

Mortality and Expense Studies

SOA Spring Meeting – San Antonio

Session 29 PD

June 14, 2004

Introduction and Overview

SOA Inter-Company Individual Life Mortality Study
– Sharon Brody

SOA Inter-Company Individual Life and Annuity
Expense Study
– Sam Gutterman

Experience Study Considerations
– Chris Noyes

Moderator – Mary Broesch

Individual Life Mortality

Sharon Brody, FSA, MAAA
Prudential Financial, Inc.

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Mortality Under Standard Individually Underwritten Life Insurance Between 1995 and 2000 Policy Anniversaries Report of the Individual Life Experience Committee

- ◆ **Introduction**
- ◆ **Overview of Results**
- ◆ **Individual Years – Select Period Experience**
 - Non-smoker/smoker
 - Medical Basis
 - Issue Age
 - Amount Band
 - Sex
- ◆ **Five Year Study – Select Period Experience**
- ◆ **Additional Non-smoker/smoker details**
- ◆ **Ultimate Experience**
- ◆ **Next Steps for ILEC**

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Introduction

- ◆ Twelve companies contributed data to the Society of Actuaries (SOA) for some years.
- ◆ Eight companies contributed in every year of the study.
- ◆ This level of contribution is consistent with the 1995-96 study, but is down considerably from the 15-20 companies that contributed in earlier studies.
- ◆ The SOA is actively pursuing increasing the number of contributors and anticipates twenty or more companies for future reports.
- ◆ Overall level and trends should be viewed with caution due to the small number of companies and changing mix.

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Introduction

- ◆ The ratios of actual to expected mortality are based on the 1975-80 Basic Tables and the 2001 Valuation Basic Tables (VBT).
- ◆ Select period experience is experience in durations 25 and prior. Ultimate is defined as durations 26 and later.
- ◆ The 2001 VBT has smoker distinct bases. The 2001 VBT was basis for the 2001 CSO. Underlying data was based on 90-95 SOA data supplemented at higher ages and projected forward.
- ◆ A/E ratios using the 2001 VBT are calculated using the smoker distinct versions of the table when the smoking status is known.
- ◆ The lack of separate tables by smoking status causes differences because different mixes of nonsmoker, smoker, and unknown smoking status are weighted with the same mortality rate. 2001 VBT is a current better method.

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Overview of Results Select Period Experience

1995-00 Select Period Experience					
A/E Ratios by Face Amounts Based on 2001 VBT					
Combined Males, Females, Nonsmoker, Smoker and Unknown Smoker					
1995-96	1996-97	1997-98	1998-99	1999-00	1995-00
90.4%	92.2%	87.4%	84.3%	83.5%	87.2%
A/E Ratios by Face Amounts Based on 1975-80 Basic Tables					
Combined Males, Females, Nonsmoker, Smoker and Unknown Smoker					
1995-96	1996-97	1997-98	1998-99	1999-00	1995-00
66.5%	66.7%	62.7%	60.6%	59.3%	62.6%

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Overview of Results Select Period Experience

- ◆ Overall select period mortality experience decreased significantly over the individual years in the study.
- ◆ The A/E ratios using the 2001 VBT appear low given the fact that the 2001 VBT has been projected forward to the year 2001.
- ◆ Decrease partially driven by trend towards higher face amount policies with more underwriting requirements.
- ◆ Generally, male improvement is greater than female improvement.
- ◆ Improvement is greater for younger issues ages.
- ◆ Smoker mortality did not improve.

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Overview of Results Ultimate Experience

1995-00 Ultimate Period Experience						
A/E Ratios by Face Amount Based on 2001 VBT						
Combined Nonsmoker, Smoker and Unknown Smoker						
	1995-96	1996-97	1997-98	1998-99	1999-00	1995-00
Male	112.9%	103.8%	100.4%	99.6%	96.5%	102.2%
Female	120.9%	106.2%	114.1%	111.8%	112.3%	112.8%

1995-00 Ultimate Period Experience						
A/E Ratios by Face Amount Based on 1975-80 Basic Tables						
Combined Nonsmoker, Smoker and Unknown Smoker						
	1995-96	1996-97	1997-98	1998-99	1999-00	1995-00
Male	83.4%	77.9%	75.5%	75.1%	72.8%	76.7%
Female	94.8%	84.7%	90.6%	88.9%	89.1%	89.4%

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Overview of Results Ultimate Experience

- ◆ Overall A/E ratios also decreased with rate of improvement higher for males.
- ◆ The ratios are much higher than the select period ratios.
- ◆ Ratios may be indicative of lack of credible data particularly for females in development of the 2001 VBT and also the emphasis of smoothness over fit.

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Individual Years Select Period Experience

One Year Study Periods for 1995-00 Select Period Experience					
Combined Males, Females, Nonsmoker, Smoker and Unknown Smoker					
A/E Ratios by Face Amounts Based on 2001 VBT					
	1995-96	1996-97	1997-98	1998-99	1999-00
Total	90.4%	92.2%	87.4%	84.3%	83.5%

- ◆ Overall mortality is both decreasing and below the levels anticipated by the 2001 VBT.
- ◆ Over the period from 1995-2000, the decline is in the range of from 1.5% to 2% per year.

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Individual Years Select Period Experience

One Year Study Periods for 1995-00 Select Period Experience by Smoking Habit					
Combined Males and Females					
15 Year Select Period; A/E Ratios by Face Amounts Based on 2001 VBT					
Smoking Status	1995-96	1996-97	1997-98	1998-99	1999-00
Nonsmoker	87.4%	91.5%	86.1%	83.5%	80.6%
Smoker	93.1%	106.0%	99.2%	99.7%	98.0%

- ◆ The decrease in mortality is concentrated in nonsmokers.
- ◆ Over the one year study periods from 1995-2000, the smoker mortality does not indicate any clear improving trend.

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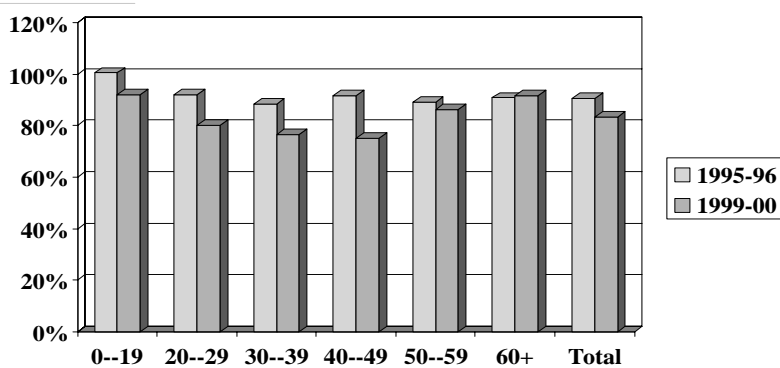
By Medical Basis

Combined Males, Females, Nonsmoker, Smoker and Unknown Smoker					
A/E Ratios by Face Amounts Based on 2001 VBT					
Medical Basis	1995-96	1996-97	1997-98	1998-99	1999-00
Medical	85.8%	81.7%	82.3%	77.2%	75.9%
Paramedical	89.7%	97.5%	87.8%	86.3%	84.0%
Non-medical	100.8%	103.4%	96.4%	93.7%	95.3%
Total	90.4%	92.2%	84.4%	84.3%	83.5%

- ◆ The results support expectation that increased underwriting results in lower A/E ratios.
- ◆ There is improvement in each category, but greatest for medical.

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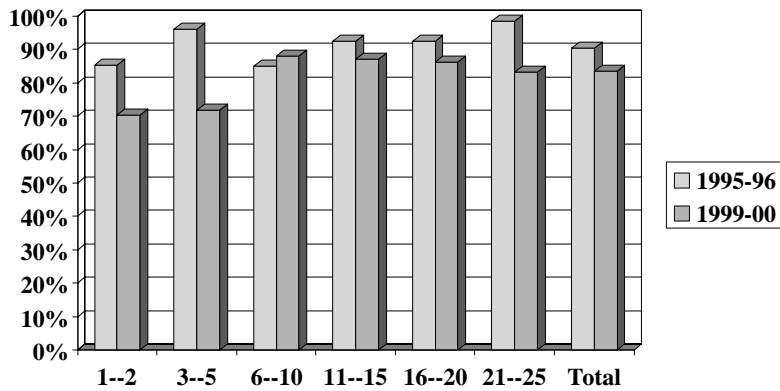
By Issue Age



- ◆ A/E ratios decrease in every issue age group except for 60+
- ◆ Improvement is greatest at issue ages 20-49

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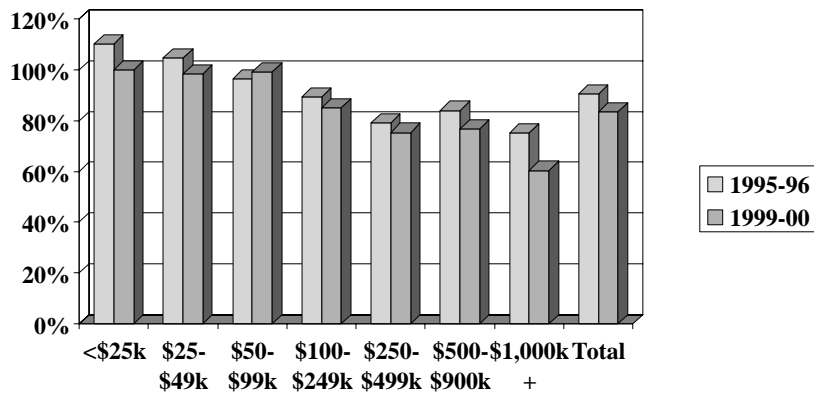
By Policy Year



- ◆ Improvement in the A/E ratios for all policy year groupings except 6-10.
- ◆ The largest percentage improvements occurred in both policy years 1-2 and 3-5.

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By Amount Bands



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By Amount Bands

- ◆ Within each study year, there is a general pattern of decreasing A/E ratios as amount bands increase for all years in the study (except for some expected fluctuations in the highest amount bands).
- ◆ Within each amount band, there is a general pattern of improvement.
- ◆ There has been a noticeable shift over the individual years in the study towards higher face amount policies. Policies with face amounts \$250,000 and over comprised about 37% of the exposure in 1995-96 and 48% in 1999-00.
- ◆ Based on shift in exposure, the decrease in overall A/E ratios during the study period is partially driven by a trend towards higher face amount policies with more underwriting requirements.

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By Sex

One Year Study Periods for 1995-00 Select Period Experience by Sex					
Combined Nonsmoker, Smoker and Unknown Smoker					
A/E Ratios by Face Amounts Based on 2001 VBT					
Sex	1995-96	1996-97	1997-98	1998-99	1999-00
Male	91.1%	93.5%	87.5%	83.4%	83.3%
Female	87.8%	87.9%	86.8%	87.3%	83.9%
Total	90.4%	92.2%	87.4%	84.3%	83.5%

- ◆ A/E ratios generally improved over the one year study periods from 1996-2000 for both males and females.
- ◆ Overall, male mortality had slightly greater improvement as A/E ratios improved from 91.1% in 1995-96 to 83.3% in 1999-00

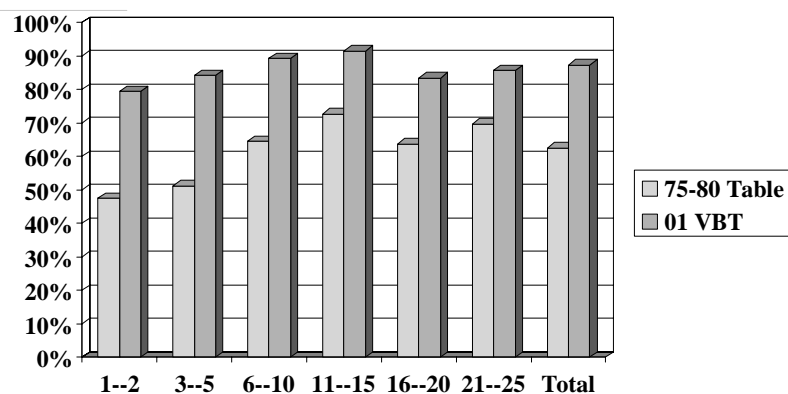
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Five Year Study Select Period Experience

- ◆ This portion of the study makes comparisons of 1995-2000 aggregate data versus 1991-1996 data. Also examined some additional drilldown categories using five years combined data.
- ◆ Results are consistent with trends in 1995-2000 individual year results.
- ◆ The results reflect a 15% decrease in overall mortality compared to the 1991-96. Male improved 15% while female experience improved 12%.
- ◆ Issue age groups 20-29, 30-39, and 40-49 experienced the most improvement for both males and females over the 1991-96 study (15-20%).
- ◆ Again, results should be viewed with caution. The improvement can also be attributed to a trend towards higher face amount policies with more underwriting requirements.

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By Policy Year



- ◆ Mortality experience by duration has a much steeper slope in the ratios using the 1975-80 Basic Table (increasing from 47.4% in durations 1-2 to 72.6% in durations 11-15) compared to the 2001 VBT due to the steeper slope built into the 2001 VBT.

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By Amount Bands Select Period Experience from 1995-00

Males, Females, Smokers, Nonsmokers, and Unknown Smoking Combined
A/E Ratios by Face Amount

Amount Band	Ratio to 1975-80 Basic Table	Ratio to 2001 VBT
<\$25,000	91.3%	106.4%
\$25,000-\$49,999	80.4%	100.2%
\$50,000-\$99,999	76.9%	99.9%
\$100,000-\$249,999	61.9%	87.4%
\$250,000-\$499,999	50.9%	76.2%
\$500,000-\$999,999	49.8%	75.4%
\$1,000,000+	50.5%	74.6%
Total	62.6%	87.2%

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By Amount Bands

- ◆ A/E ratios generally decrease by policy size.
- ◆ More comprehensive underwriting requirements are used at the larger amount bands compared to the smaller amount bands.
- ◆ Using 1975-80 Basic tables, the prevalence of smokers decreases with increasing policy size causing lower overall mortality.
- ◆ Notice the smaller reduction in mortality at the larger sizes using the 2001 VBT Table since the 2001 VBT employs smoker-distinct mortality rates.

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Smoker-Nonsmoker Experience

- ◆ Overall, nonsmokers experienced a significant improvement over the five year study period. The highest rates of improvement occurred for issue ages less than fifty, early policy durations (1-5), for males, and policies with face amounts \$500,000 – \$999,999.
- ◆ The smoker mortality does not indicate any clear improving trends.
- ◆ Experience based on first fifteen policy durations only.
- ◆ See detailed report for more information.

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Smoker-Nonsmoker Experience

A measure used in previous reports is the ratio of smoker to nonsmoker mortality. Increasing ratio highlights that the differences or lack of mortality improvement for smokers.

Study Period	1975-80 Ratio	2001 VBT Ratio **
1994-95	2.27	N/A
1995-96	2.23	2.17
1996-97	2.41	2.34
1997-98	2.39	2.31
1998-99	2.48	2.38
1999-00	2.55	2.41
1991-96	2.22	N/A
1995-00	2.42	2.33

**To obtain a similar measure as the 1975-80 Ratio, the Ratio of smoker to nonsmoker mortality for the 2001 VBT was calculated by using the nonsmoker table as the expected basis for both smokers and nonsmokers and taking A/E Smoker / A/E Nonsmokers.

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Smoker-Nonsmoker Experience By Issue Age and Sex

Issue Age	1975-80 Male Ratio	1975-80 Female Ratio
20-29	1.95	1.71
30-39	2.53	2.16
40-49	2.70	2.57
50-59	2.63	2.87
60+	1.93	1.97
Total	2.43	2.36

◆The ratio of smoker to nonsmoker mortality increases by issue age from the earliest ages where it is close to 2.0 until issue ages 40-49 for males where the ratio peaked at 2.70 and issue ages 50-59 for females where the ratio peaked at 2.87.

◆Ratio is then lower at older issue ages (60+).

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Smoker-Nonsmoker Experience By Policy Year

1995-00 Select Period Experience	
Policy Year	1975-80 Ratio
1-2	2.49
3-5	2.42
6-10	2.46
11-15	2.23

The 1995-00 study shows a significantly lower ratio of smoker to nonsmoker mortality for policy years 11-15 and similar ratios within durations 1-10.

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Ultimate Experience (Policy Years 26 and over)

Between 1995-2000 Anniversaries, Smoker, Nonsmoker and Unknown Combined

Attained Age	A/E 2001 VBT Male	A/E 2001 VBT Female	Avg. Policy Duration Male	Avg. Policy Duration Female
Under 30	80.8%	65.2%	27.3	27.3
30-39	128.7%	114.7%	31.0	31.0
40-49	106.8%	104.2%	34.2	34.8
50-59	87.4%	81.2%	35.8	36.9
60-69	90.6%	95.6%	37.7	38.8
70-79	105.6%	114.8%	40.9	41.9
80-89	107.1%	123.6%	45.7	46.0
90+	107.4%	117.8%	53.5	50.9
Total	102.2%	112.8%	39.9	40.2

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Ultimate Experience (Policy Years 26 and over)

- ◆ The A/E patterns are quite similar for both sexes.
- ◆ Looking at the 2001 VBT comparison, the under 30 age group is well below the expected basis, but then spikes upwards of 100% for attained age groups 30-39 and 40-49. This is likely due, at least in some part, to AIDS claims at these ages. The majority of the impact of AIDS claims was removed in the development of the 2001 VBT.
- ◆ Another cause of the high ratios for attained ages 30-49 could be selective lapsation since these policies were originally issued to relatively young policyholders. The data in these early age groups is also limited.

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Ultimate Experience (Policy Years 26 and over)

- ◆ The A/E ratios then dip below 100% for the next 2 age groups (50-59, 60-69) before climbing back above 100% for the balance of the older ages.
- ◆ The average duration of policies exposed increases with increasing attained age.
- ◆ Current ultimate experience is higher than anticipated in the VBT. The ultimate section of the 2001 CSO (of which the 2001 VBT was the starting point) is intended for the ultimate experience of currently issued policies under current underwriting standards.

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Ultimate Experience (Policy Years 26 and over)

1995-2000 Ultimate Experience (Policy Years 26 and over) By Premium-paying Status

1975-80 Basic Table			2001 VBT		
Premium-paying	Paid-Up	Ratio	Premium-paying	Paid-Up	Ratio
56.2%	70.2%	1.25	74.5%	92.2%	1.24

- ◆ The table above shows results for the five year study period for policies designated as either Premium-Paying or Paid-Up.
- ◆ Paid-Up policies do not include policies in a Reduced Paid-Up status or Extended Term Insurance. The results indicate Paid-Up policies experienced higher mortality, a trend which has been noticed in previous reports.

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Next Steps for ILEC

- ◆ **Coordination with findings of Mortality Studies Working Group**
- ◆ **Publish Annual Ordinary Study on a regular and predictable schedule**
- ◆ **New Mortality Data Delivery Paradigm**
 - **Pivot tables**
 - **Other Customized Analysis in Longer Term**
- ◆ **Preferred Mortality**
- ◆ **Older Age/Ultimate Mortality**

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Society of Actuaries' Inter-company Expense Study

June 2004 San Antonio SoA Meeting

Sam Gutterman, FSA, FCAS

SoA's inter-company expense study Agenda

- Background
- Methodology
- 2001 study
- 2002 study status
- Future

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SoA's inter-company expense study **Background**

- Committee on Life Insurance Company Expenses (CLICE)
 - Formed in 2000
 - First project – reviewed work of predecessor GRET POG
 - Especially problems with previous GRET – primarily due to reliance on Annual Statement information
 - Sponsored
 - CE sessions, Segal paper and Pedoe prize for top papers
 - Surveyed expense needs
 - Determined a need for publicly available inter-company benchmarks
 - Lack of publicly available expense information
 - Emphasis on data useful for pricing
 - First priority – individual life/annuities; followed by group

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SoA's inter-company expense study **2001 study**

- Initial emphasis on individual life and annuities
 - Fixed permanent life
 - Term
 - Variable life
 - COLI*
 - BOLI*
 - Fixed deferred annuities
 - Variable deferred annuities
 - Fixed immediate annuities
 - Variable immediate annuities*

* Insufficient contributions to publish

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SoA's inter-company expense study 2001 study

- Distribution channels:
 - Brokerage
 - Career
 - Direct response
 - Financial institutions
 - Multi-line
 - PPGA
 - Stockbrokers
 - Other / unallocated
- Not all combinations published due to lack of sufficient number of contributors

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SoA's inter-company expense study 2001 study

- 27 companies contributed
- Aggregate volume
 - Inforce policies: 31 million life, 4.5 million annuities
 - Expenses: \$4.9 billion life, \$2.3 billion annuities
- Results published in summer of 2003 from 2001 experience
- General overhead identified as a significant percent of reported expenses:
 - 29% of total – life insurance
 - 40% of total less commissions – life insurance
 - 13% of total – annuities
 - 31% of total less commissions – annuities

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SoA's inter-company expense study 2001 study and GRET differences

- The 2001 study
 - Privately provided data
 - Derives unit expenses by functional expense allocations
 - Segments acquisition expenses and units by distribution channel of the business
 - Life insurance only
 - Includes commissions and premium taxes separately
 - Separately handles universal life dumps
- GRET
 - Publicly available data
 - Multiple of a given set of LOMA functional seed relativities
 - Segments to primary distribution channel of a company
 - Several product types
 - Excludes commissions and premium taxes
 - Combines dumps with single premiums

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SoA's inter-company expense study Functional expense allocation

- Acquisition
 - Per \$1,000 face amount
 - Underwriting (marginal), 1/3 product development/other acquisition
 - Per policy
 - Underwriting (other), policy issue, 1/3 product dev/other acquisition
 - % premium
 - Sales/marketing
 - 1/3 product development/other acquisition
- Maintenance – per policy inforce
 - Benefit administration
 - Policyholder services
 - Overhead

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***SoA's inter-company expense study
2001 study – permanent life***

Distribution type (# contributors)	Per policy issued	Per \$1,000 issued	Percent of 1 st year premium	Commission		Per policy inforce
				1 st renewal		
Career (8)	\$165.40	\$0.66	9.4%	65.7%	3.6%	
Brokerage (5)	148.93	0.87	11.3	79.1	3.8	
PPGA (4)	118.68	2.53	24.3	98.5	3.9	
Multi-line (5)	110.42	1.70	23.5	53.9	3.8	
Other (10)	105.95	1.99	33.4	38.3	3.2	
Total (26)	120.64	1.27	17.1	53.5	3.6	\$52.87

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***SoA's inter-company expense study
2001 study – term***

Distribution type (# of contributors)	Per policy issued	Per \$1,000 issued	Percent of 1 st year premium	Commission		Per policy inforce
				1 st renewal		
Career (7)	\$283.14	\$0.53	52.8%	48.6%	4.3%	
Brokerage (6)	146.43	0.65	21.8	89.1	6.8	
PPGA (3)	231.17	0.57	49.0	82.3	2.3	
Multi-line (4)	89.35	0.73	37.8	46.1	5.5	
Other (9)	293.80	0.49	54.6	57.2	3.3	
Total (23)	137.26	0.65	39.7	56.1	4.3	\$71.72

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***SoA's inter-company expense study
2001, preliminary 2002 study, GRET***

Life Insurance Distribution type (# of contributors)	Per policy issued	Per \$1,000 issued	Percent of 1 st year premium	Commission 1 st renewal		Per policy inforce
2001						
Term (23)	\$137.26	\$0.65	39.7%	56.1%	4.3%	\$71.72
Permanent (26)	120.64	1.27	17.1	53.5	3.6	52.87
Variable (10)	480.38	0.54	27.4	44.3	3.4	204.04
Total (27)	155.93	0.74	24.8	50.0	3.7	68.02
2002 preliminary						
Term (35)	\$151.70	\$0.44	37.3%	66.1%	3.6%	\$64.08
Permanent (35)	123.67	0.74	30.6	50.8	3.6	55.74
Variable (18)	464.22	0.59	23.0	38.1	4.4	163.48
Total (37)	156.70	0.52	27.7	50.0	3.7	63.97
2003 GRET-Branch	\$66.00	\$1.15	73.0%	--	--	\$33.00

***SoA's inter-company expense study
2001 study – deferred annuities***

Distribution type (# of contributors)	Per policy issued	Percent of 1 st year/ren premium	Commission 1 st renewal		Per policy inforce
Career (9)	\$161.93	2.2%	3.0%	2.4%	
Brokerage (3)	94.03	0.8	4.7	1.8	
PPGA (3)	469.64	2.6	4.3	8.7	
Stockbroker (2)	204.64	1.3	5.8	3.9	
Financial Inst(4)	109.58	0.7	5.5	5.5	
Total Fixed (21)	105.50	1.0	5.2	3.6	\$93.32
Total Variable (11)	133.00	1.3	6.0	5.1	173.72

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***SoA's inter-company expense study
2001 study – fixed immediate annuities***

Distribution type (# of contributors)	Per policy issued	Percent of 1 st year/ren premium	Commission 1 st year	Per policy inforce
Career (5)	\$336.58	0.8%	2.8%	
Total (12)	194.86	1.3	3.3	\$109.66

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***SoA's inter-company expense study
2001 and preliminary 2002 studies***

Annuities Distribution type (# of contributors) 2001	Per policy issued	Percent of 1st year premium	Commission 1st renewal		Per policy inforce
Deferred (21)	\$105.50	1.0%	5.2%	3.6%	\$93.32
Immediate (12)	194.86	1.3	3.3	-	109.66
Variable Def (11)	133.00	1.3	6.0	5.1	173.72
Total (23)	120.31	1.2	5.6	4.9	137.08
2002 preliminary					
Deferred (34)	80.28	0.7	6.1	5.8	101.57
Immediate (26)	196.54	1.1	3.0	-	167.03
Variable Def (21)	197.74	1.5	5.3	5.6	142.40
Total (36)	129.40	1.1	5.6	5.6	121.81

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SoA's inter-company expense study
Current status – 2002 study

- Requested 2002 calendar year data last summer
 - Minor changes from 2001
 - Currently compiling results
 - Expect to publish results this summer
 - More companies were able to allocate expenses and units to distribution channel, so fewer “other” and “unallocated”
- Expanded to 44 contributors

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SoA's inter-company expense study
Future plans

- Further refinements, e.g., policy termination expenses, possibly overhead due to size
- Non-traditional Marketing Section has indicated that it will push for more direct response contributions
- Recruit additional contributors
- Study whether to expand to further coverages

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Society of Actuaries Spring Meeting 2004

Inter-Company Experience Studies
Session 29 PD
Chris Noyes

ING  Re

What to consider when using the results of inter-company experience studies

2

Expense Studies

Mortality Studies



In General

- Who
- What
- When
- Where
- Why
- How

In General

- Who is in the study?
ABC Life and XYZ Mutual? More generally, stocks, mutuals, P&C subs, small / large co's, etc.
- What
- When
- Where
- Why
- How

In General

- **Who is in the study?**

ABC Life and XYZ Mutual? More generally, stocks, mutuals, P&C subs, small / large co's, etc.

- **What is in the study?**

Life business, annuity business, Fixed vs. variable costs, substandard vs. preferred, etc.

- **When**

- **Where**

- **Why**

- **How**

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- **When was the study done?**

In 2001 on 2001 experience, or in 2001 on experience from 1995 through 2000, etc.

- **Where**

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- Where is the experience from in the study?

U.S., Canada, Northeastern U.S. vs. Southwestern U.S., statutory annual statements, etc.

- Why

- How

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To update an older study, to study something new, a refinement (older age mortality), etc.

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To update an older study, to study something new, a refinement (older age mortality), etc.

- **How was the study done?**

Exposure calculations, any data massaging, assumptions used in data massaging, etc.

Details on Mortality Studies

- **What**

- Exposure period and issue years are included?
- Type of business is included in the study (term, whole life, UL, etc.)?
- Type of rating (substandard risks, preferreds, etc.)?
- Is the treatment of reinsurance (fac vs. auto, direct amounts vs. reinsured amounts vs. retained amounts)?
- Type of underwriting was done on this experience?
- Underwriting changes took place during the issue periods in the study?
- Is the study's underlying tabular, or expected, mortality basis?
- Is the age basis, nearest or last?
- Risk class basis is in the study (unismoke vs. NS/SM, unisex vs. M/F)?

Details on Mortality Studies

- How

- Are results displayed (the more detail, the better)?
- Are pending claims handled? If included, any adjustment made for anticipated denials?
- Are contested and suicide claims handled within their periods? Is return of premium paid, but full face amount included in study?
- Is IBNR (incurred but not reported claims) handled?
- Are 9/11 claims handled (included or excluded)?
- Are exposures calculated (exact, actuarial, etc.)? Are exposures based on grouped ages, or actual ages?
- Are policy changes handled in the exposure calculation? Are conversions and exchanges treated as new issues?
- Are flat extras and table ratings reflected in the expected basis?
- Is consistency ensured between claims and exposures (when claims are removed, the associated exposure should be removed too, and vice versa)?

Mortality Study Example

- Assume:

- There are two companies in our inter-company mortality study
 - SI Term Life who only sells simplified issue term policies
 - HNW Life who only sells variable universal life to high net worth individuals
- Each company sells 1,000 policies per year and all policies are sold on January 1st (for ease of exposure calculations)
- SI Term Life started selling policies in 1995 and HNW Life started in 1997
- All SI Term Life policies are for \$50,000 face amount
- All HNW Life policies are for \$1,000,000 face amount
- Nobody lapses
- Exposure period is 1995 - 2003

Duration	Expected Mortality	
	SI Term	HNW VUL
1	0.10	0.02
2	0.20	0.05
3	0.30	0.10
4	0.40	0.20
5	0.50	0.50
6	0.60	0.60
7	0.70	0.70
8	0.80	0.80
9	0.90	0.90
10	1.00	1.00

Mortality Study Example

- Results

- The study contains 7,144 claims across 9 durations and 58,141 exposure years
- The A/E on this business is exactly 100% by amount

Therefore, we should use the expected basis as our pricing mortality assumption...

....right?



....Not Exactly!

Mortality Study Example

- Let's take a look...

For both companies and all issue years

Duration	Exposure Count	Exposure Amount	Death Count	Death Amount	Expected Count	Expected Amount	A/E by count	A/E by amount
1	16,000	7,450,000,000	604	176,500,000	1,040	185,000,000	58%	95%
2	13,468	6,248,000,000	1,044	360,000,000	1,734	366,000,000	60%	98%
3	10,640	4,921,000,000	1,266	547,800,000	1,978	541,100,000	64%	101%
4	7,800	3,513,600,000	1,336	766,000,000	1,880	730,800,000	71%	105%
5	5,174	2,077,000,000	1,482	1,125,750,000	1,761	1,043,280,000	84%	108%
6	2,846	653,400,000	1,026	338,200,000	765	420,336,000	134%	80%
7	1,306	177,400,000	322	82,600,000	221	100,195,200	146%	82%
8	624	31,200,000	58	2,900,000	29	1,451,520	200%	200%
9	283	14,150,000	6	300,000	3	163,296	184%	184%
Grand Total	58,141	25,085,750,000	7,144	3,400,050,000	9,411	3,388,326,016	76%	100%

Mortality Study Example

But for each company separately...

SI Term

Duration	Exposure Count	Exposure Amount	Death Count	Death Amount	Expected Count	Expected Amount	A/E by count	A/E by amount
1	9,000	450,000,000	450	22,500,000	900	45,000,000	50%	50%
2	7,600	380,000,000	720	36,000,000	1,440	72,000,000	50%	50%
3	6,020	301,000,000	756	37,800,000	1,512	75,600,000	50%	50%
4	4,512	225,600,000	600	30,000,000	1,210	60,480,000	50%	50%
5	3,260	163,000,000	375	18,750,000	756	37,800,000	50%	50%
6	2,308	115,400,000	724	36,200,000	363	18,144,000	200%	200%
7	1,188	59,400,000	252	12,600,000	127	6,350,400	198%	198%
8	624	31,200,000	58	2,900,000	29	1,451,520	200%	200%
9	283	14,150,000	6	300,000	3	163,296	184%	184%
Grand Total	34,795	1,739,750,000	3,941	197,050,000	6,340	316,989,216	62%	62%

HNW VUL

Duration	Exposure Count	Exposure Amount	Death Count	Death Amount	Expected Count	Expected Amount	A/E by count	A/E by amount
1	7,000	7,000,000,000	154	154,000,000	140	140,000,000	110%	110%
2	5,868	5,868,000,000	324	324,000,000	294	294,000,000	110%	110%
3	4,620	4,620,000,000	510	510,000,000	466	465,500,000	110%	110%
4	3,288	3,288,000,000	736	736,000,000	670	670,320,000	110%	110%
5	1,914	1,914,000,000	1,107	1,107,000,000	1,005	1,005,480,000	110%	110%
6	538	538,000,000	302	302,000,000	402	402,192,000	75%	75%
7	118	118,000,000	70	70,000,000	94	93,844,800	75%	75%
Grand Total	23,346	23,346,000,000	3,203	3,203,000,000	3,071	3,071,336,800	104%	104%

Mortality Study Example

And for each company by issue year...

SI Term – issue year 1995

Duration	Exposure Count	Exposure Amount	Death Count	Death Amount	Expected Count	Expected Amount	A/E by count	A/E by amount
1	1,000	50,000,000	50	2,500,000	100	5,000,000	50%	50%
2	950	47,500,000	90	4,500,000	180	9,000,000	50%	50%
3	860	43,000,000	108	5,400,000	216	10,800,000	50%	50%
4	752	37,600,000	100	5,000,000	202	10,080,000	50%	50%
5	652	32,600,000	75	3,750,000	151	7,560,000	50%	50%
6	577	28,850,000	181	9,050,000	91	4,536,000	200%	200%
7	396	19,800,000	84	4,200,000	42	2,116,800	198%	198%
8	312	15,600,000	29	1,450,000	15	725,760	200%	200%
9	283	14,150,000	6	300,000	3	163,296	184%	184%
Grand Total	5,782	289,100,000	723	36,150,000	1,000	49,981,856	72%	72%

HNW VUL – issue year 1997

Duration	Exposure Count	Exposure Amount	Death Count	Death Amount	Expected Count	Expected Amount	A/E by count	A/E by amount
1	1,000	1,000,000,000	22	22,000,000	20	20,000,000	110%	110%
2	978	978,000,000	54	54,000,000	49	49,000,000	110%	110%
3	924	924,000,000	102	102,000,000	93	93,100,000	110%	110%
4	822	822,000,000	184	184,000,000	168	167,580,000	110%	110%
5	638	638,000,000	369	369,000,000	335	335,160,000	110%	110%
6	269	269,000,000	151	151,000,000	201	201,096,000	75%	75%
7	118	118,000,000	70	70,000,000	94	93,844,800	75%	75%
Grand Total	4,749	4,749,000,000	952	952,000,000	960	959,780,800	99%	99%

Mortality Study Example

- How the actual deaths were “made up”
 - For SI Term for all issue years, the actual deaths equal the expected deaths x 50% for the first 5 durations and 200% for the next 5 durations
 - Each additional issue year layered on adds additional exposure to the early durations relative to the later durations
 - As a result, the cumulative A/E's across multiple issue years appear to decrease as the more recent issue years are added on when in fact each issue year has exactly the same slope
 - For HNW VUL for all issue years, the actual deaths equal the expected deaths x 110% for the first 5 durations and 75% for the next 5 durations
 - Again, each additional issue year layered on adds additional exposure to the early durations relative to the later durations
 - As a result, the cumulative A/E's across multiple issue years appear to increase as the more recent issue years are added on when in face each issue year has exactly the same slope

Mortality Study Example

- End result
 - The higher face amount of the HNW VUL tends to overwhelm the lower face amounts of the SI Term so results by amount across both companies' business are skewed towards the HNW VUL
 - E.g. the A/E by amount across both companies and all issue years for the first 5 durations is 104%, even though there are 2 more issue years of SI Term contributing to that number and the SI Term has a 50% A/E by amount while the HNW VUL has a 110% A/E by amount
 - And, even though the SI Term was sold for 2 more years during the study period, the mortality rates are lower for HNW VUL and more of the business is around longer to contribute exposure to the study
- The purpose of this example was to show why it's important to ask questions about the mortality study being used

Calibration

- **Secular mortality improvement**
 - Must reflect secular mortality improvements that have occurred between the exposure period and the midpoint of the expected new business flow period
 - Use the mid-point of the study exposure
 - In our example, for SI Term the business was issued and exposed from 1995 – 2003, but the mid-point of the study exposure is not 6/30/1999, it's beginning of January, 2000
 - Only issue year 1995 contributes exposure in 1995, but all 9 issue years contribute exposure in 2003
 - Obviously, the rate of improvement is up to the actuary
- **Comparisons only over study period**
 - For example, assume our mortality study example on SI Term only covered issue years 1999 – 2003 and was exposed over the same period
 - There would only be the first 5 durations in the study and it wouldn't make sense to assume the 50% A/E would hold for later durations

Calibration

- **Consistency in risk selection**
 - Make adjustments for all items that might be different between the business in the mortality study and the business being priced
 - Underwriting requirements
 - Preferred guidelines
 - Persistency
 - Target markets
 - Etc.
- **Credibility**
 - Classical credibility assigns credibility of $(\# \text{ claims}/1082)^{(0.5)}$ to a mortality study but this assumes uniform claim amounts
 - Other methods can be used

Details on Expense Studies

- **What**
 - Products are covered by the expense study?
 - Is the distribution channel(s) covered by the expense study?
 - Types of companies are in the study (mutual, stock, P&C subs)?
 - Expenses are included or excluded in the study (premium tax, commissions, etc.)?
 - Types of expenses are covered (acquisition vs. maintenance, per unit vs. per policy, overhead vs. marginal, direct vs. indirect, etc.)?
 - Is the source of the data (annual statement, etc.)?
- **How**
 - Is the expense experience going to be used (for pricing, for illustrations, etc.)?

Items to Consider with Expense Studies

- **Consider your anchors**
 - Reflect expenses as per policy, % of premium, per unit, per death claim, etc.
- **Compare to metrics**
 - How would expense factors relate to metrics such as inforce or premium
- **Understand what you're covering**
 - Should expense factors cover overhead and marginal expenses, or just marginal?
 - What's the philosophy on planned expense gaps?
 - First year vs. renewal or acquisition vs. maintenance
- **Does it make sense**
 - Do the expense factors cover the intended expenses?
 - Do the expense factors have the appropriate effect on pricing?
- **Monitor it**
 - Growth of business, types of business, etc. can make expense factors obsolete