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Highlights of the 2001 Manulife Reinsurance Mortality Study

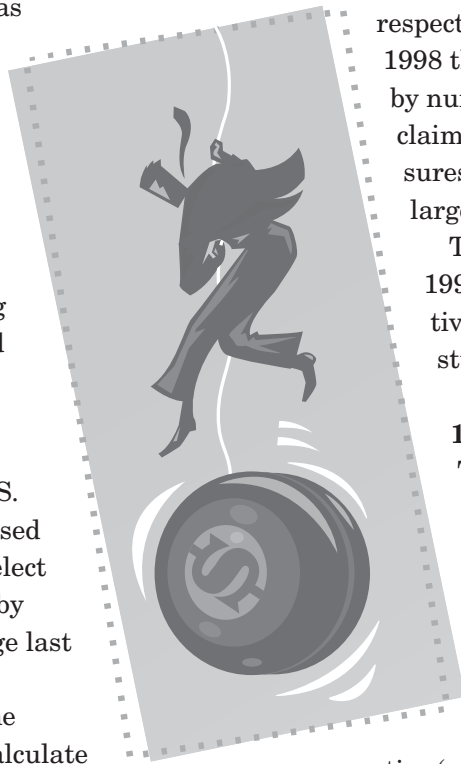
by Manon Laverdière and Valerio Valenti

Editor's Note: Copies of the full studies (text and tables) are available in the Reinsurance Section area of the SOA home page www.soa.org.

Manulife Reinsurance, in conjunction with the Reinsurance Council of the Society of Actuaries, conducts an annual study of mortality experience on large amount and older age policies. The experience data was submitted to the Society of Actuaries by six companies. The consolidated data is analyzed in terms of mortality ratios by number and amount, and the results are further subdivided by age, sex, duration, smoking and underwriting status, reinsurance method and level of retention.

The exposure includes only single life policies issued in the United States and valued in U.S. dollars. Expected deaths are based on 100% of the SOA 1975-80 Select & Ultimate table which varies by age and sex, age nearest and age last birthday. The basic tables were extended to issue age 90 and the resulting tables were used to calculate the expected mortality for issue ages greater than 70. Ultimate ages were also extended to age 105 from age 100, starting with the 1991 study.

The 2001 Large Amount study covers experience for calendar years 1997 and 1998. Manulife has been conducting these studies since 1990, covering experience during calendar years 1987 and later. The Advanced Age study has been conducted since 1993, covering experience in calendar years 1990 and later. Both studies present results individually for each of the two most recent calendar years as well as a cumulative result of all study years. The results of the Advanced Age and Large Amount studies will be discussed separately.



2001 Large Amount Study: Results

Policies for large amounts are those with a total face amount greater than \$1 million.

1997 and 1998 Results:

The experience underlying the 1997 and 1998 data is based on total exposures of \$64 billion and \$77 billion, respectively. Claims in 1997 were \$77 million and in 1998 they were \$101 million. The total 1997 exposure by number is 231,965 (275,823 in 1998). In 1997, 168 claims were reported (353 in 1998). The 1998 exposures by number and total claims represent the largest in this study's history.

The overall mortality ratios by amount for the 1997 and 1998 study are 34% and 37%, respectively. By number, the ratios for the 1997 and 1998 study are 27% and 48%, respectively.

1987 to 1998 Results:

The experience underlying the 1987 to 1998 data is based on a total exposure of \$780 billion and claims of \$1.6 billion. The total exposure by number is 1,597,918 with 2,395 claims.

The overall ratio by amount is 56 percent. This ratio decreases slightly when measured on a "by number" basis to 54 percent.

This year's study includes an analysis of the ratios (and supporting exposure) by a five year rolling average and a four year period average. The additional data allows the reader to more easily view the mortality trends and assign credibility to those trends.

The mortality ratios are also presented for various classifications—first for 1997 and 1998 experience, and then the cumulative result for the entire study period from 1987 to 1998.

Sex:

Males comprise approximately 88% of the 1997 and 1998 exposure by number (and by amount). Close to one-fifth of all male claims are classified as misadventure.

Highlights of the 2001 ...

from page 17

The mortality ratio by amount for males in 1997 is 38% and for females it is 11% (1998: 38% for males, 33% for females).

The mortality ratio by number in 1997 is 28% for males and 16% for females (1998: 47% for males, 53% for females).

Based on data from 1987 to 1998, the mortality ratio by amount for males is 55% and for females it is 62%. During this period male exposure was 90%. By number, the mortality ratios are 53% and 59% for males and females, respectively. Over the years female mortality has shown more improvement than male mortality.

Issue Age: Issue ages 30-49 represent approximately 75% of the 1997 and 1998 exposure by number and approximately 70% of the exposure by amount. However, actual claims paid are highest in the age category 50-59 for both the 1997 and 1998 data.

The mortality ratio by amount in 1997 is 40% for issue ages 50-59 (38% in 1998). By number the 1997 ratio is 34% (51% in 1998).

From 1987 to 1998, 54% of the largest claims (over \$5 million) were in the age band 50 to 69.

Policy Years: Exposure by number and by amount is the highest for the first two policy durations. The 1997 mortality ratio by number for duration one and two is 19% and 30%, respectively (36% and 29% in 1998). This compares favorably when compared to the average ratios for all durations (27% in 1997, 48% in 1998).

The 1997 mortality ratio by amount for both durations one and two is 16%. The 1998 ratios are 26% and 20%, respectively. Both 1997 and 1998 ratios are considerably better than the overall amount average of 34% in 1997 and 37% in 1998.

The 1987 to 1998 cumulative mortality ratio by amount at duration one is 55% (partly due to large aviation claims in the study's early years). It then decreases at duration two (44%) and increases over the next two durations from 51% to 56%.

In 1997 and 1998, seven out of the 19 claims with Direct Face Amounts over \$5 million occurred during the first three policy durations, the remaining claims occurred in duration six and over.

Smoking Status: The mortality ratio by amount for non-smokers is 34% in both 1997 and 1998. The ratio for smokers is 56% in 1997 (49% in 1998). The exposure by amount in 1997 for non-smoker, smoker and aggregate policies are 71%, 6%, and 23% respectively (In 1998, 89%, 6%, 5%).

The overall ratios (1987-1998) by amount for non-smoker and smoker are 48% and 104%, respectively. The ratio of smoker to non-smoker mortality has decreased considerably over the years. In fact, in some years the smoker ratio is less than the non-smoker ratio. However, the smoker exposure by amount is only 7% of the study and thus has low credibility.

Note that the expected 75-80 Basic Tables are not differentiated by smoker status.

*Underwriting**Status:*

The mortality ratio by amount for standard policies is 32% in 1997 (34% in 1998). For substandard policies, the ratio increases to 47% in 1997 and to 59% in 1998. Approximately 96% of the exposure is accounted for by standard policies.

The overall standard ratio by amount from 1987 to 1998 is 56% (55% for substandard).

*Reinsurance**Status:*

The 1997 mortality ratio by amount is 21% for automatic business, and 55% for facultative (1998: 36% for automatic and 40% for facultative). The exposure by dollar amount is approximately 80% for automatic business in both 1997 and 1998.

The 1987 to 1998 overall amount ratio is 47% for automatic and 64% for facultative business. The facultative exposure has decreased steadily since the study's inception. In the late 1980s, facultative business comprised more than 50% of the study's data.

*Plan of**Insurance:*

A large portion of contributors did not submit a plan of insurance code, and therefore, the results by plan are not very credible.

The plan of insurance was provided for approximately half of the business submitted (and almost all of it was for Term) for 1997 and 1998 data. In 1997, Term had a 22% ratio by number and 38% ratio by amount (in 1998 the ratios were 47% and 43%, respectively).

*Method of**Reinsurance:*

The 1997 mortality ratio by amount is 30% for YRT and 37% for Coinsurance (1998 ratios are 26% and 20%, respectively).

Data collection for reinsurance method began in 1991. The 1991 to 1998 mortality ratio by amount is 48% for YRT and 50% for Coinsurance.

2001 Advanced Age Study: Results

Policies for advanced age are those with an issue age of 70 or over.

1997 and 1998 Results:

The experience underlying the 1997 and 1998 data is based on total exposures of \$1.9 billion and \$2.3 billion, respectively. Claims in 1997 were \$12 million and in 1998 they were \$19 million. Total exposure by number in 1997 and 1998 was 20,578 and 28,175, respectively. In 1997, 237 claims were reported (333 in 1998). The 1997 and 1998 exposure by number and the 1998 claim number are the largest in this study's history.

The overall mortality ratios by amounts for the 1997 and 1998 study are 19% and 24%, respectively. By number, the ratio for the 1997 data is 27% (31% in 1998).

1990 to 1998 Results:

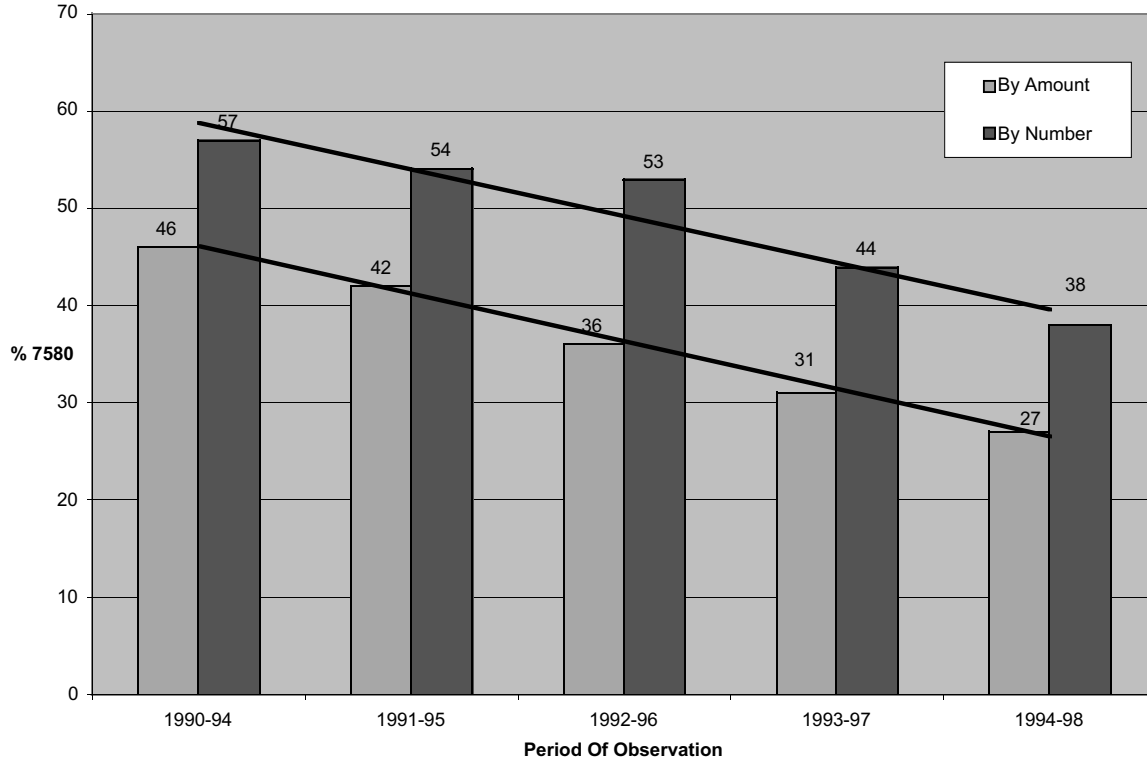
The experience underlying the years 1990 to 1998 is based on a total dollar exposure of \$15.5 billion. During those years, \$188 million of claims were experienced. The total 1990 to 1998 exposure by number is 115,106 policies with 2,023 claims.

The overall mortality ratio by amount for the 1990 and 1998 study is 36%. By number, the overall ratio is 45%.

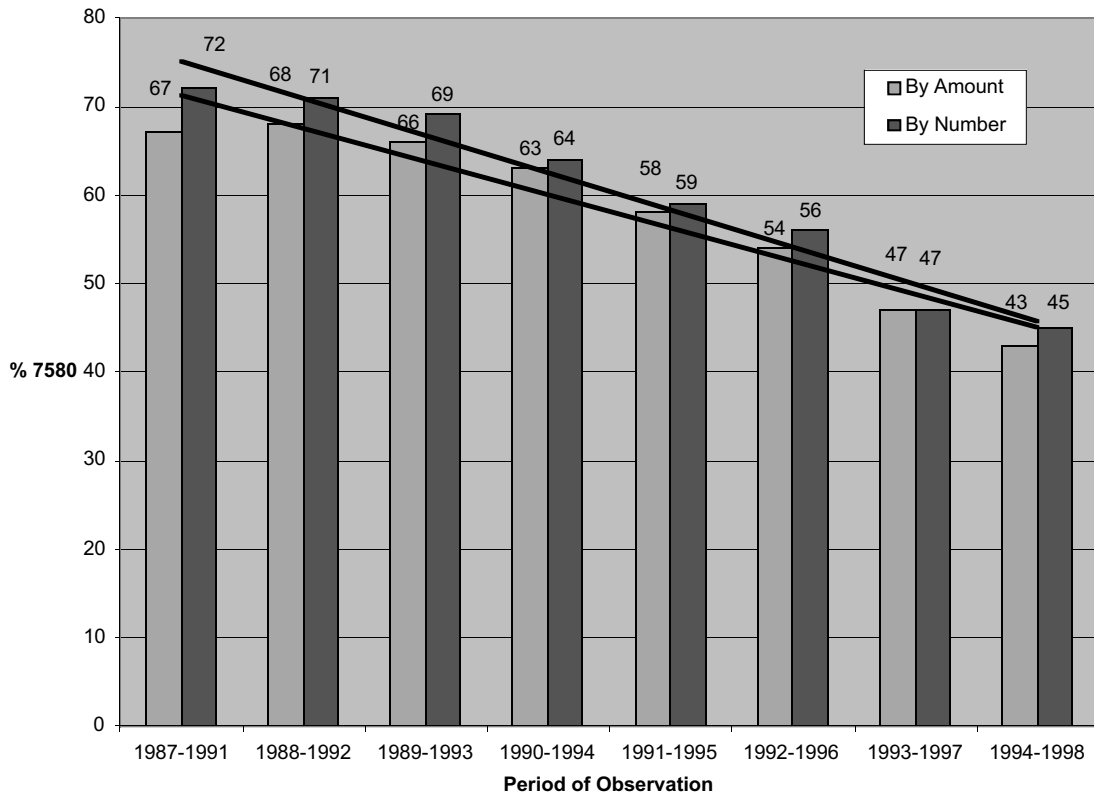
Highlights of the 2001 ...

from page 19

Reinsurance Inter-Company Mortality Study
Advanced Age - 5 Year Rolling Averages



Reinsurance Inter-Company Mortality Study
Large Amount - 5 Year Rolling Averages



		Advanced Age Inter-Company Mortality Study							
		1990-94	1991-95	1992-96	1993-97	1994-98			
By Amount	By Number	46	42	36	31	27			
		57	54	53	44	38			
		1987-91	1988-92	1989-93	1990-94	1991-95	1992-96	1993-97	1994-98
By Amount	By Number	67	68	66	63	58	54	47	43
		72	71	69	64	59	56	47	45

There is a decreasing trend in both ratios when analyzed on each of a moving average and period average.

The mortality ratios are also presented for the various classifications, first for 1997 and 1998 experience and then the cumulative result for the entire study period from 1990 to 1998.

Sex: In 1997 and 1998, 45% of policy amounts were from male lives. This marks the first time in this study's history that female amounts outnumber the male amounts.

By amount, the ratio for males is 20% in 1997, and 22% in 1998. By amount the ratio for females is 17% in 1997 and 27% in 1998.

The mortality ratios by number for males in 1997 and 1998 are 27% and 29%, respectively. Similarly, the female by number ratios are 28% in 1997 and 33% in 1998.

The mortality ratios by amount for 1990 to 1998 data are 35% for males and 38% for females. Ratios by number during the period are 44% and 46% for males and females, respectively.

Issue Age: By amount, approximately 65% of policies (75% by number) have issue ages between 70 and 74 in both 1997 and 1998. By amount in 1997, the age

band 70 to 74 experienced a ratio of 14% (27% in 1998). The age band 75 to 79 experienced a 30% ratio in 1997 (26% in 1998).



Policy Years: By policy year, the ratios vary greatly from one duration to the next.

In 1998, approximately half of all exposures by number and by amount are in durations one and two, compared to 41% for the 1997 data. The mortality ratio by amount at duration 1 is 16% in 1997 and 24% in 1998.

From 1990 to 1998, the overall by amount ratio for duration one is 31%.

Highlights of the 2001 ...

from page 21

Smoking Status: The 1997 non-smoker and smoker ratios by amount are both approximately 19%. The 1998 non-smoker ratio by amount is 24%, and surprisingly the smoker ratio is lower at 16%. However, since there are far fewer smoker exposures (10% vs. 90% for non-smokers), the validity of the smoker result is weak.

From 1990 to 1998, the ratio by amount for non-smoker is 31% (63% for smoker).

Underwriting Status:

The mortality ratio by number for standard policies is 23% and 22%, for 1997 and 1998 data, respectively. The 1997 substandard ratio by amount is 8% (29% for 1998 data). However, the standard exposure is nearly four to five times more than substandard exposure. The cumulative 1990 to 1998 by amount ratio for standard policies is 37% and for substandard it is 35%. 81% of the exposure by amount is comprised of standard policies.

Reinsurance Status:

In 1997 and 1998, the exposure by number for automatic reinsurance is approximately 90% for both years. However, the exposure by amount for automatic business comprises on average 65% of the study's data.

The ratio by amount for policies reinsured automatically is 20% (17% for facultative) for 1997 data, and 21% (28% for facultative) for 1998 data.

The 1990 to 1998 cumulative ratio by amount for policies reinsured automatically is 32%, compared to 39% for facultative policies. In the study's



early years (1990 to 1992), facultative was approximately double the automatic exposure by amount. However, in the last few years, automatic reinsurance is now double the facultative exposure.

Plan of Insurance:

In this year's two year study, many policies were classified as Unknown (1997: 48% by amount; 1998: 44%). The 1997 Term mortality ratio by amount is 30% (40% in 1998).

From 1990 to 1998, by dollar amount, Whole Life, Term and UL mortality ratios are 28%, 46% and 35%, respectively. By number, Whole Life, Term and UL mortality rates are 50%, 33%, and 50%, respectively.

Manon Laverdière, FSA, FCIA, associate actuary, has recently joined the Corporate ALM area of Manulife Financial in Toronto. She can be reached at manon_laverdier@manulife.com.

Valerio Valenti, ASA, is senior actuarial associate in the Life Pricing area of Manulife Reinsurance located in Toronto, ON. He can be reached at valerio_valenti@manulife.com.