Mortality of Beneficiaries of Charitable Gift Annuities[1]

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Abstract: This paper is an analysis of the mortality rates of beneficiaries of charitable gift annuities. Observed overall mortality rates were 83 percent of the Annuity 2000 Mortality Table (Basic) on the basis of exposed lives and 76 percent of expected on the basis of annuity income. A strong select and ultimate pattern of mortality was observed. The select and ultimate pattern explains most of the variation between actual mortality and the mortality rates in the table. Some variations in mortality by type of organization were observed but not all of the predicted variations occurred.

Background

Charitable gift annuities are an important source of funding for charitable and nonprofit organizations throughout the United States. The number of such annuities is about 200,000. The American Council on Gift Annuities (ACGA) is the primary organization advising charities in this field. The membership of ACGA numbers about 3,000 organizations, including the most significant participants in the charitable annuity field. Periodically the Council publishes advisory rates for gift annuities. These rates are established on the basis of investment returns, mortality, and expenses such that the charity is expected to receive a 50 percent future value residuum from the original gift. Remarkably, the first and only mortality study in the 84-year history of the ACGA was completed in 2002 on the basis of data from 1996 through 2000. Previously the ACGA advisory rates were based on data for insured annuities.

In a typical gift annuity transaction a donor makes a contribution in exchange for an annuity that has a present value of 60 percent to 80 percent of the contributed amount. In addition to receiving a life income, the donor receives a current tax deduction equal to the excess of the donation over the present value of the annuity on the basis of a valuation prescribed by tax regulations, typically 20 percent to 40 percent of the gross amount. Many charitable organizations include gift annuities among their planned giving alternatives. The 2005 ACGA survey showed that 8 percent of charities insure some or all of their annuities with commercial insurance companies. They refer to this as "reinsurance," even though it is not true reinsurance because the charities are not insurance companies.

We estimate that there are about 200,000 charitable gift annuity contracts in force in the United States, representing about $15 to $20 billion in annuity reserves.

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Data Used for the Study

The ACGA conducted a survey of members to obtain data on 25,000 charitable gift annuities in force at some time during the period January 1, 1996 through December 31, 2000. Twenty-five organizations contributed data. They included religious, educational, and health-related nonprofit organizations and represent about 12 percent of the total charitable gift annuity exposure during the period. The ACGA data included more than 80,000 contract years of exposure. The Hay Group had performed an analysis of the data for the ACGA, and with the permission of the ACGA, the Hay Group graciously provided us with the data that they had assembled. This study is based on the ACGA data provided to us by the Hay Group.

We reviewed the data for missing or inconsistent information and for other data problems. Approximately 1,000 records omitted critical information, such as date of birth or date of issue of the annuity or were for annuitants who died before the beginning of the study period and had no contingent annuitant. In addition, about 2,000 records omitted the sex of the annuitant. We considered using these records, but concluded that the uncertainty in interpretation of the results would be too great for these records to contribute meaningful information to the study, and these records were, accordingly, omitted. One organization apparently used a coding method that allowed the sex of the principal annuitant of joint annuities to be shown in some records and that of the joint annuitant in others. We decided to omit the data from this organization. The final database for our study included 21,815 records of which 25 percent were joint-life annuities.

We defined one year of exposure as a year starting on the anniversary date of the annuity. Thus, for example, the 1996 exposure year extended from contract anniversaries in 1996 to anniversaries in 1997. In this way the actual exposure was measured on an age-last-birthday basis. The portion of the contract year starting in 1995, but observed in 1996, as well as the exposure from anniversaries in 2000 to December 31, 2000, were measured on a fractional basis, based on the number of days of exposure within the survey period. Fractional year mortality was considered, as will be described below in the discussion of the fractional periods related to 1995 anniversaries.

Of the total 21,815 usable records, the death of the primary annuitant was recorded in 4,710 records. The dates of death were spread over more than five years. The dates of birth of the annuitants who had died spanned a wide range, but the middle half of the birth dates spanned nine years from the end of 1903 to the end of 1912. In all there are well over six million combinations for dates of birth and death in these periods, making it relatively unlikely that two individuals would share the same date. To approximate this probability, we considered a Poisson distribution with frequency parameter 4,710/6,000,000. The frequency of zero observations for this distribution is such that six million repetitions would be expected to yield 4,708 nonzero observations, so we would expect only about two cases of individuals in this group sharing the same dates of birth and death. In fact, a review of the data showed that repetitions were quite common, indicating that many individuals had more than one annuity. The average number of

annuities in this group was about two per person. While we do not know the exact number of cases in which two different individuals in the database shared the same dates of birth and death, we can be sure that the number is extremely small in comparison to the number of contracts. On the basis of the same Poisson model described above, there is virtually no chance that the number of observed repetitions of date combinations could occur except for the existence of multiple annuities per annuitant. Virtually all the cases of multiple records with the same birth and death date can be assumed to represent multiple annuities to single annuitants, since the rate of random duplications would be expected to produce only two duplications out of 4,710.

For reasons of privacy the call for data did not request the name nor Social Security number of the annuitant, so we had no way to conclusively determine whether two records were for the same annuitant. The considerations for annuitants who had died showed that we should expect many multiple records for individual annuitants, as explained above. For those annuitants who survived to the end of the study, we had only the date of birth and sex to identify different records that might relate to a single individual. We wanted to evaluate mortality on the basis of the number of individuals, rather than the number of contracts, so we sought a method to use dates of birth to count individual records. Of course the measurement of exposure based on annuity income did not present such a difficulty.

There are some years with more than 200 different birth dates for records in the database. For this reason it would not be unusual for birth dates to be shared by different individuals. To estimate the number of distinct individuals represented, we assigned an exposure count of one to each birthday represented within a given year and weighted each count by the ratio of the estimated number of individuals to the number of birthdays. To do this we used a maximum likelihood estimator based on the Poisson distribution. If the number of individuals with birth dates in a given year is n, then the number of such individuals having a given birth date can be approximated by a Poisson distribution with frequency parameter $\lambda = n/365$, and the most likely number of dates occurring as birth dates would be $365 - 365e^{-\lambda}$. Accordingly, the weight used for a given year was $w = -365\ ln(1 - b/365)/b$, where b represents the number of distinct birth dates appearing in records for the given year. For example, if 200 distinct birth dates are represented in a given year, the most likely number of individuals is 290, and a weight of 1.45 would be assigned to each date that had at least one annuitant birth date. In this way we were able to determine an exposure measure for individuals who survived that would be equivalent to the exposure for those who died, for whom the dates of birth and death gave us an essentially unique identifier.

An example may help to illustrate the thought process behind this adjustment. The database included 197 records for annuitants with dates of birth during 1910 who were still alive at the end of the study period. These records included 62 distinct dates of birth. The probability that 197 selections with replacement from 365 possible dates would select 62 or fewer distinct values is less than 10^{-24}, a negligible probability for practical purposes. Because this indicates that there are multiple contracts for some annuitants, we

used a maximum likelihood estimate for the number of distinct annuitants. In this example, the most likely number of distinct annuitants would be 68.

The annual annuity amount was indicated for all but about 800 records. These records were, in effect, ignored in the evaluation of mortality rates in relation to income amount. The median annual income per record was approximately $1,000, and the distribution of amounts was strongly skewed to the right. The maximum annual amount was more than $400,000. To avoid placing too much weight on a single annuitant, we decided to cap the annual income considered per person. We limited the total annual income for any individual during any year of the study to not more than $30,000. We selected this cutoff amount based on our judgment, because it was a relatively low value yet it limited only a small number of annuitants. Approximately one percent of the income amounts were capped. The limit was effected by reducing the amount of each annuity in force during the given year for the individual by the same proportion.

We did not have data that could be used to measure reporting lags for deaths, but the relatively long period from the end of the observation period to the due date for the data would be expected to allow for full reporting. There was no evidence to indicate underreporting of deaths in the final period of the study.

We measured mortality for the stub period from January 1, 1996 to the anniversary date in 1996 using fractional exposure. We had previously fitted a Gompertz distribution to the mortality rates in the Annuity 2000 Mortality Table (Basic). With this mortality distribution the rate of mortality for the second half of a year exceeds that of the year as a whole by an amount that depends on the overall rate for the year. At the ages of most importance in this study the rate for the second half of the year exceeds the rate for the year by an average of about 5percent. Therefore, we expected that the observed mortality for 1996 would be about 5 percent higher than the tabular rates for the second half of the exposure year. Instead, for the initial 1996 stub period, we obtained rates far below those of other years, showing approximately 65 percent of the expected number of deaths. The probability of this level of difference in a consistently measured data set would be very low (approximately 3.4 standard deviations below the level of mortality in other years). Upon further investigation we noted that many of the organizations reported no deaths during the exposure year starting in 1995, while others had mortality close to expected for the 1996 stub period. In view of this inconsistency we decided to omit data for the 1996 stub period from our analysis.

Age at issue for charitable gift annuities tends to be older than would typically be the case for commercial annuities. The average issue age during the year 2000 in the database, weighted by annual annuity amount, was 81 years. Annuities were issued during that year to individuals as old as 101. We reconstructed the number of annuities issued by year, using assumed survival probabilities, and found that the level of new annuities issued during the late 1990s exceeded the level earlier in the decade, except for a peak in 1993 that was at a level comparable to the level of the late 1990s. The level during the 1980s appeared to be about one-fourth the level during the late 1990s. The average age of new annuitants tended to be elderly throughout the period.

Tables 13 to 16 in the Appendix provide analyses of exposure in the database. These tables present exposure by age and sex, by duration and sex, and by type of organization. The total number of life years of exposure is 42,327. The exposure by annual income is approximately $123 million.

Measurement of Actual to Expected Mortality

We wished to investigate relative mortality for a variety of groupings within which individual mortality would be expected to vary widely. For each year of the analysis, we associated an expected mortality rate with each record on the basis of the Annuity 2000 Mortality Table (Basic) for male and female lives [Johansen, 1996]. This table was derived from the 1983 Table projected to 2000 by a modification of Scale G. This basic table was used to develop the valuation table adopted by the National Association of Insurance Commissioners. While this table is based on age nearest birthday we compared its rates to data based on age last birthday, as is usually used by charities to measure age in the administration of their gift annuities. We have used this table throughout this paper as the basis for expected mortality.

We tested the variance of measurement of actual to expected ratios by simulating mortality for a group of individuals with an age distribution approximating that of the population under study. We found that the variance was close to the number of observed deaths, as would be the case for a Poisson distribution. On the basis of this analysis we present actual to expected ratios for various groupings of interest, and approximate the variance by the observed number of deaths. On the basis of the population as a whole we observed an actual to expected ratio of 83 percent for number of deaths with a standard error of 2 percent and an actual to expected ratio of 76 percent on the basis of annual income with a standard error of 6 percent. While the actual to expected ratio by amount is less than that on the basis of number of deaths, as expected, the difference is only slightly more than one standard deviation. Therefore, although the probability of an occurrence of such a difference at random is only about 15 percent, we do not have enough evidence to rule out the possibility that the mortality ratios are the same. As noted below, the difference between overall mortality rates on the basis of lives and income reverses when select and ultimate mortality is taken into account, which would be evidence that the difference identified above is not significant.

We have estimated the standard error for mortality ratios for the population as a whole based on income by means of a simulation. The standard error for mortality ratios based on income for subsets of the population would be highly variable, and in some cases much higher because the income amounts are highly variable. It is not feasible to simulate the standard errors for all of the subsets considered.

Select and Ultimate Mortality

The occurrence of select mortality is typically attributed to insurance company selection of risks in relation to life insurance. It is reasonable to assume that self-interest would cause selection among applicants for annuities, and this is, in fact, strongly borne out by our analysis. In cases in which an individual had more than one annuity with such annuities having different durations, we allocated the exposure over the different durations represented. Comparing the relative mortality for annuities in durations one through six with that of annuities in durations greater than six, with approximately half of the deaths in each subset, the difference in relative mortality is 11 standard deviations.

The annuities represented in the database have a relatively low overall duration because of the high levels of new annuities issued during the late 1990s and the high mortality of annuitants from prior years consistent with their advanced average age. This increases the impact of select mortality on the observed data, and much of the downward deviation of observed versus tabular mortality arises from low mortality rates during the first five years after the issuance of the annuities. The high ages typical of charitable gift annuitants would lead one to expect a rapid convergence to ultimate mortality rates, and this is, indeed, observed in the data. The ratio of ultimate to first-year select mortality is similar to but slightly smaller than that observed with insured lives of similar age. For example, for life insurance the ratio of mortality for a 75-year-old, non smoking male insured 15 years earlier is 3.1 times the mortality of a newly selected 75-year-old according to the 1990-95 U.S. Society of Actuaries Table for select and ultimate mortality of insured lives. This ratio for life insurance is comparable to the overall ratio of about 2.2 of ultimate to first-year select mortality observed here. For purposes of comparison with life insurance select and ultimate mortality, we have included a grouping of durations to correspond with typical life insurance groupings in Table 3.

Tables 1, 2 and 4 show the ratio of actual to expected mortality at attained age by duration on the basis of number of lives and the standard error of the ratio. Charts 1 through 3 present these results graphically, along with an error band based on plus or minus one standard error. In all of the tables and charts below we use duration 15 to designate ultimate durations of 15 and higher.

Table 1
Actual to Expected Mortality by Duration
Based on the Annuity 2000 Mortality Table (Basic)
Exposure Based on Estimated Number of Lives
Female Lives

Duration	Actual	Expected	Ratio	Standard Error
1	76.3	166.3	46%	5%
2	114.0	166.6	68%	6%
3	110.9	153.7	72%	7%
4	115.7	168.5	69%	6%
5	131.0	169.6	77%	7%
6	139.4	153.9	91%	8%
7	140.7	137.9	102%	9%
8	98.4	100.9	98%	10%
9	74.8	68.6	109%	13%
10	47.5	45.6	104%	15%
11	47.1	41.9	112%	16%
12	40.2	35.6	113%	18%
13	38.3	29.5	130%	21%
14	30.1	24.1	125%	23%
15 or more	295.7	255.3	116%	7%

Chart 1
Comparison of Mortality to the Annuity 2000 Mortality Table (Basic)
Female Lives

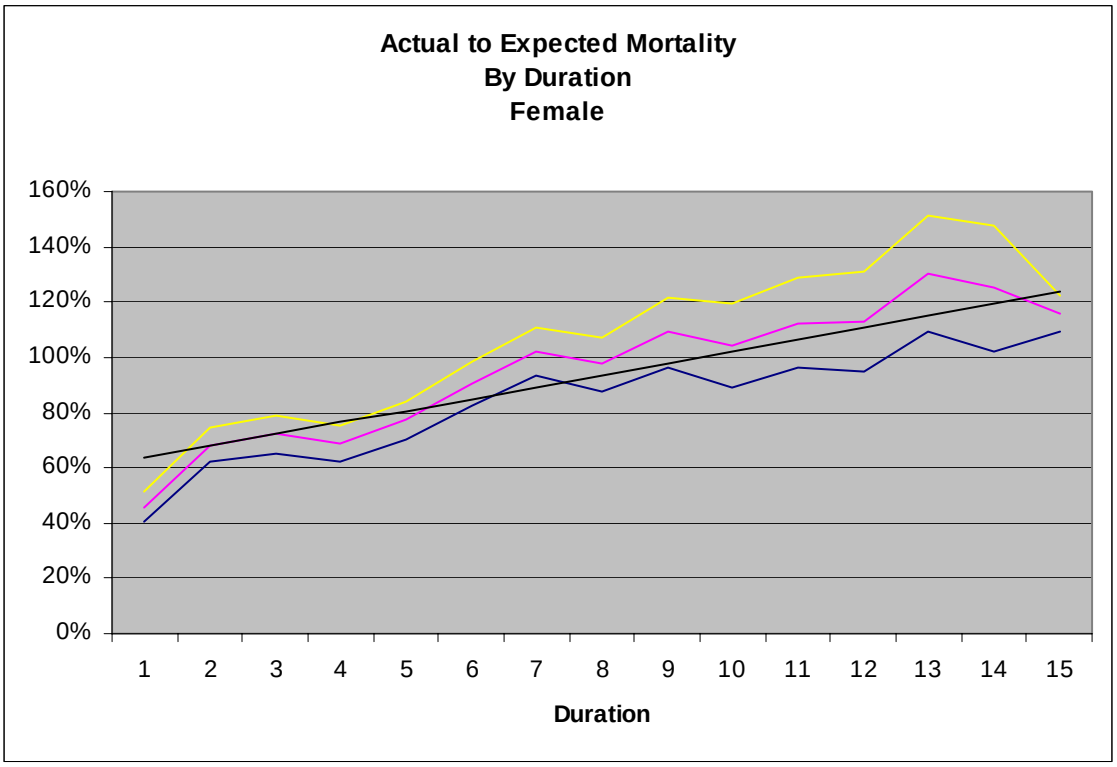
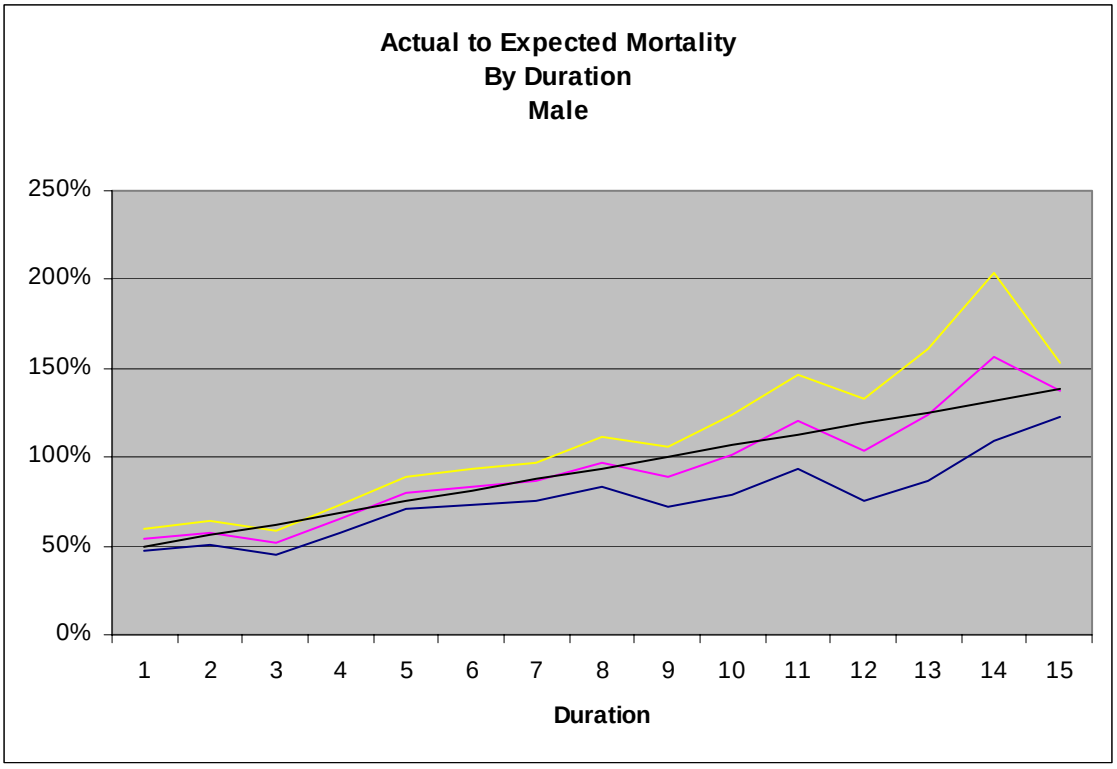


Table 2
Actual to Expected Mortality by Duration
Based on the Annuity 2000 Mortality Table (Basic)
Exposure Based on Estimated Number of Lives
Male Lives

Duration	Actual	Expected	Ratio	Standard Error
1	80.9	150.6	54%	6%
2	76.2	132.4	58%	7%
3	60.0	115.6	52%	7%
4	73.1	111.7	65%	8%
5	80.7	100.5	80%	9%
6	72.2	86.5	83%	10%
7	64.3	74.5	86%	11%
8	48.4	49.8	97%	14%
9	27.7	31.1	89%	17%
10	21.2	20.9	101%	22%
11	20.8	17.3	120%	26%
12	13.3	12.8	104%	29%
13	11.2	9.0	124%	37%
14	10.8	6.9	156%	48%
15 or more	81.4	59.1	138%	15%

Chart 2
Comparison of Mortality to the Annuity 2000 Mortality Table (Basic)
Male Lives



As noted above, we present in Table 3 a grouping of the select and ultimate actual to expected ratios to facilitate comparison with life insurance experience.

Table 3
Actual to Expected Mortality by Duration Groups
Based on the Annuity 2000 Mortality Table (Basic)
Exposure Based on Estimated Number of Lives

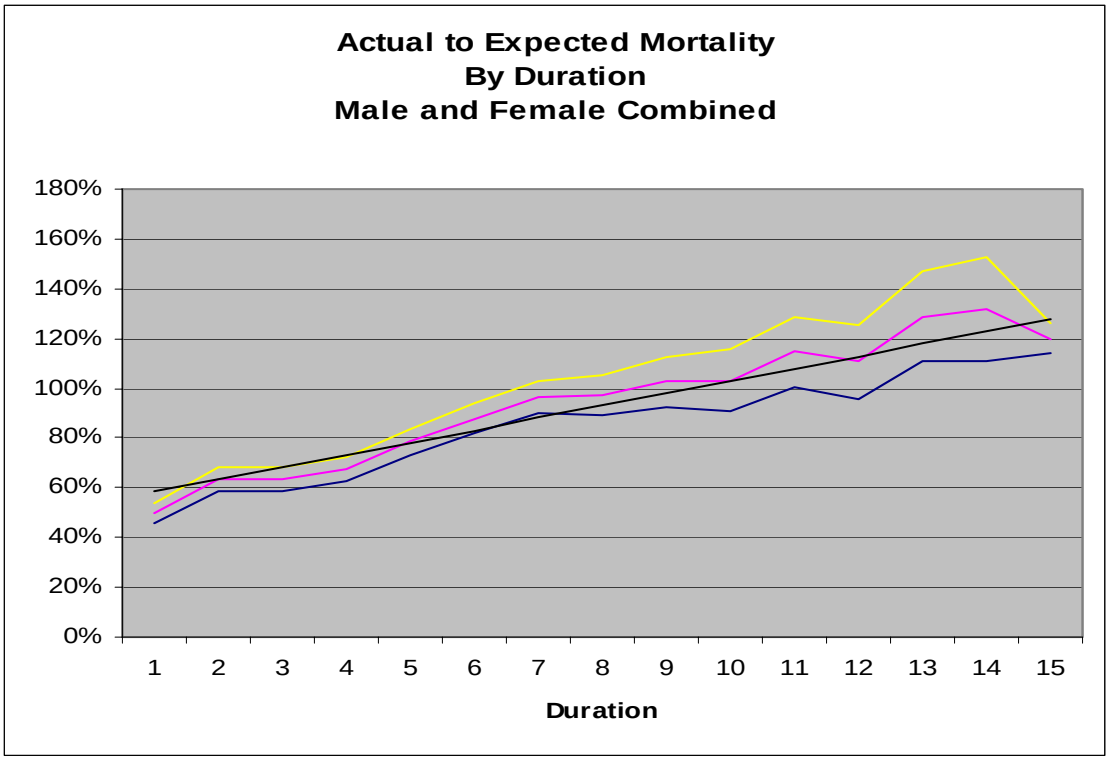
Duration	Actual to Expected	
	Female	Male
1	46%	54%
2-5	72%	63%
6-10	99%	89%
11 or more	117%	131%

We evaluated the pattern of select and ultimate mortality separately for males and females, obtaining the results shown in Tables 1 and 2 and Charts 1 and 2 above. We simulated the best linear fit to random mortality data with the mean and standard deviation observed by duration for males and females and compared the ratios at duration 1 and ultimate durations. The fitted first-year mortality ratios for males and females differed by 1.6 standard deviations, and the ultimate rates differed by 0.45 standard deviations. On this basis we concluded that it was not possible to distinguish different select and ultimate patterns of mortality for males and females, so our analyses are based on the combined results for select and ultimate ratios.

Table 4
Actual to Expected Mortality by Duration
Based on the Annuity 2000 Mortality Table (Basic)
Combined Results for Male and Female Lives
Exposure Based on Estimated Number Lives

Duration	Actual to Expected	Standard Error
1	50%	4%
2	64%	4%
3	63%	5%
4	67%	5%
5	78%	6%
6	88%	6%
7	96%	7%
8	98%	8%
9	103%	10%
10	103%	13%
11	115%	14%
12	111%	15%
13	129%	18%
14	132%	21%
15	120%	6%

Chart 3
Comparison of Mortality to the Annuity 2000 Mortality Table (Basic)
Combined Results for Male and Female Lives



We prepared a stationary population model on the basis of entry ages during 2000 and assumed mortality. We then determined a weighted least-squares linear fit to 14-year select and ultimate mortality that would produce the same total mortality for the stationary population as the Annuity 2000 Mortality Table (Basic) that we used for expected mortality. The observed pattern of select and ultimate mortality with equivalent total mortality for the stationary population is given by the following formula for durations 1 through 15:

(1) $0.54 + 0.05 \times \text{duration}$.

For durations greater than 15 the mortality is assumed to be 129 percent of the basic table.

The strong self-selection effect and the large proportion of new annuities in the database suggest that the analysis of mortality must take the select and ultimate pattern into account. The basic table that we are using to estimate expected mortality is an aggregate table, so the actual to expected ratios for our select and ultimate data will tend to be below 100 percent in the early select period and above 100 percent at ultimate durations. The effect of select and ultimate mortality is greater than any of the other mortality relationships found in this study. In particular, after adjustment for select and ultimate mortality rates the overall comparison of actual to expected mortality is 98 percent on the

basis of number of lives and 106 percent on the basis of income amount. This reverses the relationship between these ratios before consideration of select and ultimate mortality rates. As noted above, the difference between these ratios is not statistically significant.

The high mortality at advanced ages implies that there would be a small amount of exposure at high durations for contracts issued at advanced ages. There were approximately 800 life years of exposure for annuitants aged 95 or greater in durations 10 or greater, with about 200 deaths in this group. The overall relationship of select and ultimate mortality weights all issue ages in accordance with their respective expected mortality and is appropriate for use with a group of annuities, although the fit may be less accurate for subsets with low exposure.

Organizations that issue charitable gift annuities tend to focus on the life expectancy of annuitants when they compare different sets of mortality assumptions. Taking into account the select and ultimate mortality pattern, the mortality rates observed in this study lead to higher life expectancies than are obtained with the use of the Annuity 2000 Mortality Table. The additional life expectancy for females ranges from 3.5 years at age 40 to 3.1 years at age 60 and 2.0 years at age 80. Male life expectancies are increased by 3.9 years at age 40, by 3.3 years at age 60, and by 2.0 years at age 80. All of these increases are measured from the time of issue of a new annuity. While the pattern of mortality is quite different from that of the Annuity 2000 Mortality Table, we have performed limited tests that indicate that there is a relatively small difference between the present value of benefits on the basis of observed mortality and the present value on the basis of the valuation table.

Mortality Relationships to Type of Group

Various theories have been proposed to predict the relative mortality of donors to various types of charitable organizations. For example, donors to universities might be expected to have low mortality because of high socio-economic status and educational attainment. Donors to religious charities might have low mortality because of a healthy lifestyle. It was also theorized that donors to health-related organizations might have high mortality, because they would include victims of various serious diseases. We analyzed the relative mortality by type of charity, taking into account select and ultimate mortality. In a few cases the same individual had charitable annuities with more than one charity. In these cases we allocated the exposure over the annuities in force with fractional exposure being allocated to the respective charities.

Table 5
Actual to Expected Mortality by Type of Group
On the Basis of Lives
Combined Male and Female Results
Adjusted for Select and Ultimate Mortality

Type of Group	Actual	Expected	Ratio	Standard Error
Secular College	116	95	122%	11%
Health Research or Care	238	210	113%	7%
Religious Charity	1,689	1,749	97%	2%
Religious College	199	241	83%	6%

Table 6
Actual to Expected Mortality by Type of Group
On the Basis of Annuity Income
Combined Male and Female Results
Adjusted for Select and Ultimate Mortality

Type of Group	Actual	Expected	Ratio
Secular College	883,389	750,092	118%
Health Research or Care	989,270	798,915	124%
Religious Charity	4,496,035	4,365,179	103%
Religious College	615,484	685,549	90%

Some of the theories about mortality by type of charity are supported by our analysis. Other theories are not supported. Health-related charities had mortality about 13 percent above the average of the group, with a standard error of 7 percent. Colleges with a religious focus had mortality about 17 percent less than the average of the group with a standard error of 6 percent. Secular colleges had mortality 22 percent above the average of the group with a standard error of 11 percent. General religious charities had mortality close to the average of the group, taking into account the statistical uncertainty of the results. The average income for annuities is largest for secular colleges and smallest for religious colleges and religious charities, so the effects observed by organization type cannot be explained on the basis of differences in income amount.

It should be noted that the charities that submitted data do not represent a random sample of the population of charities as a whole and may not be representative of the universe of charitable annuities. In particular, more than 75 percent of the data came from religious charities other than colleges. The mortality of the organizations in the database may not be representative of that of other charities with a similar mission.

Pattern of Mortality by Age

We evaluated actual to expected mortality by age and sex within relatively broad groups. Once multiple annuity contracts to single individuals were combined, we observed 2,200 deaths in the database. Separating these by age and sex reduced the credibility of the individual results, so we grouped the ages to provide for reasonable credibility. Although virtually all ages were represented in the group, the exposure at younger ages was very low. Only 21 deaths were observed for individuals younger than age 70, so it was not possible to obtain separate meaningful results for these ages. For ages 70 and above we grouped the data into 10-year groupings. The group of females above age 100 actually includes about 10 life years of exposure for ages greater than 110.

If we had not considered select and ultimate mortality, the data by age would be severely distorted by the fact that there are a large number of newly issued annuities for individuals in their 60s and 70s. For this reason we modeled expected mortality by using the Annuity 2000 Mortality Table (Basic) with an adjustment for duration. The duration adjustment was the simple linear approximation shown in formula (1) above. Results by age are shown in Tables 7 and 8 below. Detailed results are presented in Tables 17 through 20 in the Appendix.

Table 7. Actual to Expected Mortality for Females
Adjusted for Select and Ultimate Mortality

Age	Actual to Expected Ratio for Number of Deaths	Actual to Expected Ratio for Annual Income	Standard Error for Ratio Based on Number of Deaths
Less than 70	120%	164%	34%
70-79	94%	96%	9%
80-89	94%	107%	4%
90-99	106%	110%	4%
100 or More	86%	167%	12%

Table 8. Actual to Expected Mortality for Males
Adjusted for Select and Ultimate Mortality

Age	Actual to Expected Ratio for Number of Deaths	Actual to Expected Ratio for Annual Income	Standard Error for Ratio Based on Number of Deaths
Less than 70	62%	22%	21%
70-79	71%	54%	7%
80-89	91%	104%	5%
90-99	115%	107%	7%
100 or More	141%	191%	32%

The observed female mortality follows the tabular mortality fairly closely, taking into consideration the standard error of measurement. Male mortality is lower than the reference table at younger ages and higher at older ages, even considering the standard

error of measurement. In comparing actual to expected mortality the effect of select and ultimate mortality is very significant in all cases.

Tables 17 through 24 in the Appendix present details of actual to expected mortality by age on the basis of number of lives and amount of annual income and both with and without adjustment for select and ultimate mortality. Because of the relatively low credibility of the data and the close relationship of ultimate female actual to expected mortality at most ages, we have not developed a specific mortality table for charitable gift annuities.

Select and Ultimate Mortality by Contract

As suggested by the Project Oversight Group we analyzed the pattern of select and ultimate mortality by contract. This was thought to be generally advisable, but was particularly necessary in this case in view of the rather unusual approach that we took to the measurement of exposure by lives. In this analysis we assigned a weight of one to each contract, without regard to the possibility of duplicate contracts per person. We did not estimate the standard error of the actual to expected ratios, because the variability of the number of contracts per person would cause the number of actual deaths to follow a distribution other than the binomial distribution. This distribution might not be well approximated by the Poisson distribution used for the estimate of the standard deviation of the results on the basis of lives. The standard deviations of the results by contract would be greater than those for the results based on lives.

The pattern of select and ultimate mortality as measured on the basis of exposure by contract is very strong, although not quite as strong as the results on the basis of estimated number of lives. Tables 9 through 12 present the results for females, males, females and males combined, and by duration groupings, respectively.

Table 9
Actual to Expected Mortality by Duration
Based on the Annuity 2000 Mortality Table (Basic)
Exposure Based on Number of Contracts
Female Lives

Duration	Actual	Expected	Ratio
1	120	323	37%
2	229	340	67%
3	174	304	57%
4	192	329	58%
5	208	322	65%
6	238	305	78%
7	250	318	79%
8	181	219	83%
9	117	143	82%
10	87	107	81%
11	99	99	100%
12	86	85	101%
13	80	75	106%
14	69	73	94%
15 or more	615	619	99%

Table 10
Actual to Expected Mortality by Duration
Based on the Annuity 2000 Mortality Table (Basic)
Exposure Based on Number of Contracts
Male Lives

Duration	Actual	Expected	Ratio
1	148	257	58%
2	138	238	58%
3	105	215	49%
4	132	201	66%
5	133	177	75%
6	132	164	81%
7	143	159	90%
8	92	101	91%
9	62	64	97%
10	35	46	77%
11	41	37	111%
12	28	29	96%
13	19	24	78%
14	22	20	112%
15 or more	92	69	134%

Table 11
Actual to Expected Mortality by Duration
Based on the Annuity 2000 Mortality Table (Basic)
Exposure Based on Number of Contracts
Female and Male Lives Combined

Duration	Actual	Expected	Ratio
1	268	580	46%
2	367	578	63%
3	279	519	54%
4	324	530	61%
5	341	499	68%
6	370	469	79%
7	393	477	82%
8	273	320	85%
9	179	207	86%
10	122	153	80%
11	140	136	103%
12	114	114	100%
13	99	99	100%
14	91	93	98%
15 or more	707	688	103%

Table 12
Actual to Expected Mortality by Duration Groups
Based on the Annuity 2000 Mortality Table (Basic)
Exposure Based on Number of Contracts

Duration	Actual to Expected	
	Female	Male
1	37%	58%
2-5	62%	61%
6-10	80%	87%
11 or more	100%	113%

The number of contracts per person varied greatly from the pattern that would be typical of commercial annuities. Our grouping of contracts on the basis of birth dates produced annuity counts per person reaching to more than 60 contracts for a single individual. This highly unusual result prompted us to review certain contract records in detail to see whether it was plausible that a single individual could have so many contracts. In a number of cases it was possible to make a very strong inference that the records with a common date of birth did, in fact, represent a single individual. The evidence for this conclusion included the fact that the contracts were issued by the same charity and the existence of a joint annuitant who also had a consistent birth date from one record to the next. In view of the very high weight associated with certain individual lives in the analysis by contract, we did not pursue further analyses on this basis.

Mortality of Contingent Beneficiaries

As noted above, 25 percent of the annuity contracts in the database were joint annuities. Such annuities indicated a principal annuitant and a secondary annuitant, whom we refer to here as a contingent beneficiary. We would not expect that the data for deaths of contingent beneficiaries would be maintained accurately during the life of the principal annuitant, since the death of a contingent beneficiary during this period would not affect the amount of annuity benefits payable. Therefore, we evaluated the mortality rates for contingent beneficiaries only after the death of the principal annuitant. In addition to deaths of primary beneficiaries, the database included 51 deaths of contingent beneficiaries during the study period and after the death of the primary annuitant. The ratio of actual to expected mortality on the basis of the Annuity 2000 Mortality Table (Basic) without any adjustment for select and ultimate mortality was 113 percent on the basis of the number of deaths, with a standard error of 16 percent. The actual to expected ratio based on amount of annual income was 133 percent, also without adjustment for select and ultimate mortality. The ratio of actual to expected mortality with the select and ultimate adjustment of formula (1) above was 110 percent, plus or minus 15 percent, on the basis of number of deaths and 143 percent on the basis of the amount of annual income.

The small amount of data for contingent beneficiaries does not permit analysis of mortality for subsets of these individuals.

Conclusion

Overall, mortality for beneficiaries of charitable gift annuities is lower than the rates in the Annuity 2000 Mortality Table. Most of the difference is attributable to a strong pattern of select and ultimate mortality, which can be reasonably approximated by a linear adjustment to the tabular rates at durations 1 through 14. Ultimate mortality is greater than tabular mortality. Differences in mortality among organizations of different types exist, but not all of the expected differences were observed in the data. Differences in actual to expected mortality by age are small for females, but exhibit a pattern of increasing actual to expected ratios by age for males. Such differences are difficult to quantify because of limited statistical credibility.

References

BEHAN, DONALD F. 1996. "Planned Giving with Gift Annuities," *Nonprofit World*, 14(2) 11-15.

CLONTZ, BRYAN AND DONALD F. BEHAN. 2004. "Optimizing Charitable Gift Annuity Risk Management: Collaring the Bear and the Grim Reaper," *The Journal of Gift Planning.* 8(1) 5-9, 33-41.

JOHANSEN, ROBERT J. 1995. "Review of Adequacy of 1983 Individual Annuity Mortality Table," *Transactions of the Society of Actuaries.* (47) 211-49.

JOHANSEN, ROBERT J. 1996. "Annuity 2000 Mortality Tables," *Transactions of the Society of Actuaries 1995-96 Reports.* 263-90.

NEWTON, MARK AND BRYAN CLONTZ. 1998. "An Analysis of Commercial Insurance as an Alternative Gift Financing Option," *Journal of Gift Planning.* 2(4) 5-53.

Appendix: Details of Exposure and Mortality Ratios

Table 13
Exposure for Females by Age

Age	Life	Income	Contract	Age	Life	Income	Contract
≤30	23	9,323	28	70	347	602,597	589
31	2	290	2	71	433	812,356	717
32	2	0	2	72	503	857,805	826
33	4	718	5	73	588	1,105,256	958
34	4	1,018	4	74	664	1,267,899	1,040
35	5	1,018	8	75	785	1,560,565	1,261
36	7	1,548	10	76	862	1,675,832	1,425
37	8	1,291	15	77	923	1,887,844	1,471
38	11	1,588	18	78	1,032	2,078,481	1,657
39	11	1,920	21	79	1,091	2,234,897	1,759
40	11	2,398	19	80	1,190	2,571,310	1,936
41	11	2,779	16	81	1,262	2,940,219	2,116
42	15	26,617	16	82	1,309	3,513,823	2,278
43	18	25,927	20	83	1,312	3,689,145	2,408
44	24	29,009	32	84	1,296	3,567,108	2,411
45	23	31,782	29	85	1,277	3,586,894	2,364
46	20	29,209	25	86	1,279	3,490,841	2,325
47	25	69,642	31	87	1,220	3,411,344	2,305
48	26	68,090	31	88	1,167	3,406,270	2,246
49	28	82,007	35	89	1,104	3,474,164	2,229
50	31	88,503	38	90	1,004	3,185,099	2,045
51	30	51,748	45	91	855	2,827,017	2,031
52	26	40,968	38	92	719	2,443,675	1,684
53	26	33,426	33	93	599	2,138,408	1,503
54	39	51,088	56	94	484	1,808,652	1,142
55	42	82,865	63	95	375	1,388,502	875
56	38	87,618	53	96	280	932,841	665
57	36	77,295	59	97	228	748,426	598
58	30	64,371	53	98	154	482,932	517
59	31	37,373	36	99	117	423,599	311
60	53	103,189	71	100	75	269,891	212
61	72	133,739	101	101	43	174,660	111
62	91	159,601	145	102	26	95,292	55
63	92	170,204	152	103	17	20,859	29
64	128	197,555	207	104	12	10,839	18
65	158	288,344	230	105	9	4,798	12
66	184	359,713	271	106	6	1,658	7
67	210	367,231	324	107	5	1,668	7
68	243	378,593	374	108	2	1,101	2
69	291	459,431	460	109	3	970	4
70	347	602,597	589	≥110	5	1,209	6

Table 14
Exposure for Males by Age

Age	Life Years	Income	Contract Years	Age	Life Years	Income	Contract Years
≤30	28	11,180	29	70	305	783,480	509
31	3	930	4	71	352	886,244	637
32	3	917	4	72	392	945,149	667
33	3	1,098	4	73	426	958,948	732
34	3	1,922	3	74	492	1,186,086	858
35	5	2,190	6	75	577	1,540,381	948
36	7	2,180	9	76	600	1,669,554	1,035
37	7	2,105	7	77	662	2,163,666	1,152
38	7	1,676	8	78	685	2,248,397	1,239
39	14	3,269	18	79	715	2,352,318	1,321
40	16	3,894	23	80	733	2,555,373	1,398
41	17	3,633	21	81	766	2,730,182	1,377
42	16	2,884	33	82	780	2,909,905	1,414
43	16	17,271	17	83	788	3,111,228	1,453
44	12	18,387	18	84	763	2,995,715	1,390
45	12	16,708	18	85	724	2,848,511	1,393
46	14	21,553	20	86	666	2,733,294	1,315
47	20	52,424	24	87	584	2,370,048	1,139
48	21	40,512	28	88	503	2,163,273	972
49	22	26,795	36	89	435	1,968,352	891
50	26	27,070	43	90	387	1,773,563	802
51	26	35,350	41	91	319	1,614,756	759
52	23	24,856	40	92	261	1,405,557	634
53	20	23,668	38	93	211	1,199,918	570
54	18	17,003	34	94	154	1,080,499	409
55	24	34,112	44	95	120	815,746	292
56	21	63,458	30	96	95	694,808	235
57	24	57,973	28	97	58	412,324	169
58	39	85,765	48	98	39	259,936	146
59	45	60,805	60	99	30	196,521	152
60	47	52,060	69	100	23	147,591	101
61	68	115,179	113	101	12	75,508	64
62	67	99,397	85	102	6	18,851	10
63	77	183,962	122	103	4	14,235	10
64	102	258,997	167	104	2	1,147	3
65	139	291,831	220	105	1	758	1
66	164	333,027	272	106	1	758	2
67	185	413,566	313	107	0	0	0
68	240	582,580	393	108	0	0	0
69	265	706,473	440	109	0	0	0
70	305	783,480	509	≥110	0	0	0

Table 15
Exposure by Sex and Duration

Duration	Life Years		Contract Years	
	Female	Male	Female	Male
1	3,567	2,858	5,842	4,847
2	3,245	2,381	5,638	4,331
3	2,791	1,966	4,878	3,606
4	2,912	1,802	5,028	3,203
5	2,780	1,538	4,694	2,715
6	2,391	1,270	4,181	2,338
7	2,037	1,047	4,169	2,236
8	1,399	677	2,747	1,340
9	904	415	1,661	800
10	577	268	1,229	567
11	507	216	1,072	445
12	409	150	884	325
13	324	109	739	274
14	251	78	679	220
15 or more	2,697	762	5,890	1,882
Total	26,791	15,536	49,331	29,129

Table 16
Exposure by Type of Organization

Type of Organization	Life Years	Annual Income
Secular Colleges	1,858	14,322,385
Health Research and Care	5,056	17,280,789
Religious Charities	30,110	78,636,285
Religious Colleges	5,303	12,607,496
Total	42,327	122,846,956

Table 17
Actual to Expected Mortality for Females
Based on Number of Lives
Expected Mortality Based on the Annuity 2000 Mortality Table (Basic)
With Adjustment for Select and Ultimate Mortality

Age	Actual	Expected	Ratio	Standard Error
70 and under	12.3	10.2	120%	34%
71	4.0	4.1	98%	49%
72	2.5	5.3	47%	30%
73	5.0	6.9	72%	32%
74	8.0	8.9	90%	32%
75	6.0	11.9	50%	21%
76	14.0	14.9	94%	25%
77	16.5	18.1	91%	22%
78	29.2	22.9	128%	24%
79	26.3	27.3	97%	19%
80	30.8	33.4	92%	17%
81	34.3	40.2	85%	15%
82	53.1	47.6	112%	15%
83	50.4	54.3	93%	13%
84	54.1	61.0	89%	12%
85	70.6	68.1	104%	12%
86	56.5	76.7	74%	10%
87	74.5	83.2	90%	10%
88	80.8	90.4	89%	10%
89	109.7	96.8	113%	11%
90	91.3	99.2	92%	10%
91	102.7	95.3	108%	11%
92	100.7	89.3	113%	11%
93	84.3	82.3	102%	11%
94	74.7	73.1	102%	12%
95	80.4	62.7	128%	14%
96	40.9	52.1	79%	12%
97	48.6	46.1	105%	15%
98	42.0	34.2	123%	19%
99	36.0	28.2	128%	21%
100 and over	55.1	64.3	86%	12%

Table 18
Actual to Expected Mortality for Males
Based on Number of Lives
Expected Mortality Based on the Annuity 2000 Mortality Table (Basic)
With Adjustment for Select and Ultimate Mortality

Age	Actual	Expected	Ratio	Standard Error
70 and under	14.0	18.8	74%	20%
71	8.5	5.6	152%	52%
72	3.1	6.9	45%	25%
73	5.9	8.3	71%	29%
74	6.5	10.5	62%	24%
75	8.3	13.5	62%	21%
76	10.5	15.5	68%	21%
77	11.0	18.8	59%	18%
78	11.8	21.6	55%	16%
79	21.8	24.8	88%	19%
80	19.7	28.2	70%	16%
81	29.0	32.3	90%	17%
82	29.0	36.3	80%	15%
83	37.1	40.9	91%	15%
84	47.3	43.6	108%	16%
85	47.2	46.1	103%	15%
86	49.2	46.7	106%	15%
87	42.3	44.9	94%	14%
88	33.9	42.6	80%	14%
89	31.0	40.6	76%	14%
90	40.9	39.7	103%	16%
91	44.3	36.0	123%	18%
92	32.7	32.1	102%	18%
93	41.5	28.4	146%	23%
94	23.1	22.7	102%	21%
95	16.5	19.9	83%	20%
96	24.4	17.2	142%	29%
97	17.8	11.4	156%	37%
98	8.1	8.4	96%	34%
99	6.7	7.1	94%	36%
100 and over	19.0	13.5	141%	32%

Table 19
Actual to Expected Mortality for Females
Based on Amount of Annual Income
Expected Mortality Based on the Annuity 2000 Mortality Table (Basic)
With Adjustment for Select and Ultimate Mortality

Age	Actual	Expected	Ratio
70 and under	24,420	14,906	164%
71	1,883	6,663	28%
72	1,480	7,804	19%
73	6,983	11,391	61%
74	2,479	14,782	17%
75	8,576	20,637	42%
76	12,700	25,218	50%
77	22,099	31,953	69%
78	66,989	39,346	170%
79	75,550	48,119	157%
80	87,601	62,051	141%
81	35,416	78,390	45%
82	176,108	105,800	166%
83	241,688	127,823	189%
84	161,462	141,041	114%
85	159,138	160,575	99%
86	151,011	178,070	85%
87	154,984	192,226	81%
88	170,373	217,777	78%
89	283,969	248,663	114%
90	248,262	253,719	98%
91	274,858	257,671	107%
92	270,418	253,762	107%
93	181,656	239,461	76%
94	219,430	216,547	101%
95	298,044	182,802	163%
96	119,614	135,853	88%
97	152,512	122,491	125%
98	123,592	84,184	147%
99	124,626	75,815	164%
100 and over	198,948	119,103	167%

Table 20
Actual to Expected Mortality for Males
Based on Amount of Annual Income
Expected Mortality Based on the Annuity 2000 Mortality Table (Basic)
With Adjustment for Select and Ultimate Mortality

Age	Actual	Expected	Ratio
70 and under	10,150	38,090	27%
71	8,837	12,560	70%
72	4,885	14,766	33%
73	12,612	16,680	76%
74	5,314	22,217	24%
75	49,109	31,433	156%
76	17,415	38,888	45%
77	20,848	55,291	38%
78	29,643	63,328	47%
79	31,336	73,419	43%
80	35,773	88,080	41%
81	113,107	102,591	110%
82	70,370	118,286	59%
83	164,728	140,880	117%
84	206,386	152,082	136%
85	181,988	159,587	114%
86	238,810	166,515	143%
87	172,435	160,435	107%
88	181,725	158,799	114%
89	92,338	157,490	59%
90	157,337	156,414	101%
91	172,092	155,799	110%
92	167,731	146,380	115%
93	131,397	139,495	94%
94	158,313	136,057	116%
95	77,710	108,201	72%
96	166,380	103,719	160%
97	82,545	69,523	119%
98	40,076	46,457	86%
99	23,132	34,946	66%
100 and over	99,343	52,145	191%

Table 21
Actual to Expected Mortality for Females
Based on Number of Lives
Expected Mortality Based on the Annuity 2000 Mortality Table (Basic)
Without Adjustment for Select and Ultimate Mortality

Age	Actual	Expected	Ratio
Less than 70	12.3	13.1	94%
70	4.9	3.9	127%
71	4.0	5.3	75%
72	2.5	6.9	36%
73	5.0	9.0	55%
74	8.0	11.5	70%
75	6.0	15.3	39%
76	14.0	19.0	74%
77	16.5	23.0	72%
78	29.2	29.0	101%
79	26.3	34.5	76%
80	30.8	42.4	73%
81	34.3	50.5	68%
82	53.1	58.9	90%
83	50.4	66.4	76%
84	54.1	73.7	73%
85	70.6	81.6	87%
86	56.5	91.8	62%
87	74.5	98.4	76%
88	80.8	105.7	76%
89	109.7	111.8	98%
90	91.3	113.2	81%
91	102.7	106.6	96%
92	100.7	98.5	102%
93	84.3	89.6	94%
94	74.7	78.4	95%
95	80.4	65.5	123%
96	40.9	52.4	78%
97	48.6	45.2	108%
98	42.0	32.5	129%
99	36.0	26.0	138%
100 and over	55.1	58.2	95%

Table 22
Actual to Expected Mortality for Males
Based on Number of Lives
Expected Mortality Based on the Annuity 2000 Mortality Table (Basic)
Without Adjustment for Select and Ultimate Mortality

Age	Actual	Expected	Ratio
Less than 70	9.0	19.0	47%
70	5.0	5.8	87%
71	8.5	7.4	115%
72	3.1	9.2	34%
73	5.9	11.0	54%
74	6.5	14.0	46%
75	8.3	18.2	46%
76	10.5	20.8	50%
77	11.0	25.3	43%
78	11.8	28.9	41%
79	21.8	33.2	66%
80	19.7	37.5	52%
81	29.0	43.1	67%
82	29.0	48.2	60%
83	37.1	53.4	69%
84	47.3	56.7	83%
85	47.2	58.8	80%
86	49.2	59.2	83%
87	42.3	56.6	75%
88	33.9	53.1	64%
89	31.0	50.0	62%
90	40.9	48.2	85%
91	44.3	43.0	103%
92	32.7	38.0	86%
93	41.5	33.1	125%
94	23.1	26.0	89%
95	16.5	21.7	76%
96	24.4	18.4	133%
97	17.8	12.0	148%
98	8.1	8.6	94%
99	6.7	6.9	96%
100 and over	18.0	12.6	143%

Table 23
Actual to Expected Mortality for Females
Based on Amount of Annual Income
Expected Mortality Based on the Annuity 2000 Mortality Table (Basic)
Without Adjustment for Select and Ultimate Mortality

Age	Actual	Expected	Ratio
Less than 70	24,420	22,363	109%
70	3,443	6,728	51%
71	1,883	10,024	19%
72	1,480	11,781	13%
73	6,983	17,011	41%
74	2,479	21,968	11%
75	8,576	30,511	28%
76	12,700	36,994	34%
77	22,099	47,026	47%
78	66,989	58,351	115%
79	75,550	70,650	107%
80	87,601	91,487	96%
81	35,416	117,697	30%
82	176,108	158,182	111%
83	241,688	186,671	129%
84	161,462	202,844	80%
85	159,138	229,228	69%
86	151,011	250,695	60%
87	154,984	275,234	56%
88	170,373	308,462	55%
89	283,969	351,957	81%
90	248,262	359,149	69%
91	274,858	352,622	78%
92	270,418	334,915	81%
93	181,656	319,803	57%
94	219,430	293,144	75%
95	298,044	242,282	123%
96	119,614	174,112	69%
97	152,512	148,490	103%
98	123,592	101,579	122%
99	124,626	94,474	132%
100 and over	198,948	148,316	134%

Table 24
Actual to Expected Mortality for Males
Based on Amount of Annual Income
Expected Mortality Based on the Annuity 2000 Mortality Table (Basic)
Without Adjustment for Select and Ultimate Mortality

Age	Actual	Expected	Ratio
Less than 70	6,063	42,826	14%
70	4,088	14,823	28%
71	8,837	18,674	47%
72	4,885	22,105	22%
73	12,612	24,809	51%
74	5,314	33,865	16%
75	49,109	48,487	101%
76	17,415	57,910	30%
77	20,848	82,706	25%
78	29,643	94,729	31%
79	31,336	109,211	29%
80	35,773	130,651	27%
81	113,107	153,573	74%
82	70,370	179,858	39%
83	164,728	211,022	78%
84	206,386	222,648	93%
85	181,988	231,658	79%
86	238,810	242,889	98%
87	172,435	229,795	75%
88	181,725	228,509	80%
89	92,338	226,081	41%
90	157,337	221,007	71%
91	172,092	217,768	79%
92	167,731	204,614	82%
93	131,397	188,060	70%
94	158,313	181,837	87%
95	77,710	147,034	53%
96	166,380	133,796	124%
97	82,545	84,621	98%
98	40,076	56,844	71%
99	23,132	45,862	50%
100 and over	98,586	67,419	146%