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Session 95PD
Living to 100 and Beyond: Implications for Retirement

Track: Retirement Systems Practice Area/Life Insurance Practice Area

Moderator: SAM GUTTERMAN
Panelists: COLIN ENGLAND
ALAN PARIKH
ROBERT POKORSKI†

Summary: In recent years, mortality rates have decreased significantly so that many more people live to age 100 and beyond. Clearly, this trend of increased longevity has important implications for retirement benefit programs, life insurance, annuities and health insurance. This session is an outgrowth from the January 2002 symposium co-sponsored by the Society of Actuaries that explored current thinking on advanced age mortality. Panelists discuss key societal, business and family questions raised by this topic.

MR. SAM GUTTERMAN: Many actuaries have almost forgotten about one of the core risks that we've been concerned with over the years—mortality. The purpose of this session is to provide some insight into mortality and the risks associated with the projection of mortality.

We will start this panel with an excellent introduction to the topic by Bob Pokorski. Bob is a vice president of the worldwide medical research & development area for GeneralCologne Re. He's responsible for monitoring the effects of new medical technologies and diseases on morbidity and mortality. Dr. Pokorski earned his Doctor of Medicine degree at Creighton University in Omaha, and his B.A. at Heriot-Watt University in Edinburgh, Scotland. He's a Fellow of the American College of Physicians and is certified by the American Board of Internal Medicine and the Board of Insurance Medicine.

†Dr. Robert J. Pokorski, not a member of the sponsoring organizations, is vice president of worldwide medical research & development at GeneralCologne Re in Stamford, Conn.

Our second presenter, Alan Parikh, will provide some highlights and some insights gained at a recent SOA-sponsored conference in January, Living to 100 and Beyond: Survival and Advanced Ages, the topic of our session today. He is a consulting actuary with Mercer on retirement plans. He is an associate editor of *The Actuary*. He will discuss some of the theories in the field of mortality projection.

Our third speaker presenter will be Colin England. Colin is a consulting actuary with Palmer & Cay. He deals with the application of consulting services to middle size employers.

DR. ROBERT POKORSKI: Good afternoon. I was in the lobby this morning, very early, working on my presentation, and something happened that led me to believe that the Society of Actuaries isn't nearly as well known as you think it is. The night manager came up. It was just after 5 a.m. He wanted to know why someone would be working so early in the morning. I explained, "I am working with the Society of Actuaries." And the comment he made next was "Oh, is John Travolta here?" I said, "Oh no, no, no. We're actuaries, not actors." So I explained what this meeting was all about, but I really don't think I convinced him what actuaries do; and I think even now, he's probably wandering around looking for John Travolta, FSA, Fellow of the Society of Actors.

I'm going to talk about relationships between general population and insured lives mortality, and conclude with some remarks about frailty, which is of major interest when underwriting elderly people. First, I'm going to start with a few different opinions about what is going to happen to mortality in the future.

Life Expectancy Theories

Limitless Lifespan. There are two theories: The first one is that there is no limit to life expectancy in the future. It's going to continue to improve for a long time, and there is no biological limit. In fact, the person that is a proponent of this theory said that if someone suggests that there is some biological limit, on average, it's been disproved five years after the projection was made.

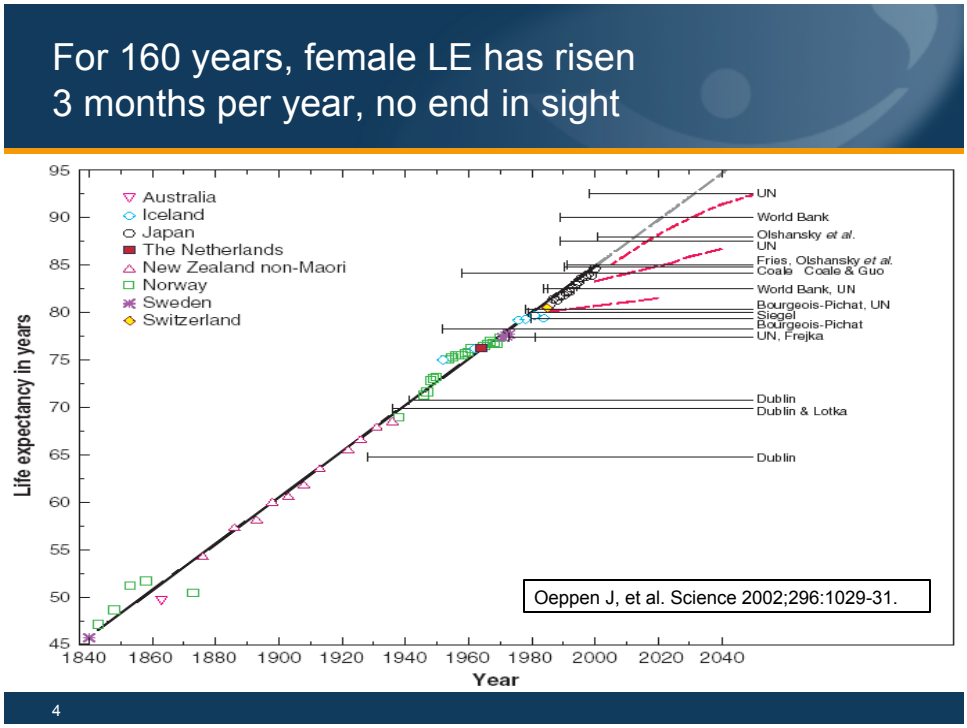
In the first half of the prior century, that mortality improved in younger people because of antibiotics, better public health and decreased childhood mortality. In the latter half of the 20th century, improvements occurred in older people principally, a decrease in cardiovascular and cancer mortality.

This same theory would suggest that in some best-practices situations, one could have a life expectancy that actually approached 100 years within as soon as six decades from now.

This is one of the charts that is used in support of this theory (Figure 1). Along the Y-axis is life expectancy in years; we have calendar years along the X-axis starting at 1840. These are Swedish women who have a life expectancy of 45 years in

1840. The figure shows a regression line for the past 160 years. Female life expectancy has increased three months per year with no end in sight. To the right of the regression line, you see prior estimates of what life expectancy might do, all of which have been exceeded. So this theory suggests there's no end in sight, and people will continue to live for longer and longer periods of time.

Figure 1

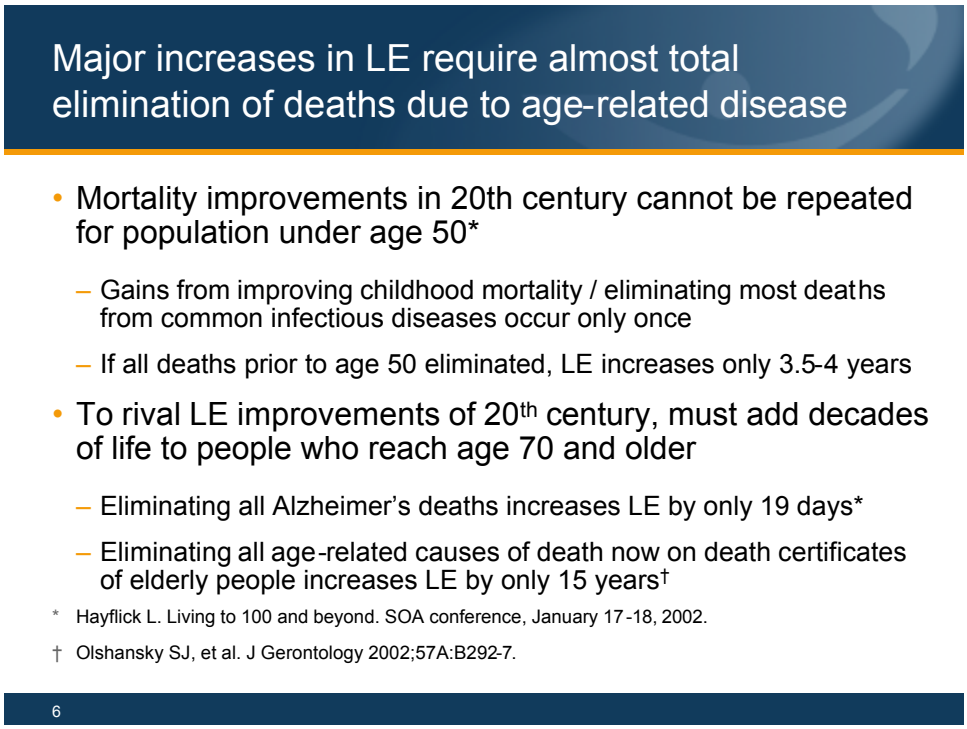


All Good Things Must End. There's another theory that proposes something different, namely, there is a limit to biological age because of biological forces. This theory draws the distinction between aging and age-related disease.

Aging means the accumulation of damage to the body's building blocks of life—DNA. This damage is in contrast to age-related diseases such as Alzheimer's disease, cardiovascular disease and cancer. This theory postulates that all aging research has been directed toward postponing or curing age-related diseases, but is doing nothing to counteract the aging process itself.

This latter theory presents some very persuasive arguments. This is one of the mathematical underpinnings for this argument (Figure 2). If you could eliminate all causes of death before age 50—nobody dies before age 50—that would improve life expectancy by only 3.5 to 4 years. And to make these major improvements, 70-year-old people would need to live on average decades longer. So this is much harder to accomplish.

Figure 2



The last two bullet points were from our aging meeting at the Society of Actuaries in Orlando in January 2002. We had a couple of real experts there, including Professors Hayflick and Olshansky. One stated that if you eliminated all causes of death due to Alzheimer's disease, life expectancy would improve only 19 days. And if it were possible to eliminate the three principal causes of death in older people—heart disease, cancer and cerebrovascular disease, life expectancy would increase only 15 years. So even then, people live only to their late 80s or early 90s.

This was an excellent paper from a 2002 issue of the *Journal of Gerontology*, a very prestigious aging journal. Fifty-two world-class aging researchers got together to debunk some popular myths about aging.

I'll read the first bullet point to you. "It's almost certainly true that since recorded history, people could have lived as long as those alive today with similar technology and lifestyles." These 52 experts are saying that if you could go back thousands of years and provide people with the same advantages that we have today, they would have lived as long as we live today. If true, this indicates that we haven't made nearly the strides that we think we've made.

The same article talks about all the interventions that you and I think are wonderful, for example, lifestyle interventions and exercise. This bullet ticks through many items that are well accepted and some that are not so well accepted:

yoga, vitamins, hormones, etc. These interventions are all directed toward age-related diseases, and according to these 52 researchers, do nothing to address the underlying problem, which is that people continue to age despite postponement of age-related diseases.

The last point is particularly noteworthy. "Any claim that biological age can be measured or modified, must be regarded as entertainment and not science." This is something to remember, because it's fairly common to open the newspaper and read that some company has finally "got it;" they have found the way to measure and postpone biological age and they're trying to sell it to you. These world-class experts say that's merely entertainment and not science.

Olshansky and others who postulate a biological limit to life expectancy suggest that population mortality will increase about 1 percent per year in the general population for the foreseeable future. They looked at mortality improvements that occurred between 1985 and 1995 and projected them, asking, "What if this trend continues? When will life expectancy in the United States hit 85 or 100 years?" For females and males, respectively, it reaches 85 at 2125 and 2239; it reaches 100 in about 500 years.

Population & Insured Lives Mortality

Next I'd like to discuss relationships between population and insured lives mortality.

GeneralCologne Re looked at the relationship between population and insured lives mortality for three decades—the '70s, the '80s and the '90s. As you know, population mortality decreased during this time. Insured lives mortality decreased, as well. The question is: What is the relationship between population and insured lives mortality over time? Has this gap between these two changed? Has it gotten wider? Has it gotten narrower?

This is the basis of our study. We chose two age groups, 35- and 65-year-old men, and selected 1970 as a time of "basic" or "traditional" underwriting. Insurers developed more sophisticated underwriting in the '80s and the '90s. We asked" What happened to the gap between population and insured lives mortality as underwriting became more sophisticated?

35-year-olds. First we'll consider the situation in 1970, characterized by basic underwriting: an application, physician's exam, physician's statement, urine specimen and maybe an electrocardiogram (ECG) at older ages.

In the '80s, insurers added cardiovascular risk profiling and assessed risks in healthy and impaired people in the context of their cholesterol, family history, blood pressure and smoking status.

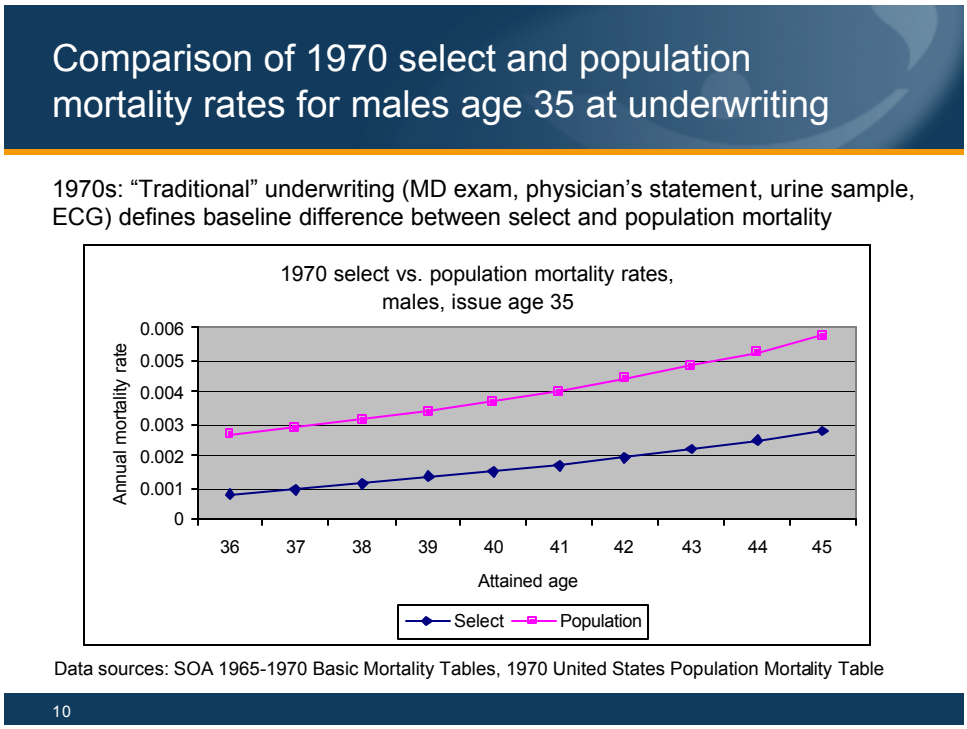
Even more sophistication was added in the '90s with preferred risk underwriting. One would naturally think, "Underwriting is getting better and better, more

sophisticated, and the gap must be increasing." With preferred risk underwriting, blood profiles are obtained on most applicants. Insurers are finding out about diabetes, liver and kidney problems. Other data include motor vehicle reports, HIV and cotinine tests and alcohol markers.

Now we'll look at the gap between population and insured lives mortality over these three decades. What our study found is not exactly what you and I might have thought.

The first example is for 35-year-old males underwritten in 1970 (Figure 3). Annual mortality rate is along the Y-axis; attained age on the X–axis. The top curve in these examples is population mortality rates, and the lower curve is select mortality rates, i.e., insured lives mortality rates after underwriting. 1970 is the decade of basic underwriting. The slide indicates the gap, or degree of separation, between population and insured lives (select) mortality rates.

Figure 3

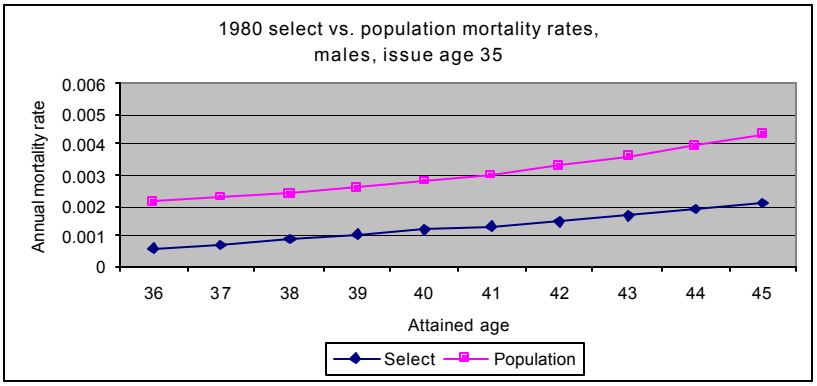


In 1980, the curves are closer together despite more sophisticated underwriting (Figure 4). This is not at all what one would expect; insurers were spending more money on underwriting tests, yet the gap was decreasing. The explanation may be related to intense competition in the '80s, both from an underwriting and a pricing perspective, including term insurance "wars."

Figure 4

Comparison of 1980 select and population mortality rates for males age 35 at underwriting

1980s: Cardiovascular risk profiling and smoker / nonsmoker products, but difference between select and population mortality narrows due to term wars / aggressive underwriting



Data sources: SOA 1975-1980 Basic Mortality Tables, 1980 United States Population Mortality Table

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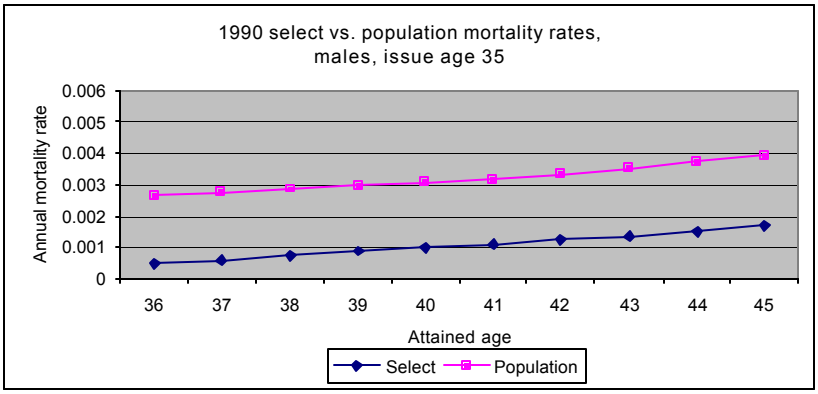
More sophistication—preferred underwriting—was added in the '90s (Figure 5). The curves are farther apart. But the data are a bit deceptive because something else intervened at that time—AIDS mortality for males. So the gap widened, but a bit more than it really should have, because population mortality did not improve as much due to AIDS.

Figure 5

Comparison of 1990 select and population mortality rates for males age 35 at underwriting

1990s: Preferred underwriting widens difference between select and population mortality (caveat: widening of gap due to underwriting is overstated because AIDS dampened potential improvement in population mortality at young ages)



Data sources: SOA 1985-1990 Basic Mortality Tables, 1990 United States Population Mortality Table

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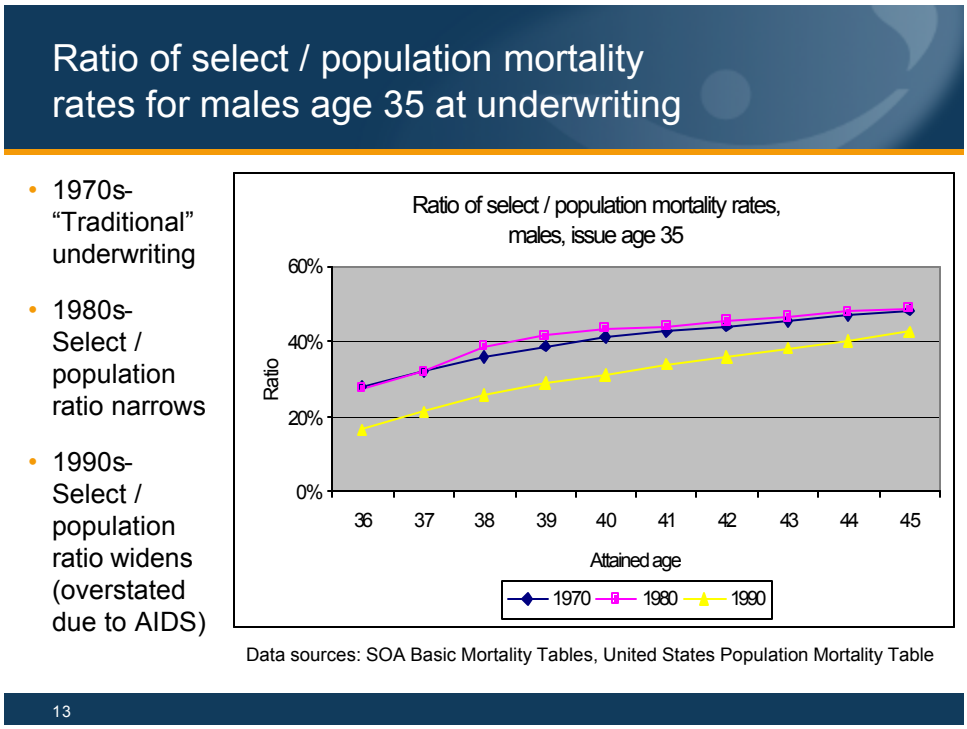
We put all three curves together and here's where it gets interesting (Figure 6). This slide displays the ratio of select to population mortality rates for 35-year–old males, with 1970 representing basic underwriting.

Figure 6



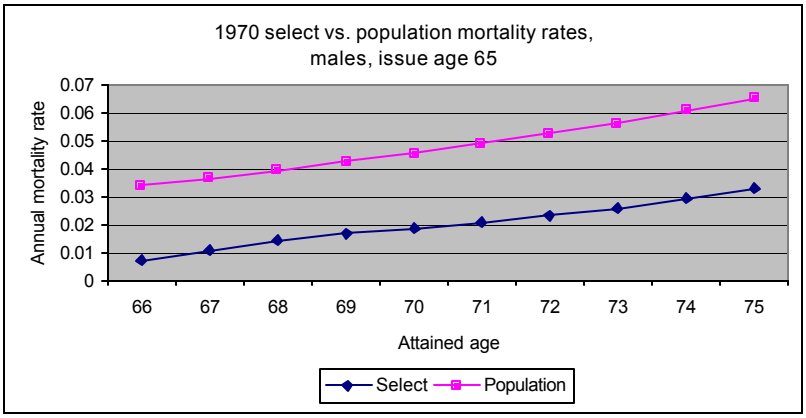
As underwriting becomes more sophisticated, you and I would think the ratio would decrease because insured lives mortality would improve relatively more than population mortality. But what happens in 1980 is not what was expected: the ratio actually deteriorated (increased) a bit. Despite more sophisticated underwriting, the gap between population and insured lives mortality did not increase. 1990 showed what we expected: the gap widened (the ratio was smaller) due to preferred risk underwriting.

65-year-olds. Now we'll consider the gap between population and insured lives mortality rates in 65-year-olds. Again, 1970 represents basic (traditional) underwriting (Figure 7).

Figure 7

Comparison of 1970 select and population mortality rates for males age 65 at underwriting

1970s: "Traditional" underwriting (MD exam, physician's statement, urine sample, ECG) defines baseline difference between select and population mortality



Data sources: SOA 1965-1970 Basic Mortality Tables, United States Medicare data

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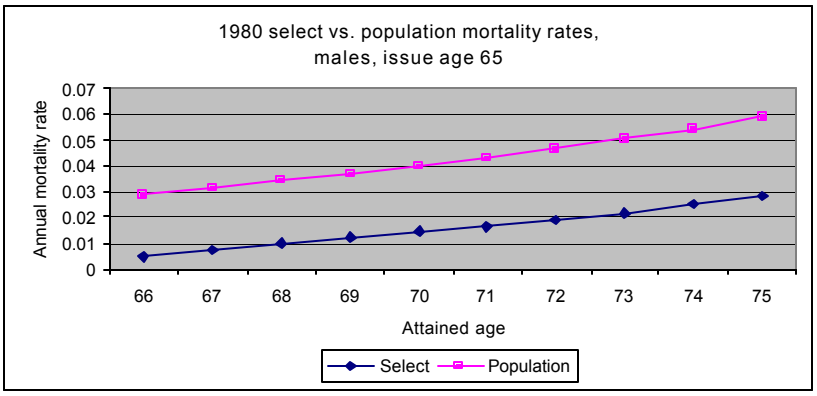
This slide is for 1980; as expected, the gap is getting wider (Figure 8).

Figure 8

Comparison of 1980 select and population mortality rates for males age 65 at underwriting

1980s: Difference between select and population mortality widens due to cardiovascular risk profiling and smoker / nonsmoker products



Data sources: SOA 1975-1980 Basic Mortality Tables, United States Medicare data

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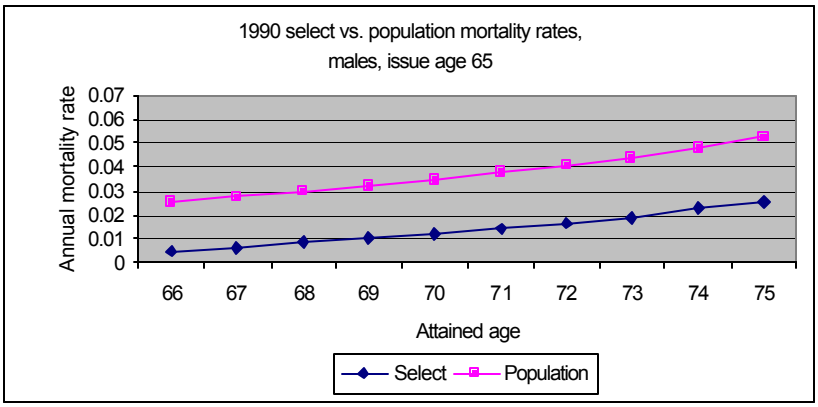
But in 1990 the gap does not change at all (Figure 9) despite preferred risk underwriting.

Figure 9

Comparison of 1990 select and population mortality rates for males age 65 at underwriting

1990s: Preferred underwriting but no significant change in difference between select and population mortality



Data sources: SOA 1985-1990 Basic Mortality Tables, United States Medicare data

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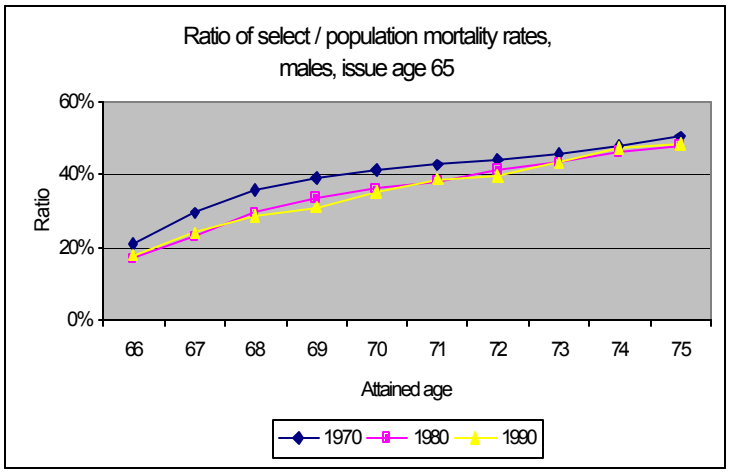
Here we examine the ratio of select to population mortality rates for 65-year–old males (Figure 10). 1970 represents the era of basic underwriting. Improvement occurs in 1980 (the ratio decreases), but not in 1990. The gap doesn't widen in 1990 as we expected.

Figure 10

Ratio of select / population mortality rates for males age 65 at underwriting

- 1970s- "Traditional" underwriting
- 1980s- Select / population ratio widens
- 1990s- Select / population ratio unchanged



Data sources: SOA Basic Mortality Tables, United States Medicare data

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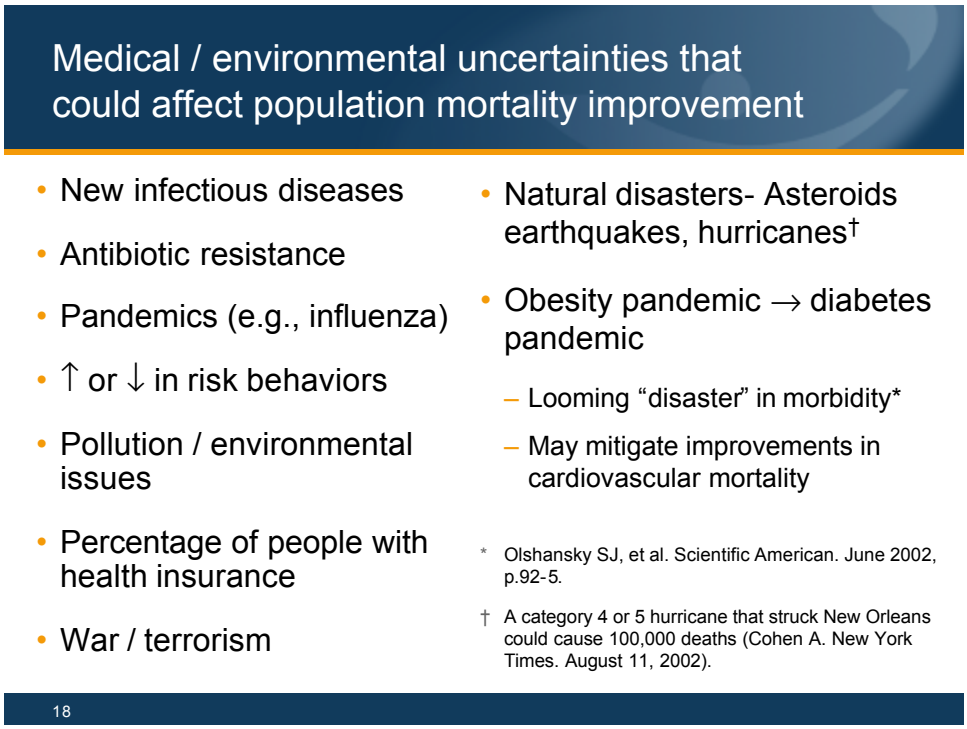
What To Do About It

Pricing actuaries make critical projections regarding life expectancy. First, they ask, "Over the next decades, what will happen to population mortality rates?" Then they ask, "Given likely changes in population mortality rates, what will happen to insured lives mortality rates?"

Possible Curve balls

Remember that Professor Olshansky suggested at the January 2002 SOA longevity meeting in Orlando that population mortality rates would increase about 1 percent per year for all ages for the foreseeable future. But he added a caveat, namely, if there were no major disruptions in population mortality during that time. Listed here are some of the disruptions that could occur (Figure 11). These may not be likely, but the probability is not zero.

Figure 11



The first possible disruption is a new infectious disease. Parts of the world have dodged the AIDS epidemic with respect to insured lives; but what if there's another disease like AIDS, only this time it involves the insured population to a greater degree? You could imagine what would happen to a "1 percent per year improvement" if there were such an epidemic.

Then there are possibilities of antibiotic resistance; pandemics like influenza, which killed 20 million people early in the 20th century; changes in risk behavior; war and terrorism (which is more of a possibility than we would have ever thought); and natural disasters (leading the list is asteroids, though not so likely). Though you probably dismiss hurricanes out of hand, there was an article in the *New York Times* not long ago saying that 100,000 people could die in New Orleans if a major hurricane hit there. And then there's the obesity pandemic, leading to a worldwide pandemic of diabetes. Conceivably this could mitigate the decrease in cardiovascular disease that would have occurred.

What's Going to Happen? Optimistic & Pessimistic Views

As a pricing actuary, now ask, "Given the likely improvement in population mortality of 1 percent per year, what's going to happen to insured lives mortality?" The question is: How efficient will underwriting be decades in the future?

There are major uncertainties. First let's look at the optimistic scenario. The idea

here is that the gap between population and insured lives mortality rates will either be stable or actually improve (widen). This would imply that underwriting becomes more efficient, and pricing actuaries could project that improvement in insured lives mortality rates would exceed or at least equal that of the general population (1 percent per year). More efficient underwriting could be due to better cardiovascular risk factors, better tumor markers and tests for biological age. The trouble is, none of these developments are on the horizon right now.

The other scenario is at least as likely. There could be three major disruptions. First, there is a strong movement toward greater privacy worldwide, and especially in the United States. Insurance buyers could say, "You can't have access to personal information that you need for underwriting, even though you say you need it."

Second, the government continues to look at risk factors used by insurers. Genetics is a perfect example. The government might say, "Insurers can't use this information, even if it is highly predictive."

The third possibility is a self-induced problem that we are seeing right now: insurers are rushing to process applications very quickly because of hypercompetition. Plus, companies are finding ways to cut costs, such as by ordering fewer tests. So insurers often receive less information, thereby reducing the benefits of underwriting.

To summarize this second major topic, population and insured lives mortality rates are decreasing. Pricing actuaries ask, "What is the likely improvement for decades in the future?" Our analysis indicates that the gap between population and insured lives mortality depends on age at underwriting, effectiveness of underwriting, degree of competition and other factors.

The likely improvement in population mortality is about 1 percent per year. But how about insured lives' mortality over decades in the future? How efficient will underwriting be? One can't automatically assume that the gap between population and insured lives mortality will continue to increase, and there are reasons to suspect that it may not.

So what could happen? If things go well, underwriting efficiency would be the same or even better in the future. In this case, the gap between population and insured lives mortality would widen, and insured lives mortality would improve by more than 1 percent per year. But at least as likely is the possibility that underwriting becomes less efficient because of privacy concerns, government restrictions on use of risk factors and hypercompetition. We'd get less information, the gap would narrow, and insured lives mortality would improve less than 1 percent per year.

My last topic is frailty, a geriatric syndrome of advanced age that renders someone vulnerable to functional decline, morbidity and mortality. It often occurs in people

who survive to old age.

Frailty is a major concern for long-term care, life and disability insurance. Figure 12 indicates the prevalence of frailty; it increases quite a bit with older age.

Figure 12

Frailty may be price for surviving to old age / important for many types of insurance

- Frailty- Geriatric syndrome of advanced age that leaves person vulnerable to falls, functional decline, morbidity, and mortality
- Postponing age-related disease pushes average survival to oldest ages → increases risk of frailty*
- Frail person higher risk for LTC / disability / life insurance

* Olshansky SJ, et al. Prospects for human longevity. Science 2001;291:1654-5.

Prevalence of frailty (%) in 5,317 community-dwelling subjects (U.S.)*

Age	Subjects	Female	Male
65-70	2308	3.0	1.6
71-74	1271	6.7	2.9
75-79	1057	11.5	5.5
80-84	490	16.3	14.2
85-89	152	31.3	15.5
90+	39	12.5	36.8

* Fried LP, et al. Frailty in older adults: Evidence for a phenotype. J Gerontol 2001;56A:M146-M156.

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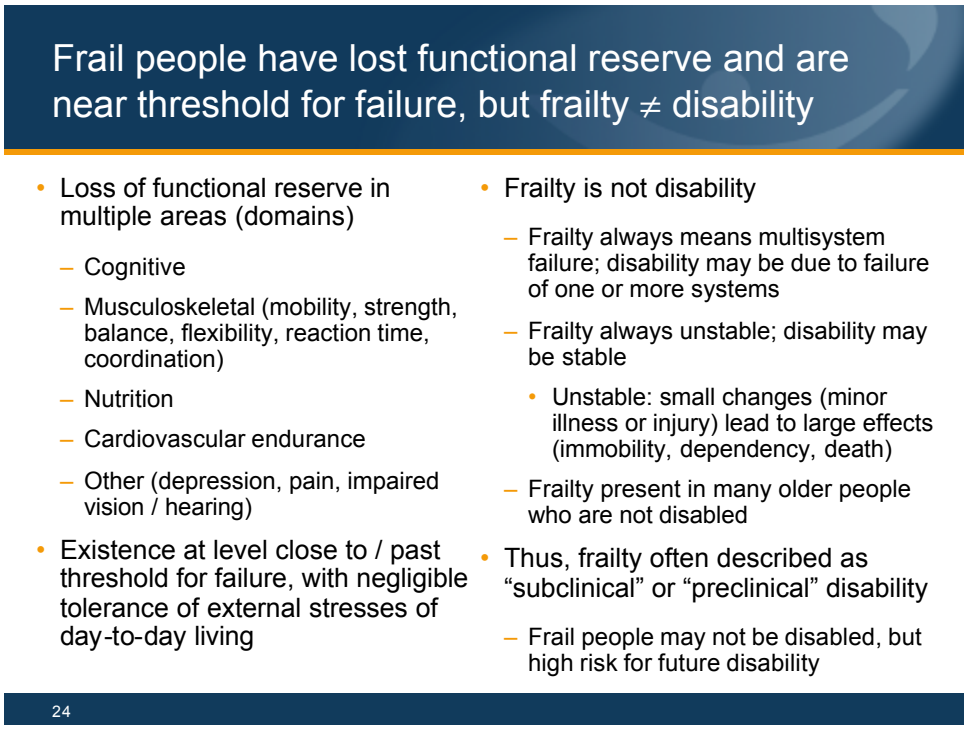
There are two principal components of frailty (Figure 13): The first is loss of functional reserve in multiple domains. This means a decrease in one or more of the following: cognitive function, musculoskeletal ability, cardiovascular endurance and nutrition.

Figure 13



The second component is existence at a level that's close to or past the threshold for failure, with negligible tolerance to the minor stresses of day-to-day living. One sees this all the time in parents or grandparents. They survive until 85 or 90. They dodge the common causes of death. They get smaller and smaller, weaker and weaker. They lose muscle mass. The wind blows, they fall, break a hip and die of pneumonia.

This is a good study by Dr. Linda Fried from the *Journal of Gerontology*. It followed 5,300 community-dwelling people (meaning they were not in nursing homes). The authors asked, "Can we predict frailty? And if we can predict frailty, what is the prognosis?"

There were five components of frailty (Figure 14). If somebody had three or more they were considered frail, one or two was possibly frail, zero was not frail. The five criteria included unintentional weight loss of 10 lbs (4.5 kilograms), self-reported exhaustion; weakness; slow walking speed; and low physical activity. The problem with their frailty index is that it may perform well clinically, when people don't have any interest in misrepresenting; but only two of the five criteria are objective: weakness (measured by hand-grip strength), and ability to walk 15 feet (4.6 meters). The others are subjective and subject to misrepresentation.

Figure 14

Frailty index

- Frailty index based on 5,317 community dwelling people age ≥65 in US*
- 5 criteria
  - 3 or more- Frail
  - 1 or 2- Possibly pre-frail
  - 0- Not frail

* Fried LP, et al. J Gerontol 2001;56A:M146-M156.

Frailty criteria†	
Criteria*	Measurement
Unintentional weight loss of 10 pounds (4.5 kg) in past year	Single question
Self-reported exhaustion	Single question
Weakness	Hand-grip strength
Slow walking speed	Time to walk 15 feet (4.6 m) at usual pace
Low physical activity	Short questionnaire

† Fried LP, et al. Frailty in older adults: Evidence for a phenotype. J Gerontol 2001;56A:M146-M156.
* Three or more criteria = frail, one or two criteria = possibly pre-frail, no criteria = not frail.

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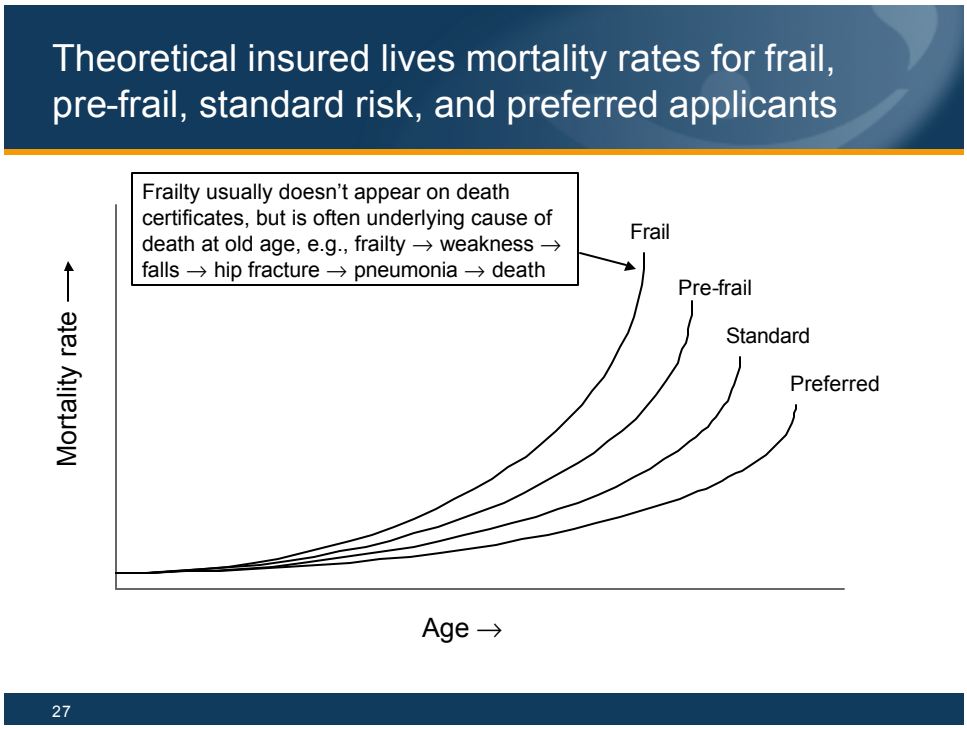
Here's what the study showed regarding three- and seven-year incidence of death, new hospitalization, new fall, activities of daily living, disability and worsening mobility disability.

At three years and seven years, non-frail people had a much lower incidence of all of these events compared to those who were frail, e.g., for mortality, 3 percent in non-frail versus 18 percent in frail individuals.

This chart presents a theoretical illustration of mortality in people who are frail, pre-frail, standard, or preferred risks (Figure 15). I'll add the caveat that nobody knows for sure what a preferred 80- or 90–year-old is; it remains to be determined.

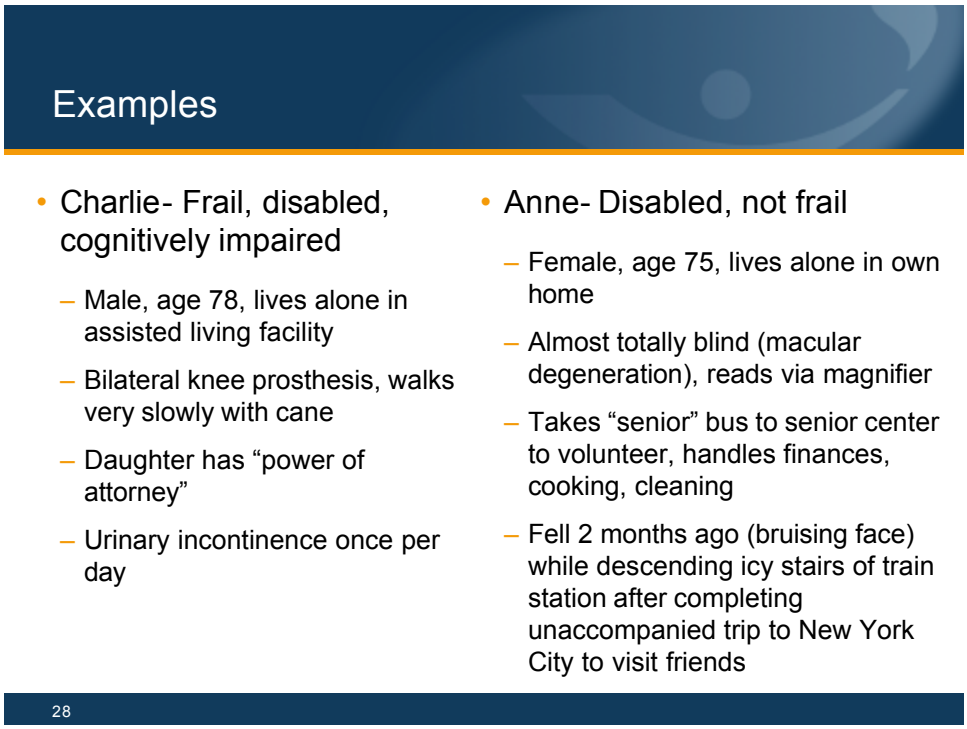
Figure 15



The pathophysiology in the slide is noteworthy: frailty kills older people all the time, but you seldom see it listed on death certificates. Here's what happens. A frail person is weak, falls, has a hip fracture, develops pneumonia and dies. The cause of death on the death certificate is pneumonia, secondary to a fall. You don't see frailty listed, yet that's the cause of death. This is why frailty is so important when underwriting elderly risks.

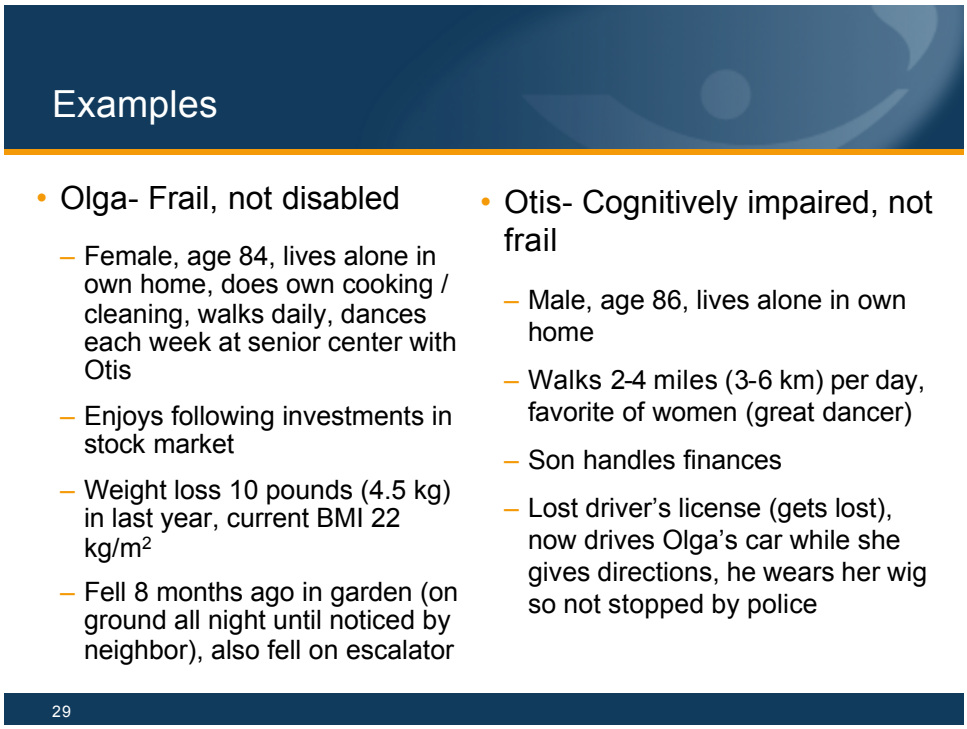
There are different combinations of frailty, disability and cognitive impairment (Figure 16).

Figure 16



Here are four examples. Charlie is frail, disabled and cognitively impaired; one would want to identify this situation at the time of underwriting. Anne is disabled but not frail. Olga (Figure 17) is frail but not disabled. And Otis is cognitively impaired but not a bit frail.

Figure 17



MR. ALAN PARIKH: Before I start, I want to make it clear that after being here for two days and listening to session after session discussing post-retirement risks, financial risks and mortality risks, including the potential downsides of things like longevity, I want to just start right off the bat and say, "I believe a longer life is a good thing." We should not lose sight of the fact that this should mean that we will enjoy more of life, and that we have more of our friends and our relatives around with us to enjoy that life. So rather than dwell 100 percent in the doom and gloom associated with this risk, I want to state that I think it's a good thing.

First, I want to kind of go over Living to 100. I attended the seminar in Orlando in January as a pension actuary trying to learn from the research of a lot of nonactuaries. There were demographers, gerontologists and people from a lot of different fields who have done research on aging and mortality. I was trying to find out what's going on here, what the trends are, what's going on at the top end of the mortality curve.

I went there hoping to learn more as a pension actuary to help me understand how retirement plan design issues might be affected, and what kind of risks my employer clients might be exposed to in the future. So this is my perspective in going to the session.

At www.soa.org, just go to the research section and click on the "Living to 100" link, and you can find the presentations and comments on the sessions. There's

some very useful information there. I encourage you to take a look at it.

Going into it, I wanted to know what the important mortality patterns were. How is mortality changing? What groupings make sense in looking at mortality experience? This is becoming an issue in the UK, where things like impaired mortality annuities are being offered; and so the Society of Actuaries is engaged in a research project, trying to gather together all of the different mortality factors that have been studied and distill that information into something useful.

And finally, the question of Omega (maximum life span)—where is Omega, what are the possibilities for reaching Omega or extending Omega? Even before Omega, the question of how we measure mortality before that is not as straightforward as we might think. That was also a big topic in the conference.

Centenarian Projections

Centenarians are people over age 100, as opposed to super-Centenarians, who are over age 110. Centenarians are not an easy group to count right now, but it's going to get easier for the Social Security Administration as their records get better and cleaner. If we go back 100 years, that's where we're going to find confirmation that these people actually are 100.

In 1980, there were about 15,000 centenarians in the United States. That number jumped to about 28,000 people in 1990. In 2000, estimates total about 72,000 people. These are rough estimates obviously; there are still data questions regarding this information.

Projections for 2050 range widely. The middle series projection of moderate mortality improvements of the Social Security actuarial projections shows 834,000 in the United States by 2050. The low series shows 265,000; the high series shows 4.2 million, which is approximately 1 percent of the projected population in 2050. So there's a wide dispersion around these estimates.

When we look at people over age 100, we're looking at the tail of the curve. We're looking at that far end of the curve, and so small differences in mortality improvements can have a big impact on the size of this population.

Bert Kestenbaum at the Social Security Administration and his group have done a lot of work in cleaning up the data on centenarians; on trying to confirm where that information is valid and where it is not. They are to be commended on this.

Right now, demographers are wrestling with the question of how we can avoid trying to project beyond the valid data of the curve. What kind of data should we be collecting? It's important to understand how our mortality tables are used; and we also, as actuaries, need to understand the impact of uncertainty with regard to mortality data.

Theories of Aging

The first few papers in the conference dealt with theories of aging. In the first paper, Gene Held talked about the current state of aging research and understanding and cited potential for advances along many different and promising avenues.

Some of us may have heard about telomere research, the idea that these tails on DNA get shorter every time the cell divides. This presents a physical limit to the number of times the cell can divide. There's also research being done on mitochondria, on oxidation in the cells. Olshansky and Hayflick believe that the inevitable process of entropy in causing deterioration of the DNA as copy after copy is made, is what leads to the inevitable decay and inability of the cell to divide. Their view is that this entropy—this inevitable disorder, which cannot be protected against—is the fundamental cause of the Omega effect, that there is a life span beyond which we are not likely to extend.

Leonard Hayflick is well known in biology circles because of the Hayflick Limit. He discovered several decades ago that the living cell, if you count and you keep track of it, is capable of dividing a finite number of times over the life span of an individual. So this finding has influenced his opinions and his research since that date.

We have had a woman in France recently die at age 122. This is now viewed by some as the ultimate cap on aging.

The elimination of all aging-related causes of death will increase average life expectancy by only 15 years. My perspective as a pension actuary, is, "Well, that's pretty significant to me." Even if I accept that Omega is not going to change—that it's going to stay right where it is, that we're not going to have the ultimate aging breakthrough and cure for aging that some are touting—I think this has got to be significant.

This ultimate limit and the very difficult nature of moving that limit is very important, because there is so much financial interest on the part of many different parties in making us believe that we can do something to stop the aging process. When there's a breakthrough of even the most minor kind, the news media is going to jump on it right away. There are people trying to sell us products that make us believe that we're going to live longer, that we can stop this process. There are venture capitalists trying to raise money on the public markets by trying to sell different investment ideas about aging.

So there is a real possibility of an investment bubble happening in the next few years around aging research. So anything that we hear in the news media about breakthroughs in aging research, we have to take with a grain of salt. It's important to listen to the arguments of Olshansky and Hayflick.

Bottom line, from my perspective as a pension actuary, I need to be concerned about what impact aging has on my employer costs for retirement plans.

Individual Causes of Death

Eric Stallard presented a paper on individual causes of death, trying to model death with a multiple-decrement model with hazards such as heart disease, cancer, stroke, etc. When he got into the data and into the death records very, very deeply, he found that a simple competing-decrement model was not a useful one—that multiple causes of death, especially at the highest ages, are the norm rather than the exception. You tend to see clusters of causes when you get people in their '90s and older.

His work is geared toward trying to forecast mortality trends and mortality changes due to progress against specific diseases; but, as he found, it's more difficult than it sounds.

Competing Expectations

Eric suggested that life expectancy will increase approximately one year in each of the next three decades. We've seen that in the last couple of decades, and perhaps that's a decent approximation for what has been happening recently in the United States. Olshansky and Hayflick might be somewhat optimistic. There's contradictory data on whether differences in mortality between men and women are narrowing. Colin will comment further on these trends.

Some experts expect more radical change. Obviously there's a lot of hype, and there's a kind of unfounded assertion going on out there.

The consequences of being wrong are different depending on what the mortality assumption is used for. Eric Stallard mentioned that the Social Security Administration projections would put the United States in 2080 where Japanese mortality is today. He thinks for that reason that we might view those projections as being too low for mortality improvements. These long-term projections have significant implications for the long-term financial health of Social Security.

Notable Patterns

What we found in looking at the empirical research—what kind of came through in a number of these studies—is that we don't get a monotonic increase in mortality rates past age 100.

I look at my old Group Annuity Mortality (GAM) '83 table, which I'm required to use for some calculations, and I see that that mortality rate after age 100 would increase monotonically to 1.0 at age 110. The experience, the result of a lot of different studies shared at this meeting, has been that we tend to see a leveling off at age 100. We're seeing around 40 percent to 50 percent per year is the ultimate mortality rate. Although there is difficulty in getting complete data here, it does seem like there is a leveling-off there. This is somewhat counterintuitive.

I was pleased to see that there is a leveling-off in the latest lump sum table, Group Annuity Reserving (GAR) '94, which we're going to be using for lump sums starting in 2003. The results of this research and others have made their way at least into a lump sum table for pension actuaries, which is good news for me.

At this rate though, the chance of surviving from 100 to 110 is about 0.6 percent. So for practical purposes, topping out that table at 110 is fine. If we think about the population of people at age 100 right now, 70,000 people, that still leaves only a few hundred people at the end of a 10-year period at age 110 and above. So for my purposes as a retirement plan actuary, that's plenty good enough.

Changes in Mortality

Michael Virga talked about his experience as actuary for the Civil Service Retirement System and the Federal Employee Retirement System. James Fox talked about the New York State Employees Retirement System. Adrian Gallop talked about the UK experience.

In general, we're seeing some consistent trends that the life spans among these populations have been increasing over the last couple of decades about a year per decade. There is a little bit of variation; but in general, the trend seems to be common across countries.

In Japan, the female life spans are increasing more rapidly than male, and they're also seeing that the trends are not slowing down. If we looked at Japan as being kind of a harbinger of future change, then things won't slow down here either. That trend seems to be marching toward Omega at the same rate it was 10 or 20 years ago.

Michael Virga had some other interesting results, especially about variation in mortality rates among income groups. First of all, he was able to verify from his data that 40 percent or so per year is a decent top-end estimate for mortality. His measured disabled mortality at retirement would be about four times that of healthy retirees for ages 55 to 59. The variation by mortality, by income or disability at retirement does have a select period that wears off after 10 or 20 years.

What's most interesting to me from this study is the strength of income as a factor in determining mortality rates, because it's kind of a select factor. He found that income at retirement is as powerful a factor as disability status in determining future mortality rates. So based at least on the Civil Service Retirement System, pay at retirement—not so much amount of benefits, though there is a correlation between them—but pay at retirement, especially the lowest paid groups versus the highest paid groups, was as useful a factor in distinguishing homogenous mortality groupings as disability was.

Groupings That Make Sense

What groupings make sense? In general, from a retirement perspective, I'm comfortable using mortality tables that are averaged over a general population. The need to get more specific about mortality rates and the need to identify distinguishing factors becomes more important when we start looking at the individual annuity market; and we're starting to see this in the UK.

The UK has reformed their Social Security system, and at least part of their system is a defined-contribution (DC) type system, of the type that is being advocated for the United States. As part of this, there has evolved an impaired annuity market through which people are actually able to go to insurance companies and buy annuities that reflect their impaired health status of various kinds—as well as smoking, gender and other factors.

It's a developing market, but it's important when we think about the equity of one type of reformed Social Security system. If we were to have account balances, and were to try to insure income against longevity by mandating that people take their account balances as annuities, if you try to force people into either simply a gender-specific mortality basis or a relatively small number of factors, then you can wind up perpetuating the perceived inequities of the existing system.

For example, if you take minorities and you ignore minority status in offering these annuities, then you'll find that, for instance, minority groups with higher mortality rates wind up getting a raw deal when you force them to convert their account balances to an annuity. That suggests the question, "Do we offer race as one of the factors in determining annuity purchase rates?" I know we can just imagine how that discussion is going to go in the public. It is kind of mind boggling, if we think about the possible future course of Social Security reform.

Income, Economic Status

Income and economic status also are factors that influence mortality. If we look to the background of the RP2000 table used by pension actuaries and look to the work that that American Academy of Actuaries did, that was an example of how we're seeing that income and, in this case collar, (blue vs. white), are important determinants.

You also can see some of this in the initial research conducted by the SOA on its Web site about factors influencing retirement mortality.

Omega

There was a lot of discussion about Omega and about how we extend the table—people trying to use Gompertz models, for example. But I think in general, we're going to have to look to empirical data to see how mortality beyond 100 develops.

I have to point to the outliers, because that's where the important stuff is happening. While it's scientifically comforting to recognize there may be a cap on

the ultimate Omega for mortality, we also need to be aware of how these tables are used, where the risks are, what the possible downsides are, and to use our tables accordingly for that. Obviously mortality tables are used for different purposes by everybody in this room.

Pension Fund Pessimism

I can understate or overstate the values of pension fund liabilities by using an inappropriate mortality assumption. Usually I have time to gradually catch up if I look at my pension liabilities, in general because the changes resulting from the use of an outdated mortality table occur over decades, I have time to make that up. In the short-run, the volatility in investments as we're seeing now, far outweighs the volatility in mortality rates. So it's less of a concern, but I still need to be aware of it.

Life Insurance Ramifications

Many in this audience are familiar with the importance of using the right mortality table in life insurance and annuities. We've got to make sure these tables are appropriate for the purpose, and we need to understand the consequences of uncertainty. So that's where I think the discussion about Omega is very, very important. If they are actually at a point now where they are tinkering with the machinery—even if we think it's unlikely, even if we accept the idea that this entropy in DNA is inevitable and irreversible and that we can't somehow rust-coat or galvanize our DNA—we at least need to understand what the mortality implications are if those processes are somehow arrested. From what I've seen, research has not produced practical results yet; but five years from now, 10 years from now, things could change.

Margins

Margins and understanding the downside risks are important. The implications of knowing what their effects will be on our stakeholders are important, whether they be shareholders, employees, etc. Outliers can be important. It is important for us as actuaries to focus on those, because we need to know what the downsides can be.

People Working Longer?

Can people work longer? This is a subject worth a lot of discussion. For us it's a key question, because from what I've heard the last couple of days, a lot of the evolving retirement system is moving toward people working longer.

Managing Risk

But if I look to my work, I think that what I've seen over the last 10, 15, 20 years is that my clients have moved more toward hybrid and DC plans, largely driven by their desire to get away from the investment risk.

In the process, my clients also have unloaded that longevity risk onto individuals. The consequence of that would not be so bad if individuals were then able to take

that longevity risk and go to the insurance market and immunize themselves against that risk.

From the standpoint of an employer, the investment risk can be diversified against. This risk can be mitigated, in whole or in part, by unloading that risk onto the employee or either the employer or employee can diversify their asset mix.

The longevity risk that employers are facing is diversified across a large number of employees. But when they unload that longevity risk onto those individuals, it becomes an individual risk that is far greater. Unless individuals are able to go to the insurance market and purchase protection against that kind of risk, the effect of this trend has been to magnify the amount of risk that people are exposed to.

So an important point to recognize is that in the trend toward DC plans is a magnification of the amount of risk out there, even though tools exist for people to immunize themselves against it.

More on Retirement Systems

Public pension, Social Security and Medicare haven't moved toward hybrid plans or DC in the same way that private pensions have. But if mortality improves more than expected, then future generations of taxpayers or beneficiaries will be left holding the bag for Social Security, and that will result in huge political discussions.

Less than 1 percent of qualified plan assets are used to purchase annuities. Even if you drive that up to 2 percent, that's still not significant; so in any case many individuals are left holding the longevity risk.

MR. COLIN ENGLAND: A quick observation on life expectancy: I look at life in quarters. I figure you get through the first quarter; well, virtually everybody gets to 25. The second quarter, that's when you do most of your hard work. The third quarter, hopefully you're coasting a little. And it's a struggle getting through the fourth quarter. If you get to overtime, God is with you! So we're really here talking about people making it through the fourth quarter and into overtime. So hopefully that's a good result.

Pension Plan Issues

What do those pension actuaries care about, for those of you who don't care about pension actuaries?

First, we care about pension funding. Our clients care deeply about pension expense and pension disclosure, so we care about those topics also. Our plan sponsors even occasionally care about plan termination liabilities, but not as much about these other subjects. They care not at all about mortality assumptions, because we're the actuaries. We got to put something in there that sounds actuarial; so we talk about mortality assumptions.

The biggest issue for my clients, at least, is if you actuaries don't have a clue as to what you're talking about in mortality improvement, how in the world should I recognize it? What are my choices, and what are the financial implications?

And finally, because you can't talk about liabilities without talking about assets—or we wouldn't really be actuaries—it also should affect asset duration, which certainly has at least some implications for pension plans.

Pension Funding

First off, let's talk about pension funding. Rough numbers: A five-year improvement in life expectancy at 65 is roughly a 10 percent to 15 percent increase in the present value of the benefits. That's an old rule of thumb. It even works for modern tables, so it's worked for at least the last 30 years. That is more or less equivalent to a .5 percent to 1 percent drop in the discount rate.

Obviously groups with lots of old people—and steel plans immediately come to mind—with small groups of active employees, take huge hits from changes in mortality. I can remember that the actuary of Allis Chalmers advised them that once they sold all their employees off and had a core of maybe seven employees and 11,000 vested terms and retirees, after awhile the UP84 really didn't look like the right mortality table for them. If they went to '83 GAM, one of several things would happen. The first one was they would drive the company back into bankruptcy, because they didn't have anywhere near enough revenue to make the contributions required.

The second one was, they could simply ignore this and hope that all the fiduciaries would be dead before anyone in the government and the participants caught up with them. Their attorneys advised them that that was probably not a good approach.

And third, they could suggest that maybe this would be an excellent time to take federal pension insurance, which was, in fact, what they ended up doing. And their participants, in fact, did significantly outlive that table. That tells you that there is at least some real risk here that you can't make up with additional contributions.

This may not be obvious, but the largest impact is on those people who used funding methods with slower cost recognition, such as projected unit credit, as opposed to people that use entry age normal.

One of the big issues for employers is, once you put a dollar in, you can't get that dollar back. So overfunding a pension plan is up there with giving poison ivy to all the employees in things they really want to do. The governments care both ways. The Pension Benefit Guaranty Corporation would love for you to put in every last dollar you could, even if it drives the business into bankruptcy; because at least then, you will have well-funded your pension plan. The IRS is not as enthusiastic about large deductions, so I have not ever heard of the IRS questioning anybody's

mortality assumptions. Interest assumptions, yes, but mortality has not been one of their big issues in life.

The problem is, of course, how do you recognize the increase in life expectancy, and how much time you have to fund it, once it's determined that it is, in fact, real?

Expense, Pension Disclosures

By the way, pension actuaries, are you having any issues with the recent asset changes with your clients? Yes? It sounds like it's kind of an issue. It is for mine as well; and everyone I've talked to seems to think that it's perhaps making this one of our most interesting years, to quote a Chinese proverb.

It's the same issue here for funding as in expense and disclosure—how quickly to recognize the change. The employers last year and this year were piling loss upon loss. So we're all outside of the corridor where we have to recognize gains and losses over some period of time. All the employers want well-funded plans that look good in the footnote disclosure and low expense—or negative expense, which is income—that looks great on the income statement. They are not getting that. And this is two years in a row they're not getting it, and they're getting a little excited about this.

The positive part about this is that your typical accountant couldn't tell '83 GAM from a 1959 DeSoto. So it's not a big issue for the accountants, except where they get actuaries involved. And unfortunately several of the accounting firms have actuaries, so they can tell the difference.

Termination Liabilities

Plan termination liabilities. I have never had a client ask about what the plan termination liabilities are, except in two cases. And that is when they are buying or selling a division, and it might have something to do with the sale price. Generally, for those companies that are folding—and I've unfortunately had to deal with one client going into bankruptcy; though in 20 years I guess that is not too bad a ratio—termination liabilities is not one of their critical issues. Their critical issues have nothing to do with a pension plan. It has to do with financing, which isn't our business, fortunately. So they don't really care deeply about the pension plan. At least most pension actuaries I know, when they're trying to estimate what the liability is in a termination, primarily for asset transfers, do it not by varying the mortality table to what we think the insurers are using, but by using lower interest rates.

Generational Tables

In addition to tables such as the RP 2000, generational tables are the other alternative. I'm not going to talk extensively about these, but I do have one question here: "How has life expectancy, at least as estimated by our mortality tables, changed over time?"

Based on over 40 years of mortality experience, we now think that men will live three years longer and women almost four years longer. The thing that fascinates me most, though, is the change in the '83 to '94 GAM, where we now think that women are dying quicker. God knows why. But we at least think that way.

And if you extend that to the projection scales of the '94 GAM, if you project out, say, 20 years worth of improvements, you'll discover that in 20 years, we think that women are going to die just as quickly as men. Is that reality? Who knows? I'll be back in 20 years to talk about it. If you're still here, my guess is that something went wrong.

Assumption Issues

The mortality assumption issue is the big issue here. What do we do and when do we do it? And then there are some less significant but related issues: Do we project a mortality table? That's a simple way to do things—say, '83 GAM projected 15 years. All of our computer systems hang with that. It's easy to check. It sounds like we're doing something useful, but the problem is that what we would do is to improve the mortality for the older people just like we improved it for the younger people. And the studies we have say that isn't the way it really works.

So there's been a big push recently in the Society and other places to use generational tables, which are far better reflections of improvements, because they say, that over time the younger people are more likely to be effected by improvements in mortality, because the things that would have killed them earlier are gone. So that's the way most everyone seems to be going. My pension actuarial colleagues, what do you think? What are you all doing with mortality tables? Rejecting existing tables? How about generational mortality tables? How about doing nothing? Is that a solution?

The other problem is—at least with the plans I deal with, which are generally somewhere in the 1,000 to 10,000 life plans—that they're too small to do any kind of experience rating on mortality. There isn't enough experience to do that. You need really big plans to do anything like that; so I can't really tell if one of my clients has better or worse mortality than the '83 GAM or '94 GAM or whatever. I can only tell that people are going to die either more or less than the table projects every year, because I've never been able to get a tenth of a person to die in a year. And if I project that 9.3 people die, I'm almost certain that it will be either more than nine, more than 10, or less than nine.

Recognition

And then we get to recognition. For my clients, recognizing what their actuary says is likely to be reality is a big issue, because that affects their profit and loss (P&L) and how much they have to contribute to their pension plan.

Some of my clients have said, you know, this would be a good time to contribute more to the pension plan. We can afford to do it, and the pension expense doesn't

look too bad. Yes, let's go ahead and recognize these improvements. It could be worse if we had to do it later and if you happen to be right.

And so we end up with higher contributions in early years. There is always the issue of recovering overfunding; but if you have a significant group of active employees, that shouldn't be too huge an issue, because you're probably going to be making contributions in the future. There was a period not all that long ago when people said, "These pension plans are great. People's benefits go up every year, and I don't contribute a dime! And even better than that, I show $10 million a year in pension income. It's wonderful!"

Options

Anyway, for clients, the first option does not really sound like a great idea, because putting more money in is not all that exciting, and reflecting more expense is even less exciting. So the other answer is, "Well, if we don't do it, we're going to see gains or losses. In fact, we're going to see losses because of this. Now, we may see offsetting gains from other items, but we're not likely, over the next 20 years, to see a lot of gains from mortality, because we're under-anticipating that risk."

Lower contributions are not disturbing their peace and quiet greatly, even though it means lower deductions; but perhaps their business is earning less, so they're not all that upset about losing the deduction. In effect, instead of amortizing that increase over 10 years, we're amortizing that increase over the lifetime of employees.

There's an underfunding risk, but underfunding doesn't scare employers nearly as much as overfunding does, unless they drop below 90 percent funded on a current liability basis, which does get them excited. And that's simply because of funding rules.

There is, however—for those of you who have followed the steel industry—the potential for dramatic incidents. The steel industry has fundamentally dumped most of the steel pension plans; most of them now reside at the Pension Benefit Guaranty Corp., with only a handful of them still in existence. That is because they had really old populations, and they couldn't afford to pay for those benefits. Losses due to mortality were just like somebody shooting you after they stabbed you 17 times. It did not improve their health.

Assumption Consequences

Let's talk briefly about the assumptions.

I started these with assets equal to funding liability, because that's simple. And life is always simple, right? I projected a 20-year improvement in mortality from the '94 GAM table, simply because that led me to the kind of cool result that women live as long as men. We had a long, fascinating conversation this morning about it, and I think I'm the one person of the opinion that in fact, men and women

theoretically could live approximately the same time—on earth that is. We also assumed the active population didn't shrink.

We could have done all kinds of asset performance kind of things, but that really had nothing to do with the point that I am trying to make, so we didn't do any of that. And just for simplicity, we assumed that mortality improvements apply to everybody and used the entry age funding method.

We used three plans roughly similar in size. One has a lot of old people, meaning retired, in this specific case—probably at least twice as many as the normal population. The second is more what I think of as a normal plan, a normal population. It had a reasonable group of retirees. They've had roughly the same number of actives over the last four or five years. It was a reasonably stable company, and one that's been around for only about 20 to 25 years, so they don't have a huge number of retirees yet.

And then a start-up that, if they had any retirees, there weren't many of them.

They were all roughly the same size, and we did normalize their costs a little so that the charts would be more comparable.

Anyway, first was the mature group. What a surprise—we see a big spread between early recognition and deferring recognition. There's nothing terribly exciting there. All of you had probably figured that out. Second was the normal group—not as much of a spread, much flatter lines, after the initial 10-year period.

And then we have the start-up group. After 10 years, there's not a heck of a lot of difference, except in the late years.

What does this tell us? One, the risk of deferring the recognition of future mortality is a heck of a lot greater in a mature group. So if you've got a client with a lot of retirees, this is a discussion you really need to take seriously. And you need to do what you can to convince them that deferring it has serious ramifications. Now maybe the ramifications are not as great for the employer as for the individual fiduciaries to the plan, but there's a heck of a lot more risk with a mature group.

In any case, if you recognize this early, you're going to get bigger deductions and bigger contributions and higher expense in the early years. This is nothing terribly surprising.

Asset Duration

I don't know about other pension actuaries, but asset duration has become more of a problem for my clients. This has always been an issue, because the liability duration in a pension plan—other than in a pension plan that's almost all retirees—is really long. Getting a liability duration of 20 years or more is not difficult in a pension plan.

Also, there are not a lot of long duration assets. Thirty-year Treasuries are going away. There are a few companies that offer longer-term bonds, but not many. Using 20-year Treasuries and Corporates makes it a lot more difficult to try to match the asset and liability duration.

Now there are strips and synthetics, but I'm not getting into that here, because that's beyond my expertise and certainly beyond what I'm willing to talk about.

The other half of this is, I have only a few employers that I work with that actually care deeply about wanting to try and match their asset and liability duration. As a result, they will likely experience much more volatility in expense and contributions due to changes in interest rates.

MR. GUTTERMAN: As we can see, mortality is and will continue to be significant to many aspects of actuarial work. In addition, mortality remains controversial, as there is a wide range of opinions regarding mortality projections and their implications.

Let me start off by asking a question of the panel: What do you think is the biggest risk involved in the projection of mortality?

MR. ENGLAND: I'd say the biggest risk is discontinuity. We're great at making linear projections of things or quadratic or even higher-order mathematical projections. What we're not good at, for the obvious reason, is guessing what the huge changes are that might make for massive shifts.

If tomorrow they discover some method of eliminating HIV entirely, through an inexpensive vaccine, we'd see life expectancy skyrocket in Africa over the next 10 or 15 years. We really have no good way of projecting something like that. These types of changes represent the greatest risk to pension plans, because something like that can very quickly change life expectancy.

MR. PARIKH: I think that risk that Colin described is largest with public employee plans—big plans that are more oriented toward annuities, which are obviously sensitive to this. It's less of an issue for DC-type plans, because that risk is borne by the individual. But I agree that public employee plans and Social Security—the funded status of Social Security and the long term financial health of the system—could be greatly impacted by that kind of discontinuity.

FROM THE FLOOR: Regarding population mortality improvements of the last three decades, when you eliminate the impact of the change in smoking habits, what were the residual improvements? Was that studied?

DR. POKORSKI: We didn't look at that issue separately in our study.

MR. ENGLAND: With increased life expectancy, coupled with the tendency for

people to attend school longer, it seems that people are spending less and less of their lifetime generating income, while expecting to spend more and more of their time spending it. I think that leads to the question of: Is 65 a reasonable expectation for retiring?

MR. PARIKH: Presumably people are going to college to be able to be more productive so that they will have to work fewer years to fulfill their obligations to society. If you look at the college environment, people who stay there for their whole careers and get tenure often work well into their 70s. So maybe that's a new model for a new economy going on in academia.

FROM THE FLOOR: My impression is that we have left out one major topic on pensions that deserves more attention. We have focused on funding and on expensing; but disclosure and timing is a topic that needs further discussion.

Proper disclosure would lead to the destruction of corporate balance sheets through the use of additional minimum liability calculations. There's a real issue as The IRS is now dictating more and more of what our standard mortality table should be. And so in many cases, we are simply following government regulation, rather than using the right table.

What that means is that nobody really wants to be ahead of the pack (compared to peer companies) to reflect what are realistic mortality tables. That would create a competitive disadvantage on our income statements, on our balance sheets and so forth, even though as actuaries, we may say, "That's a smart thing to do." So I think a third topic in any discussion on mortality should include disclosure issues.

MR. PARIKH: I agree that the fact that the IRS has gotten into the business of mandating our mortality tables, and the fact that we've been simply complying with the requirements and accepting the standards that they set, means that we've lost control of the assumption. And sometimes we forfeit the control of that assumption for our FAS determinations, which should be independent. Our FAS determination should reflect what we think are the best expectations of the experience for this group of employees for the plan.

So I absolutely agree, especially now with what's going on in balance sheets for June 30 and September 30 and, the upcoming December 31 measurement dates. I think that's a valid topic for further discussion.

FROM THE FLOOR: At the same time, I wonder what kinds of movements we've seen in the change of mortality assumptions on calculations that are not tied to the current liability.

I've picked up a number of reports over the past few years on which I see actuarial assumptions that are quite old that haven't been updated. I wonder if the Society has done a study on the changes made in underlying mortality assumptions for

purposes other than the determination of the current liability. I think in some sense, the IRS has served to drag us from moving in an area that we really should go.

As a follow up, this morning a number of us sat in on an interesting session on ethics for actuaries. I wonder in today's environment what kind of ethical pressure we're under to raise these topics, at the same time that our clients are telling us that they don't want to make further contributions.

FROM THE FLOOR: I'd say that from an ethical standpoint, we have to raise these issues. We also have to be aware of what our clients' concerns are. Maybe we don't recognize things immediately, but I think it is our obligation to our clients to describe what we think reality is. And our reality covers over a long horizon, as pension funds involve fundamentally long-term promises.

This is a subject that I have discussed with all of my clients, at least some time in the last two or three years. We have developed a plan for all of them as to what we're going to do. Either this is something that we have already recognized, have intentionally deferred or, in one case, are planning to obtain agreement of the auditors over the use of different assumptions for contributions and expense.

MR. ENGLAND: How do you respond to the requirement that we're supposed to use our best estimate? Is that the best way to recognize your best estimate—a delay of recognition until a time that is comfortable to do so? Or is it our best estimate today? If you really think people are living longer, it seems to me that we don't have a lot of freedom to delay changing our assumptions.

FROM THE FLOOR: I would argue that my best estimate is a range, and there are high and low ends of the range that would be reasonable. But yes, if somebody was using '71 GAM or '51 GAM, I'm sure we would have changed it already.

FROM THE FLOOR: I'm wondering whether in view of these cost concerns we should be doing more to encourage employers to increase their normal retirement age, thereby reducing their liability.

I know the first reaction would be, "Well, we can't do that, because Social Security retirement age isn't that high." I think we ought to be doing more to increase Social Security's retirement age even more, considering how much longer people live today compared with when Social Security was put into effect.

MR. PARIKH: I think that this is one reason that there is a move to DC or hybrid plans. Making that move to cash balance plans, for instance, is a way to reduce or eliminate the early retirement subsidy. Obviously ERISA protection for the accrued benefit applies so that any kind of change you make to that is going to be something you'll have to live with—kind of a phase-in period of a number of years.

FROM THE FLOOR: I would like to comment about increasing the retirement age past 65.

One of the things that I know was found in the research done for the RP2000 table was a substantial difference between mortality for the white collar and blue collar plans. While raising the retirement age might make a lot of sense for white collar plans where there's not a lot of physical stress on the participants, for a blue collar plan, it does not make as much sense. It really is not very practical for those participants to continue working past age 65. In fact, our mortality assumptions for those plans should also reflect these differences in mortality, which would result in a smaller impact on the plan sponsors for mortality improvement in the blue collar plans.

A question was raised earlier concerning the difference between smoker and nonsmoker mortality. I believe that a lot of the mortality improvement that we've been seeing recently is because of changes in smoking habits. Given that the most initial smoking is begun before age 20, there's a substantial lag between the change in overall smoking prevalence and when that shows up in mortality statistics, as the mortality impact of smoking doesn't show up until the 40s and 50s and even 60s.

MR. GUTTERMAN: We saw in the 1960s a very substantial difference between men and women and smoking habits, where approximately half of men smoked, but less than 20 percent of women. That difference has narrowed substantially, which is a significant reason why the trends in male mortality have been better recently than female mortality. My personal opinion is that mortality for men isn't going to catch up; we're at a point where those smoking prevalences have pretty much stabilized, and in the next couple of decades we'll move back to a more historic difference between male and female mortality.

Separately, there are different types of mortality discontinuities. There are one-shot discontinuities, such as September 11, and then there is another type of discontinuity, consisting of structural differences and changes, evidenced in the short or the long term.

HIV-AIDS in the United States for a while, at least, was very short-term. The effect of smoking is long term, which is far more difficult to pick up and potentially far more important in the long term.