TRANSACTIONS OF SOCIETY OF ACTUARIES
1983 VOL. 35

DEVELOPMENT OF THE 1983 GROUP ANNUITY MORTALITY TABLE

COMMITTEE ON ANNUITIES*

INTRODUCTION

The (C) Committee Technical Task Force on Valuation and Nonforfeiture Value Regulation of the National Association of Insurance Commissioners met in Los Angeles in December of 1979. A Standard Valuation law based on dynamic interest rates had been introduced which would affect reserve requirements. The committee recognized that, when the law went into effect, interest margins in minimum annual statement reserve calculations would be decreased. The Technical Task Force was also concerned that the mortality margins might have eroded over time resulting in the minimum reserves being inadequate.

At that meeting, the Technical Task Force asked the Society of Actuaries to evaluate group annuitant mortality as well as the adequacy of the published mortality rate projection factors. If the Society determined that there was a need, it should "commence directly with developing new bases or tables."

In response to the request of the Task Force, the Society appointed its Group Annuity Mortality Committee (hereafter called the committee) to evaluate current levels of pensioner mortality. The committee's initial task was to analyze both the 1971 Group Annuity Mortality Table and its accompanying Projection Scale D. The 1971 GAM Table had been developed from the 1966 Experience Table, which was based on experience from 1964 through 1968.

The committee examined recent insured, uninsured and population data. All experience examined indicated a definite decrease in mortality rates. The pensioner mortality data were subject to considerable fluctuations due to heterogeneity of data or insufficient exposures. Therefore, the committee relied heavily upon nonpensioner mortality data as the basis for much of its work.

*Committee membership: Robert M. Chmely (chairman), Donald Fischer, Michael H. Gersie, Jean Gregoire, Gerald Griswold, Herman Lewis, Robert S. McClester, John A. Nikander, Charles A. Peirce, Francis P. Sabatini.

The committee concluded that the 1971 GAM Table, in either its unprojected or projected form, had become inadequate as a basis for determining minimum statutory reserves for current group annuitants. Then the committee developed mortality projection rates based heavily on population data since 1966. These projection rates were applied to the 1966 Experience Table at quinquennial ages. The resulting unloaded mortality rates were graduated and then loaded with a 10 percent margin to produce a new group annuity mortality table.

This paper describes the analysis made of the 1971 GAM Table and introduces the 1983 Group Annuity Mortality Table along with revised mortality rate projection scales. The new table is intended to be used as an interim valuation basis pending the development of a new mortality table. The committee is now collecting data to produce a new table based upon intercompany experience to be collected for the years 1981-85.

An exposure draft of this report was sent to all members of the Society of Actuaries. Several comments on the exposure draft were received and revisions have been made as appropriate. Revisions have been made to a number of tables to correct an error in the final q_x for females at age 87, and to correct an error in Projection Scales G and H for males at age 37. (These corrections had only minimal effect on annuity values.) An addition has been made to the text to avoid any confusion as to method of the interpolation used in Projection Scale H. Comments were received on the assumptions used to develop mortality rates for the aged and for females, and on the recommendation that individual tables be used when antiselection is expected. These portions of the table were not changed, but we hope to produce additional data to analyze these areas when a permanent table is developed in the future.

SOURCES OF DATA

The last intercompany study of group annuity mortality data was included in the 1975 Reports. Since 1973, only six companies have contributed experience data for further study. After review, it was found that the data contributed by four of the six companies contained serious inconsistencies and should not be used. As a result, the committee limited its review of insured group annuity data to experience submitted by Prudential for calendar years 1976-80 inclusive and by the Bankers Life for the years 1973-74 and 1980-81.

PRUDENTIAL EXPERIENCE

A study of mortality ratios was performed separately for male and female retired lives insured under Prudential group annuity contracts. This study,

TABLE 1

ACTUAL/EXPECTED DEATH RATIOS*
PRUDENTIAL EXPERIENCE
1976 AND 1980

CENTRAL AGE	MALES				FEMALES			
	1976		1980		1976		1980	
	Lives	A/E	Lives	A/E	Lives	A/E	Lives	A/E
60	9,431.00	1.26	9,435.75	1.12	3,625.00	1.39	5,016.75	0.88
65	32,390.50	1.11	30,035.25	0.85	9,634.25	1.25	11,535.00	0.99
70	36,727.25	0.95	39,891.50	0.95	11,287.50	0.94	15,326.75	0.94
75	24,304.25	0.91	29,467.50	0.89	7,199.75	0.79	11,151.00	0.73
80	2,662.00	0.86	17,195.00	0.85	3,620.00	0.73	6,198.50	0.73
85	5,461.00	0.84	7,652.00	0.85	1,595.00	0.92	2,773.50	0.79
†Total 60-85	120,976.00	0.94	133,677.00	0.89	36,961.50	0.89	52,001.50	0.80

* Expected values based on the 1966 Experience Table.
† Totals for A/E ratios are total actual deaths ÷ total expected deaths.

which covered the years 1976-80, was based on number of lives. In Table 1, actual to expected ratios are shown for 1976 and 1980 with expected values based on the 1966 Experience Table. Exposure values are shown for each cell.

Table 1 shows a definite decrease in the rates of mortality between 1976-80, with the larger decreases occurring at the younger ages. Since all actual to expected ratios after age 65 are less than 1.00, Table 1 indicates that the 1966 Experience Table may be inadequate for predicting mortality for both males and females after age 65.

Table 2 illustrates the average annual percent decreases in mortality rates on a geometric basis for the period 1976-80. The table shows that there has been a decrease in mortality rates, and it also illustrates considerable variation in the percentage decline by both attained age and sex. The Prudential experience shows average annual decreases in mortality rates which are generally greater than the values in Projection Scale D.

TABLE 2

AVERAGE ANNUAL PERCENT DECREASES IN MORTALITY RATES

PRUDENTIAL EXPERIENCE

(Geometric Basis)

1976 to 1980

CENTRAL AGE	MALES		FEMALES	
	Prudential	Scale D	Prudential	Scale D
60	2.81	0.65	10.78	1.30
65	6.31	0.63	5.75	1.28
70	0.04	0.56	0.09	1.21
75	0.64	0.46	1.93	1.09
80	0.49	0.36	0.06	0.92
85	(0.29)*	0.26	3.52	0.68
Totals 60-85	1.31	0.52†	2.51	1.15†

* ( ) indicates negative value

† Calculated by weighting Scale D values by 1980 Prudential exposures.

BANKERS LIFE EXPERIENCE

The Bankers Life Company prepares an annual internal study of retired life mortality on all pension products in its group pension line. Table 3 displays the number of lives exposed and actual to expected death ratios for study years 1973-74 and 1980-81. Two years of experience were combined to provide greater exposure significance. All expected values were based on the 1966 Experience Table.

The data show a general reduction in mortality in the later period, with the exception of males aged 85-89 and females aged 80-84. In the 1980-81

TABLE 3

ACTUAL/EXPECTED DEATH RATIOS*

THE BANKERS LIFE EXPERIENCE

1973-1974 AND 1980-81

AGE GROUP	MALES				FEMALES			
	1973-74		1980-81		1973-74		1980-81	
	Lives	A/E	Lives	A/E	Lives	A/E	Lives	A/E
55-59	854.34	2.61	1,519.42	2.37	519.52	3.13	1,588.59	1.67
60-64	3,876.80	1.60	6,886.45	1.27	2,107.60	1.59	5,593.43	1.49
65-69	12,045.44	1.17	19,422.51	1.05	4,908.21	1.06	13,448.19	0.93
70-74	8,576.56	1.01	16,988.04	0.94	2,932.28	1.15	9,893.62	0.90
75-79	5,493.09	0.98	9,979.32	0.97	1,693.31	0.96	5,074.61	0.75
80-84	2,696.34	0.98	5,094.44	0.96	802.05	0.74	2,389.08	0.90
85-89	844.40	0.95	2,040.04	0.98	240.16	0.91	889.77	0.87
†Totals 55-89	34,386.97	1.06	61,930.22	1.00	13,203.13	1.03	38,877.29	0.90

* Expected values based on the 1966 Experience Table.

† Totals for A/E ratios are total actual deaths ÷ total expected deaths.

study, actual to expected ratios were less than 1.00 for males above age 69 and for females above age 64.

Table 4 illustrates the average annual percent decreases in mortality rates experienced by Bankers Life data. Once again, the committee noted variation of results by age and sex, with decreases generally greater than those assumed by Projection Scale D.

TABLE 4

AVERAGE ANNUAL PERCENT DECREASES IN MORTALITY RATES

THE BANKERS LIFE EXPERIENCE

(Geometric Basis)

1973-74 to 1980-81

CENTRAL AGE	MALES		FEMALES	
	Bankers Life	Scale D	Bankers Life	Scale D
57	1.39	0.65	8.55	1.30
62	3.22	0.65	0.92	1.30
67	1.52	0.61	1.78	1.26
72	0.93	0.52	3.41	1.17
77	0.18	0.42	3.53	1.03
82	0.31	0.32	(2.86)*	0.84
87	(0.45)*	0.22	0.63	0.56
Totals 57-87	0.89	0.52†	1.85	1.17†

* ( ) indicates negative value.

† Calculated by weighting Scale D values by 1980-81 Bankers exposures.

GEORGE B. BUCK

Because of the shortage of data covering insured annuitants, the committee decided to review the private mortality studies conducted by George B. Buck

Consulting Actuaries in 1974 and 1979. These studies covered the periods 1969-72 and 1973-77, respectively. Table 5 shows the ratios of actual to expected deaths for the retired life portion of these studies. The ratios are shown separately for males and females with expected deaths based on the 1966 Experience Table. Exposures and deaths were calculated by number of lives.

TABLE 5

ACTUAL/EXPECTED DEATH RATIOS*

BUCK CONSULTANTS PENSION PLAN DATA

(Retired Lives)

	MALES				FEMALES			
	1969-72		1973-77		1969-72		1973-77	
AGE	Lives	A/E	Lives	A/E	Lives	A/E	Lives	A/E
55	14,395.5	2.07	15,852.5	1.59	5,738.0	1.92	8,850.0	1.95
60	44,516.0	1.66	56,280.5	1.35	12,332.0	1.74	21,303.5	1.44
65	130,137.5	1.25	124,857.0	1.09	21,016.0	1.29	33,767.5	1.26
70	122,944.5	1.11	109,070.5	1.00	16,529.0	1.11	26,881.5	1.04
75	91,395.0	1.15	72,871.0	0.99	9,297.0	0.98	16,691.0	0.94
80	53,456.0	1.08	44,248.5	0.98	4,251.5	0.91	8,349.0	0.86
85	20,643.0	1.05	19,185.0	0.97	1,229.5	0.99	2,954.5	0.91
90	4,015.5	1.06	4,928.5	1.04	150.5	1.11	599.5	0.87
†Totals 55-90	481,500.0	1.14	447,293.5	1.02	70,543.5	1.11	119,396.5	1.02

* Exposures and deaths based on numbers of lives. Expected deaths based on the 1966 Experience Table.

† Total A/E ratios are total observed deaths ÷ total expected deaths.

The summary figures at the bottom of Table 5 indicate that the average of the actual to expected ratios is greater than 1.00 for both males and females in both studies. Without reviewing other data, this would indicate that the 1971 GAM Table, which is more conservative than the 1966 Experience Table, is an adequate mortality basis. However, these results are not typical of other available pensioner data, possibly due to the unusually high proportion of persons included in the study who were employed in heavy industries. On the other hand, Table 5 shows a general reduction in mortality for the 1979 study when compared with the results of the 1974 study.

Table 6, which shows the average annual percent decreases in mortality rates derived from the Buck studies, indicates decreases in mortality rates among male lives at a much greater pace than those incorporated in Projection Scale D. No clear pattern emerged for female lives.

TABLE 6

AVERAGE ANNUAL PERCENT DECREASES IN MORTALITY RATES

BUCK CONSULTANTS DATA—RETIRED LIVES

(Geometric Basis)

1969-72 to 1973-77

CENTRAL AGE	MALES		FEMALES	
	Buck	Scale D	Buck	Scale D
55	5.74	0.65	(0.41)*	1.30
60	4.57	0.65	4.15	1.30
65	2.99	0.63	0.55	1.28
70	2.47	0.56	1.29	1.21
75	3.29	0.46	0.97	1.09
80	2.15	0.36	1.29	0.92
85	1.64	0.26	1.83	0.68
90	0.47	0.16	5.31	0.38
Totals 55-90	3.30†	0.54†	1.45†	1.20†

* ( ) indicates negative value.

† Calculated by weighting Scale D values by 1973-77 Buck exposures.

POPULATION STATISTICS

The reviews of retired life pensioner data indicated that mortality rates had decreased since the publication of the 1971 GAM Table. However, the data did not include sufficient information to form the basis for a new or updated mortality table. Consequently, the committee turned to population statistics. The committee analyzed U.S. white population statistics for the period from 1965 through 1978. Average annual percent decreases in mortality rates were calculated using annual death rates for five-year age cells. The committee observed that the period 1974-75 seemed to mark the start of accelerated mortality rate decreases.

To test this observation, multiple comparisons were performed based on Friedman's Rank Sum Test[1] to analyze the annual rates of mortality decrease. Friedman's Test is a nonparametric procedure for analyzing a statistical model with two factors. The model controls for the first factor, age, and tests for differences in the second factor, annual rates of mortality decrease. In order to assure greater applicability to pensioners, only ages 50 and older were included in the statistical analysis. The results indicated that the rates of decrease for the years 1974, 1975, and 1977 were significantly greater than for the years prior to 1974. The committee then decided that a proper description of mortality rate decrease for the period since 1966 should include two separate periods of improvement. Based on the analyses made, it was decided that 1975 was an appropriate dividing line.

Average annual percent decreases in mortality rates were calculated (on a geometric basis) for the periods from the end of 1966 to the beginning of

[1]Myles Hollander and Douglas A. Wolfe, *Nonparametric Statistical Methods* (New York: John Wiley & Sons, 1973), pp. 151–54.

TABLE 7

AVERAGE ANNUAL PERCENT DECREASES IN MORTALITY RATES

U.S. WHITE POPULATION

(Geometric Basis)

1965-1978

	MALES		FEMALES	
AGE CELL	U.S. White Population (1965-67 to 1973-75)	U.S. White Population (1973-75 to 1976-78)	U.S. White Population (1965-67 to 1973-75)	U.S. White Population (1973-75 to 1976-78)
20-24	(0.90)*	0.86	0.53	0.70
25-29	(0.77)*	0.91	0.81	2.31
30-34	0.26	2.20	1.59	3.49
35-39	1.02	3.12	1.58	4.47
40-44	1.13	3.36	1.16	3.75
45-49	0.91	3.71	1.02	2.94
50-54	1.67	2.45	1.08	1.98
55-59	1.47	3.51	0.60	2.49
60-64	0.99	2.25	0.62	0.82
65-69	1.12	2.52	2.02	1.94
70-74	0.89	2.21	1.74	2.88
75-79	(0.06)*	1.67	1.06	2.83
80-84	0.39	1.19	1.81	2.28
85 & over	1.48	1.94	3.04	2.98

* ( ) indicates negative value.

1975 and from the beginning of 1975 to the end of 1978. For each of the starting and ending dates, three years of data were used to increase smoothness. The results of the calculations are shown in Table 7 for males and females separately. With the exception of females aged 65-69 and females aged 85 and over, all cells showed greater rates of mortality reduction for the period 1975-78 than for the period 1966-75.

Canadian population statistics were also reviewed for two quinquennial periods from 1966 to 1976. Average annual percent decreases in mortality rates are shown in Table 8. Unlike the results for the U.S. population statistics, the Canadian population results did not show consistently greater rates of mortality decrease for the more recent of the two periods. Also, the Canadian population results did not show rates of decrease that are significantly greater than Projection Scale D. However, if 1975 is indeed a transition year, the effect of greater mortality rate reduction would not appear in the Canadian population data shown because the data were available only for quinquennial periods through the end of 1976.

The committee became convinced that the 1971 GAM was no longer an adequate mortality basis for statutory reserves for insured annuities. It then examined recent individual annuity, standard ordinary and Medicare experience to determine if these sources verified its conclusions.

TABLE 8

AVERAGE ANNUAL PERCENT DECREASES IN MORTALITY RATES
CANADIAN POPULATION
1966-1971 AND 1971-1976

AGE	MALES		FEMALES	
	1966 to 1971	1971 to 1976	1966 to 1971	1971 to 1976
45	0.03	0.69	0.76	0.67
50	0.58	0.76	1.02	1.37
55	0.86	0.58	0.96	1.63
60	0.84	0.79	1.49	1.31
65	0.48	1.11	1.70	1.30
70	(0.05)*	0.80	1.40	1.45
75	0.30	0.60	1.80	1.80
80	0.64	0.39	2.30	1.71
85	0.34	0.12	2.46	1.20
90	(0.47)*	(0.17)*	2.40	0.55

* ( ) indicates negative values.

Individual Annuity Experience

Table 9 shows ratios of the observed mortality rates for the period 1971 to 1976 to the corresponding rates for the period 1967 to 1971 for individual immediate annuities, as reported in the *Transactions*. The exposure periods are from anniversary to anniversary, so no overlapping of data occurred. All rates were calculated on a per life basis. The ratios are shown separately for males and females, for refund annuities and non-refund annuities, and the aggregate of the two. The table indicates a definite reduction in aggregate mortality rates for males aged 60 and over and for females aged 70 and over.

TABLE 9

INDIVIDUAL IMMEDIATE ANNUITIES
RATIO OF 1971-76 EXPERIENCE TO 1967-71 EXPERIENCE

AGE CELL	MALES			FEMALES		
	Refund	Non-Refund	Total	Refund	Non-Refund	Total
Under 50	1.286	6.871	2.040	0.536	0.609	0.601
50-59	1.242	2.054	1.368	1.047	1.551	1.157
60-69	0.868	1.236	0.921	1.050	1.450	1.101
70-79	0.926	1.001	0.942	0.991	0.964	0.977
80 and up	0.936	0.842	0.897	1.049	0.857	0.973
All*	0.930	1.116	0.960	1.025	0.987	1.000
Exposures 1971-1976	102,291	30,496	132,787	249,824	68,912	318,736

* Calculated using 1971-1976 exposures for various age cells.

Standard Ordinary Experience

Table 10 shows ratios of ultimate standard ordinary mortality experience

TABLE 10

STANDARD ORDINARY MORTALITY

ULTIMATE EXPERIENCE

(Policy Years 16 and Later)

Ratio of 1972-77 Experience to 1968-73 Experience

AGE CELL	MALES	FEMALES
50-54	0.864	0.837
55-59	0.878	0.908
60-64	0.877	0.912
65-69	0.893	0.985
70-74	0.906	0.892
75-79	0.934	0.915
80-84	0.939	0.871
85-89	0.965	0.946
90-95	0.941	1.074

from 1972 through 1977 anniversaries to the corresponding experience from 1968 through 1973 anniversaries. Calculated on the basis of amounts of insurance, the data were taken from the 1974 and 1978 Reports of the Society of Actuaries. Except for the cell for females aged 90-95, a reduction in mortality rates was noted at all ages. Table 11 shows the average annual percent reduction in observed mortality rates (on a geometric basis) for the values shown in Table 10. For ages 55 through 79, where most of the risk exists for the pension business, the rate of reduction in mortality rates av-

TABLE 11

AVERAGE ANNUAL PERCENT DECREASES IN MORTALITY RATES

STANDARD ORDINARY ISSUES

ULTIMATE EXPERIENCE

(Geometric Basis)

1968-73 to 1972-77

CENTRAL AGE	MALES	FEMALES
52	3.58	4.35
57	3.20	2.39
62	3.23	2.28
67	2.79	0.38
72	2.44	2.82
77	1.70	2.19
82	1.55	3.40
87	0.88	1.38
92	1.51	(1.79)*
Average for ages 55 through 79	2.67	2.01

* ( ) indicates negative value.

eraged 2.67 percent per year for males and 2.01 percent per year for females (based on individual cells weighted by actual experience). It was noted that these decreases were much greater than those assumed by Projection Scale D.

Medicare

Finally, the committee analyzed the average annual percent decreases in mortality rates for persons covered under Medicare between 1973 and 1977. The data, which are shown in Table 12 for ages 52 to 82 inclusive, indicate rates of decrease in excess of 2.0 percent for most male ages and in excess of 2.7 percent for most female ages, both of which are much greater than Projection Scale D.

TABLE 12

AVERAGE ANNUAL PERCENT DECREASES IN MORTALITY RATES

MEDICARE

(Geometric Basis)

1973 to 1977

CENTRAL AGE	MALES	FEMALES
52	2.40	2.35
57	2.21	3.44
62	1.97	3.78
67	2.75	3.53
72	2.15	3.54
77	2.15	2.71
82	1.59	1.02

REVIEW OF DATA

Table 13 summarizes the average annual percent decreases in mortality rates for males as obtained from each of the sources described earlier in this paper. Except for the Canadian population statistics and a few age cells from each of the Prudential, Bankers and U.S. population statistics, all the sources show a greater annual decrease than is found in Projection Scale D. This evidence convinced the committee that Projection Scale D for males is not adequate for projecting the 1966 Experience Table (males) to a current date. The committee decided that a new projection scale for projecting the 1966 Experience Table was required, and the scale should reflect the larger annual decreases in mortality rates since 1966.

The committee also agreed that the 1971 GAM Table no longer provides an adequate mortality basis for the valuation of group annuity benefits for males. The 1971 GAM included a loading of 8 percent for males. Based

TABLE 13

AVERAGE ANNUAL PERCENT DECREASES IN MORTALITY RATES

MALES

AGE	PROJECTION SCALE D	U.S. WHITE POPULATION		STANDARD ORDINARY	1965 Canadian Population		PRUDENTIAL	BANKERS LIFE	BUCK	MEDICARE
		1965-67 TO 1973-75	1973-75 TO 1976-78	1968-73 TO 1972-77	1966-71	1971-76	1976-80	1973-74 TO 1980-81	1969-72 TO 1973-77	1973-77
50	0.65				0.58	0.76				
52	0.65	1.67	2.45	3.58						2.40
55	0.65				0.86	0.58			5.74	
57	0.65	1.47	3.51	3.20				1.39		2.21
60	0.65				0.84	0.79	2.81		4.57	
62	0.65	0.99	2.25	3.23				3.22		1.97
65	0.63				0.48	1.11	6.31		2.99	
67	0.61	1.12	2.52	2.79				1.52		2.75
70	0.56				(0.05)*	0.80	0.04		2.47	
72	0.52	0.89	2.21	2.44				0.93		2.15
75	0.46				0.30	0.60	0.64		3.29	
77	0.42	(0.06)*	1.67	1.70				0.18		2.15
80	0.36				0.64	0.39	0.49		2.15	
82	0.32	0.39	1.19	1.55				0.31		1.59
85	0.26				0.34	0.12	(0.29)*		1.64	
87	0.22			0.88				(0.45)*		
90	0.16				(0.47)*	(0.17)*			0.47	
92				1.51						

* ( ) indicates negative value.

TABLE 14

AVERAGE ANNUAL PERCENT DECREASES IN MORTALITY RATES

FEMALES

AGE	PROJECTION SCALE D	U.S. WHITE POPULATION		STANDARD ORDINARY	Canadian Population		PRUDENTIAL	BANKERS LIFE	BUCK	MEDICARE
		1965-67 TO 1973-75	1973-75 TO 1976-78	1968-73 TO 1972-77	1966-71	1971-76	1976 TO 80	1973-74 TO 1980-81	1969-72 TO 1973-77	1973-77
50	1.30				1.02	1.37				
52	1.30	1.08	1.98	4.35						2.35
55	1.30				0.96	1.63			(0.41)*	
57	1.30	0.60	2.49	2.39				8.55		3.44
60	1.30				1.49	1.31	10.78		4.15	
62	1.30	0.62	0.82	2.28				0.92		3.78
65	1.28				1.70	1.30	5.75		0.55	
67	1.26	2.02	1.94	0.38				1.78		3.53
70	1.21				1.40	1.45	0.09		1.29	
72	1.17	1.74	2.88	2.82				3.41		3.54
75	1.09				1.80	1.80	1.93		0.97	
77	1.03	1.06	2.83	2.19				3.53		2.71
80	0.92				2.30	1.71	0.06		1.29	
82	0.84	1.81	2.28	3.40				(2.86)*		1.02
85	0.68				2.46	1.20	3.52		1.83	
87	0.56			1.38				0.63		
90	0.38				2.40	0.55			5.31	
92	0.26			(1.79)*						

* ( ) indicates negative value.

upon Projection Scale D, the extra longevity produced by this loading would have been offset in about thirteen years. Assuming that the annual decreases actually occurred at about 1.5 percent to 2.0 percent (as suggested by the U.S. population statistics), the loading would have been eliminated in about 1976. Thus, although adequate when approved by the NAIC in 1972, the 1971 GAM Table for males may have become outdated before it was approved for use in all the states.

Similarly, Table 14 summarizes the annual percent decreases in mortality rates for females as obtained from each of the sources. For females, most age/source cells also show a greater percent decrease than that used in Projection Scale D. The same general conclusions can be drawn as for the males. Decreases in mortality rates have been more pronounced than indicated by Projection Scale D, and Projection Scale D cannot be used successfully to project the 1966 Experience Table to a current date. The committee decided that a new projection scale for projecting the 1966 Experience Table for females was also required, and the scale should reflect the larger annual decreases in mortality rates since 1966.

As was concluded for males, the committee agreed that the 1971 GAM no longer provided an adequate mortality basis for the valuation of group annuity benefits for females. The 1971 GAM Table included a loading of 10 percent for females. Based upon Projection Scale D, the extra longevity produced by this loading would have been offset in about eight years. Assuming that the annual decreases actually occurred at about 1.5 percent to 2.0 percent (as suggested by the U.S. population statistics) the loading would have been eliminated in about 1977. Thus, although adequate when approved by the NAIC in 1972, the 1971 GAM Table for females had apparently become outdated before it was approved for use in all the states.

SCALES X, Y AND Z

The committee concluded that the 1971 Group Annuity Mortality Table did not represent current mortality and that published mortality projection factors understated mortality improvement rates. The committee's charge was to then "commence directly with developing new bases or tables."

Since the earliest possible date for construction of a new table based on insured group annuity data is 1987 and a new table was desired sooner, one plausible alternative was to develop a new projection of the 1966 Experience Table to a specified base year. This table could be used until a table based fully on pensioner mortality experience could be developed. The committee decided to use 1983 as the base valuation year since it is the first year the table could be used.

The committee then had to decide how to employ the available statistics to develop a new projection scale. References to Tables 13 and 14 will help the reader understand the committee's dilemma. The committee would have preferred to rely most heavily upon the statistics obtained from insured retired lives, but these were quite erratic by age and source, and the quantity of data was limited.

Population statistics appeared to be quite consistent by age. The U.S. population statistics were the most extensive and most credible source available. The collection techniques employed in the construction of population statistics should produce internally consistent results with little random variation by age and sex. Therefore, population statistics were chosen as the basis for the committee's work.

The next step was to reach a consensus on the level of mortality improvement for the seventeen year period from 1966-83. The committee was hampered by the lack of credible insured pensioner data. The available data (shown in Tables 13 and 14) were derived from a variety of sources, each having different group compositions and covering different periods.

After much discussion, the committee reached two conclusions:

1. Rates of mortality improvement increased during the 1970's, and
2. Population data are the most credible data available, and improvement rates found in population data should not differ significantly from improvement rates experienced by group annuitants.

The committee split population experience into two periods: 1966-75 and 1976 and later. For convenience, the Committee called the improvement rates for the first period "Scale X" and for the second period "Scale Y." Note that Scale X is based entirely on historical data while Scale Y involves some extrapolation of data to the 1983 base year.

Scales X and Y were based heavily upon population experience and then were adjusted by comparison to other available experience. Population data were the sole basis for improvement rates for ages under 50. Scales X and Y are shown in Table 15. The development of appropriate projection scales is largely a matter of judgment. The committee believes that these two scales represent a reasonable approximation of the annual rates of mortality improvement for the two periods.

The committee used Scales X and Y values to develop average mortality improvement rates for the entire 1966-83 period. The combined scale, called Scale Z, was calculated as the geometric average of improvement rates for the periods associated with Scale X and Scale Y. The following formula was used to determine the values of Scale Z from the values in Scale X and Scale Y:

$$Z = 1 - [(1 - X)^9 (1 - Y)^8]^{1/17}$$

Scale Z (see Table 15) was also examined for consistency and smoothness. It was compared against all data sources and fell within a reasonable range. As expected, Scale Z rates of mortality improvement were much higher than those forecast by Scale D.

TABLE 15

GROUP ANNUITY MORTALITY PROJECTION SCALES
ANNUAL DECREASE IN MORTALITY RATES

	Males			Females		
Age	X (1966-75)	Y (1975-83)	Z* (1966-83)	X (1966-75)	Y (1975-83)	Z* (1966-83)
25	0.10%	0.50%	0.29%	1.00%	0.00%	0.53%
30	0.50	1.00	0.74	1.00	1.00	1.00
35	1.10	2.00	1.52	1.50	3.00	2.21
40	1.30	2.00	1.63	1.60	3.00	2.26
45	1.50	2.00	1.74	1.60	3.00	2.26
50	1.50	2.00	1.74	1.60	2.00	1.79
55	1.50	2.25	1.85	1.60	2.00	1.79
60	1.50	2.75	2.09	1.60	2.00	1.79
65	1.50	2.25	1.85	2.00	2.00	2.00
70	1.25	1.75	1.49	2.00	2.00	2.00
75	1.00	1.50	1.24	2.00	2.00	2.00
80	0.80	1.00	0.89	1.75	1.75	1.75
85	0.60	0.60	0.60	1.75	1.25	1.52
90	0.40	0.40	0.40	1.75	1.00	1.40
95	0.20	0.20	0.20	1.00	1.00	1.00
100	0.00	0.00	0.00	0.50	0.50	0.50

* Z values calculated using $Z = 1 - [(1 - X)^9 (1 - Y)^8]^{1/17}$

Scale Z values were applied to the 1966 Experience Table at the appropriate quinquennial ages to obtain the 1983 unadjusted mortality rates shown in Table 16.

TABLE 16

1983 UNADJUSTED MORTALITY RATES

Age	1966 Experience Table	Projection Scale Z	Unadjusted 1983 Rates
	Males		
25	0.000687	0.29%	0.000654
30	0.000899	0.74	0.000792
35	0.001246	1.52	0.000960
40	0.001814	1.63	0.001372
45	0.003246	1.74	0.002409
50	0.005872	1.74	0.004357
55	0.009464	1.85	0.006890
60	0.014574	2.09	0.010177
65	0.023594	1.85	0.017177
70	0.039929	1.49	0.030935
75	0.060841	1.24	0.049212
80	0.095723	0.89	0.082227
85	0.141727	0.60	0.127944
90	0.194510	0.40	0.181698
95	0.260096	0.20	0.251393
100	0.354650	0.00	0.354650

TABLE 16-*continued*

1983 UNADJUSTED MORTALITY RATES

AGE	1966 EXPERIENCE TABLE	PROJECTION SCALE Z	UNADJUSTED 1983 RATES
	Females		
25	0.000407	0.53%	0.000372
30	0.000550	1.00	0.000464
35	0.000764	2.21	0.000523
40	0.001100	2.26	0.000746
45	0.001639	2.26	0.001111
50	0.002523	1.79	0.001856
55	0.003820	1.79	0.002810
60	0.006440	1.79	0.004737
65	0.011208	2.00	0.007950
70	0.019243	2.00	0.013649
75	0.037592	2.00	0.026665
80	0.064547	1.75	0.047811
85	0.101400	1.52	0.078155
90	0.155209	1.40	0.122131
95	0.238457	1.00	0.201006
100	0.364429	0.50	0.334661

GRADUATION OF 1983 (MALE) TABLE

The graduation method used in the construction of the 1971 GAM Table was a nine-factor linear compound, minimum smoothing coefficient formula. The values to be graduated were available at individual ages. A linear compound formula was appropriate since many terms were available for graduating.

Since the committee had data only at quinquennial ages, it had to select a method that was appropriate for grouped data and for obtaining intermediate values. With these objectives in mind, the committee decided to use Jenkins' fifth difference modified osculatory interpolation formula to graduate the unadjusted 1983 rates.

The Jenkins formula was applied to all ages between 35 and 85. Graduated values at the extreme ages were fitted by graduation with reference to the 1966 Experience Table. A complete list of the graduated, unloaded 1983 mortality rates is found in Table 17-A (males) and in Table 17-B (females).

TABLE 17-A

GRADUATED
1983 MALE RATES

Age	q_x	Age	q_x	Age	q_x
5	0.000380	40	0.001375	75	0.049552
6	0.000353	41	0.001522	76	0.054876
7	0.000336	42	0.001697	77	0.060842
8	0.000327	43	0.001905	78	0.067420
9	0.000324	44	0.002147	79	0.074583
10	0.000325	45	0.002426	80	0.082300
11	0.000331	46	0.002745	81	0.090538
12	0.000338	47	0.003100	82	0.099244
13	0.000344	48	0.003487	83	0.108361
14	0.000352	49	0.003903	84	0.117830
15	0.000361	50	0.004343	85	0.127595
16	0.000370	51	0.004804	86	0.137967
17	0.000381	52	0.005283	87	0.148744
18	0.000392	53	0.005778	88	0.160081
19	0.000405	54	0.006289	89	0.172066
20	0.000419	55	0.006812	90	0.184785
21	0.000435	56	0.007353	91	0.198016
22	0.000453	57	0.007932	92	0.211622
23	0.000471	58	0.008577	93	0.225563
24	0.000493	59	0.009315	94	0.242116
25	0.000515	60	0.010175	95	0.260096
26	0.000542	61	0.011182	96	0.276040
27	0.000570	62	0.012370	97	0.293282
28	0.000602	63	0.013768	98	0.312003
29	0.000636	64	0.015409	99	0.332393
30	0.000674	65	0.017324	100	0.354650
31	0.000717	66	0.019532	101	0.378984
32	0.000763	67	0.022004	102	0.405613
33	0.000815	68	0.024699	103	0.436780
34	0.000872	69	0.027574	104	0.474728
35	0.000955	70	0.030589	105	0.521701
36	0.001008	71	0.033727	106	0.579939
37	0.001073	72	0.037078	107	0.651687
38	0.001154	73	0.040756	108	0.739187
39	0.001253	74	0.044876	109	0.844683
				110	1.000000

TABLE 17-B

GRADUATED
1983 FEMALE RATES

Age	q_x	Age	q_x	Age	q_x
5	0.000190	40	0.000739	75	0.026658
6	0.000156	41	0.000796	76	0.030205
7	0.000131	42	0.000861	77	0.034080
8	0.000116	43	0.000935	78	0.038288
9	0.000108	44	0.001021	79	0.042832
10	0.000107	45	0.001122	80	0.047717
11	0.000116	46	0.001241	81	0.052950
12	0.000126	47	0.001374	82	0.058546
13	0.000135	48	0.001518	83	0.064523
14	0.000146	49	0.001672	84	0.070897
15	0.000156	50	0.001830	85	0.077687
16	0.000166	51	0.001992	86	0.085078
17	0.000177	52	0.002165	87	0.093189
18	0.000187	53	0.002355	88	0.102150
19	0.000199	54	0.002572	89	0.112616
20	0.000210	55	0.002823	90	0.124167
21	0.000223	56	0.003114	91	0.136751
22	0.000236	57	0.003448	92	0.150700
23	0.000250	58	0.003825	93	0.166197
24	0.000265	59	0.004246	94	0.183448
25	0.000281	60	0.004712	95	0.202688
26	0.000298	61	0.005225	96	0.224174
27	0.000315	62	0.005789	97	0.246715
28	0.000335	63	0.006410	98	0.270999
29	0.000356	64	0.007095	99	0.297983
30	0.000380	65	0.007849	100	0.327986
31	0.000404	66	0.008686	101	0.361361
32	0.000431	67	0.009646	102	0.398774
33	0.000460	68	0.010780	103	0.439825
34	0.000492	69	0.012135	104	0.487067
35	0.000529	70	0.013761	105	0.542018
36	0.000558	71	0.015698	106	0.606540
37	0.000595	72	0.017955	107	0.682566
38	0.000637	73	0.020534	108	0.772094
39	0.000686	74	0.023435	109	0.877193
				110	1.000000

GROUP ANNUITY VERSUS INDIVIDUAL ANNUITY

Before recommending the adoption of the proposed 1983 Group Annuity Mortality Table, the committee compared the proposed table with the recently developed 1983 Table *a*. [See "Report of the Committee to Recommend a New Mortality Basis for Individual Annuity Valuation" (Derivation of the 1983 Table *a*), TSA XXXIII, 1982, pp. 675-735]. For this purpose, a graph was plotted of the ratios of the proposed 1983 unadjusted and unloaded mortality rates developed by the committee to the corresponding unloaded Individual 1983 Basic Table mortality rates. Graph 1 shows these ratios at quinquennial ages as a broken line. In addition, it shows as a solid line the corresponding ratios of the 1966 Group Experience Table to the 1963 Individual Experience Table with projection to 1966.

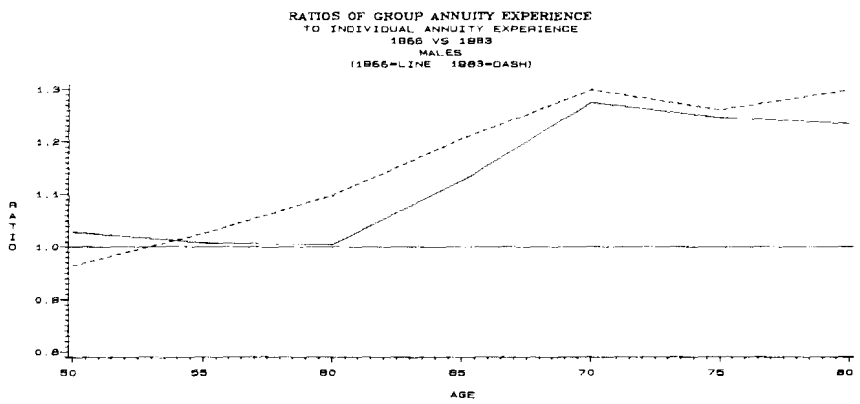
The result for males is reasonably consistent for both periods with ratios exceeding 1.0 at ages 55 through 80. The corresponding ratios for females in Graph 2 show a similar pattern, although the ratios for the 1983 period are lower than those for 1966, except at ages 55, 60 and 80.

The graphs suggest that at most quinquennial ages, the 1983 group annuitant mortality rates are higher than the 1983 mortality rates experienced by individual annuitants. The same pattern held in 1966. The result is not unexpected since selection opportunities would tend to produce lower mortality among individual annuitants than among group annuitants.

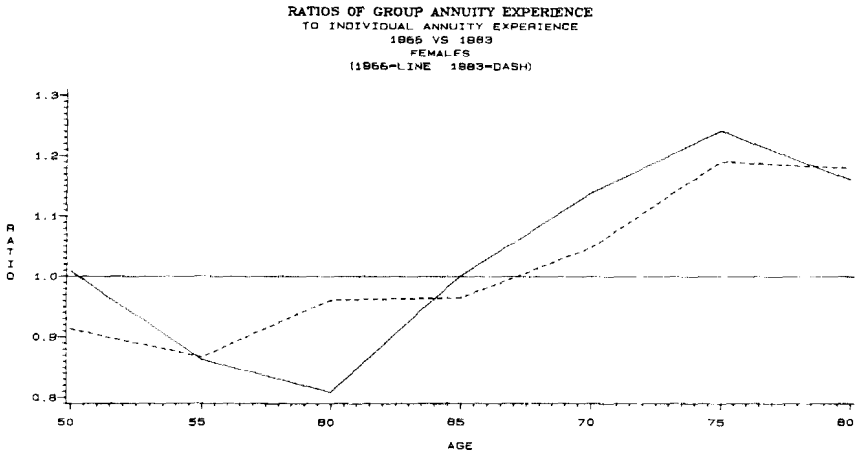
The result for males is reasonably consistent for both periods with ratios exceeding 1.0 at ages 55 through 80. The corresponding ratios for females in Graph 2 show a similar pattern, although the ratios for the 1983 period are lower than those for 1966, except at ages 55, 60 and 80.

The graphs suggest that at most quinquennial ages, the 1983 group annuitant mortality rates are higher than the 1983 mortality rates experienced by individual annuitants. The same pattern held in 1966. The result is not unexpected since selection opportunities would tend to produce lower mortality among individual annuitants than among group annuitants.

GRAPH 1



GRAPH 2



MARGINS

Margins are designed to assure conservatism in the mortality rates. For valuation purposes, margins add a degree of safety to reserves. Since mortality experience varies by company, margins should insure that the mortality table can cover the lightest mortality experience of all companies except for truly exceptional cases.

The Individual Annuity Committee used a level 10 percent margin in the construction of the 1983 Table *a*. Level margins of 8 percent for males and 10 percent for females were used for the construction of the 1971 GAM. The committee decided that a level 10 percent margin would be included in the proposed 1983 Group Annuity Mortality Table. The final graduated, loaded mortality rates for the 1983 GAM Table are shown in Tables 18-A and 18-B.

TABLE 18-A

1983 GROUP ANNUITY MORTALITY TABLE

(Males)

Age	q_x	Age	q_x	Age	q_x
5	0.000342	40	0.001238	75	0.044597
6	0.000318	41	0.0013700	76	0.049388
7	0.000302	42	0.001527	77	0.054758
8	0.000294	43	0.001715	78	0.060678
9	0.000292	44	0.001932	79	0.067125
10	0.000293	45	0.002183	80	0.074070
11	0.000298	46	0.002471	81	0.081484
12	0.000304	47	0.002790	82	0.089320
13	0.000310	48	0.003138	83	0.097525
14	0.000317	49	0.003513	84	0.106047
15	0.000325	50	0.003909	85	0.114836
16	0.000333	51	0.004324	86	0.124170
17	0.000343	52	0.004755	87	0.133870
18	0.000353	53	0.005200	88	0.144073
19	0.000365	54	0.005660	89	0.154859
20	0.000377	55	0.006131	90	0.166307
21	0.000392	56	0.006618	91	0.178214
22	0.000408	57	0.007139	92	0.190460
23	0.000424	58	0.007719	93	0.203007
24	0.000444	59	0.008384	94	0.217904
25	0.000464	60	0.009158	95	0.234086
26	0.000488	61	0.010064	96	0.248436
27	0.000513	62	0.011133	97	0.263954
28	0.000542	63	0.012391	98	0.280803
29	0.000572	64	0.013868	99	0.299154
30	0.000607	65	0.015592	100	0.319185
31	0.000645	66	0.017579	101	0.341086
32	0.000687	67	0.019804	102	0.365052
33	0.000734	68	0.022229	103	0.393102
34	0.000785	69	0.024817	104	0.427255
35	0.000860	70	0.027530	105	0.469531
36	0.000907	71	0.030354	106	0.521945
37	0.000966	72	0.033370	107	0.586518
38	0.001039	73	0.036680	108	0.665268
39	0.001128	74	0.040388	109	0.760215
				110	1.000000

TABLE 18-B

1983 GROUP ANNUITY MORTALITY TABLE
(Females)

Age	q_x	Age	q_x	Age	q_x
5	0.000171	40	0.000665	75	0.023992
6	0.000140	41	0.000716	76	0.027185
7	0.000118	42	0.000775	77	0.030672
8	0.000104	43	0.000842	78	0.034459
9	0.000097	44	0.000919	79	0.038549
10	0.000096	45	0.001010	80	0.042945
11	0.000104	46	0.001117	81	0.047655
12	0.000113	47	0.001237	82	0.052691
13	0.000122	48	0.001366	83	0.058071
14	0.000131	49	0.001505	84	0.063807
15	0.000140	50	0.001647	85	0.069918
16	0.000149	51	0.001793	86	0.076570
17	0.000159	52	0.001949	87	0.083870
18	0.000168	53	0.002120	88	0.091935
19	0.000179	54	0.002315	89	0.101354
20	0.000189	55	0.002541	90	0.111750
21	0.000201	56	0.002803	91	0.123076
22	0.000212	57	0.003103	92	0.135630
23	0.000225	58	0.003443	93	0.149577
24	0.000239	59	0.003821	94	0.165103
25	0.000253	60	0.004241	95	0.182419
26	0.000268	61	0.004703	96	0.201757
27	0.000284	62	0.005210	97	0.222044
28	0.000302	63	0.005769	98	0.243899
29	0.000320	64	0.006386	99	0.268185
30	0.000342	65	0.007064	100	0.295187
31	0.000364	66	0.007817	101	0.325225
32	0.000388	67	0.008681	102	0.358897
33	0.000414	68	0.009702	103	0.395843
34	0.000443	69	0.010922	104	0.438360
35	0.000476	70	0.012385	105	0.487816
36	0.000502	71	0.014128	106	0.545886
37	0.000536	72	0.016160	107	0.614309
38	0.000573	73	0.018481	108	0.694885
39	0.000617	74	0.021092	109	1.789474
				110	1.000000

FUTURE MORTALITY IMPROVEMENT

The final task for the committee was to decide what projection scale would be applied to the 1983 mortality rates to account for mortality improvements after that date. The committee considered Scale D, Scales X, Y, Z and Scale G recommended by the Individual Annuity Committee (see Table 19 and Table 20). Since the 1983 GAM Table is to be used on an interim basis only, the committee decided to support the use of a modified Scale G, to be called Projection Scale H. Scale H differs from Scale G at the higher ages. Scale G drops from 1.25 percent at age 87 to 1.0 percent at ages 92 and over for males and from 1.5 percent at age 87 to 1.25 percent at ages 92 and over for females. Scale H gradually decreases from 1.25 percent at

age 82 to 0.0 percent at age 100 for males and from 1.5 percent at age 82 to 0.0 percent at age 100 for females. Linear interpolation is used to develop values for the ages between those shown. In addition, values for ages five and six are the same as at age seven, and values above age 100 are zero. Scale H is also shown in Tables 19 and 20.

TABLE 19

PROJECTION SCALE

(Males)

AGE	D	X	Y	Z	G	H
5	0.65%	0.00%	0.00%	0.00%		
7	0.65				1.50%	1.50%
10	0.65	0.00	0.00	0.00		
12	0.65				0.25	0.25
15	0.65	0.00	0.00	0.00		
17	0.65				0.20	0.20
20	0.65	0.00	0.25	0.12		
22	0.65				0.10	0.10
25	0.65	0.10	0.50	0.29		
27	0.65				0.10	0.10
30	0.65	0.50	1.00	0.74		
32	0.65				0.75	0.75
35	0.65	1.10	2.00	1.52		
37	0.65				2.00	2.00
40	0.65	1.30	2.00	1.63		
42	0.65				2.00	2.00
45	0.65	1.50	2.00	1.74		
47	0.65				1.75	1.75
50	0.65	1.50	2.00	1.74		
52	0.65				1.75	1.75
55	0.65	1.50	2.25	1.85		
57	0.65				1.50	1.50
60	0.65	1.50	2.75	2.09		
62	0.65				1.50	1.50
65	0.63	1.50	2.25	1.85		
67	0.61				1.50	1.50
70	0.56	1.25	1.75	1.49		
72	0.52				1.25	1.25
75	0.46	1.00	1.50	1.24		
77	0.42				1.25	1.25
80	0.36	0.80	1.00	0.89		
82	0.32				1.25	1.25
85	0.26	0.60	0.60	0.60		
87	0.22				1.25	0.75
90	0.16	0.40	0.40	0.40		
92	0.12				1.00	0.50
95	0.06	0.20	0.20	0.20		
97	0.02				1.00	0.10
100	0.00	0.00	0.00	0.00		0.00

TABLE 20

PROJECTION SCALE

(Females)

AGE	D	X	Y	Z	G	H
5	1.30%	0.00%	0.00%	0.00%		
7	1.30				1.50%	1.50%
10	1.30	0.00	0.00	0.00		
12	1.30				1.00	1.00
15	1.30	0.50	0.00	0.27		
17	1.30				0.50	0.50
20	1.30	0.75	0.00	0.40		
22	1.30				0.50	0.50
25	1.30	1.00	0.00	0.53		
27	1.30				0.75	0.75
30	1.30	1.00	1.00	1.00		
32	1.30				1.25	1.25
35	1.30	1.50	3.00	2.21		
37	1.30				2.25	2.25
40	1.30	1.60	3.00	2.26		
42	1.30				2.25	2.25
45	1.30	1.60	3.00	2.26		
47	1.30				2.00	2.00
50	1.30	1.60	2.00	1.79		
52	1.30				2.00	2.00
55	1.30	1.60	2.00	1.79		
57	1.30				1.75	1.75
60	1.30	1.60	2.00	1.79		
62	1.30				1.75	1.75
65	1.28	2.00	2.00	2.00		
67	1.26				1.75	1.75
70	1.21	2.00	2.00	2.00		
72	1.17				1.75	1.75
75	1.09	2.00	2.00	2.00		
77	1.03				1.50	1.50
80	0.92	1.75	1.75	1.75		
82	0.84				1.50	1.50
85	0.68	1.75	1.25	1.52		
87	0.56				1.50	1.00
90	0.38	1.75	1.00	1.40		
92	0.26				1.25	0.50
95	0.08	1.00	1.00	1.00		
97	0.00				1.25	0.25
100	0.00	0.50	0.50	0.50		0.00

SEX DISTINCT TABLES

Prior studies, including the 1964-68 intercompany group annuity study and the study underlying 1983 Table *a* for individual annuity valuation, have shown that female mortality rates are lower than those for males. The committee has turned up no evidence to the contrary and believes that sex distinct tables should be developed and may be desirable for valuation purposes.

However, in the past, exposures on female lives have been relatively small. This has made development of female tables difficult and of limited

financial significance from a valuation standpoint. The committee expects that a larger collection of data will be available in the future and separate female tables should be developed. The committee hopes that the 1981-85 intercompany study will provide sufficient data for that purpose. Until such data are available, the committee recommends that an age setback to the male table be used for females.

A series of calculations was performed to develop an appropriate age setback recommendation for females. The calculations were similar to those presented in the 1971 GAM paper. Annuity values, based on projected mortality rates, were compared for males and females at various setbacks for 1983 and 1987. The comparisons were performed at interest rates of 7 ½ percent and 10 percent.

TABLE 21

COMPARISON OF 1983 GROUP ANNUITY MORTALITY PROJECTION H
MALE AND FEMALE ANNUITY VALUES
ANNUITY VALUES IN CALENDAR YEAR 1983

AGE x	FEMALE $\ddot{a}_x^{(12)}$	MALE $\ddot{a}_{x,t}^{(12)}$			r^*	FREQUENCY DISTRIBUTION‡ (PERCENT)
		$t=5$	$t=6$	$t=7$		
	7 1/2 Percent Interest Rate					
58	11.6559	11.4177	11.5545	11.6853	6.78	5.4196
63	10.8569	10.6273	10.8015	10.9670	6.33	22.6793
68	9.8366	9.6260	9.8426	10.0518	5.97	38.2397
73	8.6017	8.4599	8.7002	8.9381	5.59	21.1078
78	7.2763	7.2259	7.4783	7.7274	5.20	8.9299
83	5.9653	5.9491	6.2011	6.4566	5.06	2.7778
88	4.7012	4.7837	5.0012	5.2272	4.61	0.8459
					$\bar{r} = 5.91$†	
	10 Percent Interest Rate					
58	9.4612	9.2943	9.3766	9.4544	7.09	5.4196
63	8.9685	8.7991	8.9113	9.0163	6.55	22.6793
68	8.2906	8.1247	8.2746	8.4173	6.11	38.2397
73	7.4097	7.2890	7.4647	7.6370	5.69	21.1078
78	6.4099	6.3596	6.5536	6.7431	5.26	8.9299
83	5.3731	5.3468	5.5505	5.7552	5.13	2.7778
88	4.3272	4.3826	4.5652	4.7536	4.69	0.8459
					$\bar{r} = 6.06$†	

* Where r is chosen such that female $\ddot{a}_x^{(12)}$ = male $\ddot{a}_{x-r}^{(12)}$.

† $\bar{r}$ is the weighted average value of r values.

‡Frequency distribution is based on 1966 intercompany group annuity study (amounts of annual income—females).

TABLE 22

COMPARISON OF 1983 GROUP ANNUITY MORTALITY PROJECTION H

MALE AND FEMALE ANNUITY VALUES

ANNUITY VALUES IN CALENDAR YEAR 1987

AGE x	FEMALE $\ddot{a}_x^{(12)}$	MALE $\ddot{a}_{x-r}^{(12)}$ $t=5$	$t=6$	$t=7$	r^*	FREQUENCY DISTRIBUTION‡ (PERCENT)
	7 1/2 Percent Interest Rate					
58	11.7260	11.4938	11.6279	11.7560	6.77	5.4196
63	10.9447	10.7181	10.8890	11.0516	6.34	22.6793
68	9.9420	9.7326	9.9464	10.1523	5.98	38.2397
73	8.7190	8.5765	8.8158	9.0520	5.60	21.1078
78	7.3934	7.3454	7.5972	7.8459	5.19	8.9299
83	6.0606	6.0641	6.3183	6.5752	4.99	2.7778
88	4.7593	4.8721	5.0978	5.3302	4.48	0.8459
					$\bar{r} = 5.91$†	
	10 Percent Interest Rate					
58	9.5048	9.3423	9.4225	9.4981	7.09	5.4196
63	9.0269	8.8595	8.9688	9.0712	6.57	22.6793
68	8.3653	8.1998	8.3468	8.4864	6.13	38.2397
73	7.4981	7.3758	7.5498	7.7201	5.70	21.1078
78	6.5032	6.4530	6.6456	6.8339	5.26	8.9299
83	5.4529	5.4414	5.6460	5.8509	5.06	2.7778
88	4.3777	4.4584	4.6474	4.8407	4.56	0.8459
					$\bar{r} = 6.07$†	

* Where r is chosen such that female $\ddot{a}_x^{(12)}$ = male $\ddot{a}_{x-r}^{(12)}$.

† $\bar{r}$ is the weighted average value of r values.

‡ Frequency distribution is based on 1966 intercompany group annuity study (amounts of annual income—females).

For 1983, as can be seen from Table 21 and 22, an age setback of about six years would be appropriate at 7 ½ percent as well as at 10 percent. The results do not differ appreciably for 1987.

COMMUTATION FUNCTIONS

Tables 23 through 28 give commutation functions for the 1983 GAM Table. All values shown are based on the 1983 GAM mortality rates without projection.

Table 29 compares male annuity values at 7 ½ percent, 10 percent and 12 ½ percent based on the 1971 GAM Table and the 1983 GAM Table. Values are shown for monthly annuities due, by quinquennial ages, for ages 50 through 90. Table 29 shows that the reserves required by the 1983 GAM Table exceed those required by the 1971 GAM Table by 3-7 percent for male ages above 50.

TABLE 23

1983 GROUP ANNUITY MORTALITY COMMUTATION FUNCTIONS AT 7½ PERCENT
(Males)

AGE X	l_x	d_x	D_x	$N_x^{(12)}$
5	1,000,000.0000	342.0000	696,558.6324	9,546,871.9113
6	999,658.0000	317.8912	647,739.9156	8,872,688.5242
7	999,340.1088	301.8007	602,357.1482	8,245,749.0436
8	999,038.3080	293.7173	560,163.0106	7,662,730.8751
9	998,744.5908	291.6334	520,928.6722	7,120,550.2696
10	998,452.9574	292.5467	484,443.3126	6,616,344.0539
11	998,160.4106	297.4518	450,512.9030	6,147,452.1790
12	997,862.9588	303.3503	418,956.8839	5,711,402.4515
13	997,559.6085	309.2435	389,608.8567	5,305,896.7467
14	997,250.3650	316.1284	362,314.4911	4,928,797.8076
15	996,934.2367	324.0036	336,929.8953	4,578,117.9229
16	996,610.2330	331.8712	313,321.2959	4,252,008.6357
17	996,278.3618	341.7235	291,364.6139	3,948,750.8190
18	995,936.6383	351.5656	270,943.8845	3,666,745.7062
19	995,585.0727	363.3886	251,951.8523	3,404,506.5031
20	995,221.6842	375.1986	234,288.2697	3,160,650.4595
21	994,846.4856	389.9798	217,860.4121	2,933,891.6245
22	994,456.5058	405.7383	202,581.4054	2,723,034.0905
23	994,050.7675	421.4775	188,370.9323	2,526,965.8186
24	993,629.2900	441.1714	175,154.4772	2,344,652.4282
25	993,188.1186	460.8393	162,862.0545	2,175,131.9781
26	992,727.2793	484.4509	151,429.2898	2,017,509.9407
27	992,242.8284	509.0206	140,795.7138	1,870,954.3732
28	991,733.8078	537.5197	130,905.5680	1,734,691.6429
29	991,196.2881	566.9643	121,706.6206	1,608,002.2592
30	990,629.3238	601.3120	113,150.7018	1,490,217.1013
31	990,028.0118	638.5681	105,192.5761	1,380,713.8738
32	989,389.4437	679.7105	97,790.4436	1,278,913.9418
33	988,709.7332	725.7129	90,905.3596	1,184,279.1616
34	987,984.0202	775.5675	84,501.0559	1,096,309.1079
35	987,208.4528	848.9993	78,543.9280	1,014,538.4023
36	986,359.4535	894.6280	73,001.2839	938,534.8529
37	985,464.8255	951.9590	67,846.5784	867,896.1423
38	984,512.8665	1,022.9089	63,052.1289	802,247.0200
39	983,489.9576	1,109.3767	58,592.2025	741,239.0240
40	982,380.5809	1,216.1872	54,442.8935	684,548.5881
41	981,164.3938	1,344.1952	50,581.8542	631,875.3376
42	979,820.1986	1,496.1854	46,988.4251	582,940.4718
43	978,324.0131	1,677.8257	43,643.4175	537,485.1751
44	976,646.1874	1,886.8804	40,528.9014	495,269.2442
45	974,759.3070	2,127.8996	37,628.4647	456,069.7096
46	972,631.4074	2,403.3722	34,926.8110	419,679.5028
47	970,228.0352	2,706.9362	32,409.7738	385,906.3339
48	967,521.0990	3,036.0812	30,064.5121	354,571.4717
49	964,485.0178	3,388.2359	27,879.2276	325,508.5483
50	961,096.7819	3,756.9273	25,843.0585	298,562.5649
51	957,339.8546	4,139.5375	23,946.0818	273,588.9540
52	953,200.3171	4,532.4675	22,179.1060	250,452.7361
53	948,667.8496	4,933.0728	20,533.6227	229,027.8099
54	943,734.7768	5,341.5388	19,001.7189	209,196.3098
55	938,393.2379	5,753.2889	17,575.9713	190,848.0585
56	932,639.9490	6,172.2112	16,249.5005	173,880.0530

TABLE 23-*continued*

1983 GROUP ANNUITY MORTALITY COMMUTATION FUNCTIONS AT 7½ PERCENT

(Males)

AGE X	l_x	d_x	D_x	$N_x^{[12]}$
57	926,467.7378	6,614.0532	15,015.7780	158,196.0086
58	919,853.6846	7,100.3506	13,868.4468	143,706.0908
59	912,753.3340	7,652.5240	12,801.2989	130,326.7534
60	905,100.8101	8,288.9132	11,808.3468	117,980.5576
61	896,811.8968	9,025.5149	10,883.9125	106,595.9099
62	887,786.3819	9,883.7258	10,022.6761	96,106.7307
63	877,902.6561	10,878.0918	9,219.6220	86,452.1211
64	867,024.5643	12,023.8967	8,470.1225	77,576.0197
65	855,000.6677	13,331.1704	7,769.9152	69,426.8256
66	841,669.4972	14,795.7081	7,115.1318	61,957.0195
67	826,873.7892	16,375.4085	6,502.3766	55,122.7338
68	810,498.3806	18,016.5685	5,928.9335	48,883.1853
69	792,481.8121	19,667.0211	5,392.6877	43,200.0311
70	772,814.7910	21,275.5912	4,891.9603	38,036.8434
71	751,539.1998	22,812.2209	4,425.3811	33,358.7319
72	728,726.9789	24,317.6193	3,991.6773	29,132.1317
73	704,409.3596	25,837.7353	3,589.2791	25,324.8869
74	678,571.6243	27,406.1508	3,216.3947	21,906.5132
75	651,165.4736	29,040.0266	2,871.1544	18,848.3536
76	622,125.4469	30,725.5316	2,551.7298	16,123.6022
77	591,399.9154	32,383.8766	2,256.4697	13,707.1999
78	559,016.0388	33,919.9752	1,984.1023	11,575.5653
79	525,096.0636	35,247.0733	1,733.6846	9,706.2378
80	489,848.9903	36,283.1147	1,504.4754	8,077.6074
81	453,565.8756	36,958.3618	1,295.8501	6,668.7520
82	416,607.5138	37,211.3831	1,107.2177	5,459.3584
83	379,396.1307	37,000.6076	937.9731	4,429.7111
84	342,395.5230	36,310.0180	787.4393	3,560.7327
85	306,085.5050	35,149.6351	654.8221	2,834.0763
86	270,935.8699	33,642.1070	539.1860	2,232.2541
87	237,293.7630	31,766.5160	439.2886	1,738.8544
88	205,527.2469	29,610.9270	353.9358	1,338.6859
89	175,916.3199	27,242.2254	281.8077	1,017.8088
90	148,674.0945	24,725.5426	221.5509	763.6188
91	123,948.5519	22,089.3672	171.8190	564.8616
92	101,859.1846	19,400.1003	131.3474	411.5921
93	82,459.0843	16,739.7713	98.9125	295.1107
94	65,719.3130	14,320.5012	73.3326	207.9223
95	51,398.8118	12,031.7423	53.3518	143.7475
96	39,367.0696	9,780.1973	38.0120	97.4265
97	29,586.8723	7,809.5733	26.5753	64.6563
98	21,777.2990	6,115.1309	18.1959	41.9216
99	15,662.1681	4,685.4002	12.1735	26.4859
100	10,976.7679	3,503.6197	7.9365	16.2544
101	7,473.1482	2,548.9862	5.0263	9.6518
102	4,924.1620	1,797.5752	3.0808	5.5171
103	3,126.5868	1,229.0675	1.8197	3.0143
104	1,897.5193	810.7246	1.0273	1.5578
105	1,086.7947	510.2838	0.5473	0.7505
106	576.5109	300.9070	0.2701	0.3302
107	275.6039	161.6467	0.1201	0.1289
108	113.9573	75.8121	0.0462	0.0426
109	38.1451	28.9985	0.0144	0.0110
110	9.1466	9.1466	0.0032	0.0017

TABLE 24

1983 GROUP ANNUITY MORTALITY COMMUTATION FUNCTIONS AT 7½ PERCENT

(Females)

AGE x	l_x	d_x	D_x	$N_x^{(12)}$
5	1,000,000.0000	171.0000	696,558.6324	9,596,736.1536
6	999,829.0000	139.9761	647,850.7170	8,922,501.9824
7	999,689.0239	117.9633	602,567.4586	8,295,406.0922
8	999,571.0606	103.9554	560,461.7261	7,712,137.0943
9	999,467.1052	96.9483	521,305.5238	7,169,621.9609
10	999,370.1569	95.9395	484,888.3323	6,665,007.6499
11	999,274.2174	103.9245	451,015.6121	6,195,644.3144
12	999,170.2929	112.9062	419,505.7735	5,759,070.7116
13	999,057.3866	121.8850	390,193.8319	5,352,999.5781
14	998,935.5016	130.8606	362,926.7240	4,975,303.1706
15	998,804.6411	139.8326	337,562.0284	4,624,001.9321
16	998,664.8084	148.8011	313,967.2277	4,297,254.1874
17	998,516.0074	158.7640	292,019.0200	3,993,346.5549
18	998,357.2433	167.7240	271,602.4084	3,710,685.1485
19	998,189.5193	178.6759	252,610.9574	3,447,787.1551
20	998,010.8434	188.6240	234,944.8744	3,203,273.1524
21	997,822.2193	200.5623	218,512.0650	2,975,859.9823
22	997,621.6571	211.4958	203,226.1805	2,764,353.9477
23	997,410.1613	224.4173	189,007.5317	2,567,644.6479
24	997,185.7440	238.3274	175,781.4000	2,384,699.0932
25	996,947.4166	252.2277	163,478.5007	2,214,556.5221
26	996,695.1889	267.1143	152,034.5494	2,056,323.1657
27	996,428.0746	282.9856	141,389.5853	1,909,167.5582
28	996,145.0890	300.8358	131,487.8424	1,772,316.2717
29	995,844.2532	318.6702	122,277.3331	1,645,049.9127
30	995,525.5831	340.4697	113,709.9576	1,526,699.2934
31	995,185.1133	362.2474	105,740.5291	1,416,641.9905
32	994,822.8659	385.9913	98,327.4786	1,314,299.1096
33	994,436.8746	411.6969	91,431.9326	1,219,132.0895
34	994,025.1778	440.3532	85,017.7487	1,130,639.9912
35	993,584.8246	472.9464	79,051.2426	1,048,356.8912
36	993,111.8783	498.5422	73,501.0365	971,849.4931
37	992,613.3361	532.0407	68,338.7339	900,714.5119
38	992,081.2953	568.4626	63,536.8413	834,576.6455
39	991,512.8328	611.7634	59,070.1718	773,087.0278
40	990,901.0693	658.9492	54,915.0935	715,921.2669
41	990,242.1201	709.0134	51,049.8371	662,777.7493
42	989,533.1068	766.8882	47,454.2190	613,375.9038
43	988,766.2186	832.5412	44,109.2484	567,454.7963
44	987,933.6775	907.9110	40,997.3101	524,771.8529
45	987,025.7664	996.8960	38,101.9847	485,101.5669
46	986,028.8704	1,101.3942	35,407.9086	448,234.3671
47	984,927.4761	1,218.3553	32,900.7981	413,975.5508
48	983,709.1208	1,343.7467	30,567.5347	382,144.1651
49	982,365.3742	1,478.4599	28,396.0739	352,571.8833
50	980,886.9143	1,615.5207	26,375.1980	325,102.0441
51	979,271.3936	1,755.8336	24,494.6586	299,588.7600
52	977,515.5599	1,905.1778	22,744.8741	275,896.0860
53	975,610.3821	2,068.2940	21,116.7855	253,897.4191
54	973,542.0881	2,253.7499	19,601.8771	233,474.9667
55	971,288.3382	2,468.0437	18,192.0919	214,519.2411
56	968,820.2945	2,715.6033	16,879.8751	196,928.5819
57	966,104.6912	2,997.8229	15,658.1961	180,608.6430

TABLE 24-*continued*

1983 GROUP ANNUITY MORTALITY COMMUTATION FUNCTIONS AT 7½ PERCENT

(Females)

AGE X	l_x	d_x	D_x	$N_x^{(12)}$
58	963,106.8684	3,315.9769	14,520.5663	165,471.8605
59	959,790.8914	3,667.3610	13,460.9972	151,436.9301
60	956,123.5304	4,054.9199	12,474.0118	138,428.3012
61	952,068.6105	4,477.5787	11,554.5205	126,375.7229
62	947,591.0319	4,936.9493	10,697.8415	115,213.8470
63	942,654.0826	5,438.1714	9,899.6332	104,881.8509
64	937,215.9112	5,985.0608	9,155.8347	95,323.1254
65	931,230.8504	6,578.2147	8,462.6656	86,484.9932
66	924,652.6356	7,228.0097	7,816.6375	78,318.4239
67	917,424.6260	7,964.1632	7,214.4510	70,777.7885
68	909,460.4628	8,823.5854	6,652.8580	63,820.7343
69	900,636.8774	9,836.7560	6,128.6623	57,408.1326
70	890,800.1214	11,032.5595	5,638.8140	51,503.9841
71	879,767.5619	12,429.3561	5,180.4440	46,075.2564
72	867,338.2058	14,016.1854	4,750.9346	41,091.6709
73	853,322.0204	15,770.2443	4,348.0553	36,525.3893
74	837,551.7761	17,665.6421	3,969.9525	32,350.6311
75	819,886.1341	19,670.7081	3,615.0867	28,543.3254
76	800,215.4259	21,753.8564	3,282.1894	25,080.8166
77	778,461.5696	23,876.9733	2,970.1982	21,941.6232
78	754,584.5963	26,002.2306	2,678.2291	19,105.2441
79	728,582.3657	28,086.1216	2,405.5256	16,552.0042
80	700,496.2441	30,082.8112	2,151.4372	14,262.9358
81	670,413.4329	31,948.5521	1,915.3895	12,219.6871
82	638,464.8808	33,641.3530	1,696.8480	10,404.4624
83	604,823.5277	35,122.7071	1,495.2925	8,799.9941
84	569,700.8207	36,350.9003	1,310.1947	7,389.5381
85	533,349.9204	37,290.7597	1,141.0187	6,156.8823
86	496,059.1607	37,983.2499	987.2009	5,086.3634
87	458,075.9107	38,418.8266	848.0102	4,162.9583
88	419,657.0841	38,581.1740	722.6861	3,372.3883
89	381,075.9101	38,623.5678	610.4614	2,701.1385
90	342,452.3423	38,269.0492	510.3150	2,136.5776
91	304,183.2930	37,437.6630	421.6626	1,666.8949
92	266,745.6301	36,178.7098	343.9684	1,280.8421
93	230,566.9202	34,487.5082	276.5730	967.7632
94	196,079.4120	32,373.2992	218.7945	717.6720
95	163,706.1129	29,863.1054	169.9264	521.2754
96	133,843.0075	27,003.7637	129.2359	369.9989
97	106,839.2438	23,723.0131	95.9643	256.0125
98	83,116.2307	20,271.9656	69.4475	172.2017
99	62,844.2652	16,853.8893	48.8459	112.1966
100	45,990.3759	13,575.7611	33.2522	70.4979
101	32,414.6148	10,542.0431	21.8015	42.4939
102	21,872.5717	7,850.0004	13.6847	24.4126
103	14,022.5713	5,550.7367	8.1612	13.2595
104	8,471.8346	3,713.7134	4.5867	6.7366
105	4,758.1212	2,321.0877	2.3963	3.1538
106	2,437.0336	1,330.3425	1.1417	1.3325
107	1,106.6911	679.8503	0.4823	0.4930
108	426.8408	296.6053	0.1730	0.1525
109	130.2355	102.8176	0.0491	0.0362
110	27.4180	27.4180	0.0096	0.0052

TABLE 25

1983 GROUP ANNUITY MORTALITY COMMUTATION FUNCTIONS AT 10 PERCENT

(Males)

AGE X	l_x	d_x	D_x	$N_x^{(12)}$
5	1,000,000.0000	342.0000	620,921.3231	6,509,392.3484
6	999,658.0000	317.8912	564,280.8800	5,914,431.2284
7	999,340.1088	301.8007	512,819.4897	5,373,736.8190
8	999,038.3080	293.7173	466,058.7438	4,882,349.3378
9	998,744.5908	291.6334	423,565.2023	4,435,766.8005
10	998,452.9574	292.5467	384,946.8375	4,029,901.6821
11	998,160.4106	297.4518	349,849.1346	3,661,041.2917
12	997,862.9588	303.3503	317,949.8905	3,325,812.6439
13	997,559.6085	309.2435	288,957.4852	3,021,150.9392
14	997,250.3650	316.1284	262,607.1895	2,744,270.6728
15	996,934.2367	324.0036	238,658.1300	2,492,640.1356
16	996,610.2330	331.8712	216,891.4237	2,263,958.4126
17	996,278.3618	341.7235	197,108.3626	2,056,134.2252
18	995,936.6383	351.5656	179,127.9586	1,867,266.8811
19	995,585.0727	363.3886	162,786.1149	1,695,628.9342
20	995,221.6842	375.1986	147,933.3618	1,539,650.3311
21	994,846.4856	389.9798	134,434.1736	1,397,904.0972
22	994,456.5058	405.7383	122,164.9776	1,269,093.3051
23	994,050.7675	421.4775	111,013.7585	1,152,039.3029
24	993,629.2900	441.1714	100,878.8079	1,045,670.7302
25	993,188.1186	460.8393	91,667.2888	949,013.8686
26	992,727.2793	484.4509	83,295.2320	861,183.7725
27	992,242.8284	509.0206	75,685.9854	781,376.1119
28	991,733.8078	537.5197	68,770.1440	708,859.8871
29	991,196.2881	566.9643	62,484.4278	642,970.6964
30	990,629.3238	601.3120	56,771.5334	583,104.6785
31	990,028.0118	638.5681	51,579.1573	528,712.9841
32	989,389.4437	679.7105	46,859.8989	479,296.8202
33	988,709.7332	725.7129	42,570.6420	434,402.8307
34	987,984.0202	775.5675	38,672.1774	393,618.9850
35	987,208.4528	848.9993	35,128.9270	356,570.7974
36	986,359.4535	894.6280	31,907.9238	322,918.1636
37	985,464.8255	951.9590	28,980.8939	292,351.7952
38	984,512.8665	1,022.9089	26,320.8167	264,590.1033
39	983,489.9576	1,109.3767	23,903.1539	239,377.3821
40	982,380.5809	1,216.1872	21,705.6284	216,481.4274
41	981,164.3938	1,344.1952	19,707.9607	195,691.3967
42	979,820.1986	1,496.1854	17,891.7826	176,815.8510
43	978,324.0131	1,677.8257	16,240.4198	159,680.9430
44	976,646.1874	1,886.8804	14,738.6977	144,128.8125
45	974,759.3070	2,127.8996	13,372.9296	130,016.0918
46	972,631.4074	2,403.3722	12,130.6695	117,212.5314
47	970,228.0352	2,706.9362	11,000.6315	105,599.7960
48	967,521.0990	3,036.0812	9,972.6725	95,070.3123
49	964,485.0178	3,388.2359	9,037.6166	85,526.2071
50	961,096.7819	3,756.9273	8,187.1522	76,878.3867
51	957,339.8546	4,139.5375	7,413.7715	69,045.7006
52	953,200.3171	4,532.4675	6,710.6494	61,954.1934
53	948,667.8496	4,933.0728	6,071.5821	55,536.4499
54	943,734.7768	5,341.5388	5,490.9180	49,731.0055
55	938,393.2379	5,753.2889	4,963.4904	44,481.8252
56	932,639.9490	6,172.2112	4,484.5993	39,737.8265
57	926,467.7378	6,614.0532	4,049.9275	35,452.4518

TABLE 25-*continued*

1983 GROUP ANNUITY MORTALITY COMMUTATION FUNCTIONS AT 10 PERCENT

(Males)

AGE X	l_x	d_x	D_x	$N_x^{(12)}$
58	919,853.6846	7,100.3506	3,655.4682	31,583.3181
59	912,753.3340	7,652.5240	3,297.5015	28,091.9180
60	905,100.8101	8,288.9132	2,972.5957	24,943.3316
61	896,811.8968	9,025.5149	2,677.6115	22,105.9370
62	887,786.3819	9,883.7258	2,409.6946	19,551.1208
63	877,902.6561	10,878.0918	2,166.2431	17,253.0081
64	867,024.5643	12,023.8967	1,944.9102	15,188.2093
65	855,000.6677	13,331.1704	1,743.5802	13,335.5753
66	841,669.4972	14,795.7081	1,560.3584	11,675.9718
67	826,873.7892	16,375.4085	1,393.5717	10,192.0573
68	810,498.3806	18,016.5685	1,241.7940	8,868.0504
69	792,481.8121	19,667.0211	1,103.8092	7,689.4994
70	772,814.7910	21,275.5912	978.5600	6,643.0960
71	751,539.1998	22,812.2209	865.1093	5,716.5343
72	728,726.9789	24,317.6193	762.5907	4,898.4126
73	704,409.3596	25,837.7353	670.1301	4,178.1997
74	678,571.6243	27,406.1508	586.8634	3,546.2335
75	651,165.4736	29,040.0266	511.9647	2,993.6988
76	622,125.4469	30,725.5316	444.6660	2,512.5793
77	591,399.9154	32,383.8766	384.2771	2,095.5916
78	559,016.0388	33,919.9752	330.2135	1,736.0937
79	525,096.0636	35,247.0733	281.9789	1,427.9877
80	489,848.9903	36,283.1147	239.1373	1,165.6445
81	453,565.8756	36,958.3618	201.2949	943.8516
82	416,607.5138	37,211.3831	168.0842	757.7782
83	379,396.1307	37,000.6076	139.1554	602.9530
84	342,395.5230	36,310.0180	114.1675	475.2504
85	306,085.5050	35,149.6351	92.7822	370.8845
86	270,935.8699	33,642.1070	74.6613	286.4078
87	237,293.7630	31,766.5160	59.4460	218.7201
88	205,527.2469	29,610.9270	46.8072	165.0669
89	175,916.3199	27,242.2254	36.4214	123.0198
90	148,674.0945	24,725.5426	27.9830	90.4660
91	123,948.5519	22,089.3672	21.2084	65.5881
92	101,859.1846	19,400.1003	15.8443	46.8382
93	82,459.0843	16,739.7713	11.6605	32.9115
94	65,719.3130	14,320.5012	8.4485	22.7231
95	51,398.8118	12,031.7423	6.0069	15.3937
96	39,367.0696	9,780.1973	4.1825	10.2230
97	29,586.8723	7,809.5733	2.8576	6.6477
98	21,777.2990	6,115.1309	1.9121	4.2234
99	15,662.1681	4,685.4002	1.2502	2.6147
100	10,976.7679	3,503.6197	0.7965	1.5724
101	7,473.1482	2,548.9862	0.4930	0.9150
102	4,924.1620	1,797.5752	0.2953	0.5126
103	3,126.5868	1,229.0675	0.1705	0.2745
104	1,897.5193	810.7246	0.0940	0.1391
105	1,086.7947	510.2838	0.0490	0.0657
106	576.5109	300.9070	0.0236	0.0283
107	275.6039	161.6467	0.0103	0.0108
108	113.9573	75.8121	0.0039	0.0035
109	38.1451	28.9985	0.0012	0.0009
110	9.1466	9.1466	0.0003	0.0001

TABLE 26

1983 GROUP ANNUITY MORTALITY COMMUTATION FUNCTIONS AT 10 PERCENT

(Females)

AGE X	l_x	d_x	D_x	$N_x^{(12)}$
5	1,000,000.0000	171.0000	620,921.3231	6,527,594.0016
6	999,829.0000	139.9761	564,377.4050	5,932,588.6410
7	999,689.0239	117.9633	512,998.5383	5,391,759.8832
8	999,571.0606	103.9554	466,307.2768	4,900,161.5064
9	999,467.1052	96.9483	423,871.6190	4,453,303.9061
10	999,370.1569	95.9395	385,300.4577	4,047,110.7360
11	999,274.2174	103.9245	350,239.5171	3,677,879.8761
12	999,170.2929	112.9062	318,366.4475	3,342,248.8493
13	999,057.3866	121.8850	289,391.3382	3,037,162.6602
14	998,935.5016	130.8606	263,050.9386	2,759,844.0051
15	998,804.6411	139.8326	239,105.8899	2,507,767.8805
16	998,664.8084	148.8011	217,338.5592	2,278,638.6838
17	998,516.0074	158.7640	197,551.0689	2,070,369.3910
18	998,357.2433	167.7240	179,563.3257	1,881,062.7044
19	998,189.5193	178.6759	163,211.9628	1,708,993.7534
20	998,010.8434	188.6240	148,347.9526	1,552,594.4620
21	997,822.2193	200.5623	134,836.2862	1,410,439.3565
22	997,621.6571	211.4958	122,553.8037	1,281,232.5415
23	997,410.1613	224.4173	111,388.9294	1,163,795.9718
24	997,185.7440	238.3274	101,239.8790	1,057,058.6905
25	996,947.4166	252.2277	92,014.2569	960,047.2217
26	996,695.1889	267.1143	83,628.1612	871,876.5919
27	996,428.0746	282.9856	76,005.2262	791,742.2759
28	996,145.0890	300.8358	69,076.0371	718,912.9280
29	995,844.2532	318.6702	62,777.4328	652,723.7512
30	995,525.5831	340.4697	57,052.1309	592,570.4151
31	995,185.1133	362.2474	51,847.8356	537,903.5862
32	994,822.8659	385.9913	47,117.2390	488,223.9408
33	994,436.8746	411.6969	42,817.2341	443,077.5373
34	994,025.1778	440.3532	38,908.6435	402,051.7406
35	993,584.8246	472.9464	35,355.8245	364,771.4725
36	993,111.8783	498.5422	32,126.3592	330,895.8196
37	992,613.3361	532.0407	29,191.1198	300,114.7785
38	992,081.2953	568.4626	26,523.1576	272,146.4747
39	991,512.8328	611.7634	24,098.1453	246,734.7811
40	990,901.0693	658.9492	21,893.8879	223,646.9204
41	990,242.1201	709.0134	19,890.2986	202,671.3442
42	989,533.1068	766.8882	18,069.1429	183,615.7420
43	988,766.2186	832.5412	16,413.7630	166,305.3149
44	987,933.6775	907.9110	14,909.0387	150,581.2172
45	987,025.7664	996.8960	13,541.2158	136,299.0973
46	986,028.8704	1,101.3942	12,297.7628	123,327.7974
47	984,927.4761	1,218.3553	11,167.2966	111,548.1650
48	983,709.1208	1,343.7467	10,139.5297	100,851.9282
49	982,365.3742	1,478.4599	9,205.1628	91,140.6500
50	980,886.9143	1,615.5207	8,355.7355	82,324.8081
51	979,271.3936	1,755.8336	7,583.6123	74,322.9624
52	977,515.5599	1,905.1778	6,881.8318	67,060.9995
53	975,610.3821	2,068.2940	6,244.0173	60,471.4993
54	973,542.0881	2,253.7499	5,664.3455	54,493.1649
55	971,288.3382	2,468.0437	5,137.4841	49,070.2976
56	968,820.2945	2,715.6033	4,658.5725	44,152.3146
57	966,104.6912	2,997.8229	4,223.1950	39,693.2901

TABLE 26-*continued*

1983 GROUP ANNUITY MORTALITY COMMUTATION FUNCTIONS AT 10 PERCENT

(Females)

AGE X	l_x	d_x	D_x	$N_x^{(12)}$
58	963,106.8684	3,315.9769	3,827.3550	35,651.5218
59	959,790.8914	3,667.3610	3,467.4340	31,989.1307
60	956,123.5304	4,054.9199	3,140.1681	28,671.6935
61	952,068.6105	4,477.5787	2,842.5915	25,667.9147
62	947,591.0319	4,936.9493	2,572.0207	22,949.3348
63	942,654.0826	5,438.1714	2,326.0186	20,490.0651
64	937,215.9112	5,985.0608	2,102.3635	18,266.5551
65	931,230.8504	6,578.2147	1,899.0343	16,257.3841
66	924,652.6356	7,228.0097	1,714.1996	14,443.0657
67	917,424.6260	7,964.1632	1,546.1816	12,805.8743
68	909,460.4628	8,823.5854	1,393.4174	11,329.7097
69	900,636.8774	9,836.7560	1,254.4532	9,999.9842
70	890,800.1214	11,032.5595	1,127.9564	8,803.5088
71	879,767.5619	12,429.3561	1,012.7151	7,728.3713
72	867,338.2058	14,016.1854	907.6432	6,763.8141
73	853,322.0204	15,770.2443	811.7961	5,900.1009
74	837,551.7761	17,665.6421	724.3575	5,128.3808
75	819,886.1341	19,670.7081	644.6176	4,440.5708
76	800,215.4259	21,753.8564	571.9563	3,829.2563
77	778,461.5696	23,876.9733	505.8252	3,287.6101
78	754,584.5963	26,002.2306	445.7368	2,809.3254
79	728,582.3657	28,086.1216	391.2520	2,388.5609
80	700,496.2441	30,082.8112	341.9724	2,019.8954
81	670,413.4329	31,948.5521	297.5330	1,698.2910
82	638,464.8808	33,641.3530	257.5946	1,419.0631
83	604,823.5277	35,122.7071	221.8379	1,177.8569
84	569,700.8207	36,350.9003	189.9596	970.6299
85	533,349.9204	37,290.7597	161.6717	793.6356
86	496,059.1607	37,983.2499	136.6981	643.4101
87	458,075.9107	38,418.8266	114.7556	516.7690
88	419,657.0841	38,581.1740	95.5737	410.8051
89	381,075.9101	38,623.5678	78.8974	322.8747
90	342,452.3423	38,269.0492	64.4553	250.5867
91	304,183.2930	37,437.6630	52.0476	191.8282
92	266,745.6301	36,178.7098	41.4926	144.6183
93	230,566.9202	34,487.5082	32.6045	107.1995
94	196,079.4120	32,373.2992	25.2069	77.9855
95	163,706.1129	29,863.1054	19.1320	55.5630
96	133,843.0075	27,003.7637	14.2199	38.6824
97	106,839.2438	23,723.0131	10.3191	26.2503
98	83,116.2307	20,271.9656	7.2980	17.3159
99	62,844.2652	16,853.8893	5.0164	11.0637
100	45,990.3759	13,575.7611	3.3373	6.8169
101	32,414.6148	10,542.0431	2.1384	4.0291
102	21,872.5717	7,850.0004	1.3117	2.2696
103	14,022.5713	5,550.7367	0.7645	1.2086
104	8,471.8346	3,713.7134	0.4199	0.6021
105	4,758.1212	2,321.0877	0.2144	0.2764
106	2,437.0336	1,330.3425	0.0998	0.1145
107	1,106.6911	679.8503	0.0412	0.0415
108	426.8408	296.6053	0.0144	0.0126
109	130.2355	102.8176	0.0040	0.0029
110	27.4180	27.4180	0.0008	0.0004

TABLE 27

1983 GROUP ANNUITY MORTALITY COMMUTATION FUNCTIONS AT 12½ PERCENT
(Males)

AGE X	l_x	d_x	D_x	$N_x^{(12)}$
5	1,000,000.0000	342.0000	554,928.9573	4,723,820.3863
6	999,658.0000	317.8912	493,101.4859	4,197,229.0201
7	999,340.1088	301.8007	438,173.0485	3,729,303.0680
8	999,038.3080	293.7173	389,369.5291	3,313,498.2992
9	998,744.5908	291.6334	346,004.4929	2,944,004.4117
10	998,452.9574	292.5467	307,469.7418	2,615,661.6797
11	998,160.4106	297.4518	273,226.3584	2,323,886.8220
12	997,862.9588	303.3503	242,795.4995	2,064,607.9406
13	997,559.6085	309.2435	215,752.6130	1,834,207.0973
14	997,250.3650	316.1284	191,720.6487	1,629,469.1346
15	996,934.2367	324.0036	170,364.3317	1,447,536.7979
16	996,610.2330	331.8712	151,385.7452	1,285,870.9850
17	996,278.3618	341.7235	134,520.2967	1,142,215.2371
18	995,936.6383	351.5656	119,532.5833	1,014,564.3090
19	995,585.0727	363.3886	106,213.6785	901,136.2238
20	995,221.6842	375.1986	94,377.6982	800,347.3696
21	994,846.4856	389.9798	83,859.6603	710,790.4388
22	994,456.5058	405.7383	74,512.6998	631,214.8021
23	994,050.7675	421.4775	66,206.4877	560,509.1162
24	993,629.2900	441.1714	58,825.2588	497,685.6917
25	993,188.1186	460.8393	52,265.9025	441,866.8046
26	992,727.2793	484.4509	46,437.0233	392,272.4717
27	992,242.8284	509.0206	41,257.2107	348,209.5292
28	991,733.8078	537.5197	36,654.2629	309,062.0030
29	991,196.2881	566.9643	32,563.9078	274,282.4862
30	990,629.3238	601.3120	28,929.1389	243,384.5142
31	990,028.0118	638.5681	25,699.1812	215,935.7726
32	989,389.4437	679.7105	22,828.9824	191,552.0991
33	988,709.7332	725.7129	20,278.4879	169,892.0933
34	987,984.0202	775.5675	18,012.0920	150,652.3702
35	987,208.4528	848.9993	15,998.1800	133,563.3212
36	986,359.4535	894.6280	14,208.3747	118,385.4686
37	985,464.8255	951.9590	12,618.2113	104,905.9187
38	984,512.8665	1,022.9089	11,205.3530	92,935.2674
39	983,489.9576	1,109.3767	9,949.9650	82,305.3006
40	982,380.5809	1,216.1872	8,834.4369	72,866.6193
41	981,164.3938	1,344.1952	7,843.1110	64,486.5401
42	979,820.1986	1,496.1854	6,962.1030	57,047.2245
43	978,324.0131	1,677.8257	6,179.0861	50,444.0042
44	976,646.1874	1,886.8804	5,483.1013	44,583.9111
45	974,759.3070	2,127.8996	4,864.4515	39,384.3576
46	972,631.4074	2,403.3722	4,314.5177	34,771.9591
47	970,228.0352	2,706.9362	3,825.6503	30,681.5056
48	967,521.0990	3,036.0812	3,391.0904	27,055.0286
49	964,485.0178	3,388.2359	3,004.8437	23,840.9680
50	961,096.7819	3,756.9273	2,661.5890	20,993.4493
51	957,339.8546	4,139.5375	2,356.6088	18,471.6429
52	953,200.3171	4,532.4675	2,085.7056	16,239.1981
53	948,667.8496	4,933.0728	1,845.1450	14,263.7494
54	943,734.7768	5,341.5388	1,631.6002	12,516.4791
55	938,393.2379	5,753.2889	1,442.1025	10,971.7320
56	932,639.9490	6,172.2112	1,274.0098	9,606.6720
57	926,467.7378	6,614.0532	1,124.9586	8,400.9774

TABLE 27-*continued*

1983 GROUP ANNUITY MORTALITY COMMUTATION FUNCTIONS AT 12½ PERCENT

(Males)

AGE X	l_x	d_x	D_x	$N_x^{(12)}$
58	919,853.6846	7,100.3506	992.8244	7,336.5803
59	912,753.3340	7,652.5240	875.6985	6,397.4386
60	905,100.8101	8,288.9132	771.8726	5,569.3270
61	896,811.8968	9,025.5149	679.8256	4,839.6427
62	887,786.3819	9,883.7258	598.2078	4,197.2252
63	877,902.6561	10,878.0918	525.8204	3,632.1950
64	867,024.5643	12,023.8967	461.6044	3,135.8069
65	855,000.6677	13,331.1704	404.6248	2,700.3181
66	841,669.4972	14,795.7081	354.0586	2,318.8695
67	826,873.7892	16,375.4085	309.1863	1,985.3774
68	810,498.3806	18,016.5685	269.3895	1,694.4313
69	792,481.8121	19,667.0211	234.1344	1,441.2004
70	772,814.7910	21,275.5912	202.9546	1,221.3568
71	751,539.1998	22,812.2209	175.4375	1,031.0142
72	728,726.9789	24,317.6193	151.2109	866.6805
73	704,409.3596	25,837.7353	129.9245	725.2258
74	678,571.6243	27,406.1508	111.2523	603.8594
75	651,165.4736	29,040.0266	94.8969	500.1033
76	622,125.4469	30,725.5316	80.5909	411.7633
77	591,399.9154	32,383.8766	68.0984	336.8981
78	559,016.0388	33,919.9752	57.2173	273.7868
79	525,096.0636	35,247.0733	47.7738	220.8978
80	489,848.9903	36,283.1147	39.6151	176.8635
81	453,565.8756	36,958.3618	32.6051	140.4613
82	416,607.5138	37,211.3831	26.6207	110.5990
83	379,396.1307	37,000.6076	21.5493	86.3026
84	342,395.5230	36,310.0180	17.2869	66.7069
85	306,085.5050	35,149.6351	13.7366	51.0473
86	270,935.8699	33,642.1070	10.8081	38.6529
87	237,293.7630	31,766.5160	8.4143	28.9420
88	205,527.2469	29,610.9270	6.4781	21.4151
89	175,916.3199	27,242.2254	4.9287	15.6472
90	148,674.0945	24,725.5426	3.7026	11.2804
91	123,948.5519	22,089.3672	2.7439	8.0173
92	101,859.1846	19,400.1003	2.0043	5.6124
93	82,459.0843	16,739.7713	1.4423	3.8656
94	65,719.3130	14,320.5012	1.0218	2.6161
95	51,398.8118	12,031.7423	0.7103	1.7370
96	39,367.0696	9,780.1973	0.4836	1.1306
97	29,586.8723	7,809.5733	0.3231	0.7206
98	21,777.2990	6,115.1309	0.2114	0.4487
99	15,662.1681	4,685.4002	0.1351	0.2723
100	10,976.7679	3,503.6197	0.0842	0.1605
101	7,473.1482	2,548.9862	0.0509	0.0916
102	4,924.1620	1,797.5752	0.0298	0.0503
103	3,126.5868	1,229.0675	0.0168	0.0264
104	1,897.5193	810.7246	0.0091	0.0131
105	1,086.7947	510.2838	0.0046	0.0061
106	576.5109	300.9070	0.0022	0.0026
107	275.6039	161.6467	0.0009	0.0010
108	113.9573	75.8121	0.0003	0.0003
109	38.1451	28.9985	0.0001	0.0001
110	9.1466	9.1466	0.0000	0.0000

TABLE 28

1983 GROUP ANNUITY MORTALITY COMMUTATION FUNCTIONS AT 12½ PERCENT

(Females)

AGE X	l_x	d_x	D_x	$N_x^{(12)}$
5	1,000,000.0000	171.0000	554,928.9573	4,732,619.8665
6	999,829.0000	139.9761	493,185.8351	4,205,989.8403
7	999,689.0239	117.9633	438,326.0347	3,737,948.0803
8	999,571.0606	103.9554	389,577.1664	3,321,965.2769
9	999,467.1052	96.9483	346,254.8004	2,952,244.1949
10	999,370.1569	95.9395	307,752.1899	2,623,636.4244
11	999,274.2174	103.9245	273,531.2406	2,331,568.8362
12	999,170.2929	112.9062	243,113.5941	2,071,979.0169
13	999,057.3866	121.8850	216,076.5531	1,841,257.3999
14	998,935.5016	130.8606	192,044.6149	1,636,195.4851
15	998,804.6411	139.8326	170,683.9619	1,453,941.1695
16	998,664.8084	148.8011	151,697.8365	1,291,959.1818
17	998,516.0074	158.7640	134,822.4298	1,147,995.9066
18	998,357.2433	167.7240	119,823.1049	1,020,048.1674
19	998,189.5193	178.6759	106,491.5330	906,335.3662
20	998,010.8434	188.6240	94,642.1965	805,274.7791
21	997,822.2193	200.5623	84,110.4970	715,459.6116
22	997,621.6571	211.4958	74,749.8585	635,639.4072
23	997,410.1613	224.4173	66,430.2324	564,702.7107
24	997,185.7440	238.3274	59,035.8095	501,661.5888
25	996,947.4166	252.2277	52,463.7332	445,637.9809
26	996,695.1889	267.1143	46,622.6310	395,851.4195
27	996,428.0746	282.9856	41,431.2322	351,608.1797
28	996,145.0890	300.8358	36,817.3028	312,291.6651
29	995,844.2532	318.6702	32,716.6080	277,353.8474
30	995,525.5831	340.4697	29,072.1233	246,307.6282
31	995,185.1133	362.2474	25,833.0494	218,720.0805
32	994,822.8659	385.9913	22,954.3522	194,206.4339
33	994,436.8746	411.6969	20,395.9519	172,424.6819
34	994,025.1778	440.3532	18,122.2293	153,070.8528
35	993,584.8246	472.9464	16,101.5122	135,874.7855
36	993,111.8783	498.5422	14,305.6425	120,596.3803
37	992,613.3361	532.0407	12,709.7432	107,022.1917
38	992,081.2953	568.4626	11,291.4940	94,962.4793
39	991,512.8328	611.7634	10,031.1324	84,248.6511
40	990,901.0693	658.9492	8,911.0606	74,730.8849
41	990,242.1201	709.0134	7,915.6754	66,276.0425
42	989,533.1068	766.8882	7,031.1180	58,765.7892
43	988,766.2186	832.5412	6,245.0390	52,094.9574
44	987,933.6775	907.9110	5,546.4717	46,170.0951
45	987,025.7664	996.8960	4,925.6662	40,908.1592
46	986,028.8704	1,101.3942	4,373.9478	36,235.3639
47	984,927.4761	1,218.3553	3,883.6108	32,086.1539
48	983,709.1208	1,343.7467	3,447.8282	28,402.2768
49	982,365.3742	1,478.4599	3,060.5498	25,131.9512
50	980,886.9143	1,615.5207	2,716.3943	22,229.1394
51	979,271.3939	1,755.8336	2,410.5960	19,652.9026
52	977,515.5599	1,905.1778	2,138.9100	17,366.8294
53	975,610.3821	2,068.2940	1,897.5478	15,338.5437
54	973,542.0881	2,253.7499	1,683.1333	13,539.2692
55	971,288.3382	2,468.0437	1,492.6550	11,943.4385
56	968,820.2945	2,715.6033	1,323.4330	10,528.3435
57	966,104.6912	2,997.8229	1,173.0875	9,273.8189

TABLE 28-*continued*

1983 GROUP ANNUITY MORTALITY COMMUTATION FUNCTIONS AT 12½ PERCENT

(Females)

AGE X	l_x	d_x	D_x	$N_x^{(12)}$
58	963,106.8684	3,315.9769	1,039.5088	8,161.9549
59	959,790.8914	3,667.3610	920.8265	7,176.8422
60	956,123.5304	4,054.9199	815.3849	6,304.3431
61	952,068.6105	4,477.5787	721.7127	5,531.8913
62	947,591.0319	4,936.9493	638.5054	4,848.3152
63	942,654.0826	5,438.1714	564.6033	4,243.6816
64	937,215.9112	5,985.0608	498.9743	3,709.1582
65	931,230.8504	6,578.2147	440.7004	3,236.8928
66	924,652.6356	7,228.0097	388.9664	2,819.9038
67	917,424.6260	7,964.1632	343.0452	2,451.9846
68	909,460.4628	8,823.5854	302.2820	2,127.6225
69	900,636.8774	9,836.7560	266.0882	1,841.9293
70	890,800.1214	11,032.5595	233.9396	1,590.5759
71	879,767.5619	12,429.3561	205.3709	1,369.7303
72	867,338.2058	14,016.1854	179.9728	1,176.0002
73	853,322.0204	15,770.2443	157.3906	1,006.3776
74	837,551.7761	17,665.6421	137.3172	858.1873
75	819,886.1341	19,670.7081	119.4853	729.0431
76	800,215.4259	21,753.8564	103.6610	616.8106
77	778,461.5696	23,876.9733	89.6382	519.5768
78	754,584.5963	26,002.2306	77.2345	435.6236
79	728,582.3657	28,086.1216	66.2872	363.4067
80	700,496.2441	30,082.8112	56.6505	301.5363
81	670,413.4329	31,948.5521	48.1935	248.7619
82	638,464.8808	33,641.3530	40.7972	203.9584
83	604,823.5277	35,122.7071	34.3534	166.1146
84	569,700.8207	36,350.9003	28.7631	134.3235
85	533,349.9204	37,290.7597	23.9358	107.7729
86	496,059.1607	37,983.2499	19.7887	85.7379
87	458,075.9107	38,418.8266	16.2431	67.5743
88	419,657.0841	38,581.1740	13.2273	52.7134
89	381,075.9101	38,623.5678	10.6767	40.6551
90	342,452.3423	38,269.0492	8.5285	30.9630
91	304,183.2930	37,437.6630	6.7337	23.2571
92	266,745.6301	36,178.7098	5.2489	17.2040
93	230,566.9202	34,487.5082	4.0329	12.5124
94	196,079.4120	32,373.2992	3.0486	8.9307
95	163,706.1129	29,863.1054	2.2624	6.2425
96	133,843.0075	27,003.7637	1.6442	4.2634
97	106,839.2438	23,723.0131	1.1666	2.8381
98	83,116.2307	20,271.9656	0.8067	1.8364
99	62,844.2652	16,853.8893	0.5422	1.1509
100	45,990.3759	13,575.7611	0.3527	0.6955
101	32,414.6148	10,542.0431	0.2210	0.4032
102	21,872.5717	7,850.0004	0.1325	0.2228
103	14,022.5713	5,550.7367	0.0755	0.1164
104	8,471.8346	3,713.7134	0.0406	0.0568
105	4,758.1212	2,321.0877	0.0202	0.0256
106	2,437.0336	1,330.3425	0.0092	0.0104
107	1,106.6911	679.8503	0.0037	0.0037
108	426.8408	296.6053	0.0013	0.0011
109	130.2355	102.8176	0.0003	0.0003
110	27.4180	27.4180	0.0001	0.0000

TABLE 29

MALE ANNUITY VALUES

$\ddot{a}_x^{(12)}$

INTEREST RATE	MORTALITY RATE	AGE								
		50	55	60	65	70	75	80	85	90
7½%	1983 GAM	11.553	10.858	9.991	8.935	7.775	6.565	5.369	4.328	3.447
	1971 GAM	11.156	10.388	9.468	8.399	7.254	6.133	5.019	4.085	3.313
	Ratio*	1.036	1.045	1.055	1.064	1.072	1.070	1.070	1.059	1.040
10%	1983 GAM	9.390	8.962	8.391	7.648	6.789	5.847	4.874	3.997	3.223
	1971 GAM	9.138	8.645	8.018	7.248	6.380	5.497	4.579	3.785	3.114
	Ratio*	1.028	1.037	1.047	1.055	1.064	1.064	1.064	1.056	1.038
12½%	1983 GAM	7.888	7.608	7.215	6.674	6.018	5.270	4.465	3.716	3.047
	1971 GAM	7.719	7.385	6.940	6.366	5.690	4.981	4.212	3.530	2.939
	Ratio*	1.022	1.030	1.040	1.048	1.058	1.058	1.060	1.053	1.037

* Ratios shown are the annuity values based on the 1983 GAM divided by the corresponding values based on the 1971 GAM.

CONCLUSION

The committee's review of available information yielded three important conclusions:

1. Survivorship has improved considerably since the 1971 GAM Table was published;
2. The 1971 GAM Table and Projection Scale D are no longer appropriate measures of group annuitant mortality; and
3. Population statistics currently provide the most credible measure of improvements in survivorship at high ages.

Only a limited amount of insured pensioner data was available, too limited to support the construction of an entirely new table. As a result, the committee updated the 1966 Experience Table (the last table developed from the experience of insured group annuitants) with a projection scale. For this purpose, the committee developed Projection Scale Z from the data available but with heaviest emphasis upon U.S. population statistics.

The new table is called the 1983 Group Annuity Mortality Table (1983 GAM). The committee acknowledges that there is no single correct technique for determining the actual current level of group annuitant mortality. The projected 1983 mortality rates represent the committee's best estimate using the available data.

Generally, a table that receives approval from the Society of Actuaries and the National Association of Insurance Commissioners will gain broad acceptance among actuaries. The committee believes that the 1983 GAM Table should be accepted widely but that it should be evaluated carefully before it is used for various applications. We believe that the new table is a valid and conservative basis for measuring the mortality of insured group pensioners who have no opportunity for selection. The table may, however, predict an inadequate level of survivorship where individuals are allowed to select the form of their benefits without an extended waiting period. For example, a plan may allow participants to take a lump sum cash payment instead of their monthly annuity payments. In such a plan, one would expect higher levels of survivorship among the annuitants. The committee believes that benefits for plans that allow financial selection by participants may be more properly valued by an individual annuity mortality table.

In the final analysis, the actuary must use his professional judgment when selecting valuation assumptions. For annual statement purposes, he must certify that the reserves make good and sufficient provision for all unmatured obligations which are guaranteed under the terms of his company's contracts. Subject to the above cautions, the committee is confident that the 1983 Group Annuity Mortality Table is an appropriate table for use as a basis for valuing group annuity reserves.