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Session 63PD
The Truth About Preferred Risk Product Design

Track: Product Development

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Summary: This session addresses the important elements in designing preferred risk products. Theoretical and pragmatic approaches to establishing a sound policy for setting underwriting requirements and mortality assumptions are discussed, including the real mathematics of preferred risk classification, distribution of risk profiles by age and the key elements of age-specific underwriting.

MR. RICHARD L. BERGSTROM: We're going to learn all about what we've been doing wrong with preferred mortality in the last 15 years, or at least some ideas about that.

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Previously, Steve was director of product development and consulting responsible for pricing and designing insurance products for direct products. He's been with ING Reinsurance since 1998 and has over 16 years of experience working in a variety of actuarial professions.

Note: The chart(s) referred to in the text can be found at the end of the manuscript.

Doug Ingle is vice president and chief reinsurance underwriter for American United Life (AUL). He began his underwriting career in 1975 and his first 10 years were spent at direct writing life companies and the last 16 years in reinsurance.

MR. STEVEN L. ANDREWS: This session is the second in a series of three sessions at this meeting on risk classification. I'm going to be talking about the current approach to designing and pricing preferred risk classes. I define that as using uniform underwriting criteria for all ages. However, to every rule there is an exception. In this case, there are two: blood pressure and sometimes cholesterol. Along with that approach of underwriting goes two implicit assumptions. Those would be first that the qualification rates into these preferred classes are the same for all ages. The second one is that the same level of discount should apply across all ages for these preferred classes.

Rick commented recently that these two implicit assumptions were wrong. I'm going to talk about the why of why that's wrong. Hopefully, by the end of my presentation you'll be able to explain the impact of this traditional design approach and pricing approach of working with preferred classes. You'll know why the preferred criteria that do not vary by age, necessitate pricing assumptions that do. Finally you'll be able to identify methods to more accurately price for preferred risks.

By way of background, a group of applicants is subdivided into various preferred risk classifications, through the use of individual underwriting criteria. The risks factors include things like cholesterol, blood pressure, family history, build, etc. The percentage qualifying into a given class is affected by the number of criteria used, the specific criteria that are used, and, of course, the thresholds that are used for each criteria.

Throughout my presentation, I'm going to be referring to a group of insureds that are not ratable and so as a whole they are considered a standard group. So just keep that in mind. When we are talking standard lives, we are talking about lives that are not ratable.

We have already talked about what the current approach is. We should then ask ourselves, is this appropriate? In order to address that question, I think you need to answer two other questions that have to do with the implicit assumptions that are made. Are the qualification rates indeed the same for all ages? Do the preferred risks indeed experience the same relative discount from the standard group from all ages?

Consider the first question; are the qualification rates the same for all ages? I've created a sample product with three classes, two preferred and a residual standard. We have three underwriting criteria: cholesterol, blood pressure and build. So in this example in order to qualify for super preferred class, you would need cholesterol less than 220, blood pressure less than 140 over 85 if you're under age

60, and you'd need to meet a pretty standard build table for the industry. For example, a male 5'10" and 195 lbs.

We looked at this group of standard lives and determined what percentage meet the requirements at various ages. Of those aged 20-29, 89 percent have cholesterol less than 220, 98 percent meet the blood pressure requirement, being less that 140 over 85, and 79 percent meet the build table requirements. Overall, 70 percent of those ages 20-29 would qualify for our super preferred class.

Now the interesting thing is with both cholesterol and build, as we move on to the older ages, the percentage of lives meeting each individual requirement decreases. But with blood pressure, we're using an age-specific requirement, so the percentage stays relatively constant. In fact, if we had used the 140 over 85 requirement for ages 60-69, that would have been 77 percent, so it would have shown a similar decline across all ages. In total, the percentage of lives qualifying for our super-preferred class decreases significantly as the ages increase.

Let's now consider the percent qualifying for the preferred class, excluding those who are already segmented into the super-preferred class. There is a pretty consistent level; it's pretty low because we've carved out so many people from in the super-preferred class. There is a pretty consistent level for the blood pressure requirement as opposed to the cholesterol and the build table. Everybody who is left over obviously then would fall into the residual class. So what does this mean? As we've seen, qualification rates do vary by age when the preferred underwriting criteria thresholds are consistent across ages. As we've seen with the blood pressure requirement, the use of age-specific requirements can achieve more consistent qualification rates across ages. Now this isn't to say that uniform criteria are inherently bad or wrong or incorrect, but what it does point out is the need to examine your underwriting approach and make sure that the pricing assumptions are consistent with that.

Let's consider the second question now. Should the same mortality discount apply for all ages? In this example, I'm going to assume conservation of deaths. We're going to assume that the overall mortality for our standard group of applicants is 100 percent of a given table, whatever that may be. We're going to assume that our super-preferred class has a 15 percent discount off of the standard group and the preferred mortality gets a 5 percent discount off that standard group. This is very much like the current, traditional approach to pricing in preferred risk classes.

Then the question is, what is the resulting mortality for the residual class? In our previous example, we determined the qualification rates for each risk class for the various ages. I'm just going to deal with the 20-29 year olds and the 60-69 year olds. We have a standard conservation of deaths formula. For our example, we'll have to expand it with another term, because we're dealing with three classes. But essentially, we know the standard level, we know the qualification rates for both preferred classes, we know what we're assuming for a preferred discount and we need to solve for the residual mortality.

When we plug in our 15 percent discount and 5 percent discount for the preferred classes and these qualification rates, it turns out that the residual mortality for those in their 20s comes out to 195 percent. For those in their 60s, would be 113 percent. Let's look at that number for a second. Remember, we're talking about a group of non-ratable lives, a group of standard lives, and we're saying that as a group they would be rated table four. I think that's a little bit unrealistic and unattainable. But I'll let you decide that.

To say this in a different way, if preferred criteria are consistent across all ages, it is, in my mind, unrealistic to assume the same level of preferred discount for the preferred classed for all ages. Let's examine the mortality distribution profile for people in their 20s and those in their 60s. I'm not meaning to imply that they have the same expected level. In general, 60 year olds would have a wider disparity, a wider variance around their mean. I think we can all agree on that.

The 20-year-old group is our group of standard lives as a whole. Going back to our example, 70 percent of those in their 20s would qualify for our sample super-preferred class.

In theory then, our mortality assumption for pricing purposes should be 85 percent of the standard mortality. So that means we end up underpricing for those in their 20s.

For the 60 year olds group, the opposite occurs. We had 27 percent qualify for the super-preferred class. The theoretical expected average of that group is 85 percent of the standard group as a whole. So a possible more refined approach would be an iterative process.

You first need to know what your objectives are with your product. What are you trying to achieve in the marketplace? You set your underwriting criteria for your preferred classes. You determine the percent qualifying into those classes and the appropriate level of mortality for each class. You can do that through your own internal experience, through national studies, public studies, knowledge and information that you can gather from your underwriters and actuaries and medical directors.

You see what comes out in terms of qualification rates, mortality discounts, mortality differentials between classes, and see if those meet your objectives. Maybe you want to have a super-preferred class that competes with company XYZ and the first set of assumptions or criteria won't allow that. So you go back and make it more restrictive. In theory, that should lower the mortality level. Maybe you're looking for a certain differential between your best class and your second best class. Whatever that is, you continually tweak the underwriting criteria until you achieve the objective you're looking for in terms of discounting qualification rates.

It's not wrong to use the same preferred criteria for all ages. But what might be wrong is the set of assumptions used in conjunction with those criteria. The bottom line is that you want to insure consistency between your preferred criteria, your assumed qualification percentage for the preferred classes and the assumed level of mortality discount or add on for your preferred or residual classes. Insuring consistency among all of these things will enable you to meet your objectives.

MR. BERGSTROM: I am curious as to how many companies out there have preferred plans with three or more preferred classes. I may have misstated that the conservation of death theory is wrong. It's not wrong. It's the application of what we've been doing with it that I think is inappropriate. Clearly the deaths have to add up to the right number, there's no question about that. When we split a cohort of lives into two or more risks, the mortality for each class, once combined, has to, or should theoretically reproduce the number that we started with. So in theory that equation has to work.

The percentage of preferred, times the preferred mortality, plus the percentage of residual standard, times the residual standard mortality, has to come back to the standard mortality. Solving that algebraic equation does work. The question is, what are the numbers we put in there and how do we come up with those numbers?

I'm going to give you three examples. The following is the basic set of assumptions for all three of these examples. There will be 60 percent preferred, 40 percent residual standard, and we're going to get a 20 percent discount from standard mortality for preferred. The preferred mortality is 80 percent of standard, which leads us to solving the algebraic equation. The ratio of the residual standard in my example is 163 percent.

The question is, how do we know that we can find 60 percent that have an average mortality of 80 percent? Second, should those things not differ by age? Steve had a very good example using the cholesterol and the other laboratory test assumptions at the younger ages. That doesn't work. How many of you actually, of those of you who have, vary your preferred qualifications by age? (Two.) Let me ask a different question, how many of you do not vary it by age? (Most of the audience.)

It comes down to what the mortality distribution looks like. Does anybody really know? We can come up with the mathematical distribution as we choose to, and we do that for a very good reason, because they're easy to work with. They have numbers and we can define them mathematically. We can pick a point, we know how to calculate it, but what does it actually look like?

I'd really like to look at the normal curve because my intuition tells me that mortality needs to look something like that. Why are the majority of the classical risks less than mean of the standard distribution? Most of them have to be someplace in the middle, don't they? No matter how you squish this or spread it apart, intuitively I feel that is how it should look(Chart 1).

If we overlay that normal curve with an underwriting mortality (Chart 2), such that mortality varies between a low of 50 percent of standards to a high of 150 percent of standard for the standard total. We want 60 percent to qualify in my example. Everything is at 60 percent. In using the normal curve and mathematics we can calculate where those numbers need to be. The problem is with 60 percent under a standard normal curve that indicates the mean. The mean of the area not under the curve is X=.935. What that indicates, if you believe the normal distribution, that we're allowed a 6.5 percent discount, not 20 percent.

That also tells me that we have to add on 10.5 for the residual standard in the surcharge. Our ratio of residual standard is 118 percent, not the 163 percent that I showed you earlier on, which I wanted it to be (Chart 3).

I tried to figure out how to make it simpler for people to look at this without having to go through the normal curve mathematics. We'll take something simple, a triangle (Chart 4). The area under that triangle is one. So that's our standard distribution. The preferred 60 percent would be on the left side of the triangle in distribution and you would shade it. The 40 percent of standard risk would be on to the right and you would not shade it. What are the means now of these two sides? Well if S is the mean of my preferred distribution, I can actually give myself a 22.5 percent discount going in that direction. It would be 0.225 where –1 is the lower limit (Chart 5). The mean of the residual standard, in this case, is 0.368 where the section at the right is equal to the maximum of our standard underwriting risk.

If we overlay the underwriting map on this then, we're saying that the actual discount we can get is 11 percent or the mean of the preferred is 89 percent of standard (Chart 6). The mean of the residual standard is 118 percent. So the ratio now has gone up from 118 percent to 133 percent under the triangle.

If you were to look at it as a rectangle, what this indicates, and unfortunately, this is the way that I think that we've been doing things, is a uniform distribution of risks across the standard (Chart 7). So the probability of any one mortality level is the same irrespective across the whole standard realm. If we now overlay the underwriting mortality, we're 50 percent at the low end and 150 percent at the high end. The mean of the 60 percent preferred now is at 80 percent and the mean of the residual standard is at 133 percent. We've gotten back to the 163 percent where it was before (Chart 8). That was where I wanted it to be. But consider what I had to do with my distribution to get there, I had to squish it down, flatten it out, and that's not real.

What I've come up with is what I call a set of boundaries or conditions. I would like to give you an example of mixed numbers under that set of assumptions. You can all put your own assumptions in there and play with them, and you should, I might add. Under the high to low of the mean of the preferred gives me a discount of either 20 percent or 6.5 percent, with 20 percent being the rectangle and 6.5 percent being the normal curve. The triangle is some place in-between.

The mean of the residual standard was someplace between 10.5-30 percent above standard. The ratio was 118 percent of residual standard to 163 percent of preferred. Again, the low being the normal curve and the high being the rectangle for both those categories.

So the question really comes down to, can we describe, even roughly, what the mortality distribution would look like mathematically? My purpose of showing you the triangle or rectangle, the non-normal curves, was that you don't even have to describe it mathematically. All you have to really be able to do is find areas under curves and you can draw whatever shape you want to. If you could approximate what the area under the curve is, that's how you describe it mathematically. It doesn't have to be a nice equation, you just need to know what it looks like and approximate what the areas look like.

Should it be done by age? Absolutely, you can't not do it by age. As I told the group yesterday, 90 percent of all deaths under the age of 35 are non-medically related. We have a tough time underwriting that much out to get us down to that 20 percent discount. At ages under 35, it can't be done.

Once we've defined a mathematical description, or what it looks like in respect to whether it's mathematically described or not, we're only allowed to really reflect one of the variables. It's two equations and it's two unknowns. You can pick one variable. You can't pick them both.

That is the message that I want to leave you with. The conservation of deaths theory works, but you can't describe the two things that you want to describe to pick the third. You can pick one and whatever your distribution looks like, that sets the pattern for the other two. That's the key.

Finally, how do we then define the underwriting rules? Doug's going to talk about this. How do we then define what the underwriting rules should be and the requirements should be such that we can at least attempt to get the levels of mortality that we're looking at and that what we want to achieve?

MR. DOUGLAS A. INGLE: I am a real strong proponent of the collaboration between the underwriters and the actuaries. It's the key secret, I think, in our success in the industry as we get our two disciplines together and great things happen. I will talk a little bit about one of the great collaborative efforts between myself and an actuary, Dave Wylde from AUL. The two of us have come up with our preferred version. The great thing about it is it matches what everybody else has been saying so far.

Let's talk a little bit about preferred. We've been talking about what, theoretically, is the shape of the curve. Do we have any mathematics that we could look to, to help us say we really do know what the shape of the curve is? We've got data. We understand it. In 1979, the Society of Actuaries, along with the medical directors association produced two wonderful books. They were called, *The '79 Build* and *The '79 Blood Pressure Study*. These books are full of wonderful information. There are about 2.5 million policies for each of these studies. They are tracked for 7-10 years, I think, all together. There is wonderful information on mortality by build and by blood pressure. So I'm going to talk for a second about *The '79 Blood Pressure Study*.

In the volume, there's information on the distribution of blood pressures by age and sex. The volume also includes mortalities by systolic and diastolic blood pressure. If we can take that information, maybe we can make a correlation between the distribution and mortality curves to give mortality as a function of the qualifying percentage.

What do I mean? There was another normal curve that, in essence, said the average systolic blood pressure of everyone over the age of 40 was about 127 (systole represents the 140 in a blood pressure reading of 140 over 90). Systolic blood pressure, on average in 1979, was about 127. If you take that, you take the 2.5 million lives, you distribute them out and graph the data and you've got a normal curve. Things in nature tend to be normally distributed.

If you take the 2.5 million blood pressure mortality records and you say, looking overall, what was the mortality rate for all 2.5 million individuals, that becomes your denominator. Your numerator is the sub-sets of the overall cohort that had blood pressures in these ranges. It's like some number under to some number over, group them together, and track their mortality. You find out that lower blood pressures get you better mortality. Higher blood pressures get you much worse mortality.

What can we do with that? This is interesting, if you take and combine these two pieces of information, you can actually determine mortality as a function of the qualifying percentage. I'm basically saying if you took all the people with all the different blood pressures, you have 100 percent of them, the mortality rate is going to be obviously 100 percent. That's what the overall group was.

Let's say that I only want to look at the mortality of those individuals who had blood pressures less than 160 systolic. That would be about the top 80 percent of the population. You get the idea I'm going after.

I'm only going to look at the mortality rate of everybody else who had blood pressures less than 160 compared to the total population. If only 80 percent qualify for 160 or less, the mortality then would be at 92 percent. So you can correlate qualifying percentage with results and mortality.

If the average blood pressure is about 127, I'm only going to take blood pressures of 127 or better. That's probably about 50 percent of the population. I would actually get a mortality ratio of about 82 percent.

So if, as underwriters, we decide we are going to use one criteria for preferred and we're going to make it blood pressure, we have a study to get data from, We're going to say you've got to have a systolic blood pressure of less than 127. We actually have a study from 1979 on insured lives that would give the mortality improvement. So we have statistics that we can use to help us answer the questions that we've been talking about.

As far as the build study, everything is normally distributed again. I'm 5'10" and weigh a little less than what the average weight was from *The 1979 Blood Pressure Study*. On average people 5'10" weighed about 176 lbs. then. We looked at the distribution of weights for individuals compared to the average weight as it described in the 1979 build study. Obviously some people are heavier than average and some are lighter than average.

Builds are normally distributed about the mean and most people are right at about the mean. The famous J curve is associated with build mortality.

How far down can you ratchet your preferred criteria? It's the whole idea of, if I get a lower blood pressure, or if I get a lower build, I should get better mortality. Except that, with the build study, as you get down to people that are severely underweight, mortality actually starts to go up again.

Mortality is a function of the qualifying percentage. If I'm only going to take the lightest 10 percent, the people that are 35 percent underweight, my mortality is actually going to go way above 100 percent, the old average. So there is a point at which you can't exceed for preferred criteria. If I was going to use build as my descriptive indicator of a preferred class, the best I can do is a mortality of about 96 percent of the total cohort. I can't get a lot of bang out of build like I can out of blood pressure or perhaps some other things.

I'm sure all of you and every underwriter in the world has to deal with the individual pieces and try to figure out what are the most important pieces in the preferred criteria make up.

As cholesterol goes up, mortality goes up. I think enough has been said to come to our conclusions. Mortality is dependent on the factor value. Distribution of the factor values can be modeled with the normal curve. The normal curve is the way to go. Things in nature are normally distributed.

Can we then also make the one leap that the qualifying percentage, that mortality should be a function of the qualifying percentage. Everyone, in your pricing and preferred risk products, has used some form of that theory, as long as the preferred criteria are reasonable and relevant.

Qualifying percentage in and of itself may not do it, because if you take the red-haired people with blood pressures of XYZ, versus the black-haired people with blood pressure of XYZ, you get a different qualifying percentage. There is no relevance to red hair versus black hair. That’s a true statement. If you were to do a graph of the mortality for red hairs versus black hairs you get a scatter plot rather than a linear regression.

It’s important that we make sure we’re using relevant criteria. If we use relevant criteria, we're going to end up with some sort of a function going on. We built a system that basically uses a database of insurable lives and a mortality engine. It will calculate the mortality improvement for a preferred class based on the proportion of insurable population that could theoretically qualify for that class.

I'm going to do the same thing that Steve did and come up with the super preferred and a preferred and a residual standard class, although I do have different criteria. Let’s take a look at what the database does. I'm only going to go through just one component of this, the percentage of the base qualifying. This is ages up to 40; 40-60; and 60-80, using one set of super-preferred criteria. The qualifying percentage goes down as the cohort ages.

This is exactly what everyone was talking about earlier. About 40 percent qualify for super-preferred in the 18-40 age range, and only 22 percent for the 40-60 age range. There are only 13.8 percent of the 60-80 years will qualify for that knock out. On average, it’s about 28 percent. We do sling it all back into what is, overall, the mortality. It may be a little off on the younger ages, a little off on the older ages, but in the broad scheme of things, right now we’re coming out okay.

We do need to move to the next level in this presentation to quantify individually by different ages. One other thing I just thought of is, in the underwriting community, of the standard class of the population that qualifies in the 20–29 age group, perhaps 98 percent of the people applying for life insurance qualify for standard life insurance. As you move up into the 60-69 or over age 70, generally 65 percent qualify for standard life insurance. There is a skewing that takes place even in the standard class, let alone what’s going on in the preferred classes. The sample life preferred criteria shows approximately 31-32 percent qualify for that criteria. There wasn’t quite the change skewing going on in this particular class.

Can we use this to theoretically model what we’re doing? We believe that we can. We skewed it out a little bit on the ends it would be very close to the model Rick was discussing.

Rick made a great comment recently. There are even a few people that will get in at that table two-ish level because either the underwriter didn't know about a certain part of the medical history or they make an exception. They sometimes take a table three case and because it's a great agent, they throw it into the standard class. The underwriters will throw those up to table two in the standard class. So there are going to be tails.

In a perfect world, we could build a perfect curve. One summary curve would include breakouts for super preferred, preferred and residual standard. What you end up doing is you take a weighted average of the area under the curve.

In other words, I've got one person with a mortality of 40, I have maybe 10 people with a mortality of 50, I have 25 with a mortality of 60, etc. You take the weighted average of that area for all those different individuals inside. Think of it as a discreet function and determine what the weighted average is for that number. Now what's important is it doesn't look like an exact normal curve. If it looked like that, we would be in trouble in the insurance industry because we would have been badly underpriced on our mortality on our super preferreds.

There's another component that we're going to touch on a little bit. We really just start with the unbiased qualifying proportions. Then we take the preferred criteria, run it against the standard class and find out how many people qualify. Remember that sample life example we were looking at? There were 28 percent who qualified for super preferred, 31 percent for preferred and then the residuals were 41 percent.

There are other things going on dynamically in the market that you're all aware of. In the preferred risk brokerage market agents have preferred criteria for five or six companies and in the process they spreadsheet it. They'll look at those six preferred criteria and choose whose policy they're going to take for that applicant.

There is some skewing, what we refer to as agent field selection going on out in the real world. Maybe the agents give you a little more business than they give to some of the other companies and you may end up actually with a placed distribution that is very much different from the base that you started with. Now this has been interesting because underwriters and actuaries, we will work together to come up with an unbiased qualifying proportion. Then after a year and a half or two years, we say, wait a minute—it's not turning out the way we planned on it to turn out.

That could be because the agents are doing some things out there. They're determining where they're going to send the business. The other thing that we want to bring into our model is a migration factor. It's speculative at this time, but it's something that we can do to mathematically adjust for another component. We do that for the best people in each of the residual classes. That would be less than the best class.

In this case, I have a super preferred and a preferred. The best people in the preferred class now have the data, they know what their build, blood pressure, cholesterol and everything else was. They get the preferred rather than the super preferred. There is a chance that if the brokerage agent tells the person that they can get a better deal at XYZ company, let's take the information over to there and let's get that person that company's super preferred class.

Let's talk about a base mortality of 100 percent. What are some of the things that are going on? I'm not going to go through this in a lot of detail, but I will hit a couple of highlights. If we start with the unbiased qualifying proportions that we talked about a few minutes ago, you actually end up with, as I said, agents skewing more business into the super-preferred class. The placed proportions will change.

If you say the mortalities for each of the individual classes, the weighted averages based on those numbers out there, come out is to be about 71.4 for the super-preferred, 97 for the preferred and 128 for the residual standard. Using a weighted average of 45 percent at that super-preferred mortality, 37 percent at preferred, and 16 percent at standard, your new overall mortality for your company is going to be 90.6 percent. Why? it is because most of the super-preferreds make up your new cohort of what your overall standard class is. In doing a mortality study, it's important to remember you have to do mortality studies that are class driven, on each of the individual classes.

We have adjusted for the migration effect. We have three classes that we were talking about a few minutes ago. The very best preferred risks are the ones that probably are going to migrate out altogether and go to some other company. What we need to do is mathematically adjust for that, and perhaps this takes place in the standard class as well. These individuals may qualify for someone else's preferred class.

Dave Wylde has been able to figure out a way to actually factor this into the model that we use. As a conservative underwriter, I'm glad he's done that because I like to make adjustments. The weighted average of these three classes are made up of that. It fills in the little adjustments that we have to do for what's really going on in the real world with the agents, with our products, with our markets and everything like that. This is scaleable. We can adjust that, so we do like to think we take these things into consideration.

Through looking at the medical literature, we've come up with using the Cox Proportional Hazard Model as a method to model what the distribution of mortality would be in the standard class. This model takes each of the individual criteria. The denominator for the hazard ratio becomes what is the standard mortality. Consider what a normal cholesterol would be out of the standard class. If the average cholesterol is 203, that is the X factor for that. The beta regression co-efficient is the drive component that we have to come up with using Cox Proportional Hazard Models.

You then go to systolic blood pressures. I said that was 127 on average. That becomes the denominator, the numerator becomes each individual's results. Their cholesterol is 186, their blood pressure is 110, etc. The hazard ratio is that, between those two, they would expect to have a lower mortality than the average. Through the wonders of computer spreadsheets, I'm able to take over 11,000 lives, run a Cox Proportional Hazard Model against it and find out how the mortality is distributed out for the individuals that qualified as a standard risk.

There's a little bit of skewing out that I'll talk about a little bit later. Let's say we decide this is where we're going to block off, these are the ends of the standard risks. There's no one at zero, which is good and therefore, possibly a few are at 40 percent. We think this is probably a pretty good idea of what the mean and standard deviation is for the distribution of mortality.

As we talked about, a normal curve does a pretty good job of approximating what's going on. A gamma distribution probably models it slightly better. With the normal curve and the gamma we are pretty much in the same range.

The last component that I wanted to bring up was, what happens from an underwriting perspective, regarding these different preferred classes when you run a Cox Proportional Hazard Model against it? We like to refer to the super-preferred class as a knock out system. Your blood pressure has to be better than 135 over 85, if it's 136 over 85, you're out. If your build is two pounds over you're out and so on.

In the real world, and this is the reason I love the collaboration between the underwriters and the actuaries, we know that the underwriters tend to make exceptions to the rules. The Cox Proportional Hazard Model gives us an opportunity to look and think about this in a different way.

If an individual had wonderful cholesterol, wonderful blood pressure, HDL was really, really high, but missed the preferred class by two pounds on the build chart, should that person be the super-preferred risk? Should he or she be moved into the preferred category? Most of the underwriters in your companies probably squeezed that person into the super-preferred category.

a, What the Cox Proportional Hazard Model is doing is taking each individual component and weighting the importance of that component toward determining what the overall mortality for that individual will be. It takes each of the individual factors and gives it a certain number of credit points for each factor and then adds them all up to figure out where that individual ends up in.

It is a knockout system. In reality, it may be a better idea to look at what's actually going on as the distribution of mortality in the super preferred class is more normalish actually. But the interesting nuance to this is that the average mortality of this group of individuals is 77.9 percent, which actually tends to approximate the normal curve assumption that we were making earlier. What happens to the preferred class?

Average mortality of the preferred class is 99.5, again distribution of mortality using the model I've talked about. For the standard class, there's a real range that goes. The average mortality is 127.

Use a Cox Proportional Hazard Model to say how the mortality would be distributed out, but then run that against each of the knock out systems. So I basically took each of the individuals that were in the super-preferred class, according to the knock out system, and ran it against the Proportional Hazard Model. There were some preferreds that were actually way over. Finally, do the comparison with the standard class.

On average, the mortalities turn out to be just about what the normal curve showed. A normal curve is a theoretical description of perfection. If we underwriters had 2,000 components and we knew exactly what the appropriate mortalities were for each of these 2,000 components, we could run it against each individual. We could actually fix the skewing problem. When we were done redistrib uting that, we would have a normal curve again, which is the model that we're using.

We don't have the ability to do that. This is probably more reality of what's going on, but the cool thing is, it's working.

We have actually run our models against databases that we have at our company. We do have a copy of the Framingham database. I can take a super preferred from sample life, and run it against the Framingham study to find out what would have happened in that cohort. Now think of it, these are closed blocks that we have build, blood pressure and cholesterol on. We have all the data on these individuals, and we also have tracked their mortality.

I'm aggregating the groups into the three categories and seeing what do these mortalities do compared to the overall standard for each of these groupings. We're trying to find out if we are using the right size of the curve.

By using the Framingham data, that super preferred criteria would get that cohort exhibiting a mortality of 78 percent, preferred is 97 percent, and standard is 125 percent. We should take some solace in the fact I think the means and the standard deviations we're using, are about as wide as we're figuring out.

I think that we're on the right path. I think it would be interesting to get together again some time in the future and talk about the shapes of the curves for the different age groups. We also have been able to take this sort of data and modeling and run it against our insured lives and have found mortality results that looked similar, once again, to what we've described here. Maybe at another session we'd go into our actual mortality that we've gotten from our insured lives data.

MR. BERGSTROM: Irrespective of what pattern or what description of mortality we give the different classes, we cannot cut the classes. We can not slice them with a knife. When all is said and done, we still end up with a distribution in each class. That even brings the means that much closer to the middle again. Irrespective of what we think, theoretically you've got the actual reality because we can't slice it that tightly. It doesn't push it closer together.

I want to make one other statement in regard to a study I did for a company not too long ago. The company wanted to add a class. One of the nice things about this company is they didn't want to add it at the far end, they were actually going to add a middle class. They weren't trying to reduce the mortality. They were just going to try to separate the preferred mortality.

They came up with some underwriting requirements. Cholesterol now would be 240 versus 220. They had a certain height/weight table. Blood pressures would be 150 versus 140. There are about 12 different criteria, each with a different level of allowance for the new class. They wanted this to be maybe 20 percent mortality greater than what their other class was.

When we started looking at the individual components and what the mortality increment would be for each of those components, we came up with an 80 percent increase. That may sound strange, but the reality of it is if everybody qualified exactly for those requirements, the mortality would be way out of proportion for what they wanted and there's a reason for that. The reason is because not everybody is going to have all 12 of those. We always have a distribution. The underwriters that I've talked to, say typically the reason a person does not qualify for say super preferred is because of one or two components, period.

MR. PAUL MARGUS: I noticed, first of all, you could do a similar analysis even for substandard. Most of the time our substandard is highly simplified and we have table multiples and whose to say that you know you should use 125 percent or whatever. You could probably say standard is super preferred and everybody else is substandard in some fashion and should be analyzed that way.

Just a slightly factious question: How do you really know that hair color is really irrelevant? If your data shows a genuine difference, it might be something genetic or whatever, and you should keep an open mind at all times.

MR. ANTHONY J. ZAJAC JR.: Doug, looking at a system like yours, have you looked at ways you could possibly use this to analyze the impact of a company moving from ordinary, substandard classifications to intentional table shaving programs, such as table three or table four of the standard program? Have you looked at this kind of implication? What kind of things could you do with that?

MR. INGLE: If I understand correctly, what you're saying would be as you look at the distribution of mortality, actually bring in the right side of the curve so that you're including individuals that qualified up to, say, table four, into the bell shaped curve, then you run your model with that assumption underneath it?

MR. ZAJAC: That is correct.

MR. INGLE: Yes, we could do that.

MR. JACK F. GULICK: One thing that I've noticed with mortality standards is that it's very common when we do a base mortality table that we select an ultimate. In other words, we reflect the fact that the value of underwriting runs off over time. It's not uncommon for substandard we run off the effects of substandard over time, at some high age. I've noticed in the preferred classes, we tend not to drop off the effects of preferred as rapidly.

Has anybody looked at what theoretical justification that has? It seems to me to be contradictory to what we're doing in our standard and our substandard cases.

MR. BERGSTROM: You raise a very good question, and typically if the pricing actuaries pick a number, irrespective of whether it varies by age or not, that number is constant by duration.

The experience that I have actually analyzed for companies is there are not that many durations out there yet, but say six, seven durations. There's no question that the select selection runs off over a period of time. It typically is about five years when it gets back to where it probably should have been. You can discount deeply, in fact, in the first couple of years. That gets back to where you think you might be within about a five-year period of time, at least that's the experience that I've had.

MR. ANDREWS: I'd echo Rick's comments. Unfortunately, we're still getting emerging data at the later durations, so it's not too credible yet. We are seeing over a six- or seven-year period the selection factor wearing off. We are having theoretical discussions whereby there may be instances where the selection at certain ages wears off faster than others. That may even go the opposite way and diverge.

MR. INGLE: We're working on that question as well. We're finding slightly different results than the other two panelists. One of example that we have, I mentioned earlier, the Framingham study covers these individuals of over forty years.

So we have some data that we can actually look at and see how their mortality is emerging over that 40-year period of time. It's not totally theoretical on our part, though it is using a modified standard population. We've been finding that preferred is hanging on. Obviously the selection process wears off, so mortality is going to be going up just due to the way the curve is shaped.

From an intuitive standpoint, think about everyone you know, no one here has suddenly gone from whatever their weight is today and then two years later they've doubled their weight or doubled their cholesterol or things like that. Intuitively, we're finding that we think that people are where they are in the broad scheme of things, and they don't move way out into some other particular class.

Some of our initial data is showing that I do agree that preferred does wear off, but maybe not as much as some of our assumptions, at least by some of the data that we have.

MR. ANDREWS: I guess we're just going back and forth here, but there is one other thing to consider if you are assuming a level discount off your standard rate. Of course what that means in the later durations is that you actually have an assumption of a divergence between your classes in terms of actual difference as opposed to relative difference.

MR. ROBERT A. GABRIEL: I think you've convinced us that we should vary the criteria by age. You said nothing about varying it by male/female, and I was wondering what you thought about that. We all know that females have about 40 percent lower mortality. We probably all have guesses as to why.

About 15 years ago I was doing a study on super preferred, and I had the same criteria for male and female. I found that a higher percentage of females was qualifying for the super preferred. Now maybe that means they all have better cholesterol, or they tend to have better blood pressure or whatever. Maybe that's why they have a low mortality. My question is, have you thought about varying criteria by sex?

MR. BERGSTROM: No I haven't, not from the standpoint of what you said. It is true that if you look at laboratory statistics, up until about age 50, females, for example with cholesterol, will inherently be 30 percent lower than males. Yet we do not have different requirements for sexes. There are a couple other lab tests that show the same thing.

So could we do that? Yes we could. And should we do that? Probably we should, Doug.

MR. INGLE: I think there definitely are differences and I don't have the answer to this question. But I'm wondering if there are some discriminatory issues between the male/female thing. I don't know for sure. We have male and female mortality table. Perhaps not. Maybe we could do something with that.

MR. A. GRANT HEMPHILL: I have an overall comment. Doug said there are a lot of dynamic things going on with the field force, the agents, interactions with underwriters and that sort of thing. I'd say yes, it's all interesting, but it's not dynamic. If it were dynamic, the solution would be to do some calculus. I'd say what's going on is strategic.

This gives me a different perspective on what's wrong with conservation of deaths. What's wrong is, it assumes conservation of applications. You're going to get a different set of applications if you change your criteria, because those applicants and the agents are behaving strategically. They are acting in their own self-interest, so you get a different set of applications.

MR. BERGSTROM: The other work that I've done for several clients involved with what I call business decisions. We did an audit and 30 percent of their issues were business decisions, and they couldn't understand why the mortality wasn't working out.

I have a rule of thumb that if your business decisions are more than about five percent, you are going to strategically effect your mortality experience. You should not have more than about 1 in 20 move from one class to the other.

MR. YOURI N. MATIOUNINE: You mentioned several times that if you look at the distribution of mortality, if you pick certain age groups and you see how the mortality is distributed, then it's a lot wider distribution for high issue ages. Is that an experimental fact? Is it just your belief based on theoretical assumptions? If you have some experimental information for that, how much wider would you say mortality in the 50s would be as opposed to in the 20s. What sort of numbers are we talking about?

Some people actually made comments or arguments that at higher issue ages, perhaps you should see more male mortality distribution.

MR. BERGSTROM: If you look at the percentage of different types of deaths, it's quite varied at the older ages. If you look at the younger ages, clearly about 90 percent are simply not medical. They're accidents, homicides, suicides and AIDS. AIDS is medical perhaps, but it's a lifestyle choice, not something that deteriorates from a disease position.

I think that's an intuitive feeling that I have. I would not have the foggiest idea how to actually measure that width, though.

MR. MATIOUNINE: I agree with it, it does make sense. I was just wondering if it comes from actual experimental information or not.

MR. BERGSTROM: I think the most readily available evidence is certainly just a plain old select and ultimate mortality table. If you look at low issue ages, there tends to be not a whole lot of difference between select and ultimate. At the higher issue ages, that's much more material. If you take attained age 65 against issue age 65, you get a pretty big mortality ratio. I think that that's really a manifestation of the distribution that we're talking about. There is a much wider distribution at the higher issue ages.

I have a problem with the current way that we have done mortality, even with the 2001 VBT tables in the sense that we've used it 25 years. The select period is pretty much irrespective across the age spectrum. There is no 25-year selection period under age 25. It just isn't there and there isn't one over age 75 either.

We have done the math that way, and we've done it because we like to think in terms of uniformity and so forth. But in reality, it simply doesn't exist.

MR. DAVID WYLDE: Does the criteria need to vary by age, perhaps, but the real answer is do the mortality assumptions need to vary by age? If you're going to set your criteria across all ages, use the various normal curves to decide how many are going to qualify and relate that to the mortality assumption that you're going to use for that age.

So rather than having merely one or two or three normal curves, the reality situation is that you have a whole array. There is a universe of normal curves for male, for female, for age 25, for age 26, for age 27, you name it.

These curves are measuring mortality as a percentage of some base table. The base table already has these select and ultimate natures built into it. When we're saying that there's a 22 percent reduction for every duration, we've already built in the selection. I'm not sure that the comment of looking at select versus ultimate tells you what the distribution of mortality is. We've already considered that in what the normal curves are trying to do.

But in reality, we really need a lot of curves. The more the better, literally for each age group. You're absolutely right. The younger ages have less mortality. Perhaps even a better idea is to extract out your accidental deaths. Take the typical 75-80 or 90-95 tables, extract out what you would consider accidental deaths. Then you have basically cardiovascular and some cancer. If you take those out, then perhaps those curves aren't very similar in their standard deviation across a wider range of ages.

MR. G. DAVID SODERQUIST: I'm concerned about the concentration on the medical aspect of this selection criteria. As was pointed out, the curve for the younger ages was quite narrow, for the older ages it was quite wide. This is because non-medical causes of death are quite frequent at the younger ages. Have you considered things like driving records, for example?

One of the things we're possibly considering is maybe introducing another class. We haven't decided yet on driving records. It's been proposed that somebody who has not had a DUI conviction in five years could be super preferred. That really bothers me. . Are there any statistics available on, for example, driving records versus mortality by age? It could be incorporated in the same manner as the medical causes.

MR. ANDREWS: Rick Bergstrom is currently the chair of the Morbidity Mortality Liaison Committee. The responsibilities of that committee include doing impairment studies off of insured lives. That committee collects data from insurance companies across the United States and is in the process of doing impairment studies on them. We have a database right now that includes driving records in it. It is one of the future studies that we are planning on doing through the asepses of the Morbidity Mortality Liaison Committee. I'm hopeful we can get something for you here in a few years.

FROM THE FLOOR: Doug, you have these statistics where you say that the standard population has certain distribution of super preferred, preferred and sub standard. When you actually go to the market, the percentages change. The average mortality also changes. There is some selection going on, and this also has a connection with what the grand temple actually commented on a strategic being made there. If you take a simple example of two companies, A and B, and suppose that A cuts off its substandard at X and B cuts off its substandard at X+Y, then what would happen is that the mortality that A sees would be of the people of the X+Y and beyond, because assuming that the two companies have all the experts, factors and other things that were very similar, the people who are above X+Y would come to company A and those between X and X+Y would go to company B, because they would be in a better group.

So to me it is not clear in practice whether these kinds of ethics do actually change the mortalities that you observe after you enter the market. If you are in the market when somebody enters the market is that a substantial change?

MR. INGLE: One of the components of our bell-shaped curve was this thing we refer to as the migration factor, which was the hatched portion of the normal curve that's scaleable. You can take exactly what you're talking about, you can literally set two sets of preferred criteria next to each other and try to determine where you think the applicants are going to go. With that hatched area, the migration factor, you could adjust to place the people in the correct two companies that you referred to there.

Our model then allows you to see what the mortality is from whoever is left after you've adjusted for these people moving to the different companies. These are the true marketing things that you guys are dealing with.

FROM THE FLOOR: The numbers would change, right?

MR. INGLE: Yes.

FROM THE FLOOR: You retained the same numbers, but you have to change it, right?

MR. INGLE: You start with the unbiased qualifying percentage, but then when you get to the end of that particular page, you've adjusted for the dynamics in the market to get new numbers at the end of the day that reflect exactly what you're talking about.

MR. DAVID M. BURRIDGE: Four years ago I went to a Home Office Life Underwriters Association seminar. They did have a statistic that Hank George did at even just one DUI. Within the last two to five years, it had an incredible increase in the actual to expected ratio. It was like double or even worse than that. He could be contacted, and I'm sure he'd be willing to give that information.

Rick, you gave a statistic on 90 percent of deaths under age 35 are due to nonmedical causes, and therefore you couldn't justify a 20 percent discount at that age. That would be true, if you didn't have any lifestyle underwriting, avocation and driving record, and if there wasn't any correlation between the medical things and other things about a person's lifestyle if you are just talking about some short-term policy where all you care about is the mortality right then. Otherwise, there is a relevance.

Things like family history, persist forever, which by the way is one of the reasons the curves don't just go together way out in the ultimate period.

Doug, when you had the four different studies, three of the studies showed only a very slight discount for the preferred class. Does that mean that are you always supposed to conclude from that, that companies aren't giving too much of a discount for their preferred class? Is that just all relative to what their base standard is?

MR. ANDREWS: In terms of the discount for preferred, with three classes you have a low class, a high class and a middle one. As long as you're getting roughly equivalent qualification percentages in each class, that middle class is going to be about the aggregate standard level of mortality overall.

Now whether companies in practice are giving a greater discount for that preferred class because it has the name preferred, I think that goes to some of the things we talked about here. Are you accurately assessing the mortality assumptions and qualification percentages relative to your preferred criteria? I think that's a question each company has to answer.

MR. BERGSTROM: One of the companies I did some experience analysis for not so long ago showed that their actual expected ratios were really out of line from what they wanted them to be. Maybe 130 percent off of what they wanted the best-preferred class to be. But they were doing that by face amount. When we went in and looked at it by policy count, they were actually outperforming what they had thought they should.

So the question is, which one do we believe? Clearly the face amount has the most effect on the bottom line, but does that necessarily mean we have to change our underwriting criteria if the fundamental mortality underneath, based on actual deaths, number of deaths, is good? In other words, if there really is anti-selection by face amount, what do we alter to try to correct that?

Do we alter our assumption, or do we alter our underwriting?

MR. ANDREWS: I'll just say it's a question that might be different based on each company's individual objectives in the marketplace.

Chart 1

Assume that the probability distribution function resembles the shape of a normal curve.

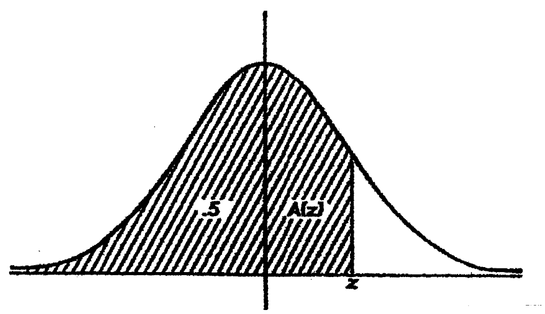

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Chart 2

Now assume that the extremes represent 50% and 150% of standard mortality, with 100% in the middle.

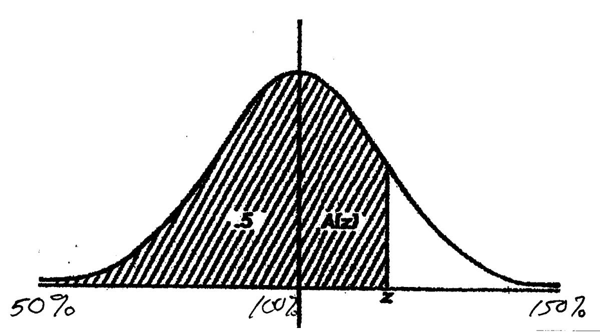

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Chart 3

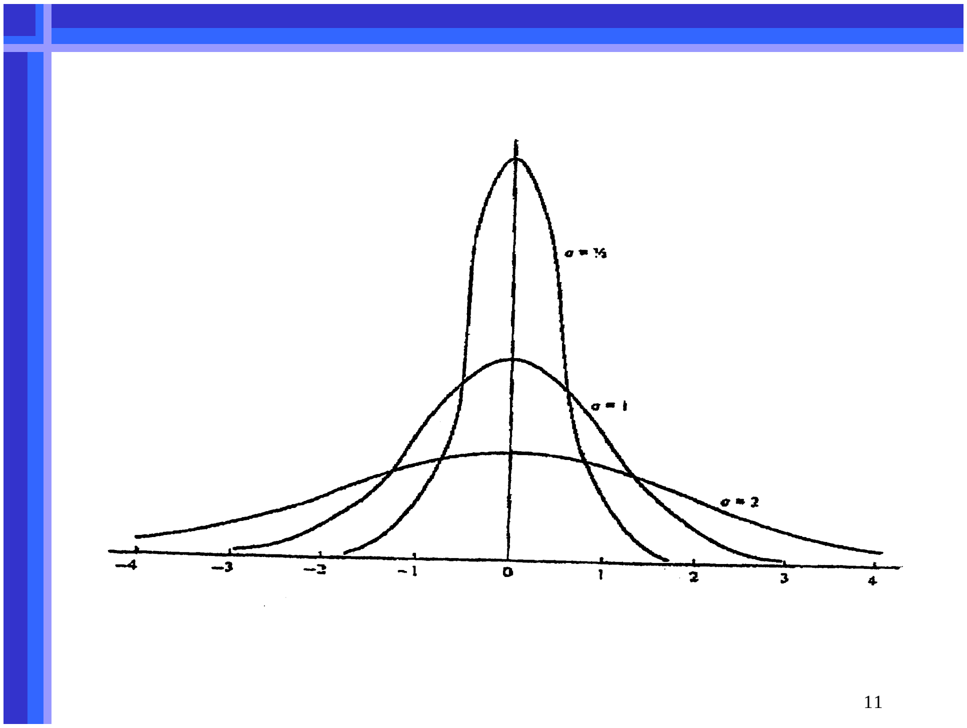

Chart 4

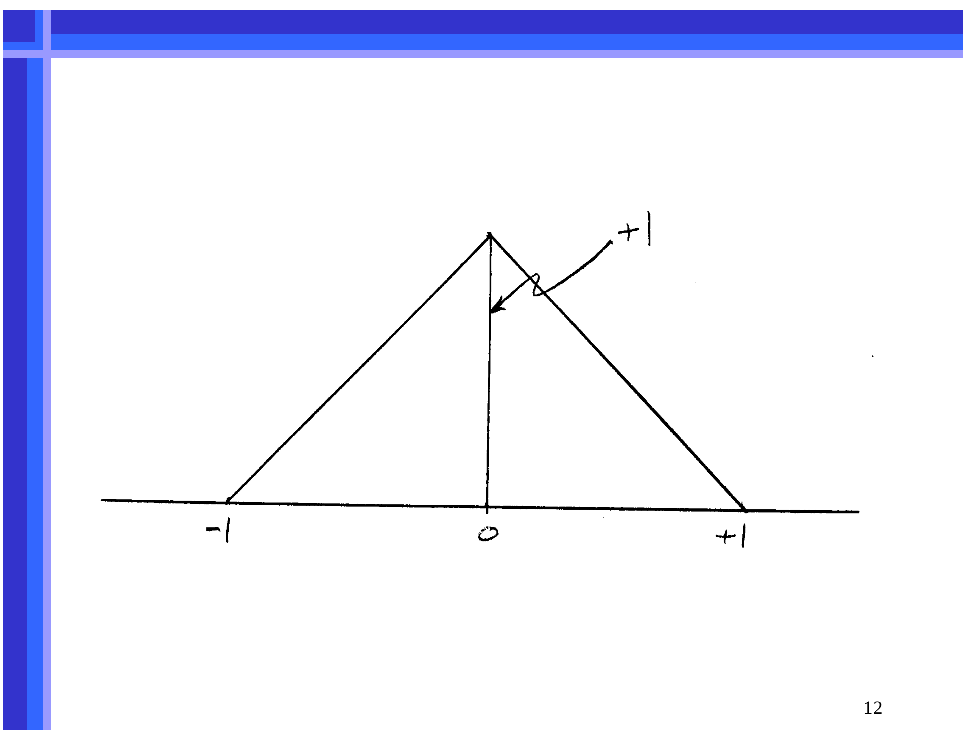

Chart 5

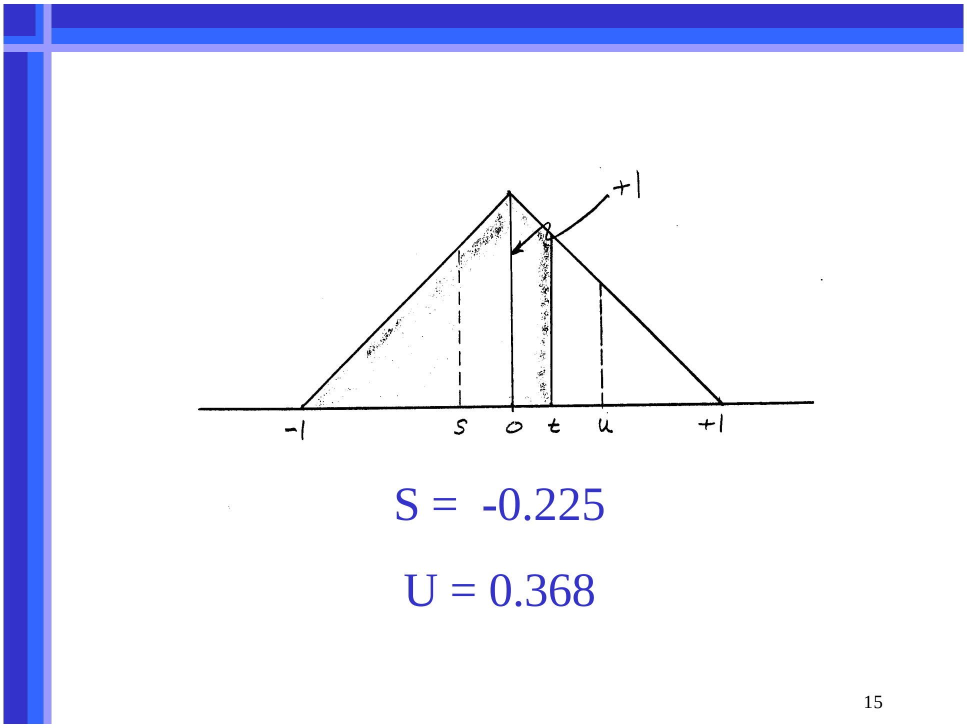

Chart 6

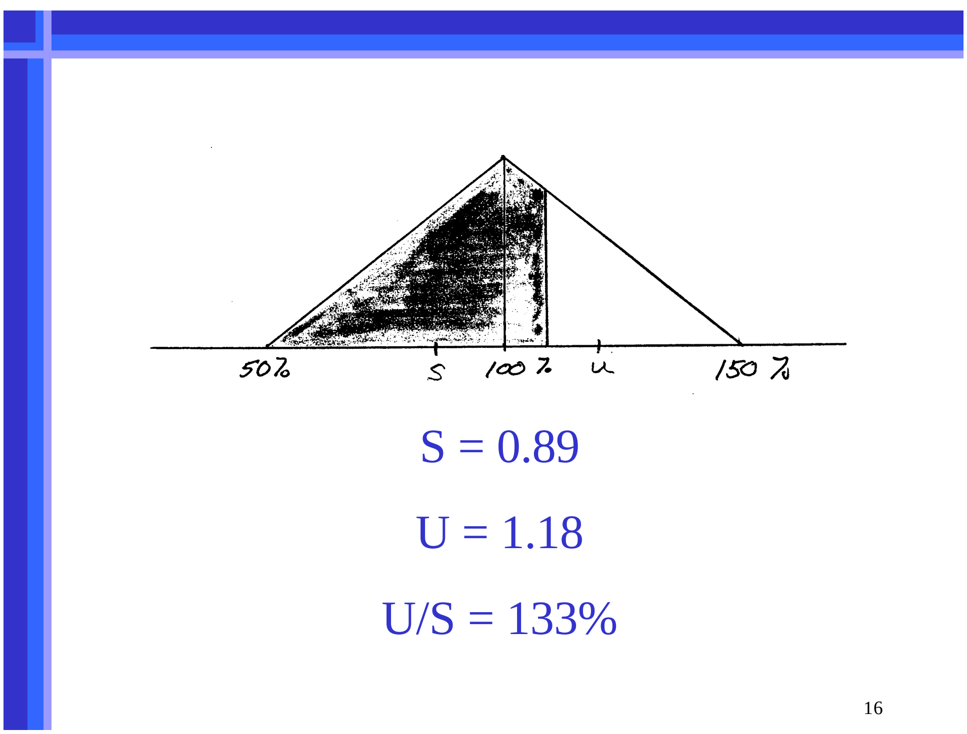

Chart 7

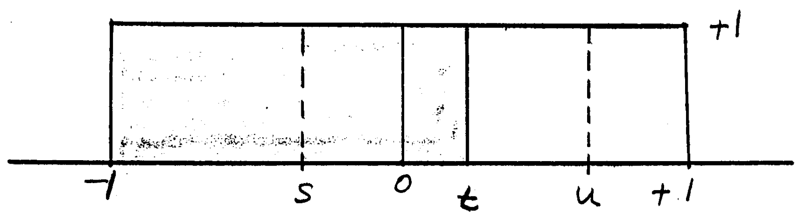

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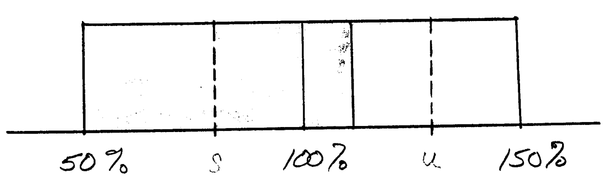
Chart 8



S = 80%

U = 130%

U/S = 163%

18