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MORTALITY EXPERIENCE AND UNDERWRITING STANDARDS

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A review of experience studies and research on:

- Smoking
  - Differences by sex
  - Passive smoking
  - Insured studies
- Medical impairments
- Preferred underwriting

MR. A. GORDON JARDIN: I am vice president, reinsurance, for Sun Life of Canada. Sun Life in its reinsurance capacity acts as a retrocessionaire assisting professional reinsurers in developing their business by participating in the large case mortality risk that these reinsurers assume. Crispina Caballero is with Manulife Financial, also in the reinsurance operation. Manulife is also a retrocessionaire. Crispina has spearheaded a large amount mortality study using the intercompany contributions of, I believe, over 15 different reinsurance companies. Last, but not least, is Faye Albert, President of Albert Associates. She is an actuarial consultant, and she will be sharing with us some very interesting information. Faye will be presenting information based upon the data collected by Bragg Associates.

My role as moderator gives me a lot of power including the right to make a presentation myself, and I'm going to do so last, adapting a presentation that I made earlier in the year at a Canadian Institute of Actuaries' meeting.

MS. FAYE ALBERT: Bragg Associates has been studying mortality from insurance company data since 1986, and it has based these studies on experience that it has collected from 1980. I'm not sure how many of you are familiar with it. Perhaps some of you are. It prepared its first report in 1986 and has had annual updates since then. The 1990 report includes exposures through 1988, and the 1991 table, a new, basic table, is being prepared which will include information through 1989. These studies concentrate on determining differences in mortality experience for smokers and nonsmokers by sex and duration. As it is collecting this data it has also asked for information by cause of death.

Some additional work has been done on claims on AIDS cases that sort of fell out of its main study. These data complement the Society of Actuaries' studies and supplements them. The most recent Society report includes studies for 1985, 1986 and 1987 with standard ordinary mortality between 1981 and 1986 anniversaries. But the data that the Society has been able to collect so far on smoker and nonsmoker information is still relatively new, only about five years old. Since the basic select-and-ultimate tables the Society has constructed do not differentiate between smokers and nonsmokers, it's hard to tell how data are changing because of those

characteristics when you look at them year by year. That's the purpose of the information that Bragg gathered: to differentiate between smokers and nonsmokers by sex and mortality. I guess it's no surprise to anybody that nonsmokers get rating discounts from insurance companies. This has been increasing, and the amount of the discount has been increasing as the information on differential mortality rates because of smoking and nonsmoking has become available.

You can see in Table 1 the crude q_x overall and the difference between smoker and nonsmoker mortality on insured lives. It's not new to any of us, but it is an introduction to put you in a mind-set that mortality for smokers is overall twice as high, at least for males, as nonsmokers.

TABLE 1
Crude 1,000q

Nonsmoker Male	1.254
Smoker Male	2.604
Nonsmoker Female	0.552
Smoker Female	0.951

Let me just share the numbers of Table 2 with you. The database that has been used for this study is insured lives. So naturally, the distribution of the population being studied is going to affect the overall crude mortality. In 1975, of the insured lives in this study, 40.8% of males and 34.2% of females were smokers. By 1988 only 21.4% of males and 18.9% of females of these insured lives were smokers. So, you can see that our campaign to reduce smoking has been working, and among insured lives there are a lot fewer people in our database that smoke.

TABLE 2
Percent who Smoke

	Male	Female
1975	40.8	34.2
1979	30.5	28.8
1982	25.7	26.2
1988	21.4	18.9

Table 3 is select mortality at age 55 in the first year between smokers and nonsmokers, for males and females, and this holds true for all durations. There is a tremendous difference between smokers and nonsmokers.

TABLE 3
1,000q (55)

Nonsmoker Male	2.38
Smoker Male	5.40
Nonsmoker Female	1.49
Smoker Female	2.54

Now, Table 4 shows the relative mortality for males by smoking category. Nonsmokers have been defined to include people who smoked 10 years ago or more, people who never smoked, and pipe and cigar smokers. They were all, for this study, classified as nonsmokers, and their relative mortality is 100%. For heavy cigarette smokers, people who smoke 20 cigarettes a day or more, mortality is 205%. For light cigarette smokers, it is 163%. And all cigarette smokers have 182% relative mortality. This is just another way of looking at the same kind of information.

TABLE 4
Male Relative Mortality

	Male Relative Mortality	Distribution
Cigarette Smokers		
Heavy Cigarette	205%	14%
Light Cigarette	163	17
All Cigarette	182	31
Smokers		
All Cigarette	182%	31%
Pipe and Cigar	120	5
All Smokers	173	36
Definition Nonsmokers*		
Pipe and Cigar	120%	5%
Former Smokers	108	29
Never Smoked	90	35
"Definition Nonsmokers"	100	69

* Definition Nonsmoker – people who quit over one year ago, and cigar and pipe smokers (100).

The mortality by cause, if you look at lung cancer (Table 5), shows particularly how smoking is a hazard for lung cancer, which again is not too much of a surprise.

TABLE 5
Lung Cancer
(Death Rates per 100,000)

	Nonsmokers	Smokers
Male		
Under 40	1.1	6.8
40 and over	16.1	67.2
Female		
Under 40	0.3	7.8
40 and over	1.1	60.1

But for males under 40 it's about a six times higher incidence, and over 40, more than four times higher.

Table 6 shows what our mortality trends have been. Starting on the basis of the Society 1975-80 Basic Table, by the 1980-85 years of experience that Bragg studied first, the overall mortality was 88% of that. In 1986, it went down to 80.9%, then 79.6%, and in 1988, sort of leveled off. But in 1988 it went up a little bit to 82.5% overall compared to the 1975-80 Basic Table. Of course, we're not exactly sure of why this happened, but we think that probably it's because underwriting standards were relaxed a little bit in the 1985, 1986, 1987 timeframe. It doesn't appear to be because of additional AIDS claims. That's really the first thing I think that people think about.

TABLE 6
Mortality Trend Versus 1975-80 Basic

1975-80	100.0% (Basis of Table)
1980-85	88.1
1986	80.9
1987	79.6
1988	82.5

In Table 7, the middle line shows the nonsmoker male and smoker male mortality for attained ages 35 and 55. This attempts to modify basic mortality rates based on lives that have other underwriting characteristics that are desirable, whether they have good blood pressure, whether they have good exercise habits, chemical readings in the blood, other kinds of underwriting criteria. They have been adjusted for those characteristics upward and downward (percentagewise) on the basis of a sample of differences in the mortality between underwriting characteristics within the smoker and nonsmoker category. In fact, in the next study those are going to be created by approximate methods.

TABLE 7
1,000q by Preferred/Standard Duration

	Attained Age 35 (M)		Attained Age 55 (M)	
	Duration 1	Duration 16	Duration 1	Duration 16
Nonsmoking Male				
Highly Preferred	0.44	0.78	1.91	3.84
Standard	0.55	0.97	2.38	4.79
Less Preferred	0.60	1.06	2.59	5.22
Smoking Male				
Highly Preferred	0.87	1.34	4.91	9.99
Standard	0.96	1.44	5.40	10.99
Less Preferred	1.10	1.66	6.21	12.64

There's going to be sufficient experience to determine what the differences in mortality are for the more preferred and the substandard risks within the smoker and nonsmoker category. I think the thing that's interesting about this is that the difference between smokers and nonsmokers is much greater than any other underwriting characteristics that we can identify in terms of anticipating mortality. For example, the ultimate male age 35 mortality is 0.97, for the entire category of nonsmoking, standard males. For the highly preferred category, it's 0.78, and for the less preferred category it's 1.06, but the smokers overall have 1.44 per thousand mortality rate.

Table 8 is just an additional aside for information purposes about the percentage of mortality that has been experienced because of AIDS in these years, as found in various studies. The Bragg data shows that there were more AIDS claims, and for higher average amounts than either the ACLI study of death claims or the Home Service study. That's perhaps because the people submitting the data have been more careful about identifying AIDS claims.

TABLE 8
Life Insurance Company Mortality
AIDS Claims as Percentage of Total Claims

	ACLI	AIDS%-Life Insurers' Conference Home Service Business	Bragg Data
1984			0.04
1985			0.33
1986	0.9		1.97
1987	1.2	0.8	3.81
1988	1.1	1.1	2.92
1989	1.7	1.3	
1990		1.8	
Average Claim		$5,842 (1990)	$58,785 (all)

These observations that I just shared with you are based on a very large amount of data, $1.3 trillion of exposed amounts of insurance and $1.6 billion in claims. This is comparable, in fact, to the volume of experience underlying the 1975-80 Basic Tables. It's actually a slightly higher exposure with slightly lower amounts of claims, but it's just about comparable in size. I guess that this is just another adaptation to the fact that smoking is a tremendously important underwriting factor that cannot be sneezed at in looking at your anticipated mortality, and, in fact, it is so important that it really can't be properly taken into account by approximate methods very well.

We have a lot of information available to study it now, and it's probably best to directly reflect it in any of the work that you're doing in anticipating future mortality.

MS. CRISPINA O. CABALLERO: Let me talk about insurance mortality and underwriting standards. Mortality is one of the most critical assumptions for reinsurers in pricing for any reinsurance for life products. In the past we have had to use results of standard ordinary mortality results simply because of lack of available information.

What I'd like to do is three things. First, I'd like to give you a list of items that a reinsurance pricing actuary would normally look for in a mortality study. Then, second, I'd like to share with you the results of the 1987-89 Intercompany Large Amount Insurance Mortality Study, and, lastly, give you a few examples of mortality studies, maybe not of insured lives, which I think could be used selectively if reinsurers could react fast enough to changes in the market. I'm referring especially to one particular situation which is preferred risk underwriting and pricing.

Now, here are some items that a reinsurance pricing actuary would normally be looking for. Results by sex, age and duration are something that you'd normally see even in regular mortality studies. Duration is fairly crucial due to the fact that we'd like to be able to trace the results of the mortality in comparison to the times when underwriting has been fairly aggressive, and I think that happened in reinsurance maybe in the 1970s and early 1980s.

For smoking status, there is preferred nonsmoker, nonpreferred nonsmoker, nonsmoker, the same thing for smoker, and then aggregate.

Then there are classification amounts. Now, here the difference between your regular mortality study and a reinsurance mortality study would be the amount that you're talking about. Reinsurance face amounts are normally larger face amounts, over the direct company retention, and so normally are not the first dollar coverage. And so you'd see classifications in less than 1 million, 1 million, 1-3 million, 3-5 million, and over 5 million.

Then there are plans of insurance, universal life, traditional whole life, term to 65, term over 65, joint life survivorship cases, and reentry products. Now, reinsurers are fairly sensitive to experience on the joint life survivor plans where premiums are fairly thin. Reentry products are where antiselective lapsation and the level of underwriting have a very direct impact on the mortality results. Term 100 products are where premium rates are getting more and more competitive. I don't know why.

Another classification of information that's available on regular mortality studies would be the cause of death. One of the things that a cause of death result could generate is additional interest, so studies could be done on special, specific medical impairments.

Now, there is also a category called over age 70 simply because we should not lose sight of the fact that the baby boomer group is going to be changing the demographics of the North American continent in the next two decades.

There are other classifications that are normally not going to be present in a regular mortality study. There is the reinsurance method, YRT or coinsurance or modco. Then we're also interested in the ceding company retention, whether it's full, partial or no retention at all, and this is basically the level of sharing that the direct company has with a reinsurance company. This is particularly sensitive on products that are fairly new and highly innovative. Then there is standard and substandard. A standard case for a reinsurer is definitely not the same as a standard case for the direct writing company. Now, reinsurers would have more experience with medically impaired risks, where there are more complex financial dealings. There are also

categories called automatic versus facultative versus shopped. Now, the shopped market is becoming more and more competitive. And then there is a category which is self-administered versus individual session. Right now, for reinsurers, the availability of data is present more on the individual session type of business. Unfortunately, the trend is moving towards more self-administered cases, meaning there is less information than is now available.

Now, let me tell you a little history about reinsurance mortality. There were two attempts in the 1980s on coming up with a reinsurance mortality study on an intercompany basis. One attempt was made in 1980. Another one was made in 1988. And luckily for us early this year we completed the 1987-89 Large Amount Intercompany Reinsurance Mortality Study. Now, all Manulife did was collate the data. It's really the reinsurers who participated in the study that made the study both possible and meaningful.

The policies that were included in the study were basically standard ordinary reinsured policies with face amounts of $1 million and over. We only concentrated on single life policies, and the study was conducted on a policy basis rather than a life basis. The exposure totals to $161.5 billion for about 87,000 policies, claims of $371.5 million for 195 policies. The exposure, the $161.5 billion, is about a third of the 1978-83 Society Large Amount Intercompany Mortality Study. The overall experience is 61.3% on a by-policy basis and 63% on a by-amount basis. Now, for the by-amount basis there were two large female claims in 1988 totalling $13.3 million and $21 million. If we adjust the results for these two female lives, our results go down to 57.2%. Now, I doubt that we'd like to do that. If you remove it from the study, it doesn't mean that you don't have to price for it. Normally, in reinsurance you'd find some large cases like this happening every decade. In the 1970s there was the $15 million claim on the Mullendore case, and I guess in the 1980s there were these two female lives.

Now, before the 1987-89 study most reinsurance companies were probably using the Society large amount studies. Two were done in the past, for 1973-78 experience and for 1978-83. There's a big difference in the definition of large amount between the 1987-89 study and the Society studies. In the Society studies a large amount is $100,000 face amount for 1974 policies and later, and $50,000 for earlier ones. From 1987-89 it is $1 million.

What I tried to do in Table 9 is put the results of these three studies side-by-side using the same expected basis, which is the SOA 75-80. This is an aggregate table, meaning aggregate instead of smoker/nonsmoker with female and male rates.

TABLE 9
Comparison of Large Amount Experience of this Study
and the SOA 1973-78 and 1978-83 Studies (By Amount)

Sex	SOA 1973-78	SOA 1978-83	1987-89	1987-89
Male	100.0%	87.0%	57.9%	57.9%
Female	111.0	106.0	112.3	49.6
All	101.0	89.0	63.0	57.2

Mortality Ratios Based on the 1975-80 Basic Tables

If you look at the results by sex, I guess I wouldn't want to make any conclusions about the female results for the 1987-89 study. The exposure for females is only about 10%. The third column is basically nonadjusted results by face amount, and the last column is adjusted for the two, large cases.

By issue age, if you look at the result in Table 10, you'd note that for issue age bracket 30-39 it's unusually higher than the other brackets, and I guess this could be due to accidental death claims.

TABLE 10
Comparison of Large Amount Experience of this Study
and the SOA 1973-78 and 1978-83 Studies (By Amount)

Issue Ages	SOA 1973-78	SOA 1978-83	1987-89	1987-89
< 20	N/A	88.8%	0.0%	0.0%
20-29	117.0%	105.0	0.0	0.0
30-39	103.0	94.0	166.1	82.7
40-49	101.0	86.0	56.3	56.3
50-59	100.0	85.0	79.6	79.6
60-69	89.0	89.0	48.6	48.6
70+	93.0	61.0	9.5	9.5
All	101.0	89.0	63.0	57.2

Mortality Ratios Based on the 1975-80 Basic Tables

By policy year (see Table 11), one thing to note is the result for durations 1-2. I was just talking to our underwriting director about this.

TABLE 11
Comparison of Large Amount Experience of this Study
and the SOA 1973-78 and 1978-83 Studies (By Amount)

Policy Years	SOA 1973-78	SOA 1978-83	1987-89	1987-89
1-2	103.0%	100.0%	60.9%	60.9%
3-5	99.0	92.0	55.0	55.0
6-10	102.0	84.0	89.8	59.4
11-15	96.0	84.0	52.0	52.0
16+	N/A	86.1	46.0	46.0
All	101.0	89.0	63.0	57.2

Mortality Ratios Based on the 1975-80 Basic Tables

She's basically saying that there are certain antiselection criteria that are not offset by underwriting, where the results or the impact on the mortality experience usually wears off after two years. Now, we were not able to break the experience for policy year 1-2 into more refined categories simply because the exposure would not permit it. Credibility would be the issue. But she was basically saying that it's quite possible that this situation is more pronounced for larger face amounts. She's talking about maybe $3 million and up for older ages. And I think if you look at the results, that's also true for the two Society large amount studies.

Table 12 is a comparison where there is the same classification amount. One thing that we should be aware of is that there's a difference in the definition of large amount. The proportion of smoker/nonsmoker in the 1970s and 1980s has been changing where the proportion of smoker is getting to be smaller and smaller.

TABLE 12
Comparison of Large Amount Experience of this Study
and the SOA 1973-78 and 1978-83 Studies (By Amount)

Classification Amounts	SOA 1973-78	SOA 1978-83	1987-89	1987-89
One Million and Over	93.0%	84.0%	63.0%	57.2%

Mortality Ratios Based on the 1975-80 Basic Tables

Table 13 shows results only for the 1987-89 study. These are more specific reinsurance classifications. Note that for a smoker/nonsmoker you will see the expected relationship between smoker and nonsmoker mortality.

TABLE 13
Trends in Mortality Ratios by Amount

	1987	1988	1989	1987-89
Smoking Status				
Nonsmoker	68.8%	47.3%	52.2%	54.7%
Smoker	114.4	44.0	153.8	107.5
Aggregate	48.4	102.1	50.0	66.5
All	62.0	70.0	57.9	63.0
Underwriting Status				
Standard	62.8%	73.8%	55.6%	63.5%
Substandard	56.6	46.9	71.3	59.6
All	62.0	70.0	57.9	63.0
Reinsurance Status				
Automatic	49.4%	39.5%	41.7%	43.0%
Facultative	71.1	87.8	65.8	74.5
Shopped	0.0	23.5	63.7	34.9
All	62.0	70.0	57.9	63.0

Mortality Ratios Based on the 1975-80 Basic Tables

For underwriting status, standard and substandard results were fairly similar. On the reinsurance status, facultative has twice as much exposure as the automatic, and you could also see what is normally expected of facultative cases. It's a much higher ratio than the automatic. Now unfortunately, for the shopped cases where you'd probably expect a higher mortality ratio, it's quite low. That's because we don't have as much exposure.

In interpreting the results (see Table 14), I'm giving you the standard deviation for the study. You're looking at the 4.51% deviation on the 63% ratio by amount. On any other breakdown of the data you're looking at much higher standard deviations.

TABLE 14
Standard Deviations

	Actual Claims	Mortality Ratio	Standard Deviation
All Combined	195	63.0%	4.51
Sex			
Male	168	57.9	4.47
Issue Ages			
40-49	47	56.3	8.21
50-59	88	79.6	8.49
Policy Years			
4	35	72.9	12.32
6-10	44	89.8	13.54
Classification Amounts			
$1,000,000-$2,999,999	168	57.9	4.47
Smoking Status			
Nonsmoker	89	54.7	5.80
Aggregate	84	66.5	7.26
Underwriting Status			
Standard	167	63.5	4.91
Reinsurance Status			
Automatic	45	43.0	6.41
Facultative	147	74.5	6.14

Mortality Ratios Based on the 1975-80 Basic Tables. Standard deviation calculations are done for cases in which at least 35 deaths are observed.

Table 15 is a list of all the large claims, over $5 million. One other thing to remember when you're looking at the results, the actual-to-expected numbers do not necessarily reflect the relationship between the experience and the pricing standards of reinsurers. What I did was use A75-80 at 100% level, just to give you a basis of comparison. One thing to note on these large claims is there are 6-10 durations, as well as one and two durations.

Now, let me touch base on a few mortality studies that are also available and that are useful for setting any underwriting guidelines for any market changes that are coming in fairly fast. I've got a list of a few here.

There was a cancer prevention study which has shown that there's a higher mortality ratio for smokers in impaired health in contrast to smokers who are ostensibly healthy. I've also seen the results of the 1983 medical impairment study which has shown that there's a mortality ratio of about 200% for male standard insureds if they have a family history of cardiovascular disease. One of the results of the Framingham study has shown that the predicted value of serum cholesterol and HDL and triglycerol with respect to cardiovascular heart disease is quite strong at younger ages and persists in old ages. Then there are a few more studies showing relationships between weight index, and build and blood pressure with mortality results. Now, I've seen these mortality studies, which sometimes are of insured lives and sometimes not, published in a very comprehensive book which was a coordinated effort between the

TABLE 15

List of Large Claims Over $5 Million on One Life

	Amount (In Millions)	Sex	Age Group	Policy Year	Smoking Status	Rating
1	$21	Female	30–39	6–10	Aggregate	100%
2	13.3	Female	30–39	6–10	Aggregate	100
3	8	Male	30–39	2–4	Nonsmoker	100
4	8.7	Male	40–49	1	Nonsmoker	100
5	5.5	Male	40–49	1	Nonsmoker	100
6	5	Male	40–49	1	Smoker	250
7	15.8	Male	50–59	4–5	Nonsmoker	100 175
8	10	Male	50–59	6–10	Nonsmoker	100
9	9.75	Male	50–59	3	Nonsmoker	100
10	9	Male	50–59	5	Aggregate	100
11	5	Male	50–59	1	Smoker	100
12	9.25	Male	60–69	6–10	Aggregate	100
13	7.5	Male	60–69	2	Nonsmoker	175
14	6.2	Male	60–69	4	Nonsmoker	100
15	5	Male	60–69	6–10	Aggregate	100

Association of Life Insurance Medical Directors of America and the Society of Actuaries. They've done two of these studies. I've got some results here.

Table 16 shows the results of the nonsmoker mortality comparing the two groups of healthy smokers and medically impaired smokers.

Table 17 shows the results where the male insured lives have a family history of cardiovascular disease.

Table 18 shows the relationship between mortality ratios and weight index, males and females.

Chart 1 shows the relationship between levels of HDL serum cholesterol on the rate of cardiovascular heart disease development.

In conclusion I'd like to say three things. Based on the results of the 1987-89 Large Amount Reinsurance Mortality Study, I don't think it looks bad for the reinsurers. The results did not give us anything that was not expected. There is going to be a follow-up to the study which will be for the 1990 experience, and hopefully by the end of summer we'll have the results available. There is also enough difference between direct and reinsurance mortality experience. There's also a bigger difference in the classification of the results that a reinsurance pricing actuary would be looking for in comparison to a direct pricing actuary. And lastly, there's really a need for a regular intercompany reinsurance mortality study. I'm lucky to share the information with you that the Reinsurance Section, in coordination with the Committee on Studies of the Society, is planning to do this fairly soon. Hopefully, it will be done in 1992.

MR. JARDIN: Besides working for Sun Life, I'm also chairperson of the Subcommittee on Individual Expected Experience of the Canadian Institute of Actuaries (CIA). This subcommittee is responsible for providing experience studies to assist actuaries in pricing and valuing individual life insurance products. We try to study mortality, persistency and expenses. Expense studies have always been fraught with problems due to the subjectivity involved in allocating expenses. Persistency studies on longer-term experience have never been well done, due to poor record-keeping. These studies have been complicated by the introduction of universal life, reentry term, updating policies, conversions, term-to-term rollovers, etc. This is especially important in Canada where we have lapse-supported products. The one constant has been the Annual Intercompany Mortality Study and the periodically produced industry mortality tables. These have always been used by actuaries, especially those with smaller companies, as a basis for pricing business in Canada, and as a basis for valuing business. Unfortunately, this one constant is not so constant anymore and seems to be heading further away from being such a constant as more and more products are being developed on a smoker/nonsmoker basis or a tobacco/nontobacco basis or a preferred/nonpreferred basis or a combination of the above. It is becoming less and less possible, therefore, to estimate the current underlying level of mortality and also the trend of improvements.

I want to update you on the Canadian Assureds Mortality and the progress that we have been making towards creating a new mortality table based on Canadian lives. Included here will be a discussion of some of the factors that create our mortality

ANALYSIS OF MORTALITY IN SMOKERS BY HEALTH STATUS (1960-72)

Persons Smoking One or More Packs of Cigarettes in Ostensibly Good Health and in Impaired Health

	DEATH RATES PER 1000				MORTALITY RATIOS* To All Ostensibly Healthy Subjects			MORTALITY RATIOS† To Insured Lives 1965-70 Basic Table		
					Smokers			Smokers		
Age	Ostensibly Healthy All Subjects	Ostensibly Healthy Smokers	Smokers in Impaired Health	All Smokers	Ostensibly Healthy Smokers	in Impaired Health	All Smokers	Ostensibly Healthy Smokers	in Impaired Health	All Smokers
					MALES					
40-44	2.68	4.14	5.33	4.59	154%	199%	171%	154%	199%	171%
45-49	3.82	5.77	9.02	7.04	151	236	184	131	204	159
50-54	5.74	8.92	14.25	11.06	150	240	186	119	190	147
55-59	9.47	14.05	21.06	16.97	148	222	179	113	170	137
60-64	14.70	22.31	33.52	27.29	152	228	186	113	170	139
65-69	21.97	33.85	49.09	41.15	154	223	187	108	156	131
70-74	33.99	51.02	74.70	63.07	150	220	186	107	157	133
75-79	52.34	75.16	101.70	89.73	144	194	171	102	140	122
80-84	81.90	115.30	151.35	135.21	141	185	165	103	136	121
85-89	137.72	179.62	213.09	198.82	130	155	144	107	127	119
					FEMALES					
40-44	1.31	2.06	3.32	2.70	157%	253%	206%	108%	174%	141%
45-49	1.77	2.75	4.99	3.91	155	282	221	94	171	134
50-54	2.89	4.68	6.94	5.90	162	240	204	107	158	134
55-59	3.88	6.90	9.70	8.48	178	250	219	107	151	132
60-64	5.86	9.73	15.40	13.17	166	264	225	96	153	131
65-69	8.96	15.83	23.60	20.74	177	263	231	107	160	140
70-74	14.80	25.07	38.44	33.99	169	260	230	96	148	131
75-79	27.08	38.46	57.56	51.41	142	213	190	78	117	134
80-84	51.03	72.27	92.81	86.48	142	182	169	91	117	109
85-89	90.35	106.83	143.30	132.03	118	159	146	85	113	105

* Expected death rates calculated on men and women in ostensibly good health in the study, regardless of smoking habits.

† Expected death rates calculated on 1965-70 Ultimate Basic Tables (Insured Lives).

Source: Lew, Edward A.; Gajewski, Jerzy; *Medical Risks Trends in Mortality by Age & Time Relapsed*, Vol. 1, Pg. 3-79, Praeger Publishers, New York, New York, 1990.

TABLE 17

Single Impairment Mortality Experience
1952-76 Issues by Number of Policies*
Experience Between 1962 and 1977 Anniversaries
Compared With 1965-70 Basic Tables - Modified

M1 FAMILY HISTORY OF CARDIOVASCULAR DISEASE — MALE - STANDARD						M1 FAMILY HISTORY OF CARDIOVASCULAR DISEASE — MALE - SUBSTANDARD				
Pol. Yrs. Exposed	Number of Deaths Actual	Number of Deaths Expected	MORT. RATIO †	Extra Deaths/M		Pol. Yrs. Exposed	Number of Deaths Actual	Number of Deaths Expected	MORT. RATIO †	Extra Deaths/M
					TOTAL					
76,490	627	331	**189%**	3.86		5,233	55	22	**248%**	6.28
					BY DEGREE OF RATING					
					To 175%	4,201	40	17	**237**	5.51
					180-250%	211	8	1	—	—
					Over 250%	234	4	1	—	—
					Other	585	3	3	—	—
					BY ISSUE AGE					
15,614	31	15	**(200)**	.99	**15-29**	1,021	0	1	—	—
26,482	152	62	**245**	3.39	**30-39**	1,990	19	5	**(388)**	7.08
23,973	245	135	**182**	4.60	**40-49**	1,699	23	11	**(209)**	7.06
9,617	167	102	**163**	6.72	**50-59**	436	10	4	**(263)**	14.21
802	32	17	**(188)**	18.76	**60-69**	84	3	1	—	—
					BY POLICY YEAR					
13,881	36	22	**161**	.99	**1-2**	1,057	4	2	—	—
19,102	87	53	**165**	1.80	**3-5**	1,142	4	3	—	—
24,631	224	106	**210**	4.77	**6-10**	1,568	11	6	**(174)**	3.00
14,086	188	93	**201**	6.73	**11-15**	1,012	21	6	**(332)**	14.50
4,788	92	57	**161**	7.29	**16-25**	452	15	5	**(296)**	21.99

Source: *Medical Impairment Study*, 1983. Vol. 1, Pg. 73, SOA & Association of Life Insurance Medical Directors' of America, March, 1986.

TABLE 18

AMERICAN CANCER SOCIETY STUDY

ANALYSIS OF MORTALITY BY CAUSE OF DEATH, SEX, AND WEIGHT INDEX

Cause of Death	7th Rev. ICD	Sex	WEIGHT INDEX*						
			80	80-89	90-109	110-119	120-129	130-139	140
			Mortality Ratios*						
All Causes of Death		M	1.25	1.05	1.00	1.15	1.27	1.46	1.87
		F	1.19	0.96	1.00	1.17	1.29	1.46	1.89
Coronary Heart Disease	420	M	0.88	1.90	1.00	1.23	1.32	1.55	1.95
		F	1.01	0.89	1.00	1.23	1.39	1.54	2.07
Cancer (All Sites)	140-250	M	1.33	1.13	1.00	1.02	1.09	1.14	1.33
		F	0.96	0.92	1.00	1.10	1.19	1.23	1.55
Diabetes	260	M	0.88	0.84	1.00	1.65	2.56	3.51	5.19
		F	0.65	0.61	1.00	1.92	3.34	3.78	7.90
Digestive Diseases	540-542 570-578	M	1.39	1.28	1.00	1.45	1.88	2.89	3.99
	584-586	F	1.58	0.92	1.00	1.66	1.61	2.19	2.29
Cerebral Vascular Diseases	330-334	M	1.21	1.09	1.00	1.15	1.17	1.54	2.27
		F	1.33	0.98	1.00	1.09	1.16	1.40	1.52

* Mortality ratio for weight index 90-109 is 1.00.

Source: Reproduced with permission of Pergamon Press, Ltd. and the authors from Table 4 in article "Variations in Mortality by Weight Among 750,000 Men and Women," E. A. Lew and L. Garfinkel, J. Chronic Dis. 32 (1979).

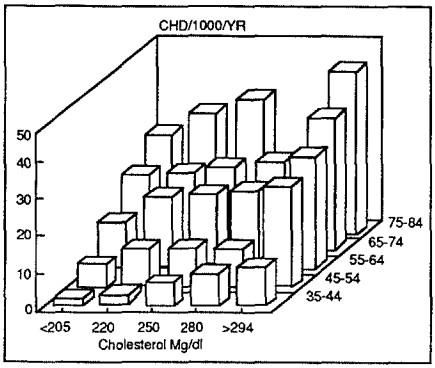


FIGURE 1. Relation of serum cholesterol to development of coronary heart disease in men by age (Framingham Heart Study, 30-year data). (Reprinted with permission from *Can J Cardiol.*)

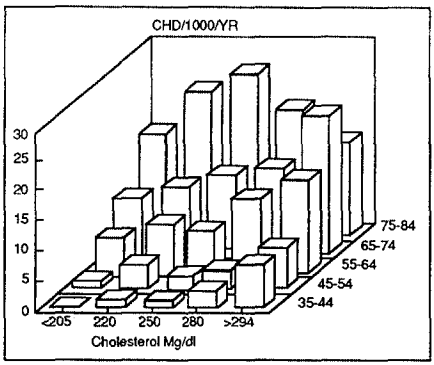


FIGURE 2. Relation of serum cholesterol to development of coronary heart disease in women by age (Framingham Heart Study, 30-year data). (Reprinted with permission from *Can J Cardiol.*)

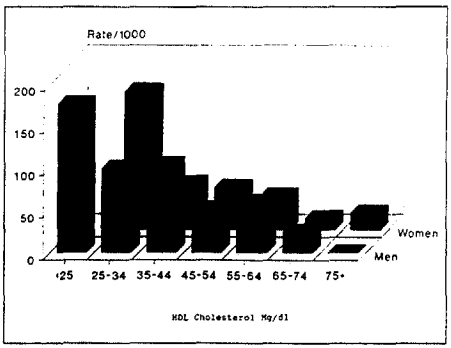


FIGURE 7. Inverse relation between coronary heart disease rate and high-density lipoprotein (HDL) concentrations.

experience and our mortality trends. These trends are so important to the pricing and valuation actuaries. In this section I will talk about the difficulties in getting this underlying mortality trend unaffected by such things as changes in the percentage of the population who smoke or a movement towards the replacement of older, outdated policies or other such things. I want to warn you now that I might take a bit longer on this subject, and many of you might find me belaboring some of these points, but the actuary's responsibility is to accurately estimate future pricing and valuation assumptions on life insurance products. Our future mortality will be affected by such things as genetics and environment, but I also want to make sure that we have a proper understanding of the mortality assumption currently before we go off trying to extrapolate it into the future.

In Canada, as in the United States, mortality is still improving. This has been the case and I guess it will continue to be the case, barring any uptick in the AIDS experience. The Annual Intercompany Mortality Studies have shown this improvement and the new CIA mortality tables, which are just about ready for presentation to the Institute, have also shown the same trend of mortality.

The new tables have been based on the observation period 1982-88, with a mid-year of 1985. The previous tables produced cover the period 1969 through 1975 with a mid-year of 1972. We will be updating the tables by 13 years on average. The average observation year, 1985, also means that actuaries will need to extrapolate these results forward seven years to obtain mortality rates that are indicative of 1992 mortality. This task will be fraught with the danger of using assumptions that may be improper.

Producing the tables has not been too difficult. Where the difficulty comes in is in trying to identify what has caused the improvement, where it has come from and why. Certainly there are typical reasons for the improvement, such as improved health care, better early diagnostic procedures and advances in treatment of cancer and heart-related diseases, the two largest causes of death. Within the population there have also been some other factors that have perhaps resulted in improved mortalities. Such factors relating to accidental death are lower speed limits, tougher driving-under-the-influence penalties, safer cars and safer car accessories. Such factors relating to general health are exercise programs, participation, health consciousness and improved eating and drinking habits. Such factors relating to the environment are tougher pollution laws, restrictive smoking rules, reduction in second-hand smoking exposure, reduction in the percentage of the population that smokes, and light cigarettes. Such factors relating to workplace environment include a shift as the North American economies continue to migrate away from a natural resource manufacturing economy to a service economy. All these factors have contributed to improved insured lives mortality.

As pricing and valuation actuaries we rely on the Annual Intercompany Mortality Study to help us estimate these current levels of underlying insured mortality and also to help us develop a mortality trend for future experience. However, there are other factors that have particular effect on the mortality studies that we are doing, especially a study that has covered the decade of the 1980s. In order for us to be able to wade through the data and find the underlying true mortality level, we must identify these other factors and their effect on the mortality reports that we receive. I don't

claim to know the true effects of these factors or even all of the factors. However, I would like to concentrate on a few of the more obvious ones.

The first, and one that's been touched on by the other two panelists, has been the introduction of premium rates based on smoking status. It's been almost a decade now since premium rates were based upon smoking status. What has been the effect on various mortality studies? From the smoker-distinct information received by our committee we have noticed that the average size of a nonsmoker policy is of the order of 150% of the average size smoker policy. This is probably due mostly to the fact that the price-per-thousand is lower for nonsmoker business. What effect does this have on mortality? Well, for companies that have been able to segregate their data in Canada, 35% of the cases issued were smoker and 65% were nonsmoker. The closest approximation we have to the similar percentages for the 1969-75 Canadian Assureds Table was 48% smokers and 52% nonsmokers. This is fairly consistent, I guess, with the numbers shown by Faye earlier. Since there was no price differential in the rates underlying the 1969-75 Table, it is probably a safe assumption that the average size smoker policy equalled the average size nonsmoker policy at the time of the 1969-75 Table. These percentages were taken from a study done to produce smoker-distinct mortality tables for tax reserves in the early 1980s. I have, in fact, simplified this table of ratios, which was produced to vary by age. So, what then is the underlying improvement in mortality? Recent Canadian experience shows that select mortality experience is running less than 70% of the old table. How much of that gain can be accounted for by the change in smoking percentages? Let's do the arithmetic using smoker mortality equal to twice nonsmoker mortality.

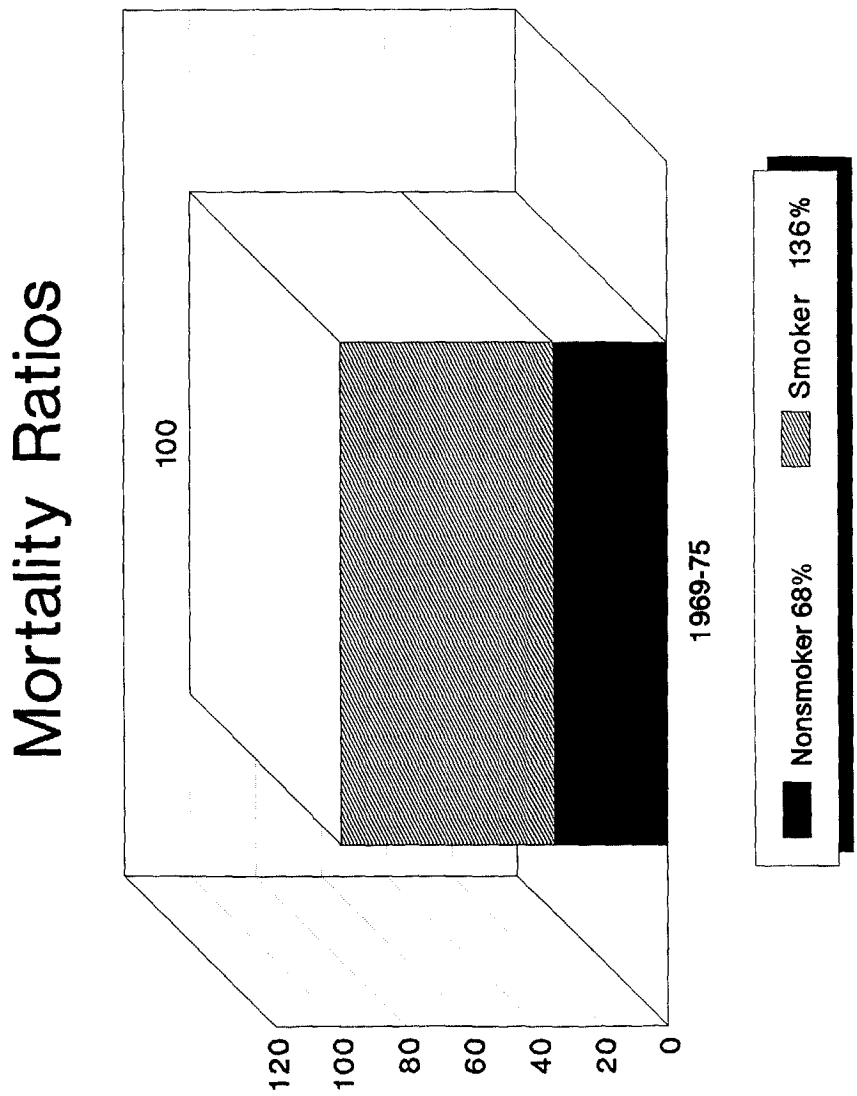
Looking at Chart 2 which is 100% of the 1969-75 Table, we use 48% (the experience being smoker) with the ratio of 136% of standard mortality. Also, 52% is nonsmoker, with a ratio of 68% or half the expected mortality of the smokers. Now we will see the effect of the changes in smoking habits, assuming that the data underlying the 1982-88 table is 35% smokers and 65% nonsmokers. (See Chart 3.)

Without any change in the underlying mortality experience, that is still 136% for smokers and 68% for nonsmokers, we have an aggregate mortality now equal to 92% of the 1969-75 Table. We have yet to account for the fact that the nonsmoker policies are on average a larger size, and we might not find out. Factoring in the smoker percentage by amount, the 35% is now reduced to 26%. Therefore 74% of the business is nonsmoker at 68% of the aggregate mortality, and only 26%, remember that's down from the 48% before, is at 136%.

The overall aggregate mortality would be 86% of the old table, again without any improvement on the underlying mortality. (See Chart 4.)

This analysis, therefore, would suggest that 14 points of the 30-point improvement in mortality that I mentioned before are due only to the change in the relative share of the business that is smoker, rather than any true underlying mortality improvements. Therefore, those actuaries who have been making assumptions that the underlying mortality experience has improved by 30 points or more might be pricing themselves into a substantial loss position in the near future.

CHART 2


Mortality Ratios
100
120
100
80
60
40
20
0
1969-75
Nonsmoker 68%
Smoker 136%

Mortality Ratios

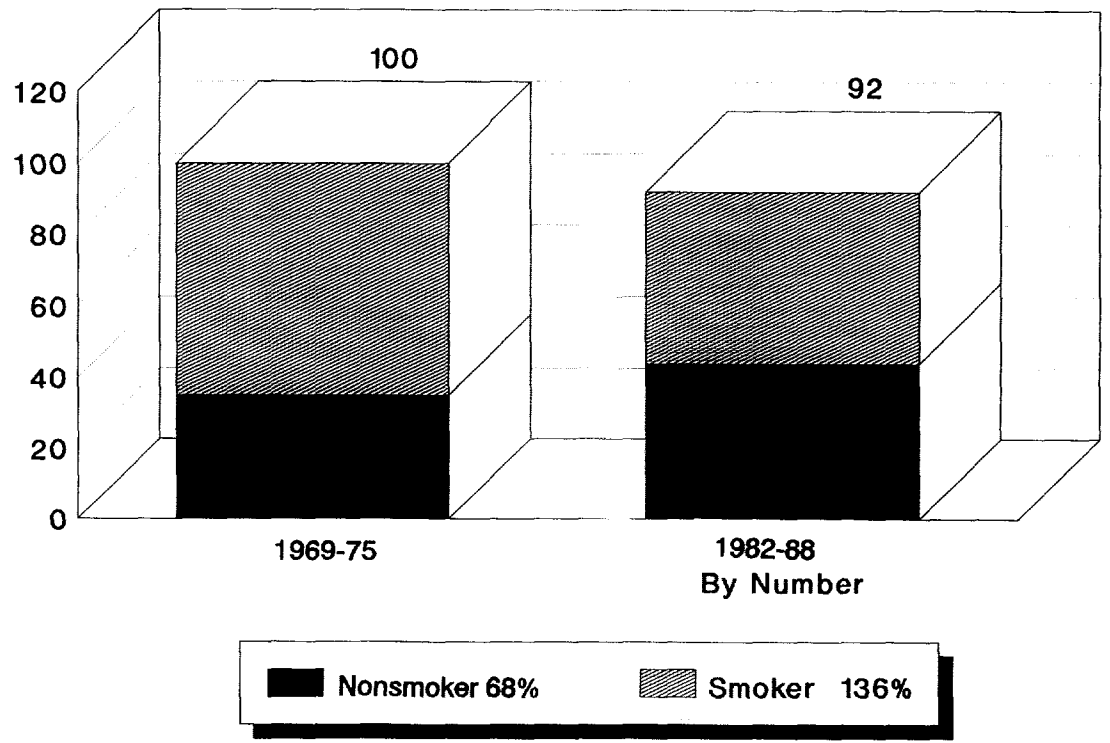
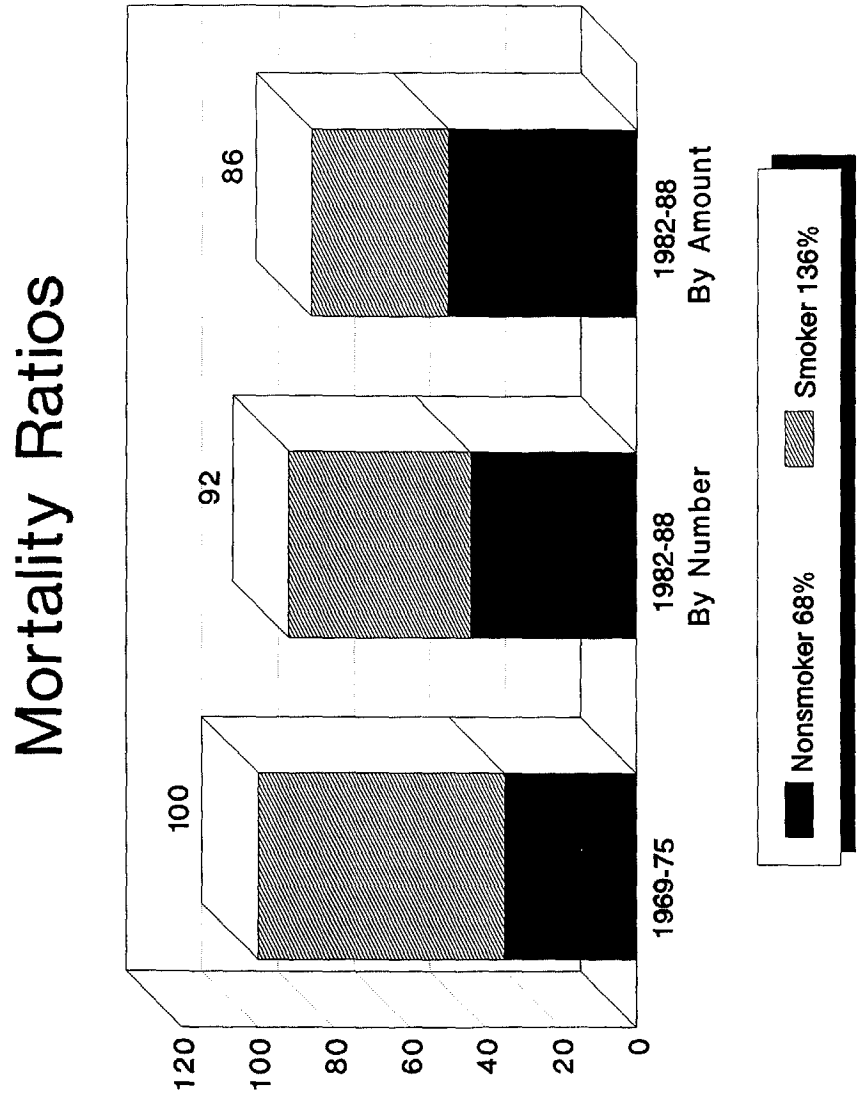


CHART 4


Mortality Ratios
120
100
80
60
40
20
0
100
92
86
1969-75
1982-88
By Number
1982-88
By Amount
Nonsmoker 68%
Smoker 136%

There is still a substantial amount of data submitted to the Canadian Institute of Actuaries that cannot be split by smoking status. Unfortunately, it's still about 40% of the new business. I would feel more comfortable about this analysis I have presented to you if we were able to include all the business that has been sold on a smoking status basis in the appropriate categories. However, I still think the analysis you've just seen is valid.

Second, let me talk about the effect of more stringent underwriting in the past few years. The underwriting processes put into place because of the AIDS epidemic have, as expected, resulted in better, early duration mortality as well as substantially higher underwriting costs. The AIDS screening process should eliminate almost all early duration AIDS claims, but ultimately most of the effect of the screening process will wear off and we will still get more AIDS claims in later policy years. What, in effect, is happening is that for the period of time that AIDS is a risk, and we still impose stringent underwriting processes, I believe the slope of our mortality curve will change. Select mortality ratios will start lower in duration 1, and the slope of the ratios will become steeper when we include the AIDS claims. What effect does this have on the mortality that we have now been experiencing? Well, it has a couple of effects.

First, we have received the advantage of the early duration improvement in mortality, but we have not yet felt the full effect of the AIDS epidemic on our claims. Therefore, while there is still some evidence in the data that the slope is changing, it is not yet as pronounced as it probably will be in a few years from now. The second effect is the inflation effect on business. The average size policy has been increasing every year by about 5-10%. Therefore, the duration 1 nonsmoker issues are 50% (or more) larger than the average case in the duration 6-10 group. This will place more weight on the better-than-average duration 1 mortality and less weight on the duration 10 mortality when we review the overall select experience by amount. On a smoker-distinct mortality ratio this could possibly account for a few points, let's say two, of movement in the overall select experience as a ratio to the original expected table. Therefore, we can possibly account for 16 of the 30-point improvement in aggregate mortality as not truly being mortality improvement.

Third, let me talk about permanent versus term mortality. Interestingly, the Canadian Intercompany Mortality Study shows that term mortality experience is at least as good as, and probably better than, permanent experience. This is certainly not consistent with historical thought. Why is this happening? We've already talked about the different average size policies by smoking status. The smoker experience published by the CIA does not segregate permanent or term business by smoking status. So, let me ask you a couple of what-ifs that might help explain the situation. What if the average size term policy for a nonsmoker was twice the size of that for a smoker? What if the average size permanent policy for a nonsmoker was about the same size as that for a smoker? These what-ifs are probably not far from reality, noting that I am excluding from our Canadian study term-to-100 business. Now, if the above was true, then using the mortality equations as before we would have term business made up of, now by amount, 21% smokers and 79% nonsmokers. On an aggregate basis this would produce 82% of the old table.

Permanent business, though, would be based on 35% smokers and 65% nonsmokers. On an aggregate basis that would come out to 92%, or a 10% differential, again assuming the same underlying mortality. So the spread of 10 points between the aggregate term mortality versus the aggregate permanent mortality can therefore be created without any underlying mortality differential. (See Chart 5.)

I cannot verify whether or not this is the case without doing some additional analysis of the data, but while I'm at this let me ask you one more what-if on term versus permanent business. What if 75% of the term issues were to nonsmokers but only 60% of the permanent issues were to nonsmokers (again using the same equations)? (See Chart 6.)

We now have a term portfolio made up of only 14% smokers and 86% nonsmokers versus a permanent portfolio that's made up of 40% smokers and 60% nonsmokers. On an aggregate basis we have term mortality at 78% versus permanent mortality at 95%. So I've now increased the spread to 17 points without any underlying differential in mortality. Again, one cannot tell from the published data whether or not such assumptions are valid. One only knows that term mortality does look better than permanent.

I have one last comment on permanent versus term mortality, and it has to do with antiselective lapsation. Such lapsation is theorized to affect term business much more than permanent business. Since higher lapses are experienced on term business, the result should be deteriorating mortality experience in term business and, therefore, higher ultimate mortality. In fact, the Canadian Institute of Actuaries published experience does not support this theory either. Ultimate mortality experience in term business is at least as good as for permanent. Could this again be the case of smoking status masking the results? This is possible if enough companies change their in-force term policies to a smoking-distinct basis at the time they introduce nonsmoker rates. Was this the case or is the theory of antiselective lapses only that, a theory? Of course, there has possibly been some antiselective lapsation effect on the permanent business as well. So, let's look at that next.

The early 1980s were a period of high inflation and high interest rates. New money products and interest-sensitive products were supposedly vehicles providing for widespread replacement of old, permanent, in-force, cash-value products which had built up a substantial settlement value. Again, using the theory of antiselective lapsation, this should have resulted in deteriorating mortality on the remaining block of in-force, permanent business. Well, perhaps it did. Perhaps this is why ultimate term mortality is better than, or at least as good as, permanent. The question that the pricing or valuation actuary has to ask himself is whether this has resulted in ultimate mortality rates that are now too high relative to the underlying true mortality that we are now trying to determine. Perhaps ultimate mortality experience will actually be much better than what we have been developing using the intercompany experience, which has been artificially increased because of these factors mentioned above.

I apologize for going on so much in reviewing mortality, but I believe that it is important to see how taking mortality experience at face value without analyzing its source can be very dangerous.

CHART 5

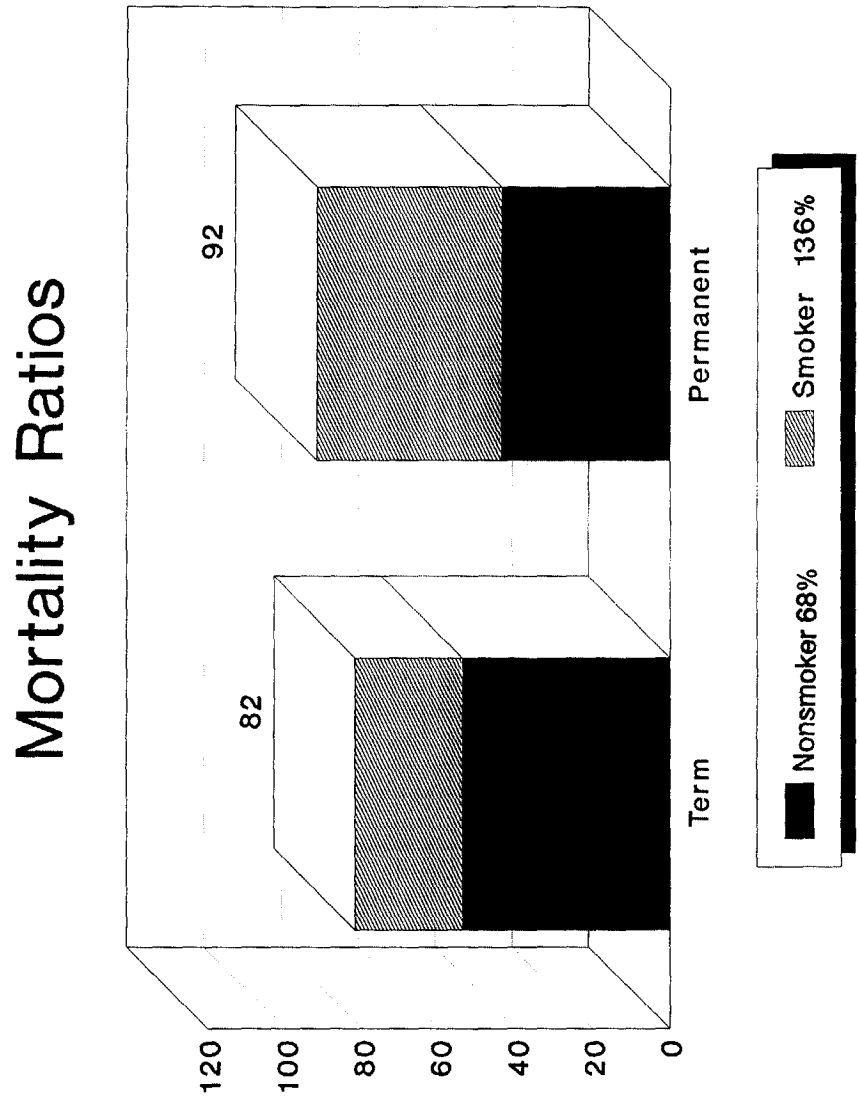
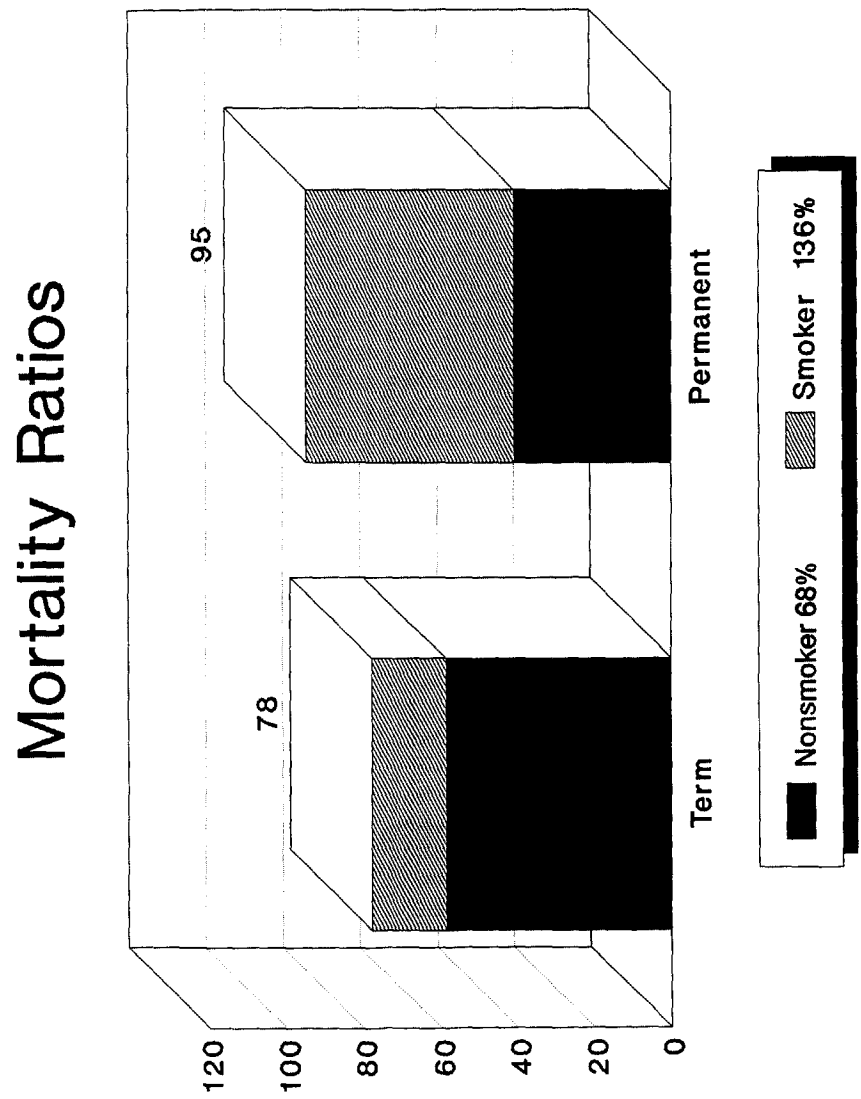

Mortality Ratios
120
100
80
60
40
20
0
82
92
Term
Permanent
Nonsmoker 68%
Smoker 136%

CHART 6


Mortality Ratios
120
100
80
60
40
20
0
78
95
Term
Permanent
Nonsmoker 68%
Smoker 136%

MR. THOMAS P. EDWALDS: Ms. Caballero, you made the comment when you looked at the age 30-39 blip in the data that it might be due to accidental death. I was wondering why you had concluded that it wasn't due to AIDS?

MS. CABALLERO: I talked about the possibility of AIDS with one of our underwriting directors. She basically said it could be more so accidental death. Unfortunately, for that study we didn't have any cause of death, so we couldn't determine what it was. It could possibly be AIDS.

MR. JAMES W. PILGRIM: A couple of observations. I think Manulife Financial is to be commended for the job it has done in a very short period of time with the reinsurance mortality study. I would ask a couple of things for clarification when you do future studies. First, the large amount study for the Society of Actuaries has a very specific definition of classification amount, and it's tough to match that up with amounts of policies. It was my understanding, and we were a contributing company, that you asked for amounts of reinsurance of a million dollars or over. Now, that could be a $5 million policy. It could be a $10 million policy, what-have-you. The definition of a classification amount in the Society of Actuaries' large amount study is the total amount that the particular company that is underwriting the case at that time knows about relative to that particular insured life, and it may not be the total in-force and applied for that we're all familiar with in the reinsurance industry. So, I think we need to make sure that we specifically identify the difference in definition.

I think your comparison, however, with the $1 million and over category was most appropriate because that's the closest classification amount in the intercompany study to the levels that you had in your reinsurance study. Second, it's unfortunate you didn't have cause of death. I hope that in future studies you do have cause of death. When I was with my former company I used to analyze our reinsurance experience relative to the Intercompany Large Amount Study, and the way we did it was to add back the ceding company's retention limit on a by-life basis to the amount of reinsurance we had so we could get it as close to the Intercompany Large Amount Study as possible. The interesting thing we found was that for reinsurance experience you have a much larger percentage of traumatic deaths, accidents, homicides and suicides. So you get a much flatter curve in the mortality of reinsured cases than you do in the Intercompany Society of Actuaries' Large Amount Study.

MS. CABALLERO: The two points that you mentioned are well taken about the classification amounts and cause of death. Actually, one of the things that we tried to do was not to discourage the reinsurers who contributed to this study. So we tried to get information that would make it easier for reinsurers to submit the data to us as fast as possible and also to come out with the results fairly fast. I think where the last two attempts were done, reinsurers have been waiting for months before anything has come out. The first reaction of our medical director was interest in the cause of death, and for the 1990 study those two items are some of the changes that we've made. Now, what we'd like to do on the classification amount is to get the direct face amount and get the reinsurance net amount at risk so that we will be avoiding duplication.

MR. IAN ARTHUR GLEW: I have a question for Faye, and it really relates to the comments that Gordon was making with regard to differentials in smoker and nonsmoker

mortality. You quoted some numbers that showed under the Bragg study that in the early 1980s mortality was around 88%, and it declined to somewhere around about 80-82% for years 1986, 1987 and 1988. You also say that the percentage of smokers had also declined during that period of time. Do you know whether that improvement in mortality in the Bragg study was mainly due to a change in the percentage of smokers?

MS. ALBERT: I can't tell you that it was directly due to that, no.

MR. PAUL A. HEKMAN: Relative to the amount of insurance between smokers and nonsmokers, I've seen some statistics, and I can't remember where, which seem to indicate a significant difference in the socioeconomic level between smokers and nonsmokers. I don't know if somebody else could confirm that.

MR. JARDIN: I would just say that seems to be the case, and I think that has had an effect again on the different mortality levels.

MR. ROBERT J. JOHANSEN: I've been doing a little bit of research on smoker versus nonsmoker mortality and looking at some older studies including the Surgeon General's reports. They do indicate that smokers tend to be more blue collar, have lower income and, I suppose, other factors of a socioeconomic character, so that you have that effect in a split of smoker versus nonsmoker mortality. The problem is to figure out what the actual effect is of the differences in those characteristics. Unfortunately, the data don't help you at all on that. So, you have to try to estimate it or do something. This is related to something else which is part of the mystery of smoker and nonsmoker mortality, and that is let's say you have two groups of lives. Both have been selected by nonmedical or medical selection processes. Now, you would expect that in the first policy year both groups would be healthy. Yet why is it that in the first policy year the smoker mortality is about double the nonsmoker? Could they have developed lung cancer, emphysema, heart disease, within that first year? It doesn't seem reasonable. So, there must be some other factor in there, which may be socioeconomic, and that's the kind of mystery I'm trying to solve.

MS. ALBERT: Bob, I would just like to comment on that. I think that the main category that you classify people in for anticipating their mortality is by age first and then sex. So, at a particular age and sex you might have a mortality rate, say, for somebody age 35 that is a nonsmoker. A healthy life that you have underwritten that is older would have a higher mortality rate, even if they were still in the select period, and I think that it's possible that the effects of smoking are similar on the body to aging. It just puts you in a more deteriorated state, even in the select period. I don't know if that's a total answer, but that's what I have thought it might be.

MR. JOHANSEN: I do recall working on a study of smoker versus nonsmoker. They were white male, defined as middle class and traced over a short period of years. My recollection is that the mortality of the two groups in the first year was very close, and gradually the difference between them widened as the study got older. I've been able to track down that study and, unfortunately, the published data does not show anything by duration.

MR. EDWALDS: A quick comment on Bob's observation. I know that on the property and casualty side they have found that there are pricing differentials on private passenger auto insurance between smokers and nonsmokers. So, it's quite possible there may be a higher accidental death rate for smokers than nonsmokers as well.

I did have a couple more questions for Faye. First, to what extent can we rely on the representation of smoker versus nonsmoker from the underwriting application and how might misrepresentation on the application get into the data? Second, I noticed that there seemed to be a fairly significant differential between the never-smoked and the quit-smoked categories. I want to know if you'd opine if this is a pricing opportunity for a rate differential.

MS. ALBERT: Well, it sounds like those are two connected questions. The problem of misrepresentation on the application is not dealt with directly in this data. We really rely on the companies to verify that their applications are correct and that they've presented the data to us correctly. Where it is subdivided between lighter smoking and heavier smoking, that is a subset of the total data. Not every company keeps that. Probably that is more accurate. I think those companies that pay attention to recording that kind of information are pretty careful about verifying it and may, in fact, already be doing pricing and have differential pricing based on that. I think it's a good opportunity.

MR. JARDIN: I would just make one comment to say that I know in the past, and maybe still today in Canada, there was a never-smoked policy sold. I don't know what the definition was, whether it was not smoked for 10 years or five years or what; it was certainly some period longer than one year anyways.