

**MINNEAPOLIS FIREFIGHTERS'  
RELIEF ASSOCIATION**

*Mortality Experience Study  
2000 to 2004*

July 2005

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**Introduction and Actuarial Certification**

Van Iwaarden Associates has served as the actuary for the Minneapolis Firefighters' Relief Association since 1998. We have performed actuarial valuations annually beginning with the December 31, 1998 report. During that period we have monitored how well the assumptions we use in these reports tracks with experience from year to year.

The actuarial assumptions used in the annual valuations for MFRA are intended to be reasonable estimates of future events that affect the amount and timing of the payment of benefits and the accumulation of trust assets. These estimates are in turn used to determine, as dictated by statute, the annual contributions needed to provide for the payment of these future benefits. The funding interest rate and the assumed salary increase rate, both dictated by statute, are significant economic assumptions that affect contribution amounts. The *actual* return on assets will generally have the largest impact on contribution levels. However, because of the declining number of active participants, the most significant *demographic* assumption affecting contribution levels is mortality.

In recent years we have noted consistent actuarial losses, that is, for several years the liabilities measured have turned out to be higher than expected based on the previous year's results. The deviations have not been substantial, but nonetheless it is important that actuarial assumptions be reviewed periodically to ensure that they remain reasonable and appropriate.

The most significant demographic assumption used in measuring liabilities is mortality. The mortality table that we have used was used with the MFRA valuations by the prior actuary since at least 1989. This table was first published for use by actuaries in general in 1974. Given the age of the table and given the actuarial losses we noted, we felt that it would be prudent to more directly study MFRA's mortality experience to determine whether a switch to a more recent table would be warranted.

This report presents the results of a study of the mortality experience of the Minneapolis Firefighters' Relief Association (MFRA). We have used participant data from the actuarial valuations prepared for the plan to study the five-year period from 2000 through 2004.

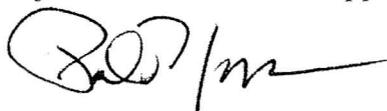
The report is divided into three sections. The first section describes the participants included in this study, the current mortality assumptions used to perform the annual actuarial valuations, and the actuarial methods employed in reviewing these assumptions. The second section details the results of the study. The third section provides a summary of the results and our professional conclusions.

**Actuarial certification**

This report has been conducted in accordance with generally accepted actuarial principles and practices. To the extent applicable we have followed the actuarial standards of the State of Minnesota as they relate to experience studies. The study is to the best of our knowledge complete and accurate. The actuarial methods have been applied on an objective basis and were appropriate for the purpose described.

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## Basis of Study

### Plan participants

The individuals included in this study were members of the Minneapolis Firefighters' Relief Association ("MFRA"). Census data collected for the December 31, 2000 through December 31, 2004 actuarial valuations for MFRA form the basis for this review. The data used is the historical data including adjustment for later corrections. This produces a slight inconsistency with the valuation results as originally reported, but the differences are not material.

We have limited our review to retirees and beneficiaries because this is by far the largest group of participants and will soon be the only group. The number of active or deferred vested participants during the period of this study were not large enough to provide a basis for meaningful conclusions.

The census data and the current mortality assumptions described below were used to determine the expected number of deaths during 2000 through 2004. The actual numbers of deaths were accumulated on an annual basis from the valuation data described. This data was reviewed for accuracy and consistency.

### Mortality assumption

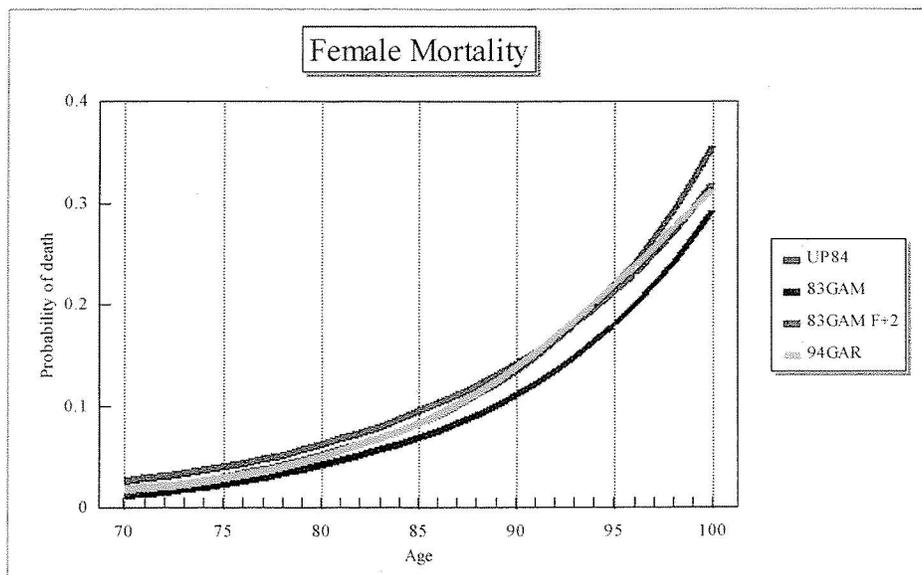
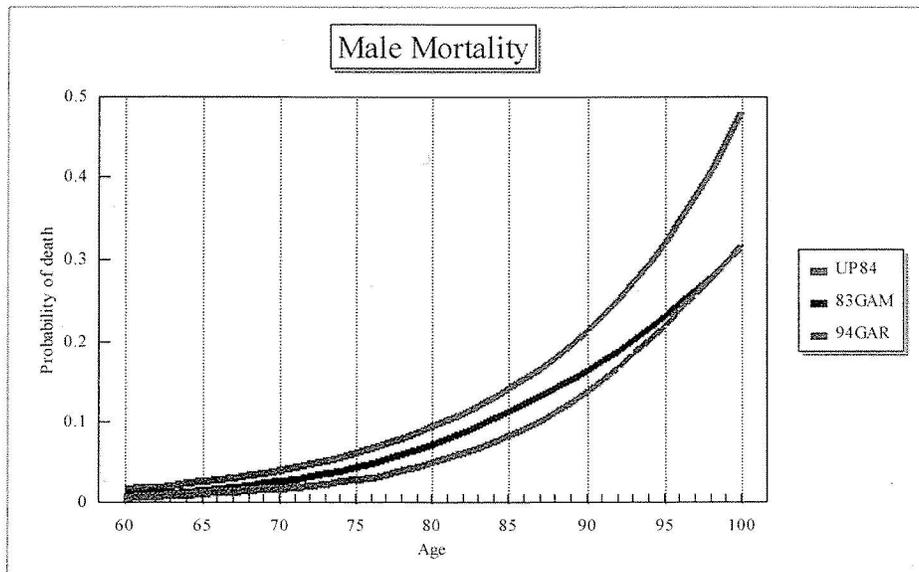
Mortality tables are used to give an estimate of the duration of benefit payments to participants and their beneficiaries. These tables provide, for each age, the probability of death during the ensuing year. In general, population sizes of millions of individuals are required to produce mortality tables that are statistically reliable. Few retirement plans have sufficient participants to generate their own tables, and so most plans use "standard" mortality tables produced by combined scientific studies. For the MFRA, we are currently using the "UP 1984" mortality table, with certain age adjustments for male and female participants or beneficiaries (adj UP84). This table was completed in the early 1970's. Sample rates from the adjusted UP 1984 table are as follows:

<u>Age</u>	<u>Males</u>	<u>Females</u>
60.0	0.01701	0.01081
65.0	0.02723	0.01701
70.0	0.04087	0.02723
75.0	0.06314	0.04087
80.0	0.09622	0.06314
85.0	0.14318	0.09622
90.0	0.21504	0.14318
95.0	0.32255	0.21504
100.0	0.48383	0.32255

## Basis of Study

### Comparison of alternative mortality tables

The graphs below show a comparison of the adjusted UP 1984 table with two more recent standard mortality tables - the 1983 Group Annuity Mortality table (83GAM), and the 1984 Group Annuity Reserve table (94GAR). We have also included in the female graph an adjusted 1983 GAM table. This table includes a 2-year "set forward".



Note that in the female graph the 94GAR and 83GAM F+2 lines are very similar.

## Basis of Study

### Actuarial methodology

Based on the participant data and mortality assumptions described above, the expected numbers of deaths were determined for each age and then accumulated into five-year age groups. The expected occurrences were then compared to the actual number of occurrences for each year from 2000 through 2004. The results for each year were then accumulated into tables covering the entire period.

The UP 1984 table is a unisex table that has been adjusted to obtain sex-distinct mortality rates.

The 1983 GAM table was constructed by a Society of Actuaries committee using 1966 experience projected to 1983 with a 10% margin included in the final rates.

The 1994 GAR table was also constructed by the Society of Actuaries. It is a unisex table adopted by the Internal Revenue Service for valuing lump sums. It has a 7% margin and is designed to be used as a generational table. For purposes of this study, we simply used the current 94 GAR rates without projection.

## Results of Study

### Retiree and beneficiary mortality - current assumptions

The tables below show a comparison by age and gender of the actual versus expected number of deaths for retirees and beneficiaries of MFRA over the five years 2000 through 2004. Results were compiled for each year and then accumulated into these tables. The columns labeled "Exposure" indicate the number of retirees/beneficiaries counted once for each of years they were considered. Overall, the number of deaths was less than what would have been predicted by the current mortality assumptions, although the prediction would have been closer for females than for males. The total number of female deaths was 98% of expected. Male deaths were only 77% of expected.

**TABLE 1**  
**Current Assumptions (adj UP84)**

<u>Age</u>	<u>Exposure</u>	<u>Female</u>			<u>Male</u>			
		<u>Actual Deaths</u>	<u>Expected Deaths</u>	<u>Actual/Expected</u>	<u>Exposure</u>	<u>Actual Deaths</u>	<u>Expected Deaths</u>	<u>Actual/Expected</u>
40-44	5	0	0.0	0%	0	0	0.0	0%
45-49	6	0	0.0	0%	0	0	0.0	0%
50-54	21	0	0.1	0%	179	4	1.6	251%
55-59	35	1	0.3	339%	300	5	3.9	127%
60-64	56	1	0.7	137%	321	4	6.6	61%
65-69	79	0	1.7	0%	344	3	11.4	26%
70-74	104	3	3.3	90%	424	14	20.5	68%
75-79	135	7	6.6	106%	315	10	23.1	43%
80-84	194	15	14.9	101%	114	11	12.6	87%
85-89	216	19	24.1	79%	125	21	20.9	101%
90-94	87	14	14.2	99%	42	14	10.5	134%
95 +	22	10	5.1	195%	8	2	2.9	68%
	960	70	71.1	98%	2,172	88	113.9	77%

## Results of Study

### Retiree and beneficiary mortality - alternative assumptions

The following table shows actual versus expected deaths using the 1983 Group Annuity Mortality table set forward two years for females (83 GAM F+2). The 83 GAM table is a standard table and more recent than the UP 1984 table currently used to measure liabilities. It is the table that has been used by the PERA Police and Fire funds, although based on their recent studies, they have added a one-year "setback" to male and female rates.

Overall, the number of deaths was higher than what would have been predicted under 83 GAM F+2. The margin - the amount by which these rates exceed 100% - is somewhat above the 5% to 10% margin used by standard mortality tables. Given that mortality rates generally improve over time, a margin allows a table to have a longer "shelf-life" because it builds in an allowance for mortality improvement.

**TABLE 2**  
**Alternative Assumptions (83GAM F+2)**

Age	Exposure	Female			Male			
		Actual Deaths	Expected Deaths	Actual/Expected	Actual Deaths	Expected Deaths	Actual/Expected	
40-44	5	0	0.0	0%	0	0	0.0	0%
45-49	6	0	0.0	0%	0	0	0.0	0%
50-54	21	0	0.1	0%	179	4	0.9	437%
55-59	35	1	0.1	729%	300	5	2.2	231%
60-64	56	1	0.4	277%	321	4	3.6	111%
65-69	79	0	0.9	0%	344	3	7.1	42%
70-74	104	3	2.2	136%	424	14	14.1	99%
75-79	135	7	5.2	133%	315	10	16.9	59%
80-84	194	15	12.7	118%	114	11	10.0	110%
85-89	216	19	21.7	88%	125	21	16.6	127%
90-94	87	14	13.9	101%	42	14	7.9	177%
95 +	22	10	5.4	186%	8	2	2.1	97%
	960	70	62.6	112%	2,172	88	81.2	108%

## Results of Study

### Retiree and beneficiary mortality - alternative assumptions (continued)

The following table shows actual versus expected deaths for the MFRA using the 83 GAM F+2 M-1 table. This table produces a higher margin for males - about 19%. This table still models mortality better than the current mortality assumptions, but would probably need to be reviewed sooner than if the margin were larger. Since the population considered is smaller than the combined population, a larger margin is more appropriate.

**TABLE 3**  
**Alternative Assumptions (83GAM F+2 M-1)**

Age	Exposure	Female			Male			
		Actual Deaths	Expected Deaths	Actual/ Expected	Actual Deaths	Expected Deaths	Actual/ Expected	
40-44	5	0	0.0	0%	0	0	0.0	0%
45-49	6	0	0.0	0%	0	0	0.0	0%
50-54	21	0	0.1	0%	179	4	0.8	478%
55-59	35	1	0.1	729%	300	5	2.0	249%
60-64	56	1	0.4	277%	321	4	3.3	123%
65-69	79	0	0.9	0%	344	3	6.3	47%
70-74	104	3	2.2	136%	424	14	12.8	109%
75-79	135	7	5.2	133%	315	10	15.2	66%
80-84	194	15	12.7	118%	114	11	9.1	121%
85-89	216	19	21.7	88%	125	21	15.4	137%
90-94	87	14	13.9	101%	42	14	7.4	190%
95 +	22	10	5.4	186%	8	2	1.9	104%
	960	70	62.6	112%	2,172	88	74.2	119%

## Results of Study

### Retiree and beneficiary mortality - alternative assumptions (continued)

The following table shows actual versus expected deaths for the MFRA using the 83 GAM F+3 table. This table provides little or no margin for future mortality improvements, but it still models mortality better than the current mortality assumptions. Because of the lack of margin, this table would probably need to be reviewed within 5 years.

**TABLE 4**  
**Alternative Assumptions (83GAM F+3 M+1)**

Age	Exposure	Female			Male			
		Actual Deaths	Expected Deaths	Actual/Expected	Exposure	Actual Deaths	Expected Deaths	Actual/Expected
40-44	5.0	0.0	0.0	0%	0.0	0.0	0.0	0%
45-49	6.0	0.0	0.0	0%	0.0	0.0	0.0	0%
50-54	21.0	0.0	0.1	0%	179.0	4.0	1.0	401%
55-59	35.0	1.0	0.2	657%	300.0	5.0	2.4	213%
60-64	56.0	1.0	0.4	250%	321.0	4.0	4.0	100%
65-69	79.0	0.0	1.0	0%	344.0	3.0	8.0	38%
70-74	104.0	3.0	2.5	120%	424.0	14.0	15.5	90%
75-79	135.0	7.0	5.8	120%	315.0	10.0	18.7	54%
80-84	194.0	15.0	14.0	107%	114.0	11.0	10.9	101%
85-89	216.0	19.0	23.8	80%	125.0	21.0	17.9	118%
90-94	87.0	14.0	15.3	91%	42.0	14.0	8.4	166%
95 +	22.0	10.0	5.9	169%	8.0	2.0	2.2	91%
	960.0	70.0	69.1	101%	2,172.0	88.0	88.9	99%

## Results of Study

### Alternative assumptions - effect on funding

Use of an updated mortality table will generally result in an increase in liabilities and funding requirements. Replacement of the current mortality table with the 83 GAM F+2 table would in general increase liabilities by about 12%. Use of the alternative tables reviewed would also increase liabilities.

Based on the assets and participant data used for the December 31, 2004 actuarial valuations for the MPRA and MFRA, the alternative mortality assumptions reviewed would have had the following effect on funding:

**TABLE 5**  
(dollar values shown are in millions)

Table	Actuarial Liability	Unfunded Actuarial Liability	Funded Ratio	Amortization Payment	Life Expectancy (male age 65)
UP84 adj	\$276	\$27	90.2%	\$2.3	14.1
83GAM F+2	308	59	80.7%	5.4	16.7
83GAM F+2 M-1	314	66	79.1%	6.0	17.5
83GAM F+3 M+1	297	49	83.6%	4.4	16.0

### Summary and Observations

The number of retiree and beneficiary deaths during the period studied was lower than expected under the current mortality assumption (UP84). While the total number of deaths, and the total number of participants during the study period are too few to state with *statistical* certainty that a change is required, the results seem to indicate that an update of the mortality assumption is needed. This is consistent with the trend in retirement systems generally, and with police and fire plans in Minnesota. It is better to be slightly optimistic about the mortality than to experience future actuarial losses.

We request that the LCPR approve a change in mortality assumption to the 1983 Group Annuity Mortality table, including a two-year set forward for females. Use of this table would more closely follow recent experience and would provide a "margin" of about 5% to 10% to allow for future improvements in mortality and to reflect the unreliability of the small sample size.