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CARe Boot Camp: Pricing WC Excess of Loss Reinsurance

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Outline

- Workers Compensation Background
- Experience-Rating WC
  - Premium on-leveling
  - Large Loss Trends
  - Excess Loss Development Factors
  - Excess Benefit Level Changes*
- Exposure-Rating WC
  - Excess Loss Factors
  - Hazard Groups

Background:
Workers Compensation is different

- Mandatory coverage
- Exclusive remedy (no-fault)
- Indemnity (wage replacement)
  - Annuity-type benefits
- Medical
  - Essentially unlimited medical coverage!!
- No "Pain and Suffering"
- No policy limit
- Very little "true" FGU IBNR, but extremely long tail
- Cat-exposed (terrorism, EQ, industrial accident)

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State Differences

- Monopolistic: ND, OH, WA, WY
  - Ex-monopolistic: NV, WV (shorter data)
- Special state reinsurance facility: MN
- Opt-out: TX, OK
- Ability to settle severe claims
  - Indemnity only, Indemnity + Medical, or not at all
- Indemnity benefits/medical payments defined by statute
- State economy
- Residual markets
- Pricing freedom/regulation in general

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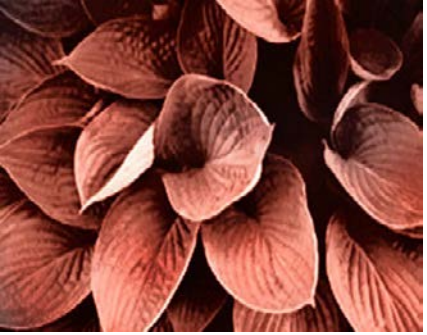
Rating bureau differences

- Other casualty lines: ISO (or nothing)
  - All states covered, data is uniform
- WC
  - NCCI in ~37 states (60% of volume)
  - Large states tend to have independent rating bureaus (CA, NY, …)
- NCCI data: Usually more detailed than ISO
  - Unit stat plan (~CSP);
  - Large loss data/Financial data/Medical data/Proof of Coverage data
  - Annual Statistical Bulletin
  - WorkComp WorkStation
  - Annual Issues Symposium
- Independent bureaus vary, influenced by NCCI (and vice-versa)



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Experience Rating

Premium On-leveling (just a reminder)

- WC is subject to benefit changes
- Occasionally, the benefit changes apply to outstanding claims as well as new claims
- Insurers get mid-term rate changes to adjust for the impact of these changes
- Technique is covered in primary ratemaking . . .
- Most states will not have a benefit change in a given year
  - If you are pricing a treaty covering many states, you may be tempted to ignore or do a rough-and-ready adjustment
  - Cold comfort if the treaty is concentrated in a single state

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Trends

- Trends should be appropriate for the kinds of claims that get into the layer being priced
  - "Large loss" frequency and severity trends
- Ideally, submission will give separate indemnity and medical amounts so severity trends can be applied separately
  - If not, must combine indemnity and medical severity trends to get a combined severity trend
  - Generally, medical is a much large portion of large claims (but not for death)
- The long tail in WC makes measuring trends difficult
- Submission claim reporting threshold should reflect trends
  - After trending, are you missing some claims?

How should trend be applied?

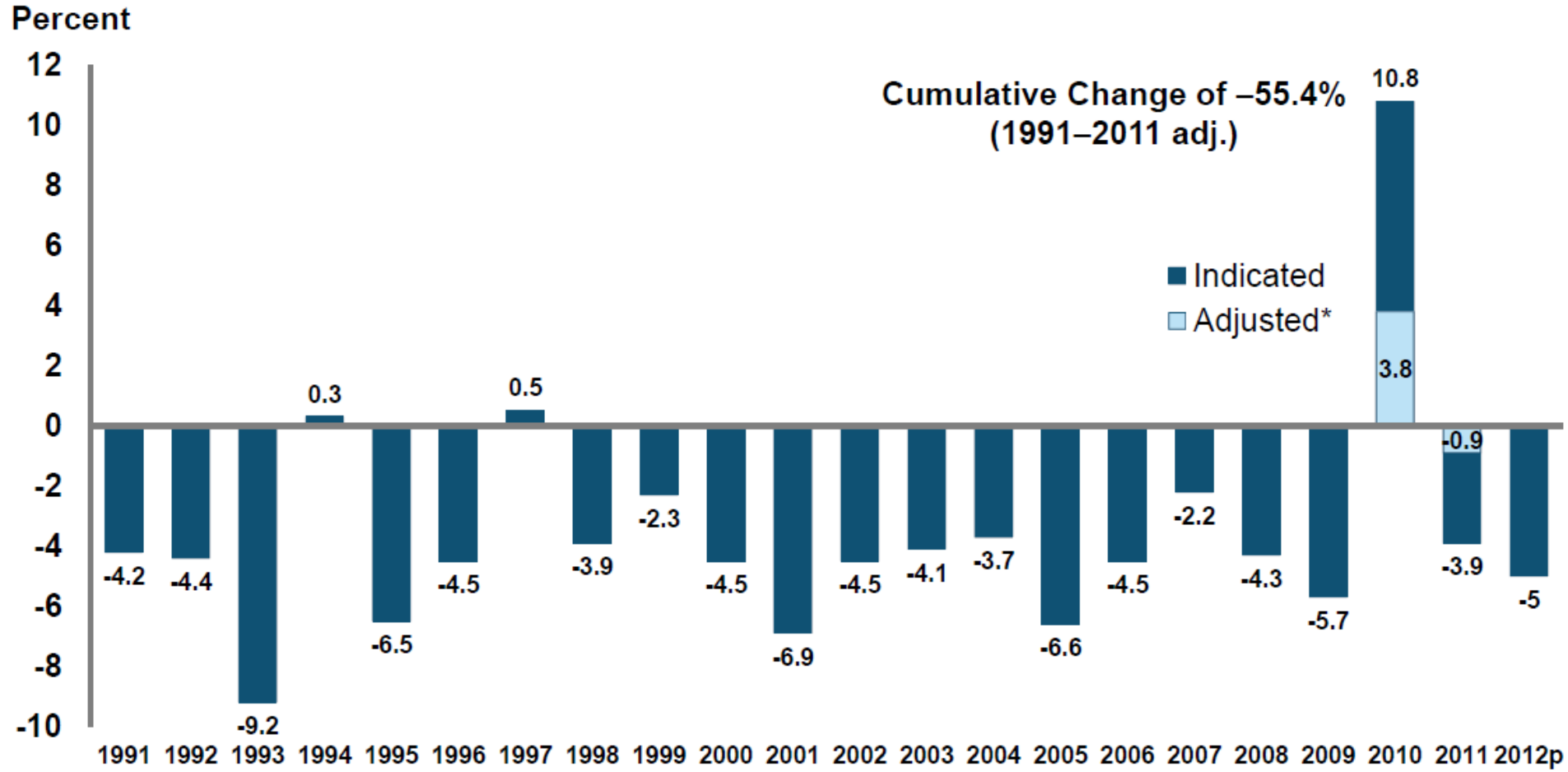
- Indemnity
  - In most states, indemnity amount is fixed at time of injury and stays constant over time
    - So AY indemnity trend makes sense
- Medical
  - Costs of medical will vary by service year
  - Usually just apply AY trends
    - Service year trend changes will show up as development

Frequency Trend

- Lost-time claims per exposure base (e.g. covered workers, covered payroll, on-leveled premium)
- Long-term, frequency trend has been negative
  - AY 2010 blip caused by Great Recession
- NCCI collects USP data by "Injury Type"
  - Fatal, Permanent Total, Permanent Partial, Temporary Total, Medical Only
- In the past, frequency trend varied by injury type
  - Generally the more severe the injury, the less negative the frequency trend
  - This meant that the mix of injury types was changing over time, and overall severity trend was affected
  - Recent experience no longer shows this effect
- Frequency will respond to law changes, economy
  - Large claim response different than small claim response

Workers Compensation Lost-Time Claim Frequency Resumes Historical Downtrend

Slide 11 Source: NCCI. Used with permission.



*Adjustments primarily due to significant changes in audit activity
2012p: Preliminary based on data valued as of 12/31/2012
1991–2011: Based on data through 12/31/2011, developed to ultimate; excludes high deductible policies
Average frequency for the states where NCCI provides ratemaking services, excluding WV; including state funds

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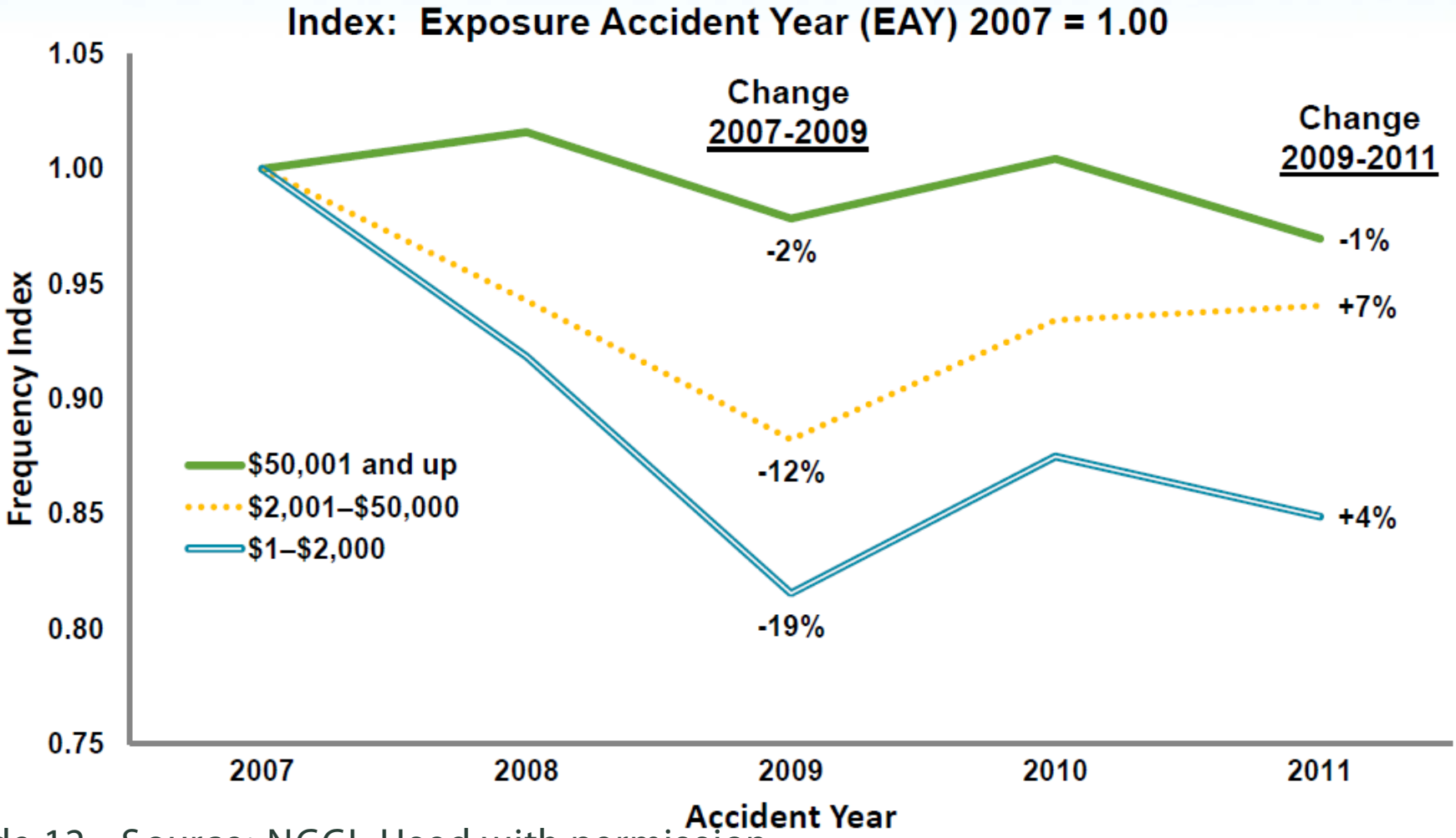
Workers Compensation Lost-Time Claim Frequency Changes by Total Size of Loss



Slide 12 Source: NCCI. Used with permission.

Lost-Time Claim Frequency at 1st report per $M wage adjusted on-leveled premium, *Statistical Plan* data
Premium is on-leveled to average carrier rate by state/class and wage adjusted by state to EAY 2011
Prior to assigning individual claims to size of loss groupings, reported loss amounts are adjusted for inflation to EAY 2011
Average frequency for the states where NCCI provides ratemaking services, excluding WV

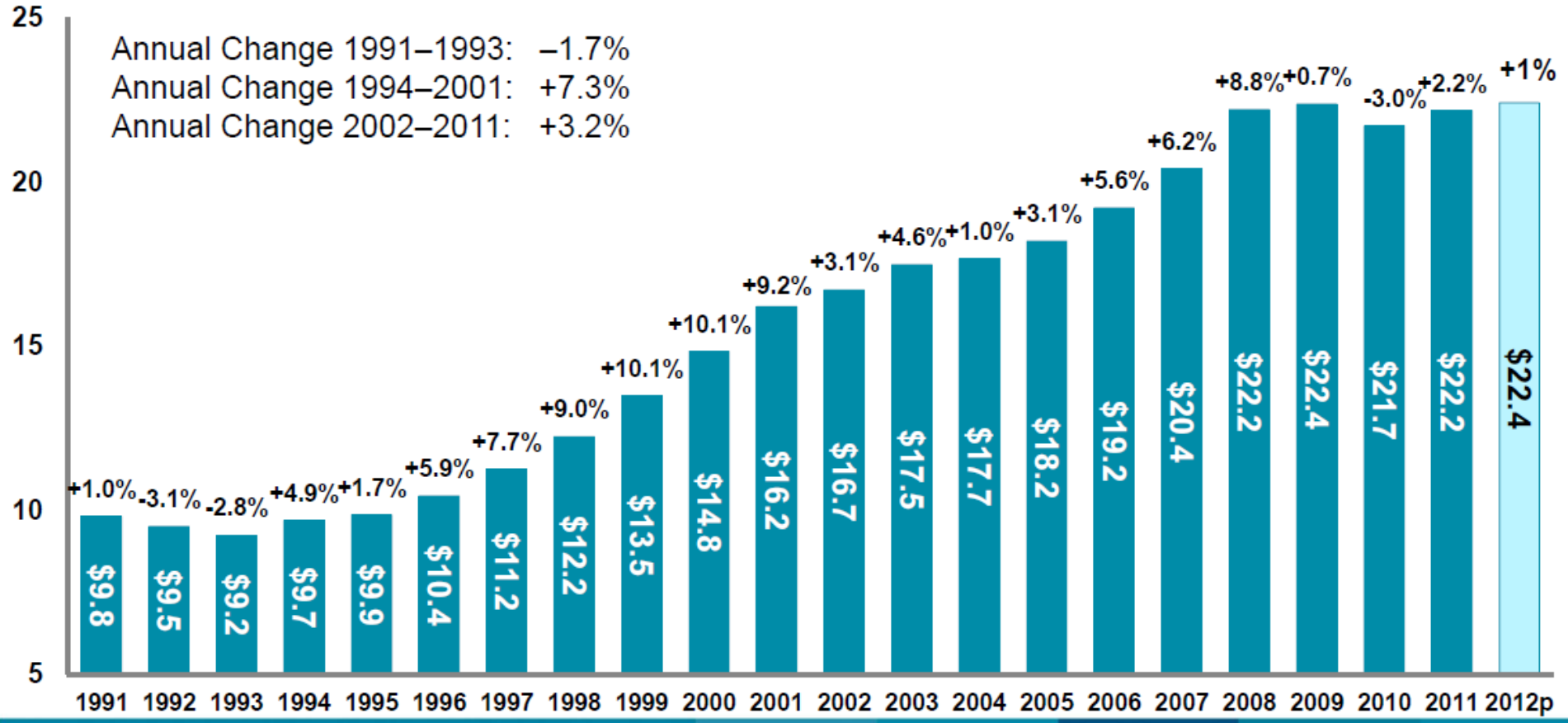
Indemnity Severity Trend

- Law changes often address indemnity levels
  - Measurement and application of trend should reflect benefit changes
- Indemnity severity "should" follow wage inflation
  - BUT: Growth can lag or exceed wage growth
    - Stay out longer/shorter in response to various influences
      - Law change
        - e.g. change in time limit on benefit, given a certain injury
      - Economy ("no job to come back to")
      - Changes in treatment
        - Shift to more outpatient treatments, with quicker return to work
      - Min and max caps on indemnity
    - Big claims less affected?

Workers Compensation Indemnity Claim Costs—Small Increase in 2012

Average Indemnity Cost per Lost-Time Claim

Slide 14 Source: NCCI. Used with permission.



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Average severity for the states where NCCI provides ratemaking services, including state funds; excluding WV

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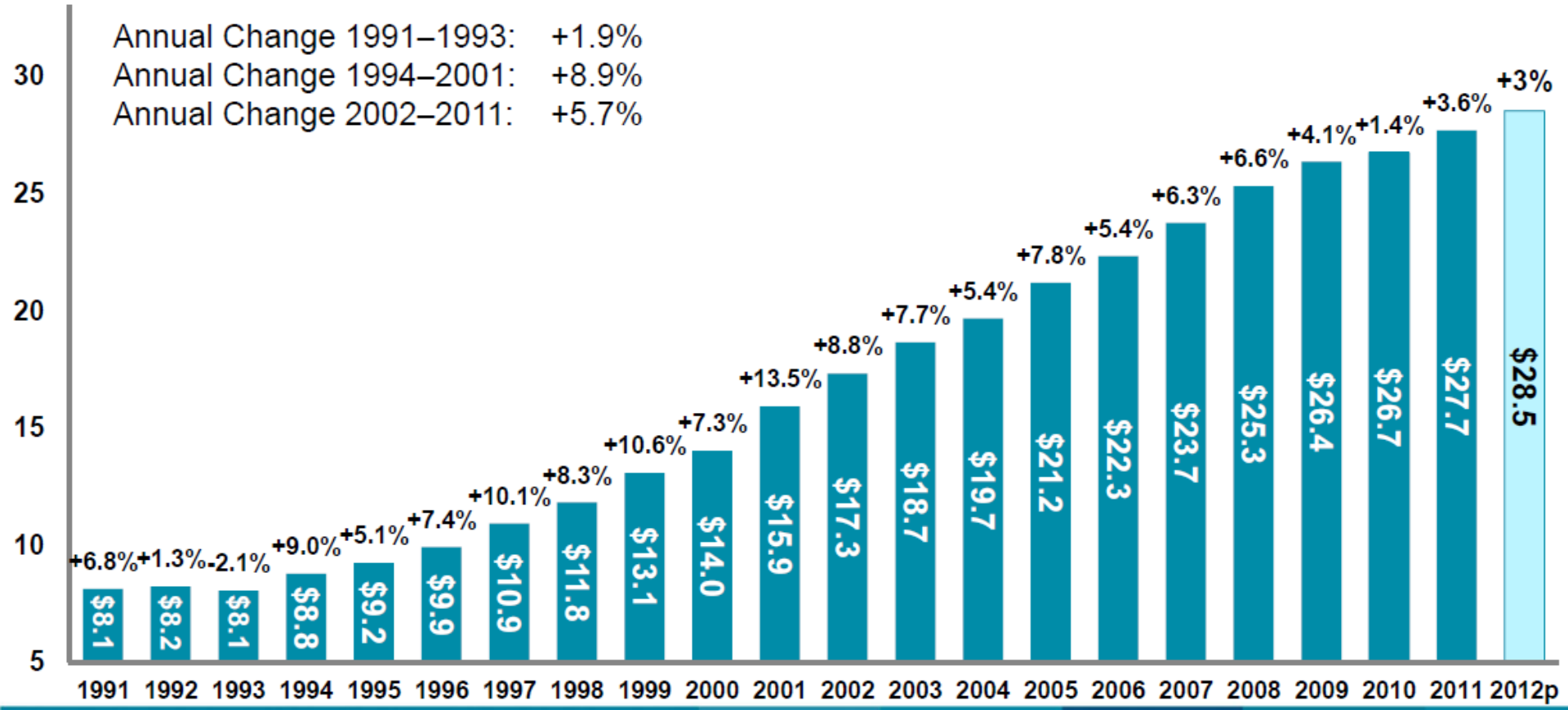
Medical Severity Trend

- WC medical benefit growth has historically been high
- Providers milk the system
  - E.g. drug repackaging; number of treatments for same injury etc.
- Attempts to control growth by states
  - Managed care
  - Provider networks
  - Choice of physician
  - Maximum payment (DRG)
- Mixture of services/goods will vary by injury type
  - Medical data call will make this clearer in future

Workers Compensation Medical Severity—Modest Increase in 2012

Average Medical Cost per Lost-Time Claim

Slide 16 Source: NCCI. Used with permission.



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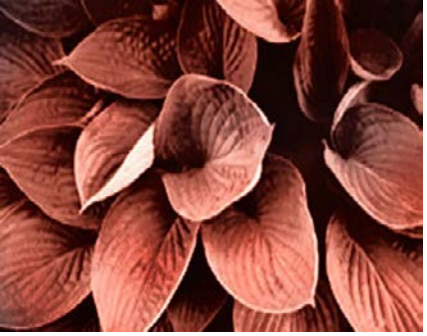

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Excess Loss Development Factors

WC's Long Tail

- Mortality assumptions used in setting reserves
- Claims often develop adversely quite late
  - Family stops taking care of claimant
  - Back injuries "creep" into the layer

Example of Impact on Reinsurer

- An injured worker is expected to live 10 years.
- Weekly indemnity benefits are 500/wk = 26,000/yr
- Initial stabilizing medical expenses are 150,000
- Annual medical expenses are 50,000/yr
- Initial case reserve = 150k+(26k+50k)*10 = 910k
- One would expect the loss to the 1Mx1M reinsurer to be zero.

Effect of Medical Inflation

- Suppose that instead of the ongoing medical expenses being 50k/yr, they are really inflating at 6% per annum.
- The primary company still books the ongoing medical loss at 500k, implicitly discounting them at 6%/yr.
- Total undiscounted ongoing medical expenses are really 659k = $50k*(1.06^{10}-1)/.06$, instead of the booked 500k
- The total undiscounted loss is 1,069k, and the 1Mx1M reinsurer will see 69k of development
- Imagine if the time horizon was longer!

Mortality Assumption Effect

- Back to the original example (no growth in medical costs), however, instead of a certain 10 year survival, there was a 50% probability of this worker living only 5 years and 50% of living 15 years.
- Losses paid if the claimant lives 5 years = 530k = 150k+(26k+50k)*5
- Losses paid if the claimant lives 15 years =1,290k = 150k+(26k+50k)*15
- With 50% probability, the 1Mx1M reinsurer will see 290k development

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Another Example

Discount rate = 6%

Time	Probability of making payment	Payment	Primary Payment	Reinsurer Payment XS of $1M	Discounted Primary Payment	Discounted Reinsurer Payment XS of $1M
0	100%	50,000	50,000	-	50,000	-
1	95%	53,000	53,000	-	50,000	-
2	90%	56,000	56,000	-	49,840	-
3	86%	59,000	59,000	-	49,538	-
4	81%	63,000	63,000	-	49,902	-
5	77%	67,000	67,000	-	50,066	-
6	74%	71,000	71,000	-	50,052	-
7	70%	75,000	75,000	-	49,879	-
8	66%	80,000	80,000	-	50,193	-
9	63%	85,000	85,000	-	50,311	-
10	47%	90,000	90,000	-	50,256	-
11	35%	95,000	95,000	-	50,045	-
12	27%	101,000	101,000	-	50,194	-
13	20%	107,000	55,000	52,000	25,786	24,380
14	15%	113,000	-	113,000	-	49,980
15	11%	120,000	-	120,000	-	50,072
16	8%	127,000	-	127,000	-	49,993
17	6%	135,000	-	135,000	-	50,134
18	5%	143,000	-	143,000	-	50,099
19	4%	152,000	-	152,000	-	50,238
20	3%	161,000	-	161,000	-	50,201
21	0%	171,000	-	171,000	-	50,301
Expected		706,190	629,320	76,870	460,553	30,909
					0.7318	0.4021

Discounting

- Discounting of case reserves prevalent
  - Explicit (lifetime pension cases)
  - Implicit (by not inflating projected future payments)
- Effect of discount can be quite large on an excess layer

Default LDFs

- Case reserving varies widely from co. to co.
  - Include future inflation? Discounted? How is remaining lifetime estimated?
- NCCI development study
  - Not to ultimate; strange trend
- RAA data
  - Is not meant for pricing, reflects reserving needs
    - Triangles include many distortions
      - ACRs, negative paid development
      - Retrocessions, LPTs, commutations, "structured" deals
      - Missing data of reinsurers that failed
        - Did they fail due to adverse development?

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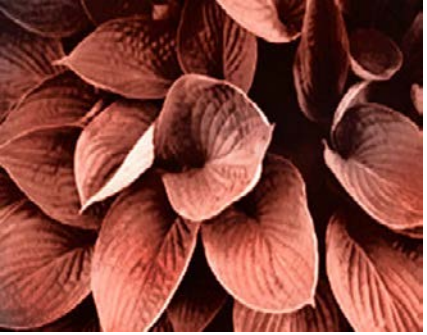
RCRs and ACRs

- RCR: "Reported Case Reserve"
  - Case reserve set up by the insurer
- ACR "Additional Case Reserve"
  - Additional case reserve set up by the reinsurer
  - EXAMPLE
    - Paid = 500,000 O/S = 500,000 (this is the RCR)
    - Reinsured Layers = 500 x 500, 1M x 1M
    - ACRs might be - 100 for 500 x 500, and + 100 for 1M x 1M
      - Claimant might die tomorrow, so expected loss to 500x500 can't be 100%
      - Claimant might live long past expected lifetime, so expected loss to 1M x 1M is not zero

Key Takeaways

- Beware of medical inflation!
- Watch longevity!
- Think hard about impacts of distortions in data



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Excess Loss Factors

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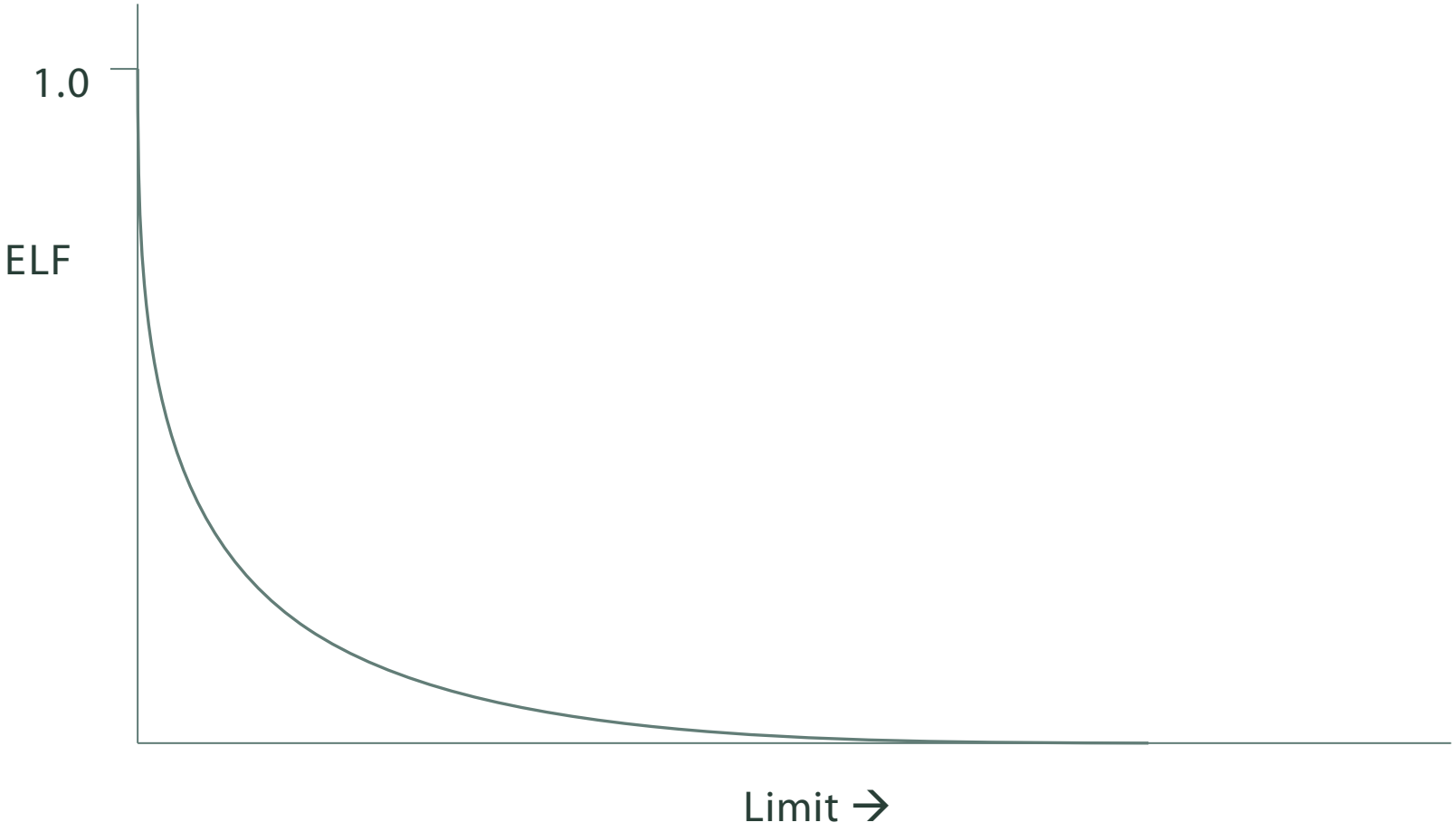
What is an ELF?

- Retrospectively rated risks may buy a limitation on the losses entering the retro calculation—the ELF is used to price the limitation
- ELFs come in various flavors:
  - (estimate of losses saved)/(total losses)
  - Same, but with premium in the denominator
  - Same, but with ALAE included
  - . . .

What an ELF curve looks like



ELF formula

- L = loss random variable
- f(x) = pdf of L
- d = loss limitation (a constant, not random)
- ELF(d) = (expected amount of loss > d) / mean(loss)
- ELF(d) = E(max(0,L-d)) / E(L)

$$= \int_0^\infty \max(0, x-d) f(x)\, dx \,/\, \int_0^\infty x f(x) dx$$

ELF vs. ILF

- ILF is used to price increased limit of cover

  Losses at policy limit (+ associated costs) divided by

  Basic Limit Losses + (associated costs)

- ELF
  - Assumes unlimited mean exists. (ILF does not necessarily.)
  - Does not include any adjustment for parameter uncertainty
  - Describes loss behavior using E(losses saved)/E(losses)
- Both
  - Use underlying severity distribution
  - Are created by rating bureaus for primary insurers
  - Do not reflect concerns of reinsurers
    - Embody bureau assumptions about trend, development, etc.

Subtract ELFs to estimate layer losses

- Example
  - Assume you have ELFs that you are happy with
  - Suppose we're pricing the $1M xs $1M layer
  - Expected Loss Ratio = 75%
  - ELF(1M) = 0.13; ELF(2M) = 0.06
  - Losses in the layer = ELF(1M) – ELF(2M) = 7.0%
  - 7.0% of the total losses are in this 1M xs 1M layer
  - Exposure Loss Cost Rate = 75% * 7.0% = 5.25%
  - This still needs to be discounted and loaded

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How NCCI constructs ELFs

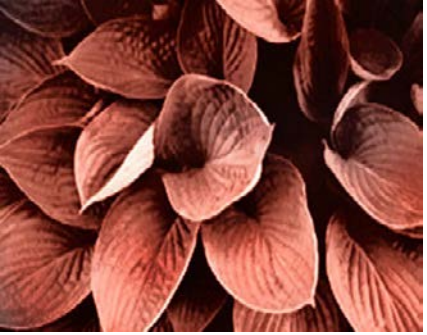
- Creates "partial ELFs" for each Injury Type in a state
- Adjusts the curves to the HG level using Average Costs per Case (ACCs)
- Weights the curves together using loss weights specific to the HG in the state

Example: Constructing an ELF

Injury Type	ACC	ELF(1M)	Inj Type Weight
Fatal	250,000	0.2385	3%
PT	1,000,000	0.5677	11%
Major PP	250,000	0.1395	44%
Minor PP	50,000	0.0001	16%
TT	10,000	0.0000	21%
Med Only	500	0.0000	5%
Overall		0.1310	100%

Hazard Groups

- Groups created by NCCI, adopted by other bureaus
- HG A is least severe, G is most severe
- Which classes are mapped into which HG?
  - Each state uses a unique set of classes
    - There should be much commonality, especially in NCCI states
  - Can tell that some states use a radically different mapping
    - Volume in most states in HG A: 2% to 7%
    - Volume in California in HG A: More than 25%
    - Volume in Texas in HG A: Less than 0.5%



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Excess Benefit Level Changes

Excess of Loss Treaties Benefit Changes

- Most benefit changes are small, increase in maximum weekly benefit, change in burial allowance, etc.
- Large changes occur rarely, but sometimes in quick succession – impact by injury type can vary
  - California AB 749 January 1, 2003 PT Benefit Impact +54%, Overall Impact +5%
  - California AB 227, SB 228 January 1, 2004, Overall Impact -9%
  - California SB 899 April 19, 2004 Overall Impact -20%, January 1, 2005 Overall Impact -14%
  - California January 1, 2006 Fatal Benefit Impact + 50%, Overall Impact +3%

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Excess of Loss Treaties
Benefit Changes by Retention

	"Retention"	Fatal	PT	Major	Minor	TT	Med Only
		partial ELFs					
HG 1	500,000	0.424	0.653	0.136	0.000	0.000	0.000
HG 2	500,000	0.447	0.675	0.146	0.000	0.000	0.000
HG 3	500,000	0.517	0.742	0.174	0.000	0.000	0.000
HG 4	500,000	0.539	0.759	0.202	0.000	0.001	0.000
		Contributions to loss above retention					
HG 1	500,000	3%	33%	64%	0%	0%	0%
HG 2	500,000	4%	35%	61%	0%	0%	0%
HG 3	500,000	8%	35%	57%	0%	0%	0%
HG 4	500,000	9%	31%	60%	0%	0%	0%

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Excess of Loss Treaties
Benefit Changes by Retention

	"Retention"	Fatal	PT	Major	Minor	TT	Med Only
		partial ELFs					
HG 1	2,000,000	0.198	0.421	0.010	0.000	0.000	0.000
HG 2	2,000,000	0.210	0.440	0.011	0.000	0.000	0.000
HG 3	2,000,000	0.251	0.500	0.014	0.000	0.000	0.000
HG 4	2,000,000	0.265	0.518	0.018	0.000	0.000	0.000
		Contributions to loss above retention					
HG 1	2,000,000	5%	80%	16%	0%	0%	0%
HG 2	2,000,000	7%	79%	14%	0%	0%	0%
HG 3	2,000,000	11%	75%	14%	0%	0%	0%
HG 4	2,000,000	14%	70%	16%	0%	0%	0%

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Q&A

Acknowledgement

- This presentation is an adaption of a presentation originally created by Gerald Yeung

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Thank you

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Appendix 1: Severity Trend, distorted by shifts in mix

- If small claim frequency is dropping at a faster rate than large claim frequency:
  - Measured ground-up severity trend will increase from the reduced frequency of the smaller claims
  - Assuming uniform trend by size of loss, the measured large loss trend will be lower than the measured ground-up trend

Example

- Two types of claims, small and large.
- In year 1, small claims have average severity of 100k, while large claims have average severity of 500k.
- In year 1, there are an equal number of small and large claims, say 50 of each claim
- Average Severity in year 1 is 300k

  = (50*100k + 50*500k)/(50+50)

Example, continued

- In year 2, there are now 40 small claims (frequency trend = -20%), while there are still 50 large claims (0% frequency trend). Total frequency trend = -10%
- The average severity for each claim type increases 10%
  - Small claim severity = 110k
  - Large Claim Severity = 550k
- But, the measured overall severity is now 354k

  = (40*110k+50*550k)/(40+50)

  This is an 18% increase!

Appendix 2: Excess Loss Factors (ELFs)

$$ELF(x) = 1 - [LEV(x)/E(X)]$$

$$= 1 - \text{Loss Elimination Ratio at } x$$

The "x" is an entry ratio, so E(X) is, by definition, unity.