

FACTORS AFFECTING RETIREMENT MORTALITY (FARM) – PHASE II

by Victor Modugno

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ABSTRACT

This paper analyzes which of the factors that affect retirement mortality determined in Phase I of the FARM project should be added to the existing mortality studies of the Society of Actuaries. Some factors were added or modified and two were dropped from those in Phase I. The factors relevant to each study were considered but in some cases would be unavailable from data sources. Methods of reflecting these factors in mortality tables are discussed. Recommendations are made for future mortality studies and to improve individual annuities for fairer pricing and to encourage insurance of longevity risk.

OVERVIEW

In the United States, the retirement system is evolving to shift responsibility for retirement security from the government and the employer to the individual. Individuals are being asked to finance and manage a greater portion of their retirement income. The growth of defined contribution plans and increase in defined benefit lump sum payments puts large sums of money into retiree hands. A booming equity market in the 1990s led many retirees to believe they could

manage those large sums themselves, but recent market declines may lead retirees to decide that they cannot tolerate the investment risk. This combination of factors could increase the market for annuities.

The insurance industry can benefit from this retiree need, but only if it can design a broad range of products and price those products accordingly. An understanding of the factors affecting retirement mortality is critical for any design or pricing exercise. In particular, if the insurance industry wishes to market annuities to a broader range of individuals (those in less than perfect health), an understanding of factors increasing mortality is critical. The industry may want to look at the United Kingdom as an example of a marketplace where the insurance industry has responded to individual needs to expand the range of available annuity products, and increase the sophistication used in their pricing.

This work has implications beyond the annuity market. The shifting of the responsibility for retirement security to the individual extends to health care and long-term care. With smaller families, less government support and a decreasing employer-sponsored infrastructure, individual retirees will have to seek out solutions to their own health care and potential long-term care needs. But again, an understanding of factors affecting mortality, and morbidity, will be critical.

BACKGROUND

The first phase of this project was a comprehensive review of literature on factors that affect retirement mortality. Twelve factors were identified as affecting retirement mortality. Currently only two of these factors, age and gender, are used in pricing individual annuities in North America. Individuals purchasing annuities are assumed to be in excellent health by self-selection. For individuals with impairments or risk factors, such as smoking and obesity, an annuity calculated on this basis would be overpriced. If a mandatory annuitization scheme, such as that in United Kingdom, were adopted in the United States, the annuity market might not be able to provide fairly priced (i.e. consistent with expected cost) products for impaired

individuals. Even in the absence of a mandatory scheme, the individual annuity market may be at a point where companies could successfully underwrite more risk factors.

The Society of Actuaries commissioned this study with two objectives—to review existing experience studies to see what factors could be added to those studies and to determine the best method for reflecting these additional factors in mortality tables. The scope of the assignment was expanded beyond retirement mortality to cover all of the Society’s mortality studies.

METHODOLOGY

Following a review of the initial paper and related materials, a list of factors relevant to each of the mortality studies was developed. Interviews were conducted with the chairperson, data contributors and others for each of the experience committees to determine what data was currently being collected and which of the factors could be added to future data requests. Discussions, review of current practice and literature were used to determine how best to reflect the factors in mortality tables.

SOCIETY OF ACTUARIES MORTALITY STUDIES

The Society of Actuaries (SOA) conducts mortality studies through six different committees. Three committees are for group and three are for individual coverage. In Phase I of this study, the following 10 factors, in addition to age and gender, were found to affect retiree mortality: education, income, occupation, marital status, religion, health behaviors, smoking, alcohol, obesity, race and ethnicity.¹

In analyzing these 10 factors relative to SOA mortality studies, some would not be available for group studies while others would be unavailable or inappropriate for use in any study. Religion, or “the practice” of religion—regular attendance at church, synagogue, temple or mosque would

¹ Brown and McDaid, “Factors Affecting Retirement Mortality”

not generally be available. A possible exception might be members of a religious order, but it is unlikely that there would be enough data for an inter-company study. Race and ethnicity could not be used in individual underwriting in the United States. In theory, these could be used for certain pension calculations, such as normal cost. However, employers would not supply such data, even if they had it as discussed below. While the effects of race and ethnicity on mortality could be obtained from governmental data, the pension actuary would not have the information needed to use these factors in a valuation and so they were dropped from consideration.

Health behaviors would seem to include smoking, alcohol use and obesity. In Phase I of the FARM study this included other behaviors, such as sedentary lifestyles. These factors would only be available in individual studies. In Phase II, we substituted medical history (build, blood pressure, blood tests, pre-existing conditions), smoking and avocations for the four factors in Phase I.

Geographic location, which studies have shown as a factor in mortality², was added to the list for both individual and group studies.³ The following sections reflect discussions of the relevant factors with members of each of the committees. With the exception of individual life insurance, the addition of many of these factors is constrained by existing databases.

Retirement Plans Experience Committee

The Retirement Plans Experience Committee (RPEC) conducts mortality studies of uninsured pension plans. One of the committee's goals in developing the RP2000 table was to ensure that the Treasury Department would have current and thorough information available when the Secretary of the Treasury promulgates mortality tables for the Current Liability⁴ as provided for by the Retirement Protection Act of 1994⁵ for years 2000 and later⁶. In addition to the Current

² Goldman, Lynn R., "Geographic Analysis Cancer Mortality Maps, U.S., 1970-1994"

³ Lackland, D., *et al.*, "Hypertension-Related Mortality and Morbidity in the Southeast"

⁴ As described in 26USC412 and 29USC1082.

⁵ General Agreement on Tariffs and Trade, Uruguay Round PL 103-465

⁶ Retirement Plans Experience Committee, Society of Actuaries, "RP2000 Tables" p.4

Liability, the RP2000 can replace the 1983 GAM for other regulatory purposes such as PBGC⁷ premiums, maximum permissible lump sum benefits, minimum lump sum benefits, and annuity rates for converting accumulated mandatory employee contributions⁸. Another purpose was to provide the enrolled actuary with mortality assumptions for valuing pension liabilities.

The RP2000 already incorporates several factors affecting mortality in addition to age and gender. Other factors measured include healthy compared to disabled annuitants, blue collar (union and hourly employees) versus white collar, the amount of annuity and the Standard Industrial Classification (SIC) of the employer. Separate tables were produced for male, female, employees, healthy annuitants and disabled retirees. For the remaining factors, multiplicative adjustments were developed. Researchers were hired to determine the correlations⁹. They concluded that there was no practical way to combine collar and amount. Either one (but not both) could be used to adjust mortality and the SIC code was not a consistent indicator of mortality, when amount and collar are taken into account.

RPEC is in the process of requesting data for an annual study to validate the RP2000. An excerpt from that data request, which is also designed for a turnover study, is included in Appendix A. The mortality factors requested are the same as those used in the RP2000. The sources of data, which are large employers' human resource databases, contain a wealth of factors that affect mortality. These employers (and their consultants) have elected not to provide data for mortality studies, partly due to significant privacy concerns. The RP2000, which was needed for a new table for the Current Liability, had 100 large, private sector employers participating. For the follow up study, only 40 are participating. The only data available is that which is provided for actuarial valuations. The only additional factor that could be added would be marital status of retirees, where those who had joint and survivor annuity forms would be assumed to be married, since married participants must get spousal waiver to elect out of this form. While this is not a perfect measure, it is a reasonable proxy. Regarding geographic

⁷ Pension Benefit Guaranty Corporation, A U.S. government agency that insures private pension plans.

⁸ Modugno, "30-Year Treasury Rates And Defined Benefit Pension Plans" pp. 15-17

⁹ Vinsonhaler, *et al.*, "Multivariate Analysis of Pension Plan Mortality Data",

location, the location of headquarters would be available; however, these employers frequently have several locations, and that would not be a valid proxy for the participants' locations.

Other factors affecting mortality could be obtained from government data. The U.S. Office of Personnel Management (OPM) has data covering 2.6 million active and 2 million retired Federal Civil Service and postal workers. Additional personnel data could be provided for employees who retired after 1972. A list of data elements can be found on the OPM Web site¹⁰. A study of some of the factors affecting mortality for retirees in this system has been published.¹¹ This data is not representative of some groups, such as industrial workers. Social Security would be a broader source but is unable to provide data for Society of Actuaries studies. Another broad source of data is the National Center for Health Statistics (NCHS)¹² and its *National Vital Statistics Reports*, which has deaths from various causes for different population groups such as marital status and education.¹³

Group Annuity Experience Committee

The main goals of the Group Annuity Experience Committee (GAEC) are to develop and validate mortality bases for statutory reserves for group annuity contracts and to provide data for pricing these annuities. The data consists primarily of “closeouts”—a group of annuities purchased usually at pension plan termination, although sometimes an ongoing plan purchases annuities as a settlement¹⁴. The remaining annuities arise from retirees under participating (DA/IPG) contracts,¹⁵ and other qualified annuities purchased from distributions from retirement plans. GAEC uses participating companies group annuity data for retirees only. Deaths on non-retired lives are not accurately reported, and so other sources of data are used for younger ages.¹⁶

¹⁰ <http://www.opm.gov/feddata/gp23.pdf>

¹¹ Virga, M. “Mortality for Retired Federal Employees and their Survivors”

¹² Centers for Disease Control, National Center for Health Statistics

¹³ Johansen, R. “Mortality by Marital Status”

¹⁴ Modugno, “Terminal Funding” TSA 1986, p. 169

¹⁵ DA stands for Deposit Administration, IPG for Immediate Participation Guarantee

¹⁶ Society of Actuaries Group Annuity Valuation Table Task Force, “1994 Group Annuity Mortality Table and 1994 Group Annuity Reserving Table”, p 871, *ff*.

New sales of group annuities have been much lower in recent years, and for many companies this is a closed block of business. Most companies do not want to devote additional resources to this business. Thus mortality studies are constrained by the existing databases—it would not be very useful to add new factors for future sales, even if this were possible.

Some companies have additional factors in their existing databases and each company seems to emphasize different factors. The following factors could be added by most, if not all, of the participating companies:

1. Marital Status—can be assumed based upon annuity form, i.e., those with survivor annuities are assumed to be married (see discussion of this under RPEC above).
2. Geographic Location—Zip codes would be available for participants for whom payments are being made (including EFT, since address would be needed for tax forms). For certain bulk check cases, individual address information may not be available, but employer address could be used.
3. Collar/Industry—Some companies could determine this by looking at the plan level data, and so these could be determined for the 20 largest cases.

As was the case with RPEC, additional factors that affect mortality will have to be obtained from governmental data sources, such as the OPM and NCHS.

Group Life Insurance Experience Committee

The Group Life Insurance Experience Committee (GLIEC) performs studies of group life insurance mortality for valuation, pricing, underwriting and tax purposes. Employers are unwilling to deliver data beyond those used in rating, eligibility determination or claims adjudication. Thus no additional factors beyond what is contained in the current data request can be added, which include age, gender and SIC code.¹⁷

¹⁷ Group Life Experience Study – Data Requirements

As was the case with the previous two committees, future mortality studies are constrained to existing databases, and any additional factors that affect mortality will have to be obtained from governmental data sources or from individual life insurance sources, as appropriately modified.

Individual Life Insurance Experience Committee

The Individual Life Insurance Experience Committee (ILIEC) performs studies of individual life insurance mortality for reserves, pricing, and underwriting.¹⁸ The data is also used to produce tables used for statutory reserves and pricing of these policies.¹⁹ This committee and related groups, such as the Task Force on Preferred Underwriting²⁰, have the most comprehensive data on mortality factors, including all of the factors under consideration here. The data requests for Factors In Risk Selection Techniques “at issue” is 39 pages²¹, and “post issue” is 28 pages²². A draft of the LIMRA/SOA experience study record format is in Appendix B. The following fields have been added to this 17-page record: marital status and build and blood pressure.

Newly underwritten issues are concentrated at the younger ages, and data at retirement ages (60 and older) is sparse. While these studies will contain a wealth of data on factors that affect mortality, they will be of limited use for retirement mortality. Data for the older ages is obtained from proprietary life insurance mortality studies from Bragg Associates. This data contains breakdown by smoking/non-smoking, preferred and duration. The old age data here is primarily from long duration contracts where the effect of the initial underwriting would be less significant.

Structured Settlement Valuation Committee

¹⁸ Individual Life Insurance Experience Committee, “Mortality Under Standard Individually Underwritten Life Insurance Between 1991-92, 1993-94, and 1994-95 Anniversaries

¹⁹ Society of Actuaries, “Final Report of the Individual Life Insurance Valuation Mortality Task Force 2001 Valuation Basic Mortality Table (2001 VBT)”

²⁰ Task Force on Preferred Underwriting, “Factors in Risk Selection Techniques”

²¹ Society of Actuaries, “Factors In Risk Selection Techniques – at Issue Format”

²² Society of Actuaries, “Factors In Risk Selection Techniques – Post Issue Format”

The Structured Settlement Valuation Committee (SSVC) performs mortality studies of structured settlement annuities, which are typically sold to settle lawsuits. The last structured settlement data request is attached in Appendix C. Data contributors that were interviewed indicated they could supply age, gender, reserve amount, form of annuity, standard or substandard (with age rating) and zip code. Zip codes may not be an accurate measure of the annuitant's location, since payments are frequently made to assignees. These data contributors were not recording impairment codes in the databases used to produce data for this study. Some companies were able to submit impairment codes with their structured settlement data, but there was not enough data with impairment codes to do meaningful analysis.

Studies of aggregate data on substandard mortality to date show conservatism and allow continuation of current practice of unlimited age rating based upon medical opinion²³. The actual pattern of mortality for specific impairments is likely to differ from the results from age ratings (which is used for pricing) or constant extra deaths (which is used for statutory reserves). However, adding impairment codes to databases would require additional resources which companies are currently unwilling to provide.

Individual Annuity Experience Committee

The Individual Annuity Experience Committee (IAEC) performs studies of individual annuity experience. Historically these studies were limited to annuities in pay status—individual immediate annuities, life income settlements and matured deferred annuities. The last study completed covered the period 1976 to 1986. Only eight companies participated and no company provided data for all 10 years²⁴. The prior study, which covered the period 1967 to 1971, had 21 companies participating²⁵. By the mid-1990s, mortality improvement noted in population and group annuity data had created concerns that the 1983 IAM had become inadequate as a reserve

²³ Structured Settlement Valuation Task Force, “Mortality Under Structured Settlement Annuities for 1990-93”

²⁴ Individual Annuity Experience Committee, “Mortality Under Individual Immediate Annuities, Life Income Settlements, and Matured Deferred Annuities between 1976 and 1986 Anniversaries”

²⁵ Individual Annuity Experience Committee, Society of Actuaries “Mortality Under Individual Immediate Annuities between 1967 and 1971 Contract Anniversaries

basis²⁶. An updated reserve basis, the annuity 2000 table, was created by projecting the 1983 IAM using scale G for males and 50 percent of Scale G for females based upon mortality improvement in population data²⁷. The last valid inter- company study goes back to the 1970s and current reserves are based upon projections of assumed mortality improvement. Life insurance data from Bragg Associates suggests that the a2000 basis may already be inadequate for reserves²⁸.

Due to the decline in participation by insurance companies in these studies, this committee is not currently active and it was difficult finding former members and data contributors to interview. Most companies do not view individual immediate annuities as a separate line of business, making it more difficult to find individuals to interview. Those data contributors that were interviewed indicated they had rudimentary information on their valuation files—gender, age, form of annuity, amount of annuity, issue year and address. For nonqualified annuities, there is no requirement for married participants to purchase a joint and survivor annuity, so the annuity form is not as usable as a proxy for marital status.

Guideline IX-C²⁹ allows for substandard individual immediate annuity reserves on the same basis as that used for structured settlements. In the future, there will be the need to track substandard mortality similar to that used for structured settlements. To the extent other factors (smoking, etc.) are used in underwriting, they will also need to be tracked.

One possible result of the FARM project could be the data necessary to establish an annuity market that allows individuals to insure longevity risk at a fair price, unlike the current practice where only age and gender are used and everyone is assumed to be a self-selected healthy risk. The United Kingdom does have an active annuity market that provides annuities at a fair price for those individuals who are not a healthy risk. In the United States, Guideline IX-C requires a

²⁶ Johansen, R.J., “Review of the Adequacy of the 1983 Individual Annuity Mortality Table”

²⁷ Johansen, R.J. “Annuity 2000 Mortality Tables”

²⁸ This information is based upon discussions with Jack Bragg

²⁹ NAIC “Accounting Practices and Procedures Manual as of March 2003”, Vol. 1, pp. C30, *ff.*

medical opinion and at least 25 percent excess mortality for substandard reserves³⁰. This needs to be expanded to allow a weaker reserve basis to reflect factors like smoking, low socioeconomic status and health conditions like obesity and hypertension that don't meet the requirements of 25 percent excess mortality and medical opinion. The initial effect of these factors will have to be developed from other data, such as the OPM and NCHS. Bragg Associates data used for life insurance studies could be used for the smoker data and for socioeconomic status. Data from inter-company long-term care study could be used for disabled life mortality.³¹ This is discussed in the Conclusions section.

METHODS FOR REFLECTING VARIATION FROM MULTIPLE FACTORS

There are two basic ways to reflect multiple factors in mortality tables—either multi-dimensional variables (*i.e.*, a separate table for each variable) or adjustment factors. Adjustment factors can be multiplicative or additive to mortality rates or be put into effect through age ratings. Today almost all applications have separate tables by gender. In the past, an age setback was used for female rates. For example for group annuities, a six-year age setback from male rates was used for females. This was reasonably accurate at important ages, but overstated the difference at older ages. Separate tables became more cost effective as computer storage and computational costs decreased and women became a more important element the workforce.

To use the RP2000 as an example, there are separate tables by age, gender, healthy annuitants, disabled annuitants, combined healthy and employees. Adjustments for collar and amount are shown as multiplicative increases to mortality, with factors varying by sex and over age ranges. Currently there are 120 ages by two genders by four categories, which equals 960 entries. To add three collar types (blue, white, and mixed) and three amount classes (small, medium and large) would increase the number of entries to 8,640. While it may be possible to deal with arrays of this size, it is more practical to use simple adjustments for some of the factors. Factors

³⁰ *Ibid*, p. C30

³¹ Society of Actuaries, “1984-99 Long-Term Care Experience Committee's Inter-company Study”, p.26 ff. Mortality for active lives may be understated since some deaths were recorded as other terminations.

that are less important and that are fairly constant at important ages lend themselves to simple adjustments.

Substandard structured settlement annuities provide another example of the use of adjustments. A medical opinion that an individual with a specific injury has a life expectancy of a number of years is obtained. This is then converted into an age set forward that is used for pricing and GAAP reserves. This life expectancy is also converted into a constant number of extra deaths that is used to adjust the mortality assumptions for statutory reserves under Guideline IX-A³². It is unlikely that the mortality of individuals with this injury will follow either rated age or constant extra deaths and studies based upon comparisons of actual to expected deaths on these bases over short periods of time may be misleading.

Once enough data has been accumulated for one of the new factors in the SOA's experience studies, statistical studies, like those completed for the RP2000 on amount, collar, and SIC codes³³ need to be completed to determine if the factor has a significant effect on mortality and the correlations between that factor and other factors. For the RP2000, a linear logistic regression model was used and tested with several statistical measures. Multiplicative factors were developed to adjust for collar and amount, but both could not be used since these factors were not independent. Under this modeling, SIC code was not a consistent predictor of mortality. Both collar and amount of annuity are indicators of socioeconomic status and thus only one of them is needed. Both are imperfect measures—amount of annuity may not be representative of an individual's wealth in companies with high turnover and “blue collar” includes groups like airline pilots that are by any measure in a high socioeconomic group. The enrolled actuary needs to use judgment in choosing which, if any, of these measures should be considered in adjusting the mortality assumptions in determining the normal cost. Airline pilots should not be considered “blue collar”, and plans with small annuities should not be considered “low amount” if, for instance, this is due to the plan being relatively new, without a past service component.

³² NAIC, *Op. Cit.*, pp. C31-C32

³³ Vinsonhaler, *et al.*, *Op. Cit.*

The RP2000 illustrates one way to handle highly correlated factors—choose one. In other situations, especially where the correlation is significantly less than 100 percent, some type of joint adjustment could be developed. For example, if amount and marital status were correlated, a different adjustment would be used for “single, low amount” and “married, low amount”. This assumes a manageable number of these correlated factors. If a point system is being used as part of the underwriting process for multiple factors to determine rating, points could be subtracted to account for correlated joint factors.

The statistical techniques to be used to fit and test the additional factors can only be determined after the data has been collected. Whatever complex or esoteric statistical techniques and tests are used to analyze data, the final results should be expressed as a simple multiplicative or additive adjustment to mortality or an age adjustment. If a factor is important and varies by age, a separate table can be used for that factor. Factors that vary only by sex are better handled by having separate adjustments by sex. Multiple correlated factors could be handled by choosing one or by using joint adjustment factors.

CONCLUSIONS AND RECOMMENDATIONS

Current SOA Experience Studies

For RPEC and GAEC, marital status (based upon annuity form) can be added. GAEC could also try adding geographic location, SIC and collar for large groups. No additional factors can be added to Group Life studies and Individual Life now has all the factors. A study of mortality by impairment for structured settlements would be valuable if the data were available and a basic study by age and gender for individual annuities is needed to validate the a2000 reserve basis. Geographic location could be added to this study. Any new factors that are statistically significant can be reflected in mortality tables either through adjustment factors or a separate table.

Improving the SOA Experience Studies

Lack of participation in SOA mortality studies by insurance companies is troubling for the profession. The profession has historically taken responsibility for developing appropriate actuarial tools and standards. Those tools include mortality tables that reflect recent experience and those factors best able to predict differences in mortality rates. Insurance regulators have relied on the profession as the best source of tables for statutory reserves. As discussed in this paper, there are numerous factors that could improve our determination of mortality risk, were the data collected and made available for analysis. The author is concerned that voluntary cooperation in mortality table studies has declined to the point where current tables may not best reflect current mortality experience, or provide ways to discriminate mortality sufficiently to ensure the health and growth of the annuity market.

The author has outlined two examples which highlight where additional data might lead to a growth in the insurance market, thus benefiting all companies participating in the study: a fair valued individual annuity market and longevity insurance. Existing regulations, both tax law and

required reserves, do not support the development of these products, but it is beyond the scope of this paper to discuss those issues.

Conditions for a Fair Valued Individual Annuity Market in the United States

Publication of SOA experience studies with additional factors will not necessarily lead to a market where individuals in less than perfect health can purchase a fair valued annuity. Current individual annuity data is limited to age and gender. Unless companies start underwriting these annuities for factors such as smoking and obesity, experience studies will never cover them. What is needed is an SOA study of some of these factors similar to how smoker/non-smoker tables were developed for life insurance. Data for these studies can be obtained from life insurance, medical studies, Long-Term Care studies, or NCHS. The United Kingdom has significant experience in collecting these other factors, and could be used as source of information for future work.

Once an empirical basis is developed for these factors, appropriate modification of the reserves should be allowed. Depending on underwriting, adjustments of up to 25 percent of excess mortality could be allowed. Excess mortality of more than 25 percent would be covered by Guideline IX-C, which requires medical opinion. Allowing companies to reduce statutory reserves for annuities for individuals with specific factors should result in pricing differences.

Longevity Insurance

Another solution would be to design a policy to cover the risk of living beyond life expectancy. An individual retiring at 65 would purchase an annuity commencing at 85, with no values prior to that date. The remaining funds are managed to provide living expenses for 20 years and whatever estate is desired. Due to the deferral period, anti-selection should be minimal. Joint and survivor forms of annuity could be used for married participants. Other features might include cost of living increases and early commencement for nursing home. This product could

be of great benefit to retirees, but would require more detailed knowledge of factors leading to increased longevity to be properly designed and underwritten.

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