

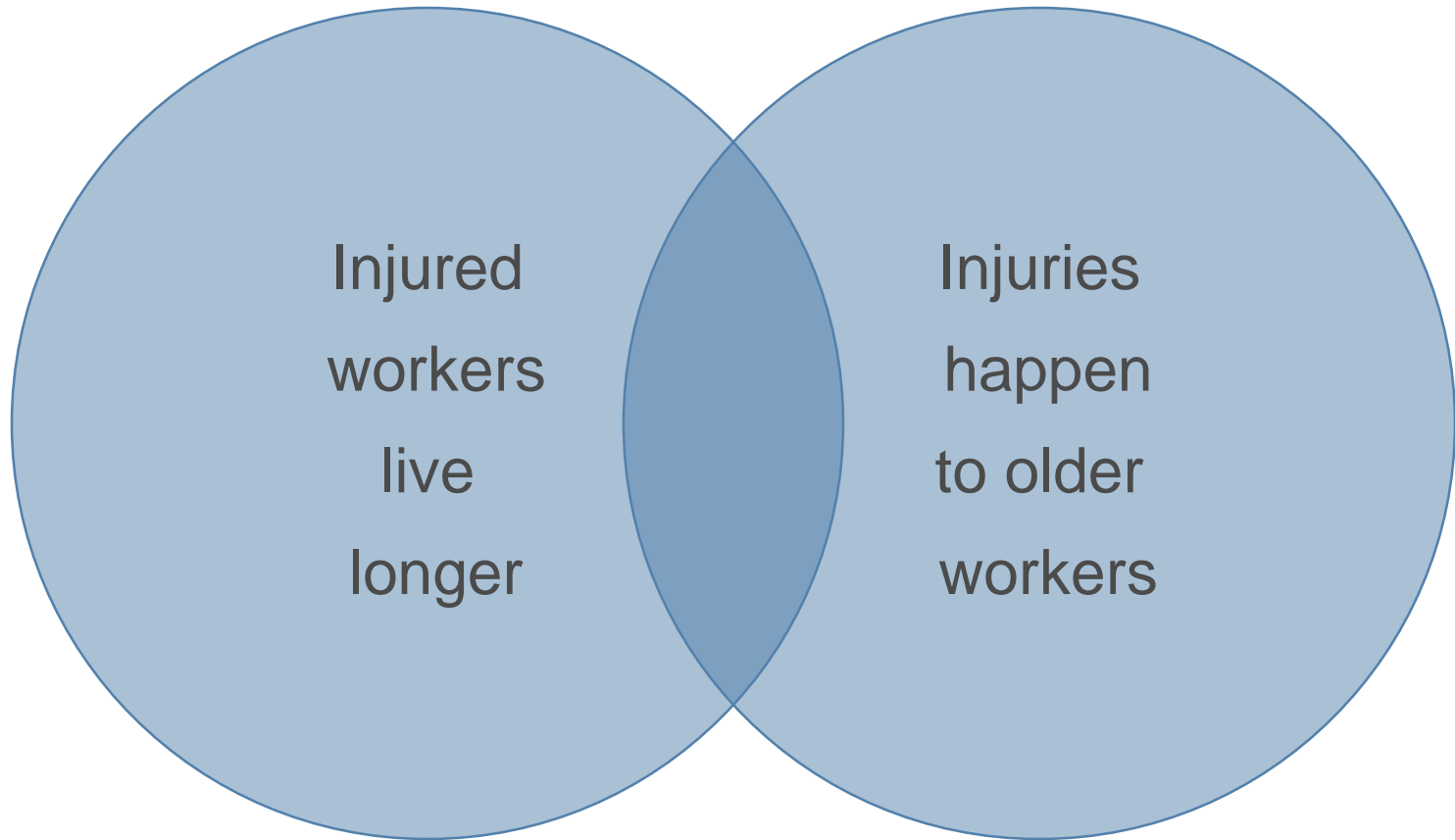
The Effect of Increased Longevity on Workers Compensation Reserving

2016 Casualty Loss Reserve Seminar

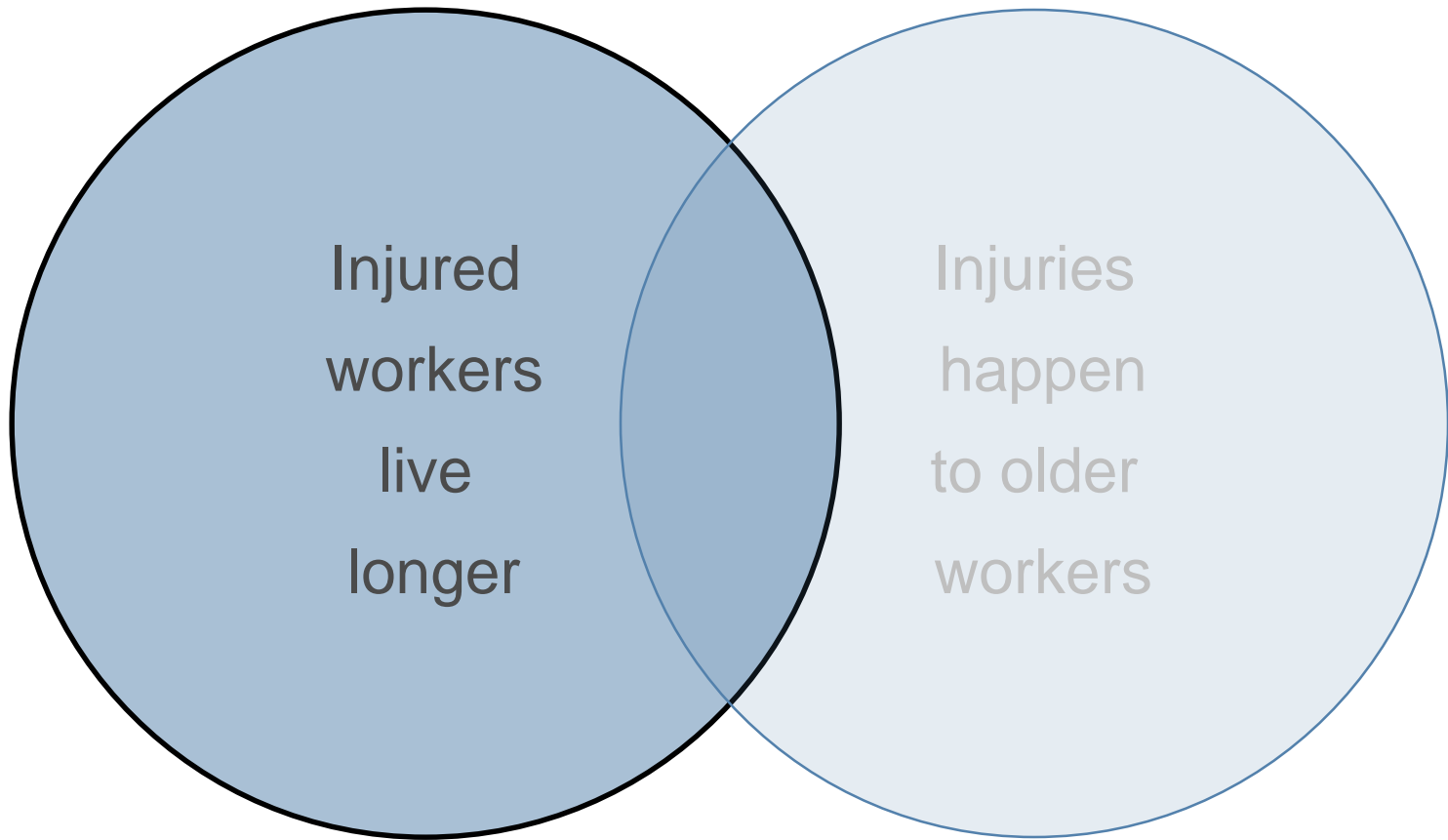
The views expressed in this presentation are solely those of the presenter, and do not reflect the views of Liberty Mutual Insurance or the CAS.

Ryan Royce
September 20, 2016

What is the effect of increased longevity on WC reserving?



Injured Workers Live Longer



Increased life expectancy will impact injury types differently

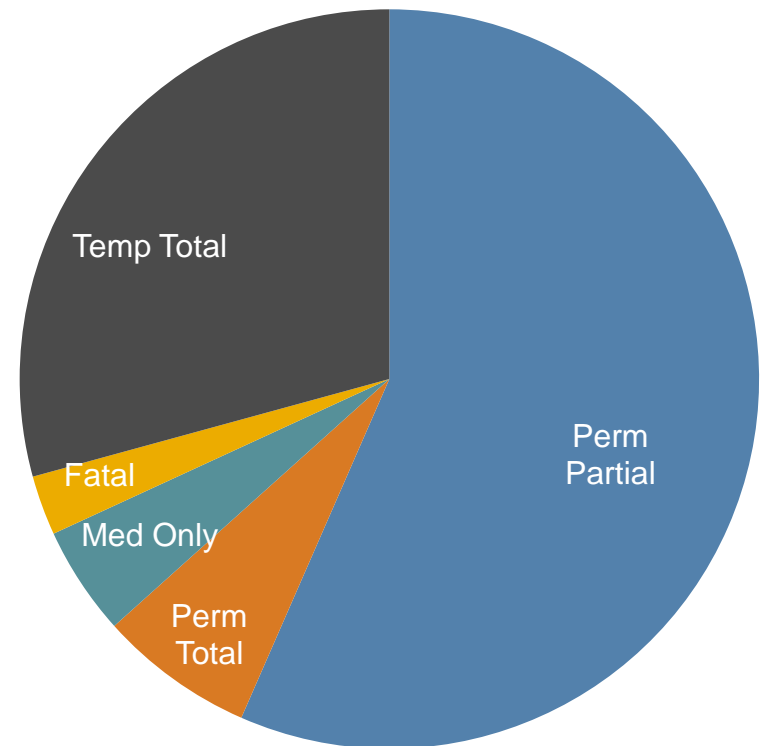
Consider a 38 year old injured worker:

1994 Life Expectancy
40.1 years



2014 Life Expectancy
42.5 years

- The largest, and most intuitive, impact will be to Permanent Total cases
 - But, these are a very small portion of overall losses
- Medical Only and Temporary Total cases are likely to have the smallest impact
- Permanent Partial injuries are likely to fall somewhere in between
 - Indemnity impact likely small
 - But, exposure to lifetime medical



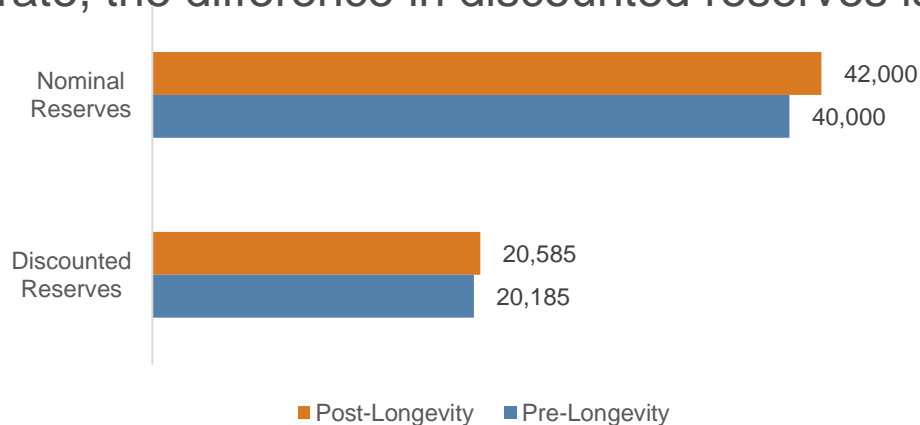
Sample Distribution of Ultimate Losses

Permanent total injuries will have the most straightforward impacts

- Indemnity impact is essentially adding duration to a stream of constant payments (other than COLA)
- Medical is more complex
 - Cost tend to increase with age
 - Sensitive to calendar year medical inflation
 - Medical technology – can be costly, but can also get workers to return to work sooner

Impacts on Life Pension Claims

- Typically permanent total (or fatal with spousal benefits) claims, these claims are most directly impacted by increased longevity
 - When projecting increased costs associated with longevity, the impact on discounting of indemnity payments should also be considered
-
- Consider a hypothetical stream of indemnity payments of \$1,000 made for 40 years
 - Let's say longevity causes a 2 year increase in payment duration (from 40 years to 42 years)
 - The difference in nominal reserves is \$2,000 (5%)
 - At a 4% discount rate, the difference in discounted reserves is \$400 (2%)

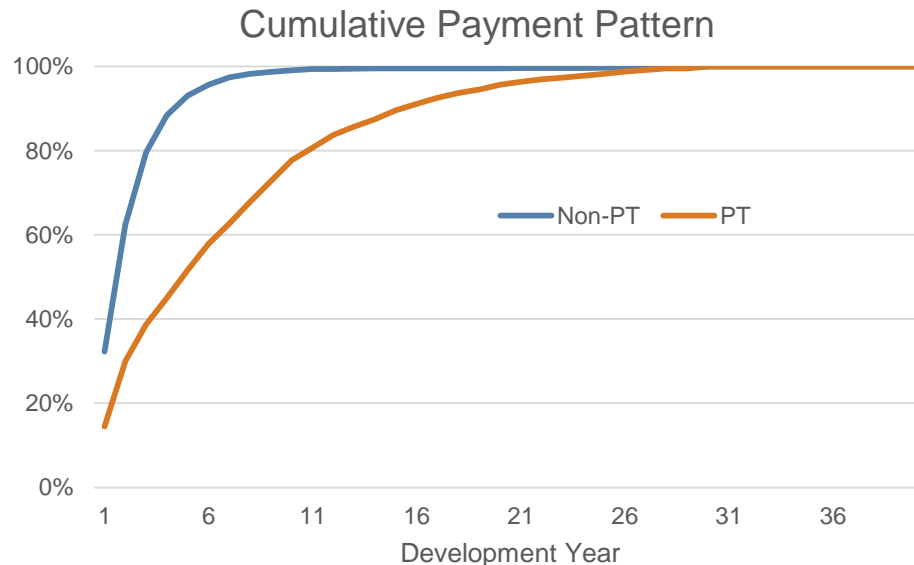


Increased longevity will drive higher permanent total severity, but what about frequency?

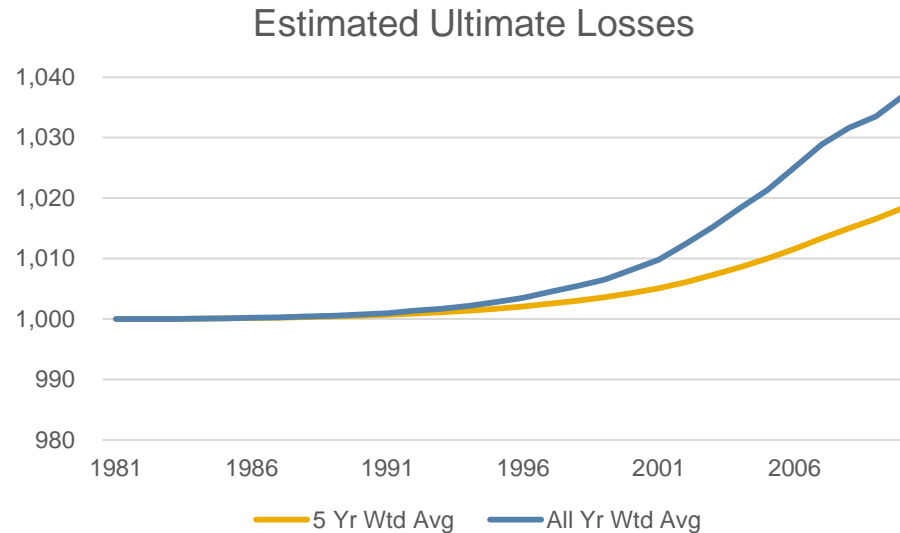
- Consider a case where PT decreases from 14% of losses to 7% of losses over a 30 year period

Scenario

- \$1,000 of total ultimate loss every year
- Portion of losses that are PT decrease uniformly each year from 14% to 7%
- PT losses and Non-PT losses develop according to the chart below
- What happens if we develop losses in aggregate instead of separately by injury type?

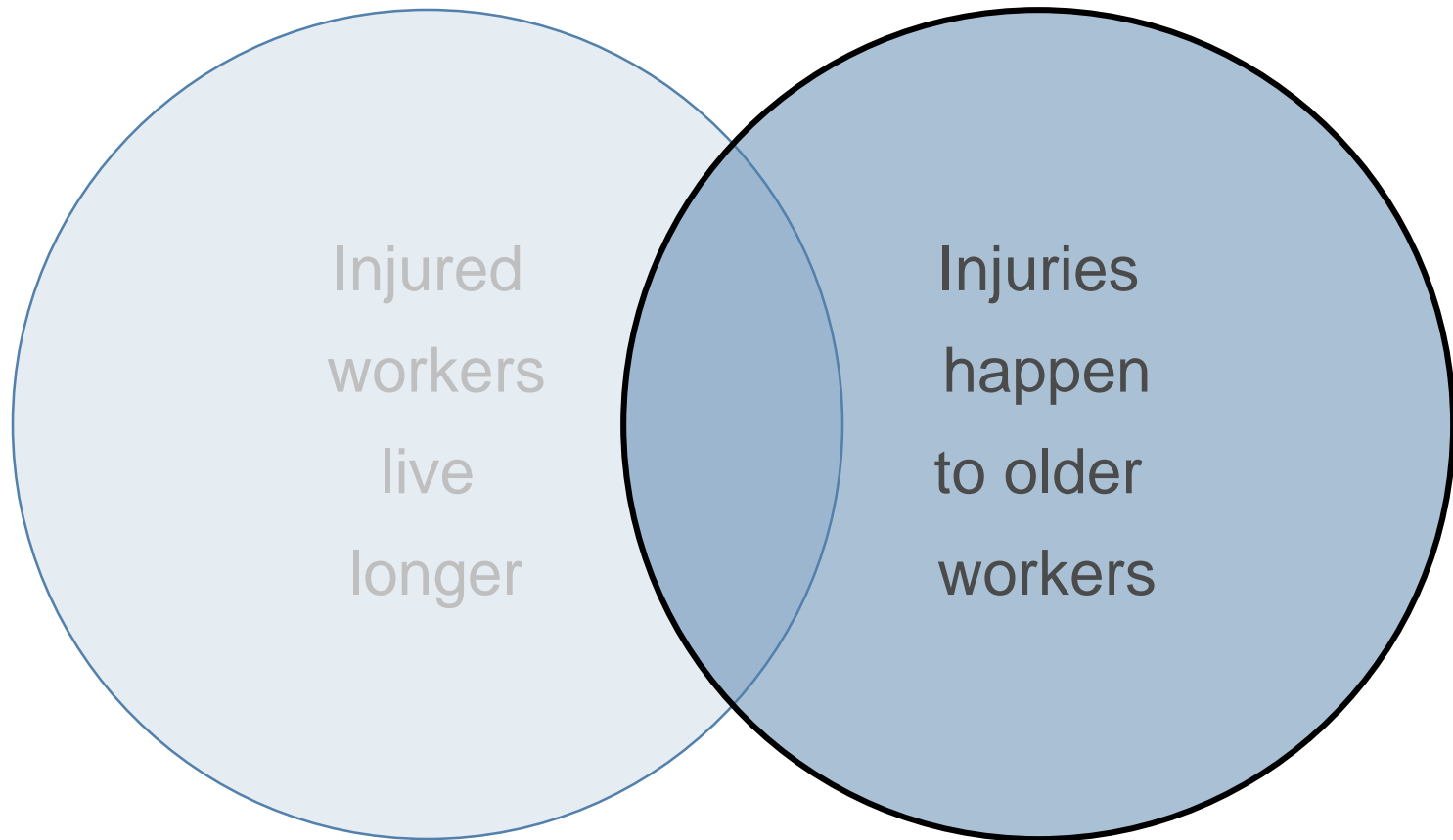


Development in aggregate instead of by injury type will produce biased results



- The magnitude of this overstatement may well offset the understatement caused by increased longevity
- Underscores the importance of incorporating not only the effect of longevity, but all material changes in mix that can occur throughout a traditional triangulation technique

Injuries Happen to Older Workers



Loss Costs and Age of Claimant

- The conventional wisdom:
 - Older claimants have higher severities
 - Greater duration of losses since older claimants take longer to heal
 - Medical costs increase with age
 - Older claimants typically have higher wages, increasing indemnity costs
 - Older workers have lower frequencies
 - Greater experience and training
 - Younger workers are more prevalent in higher risk occupations
 - Older workers tend to be more risk-averse than younger workers

Over the last 15 years, the “conventional wisdom” has been studied, with mixed conclusions

Workers' Compensation and the Changing Age of the Workforce (WCRI)¹

Severities are higher for older workers

Lower frequency for older workers largely offsets severity

Difference between older and middle aged workers isn't large

Workers Compensation and the Aging Workforce: Is 35 the New “Older” Worker? (NCCI)³

Largely confirms 2011 study, little difference in costs by age beyond 35 years

Nonfatal Occupational Injuries and Illnesses Requiring Days Away From Work (BLS)⁵

Duration of time away from work increases with age of worker

No clear relationship between age and incidence rate

2011

2014

2000

2012

2015

Workers Compensation and the Aging Workforce (NCCI)²

Costs are lower for ages 20-34, but similar for 35-64 (for temporary injuries only)

- Difference in types of injury drive severity differences
- Wages drive indemnity severity differences
- More treatments per claim drives medical higher for older workers

Traditional belief that younger workers have higher frequency isn't true post 2009

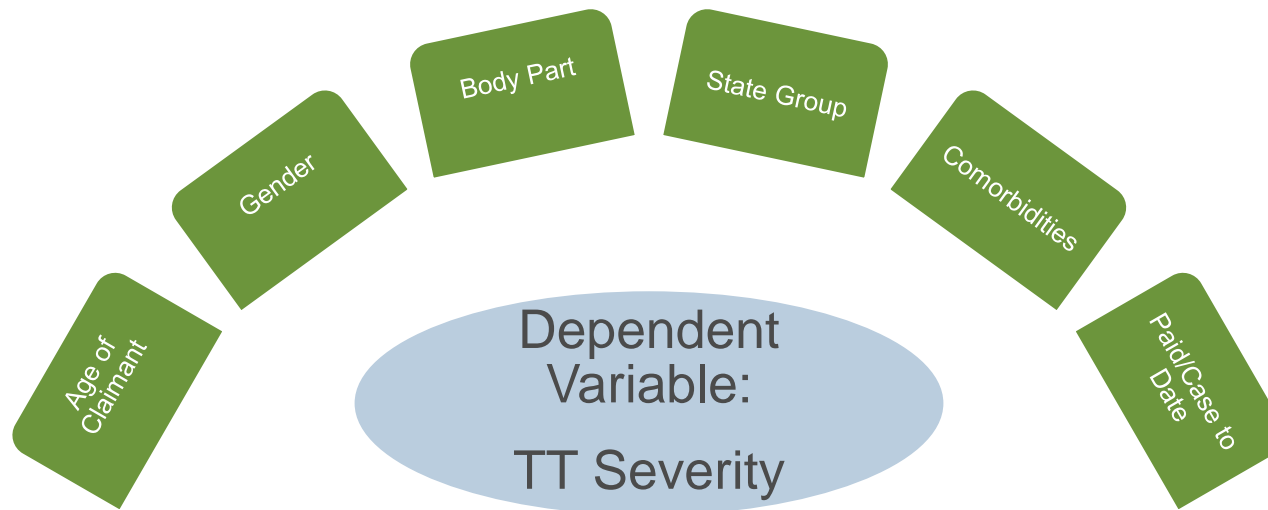
The Impact of Claimant Age on Late-Term Medical Costs (NCCI)⁴

Late term (20-30 years post injury) costs are higher for younger workers

- More para/quad injuries for younger workers
- Higher use of narcotics and other prescription drugs by younger workers

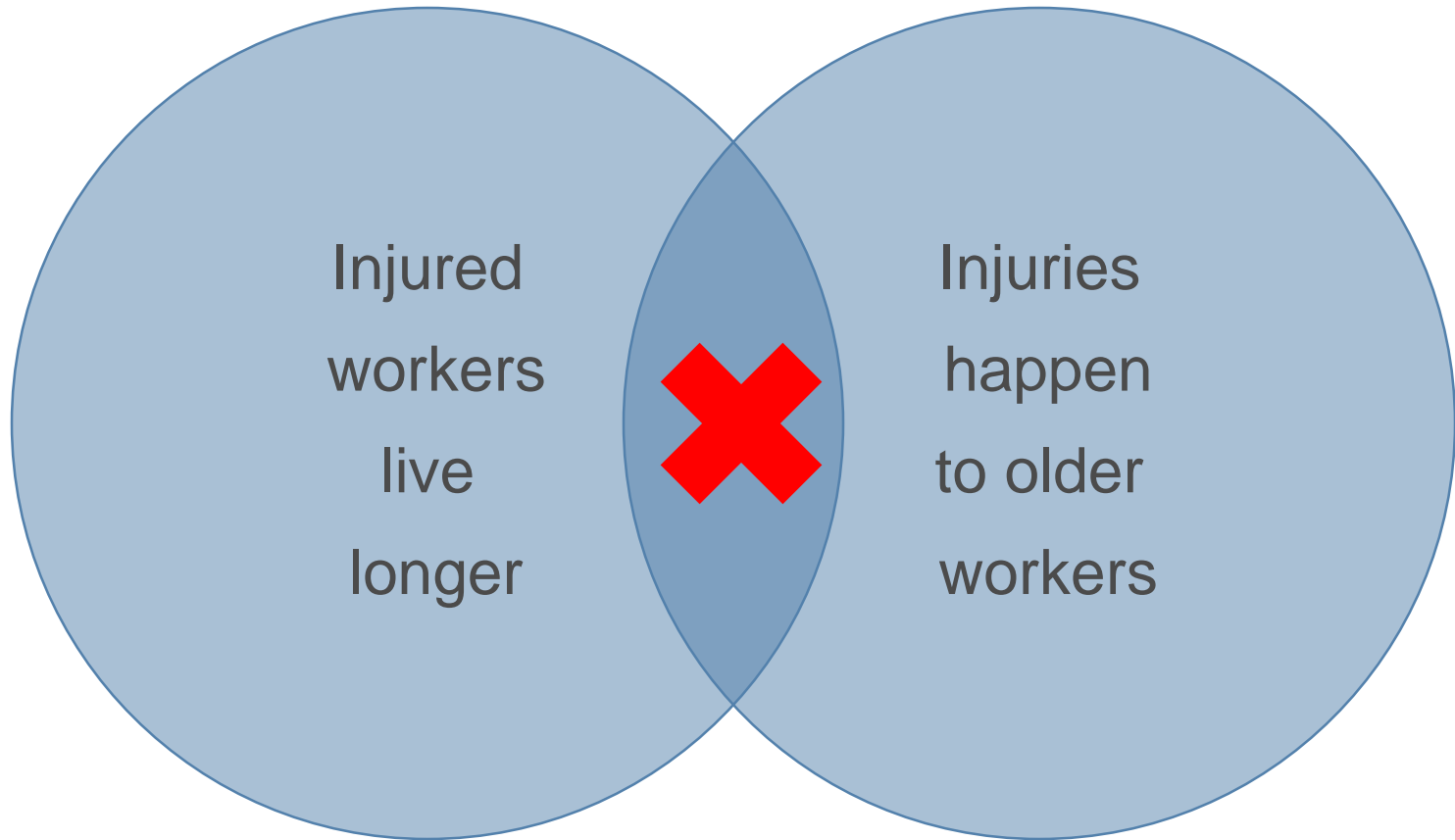
Claim level modeling may provide insight into the challenge of age impacting severity

- WC claims are reported quickly, but severity is highly uncertain, developing slowly as claims are paid
- Application of predictive modeling can help us better understand severity and its drivers

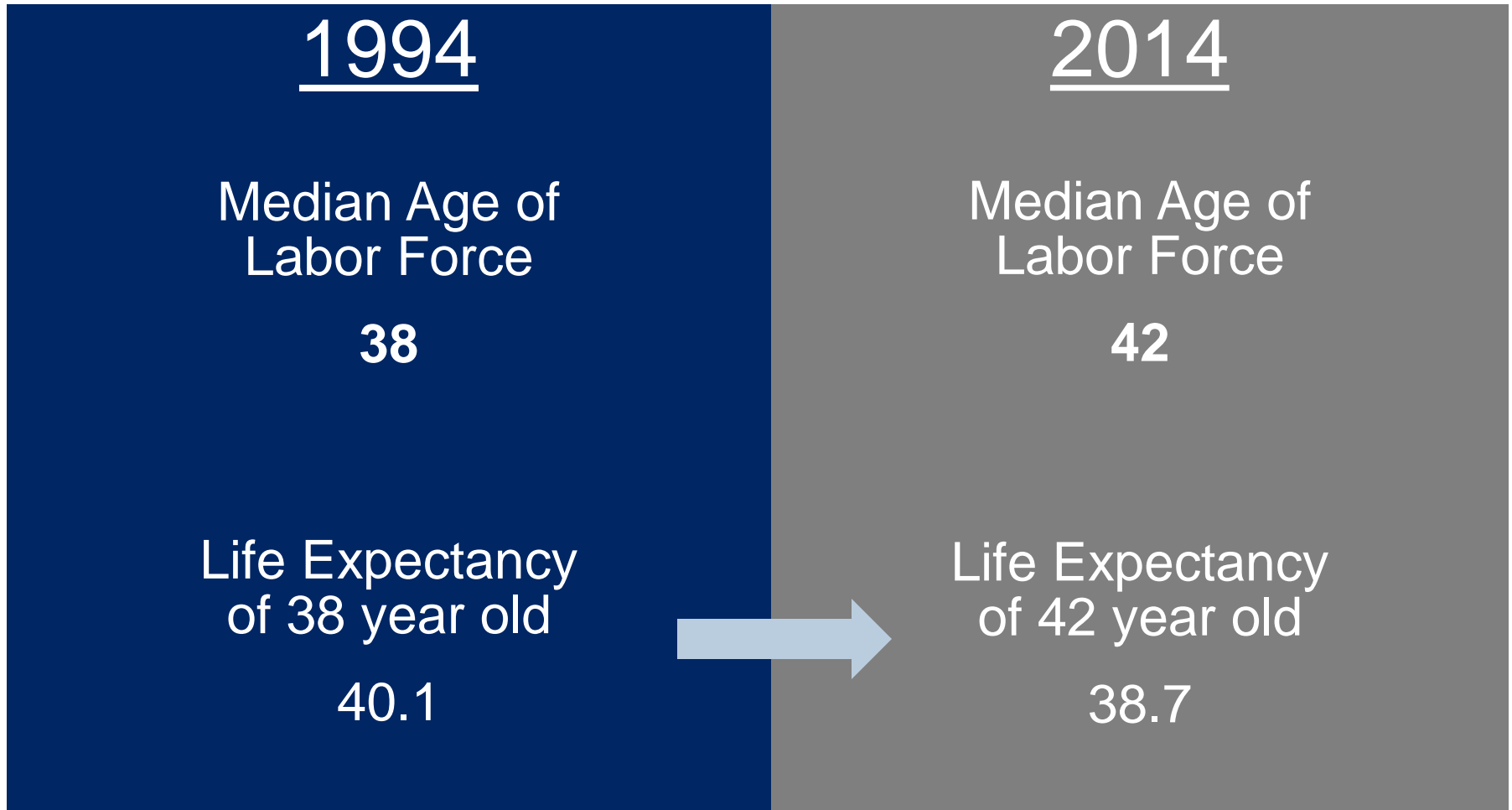


- Likely to work better for short duration claims, like temporary total (TT), where closed claim severities can be used for model parameterization
- Practitioner should be cautious of claims changing categories of injury types (temporary total becomes permanent total)

What happens at the intersection?



A simple example...



Life expectancy of the labor force has decreased!

Claim level models can capture changes in both age of injured worker and life expectancy

- Older accident periods, where open claims are predominantly permanent total injuries, can benefit from individual claim level models

Claim Data for AY 2017, as of 12/31/2031

claim	gender	age*	AY	ann med payments	ann ind payments
1	male	41	2017	30,000	20,000
2	female	40	2017	20,000	10,000
3	male	38	2017	40,000	20,000
4	female	45	2017	35,000	15,000

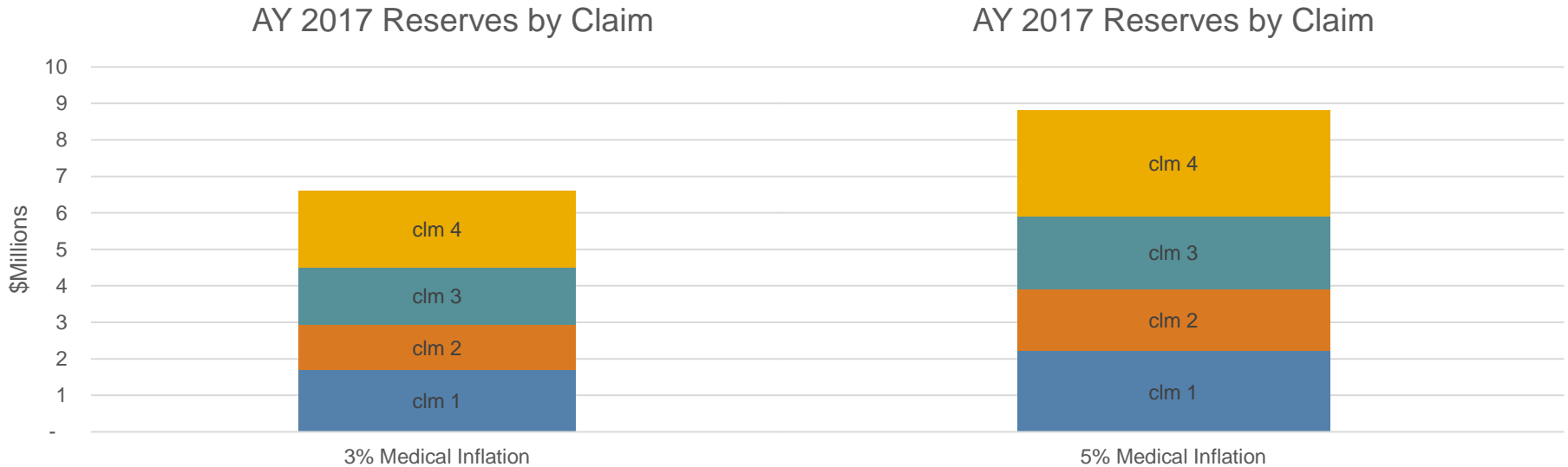
Model future payments

Year	Ind	Med	Total
2032	20,000	30,447	50,447
2033	20,000	31,360	51,360
2034	20,000	32,301	52,301
2035	20,000	33,270	53,270
2036	20,000	34,268	54,268
2037	20,000	35,296	55,296
2038	20,000	36,355	56,355
2039	20,000	37,446	57,446
2040	20,000	38,569	58,569
2041	20,000	39,726	59,726
2042	20,000	40,918	60,918
2043	20,000	42,145	62,145
2044	20,000	43,410	63,410
2045	20,000	44,712	64,712
2046	20,000	46,053	66,053
2047	20,000	47,435	67,435

Apply mortality

Exact Age	Male			Female		
	Death Probability	Number of Lives	Life Expt	Death Probability	Number of Lives	Life Expt
...
45	0.003146	94,739	33.98	0.002005	97,004	37.73
46	0.003447	94,441	33.08	0.002198	96,810	36.81
47	0.003787	94,115	32.19	0.002412	96,597	35.89
48	0.004167	93,759	31.32	0.002648	96,364	34.97
49	0.004586	93,368	30.44	0.002904	96,109	34.06

But, can also be highly sensitive to parameterization



- Claim level analysis enables modeling of explicit assumptions regarding age, inflation, COLA, death/remarriage, reinsurance
- The trade off being, these models can be sensitive to parameters and it can be difficult to project non-regular medical costs (such as durable goods)

Important to Consider Other Changing Conditions

- Regulatory: changes in benefit levels over a historical triangle can be significant
 - NY 2007 reform: capped duration of PPD claims, NYCIRB estimated a reduction of over 6% in 1 year to ultimate indemnity loss development⁶
 - Use of triangle data over 10 years old, without adjustment, will significantly overstate loss development
- Operational:
 - Mix of classes and states
 - Mix of products and plan types (e.g. large deductibles)
 - Claim settlement strategy
 - Use of reinsurance/commutations
- The added data gained by expanding a triangle to include more historical years is accompanied by an increased need to understand changing conditions.

Concluding Thoughts

- Practicing actuaries should consider both increased life expectancy and increased age of injured workers when contemplating longevity
- Impacts differ significantly by injury type, an important consideration when contemplating the type of models to most appropriately represent the effects of longevity
- Changes in the regulatory environment, company operations, and other shifts can be at least as significant as longevity

References

1. Douglas Tattre, Glenn Gotz, Te-Chun Liu. “Workers’ Compensation and the Changing Age of the Workforce” WCRI December 2000
2. Tanya Restrepo and Harry Shuford. “Workers Compensation and the Aging Workforce” NCCI Research Brief December 2011
3. Tanya Restrepo and Harry Shuford. “Workers Compensation and the Aging Workforce: Is 35 the New “Older” Worker?” NCCI Research Brief October 2012
4. David Colón. “The Impact of Claimant Age on Late-Term Medical Costs” NCCI Research Brief October 2014
5. Bureau of Labor and Statics “Nonfatal Occupational Injuries and Illnesses Requiring Days Away From Work, 2014” November 2015
6. New York Compensation Insurance Rating Board “2007 General Rate Revision” October 2007