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Pension Plan Mortality

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Summary: General Agreement for Tariffs and Trade legislation requires the use of a specified mortality table for the calculation of current liabilities. It further provides that a new table could be selected for plan years beginning in 2000 and provides that the Treasury secretary takes into account results of current independent mortality studies.

The SOA Retirement Plans Experience Committee responded to the possibility of a new table selection and the need for a current mortality study based only on uninsured pension plan experience. The session presents an overview of the committee's work. The status of the current draft report is discussed.

Mr. Edwin C. Hustead: The RP 2000 Exposure Draft is now on the Society Web site. You will get a hard copy but if you are anxious to see it, you can go to the site and look under "Research." You'll see the full report there that we're going to describe.

I'm going to talk a little bit about the background and history, and then walk you through how we produced this table and got to where we did. Ethan is going to give more of an oversight on the issues surrounding the initiation of the study and what may occur now. I suggest we hold questions on issues related to the table until Ethan is finished. If there are any technical questions or if there is something that you don't understand, feel free to ask at that point for clarification. Part of this is going to be a basic construction of the Mortality Table 101 course so you can see how we constructed the table. And if any of you are interested in doing such a thing in the future, you can see the process involved.

As far as the background and history of the study, the Retirement Plans Experience Committee (RPEC), which I co-chair, has been a standing committee for many

years. It began studying mortality in the 1950s and issued periodic reports every five years on mortality, particularly focusing on uninsured pensioners (UPs). There is another committee of the SOA, the Group Annuity Mortality Committee (GAMC), which deals with insured pensioners. Our particular focus has been UPs in group pension plans.

We had done an extensive amount of work leading up to the group annuity reserving (GAR) 94 table and the UP 94 table. After about 7 or 8 years of producing those tables, the 2 committees said, "This is it for 15–20 years, so we can relax." Then along came General Agreement for Tariffs and Trade (GATT). For those of you who aren't familiar with everyday pension work, you might wonder what GATT has to do with actuarial work. In the GATT legislation passed toward the end of 1994, there is a requirement that actuaries use a standard table for certain current liabilities purposes.

That led to a concern that perhaps we didn't have the best information to establish a mortality table for GATT purposes, which in turn led to the request by the SOA to the RPEC to investigate mortality and perhaps produce a new mortality table.

Briefly, this is the history of group annuity mortality (GAM) UP tables. The history of life insurance tables in the U.S. goes back to the American experience table. As different purposes arose during the century, different tables were constructed, and it had long been assumed (or feared) that pensioner mortality probably differed from life insurance mortality. If you think about it, the selection process involved would suggest that there might be a difference in mortality. That led to the first pensioner mortality table, the GAM table of 1951.

That was followed by the GAM table of 1971. Around the early 1970s, again concern was expressed that perhaps the GAM tables did not accurately reflect the UP mortality. The mortality data that had been gathered by the RPEC at that time was turned into the UP 84 table, and the GAM became GAM 83. GAM 83 is the table that is used for current liability purposes because the GATT legislation stipulates using the table that is used in most states for annuity regulatory purposes, and that's the GAM 83.

Then we have the GAR 94 and the UP 94, and now the RP 2000. Other than UP 84, the insurance company tables and the RP 2000 table carry the tradition that the date on the table is the year of publication. That's the year that the actuarial committee believes is the base year for the projection for the mortality. We're saying this represents our best estimate of what mortality is in the year 2000. The UP 84 table actually should have been called the UP 77 table, though. Bill Fellers and Paul Jackson produced that table. I once asked Jackson why he thwarted tradition and he said one of his favorite books was *1984* by George Orwell, and that led him to use 1984 as the date.

The other important thing about UP 84 is that it is an older table than GAM 83. The projection to 1984 proved to be far from adequate, so the rates on UP 84 generally are higher than those on the GAM 83. The other thing is, if you're familiar

with the Norris decision, which I believe was in 1982, it's important to recognize that the UP 84 table preceded the Norris decision—it did not succeed it. One of the goals of Fellers and Jackson in developing UP 84 was to show that you could have a unisex mortality table. The concern of the profession at the time was that the decisions that eventually led to Norris might require us to use unisex tables for all purposes including valuations. As you know, Norris did not do that. It just requires that benefits be calculated on a unisex table, but there was a concern that you might have to do that, so they developed a UP 84 table to show that there could be a unisex table. And UP, in their definition, meant either unisex pensioner or uninsured pensioner. We were able to use the UP again in 1994 to mean exclusively uninsured pensioner.

The GATT says that through 1999, you use the GAM 83 table for healthy lives. It suggests you can use one of two tables, depending on the disability status, whether these individuals are covered by Social Security or otherwise. Those tables are now in place and if you're working on pension plans subject to the current liability regulations, we hope you're using those tables. The legislation also says that the Secretary of the Treasury may promulgate new tables in 2000. The word "may" is key. He doesn't have to and, as we began this study, we went through several iterations about exactly what we were doing and whom we were doing it for.

There was some question at the beginning about whether we could perhaps get the Secretary of the Treasury to ask the SOA to produce a set of tables, but he didn't pay much attention to that, so we didn't do that. Then the question was, will these tables be used for the expressed purpose of providing the Secretary of the Treasury with input for the 2000 decision? Because of the different purposes of the AAA and SOA, this is not the table that the SOA is proposing to the Secretary of the Treasury to be used in 2000. This is a table that's developing the most current information. It is now the job of the AAA as the representative, if you will, to the regulatory bodies to decide whether to take this RP 2000 table or some variation to the Secretary of the Treasury and make a recommendation. The RP 2000 is not an official recommendation, but presumably the secretary will pay some attention to it in setting new regulations in 2000.

You can see the time line of our study and how we got from GATT in 1994 to something in 2000 on the Web site. There's a chance that the comments we get may change the outcome, but, assuming we can deal with those comments, there will be an RP 2000 table in 2000.

We had the GATT legislation in 1994. In 1995, we organized the RPEC and put out a call letter asking for data. In 1996, we collected and analyzed the data. We found there was not a lot of difference between the RP 2000 and the UP 94 projected to 2000. We could have stopped in 1996 and said we were confirming that the UP 94 projected to 2000 was a reasonable table. But the committee members said they would rather produce a mortality table.

Lindsay Malkiewich, who headed the GAR effort, and I worked on the UP 94 effort. We said, "That's a lot of work and it's going to take a lot of time to do it," but they

wanted it, so we proceeded to do so. We spent 1997 constructing the tables. In 1998, we completed our analysis and began our draft report, finished it in 1999, and submitted it to the Board of Governors. It is now out as an exposure draft.

I'm going to move to the detailed discussion of how you gather the data and produce a mortality table. The segments I'll talk about are:

- How we collected and analyzed the data.
- How we selected a final data set. When you get the data in there are always problems, so you have to parse the data or change them to get a final data set that then becomes your mortality study.
- How we established the base-year tables. An important process we go through is to first set up a mortality table that reflects the base year of the mortality data. These data were collected from 1990 to 1994. The base year then is 1992, so first we took the data and constructed a table representing that year.
- How we projected the 1992 table to the publication year 2000. I'll show you about the base year as well as the projection period.
- How we dealt with the differences by subgroup, which became a major issue in these tables.

One, data collection and analysis. We sent a call letter in September 1995 asking for the data to be submitted before June 1, 1996. We extended the deadline a few times, as usual. By June 1, 1996, we were pretty sure there was no outstanding large body of data coming in, so we cut the data. The data was sent to the SOA staff. There's something unusual about this study that hasn't been dealt with before and that is a concern by some of the submitters about the confidentiality of the data. Some of the submitters did not want the committee to look at the data, and that has to do with the things that led into GATT, which I think Ethan will talk about.

We took the extraordinary step of sending the data only to the SOA staff and having the analysis conducted by a contractor, Kathy Elder, an actuary with Frostburg State University. Then we reviewed, analyzed, and validated the data. The call letter asked for data in a particular format. The preferred set was 1990–94, and we asked for age, sex, participant status (active, retired, disabled, or survivor). For all of those individuals we asked for data for exposed and for those who had died, both on the number and amount paid for employees and annuity for retirees. The amounts were split according to the PBGC categories.

We also asked for information such as the company's Standard Industrial Classification code and the number of workers who were salaried and hourly, union and nonunion. We took the data and split it into blue-collar and white–collar categories. If the data was more than 70% hourly or union, we called the employees blue-collar. If they were more than 70% salary or nonunion, we called the employees white-collar. If they weren't any of those, Kathy Elder called the actuary and asked whether they should be in the blue-collar or white-collar category? If that didn't work, we called them "mixed collar." Blue-collar and white-collar, as you probably recognize, are archaic terms. I am wearing a gray collar so

I'm halfway between, I guess. But we tried to find a term that was more up-to-date to indicate what this data was; unfortunately, we were unsuccessful. If anybody has a bright idea about what to call these employees other than blue- and white-collar, we would certainly entertain it, but blue-collar employees basically are hourly, union, or both.

The membership of the RPEC did this work. We had about 12–13 practitioners in the field, mortality experts, and SOA staff support throughout this effort. We particularly appreciate and will mention several times the fine work of Tom Edwalds in not only gathering the data and analyzing it, but in helping us through some very sticky processes. We definitely could not have done anything without Tom. We also had open meetings. The SOA and the Academy found that in work of this type, it's much better to invite everybody who's interested to attend. Even if very few people do attend, you can say you had open meetings. We published all the minutes in the *Pension News,* and usually at the meetings we had representatives from the PBGC, the Treasury, sometimes the IRS, and other committees.

Two, the final data set. We took all this data and prepared the final data set. We validated the data by looking at relative mortality, outlier mortalities, and outlier ages. We would go back to the actuaries through Kathy Elder and make sure that the data was correct. We looked at year-to-year changes. There was particular concern about the treatment of the auto data, and again this goes back to the issues that led into GATT.

Given 20-20 hindsight, we would not have accepted the report restrictions the auto manufacturers put on us. They said we could not look at who they were, and the data they presented to the Society was all mushed together so we couldn't track anything. That led to an inability to really understand that data. In the end, the committee believes that the data is valid. We did, however, find as we did the process that there was one other company that submitted bad data, which had to be resubmitted.

The auto companies put restrictions on the study that you should recognize when you look at the results. We wound up with the data, but we excluded questionable data. There were very few sets of data that were questionable. We also said that this is for current liability purposes. Therefore, we excluded multiemployer plans and government plans. We wound up with a table with a set of 113 plans, total exposures of almost 11 million, and deaths of 190,800 (Table 1). Some people would like to say that this is the largest set of data we have ever had. It's only the largest if you look at the total. It's not the largest if you look at annuitants, which is the important group. The key thing is that there was plenty of data. Whether it's largest or not, we had very sufficient data to construct, build, and present a mortality table.

Three, base-year tables. As far as the construction of the base-year rates, the process we went through was to select the base-year tables, graduate the tables, and set up the raw mortality set data. We had to go through a process that normally you don't have to, and that is to do amount-adjusted Qs, which I'll

explain. Then we blended the healthy annuitant table and extended the table to extreme ages. For the selection of the tables, we observed (as has been observed many times before) a significant difference between employee and annuitant data. When people retire, the mortality becomes a lot higher. There is clearly a difference between healthy and disabled retirees and between males and females that can and should be reflected. It has been noted, and we can't really correct this because of the way we collected the data, that the data on disableds is not just disabled individuals who have Social Security benefits, so it's not exactly what is needed for the Secretary of the Treasury's purpose.

TABLE 1
FINAL DATA SET - 113 PLANS

Category	Exposed	Deaths
Employees	5,730,000	9,800
Healthy Retirees	4,120,000	135,100
Beneficiaries	730,000	26,700
Disabled	370,000	19,200
Total	10,950,000	190,800

We took the various data and, depending on how much data were graduated, used different forms of the Whittaker-Henderson Type B formula. When you deal with Whittaker-Henderson, there are two variables to consider: one is whether you use second, third, or fourth differences, and the other is the *h* value. For the healthy annuitants, where we had a whole lot of data and could use very light graduation, the table almost graduated itself into third differences with *h* equal to 1 million. In cases where we didn't have that much data, we used second differences with *h* equal to 100 million.

I mentioned that we had to amount-adjust the mortality, so let me explain what that is and why we had to do it. If you go back to your memory of the construction of mortality tables that you learned in the SOA test, you may remember that amount was always the basis. When you study life insurance mortality, you look at the amount of the life insurance policy, not at the number of people. The reason is very simple. If you have somebody who dies with a $100,000 policy, that's a much greater liability than somebody who has a $10,000 policy. Similarly, throughout the pension studies, we used amount with a number. We do need to do an amount-based mortality and, because only half of this data was produced on the amount basis (i.e., the data that had the amount with it), that meant in order not to exclude half of the data, we had to adjust the data that did not have an amount to amount-based.

Let me just walk you through why you have to amount-adjust. Let's say your total study is 1 life with a $1,000 annuity that has 110% mortality and an annuity rate of 10. Then you have another life that has a $10,000 annuity at 90% mortality with an annuity rate of 11. Your life-adjusted annuity by not looking at amount is 10.5%, but your amount-adjusted annuity factor, taking 90% of the 11, is 10.9%. The true liability for this group is $120,000, arrived at by taking $1,000 times the factor of 10 plus $10,000 times the factor of 11. If you just used a life-

adjusted liability, you would say the liability was $11,000 times 10.5%, or $115,000. The amount-adjusted annuity basis gives you a liability of $119,900, which only differs from the true $120,000 liability because of rounding.

Because this study and all other pension studies show that mortality by amount is lower for higher amounts of annuity, and because that leads to higher annuity factors, you have to have amount-adjusted tables. The amount-adjustment process we used was fairly straightforward. We calculated (1) the amount-adjusted q_x for those reporting the amount, (2) the life-based q_x for those reporting the amount, and (3) the life-based q_x for all data multiplied by the proportion of (1) to (2). The difference between amount-based and life-based for the entire group is the same as the difference between amount-based and life-based for the subgroup that we know.

We split off the employees and the annuitants and combined the annuitants and the survivors to make up the healthy retirees. The reason we didn't go as far as to say we should use separate survivor tables is, first, there was not enough data to produce a separate male survivor table, and, second, there was enough data for a separate female table, but we thought we had already made things complicated enough and decided to do one table recognizing all healthy annuitants.

Once we put the data together and graduated it, again as usually happens in mortality tables, you find that there's a certain point at which you don't have enough data. Those points were employees below age 30, employees above age 70, disableds below age 45, and annuitants above age 100. In this case, we completed the tables by adding the data we needed. We tried to produce a set of rates down to age one, even though we know annuitants and employees don't go down that far. For employees below age 30, we blended in data from the UP 94 table, which had extended rates down to that level. We said we don't really need an employee who is over age 70, so we stopped at that point. For disabled individuals below age 45 we did have data, but there was no pattern to it. The rates would vary up and down by year, so we set all the rates below age 45 equal to the age 45 rate.

For annuitants above 100, we didn't have any experience and neither did anyone else. There was an observation in the UP 94 and the GAR 94 that the old practice of going up to a final value of 1 is not really representative of mortality. If you study mortality in any of these older ages, it's asymmetric or comes close to 0.4 or 0.5. It never goes up to one. Setting the table at one and, particularly, graduating sharply up to one was misleading. Nevertheless, there are those who do want to have a final q_x equal to one so we put one in there at q_{120}.

Mr. Ethan E. Kra: Is that because of the Mosaic age? Moses lived to age 120.

Mr. Hustead: Moses lived to 120, but not Methuselah. You'll notice, too, as we look at the subgroup data later, and as you look at these tables, you presumably won't be surprised that, as you move to the later ages, if you look at annuitants, employees, disabled, nondisabled, and other subgroups, the mortality differences

tend to disappear. These tables tend all to come together anyway as we reach the 90-something age groups.

The result was to produce the 1992 base-year rates by sets for employees, healthy annuitants, and disabled annuitants. Now we're in 1992. We have to take two steps. One is to go to 2000 and the other is to go to an annuitant factor increase after 2000.

Four, year 2000 tables. To go from 1992 to 2000, we examined recent trends in mortality (Table 2). If you look at the right-hand column, you'll see the rates used to project the GAM 94 from its base year. Short-term annual trends were almost 2% for males and around 1% for females. When we observed the study data, with Social Security data and the Civil Service Retirement System (CSRS), you see that the female mortality improvement in recent years has been zero or sometimes negative, and the male mortality improvement, except from about age 65 to 80, has also been negative or close to zero.

TABLE 2
OBSERVED ANNUAL MORTALITY IMPROVEMENTS

Age/Sex	Study	Soc Sec	CSRS	GAM 94
40-44/M	-1.8%	-2.9%		1.9%
65-69/M	1.5	1.0	.9%	1.2
80-84/M	.3	.5	1.4	1.8
40-44/F	-1.6	-1.4		1.3
65-69/F	.4	-.1	.4	.7
80-84/F	-.2	-.3	.6	1.0

Our conclusion from that as far as projecting 1992-2000 was no projected improvement for females or males under age 46 or over age 89, 1% improvement per year for males ages 55–80, and mortality improvements phased in from ages 46 to 54 and from ages 81 to 90.

Having done that, we came up with the RP 2000 basic tables for employees, healthy annuitants, and disabled annuitants. And, for those who would miss the combined healthy table, which consists of healthy annuitants combined with employees as the UP 84 and UP 94 tables show, we did produce a combined healthy table. We do not recommend that you use that as long as you can use separate tables, but it's there for comparison purposes.

Let's review relative mortality. We tried to look at any observable differences in mortality from the data so actuaries can say, "Do I have a group like this? If so, perhaps I should make an adjustment." We looked at differences by collar, amount, industry, and plan. And we thought we might not have taken it far enough, so we had the University of Connecticut also perform an analysis.

For collar and amount data, there are clear differences, and the differences continue at least into the 80–90 age groups. Blue-collar males have a relative mortality of 1.37 versus 0.87 for white-collar males (Table 3). Blue-collar people have a much higher mortality rate throughout, but that rate diminishes as you get into the older

ages. The difference diminishes for males ages 75–79, but it's still there. We also observed that the differences for females are substantially lower than for males. Probably this difference by gender is the result of the fact that annuitants at this point worked most of their lives in the 1950s and 1960s when the male's job would influence mortality a lot more than the female's job.

When you look at relative mortality by amount (Table 4), there's even a greater difference between mortality for those with a small amount of benefits versus those with large amount than for the collar data. Males ages 60–64 with small annuities have almost double the mortality as those with large annuities, the difference again continuing but diminishing for males ages 75–79 and older. For females, the difference was also there, but smaller.

TABLE 3
RELATIVE MORTALITY BY COLLAR

Group	Blue Collar	White Collar
Males 60-64	1.371	.871
Males 75-79	1.128	.912
Females 60-64	1.216	.912
Females 75-79	1.029	.943

TABLE 4
RELATIVE MORTALITY BY AMOUNT

Group	Small Amount	Large Amount
Males 60-64	1.602	.827
Males 75-79	1.190	.755
Females 60-64	1.172	.906
Females 75-79	1.062	.891

A good deal of concern has been expressed about amount as an appropriate predictor for a group. We looked at this issue in many different ways. We looked at the CSRS data which allows you to parse out underlying factors. The committee is clearly convinced that the amount is probably the strongest indicator or definitely an indicator of difference in mortality.

We got a pretty mixed picture when we looked at mortality by industry. Table 5 lists industries in order of the amount of exposure they had. The most information we had was on transportation, for instance, and certainly there was no pattern that popped out at us there. You could wonder why the communications workers have 104% mortality when the petroleum workers have 79% mortality, since you would assume that the latter is much less healthy work in general. The conclusion is that mortality does differ by group, but there is nothing that says any particular industry would inherently have higher or lower mortality.

TABLE 5
RELATIVE MORTALITY BY INDUSTRY

Transportation	106.1%
Electronic Equip	83.6
Communications	104.3
Primary Metals	144.4
Chemicals	94.3
Petroleum	79.3
Oil and Gas	95.4

Finally, we looked at the question of whether there might still be differences between groups that you can't predict after controlling for amount and collar. And the answer is, yes. The actuary can't just pick up these tables and say, "I have a blue-collar worker group so, therefore, I should use *x*% more than standard mortality. Or, I have large amount so I should use *y*% less."

Tom Edwalds took data controlled for collar and amount and asked, "What would be the probability that the difference in mortality of this particular plan is predicted by random variables?" He found that for 13 plans, which includes most of this particular group, the difference was not predicted by random variables; in other words, the differences in mortality between data sets in this group could not be explained by either collar or amount. The committee struggled with all that information and came up with a conclusion that we finally adopted. This is quoted from the report and this is our advice to the actuaries using these tables starting with the RP 2000 table unadjusted: "Either collar or amount is suitable to predict differences in mortality but they should not both be used because they are not independent."

Five, projections after 2000. The RPC recommends the use of scale AA and generational projection methods to project beyond 2000. The generational recommendation has already created some concern from actuaries. First of all, they don't know what generational projections are and then, once it's explained to them, they say, "I can't do that!"

Generational mortality briefly means that if you have somebody who is age 50 today or in the year 2000, you use the age 50 rate in the year 2000. When projecting the mortality next year, you use age 51 projected 1 year after, year 52 projected 2 years after, and you go down on a diagonal. What most of us do is to take the UP 94 or whatever table we use, and, if we use projection, project it 15 years, 10 years, or whatever is reasonable. That's like a using a stopped clock only once in the projection year, but it does work. We're not saying that the results are any more accurate; you can still get to about the same point, but this is best practice.

I remember when we first said you should use multiple decrement rates and actuaries said they couldn't do that with commutation columns. The Society said, "Fine, you don't need to abandon your commutation columns, but move to this as

soon as you can." And now we're all there, so maybe in the next millennium we'll all use generational projections. We say you should use it, but we're not saying other methods are not valid.

For the projection table itself, we looked at scale AA, which is recommended for UP 94 and GAR 94. We looked at various bodies of data and said, "That projection table is probably pretty representative of where we think the future's going to be and where the long-term trends have been, so in order not to create a new scale we recommend using scale AA."

In the comparison of annuity values, at 7.5% you would find that on the male table the UP 94 projected is very close to the RP 2000. On the female table, there is a dip in the values for the RP 2000 compared to the UP 94 table. That's because the female improvement in mortality has not occurred as expected over the last seven or eight years.

And, if you want to look at totals, we have calculated the current liability in Table 6. It turns out, if you use an average group with 50% male and female and typical active and retirees, you have almost no difference in liability, whether you use RP 2000 blended or separate or GAM 83 or UP 94. However, if you have a group that's atypical, in the case of 75% female-retired, for instance, there is a substantial difference in liability among the various tables.

TABLE 6
CURRENT LIABILITY AT 7.5%
(MILLIONS)

Basis	50% Female Total Liability	75% Female Retired
RP 2000 Separate	$472.1	$310.2
RP 2000 Blended	472.0	320.3
GAM 83	471.9	316.2
UP 94	472.6	313.9

The comments on the exposure draft are due by December 31, 1999. Then, the final paper will be produced in *Reports of the Society of Actuaries* long after it's been finalized and used by everybody, but that will be permanent documentation. The AAA now has to decide when and how to present this to the Secretary of the Treasury. It's recognized that, while it will be presented to the Secretary of the Treasury, he probably won't have a lot of interest in it, and the main people who will opine on the use of the table will probably be from the PBGC, so that's really where the message is going.

As far as the future of the RPEC, Ethan has outlined some very important work for following mortality in the future and producing tables.

Mr. Kra: I'd like to discuss a few issues that came up as we went through the development of the RP 2000 mortality table. But before I go on, I'd like to give a little disclaimer. The opinions expressed are not necessarily those of the SOA, for

which I chair a committee, my employer, any committee on which I sit or observe, nor necessarily those of myself. I say that because I viewed my role in this discussion as not necessarily to present my views, but to try to express many of the views that were raised during the process of developing the table to give you some type of perspective on the issues that had to be addressed. I'd like to present some of these issues and, afterwards, if there's a desire, we can open it up for discussion. But I don't want to say that they're necessarily mine, and I don't want to be restricted to those that are mine.

Within the RP 2000 mortality tables, I'd like to cover about four major issues. First is the variation within industry, second is the discussion of collar versus amount, third is the definition of disability (Social Security versus unspecified), and fourth is the projections.

With respect to variation within industry, historically, in congressional hearings in the early 1990s (preceding GATT), there was severe criticism of the actuarial profession in the halls of Congress regarding actuaries servicing companies within the same industry and employee groups having the same collar. The discussion involved groups that one naively might assume to have very similar mortality. The actuaries were using markedly different mortality rates, which had a significant effect on results. These actuaries were criticized. How can you have such different mortality experience? Shouldn't they be similar?

The response was that the actuaries had performed experience studies. There was a significant amount of incredulity and lack of trust of the actuaries. The result was GATT, mandating the mortality basis for current liability. This study, I think, proves that actuarial judgment is necessary, that there are significant differences in mortality rates between various groups within the same industry. Different employers can have markedly different experience for their pension population, active and retired, even when you hold constant amount, collar, and industry.

There are many other factors that can affect mortality: the design of the medical plan and access to medical care, geography (suburban versus urban or different parts of the country), workforce management, prehiring physicals, and to what extent certain people are hired or not hired as part of the total human resource management of the company. I can give a litany of reasons why mortality could differ. I'm not here to prove why mortality experience has differed between different companies within a given industry. The fact is, mortality experience can differ very significantly, and I believe the ratio can be as much as a 3:2 factor between two companies within the same industry. In a single industry, it is possible to have a 50% differential in q_x based on actual, observed mortality.

When your mortality table is mandated by a regulator or by some other external force, you're forced to observe the rules and use whatever is mandated. However, for purposes of regular funding, the funding standard account, the regular ERISA for 412(b), the actuary is supposed to use best actuarial judgment. I believe it behooves the actuary to be cognizant of many of the items in Ed's fine study. His committee has put in unbelievable time with unbelievable help from the staff of the

SOA in developing this table. There are certain aspects that they've reported that I think actuaries, based on this very extensive study, should take heed of and observe as we progress in our practice. Look at differences with large clients, if you have large clients. Look at their experience. I think it's possibly going to become an Actuarial Standard of Practice to observe actuarial mortality experience for large groups. The Actuarial Standards Board is working on a standard on demographic assumptions. Don't just use cookie-cutter cookbooks.

With respect to collar versus amount, the study did show very substantial correlations between collar and mortality rates. As Ed showed, blue-collar mortality was about 150% of white-collar mortality at age 60. It graded down as we moved into the 80s, but there were still differences in mortality rates. In cases where the actuary has judgment, this paper will give the actuary the background, understanding, and wherewithal to develop mortality rates that will differ by collar.

However, the amount of the benefit also affected mortality. Actually, the data reflected plans that provided large amounts of benefits on average. I believe that's the way the data was generally reported, but Tom, please correct me.

Mr. Thomas P. Edwalds: We asked the plans to subdivide their data into strata by the individuals who had high, medium, and low annuities.

Mr. Kra: The groups that had the individuals with large amounts of benefits tended to have lower mortality rates than the individuals who had lower benefit amounts, and that was relatively consistent. However, as the study and the independent researchers showed, collar and benefit amount were not independent variables. They were very highly correlative. The actuary should not be using both factors and doubly adjusting. However, there are some problems with using either factor by itself.

In general, blue-collar tends to have higher mortality rates than white-collar. There are many reasons and rationales that may be given for that, including higher incidents of smoking and alcohol abuse and less access to the best medical care, depending on the group. But it's not necessarily cause-and-effect. Some blue-collar groups will probably have experience similar to white–collar groups. For example, airline pilots tend to have very large pensions. They were defined as blue-collar in the study because they are collectively bargained. We didn't have too many teachers included in the study because the data collection only covered nongovernment employees. However, if we were just to focus on the issue of collar as defined by collective bargaining, a teacher's group would come through as blue-collar. On the other hand, if we're looking purely at factory workers or other traditional blue-collar groups, in all likelihood it's reasonable that we would get the experience and the adjustment factor that was observed by this committee. This is why there is some need for actuarial judgment in applying these factors.

One of the problems with amount is that this factor may have been more appropriate historically and less appropriate going forward. Large accounts in 401(k) plans and the concomitant reduction in the defined-benefit (DB) promise

that many companies have put through and other changes in plan design probably are not well-reflected. Does the fact that someone has a small pension but a large profit-sharing account balance indicate that the individual would have different mortality experience than someone who had no profit-sharing account balance, but a very large pension? Similarly, that profit-sharing account may be a 401(k) balance, and we're seeing more and more of that. I have one client that went from a reasonably rich 1.5% of final pay DB plan to a 0.5% career-average pay plan, but put in a 401(k) plan that was a very rich match. Will the experience of that employer, a white-collar company, be reasonably expected to deteriorate markedly solely because the company has changed its method of delivery of pension benefits from traditional DB to 401(k) plus match? I think that many of us would have difficulty saying that that is a reasonable prognosticator of very substantial mortality deterioration solely because the company has shifted the mechanism for delivering the retirement dollars.

Other items that were probably not factored in—and in no way is this a criticism of the committee, because probably it would have been almost an impossible task to properly factor these items in—would be high-turnover industries. In companies where people go on a pogo stick from company to company, they may get a large pension in retirement, but it may come from multiple sources as opposed to the entire pension check coming from one source. The data collection was related to the pension being received from a particular company, not the total pension the individual may receive from many companies. For the person who has three or four pension checks, we only looked at each one of those separately; that person could have shown up as a small amount in four places instead of a large amount in one.

If a plan is frozen, benefit accruals do not continue. Again, there may have been some other benefit promise. Regarding cost of living adjustment (COLA), the data we received reflected the pension in pay status generally at the current date, not what the pension was when the individual retired. If you have an 85-year-old who received 3 COLAs since retirement and another 85-year-old who received no COLA since retirement, both individuals may have retired at the same pension benefit amount, but today they're getting very different amounts. It's very difficult to figure out how to adjust for those differences in factors.

The committee designed breakpoints for a plan without a COLA based on what was reasonable today. I believe the dollar amounts were $6,000 a year and $14,000 a year. That was data collected in the 1990s. Twenty years ago, in the 1970s (or 30 years ago if we have a very old retiree in the 1990s who retired in the 1960s), those dollar breakpoints would likely have been much lower because of inflation and cost of living. In real dollars, we would have much lower amounts.

An individual who, in a study 25 years ago, would have been categorized as large amount, today would be categorized as small amount, and yet there is no adjustment in this analysis for how individuals can progress through the system going from large to a small amount. The only alternative would have been to actually have breakpoints that differed by age or number of years since retirement.

If we have people who are retiring today, we would use $6,000 and $14,000; people who retired 10 years ago would have some other numbers, depending on what inflation has been. I don't know. I'm not doing these mathematically. Let's say for argument's sake, instead of $6,000 it could have been $4,500, and instead of $14,000 it could have been $11,000.

For people who retired 20 years ago, maybe the factors would have been $3,000 and $7,000. We probably would have gotten very different results because we would have had very few people in the large amounts at the old ages. I would contend that the effect of the amount wore away over time, but it very well may have been a blending of almost the entire population into the low-dollar amount at the older ages.

I think that one of the problems the committee faced in coming up with a system to apply amount to plans was how to address those types of issues and come up with something that would be a good prognosticator. A number of the people who have looked at the paper feel that to use amount prospectively may be appropriate if you have plans that are very marketed according to economic echelon, for example an executive benefit program may be "large amount." A program for people who are near minimum wage may be small amount. But to apply large, medium, and small in the middle ground may be very problematic. It may not realistically address where the breakpoints are on a prospective basis because of these muddying-up-the-waters or hazing-up-the-atmosphere factors.

With respect to disability, the collection of the data asked whether the person was disabled under the plan's provisions. It did not ask whether the person was disabled under Social Security. The data were analyzed on that basis as collected and were then used to develop disability tables based on individuals who are disabled—some of whom were Social-Security-disabled, some of whom were not. The tables are based on the plan's provisions. Anybody who was not disabled was treated as healthy.

If the IRS continues the practice that it promulgated after the enactment of GATT—that in order for an individual to be deemed disabled and to use the disability table, the individual must be Social-Security-disabled—and if we use this disabled mortality table "plan," we will be overstating the liabilities for those who are actually Social-Security-disabled. And we will be overstating the liabilities for those who are not Social-Security-disabled but are disabled under the plan provisions. Those who are Social-Security-disabled are probably experiencing a higher q_x than those who are in the general group of disableds, which include some Social Security and some other disableds.

As a result, those individuals who are disabled under Social Security but not the plan are dying off more rapidly, yet we are using a table that's based on a broader group, so we're overstating their liabilities. For those who are not Social-Security-disabled, if we are forced to use the healthy mortality table for them, then clearly we're overstating their liabilities. The mandate to use the Social Security definition of disability to differentiate the individuals for whom we apply one table versus

another will cause an overstatement of liability. Of course, if a government mandates the use of such a table, the actuary pursuant to generally accepted Actuarial Standards of Practice would be required to follow the government mandate for those purposes.

The issue came up about whether there should be generational projections. In a fully generational table, as Ed described, if we have a 50-year-old in the year 2000, we use the year 2000 mortality for age 50, the year 2001 mortality table for age 51, the year 2010 mortality table for age 60, etc., versus some type of static projection for the entire group to 2015 and use that for all ages, including those for the current year and the future years.

Current practice is that most actuaries are not projecting mortality. Those who are projecting mortality are probably doing the static projection to a fixed given year, although that is not widespread from what I've observed in reviewing many valuation reports across the country.

I believe one of the issues has been software availability. Actuaries can probably project the mortality, even if their general valuation software does not allow for it, by doing a projection in an Excel spreadsheet and then pumping one new table into the software and running the valuation. But many valuation software systems have not yet been expanded and cannot accommodate a fully generational mortality table. For many of those systems to run a "fully generational" valuation would mean segregating the data into cells by year of birth, running each separate year of birth through the valuation program, getting all the results, and then adding them at the tail end—a horribly time-consuming and expensive proposition. I believe that will change over the next ten years. As some of the major firms update their software, they will implement generational mortality as part of the next generation of upgrade. Some of the third-party vendors are also upgrading their software. The issue is that the government needs it if it's going to use it. If the PBGC is going to use it, it needs to have the software. I don't know where that is on their business plan, whether they have the ability to develop it or whether they will have it.

This will become a competitive issue, so it will be developed probably most rapidly by the large firms that have their own proprietary software. That's a major undertaking to include the ability to have generational software, and this will occur only as each of the firms goes through a major upgrade. That is a once every 5–10 year occurrence.

You can estimate by projecting a static table. The issue is, do you use a different static table each year, or do you adopt a static table and project for five years and then adopt a new static table? In other words, do you push the table one year every year and have a change in mortality table, or do you go to a certain point, wait five years, and then go again five years further? Do you also have separate tables for actives vs. retirees? What will happen in practice? We'll see. This is an area where, again, there may be a government mandate. The government

mandate may come in the form of what the government's own software can do on an interim basis.

Then there's the issue of actuarial judgment as to which estimation develops as the best actuarial estimation of the liabilities under the plan. I think many of the issues that we face in dealing with the uses of this mortality table go to that last issue: government mandate versus actuarial judgment. Should the actuary have the ability to apply actuarial judgment or will the government mandate the use of a particular table? To what extent will the actuary have judgment to make certain modifications based on collar, amount, and projection period, or to what extent will there be a one-size-fits-all, cookie-cutter approach?

Mr. Harold Cherry: Ethan, I have a question about the generational mortality tables. I'm going to use two dirty words when it comes to mortality, and they are "commutation columns." As I recall, the original Jenkins-Lew paper had a new mortality table from 1949 or some such table. I guess that's in the monograph that we all received as one of the seven landmark papers. In that paper, a method of generational mortality projection was presented, at least for annuities where income was currently payable, like for retired lives, making use of supplementary commutation columns. I think there was an H_X in it. In fact, when I worked for an insurance company in 1961, we used this for the valuation of annuities. Simply by putting these new commutation factors on what was then a punch card, you could very closely approximate the full generational value of the annuity. Maybe we ought to go back and study our old papers, and there was good reason to reprint it in this monograph.

Mr. Kra: That probably would have been more helpful 10–15 years ago. Unfortunately, or fortunately depending on perspective, many of the large firms now do not use commutation functions in the actuarial valuation software, but actually produce cash flows and then do discounted cash flows. There are no commutation functions; it is a pure cash-flow projection in discounting where they go to the basic principles and actually run through all of the decrements each year. For those valuation systems, I don't think that methodology could be applied.

Mr. Robert R. Novak: Particularly in light of the differentials in industries for annuitant data, to what extent were the effective lump sums which differ by industry analyzed?

Mr. Hustead: We didn't analyze them. We asked for information on the plans, but we didn't really find the plan design to be of much use, so we didn't use that information.

Mr. Kra: The base period for this data, Ed, was 1990–94, and probably the prevalence of lump sums in large plans was somewhat less than it is in the year 1999. I will not deny that there are plans that have lump sums, but many of those that were reviewed were probably less likely to have lump sums than they are today except for the *di minimis* small lump sums.

Mr. Hustead: They might be much less common than they are now, but within certain industries they were still very common, particularly in the oil industry, where it was almost universal in the early 1990s.

Mr. Donald J. Segal: In studying the experience, was everything basically converted to a life annuity or did you do anything with respect to form of annuity? I remember from when I was a student that you might say the more of a death benefit there was, the higher the mortality was. Did you recognize form of annuity?

Mr. Hustead: No. Let me say a few words about Ethan's comments, and I did want to say a bit more about the pre-GATT controversy because it certainly affected the work of the committee.

As far as the issues on amounts and the question about whether differentiation occurs between different groups when you consider COLAs, when you consider vested benefits being small and things like that, we did have extensive data on the CSRS under which we were able to control for all of those factors, and found them consistent throughout. However, if you take out vesteds and control for inflation, you still have very substantial differences in mortality by amount, so the committee was convinced about that. The controversy is really with GATT, which affected the autoworker data. As some of you may be aware, when the concern was expressed about the big difference in mortality, there was particular concern about two different autoworker firms that were using widely different rates. The PBGC questioned that, and I've heard both sides of this story. It came out in the *Wall Street Journal* about which company was which, and the auto industry I believe attributes that disclosure to PBGC, rightly or wrongly. That led to a lot of the confidentiality issues, which, in turn, led to a lot of the issues throughout the committee.

One of the things Tom Edwalds did when we wound up arguing about whether to use amount or not was to suggest letting the University of Connecticut study it. So we took the issue off the table for a year and came back to it.

Also, there was concern expressed that we were not doing the job we were supposed to do. I don't know what that individual is after, but we had the Society's leadership throughout those proceedings. We certainly appreciated their support in saying, "Let's get the study out and then debate it."

Mr. Kra: I also want to give significant credit to Larry Pinzur, who was head of the research committee during this period, to which the experience committee directly reported. The committee members put in herculean amounts of time and effort.

One comment I would like to make on including amount is that there are two distinct issues that you have to address in dealing with amount as an actuary. First, is it really a factor historically? Is the experience there? I think it was demonstrated that amount did have significant differences in mortality experience. Second, how would one apply that prospectively in a consistent and reasoned

fashion? I think there was more controversy in that area because of many of the factors that were enumerated. While it may be demonstrable that amount is a significant factor, how do you apply it because of those complicating factors? It might require substantially more judgment than dealing with collar or some of the other factors. Some actuaries may believe that pure actuarial judgment and experience studies on large groups probably may have even more significant prognosticative value because of these complicating factors, but there was a substantial disparity of viewpoints on this matter, some of them very vociferously expressed.

From the Floor: How did you get from the conclusion that it was not necessary to project improvement from the base period to 2000 for females or for the youngest and oldest males to the use of projection going forward in all situations? What was the rationale that connected this?

Mr. Hustead: We found a distinct difference in the short-term, fairly recent past, and the long-term secular trend in mortality. We said, for determining going from 1992 to 2000, probably what's most appropriate is what this data and other data show happened, say, between 1985 and 1995. That is the basis under which we took the much lower trends for most people to 2000. Then, in looking at what to do beyond 2000 for the long term for the various data sets—CSRS, Social Security, railroad retirement, and the GAM studies themselves—we took the longer term, 15–20 years or even longer, and used those rates. That is a distinct difference we made. If you're uncomfortable with that or have some thoughts, this is the chance to do it in your comments on the exposure draft.

Mr. Kra: While I was not directly involved in those discussions, by observing them I could rationalize and understand the basis. I had to do a major study on mortality trends for a litigation back in the early 1990s and found that, at certain age, sex, and demographic groups, there was a very noticeable deterioration in mortality experience from some time in the early 1980s into the early 1990s because of changes in certain disease patterns and the types of ages and sexes that it would attack. The assumption was that that was a onetime shift to a new plateau, that medical advances would progress from there, and mortality would then improve maybe from a lower or higher plateau, whichever way you want to describe it, but from a plateau of a higher mortality rate at certain ages. But then improvements would start to march forward as medical advances would continue to deal with that medical situation and others.