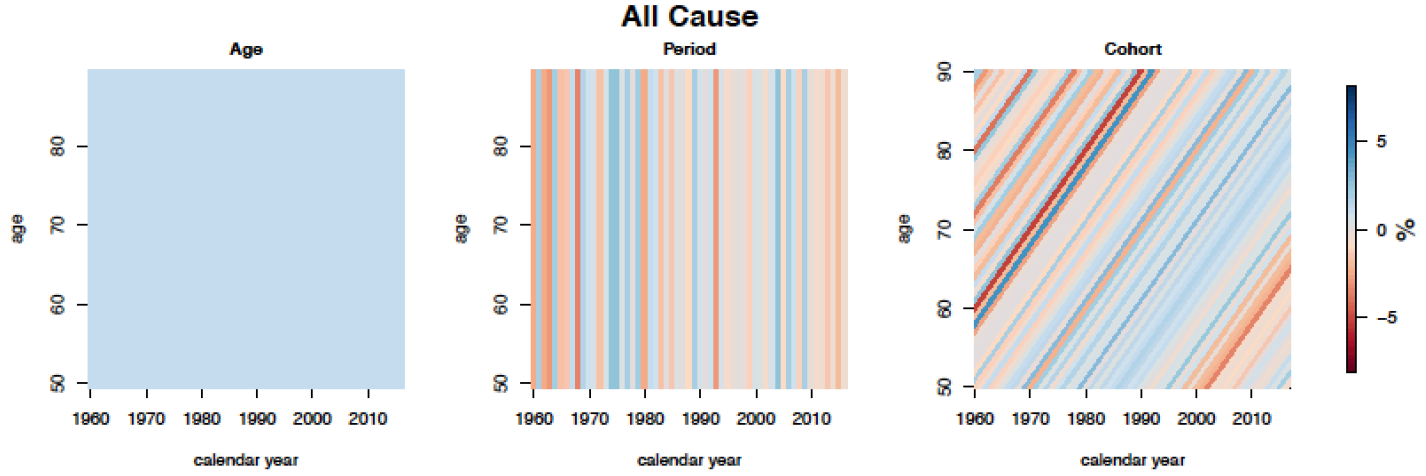


Analysis of Historical U.S. Population Mortality

- By Causes – broad and granular
  - Circulatory Disease (3)
  - Digestive System (3)
  - External Causes (3)
  - Neoplasms (7)
  - Other (6)
  - Respiratory Diseases (3)

Analysis of Historical U.S. Population Mortality

- Horizontal patterns are age effect; vertical patterns are period effect; and diagonal patterns are cohort effects



Additional SOA Mortality Improvement Research

- Balance of Quantitative and Qualitative Analysis: SOA Expert Panel
- https://www.soa.org/globalassets/assets/files/resources/research-report/2019/drivers-of-us-mortality-improvement.pdf
- Most important drivers
  - Individual behaviors
  - SES / Inequality
  - Social Policy
  - Environmental Issues

Additional SOA Mortality Improvement Research

- Mortality improvement insurance company practice survey
  - Assumptions insurers/reinsurers are using for future mortality improvement for life insurance and annuities
  - How insurers/reinsurers future mortality improvement assumptions might vary assumptions by product, birth cohort, gender or other characteristics
  - Similarities and differences:
    - US vs Canada v UK; Insurers vs. Reinsurers; Life vs. Annuities; Pricing vs. Financial Projections

Additional SOA Mortality Improvement Research

Mortality Improvement Trend - Independent Analysis

Background and Purpose

Mortality improvement is an important assumption for projecting future liability cashflows and has a material financial impact on a company. Mortality improvement is a hot topic in the industry and companies show significant interest in understanding the key factors that differentiate mortality improvement. The focus of this research is to gain a better understanding of the following main drivers of mortality improvement:

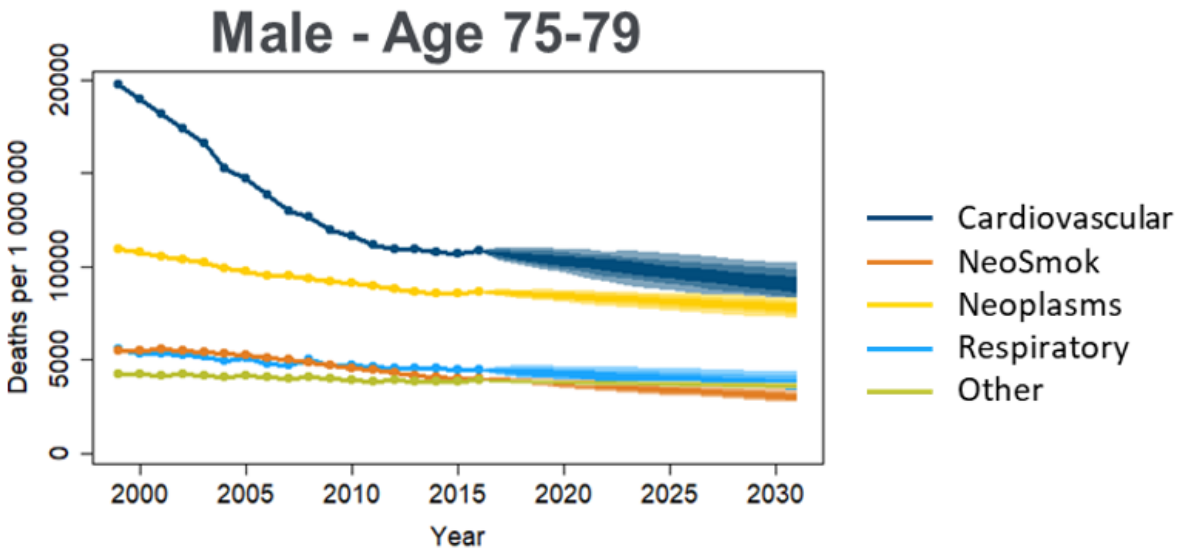
- Socioeconomic level (Marital status, occupation, income, education)
- Gender
- Attained age
- Geographical and Demographical differences
- Cause of death
- Calendar year
- Birth-year cohort

Mortality Modeling Research

- Modeling, Measurement, and Management of Longevity Risk (IFoA/CIA/SOA)
- Support further development and enhancement of USMDB and HMD

Mortality Modeling Research

- Modeling and Forecasting Cause of Death (Milliman)



Experience Studies – In Progress

- Individual Life Waiver of Premium Incidence and Termination and Group Life WOP Termination Valuation Tables
- Individual Life Post Level Term Mortality and Lapse
- Deferred Annuities
- Fixed Index Guaranteed Living Benefits Utilization
- Structured Settlements Mortality
- Private Pension Plans Mortality

Experience Studies – Accelerated Underwriting

- Survey underway
- What data might be available for a mortality study
- Looks at:
  - Structure of accelerated underwriting programs
  - How programs are monitored
  - How accelerated underwritten business is performing relative to expectations
- Targeting end of year release

JAN. 13–15, 2020

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Conclusion

- Mortality and Longevity Research Program is broad covering many topic areas for both a traditional actuarial audience and the public at large.
- Mortality Improvement continues to be an area of emphasis for the program
- More granular US population analysis is planned to provide insights for the insured population.
- As well as, continuing to examine insured population.

QUESTIONS?