



**Mortality Improvement Trends in the U.S.**

**Carrie Kelley, FSA, MAAA**

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# Introduction

- This presentation will explore trends in Mortality Improvement
- We will examine
  - Current trends in assumption setting in the industry
  - Recent historical mortality improvement results
  - The cause of death model approach for predicting future mortality improvement
- You should come away with
  - A broad view on current industry thinking on mortality improvement
  - A broad idea of how current industry standard tables compare to experience
  - Considerations for developing an independent view of mortality improvement

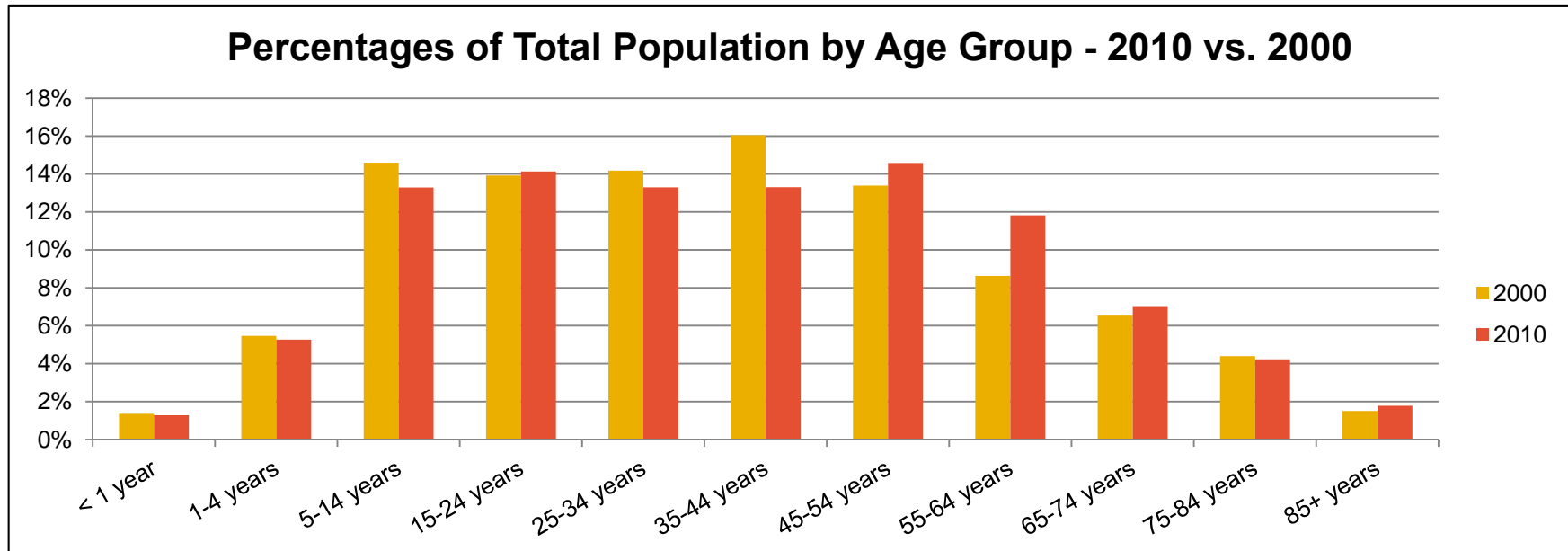
# Overview

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- Most life insurance companies are exposed to both mortality and longevity risk; pension plans are exposed to longevity risk
  - Mortality risk – dying too soon, higher mortality, shorter life expectancy
  - Longevity risk – living too long, lower mortality, longer life expectancy
- Most life insurance has mortality risk exposure
  - Can go other way under limited circumstances (heavily reinsured)
- Most longevity exposure on annuities comes from immediate annuities (i.e., SPIAs), but also some deferred annuities
  - Deferred annuities generally have less exposure, but can be more volatile (e.g., variable annuity living benefits, with exposure varying by ITM-ness)
  - Deferred annuity annuitization guarantees can be significant in some blocks

General theme: We all have to die some time,  
but it is taking longer these days

## The 10 years from 2000 to 2010 show the U.S. is an aging population, as baby boomers are hitting retirement age



- Life expectancy has increased from 76.9 years in 2000 to 78.7 years in 2010
- Overall, 2010 showed a decrease in the percent of population for people aged 0 to 44 years, and an increase in the percent of the population aged 45 and older
  - The most notable increase was 3.19% in the 55-64 year bracket, which correlates roughly to the baby boomer generation
  - American women are delaying having children and having fewer of them, as evidenced by the historically low fertility rate in 2011 of 63.2 births per 1,000 in women ages 15-44

Source: Centers for Disease Control and Prevention, National Vital Statistics System

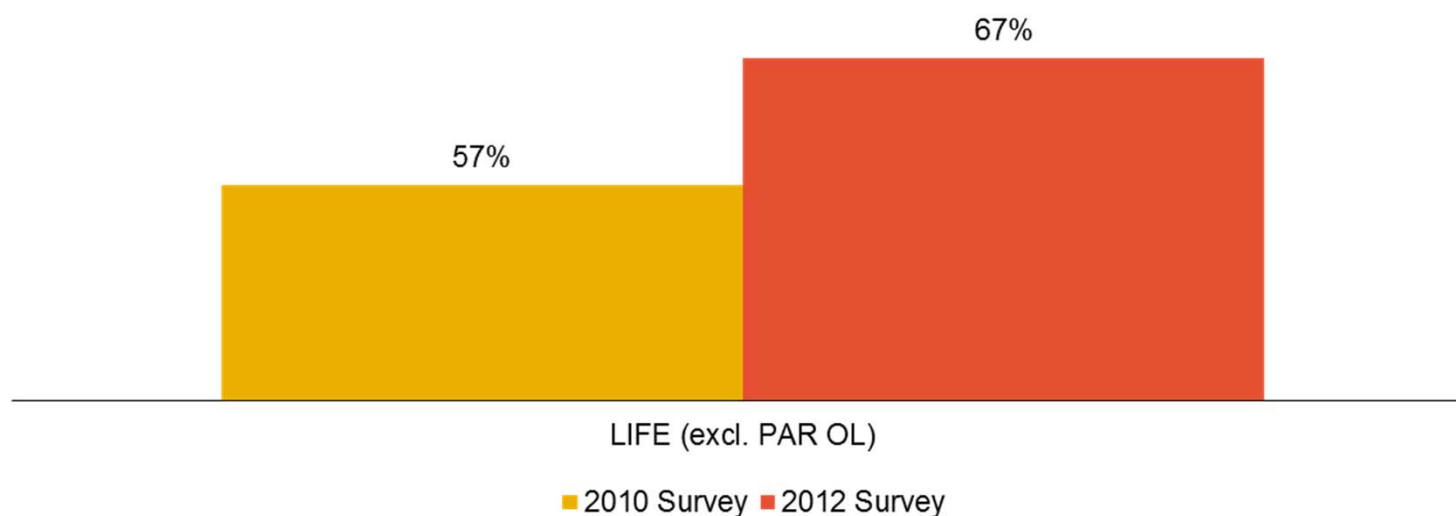
## There are two aspects of mortality improvement

- Historical mortality improvement (HMI)
  - Used to bring a table created in past up to today
  - Can also be used to adjust for time in A/E studies
  - Tied to actual historical improvement levels
- Future mortality improvement (FMI)
  - Used to develop an assumption for future (i.e., projected)
  - More of an expectation about future as opposed to tying exactly to recent experience

## **Industry Trends**

**Per our Pricing Survey, more than two-thirds of the respondents indicated that they projected future mortality improvements for life insurance**

**Projected Future Mortality Improvement  
(Percentage of Responses)**



- Projected improvements for life products were generally limited to the first 10 to 20 policy years
- For those who project mortality improvements, 59% vary the assumption by gender, 50% vary it by attained age and 14% vary it by smoker status



## Virtually all companies in the Income Annuity Survey indicate they reflect FMI in pricing retail annuities, using a variety of scales

- Three of the sixteen companies indicated they didn't reflect FMI

Projection Scale	Number of Companies
AA	2
G	4
G2	4
Internal	3
Fixed	0
None	3

\* 2013 survey

## Comparison of annuitant mortality improvement scales

Age	Male				Female			
	Scale AA	Scale G	Scale BB	Scale G2	Scale AA	Scale G <sup>1</sup>	Scale BB	Scale G2
55-59	1.70	1.50	.40	1.40	.50	1.75	.70	1.20
60-64	1.50	1.50	.90	1.50	.50	1.75	1.20	1.30
65-69	1.30	1.50	1.40	1.50	.50	1.75	1.20	1.30
70-74	1.50	1.25	1.50	1.50	.60	1.75	1.20	1.30
75-79	1.30	1.25	1.50	1.50	.70	1.50	1.20	1.30
80-84	.80	1.25	1.50	1.30	.70	1.50	1.20	1.20
85-89	.60	1.25	1.40	.90	.40	1.50	1.20	.80
90-94	.30	1.00	.90	.60	.30	1.25	.90	.50
95-99	.20	1.00	.40	.30	.10	1.25	.40	.30
100-104	0	0	.20	.10	0	0	.20	.10
105+	0	0	0	0	0	0	0	0

<sup>1</sup> Many companies have used less than 100% on females with Scale G

Towers Watson RCS group has developed guidance for use on client projects, generally in line with Scale G2, with some exceptions

# Cause of Death Analysis

## Several items should be considered on mortality improvement

- Relevant historical experience
  - U.S. population is most credible, meaningful insured data is tough to come by
  - Even robust population data shows considerable variation year to year
  - How far back does one go?
- Impact of various factors
  - Shifting causes of death
  - Healthcare spending as % of GDP
  - Smoking cessation rates
  - Obesity trends
  - Socioeconomic impact of insured lives
- Key question: how well does the past predict the future?

## Towers Watson continues to evaluate mortality improvement trends

- Starting point is U.S. population improvement
  - Insured data is not publically available
  - In general, we believe it is appropriate to use U.S. population improvement statistics to serve as the basis for the future projections
  - We assessed recent population experience
- We believe the past 30 years is most appropriate
  - Balance of long enough period for comprehensive data and a fairly homogeneous period of health care treatment
  - We reviewed cause of death trends
- We also developed a cause of death model to help project the future
- Adjustments are then overlaid to reflect socioeconomic factors

## U.S. population mortality improvement has seen some shifts over the past 30 years

Annual Average Improvement in Mortality 1979-2010								
Period	Gender	25-34	35-44	45-54	55-64	65-74	75-84	85+
1979-2000	Male	1.5%	0.8%	1.7%	1.8%	1.4%	1.0%	0.0%
	Female	0.8	0.6	1.3	0.8	0.4	0.4	-0.3
	Combined	1.3	0.7	1.5	1.4	0.9	0.6	-0.2
2000-2010	Male	-0.2	1.8	0.7	1.3	2.7	2.0	1.3
	Female	-0.1	1.0	0.0	1.8	2.3	1.5	1.1
	Combined	-0.1	1.5	0.4	1.5	2.4	1.7	1.1
1979-2010	Male	1.0	1.1	1.4	1.7	1.8	1.3	0.4
	Female	0.5	0.7	0.9	1.1	1.0	0.8	0.1
	Combined	0.8	1.0	1.2	1.4	1.4	1.0	0.2

Combined rates reflect a 50%-50% blend (a simplifying assumption)

Source: Derived from CDC mortality database

## The case for a cause of death view of mortality

- Cause of death mortality shows additional details on underlying mortality trends
- Allows the use of actuarial judgement on the sustainability of underlying trends
- A cause of death model allows actuaries to more closely work with Chief Medical Officers to develop refined views on future mortality improvement
- Cause of death data sources
  - The Center for Disease Control's Wide-ranging Online Data for Epidemiologic Research (WONDER)
  - There are some minor limitations for the data

## Although mortality for most diseases showed a slight increase from 2000 to 2010, large declines in heart disease and stroke caused an overall decline in mortality

Cause of Death	% of Total Deaths - 2000	% of Total Deaths - 2010	Δ
Heart Disease	29.57%	24.22%	-5.36%
Cancer	23.01%	23.29%	0.28%
Chronic Lower Respiratory Disease	5.07%	5.59%	0.52%
Stroke	6.98%	5.24%	-1.73%
Accidents	4.08%	4.89%	0.81%
Alzheimer's Disease	2.06%	3.38%	1.32%
Diabetes	2.89%	2.80%	-0.08%
Kidney Disease	1.55%	2.04%	0.49%
Influenza and Pneumonia	2.71%	2.03%	-0.69%
Suicide	1.23%	1.55%	0.33%
Septicemia	1.29%	1.41%	0.12%
Chronic Liver Disease and Cirrhosis	1.10%	1.29%	0.19%
Hypertension	0.76%	1.08%	0.32%
Pneumonitis due to solids or liquids	0.69%	0.69%	0.00%

- Rates for heart disease continued their long term trend of decreasing, yet it remains the leading cause of death
- One of the major increases since 2000 is the rise in deaths due to accidents
  - Much of increase is prescription drug overdoses

Source: Centers for Disease Control and Prevention, National Vital Statistics System



## Cause of death trends can be examined to better understand mortality improvement drivers

Historical Annual Mortality Improvement for Selected Causes of Death 2000-2010					
Ages:	45-54	55-64	65-74	75-84	85+
<b>Males</b>					
Heart Disease	1.7%	3.2%	4.7%	4.1%	2.8%
Malignant Neoplasms (e.g., Cancer)	1.4	1.9	2.4	1.5	1.0
Cerebrovascular Disease	1.6	3.0	4.5	5.0	5.0
Nephritis, Nephrotic Syndrome, and Nephrosis	-0.6	-1.5	-0.6	-1.1	-1.3
Alzheimer's	-0.8	-0.1	0.0	-2.6	-4.2
Accidents	-2.1	-2.3	-0.6	-0.9	-1.2
<b>Females</b>					
Heart Disease	0.7%	3.7%	5.0%	4.3%	3.5%
Malignant Neoplasms (e.g., Cancer)	1.3	2.2	1.7	0.8	0.5
Cerebrovascular Disease	2.3	3.7	4.5	4.3	4.4
Nephritis, Nephrotic Syndrome, and Nephrosis	-2.0	-0.1	0.0	-1.5	-1.9
Alzheimer's	-8.0	-0.2	-1.1	-3.0	-4.1
Accidents	-5.6	-2.3	0.0	-1.3	-2.2

Source: Derived from CDC mortality database

## We used cause of death results to project future levels

- The model results are the basis of Towers Watson's view on future mortality improvement
- We believe recent experience will drive near term results (i.e., next 10 years)
- Beyond that, there are many issues that could impact mortality improvement in the future
  - Significant medical breakthroughs
  - Rising levels of obesity: experts predict a 1-1.5 year reduction in life expectancy; this translates to a .25% per annum reduction in the future
  - Increased prevalence of diabetes
  - Universal health care
  - Drug efficacy wear-off
  - New diseases/infections
- We believe mortality improvement will be significant in future, but decline from recent levels
  - Perhaps 50% of baseline after 30 years
- We suggest using prudence for longer projection periods
  - Higher rates for longevity risk
  - Lower rates for mortality risk
- Could also consider netting risks
  - Expect to be a corporate view on this

All of these are studied in the recent Towers Watson White Paper "Longevity Trends in the United States". Also, refinements to disease-based model will allow us to examine various scenarios.

## **Other Factors**

## Obesity trends

U.S. Obesity Trends						
Class	BMI Range	1976-1980	1988-1994	1999-2002	2003-2006	2009-2012
Underweight	<18.5	3.0%	2.3%	1.9%	1.7%	1.8%
Healthy	18.5-24.9	49.6	41.7	32.9	31.4	29.4
Overweight	25.0-29.9	32.3	32.7	34.1	32.7	33.0
Obese Class I	30.0-34.9	10.5	14.8	18.1	20.0	20.4
Obese Class II	35.0-39.9	3.3	5.4	7.8	8.5	8.8
Obese Class III	40.0+	1.3	3.1	5.2	5.7	6.6
Total		100.0	100.0	100.0	100.0	100.0

Source: National Center for Health Statistics, 2014

- Not surprisingly, higher BMI and obesity classes are associated with higher levels of mortality
  - Relative risk ratios for Obese Classes I through III range from 1.2-3.7 varying by age group and class
  - Studies predict that life expectancy at age 50 could drop somewhere between 0.6 to 1.6 years as a result of U.S. obesity trends
  - We estimate that a 1.0 year reduction in life expectancy at age 45 equates to .25% per annum reduction in future annual improvement

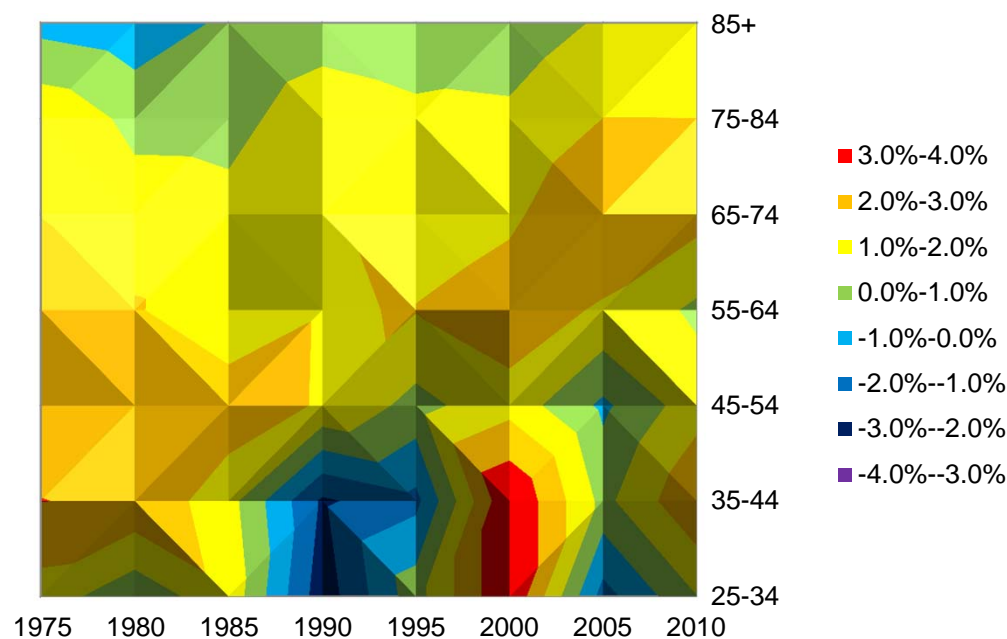
## Cohort effect

- Is there a cohort effect (i.e., vary by birth years)
  - Data shows some limited evidence of cohort effect in U.S. (males born in 1930-40, males born in 1920-30, females born in 1930-40)
  - Is there enough evidence to support inclusion in assumptions?

## Male cohort trends in the U.S.

- Limited evidence of cohort effect in U.S. for males born in 1930-40 and 1920-30
- This is represented by diagonal trends in the graph below

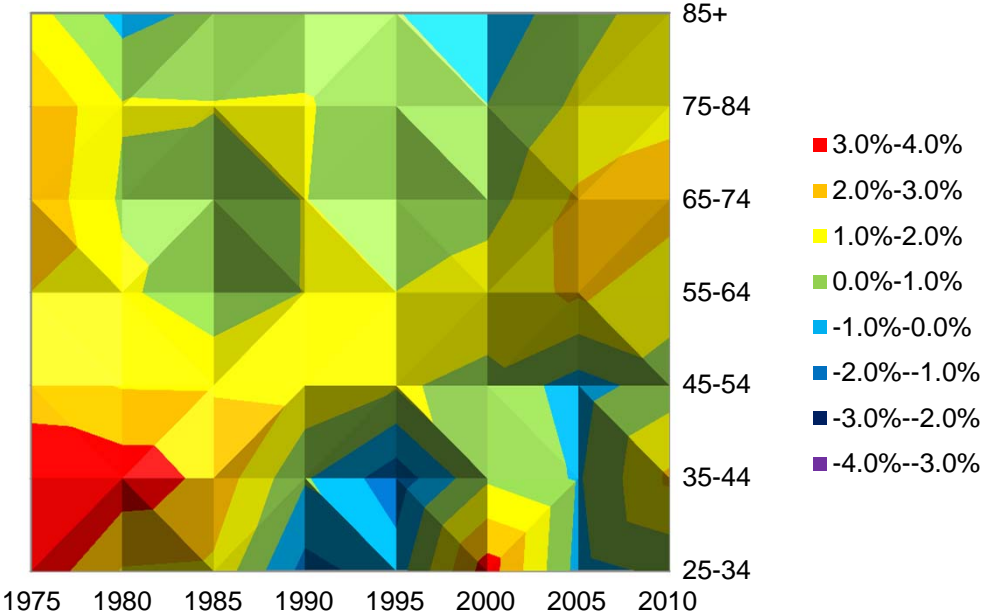
### Mortality Improvement Male



# Female cohort trends in the U.S.

- Limited evidence of cohort effect in U.S. for females born in 1930-40
- This is represented by diagonal trends in the graph below

### Mortality Improvement Female



## Other factors to consider about recent experience

- Smoking prevalence
  - The reduction in smoking prevalence may have contributed .2-.3% annual mortality improvement over the past decade (i.e., 1.0% goes to 1.2-1.3%), but given recent stabilization in smoking prevalence this is unlikely to lead to future contributions
- Socioeconomic
  - Our analysis suggests up to a 1.5% difference (i.e., 1.0% vs. 2.5%) for low vs. high earners at selected ages
  - We are in the process of developing more specific guidance for affluent, upper middle class, lower middle class, and working class segments



## **Conclusion**

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- Assumption setting for mortality improvement is still evolving in the industry
- Population mortality improvement experience shows a trend of significant improvement over the last 30 and even 10 years
- Cause of Death analysis allows us to better understand and stress test key drivers of the changes in historical mortality improvement
- Key consideration for future mortality improvement assumptions
  - Appropriate historical period to study
  - Key drivers of historical experience
  - How long and at what level should future mortality improvement be applied?
  - Obesity impact
  - Socioeconomic factor impact
  - Cohort impact

# Contact information

**TOWERS WATSON** 

**Carrie Kelley, FSA, MAAA**  
**Consultant**

3500 Lenox Road, Suite 900      T +1 404 365 1595  
Atlanta, GA 30326-4238

carrie.kelley@towerswatson.com