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Agile or Fragile? Underwriting and Mortality at the Older Ages: Part 1

Track: Product Development

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Summary: An aging population is presenting insurers with an increased number of cases being sold at older ages. For success in this market, it is crucial that the methods of assessing the health of the insured as well as the resulting mortality costs are based on the best information possible.

MR. RICHARD L. BERGSTROM: We are actually presenting two sessions on "Agile or Fragile? Underwriting and Mortality in the Older Ages." Our first panel will talk about I call the aesthetic implications of risk assessment. Our panelists consist of an underwriter, a medical director and an actuary.

I work with the Seattle life practice of Milliman. I'll be moderating this session. I'll also be moderating and speaking at the second session. Our first presenter today is Doug Ingle. Doug has spent more than 30 years as a life insurance underwriter, and his time has been split between direct writers and reinsurers. Initially he

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Note: The chart(s) referred to in the text can be downloaded at:
http://handouts.soa.org/conted/cearchive/NewOrleans-May05/079_bk.pdf.

worked at IDS and Allstate, then moved to reinsurance and worked for Allianz. He became vice president and chief underwriter for AUL. Then he worked for ING Re as vice president of underwriting mortality research, and now works as director in the underwriting research department at Northwestern Mutual. He's been published in *On the Risks*, *The Journal of Insurance Medicine*, *Contingencies*, *Best's Review* and has spoken at numerous Association of Home Office Underwriters (AHOU), SOA and American Academy of Insurance Medicine (AAIM) national meetings.

Our second speaker is Dr. Tom Ashley. Tom is vice president and chief medical director of Gen Re Life Health in Stamford, Conn. Dr. Ashley studied biochemical sciences as an undergraduate at Harvard, followed by medical school and a residency in internal medicine at Case Western Reserve University. He is board-certified in internal medicine, geriatric medicine and insurance medicine. Dr. Ashley practiced primary care internal medicine and geriatrics for 12 years in Lincoln, Neb. His insurance experience spans 16 years. He spent 11 years on the direct side before moving to Gen Re in 2002. I should also point out that both Tom and Doug are members with me on the SOA's Mortality & Morbidity Liaison Committee.

Our third speaker is Chris Shanahan. He's our token actuary on this group. Chris is senior vice president of Scottish Re. His responsibilities include management of Scottish Re's research unit. Chris joined Scottish Re on January 1 as part of Scottish Re's acquisition of ING Re's individual business. Chris spent three years with ING Re and was responsible for ING Re's mortality research team, including development of ING Re's mortality assessment system, as well as term product development, corporate-owned life insurance (COLI), business-owned life insurance (BOLI) and critical illness pricing. Prior to ING, Chris also served eight years with Lincoln Re, most recently as second vice president of pricing and product management.

MR. DOUGLAS INGLE: I'm going to start by talking about preferred the way it's done today. Then we'll segue onto interesting topics after my presentation with our other esteemed speakers here. My portion will address what's going on right now in the industry—what we have and are doing now, As well as what the advantages and disadvantages are of what we're doing with preferred right now. As we all know, preferred basically subdivides the standard class. In the underwriting community back in the 1970s and 1980s, we used to try to identify a group of individuals that were not impaired—they're basically healthy—and we used to call them "standard" risks. In the early 1990s, we started to take that healthy standard class and substratify them into finer nuances that would predict future death within that standard class. Clinical medicine was thinking about this concept 40 years prior to the life insurance industry's robust use of preferred criteria.

Back in the 1940s, they started trying to figure out what the risk factors were for developing coronary artery disease (CAD) in a healthy asymptomatic population. The American Heart Association (AHA) knew the number-one killer of people in the United States was CAD. The AHA wanted to figure out what the risk factors were for

developing coronary disease. If we can identify those factors, maybe we can modify those factors and reduce CAD in the U.S. population. So, you see a big similarity. In both ways we're talking about healthy asymptomatic populations and predicting future CAD in clinical medicine or predicting future death with preferred criteria. And, lo and behold, the vast majority of the preferred criteria are coronary risk factors, as we all know

In 1948, the little town of Framingham, Mass., started to conduct a study that was chartered by the American Heart Association. One-quarter of the population, 5,209 healthy asymptomatic men and women between the ages of 30 and 60, volunteered to be the guinea pigs that would be the healthy asymptomatic folks the clinicians would analyze. The clinicians looked at all sorts of different risk factors in an attempt to figure out what factors predicted CAD. The key factor is to note that the population was between the ages of 30 and 60, and the average age was right around 45. The goal of the Framingham Study was to find the CAD risk factors and create risk point charts. After determining the factors they weighted them through the introduction of point charts.
The statisticians and physicians worked together using multivariate formulas to determine what the factors are. It's extremely common nowadays to see these point scores in a clinician's office. The clinician ascertains your build, blood pressure, cholesterol and high-density lipoproteins (HDL). He or she can actually look up your risk for developing CAD in the next 10 years. This was the essence of the Framingham Study. It's a one-page score. Therefore, the score works very well for a cohort whose average age is right around 45.

Preferred risk factors are, in essence, doing the same thing, aren't they? We're trying to predict future mortality. Using what was produced in clinical medicine, the insurance industry took advantage of that information and came up with their own prediction scores as well. Based on the epidemiological data, the statistics from that were used to develop preferred. Again, keeping in mind that the average age was 45, wouldn't it intuitively feel to us that these predictors of mortality would vary by age? And intuitively the answer would be yes, wouldn't it? I know what they did at Framingham, but is that going to work for 20-year-olds or 70-year-olds?

Why don't we look at the preferred risk factors? We know what we're doing today, but let's talk about what's going on in the life insurance industry, and let's talk about some statistics related to that. I'm not going to go do a litany of all the different underwriting rules that are done. The rules don't interest me. What interests me are the statistics related to the rules. Generally, the rules used in the life insurance industry are fairly generic, fairly homogeneous throughout the industry. There are about 10 risk factors, most of which are related to CAD. There are some travel considerations and occupational risks and things like that that are usually thrown into the preferred criteria, but for our conversation today the bulk of them are CAD risk factors.

The rules may vary slightly for cholesterol or cholesterol HDL by age. There may be two or three age bands; it depends on the company you're working with. A fair number of companies have adjustments for the lipid levels and some for blood pressure, but generally the other factors aren't very often stratified by age.

How do these factors play out at different ages? Let's take an example that we have very good data on: smoking. It's not that smoking is necessarily a preferred risk factor, although smoking does predict future mortality, but I'm going to throw that on here because it is a Framingham risk factor and we have insured lives statistics on smoking and its ability to predict. Note, smoking as a risk factor has less impact on mortality at the older ages.

This article appeared in the *Journal of the American Medical Association* on April 20, 2005. It used the three statistical samplings from the U.S. population that are referred to as the National Health and Nutrition Examination Survey (NHANES): NHANES 1, 2 and 3. This is a random statistical sampling of the U.S. population where they gather a bunch of data on these individuals that live in the United States and track them over time. The data that they're gathering is mainly medical in nature. There are three different surveys that have been completed, and they have been tracking these people for mortality. Clinicians and statisticians can get access to the data sets, and they can do analysis on it. Katherine Flegal, et al., put a group of researchers together to see if they could figure out if there's a difference in mortality based on body mass index (BMI).
BMI takes your height and weight, and it converts it into one number. The ratio is kilograms divided by meters squared. Your weight in kilograms divided by your height in meters squared creates your BMI. The researchers took these random samples from the U.S. population and stratified BMIs, into one of these five buckets right here and tracked them over a 10- to 15-year period of time to see whether BMI made a difference. As they were analyzing the data, they figured out they need to stratify by age as well, because it turns out that, if you look at the next three graphs (Ingle Slides 8-10), at the higher BMI's—as you focus on BMI's of 35 and over —note what happens. This first slide is for 25- to 59-year-olds. The second is for 60- to 69-year-olds; note the mortality rate dropped a little bit. And for 70-and-over, it drops even more.

The important point to note is that these are relative risk models. The statisticians used the body mass index of 18.5 to 25 as the reference range. You notice for all three graphs that the reference range stays right at one. All you're doing is comparing BMIs of the different cohorts to the reference range, but the uniquely interesting thing is that, by age, the ability of BMI to predict all-cause mortality diminishes with older ages. Thus the findings from this particular study reveal weight was associated with the lower risk of mortality as age went up. Yet in the life insurance industry, we use one build table. Here are statistics that say maybe even more than one build table that is graded by age might be appropriate.

Let's go to another study. This one was published back in 1998. It's the Cardiovascular Health Study, and Tom's going to refer to it in his presentation a little bit later. This study looked at individuals age 65 or over from four different counties across the United States. There were 5,201 men and women that volunteered for this particular study. They tracked them for five years. There were over 70 risk factors they looked at to try to find risk factors that predicted mortality in this older population, and there have been a lot of reports out of this particular study. I'm going to hone in on a couple that are related to the preferred risk factors as we use them today.

Again, there are five buckets that they would throw the folks into, based on their low-density lipoprotein (LDL) cholesterol reading. LDL is often referred to as the bad cholesterol. HDL is the good cholesterol. Let's take a look at what happens for men and women ages 65 and higher. These results are totally counterintuitive to what we might have expected was going to occur. As LDL cholesterol, the bad cholesterol, numbers increased, mortality actually went in the opposite direction than we would have expected, and, in fact, the worst mortality was associated with the lowest levels of LDL cholesterol. So, as a predictor (remember, we're talking about preferred risk factor predictors of mortality) there have to be some confounding things that are going on here. It's not to say that LDL cholesterol is good for you at the older ages. It's just that statistically it's interesting to note when you run a sample and you look at the results on this they're a bit counterintuitive.

There are some other conclusions from this study that I was surprised to see. Note not only did LDL go the wrong way, but looking at HDL, which is the good cholesterol, and also at total cholesterol, these items were not associated with mortality at any point in the modeling. This is a multivariate model that adjusts for other confounding variables simultaneously. The intent is to see whether total cholesterol or HDL were important predictor’s of mortality in this older age population. So, surprisingly enough, the answer is no.

For blood pressure in general, we do stratify mortality by age, and at the older ages we allow more liberal guidelines for the blood pressure readings. Looking at the Cardiovascular Health Study, blood pressure continues to be an important predictor of mortality. Although blood pressure tends to rise with age, this shows from the perspective of risk that it still holds its ability to predict mortality. So, whether we should really be stratifying blood pressure by age as much as we do may come into question. In essence, the conclusion from this component of the Cardiovascular Health Study was that systolic blood pressure is still an important predictor of future mortality for people over the age of 65. With that, now that we've kind of thrown the preferred criteria out on its ear, I'm going to turn it over to Tom for some new ways of thinking and additional insights.

DR. THOMAS ASHLEY: It's been my experience, and I think if you talk to your underwriters and medical department, you'll find that we all share a deep intuition,

that when we look at risk assessment in elderly applicants it's a different exercise than we've been accustomed to and different from the core of our market, which are those 45-year-olds in the Framingham Study. In addition to that sense of the task of underwriting elderly applicants, we also have a suspicion that when we look at the underwriting file it doesn't contain the information that we really need. So we feel like we're a bit in the dark. And thinking about that as a geriatrician, I realized that this is essentially what makes geriatric medicine a distinct subspecialty in internal medicine. There is a reason to consider geriatric medicine differently. What geriatric medicine brought to everyone's attention is that when you're looking at elderly people, if you're trying to anticipate health problems and mortality, what really matters is function, as opposed to the way we think about younger people, where we look at medical history.

I want to cover these points: First, that mortality risk corresponds to functional capacity almost to the exclusion of medical diagnosis. Second, functional impairment in the elderly is extremely common. Third, our underwriting practices do a very poor job at detection of functional problems, and, therefore, we need to adopt a model that utilizes direct functional assessment if we want to measure mortality risk effectively in an elderly population.

First, mortality risk corresponds to functional capacity. Frailty is really an archetype of the content of geriatric medicine. Frailty is a functional syndrome. It's not a specific medical diagnosis. One of the important things to notice about this definition of frailty as a functional syndrome is that it's different from our common use of the word frailty. We all think we have some sense of what a frail old person is, but that wouldn't be good enough for clinical studies or underwriting. We can define it in an objective, more universal fashion. Here is frailty in one definition (I think the most prevalent definition in geriatric medicine). In order to consider a person frail, three of the five following attributes have to be present: unintentional weight loss, muscle weakness, slow walking speed, exhaustion and low physical activity. I put into that some of the things that I thought were critical to this definition. Except for exhaustion, all of these are objective measurable parameters that are benchmarked against a peer group of elderly people.

What matters about frailty? This study looked at a community population. They were living independently. It excluded people who were in nursing homes or who couldn't get along by themselves. A theme of some of these geriatric studies is that they're looking at populations that could very well be buying our life insurance. What's the mortality impact of frailty? In this study, over a seven-year period, people who qualified as frail had three times the mortality of the non-frail population, and that was on a univariate analysis. If you go back and adjust for lots of things that we do in underwriting—age, race, sex, smoking, activities of daily living (ADLs), even income, which makes it even closer to an insurance-buying population—and then look at common diseases—high blood pressure, diabetes, some laboratory abnormalities— you can look at all those things, control for all of

that, and still you will find a two times higher mortality in the frail elderly over a three-year period.

We'll go back to the Cardiovascular Health Study that Doug just introduced you to. Another study had a community population, living independently. There was prospective ascertainment of numerous risk factors to see which ones mattered in prediction of mortality over a five-year period. The Cardiovascular Health Study is one of the earliest and best known, but these findings are corroborated by several other studies. In this study, the mortality predictors included number one, first and foremost, that cognitive function matters in determining mortality. Physical activity and low weight, both elements of frailty, were high on the list. There were also a few laboratory predictors of mortality in the elderly; one that I'll call attention to is the serum albumen.

The conclusions of the Cardiovascular Health Study are that older adults have multiple subclinical and clinical diseases, but it's rare for any single aspect of health status to be the sole predictor of adverse outcomes. Instead, the way to predict mortality is to use objective quantitative measures of disease and not pay so much attention to the clinical history of disease. In this study, they had more information than we typically have in underwriting. Medical history won't completely vanish from what we're doing, but this study included, for example, an echocardiogram so that you know what someone's left ventricular function is. If you have that information and the other things in the Cardiovascular Health Study data set, you no longer need to pay any attention to a previous history of CAD. That doesn't change your prediction anymore if someone has had bypass surgery or a heart attack. One really important principle of the Cardiovascular Health Study is that when we look at the elderly group, there's a divergence between the medical diagnosis and the function. If you're looking at mortality risk, you need to go to the function, not the medical diagnosis. That's where the money is.

Functional impairment is also common, in addition to being an important mortality predictor. In this study of frailty, looking at a community population of the entire population above age 65, 7 percent of the subjects met the definition for frailty, and by the time you get to the population of age 80 and above, it's 20 percent of the community population. That's even after you exclude individuals that they defined as having acute and chronic medical conditions. The applications that are coming into your new business department on people in the elderly age group include quite a number of frail applicants who have significant mortality risks. Cognitive function is at least equally common.

There are two ways to categorize cognitive function. One is mild cognitive impairment, which researchers consider to be either a precursor to dementia or perhaps a risk factor for dementia. In any case, if you have a population of people with mild cognitive impairment, they will progress to dementia at a rate of about 12 percent per year of that population. Dementia is a more severe category of disease, and in the population above age 65 out in the community, 10 percent have

dementia. In the population above 75, 15 percent are mildly cognitively impaired. Above age 85, 40 percent of people have dementia, and those are not counting the people who are in the nursing home because of their dementia.

Now, our underwriting practices do a very bad job of getting at that function. One of our crucial underwriting tools in the elderly is the attending physician's statement (APS). I've been to presentations in the industry, have had questions from underwriters and other medical directors, and the questions and the presentations revolve around how you can really tell from the APS when a person is demented. What clues do you want to look for? This study says that that is an empty exercise; that it can't be done. The way this study was done was to look at a large ambulatory medical practice seeing a lot of elderly people. The investigators did formal cognitive function testing on all the people who went to see the doctor so they could figure out prospectively who was demented and who wasn't. After the patient had seen the doctor, the investigators went to the doctor and said, "Give me your assessment of the patient's cognitive function." Of the people who had mild dementia, the doctors either missed it or, if they got it right, they still left no record of their assessment on the APS. Eighty percent of the time, mildly demented patients are invisible, either because the doctor didn't notice it or because the doctor didn't record it. It gets a little better when you get up to severe dementia. If you look at the APS, 20 percent of demented patients will be undetectable from looking at their APS, and overall, about two-thirds of people with dementia. So we're not going to find the demented patients by examining the traditional body of information that comes to the underwriter.

Here are some ways of categorizing the differences between the older and younger populations. Our core market is pretty much a homogeneous risk group. Most people are very healthy, and the underwriter's task is to find the minority of people who have significant health impairments. Of those people who have health problems, most of them have only one disease. Finding the disease solves the underwriter's problem, because the medical history and the function are both highly aligned, and they both correspond to the mortality risk. But when we're talking about aged people, we have a very heterogeneous group. Many of them have a significant medical history. Many of them have multiple medical problems. Now there's a distinct divergence between the medical history and the functional ability. In my practice as a geriatrician, I would see two people with the same list of diagnoses. One would be chairbound, barely going out of the house. Another would be playing tennis. By traditional medical assessment they really looked quite similar. At the other end of the traditional medical spectrum, you will have two elderly people with no diagnosis. They don't appear to have any identifiable health problems, and again you'll see that whole range of functional ability. Some of them are housebound; some of them are playing tennis.

So, what is wrong with this picture (Ashley Slide 3, page 4)? I think that our conventional underwriting is a complete failure in the elderly population, but we haven't changed that yet. There is something wrong with that picture, and the

problem here is that this woman is dressed inappropriately for the activity that she's engaged in. Now that probably means that she has some cognitive function impairment, but I guarantee you that your underwriters and medical department are not going to be able to tell that that's a problem with this applicant. We have applicants who could either be playing tennis or having trouble holding a spoon. We have people who can ride a motorcycle. We have people who shouldn't be riding more than a rocking chair, and as underwriters we really can't reliably distinguish those risks when they come to our desks.

Worried? The conclusion is that we need to adopt a paradigm of performing direct functional assessment. We've done a lot of research on this, and our conclusion is that we need to make this universal. We need to make functional assessment, and that functional assessment needs to be a direct observation of objective measures of function in elderly applicants. Our goal was to make this specific and valid for elderly mortality risk, so we turned to the clinical geriatric literature and a nearby geriatrician. I asked Dr. Thomas Gill, a geriatrician with Yale Medical School, to help me find things that would be practical. We needed something that a paramed could perform effectively in a single home visit that would not have a huge impact on the time and cost of that paramed examination. I also wanted things that an underwriter would be able to process effectively when the application came in. Remember, it had to be a reliable mortality predictor based on clinical studies. We've called this GREAT, the Gen Re Elderly Assessment Technique.

We're not the first people to think about this. Attempts to address this problem are already prevalent throughout the industry. They depend upon surveys and on things like ADLs. If you're not familiar with that from any long-term-care business, the ADLs include these questions: Can you dress independently? Can you eat independently? Can you go to the bathroom independently? Instrumental Activities of Daily Living (IADLs) are somewhat of a higher order. Can you balance your checkbook and pay your bills? Can you ride public transportation? The main problem with that, particularly with ADLs, is that is a very low hurdle to get over. We're going to miss out on moderate and even significant risks if all we're asking for is ADLs. It's only a little bit better if you go to IADLs. Even with IADLs, we're looking at things that are self-reported. We're going to get incomplete information, and it's not going to be as reliable.

The mini mental status exam (MMSE) is a clinical cognitive function test that some companies have adopted, but the problem there is that it's very difficult to administer and to interpret it consistently, and it suffers from low sensitivity. The timed up-and-go is a test that gets at frailty. Some companies are asking the parameds to describe the applicant and the environment. There's an element of subjectivity there. It also asks parameds to do something for which they are very poorly suited. A description of abnormal gait or walking is very subtle and very difficult, and it's not something that parameds can do consistently or that your underwriters would be able to interpret consistently even if they had it.

Let's talk a little bit about the cognitive function testing, the MMSE and the clock drawing. The MMSE actually has pretty good clinical data on mortality, but it's difficult to adapt to insurance. One reason is that the MMSE was designed as a tool to look at hospital inpatients to try to separate delirium, or disease that might be temporary and related to acute illness, from dementia. A normal score on the MMSE is dependent on educational level. It's a 30-point test. There's general agreement that if you can only make 24 that there's a significant problem, but how much above 24 is very controversial. Most of us shouldn't score less than 30, maybe 29. You might miss one point. But a high-school-educated person might be unimpaired with a score of 24. It is not very sensitive. It's rather difficult to get a reliable figure on sensitivity, but it's pretty low.

One thing that I've thought about recently regarding the MMSE is that it's a 30-point scale, and they count all points equally. Four of the points come from these questions: What year is it? What month is it? What day is it? What season is it? That's part of the 30-point scale. Other questions start with "I want you to subtract seven from 100." Then it asks you to subtract seven from that, and keep subtracting seven, and you get one point for each correct answer. So if you get the first one wrong, but you subtract seven correctly after that, you don't get any points. Do we want to consider 93 minus seven one point, the same as asking what year it is? In the MMSE, if you have a threshold of 24, you could pass if you thought it was 1950, and I don't think that's a reliable way to underwrite cognitive impairment. It might not be possible to get 24 if you think it's 1950, but then the MMSE has a different problem, which is that it's redundant and inefficient, and the answers to the question don't stand by themselves.

Another popular test is a clock-drawing test, which is a very effective test at measuring the visual conceptual elements that are often part of Alzheimer's disease. In this test, we give the applicant a piece of paper with a circle on it, and we ask the applicant to draw a clock face. If you're my children's age, this will never work because they don't know what clock faces are, they have digital clocks, but the exercise is to draw a clock face and make it show seven o'clock. You can get some really interesting results. I think that none of our underwriters would have trouble saying which one fails, but there's a long way between that test and normal that is very difficult to interpret. In the literature, there are six different published scoring systems for measuring the results of a clock-drawing test. I don't think any of them are adaptable to use in the underwriting department, and I think tests like these are just very ill suited to the jobs that we need to do.

Here's a test that I chose (Ashley Slides 1–3, page 6). It's called the delayed word recall (DWR). It's published in the medical literature, including the *Process of Administration*. The paramed reads the instruction, and we've equipped the parameds with a set of flashcards with these words on them. You read the instructions. You show the applicant the flashcard, and the applicant reads the word "chimney," and then uses that word in a sentence: "My house has a chimney." Okay. The next card is "salt." "I don’t use salt." And you go through the words one

by one, saying the word and using it in a sentence. Then you go around again, and you do the same words over again. You repeat those instructions. You can use the same sentence if you want to. After you've gone through all the words twice, then we wait exactly five minutes, and the test is to remember as many of these words as you can. Take as long as you want. How many words can you remember?

The administration of that test is very important because of a process that's called registration. When I see the word, when I say the word, when I use it in a sentence, it causes me to register consciously the task and it helps me to form a memory. In people with normal cognitive function, this test, given in this way, will raise the scores, but if you have cognitive impairment, none of this reinforcement, registration and repetition will help. Your score doesn't go up if you have cognitive impairment. The way that the administration of the test is done is very important at making it more sensitive and more effective at detecting cognitive impairment. I have seen the DWR in use, but the instructions are pretty vague. One form that one of our client companies uses says to give the applicant these 10 words, and after five minutes ask him how many he can remember. But that is not going to take advantage of the repetition reinforcement. I think that administering the test that way is going to compress the scores and weaken its ability to find the people that we care about.

We've also chosen DWR because we are able to do a mortality study. We don't have mortality information on life insurance cases, but we were able to get a population of long-term-care insurance applicants. They were age 70 to 99. We had up to seven years of follow-up with an average of five years, and we had a sizable population with enough deaths to give this some credibility. In the data we got from the third-party administrator (TPA) who did the long-term-care underwriting, we also knew what the long-term-care underwriting action was. Did they issue the case? Did they decline it? And if they declined it, why did they decline it? We included in our study people who got issued long-term-care insurance or got declined solely because of their cognitive impairment. Since we're not looking at cognitive impairment in any effective way when we do life insurance underwriting, this is a surrogate for today's life insurance population. We got a mortality determination by having the TPA match these cases against the Social Security death administration public record, and then we looked at the mortality study. Laura Vecchione and Eric Golus were primarily responsible for this. Here's one way of looking at the results. Another one of the advantages of the DWR is that the outcome is very simple and straightforward. It's an integer from zero to 10, quite unambiguous. If your DWR score is two, you have almost five times the mortality of a population with a DWR score of eight. In our study, the bottom 10 percent of scores accounted for half of all the mortality.

Ashley Slide 2, page 7 has the results of the DWR cost savings analysis. The details of that are not so important because the numbers are eye-popping, I think. We assumed a very liberal estimate of a $100 acquisition cost for this test, and, excluding the bottom 10 percent, you could break even on an 80-year-old at a face

amount of $3,600. We could be off by a factor of 10 or more, and this would still be a very, very efficient test to use in life insurance underwriting.

For frailty, the timed up-and-go is a very commonly used test in clinical medicine. With that test, you have the applicant sit in a chair, and the task is to stand up, walk 10 feet, turn around, come back and sit down, and we're time how long it takes him or her to do that. That's a pretty reliable test to use, but if we ask parameds to go out and do that test, we might get an eight-foot walk and turn around. We might get a 12-foot walk and turn around. I don't think that we're going to have great reliability at getting a good measurement of a 10-foot walk, and in some examination locations we might not even be able to do this test effectively. There might not be room to do this test. Gait speed is another very effective test for frailty. It's one of the definitions of frailty. That test involves how far you can walk in six minutes. Again, that's not a very practical test to do out in the field. Hand grip is another test. I actually tried to get that one done, but when I talked to the paramed companies they didn't like the idea of finding what's called a dynamometer. It's a spring-loaded grip tester that's used in clinical medicine. So we didn't use any of those.

Instead, we turned to the repeated chair rise. It's another established protocol that's in the clinical literature in geriatrics. In order to do this test, you can't use your arms. You fold your arms across your chest, and then you stand up without using your arms, then you sit down. But we're going to make it a little harder than that, because in order to make this an effective test for frailty, we want to do more than one chair rise. We want you to do as many as you can in 30 seconds. Part of the effort that we've done with GREAT is to talk to all of the paramed companies about whether it's practical to do these tests. And it is. But how do we get a force of parameds trained to do the test? We created a video that paramed companies can use. Examination Management Services Inc. (EMSI) has been very helpful in implementing this with us. We developed a script that the paramed can take out into the field with instructions, a pre-visit screening just in case we run across some people who maybe had a heart attack last week and shouldn't do this test, and a data collection form for them to send it in and have it processed.

There is information in the clinical literature about this test. We get some ideas of what people can and can't do, and if you look at that community population again, the kind who can buy life insurance, above age 70, 22 percent of that group cannot do five chair rises. Even if you use a different form of this protocol where you give them as much time as they want, they can't do five. In a community health fair of people who might be insurance buyers, Ashley Slide 3, page 8 shows the average performance by age group. I was surprised to find that people who turn out for the community health fair can really do quite a lot of this. This is a test that is safe and effective to do, and it will tell us the kind of things that we need to know about detection of frailty in our applicant pool.

I'll close with this depiction of where I think we are with underwriting today and where I think we need to go. As Doug mentioned, we rely on cardiovascular risk factors. We look at the medical history. We're doing it wrong. We're paying more attention to overweight than underweight much of the time. We're paying more attention to high cholesterol than low cholesterol, and we should be doing it differently in an elderly population. One of the consequences of that is that there aren't very many elderly people who qualify the way we define preferred. Those people would now get standard underwriting. If we use GREAT, measure their cognitive function and screen for frailty, we'll find out that that standard population is quite mixed.

Some people have good functional capacity, and they really should be preferred. We should liberalize what we're looking at in terms of lipids and build when we define that preferred class. I think we can even liberalize what we're looking at in blood pressure. This is partly because not that the higher blood pressures don't have a higher mortality compared to ideal blood pressure, which is what Doug showed you, but since the average blood pressure is rising in this age group, our benchmark is not ideal blood pressure. It should be average blood pressure, and we can be more generous about the cutoffs as a result of that. The other part of that mixed population, though, has very poor function, and some of those people we shouldn't be insuring at all. That means that the people who pass the test can get cheaper insurance.

Another side of the spectrum is that a lot of elderly people have significant medical impairments, and underwriters are still working on the old paradigm of counting up all the impairments and adding the debits. They pretty quickly get to an unsalable expensive life insurance policy. Maybe they get to a rating. If we measured functional capacity in those applicants, we would find that they also have that mixed population. If we look at the people with good functional capacity, cognitive function and physical performance, some of those should be standard, lower rating, some sort of credit against their rating. Some of the people who are rated also have poor functional capacity, and we ought to be declining them. That's where I want to see medical and mortality risk assessment go in the elderly population, and it should be possible to implement these tests. We have cooperation from all of the nationwide paramed companies, although, as I mentioned, EMSI has gone farther toward implementing it.

MR. CHRISTOPHER S. SHANAHAN: My role in this session is to talk about the implications of this from a financial perspective. Why do we care? It should be abundantly obvious why we care. But, I think a lot of times we haven't tended to focus as an industry and as an actuarial profession on these oldest ages as much, because they generally have made up a very small proportion of the type of business that we've written.

It should be obvious after everything Doug and Tom have talked about that underwriting at the older ages is very, very hard. You're dealing with very complex

medical records. To that end, a lot of the reasons companies have pushed more into the 75-, 80-, 85-, and even, in some cases, 90-year-olds from an insurance perspective is in the quest for incremental growth, and there are some very, very large premium dollars at stake on these policies. As such, when the $1 million case on an 85-year-old comes along, there tends to be a lot of pressure to place that case because there are a lot of premium dollars at stake. So, I sympathize with the underwriters and the doctors who have to deal with this, and clearly there are multiple philosophies on how to approach these ages.

My observation over the last several years in this marketplace is that there's one of three general philosophies out there. The first is that the definition of standard is "normal." It's normal to have impairments and issues in this age group. Therefore, it's okay to have them and still be standard. Another view that we've seen in some cases is that standard means you don't have any impairments, which, as we've already talked about, has two flaws. One is that it doesn't necessarily get to the whole picture, as Dr. Ashley walked through. Equally important from a marketing perspective, good luck finding a lot of 75- and 85-year-olds who don't have any impairments. You're not going to place a lot of business that way, which leads us to what we talked about today. The third philosophy is that existing impairments don't tell the whole story. They're only part of the story, and they may not even be the important part of the story.

Clearly, different underwriting shops do things differently even at core ages, but not to the degree that they do in the older ages. Either Doug or Tom put up earlier a comparison of 40-year-olds and 80-year-olds, that showed the older age group is much more heterogeneous. That's clearly true. In addition, the underwriting practices being applied to that more heterogeneous group are more heterogeneous than the underwriting practices being applied to the core ages. Again, you have the potential for very different results, and some results are better than others. They're not necessarily right or wrong. Any time I think about pricing and underwriting, there's not so much right or wrong underwriting or right or wrong pricing. There's only misaligned pricing and underwriting. But clearly with that wide of a range of possible underwriting philosophies and results and some of the things we've talked about, it's important for anybody participating in that business to know what you're getting and what to realistically expect as a result of what you're doing.

My focus here is heavily on things from the underwriting perspective. Some of the pricing issues will be covered in the follow-up session. I think it's very important to think about or appreciate the difference between absolute and relative differences in mortality. Underwriting attempts to get at both. That's why we have table ratings and flat extras. Flat extra is your absolute difference. A table rating's relative. But we lose sight of the fact that the dollar cost associated with the same relative adjustment differs between a 25- and a 50-year old. It's going to be more because it's x percent of a larger number when you go to the 50-year-old, but what's important to realize is just how dramatic that gets when you get out to the oldest issue ages.

Mortality increases with age and so on and so forth, but sometimes if you haven't actually looked at it, just how dramatic that is can be striking. It's really a dynamic that gets to a lot of the point of this, that poor performance at these oldest ages alone, whether driven by underwriting misassessment or pricing misestimation, can materially affect the overall block of business as a whole.

Shanahan Slide 4 is a hypothetical universal life (UL) product distribution where 8 percent of the face at 25, the bulk of it being in the 45-to-65 range and then 10 percent in the 70s and 2 percent over 80. The kind of middle column there is using a typical mortality assumption. Using the present value of mortality over 30 years for each of those, you can see that you go from $3 to $5 at age 35 to $13 at age 45, but when you get up to ages 75 and 85 you're talking about some big numbers. These are discounted again, as you can see, at 8 percent interest, 4 percent lapse, as well as the mortality specific to that case. Mortality becomes a pretty important discount factor when you get out to the highest ages. But the dramatic thing to me is the impact as you look at the percentage of face distribution to the percentage of mortality on the block.

As you can see, for this group as a whole with that age distribution, the present value of mortality per thousand is about $57. If you break down where the claims are coming from over the life of the book on a 30-year present value, you get a pretty dramatic result. The 60-and-up group makes up about one-third of the face and about three-quarters of the mortality over the 30-year period, again highlighting the fact that just because it's only 10 percent of the business by face doesn't translate to it being minor to the financial performance of the block. If you talk about the dollar cost per thousand of misassessing mortality by a table, what is it? Well, at 35 it's $1.30/1000. But at 75, it's $48/1000.

There are some obvious things that come in with this. We all know how thin margins are in our business on traditional life products. Think about just the core ages, term plans, and things like that where being off on a relative basis tends to be how we think of it. We should, because most of us would acknowledge that if you're holding onto the mortality risk, either retaining it or, if you're a reinsurer, assuming it, you can't afford where margins are to have mortality that's 5 percent or 10 percent higher than what was anticipated for.

You can break it down as you get to some of these other issues and look at it on a dollar cost basis as well as why you want to fix it now, so to speak. That is affected by a lot of different things because, again, if you look at things over different time horizons, you're certainly going to get a different answer. For a 65-year-old male, it's about $8 per 1,000 over 10 years. It's kind of ignoring the tail on a 10-year term product, but it's obviously much higher than that on a UL product where you have lower lapse rates, and it's going to persist for a longer period of time. To put some dollars on it again, the cost of missing one table on a single $500,000 policy for the UL plan is about $11,000 on that one policy.

FROM THE FLOOR: What percent profit would that give you?

MR. SHANAHAN: Percent of profit is going to vary a lot case to case. That's pretty leveraged. As another way to look at it, just to provide some context of the present value of mortality per thousand over 10 years versus UL, I use 30 years basically at different ages. Again, the point of this is just the dramatic difference. It's not a little bit higher; you're talking about $190 per 1,000 versus $2 per 1,000, depending upon whether you're talking about a 10-year term on a 35-year-old or a UL on a 75-year-old. The point is that it's many, many times higher. It's *not* a linear function as you move through the ages.

With that we can construct some different things. Let's say you're talking about a 20-year term product, and this is still again on a present value per thousand basis. Think about just misassessing mortality by, in this case, four tables on a 35-year-old, 20-year term. Whether it's intentional (table shaving) or just misassessment, that's the cost of it. That's obviously going to be very material to that product or that policy. Over a 10-year period, half the period, for a 55-year-old, it's even more, and, again, now you bring in the UL. This is just being off one table. On a 75-year-old on a UL, you're talking about many, many, many times the impact in dollars of being off four tables on a 35-year-old, 20-year term plan.

One thing is that whenever I've talked about this, occasionally something that creeps in is a discussion of traditional underwriting tools at high ages not being as efficient at selecting risk, which we've already talked about. Another characteristic of that (and we're going to hit on this much more in the second session on the slope of mortality at these ages), besides being not completely effective in general about traditional underwriting in the elderly, is that it wears off. The value it does have wears off very quickly because, again, if you think about what was walked through, you're not getting at function. You're just getting at medical history, and medical histories on 75- and 80-year-olds change daily. Besides not capturing the full picture, obviously just because you had a clean medical history today doesn't mean that you're not going to have a heart attack tomorrow at the ages we're talking about.

All of that discussion sometimes has led people to suggest that traditional underwriting has little value in the elderly. I think it's important to reinforce that's not the case. Regardless of bringing in these much better assessment tools, it's important to realize that to the extent you're not, the point is not to say that we can just have slippage on that because it doesn't seem to have any value anyway. It's certainly not the case. It's not nearly as efficient as it can be. The paradigm that Tom walked through is a much better paradigm, but it's still important to note that the current underwriting process does add significant value. Even if they're not optimal standards, if you get your pricing aligned with them, it's important to stick with those because, again, while the relative value may not be so great, the dollar value is quite significant.

There are a few additional comparisons just to drive this point home. Again, the point of this portion was to hopefully create some heightened awareness of the

importance of getting the underwriting right in the elderly. Shanahan Slide 8 is similar to what I showed before, and it's a little redundant, but it helps to drive the point home. Here's the cost per thousand of, again, misassessing four tables, 100 percent off on a 45-year-old. What if you waive the $5 flat extra on a 55-year-old? Obviously that's $5 regardless of age. The only reason for picking a specific age is that the present value does take into account the mortality rates. What about shaving or missing a table at 75? Again, with shaving a table, don't think of it as shaving. Think of it as just misassessing.

Greater yet, let's talk about being off two tables on an 85-year-old, just off the charts, and, again, you can think about two tables in a lot of ways. Most people typically view the preferred standard paradigm as something to the tune of 80 percent. If a dollar were standard, 80 cents would be for preferred, $1.20 for standard, so on and so forth. It's not quite 50 percent, but somewhere in that ballpark. First of all, if you think about some of the things Doug talked about earlier, about why the preferred paradigm that we developed for core ages doesn't really stratify risk very well at all in the elderly, that's one way you can be off 40 or 50 percent easily on a large number of your older age applicants. Again, if you're off 40 or 50 percent—that's the equivalent of two tables—you're off a lot.

Think about it as from the standpoint of what Dr. Ashley went through in terms of just pure substandard underwriting. Again, you get somebody who looks great, their APS is clean, no medical history, but in reality, if you knew it, they have cognitive issues or are frail, whatever kinds of issues, you could be off easily, in that case, more than two tables. Again, as we've potentially talked about declines, but even being off two tables, this is the dollar magnitude. I've done everything on a per-thousand basis. The more tangible way to think about it is that, using the 85-year-old as an example, if you're off two tables on a single $1 million policy, you're missing about $173,000 of mortality on a present value basis. If on a significant proportion of a company's 70- and 80-year-old applicants, you're off a table or two or three or four on a number of them because of misapplying the underwriting paradigm, you can start talking about losing tens, if not hundreds of thousands of dollars per policy.

Extrapolating that as a closing point to a block of business, I thought about the UL product and a block of business that had $5 billion of inforce amount, just for simplicity. Everything I've done to this point has been male nonsmokers, though not centered on that for any particular reason, and, again, the same age distribution that I showed earlier. The present value per thousand for this block based upon that age distribution is about $57. So let's look at a couple of different things that could happen.

What if, because of the underwriting paradigm being misapplied slightly, not something terribly egregious, one out of every 10 policies in the age 60-and-up group was off by two tables? What happens to the present value of mortality? This is for the whole block. It goes up from 57 to about 59.4 per thousand, which is

about a 4 percent increase. Translating that to dollars of mortality on the block, the fact that just in the 60-and-up group, which, keep in mind, was less than one-third of the face amount, one out of every 10 policies within that group was misassessed by two tables, then this block over the 30-year present value basis is going to be missing about $11 million from a mortality perspective.

Contrast that with what if everything over 60 was done correctly, but every policy, every single one, was misassessed by two tables up to age 50? You'd get almost the same answer. It's not quite as bad; you're only off 3 percent instead of 4 percent, and it's $9 million instead of $11 million. But to put some context around that misassessing because of not understanding some of the issues in the underwriting paradigm, for the 60-and-up group, missing it by two tables on 10 percent of the policies is the equivalent of missing two tables on every policy up to age 50.

As a closing thought, taking that one level further, what if you're really off by more than that, or what if one out of every four policies was off two tables? Think about what Doug went through from a preferred standard perspective. It's very easy to get off on a high percentage at these ages on the assessment of risk by 50 percent or so, and whether you call that one in four is off 50 percent, whether you call it one in two is off 25 percent, you're talking about the entire block having its mortality off 10 percent and about $27.5 million of additional mortality. Again, speaking to whomever is retaining the mortality risk, whether that be a direct writer, reinsurer, retrocessionaire, wherever the risk lies, there aren't too many blocks of business that can hit anything resembling their target profitability levels with the entire block running at a 110 percent mortality level. In this case, all it takes is everything else to go perfectly, but one out of every four policies 60-and-up is off two tables from an assessment perspective.

Clearly, awareness is the biggest issue, both the relevance of it (if you play in this market of 70-and-above in particular, you don't have to have a lot of it to matter), as well as being aware that the kind of traditional underwriting paradigm that was developed for the core ages doesn't tell the whole story. Whether you look at this as, an opportunity or an issue to deal with, depending upon your particular situation, clearly there are some opportunities to improve our expectations of what we have on our books and how to do the business more profitably going forward.

MR. BERGSTROM: Gentlemen, thank you. That was not only a very comprehensive assessment, it was quite educational. I think the audience will probably agree with me as well.

THOMAS E. RHODES: When does older age begin? I've seen different numbers, 65 and over, 70 and over, 75 and over, or is there some sort of gradation in that?

DR TOM ASHLEY: I'll take a shot at that, and the answer is simple. Of course, there is no fixed boundary. It's a continuous function of risk, but we have to draw a

line somewhere, and I think the practical place to draw this line would be at age 70. That doesn't mean that functional testing below age 70 would be of no value, but it would be of diminishing returns, and this will be a change in marketplace practices to get the right balance between rocking the boat and getting the job done. Age 70 is where I define it.

FROM THE FLOOR: Some of those figures you presented certainly have interesting things to say about what happens with clinical medicine. As a person who takes a statin for high cholesterol, I'm beginning to think I should go upstairs and throw the bottle away. When do you go from what have been traditional treatment methods and then say that high value is actually better? There has to be some spot in there where something should change. You can use 57. That would be a good answer.

MR. INGLE: That's a good question. The researchers often use Cox models with multiple variables in multivariate formulas to determine and adjust for how well these different factors predict. Over time, other variables or parameters will end up being more important in Cox proportional hazard models. Earlier today, Tom and I were specifically talking about LDL because we were looking at that slide together, and he brought up some really good points that I want to allow him to comment on that had to do with left ventricular function and LDL.

DR. ASHLEY: I alluded to that when I was talking about the Cardiovascular Health Study. One reason you might not see high cholesterol showing up as a risk factor in this study is that if you're talking about a 75-year-old, and you're looking for risk factors for coronary disease, not everybody with high cholesterol gets coronary disease. We already have some people who have manifested their coronary disease. Therefore, for the residual ones, after you control for their coronary disease, the cholesterol will be less of a risk factor. We also know that these people have intact left ventricular functions, so their cholesterol is less powerful. And then a third point is that the impact of elevated cholesterol may be outweighed by the impact of low cholesterol, low cholesterol being a marker for severe, dangerous, chronic disease, and that may mask or dwarf the effect of the high cholesterol when you're looking at mortality as an outcome. But in answer to your practical question of when to throw away your statins, I'll give you my approach, which is that, number one, statins have an anti-inflammatory effect in addition to a cholesterol-lowering effect. So they're of some value. But somewhere probably short of 84 years old, I'm going to conclude that if I stave off my heart attack, all that's left is cancer and Alzheimer's, and I will definitely throw away my statins.

MR. BERGSTROM: Let me ask you a question. How many of you know what facility actually performs the mortality experience studies for the Society of Actuaries? Anybody? How many think the SOA actually does it? This is Tom Rhodes. He's the actuarial director of the Medical Information Bureau (MIB). They have a unit within the MIB that for many years has been performing all the experience studies on behalf of the Society of Actuaries. So, you do not need to point any fingers at Jack

Luff at the SOA about experience studies. You can ask all of your questions directly to Tom Rhodes when you get a chance to.

MR. BERGSTROM: I'll repeat the question from the audience. Does any company facility itself have any older age mortality data that shows we have been mispricing up to now? You'll see in the next session when I talk about the SOA's experience on older age that the experience really does diminish once you get above about age 75, and once you get above age 85 there's just nothing there. Does anybody look at mortality beyond age 85 as a company? It doesn't take that many deaths to have an influence, obviously.

MR. SHANAHAN: I have one additional comment on that. As you get above 85, there's not a lot of data. To be clear, that's early duration, like issue age data. There is a large amount in some of the areas. You're going to see data for ages 85 through 100 from the standpoint of issue ages at 60, 65, 70, so on and so forth. And to the question of evidence of mispricing, I don't think that's an easy question to answer. Again, we're going to get into some things in the second sessions on what data's available. There's a lot more data available than there was, say, three or four or five years ago. Whether or not there is mispricing, I think that varies a lot from case to case, because as widely as people have underwritten this age group, the mortality assumptions companies used have been equally diverse. So it's hard to answer that in general. I certainly wouldn't postulate that every company has mispriced the elderly. That's certainly not the case. There is however some significant probability that some have.

FROM THE FLOOR: Is there an opportunity lost there? Can you be overly conservative? As you said, there are big bucks there if you can underwrite it correctly, and if you're overly conservative, then you're missing that opportunity.

MR. SHANAHAN: One way to look at these ages is that it's a high risk, high reward ground to play in. The premiums are big because claims are big, and, again, the cost of being 5 percent or 10 percent wrong on relative profitability is probably similar that it is on 35- and 45-year-olds, but the earnings variance you going to see from it is materially higher. So, in the standpoint of absolute amount of dollars, the stakes are much higher both ways. If you do it right, there's an opportunity to make a lot of money. If you do it wrong, there's an opportunity to wipe out what you've done in a lot of other places.

MR. BERGSTROM: As the implementation of the 2001 CSO continues to roll out, which obviously goes to age 120, how many companies in this room actually have active plans or maybe current plans to issue policies beyond age 85? Nobody? If there are no more questions, thank you.