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RISK-APPRAISAL TECHNIQUES FOR THE 21ST CENTURY

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- Expert underwriting systems
- Experience on preferred risk and last-survivor issues
- Emerging trends

MR. JOHN O. NIGH: Our well-informed panelists include Dr. Richard Braun, second vice president and medical director at Lincoln National Risk Management; James B. Keller, chief actuary of Individual Life Reinsurance at Lincoln National; and Dr. Warren Kleinsasser, senior vice president and medical director at Osborn Laboratories in Shawnee Mission, Kansas. I am a principal in the Atlanta office of Tillinghast, a Towers Perrin company.

I will begin with a discussion about some approaches that companies take and some issues that companies face in establishing preferred-risk underwriting programs. I will also touch very briefly on some of the marketing, product design, and underwriting considerations for joint and second-to-die life insurance products.

Jim Keller will then speak on establishing assumptions for preferred-risk programs as well as some of the marketplace issues that need to be considered. This will lead into Dr. Braun's discussion on expert underwriting systems, the need for consistency in underwriting, and some of the pitfalls that might be experienced along the way. We will then finish with Dr. Kleinsasser's presentation on some of the developing trends in testing techniques and how those trends can be utilized in the underwriting process.

The first topic is preferred-risk underwriting programs. Before a company should embark on developing one of these programs, there are some basic but difficult decisions to make and questions to answer. One of the first questions is, what percentage should qualify? Obviously, the more liberal your underwriting criteria for qualification, the higher the percentage who will qualify. Similarly, the more conservative you are in establishing your qualification standards, the lower the percentage who will qualify.

What is your initial definition of standard mortality? Consider two companies that are embarking on the preferred-risk program. One company may be starting from an impaired-risk perspective and another may be, for lack of a better phrase, a large

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Eastern conservative mutual company. Obviously, its beginning definition of standard is going to be different. And hence, its preferred-risk profile may also be different.

Finally, what will the relationship be of residual standards to preferreds? You might say that's an obvious mathematical solution to two simultaneous mathematical equations. Often, however, we'll find that is not the case, because the residual standards will exhibit different mortality characteristics.

I will discuss hypothetical preferred-risk underwriting criteria for three companies. I'll look at the first company in detail and then briefly run through the next two. I separated the three companies' preferred-risk underwriting programs into what I would characterize as average, conservative and aggressive. By average, I mean that a medium level of applicants would qualify for the preferred-risk classification. Conservative means that a lower percentage would qualify, and aggressive means that a higher percentage will qualify. Again, I'll cover the average somewhat in detail and gloss over some of the more important points for the conservative and aggressive.

The first point is, I think, rather obvious. We're talking about going from a standard to a preferred risk, so I think it should go without saying that a person must first qualify as a standard risk. Company A requires no personal history of high blood pressure, diabetes, cancer, coronary artery disease, or cerebral vascular disorder, as well as no family history of coronary artery disease resulting in death before age 60. This particular company also has a smoker preferred classification. But for non-smoker preferred, there must be no tobacco use for at least 12 months.

There must be no drug or other alcohol abuse within the past ten years. There must be no driving while intoxicated (DWI) or driving under the influence (DUI) citations within the past five years, and no more than two moving violations within the last year. All blood profile and urine results must be within standards. Furthermore, no participation in any ratable avocations (Table 1) such as hang gliding and scuba diving is allowed.

Weight cannot exceed certain limits. In this case, I'll direct your attention to the 5' 8" male as a standard of reference as we go forward.

TABLE 1
Company "A" Guidelines -- Average

Male		Female	
Height	Weight [a]	Height	Weight [a]
5'4"	181	5'4"	177
5'8"	201	5'8"	196
6'0"	224	6'0"	220

[a] Weights do not exceed limits shown above.

I'll review our conservative company -- Company B -- very quickly. Cholesterol must be 250 milligrams or less with a high density lipoprotein (HDC) cholesterol ratio of roughly 6. Results of the full drug screen must be negative. All parameters of blood profile must be normal. Limits include no DWI violation and no more than two

moving violations within the last three years. No ratable impairments and no cigarette smoking for the past 12 months are allowed (no nicotine readings for any reasons whatsoever).

I've pointed out Company A's average weight for a 5' 8" male. Table 2 highlights some of the subtleties in underwriting criteria. For Company B, a 5' 8" male has to weigh less than 157 pounds. However, if he exceeds that up to 15%, he can still qualify, but must pass a body fat test. Our male example here had to have 17% or less body fat, and females must have 21% or less body fat. I run a lot of marathons and I think mine is barely under 17%.

TABLE 2
Company "B" Guidelines – Conservative

Male[a]		Female[a]	
Height	Weight	Height	Weight
5'4"	135-145	5'4"	124-138
5'8"	145-157	5'8"	136-150
6'0"	157-170	6'0"	148-162

[a] Medium frame

For Company C, the cholesterol workup cannot exceed 300. That's a bit high by standards.

Company C has an interesting feature that can qualify applicants for the preferred-risk category, but then they may be disqualified if they have any two violations: weight in excess of limits; total cholesterol in excess of 250 for nontobacco user and 230 for tobacco user; family history of coronary artery disease resulting in death of immediate family members before age 60 for nontobacco user and 70 for tobacco user; and an unsatisfactory noncholesterol blood profile, electrocardiogram (EKG), or treadmill test.

This leaves joint and second to die also referred to as joint or last to die. Here are some of the highlights of the marketplace. It tends to be an older age marketplace. It's clearly price driven and design competitive. We'll talk about some of the design characteristics soon. Because of the older age of applicants, there tend to be multiple impairments, implying impaired risks. We'll get into that in underwriting in a moment. Cases tend to be very large. It's not unusual to have $30-50 million cases. For those companies that have retention levels below say, even $10 million, their process of obtaining reinsurance can become very complex. As you can well imagine, the process of assessing two lives jointly, undertaken by several reinsurers, can result in a many different underwriting standards being imposed upon the direct writing company.

Here are some of the basic design issues that are faced by companies in the marketplace: the amount of base coverage versus what is allowed on term riders. Companies that place a limitation on the amount of term-rider coverage that can be issued relative to the base coverage often will find themselves at a competitive disadvantage. A good example of this is that a company that allows only 50% of the total coverage

to be rider coverage will not compare well against a company that will allow 90% of the total coverage to come from the term rider.

Product performance, of course, is important in areas such as dividend scale and credited interest rates.

The approach to rate determination can be important, even though theoretically a cash method should procure the same level of premiums, but often they don't. Three basic approaches are: (1) a combined table rating using a rating on each of the two individuals; (2) age adjusting each individual and then combining those; and (3) using an adjusted joint equal age.

My comments on design could probably fit under underwriting as well. And some of my underwriting comments could also fit under product design. But some of the common rules you'll see are that the second life cannot exceed a specified table or rated age. For example, a number of companies that will impose a rule saying that if the second life is rated higher than Table D or Table 4, they won't allow the policy to be issued. Another rule that we'll see is that the combined adjusted ages, when added together, cannot exceed a specified total. One example would be imposing a rule in which the combined adjusted ages cannot exceed 185.

Next, I will address some underwriting issues. As I previously stated, there are multiple impairments involved, so the underwriter needs to be versed in underwriting impaired risk. Financial underwriting -- we are again talking about very large cases -- is very important. It's particularly complex for the younger ages, say those who are aged 40-55, where their future financial needs are unknown. It's difficult. The estate needs might be $10 million, but the estate needs at age 65 very well could be $30-40 million.

We're jointly assessing two lives, not two separate lives for two separate issues. This process is more time-consuming and, therefore, more expensive than just underwriting two lives separately.

I'll discuss some of the criteria I've heard companies use. A company won't issue a policy to someone whose life expectancy is less than, say, two years. Curiously enough, we'll see policies issued on individuals in which both are uninsurable by single-life standards, meaning that both may exceed 500% extra mortality.

My final comment on underwriting is that many companies tend to be very aggressive, and some companies tend to be particularly aggressive if the second life is healthy.

MR. JAMES B. KELLER: Many of you, I'd be willing to speculate, offer a preferred classification among your company's products. At the same time, I'd also suspect that most of you aren't entirely comfortable that the marketing, underwriting, and pricing of preferred products are all perfectly synchronized. And many probably don't have absolute confidence in the resulting mortality assumptions. After discussing the pricing, I'd like to briefly touch on: a potential problem with preferred products/ pricing, a future product design that solves the problem, but which requires a great deal of skill in risk appraisal.

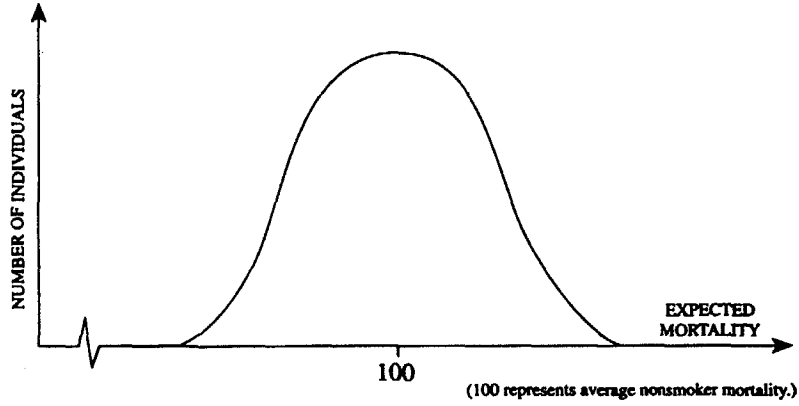
PRICING OF PREFERRED CLASSIFICATIONS

Many of us have faced the challenge of pricing preferred products. The concept of categorizing the large nonsmoker market makes sense -- about 75% of all applicants are nonsmokers -- but deciding how to make the latest split has been more difficult than establishing criteria for smoker and nonsmoker products. Unlike the first split, little or contradictory research findings exist to guide insurers entering the new market.

In a typical mix of life insurance applications, approximately 3% are declined and 4% are rated substandard. Of the remaining 93%, 15-25% are classified as standard smokers, leaving approximately 75% of all applicants in one class: standard nonsmokers.

Obviously, all subgroups of standard nonsmokers do not exhibit the same mortality. The mortality curve for the standard nonsmoker group might be characterized as a bell-shaped curve, as in Chart 1. Preferred nonsmoker plans split this large class of standard nonsmokers into two groups. Coordinating underwriting and pricing is more crucial than ever to effectively define these groups.

CHART 1
Mortality Curve for Nonsmoker Group



Preferred products are common in the U.S., whether the product is term or permanent. For permanent products, it's probably easiest to develop preferred nonsmoker premium classifications for products with internal cost-of-insurance rates, making the differentiation simply by splitting the rates.

The decision on whether to develop such a product is easy for some companies to make, but quite difficult for others. Unavoidable antiselection is a distinct concern if an undifferentiated nonsmoker product (i.e., no preferred class) is sold in the face of a

competitor's preferred nonsmoker product. Having more competitive premiums for preferred risks and reducing antiselection are two advantages of developing a preferred nonsmoker product. The greater the competition, the more important these advantages become, perhaps explaining why many companies with less-captive marketing distribution systems quickly developed preferred nonsmoker products.

However, these advantages must be weighed against the disadvantages: higher premium rates for nonpreferred nonsmokers, agent/applicant disappointment when an application is not accepted on a preferred basis, agency pressure on underwriters, and lack of related industry mortality studies. To alleviate this problem, a questionnaire may be adopted to supplement the application form, which can help both the agent and applicant understand whether "preferred" is likely to be a possibility.

When designing a preferred nonsmoker product, a marketing decision must be made concerning the desired split of the standard nonsmoker class. What percentage do you want to fall into the preferred classification? 20%? 50%? 8%? Usually, the lower the percentage, the lower the expected mortality. However, a relatively low percentage qualifying may cause some marketing/agent concern and subsequent disappointment of your field force. A relatively high percentage qualifying may be easier to administer, but may result in an uncompetitive preferred product. Most companies in the preferred risk market have found that successful preferred products have roughly a 50/50 split between "residuals" and preferreds.

These marketing considerations should not be taken lightly. One company did an excellent job of coordinating its underwriting and pricing, but forgot to include marketing in the loop. This company designed a preferred nonsmoker product with very competitive preferred nonsmoker rates, anticipating that only 30% would qualify as preferred. Agent pressure mounted as many of their clients did not qualify for preferred. Underwriters began to bend. Finally, actuaries repriced the product. Now it is dealing with agents who are unhappy about the preferred rate increase.

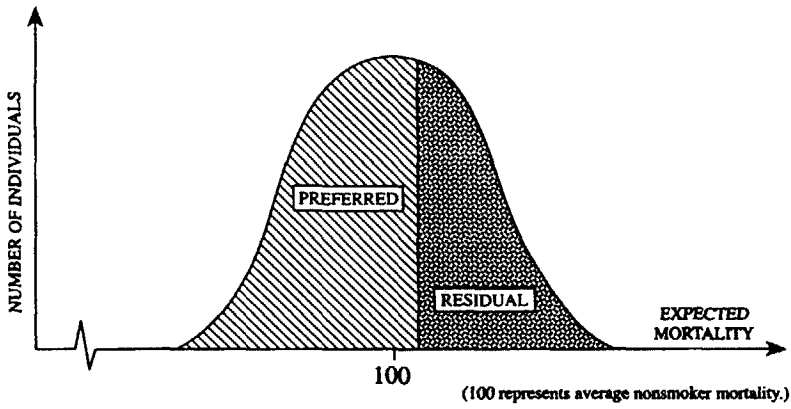
Lessons can be learned by examining what happened when many companies initially adopted a nonsmoker premium class in the early 1980s. The underwriting criterion ordinarily used to distinguish between smokers and nonsmokers was whether the proposed insured had smoked a cigarette in the last 12 months. Initial efforts in setting the mortality assumptions depended on some combination of data from U.S. Surgeon General reports and the State Mutual and Sun Life experience studies. As more companies moved from an aggregate product to smoker/nonsmoker-priced products, a new trend emerged: companies that continued with their aggregate products had a disproportionate concentration of smokers and hence were unlikely to meet their aggregate mortality objectives.

A similar situation may be developing. If your company's competitors have a preferred nonsmoker product and you don't, then your standard nonsmoker product may end up with a disproportionate amount of "nonpreferred" nonsmokers.

How should the nonsmoker group be split to minimize disproportionate concentrations of nonpreferred risks? What underwriting criteria should be used? How are the corresponding mortality assumptions set?

The standard nonsmoker class can be split numerous ways. The criteria to qualify as a preferred nonsmoker can be restrictive, allowing a low percentage to qualify as preferred, or, on the other extreme, loose or unrestrictive, permitting the majority of standard nonsmokers to fall into what is called preferred. Regardless of what percentage you wish to qualify as preferred, the utopian criteria would split the standard nonsmoker class into two distinct groups, with each individual in the preferred classification truly classifiable as having a lower mortality expectation than those in the residual class (see Chart 2).

CHART 2
Mortality Curve for Preferred/Residual Nonsmokers



Underwriters are responsible for determining what qualification criteria are practical, including which cut points to use for each criterion in distinguishing preferred risk. The process requires collaboration with the medical director and actuary, as well as with marketing, to agree on the practicality and marketability of the underwriting criteria. Underwriting factors and cut points must do more than just split the standard nonsmoker class into two segments; the segments must be two distinct risk groups, with one presenting more favorable mortality than the other.

The importance of this can be seen in an extreme example. You could designate all individuals whose last names start with A through K as preferred, and individuals whose last names start with L through Z as residual. The usual nonsmoker class has been split into two groups (roughly a 50/50 split), but both groups present the same mortality (Chart 3). Another less extreme example would be to use blood pressure alone to define the preferred nonsmoker class. Alternatively, you could determine a cut point that would roughly split the standard nonsmoker class into half preferred and half residual. The preferred class would have lower overall mortality than the

residual class (Chart 4), but many individuals in the preferred classification would be expected to have higher mortality than many of those in the residual class.

CHART 3
Mortality Curve With 50/50 Split of Nonsmokers

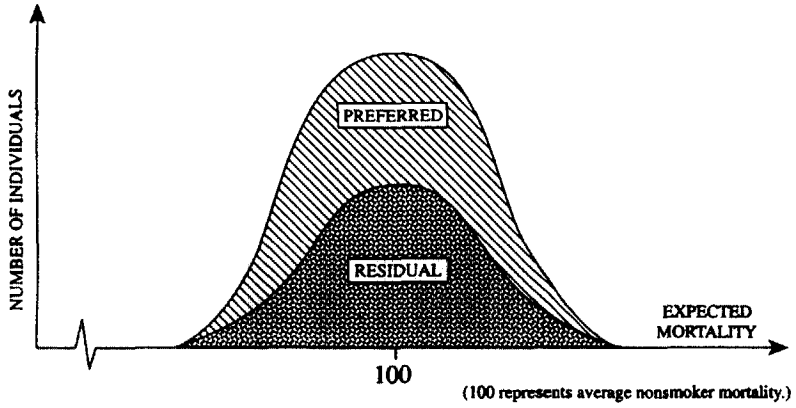
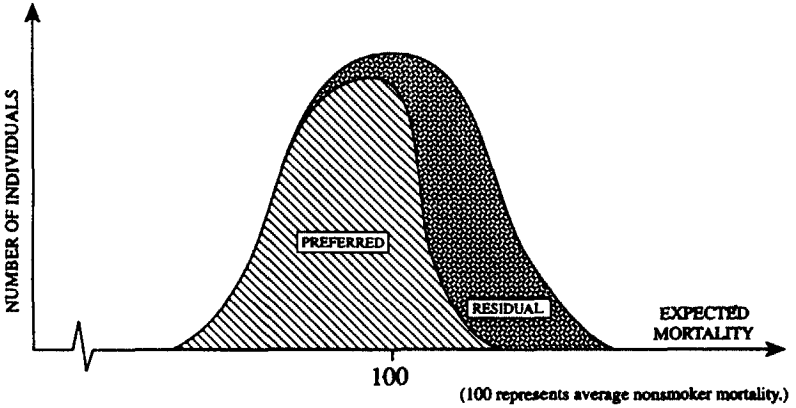


CHART 4
Mortality Curve of Nonsmokers



In the utopian design, all individuals in the preferred classification are more likely to have lower mortality than all individuals in the residual classification. Such a perfect split is unrealistic, but you may be able to come close to achieving it by requiring

several qualification criteria and related cut points. Obviously, there will be trade-offs between the utopian concept and simplicity in design. However, today's armamentarium of underwriting requirements provides an ideal opportunity to determine a preferred classification.

Legitimate underwriting criteria for determining preferred risk – in addition to cigarette smoking – include coronary risk factors (e.g., blood pressure, pulse rate, timed vital capacity, total cholesterol level and/or HDL cholesterol level, family history) and "predictors" that traditionally determine debits and credits in assessing risk.

In examining many available preferred nonsmoker products we found underwriting criteria based on factors such as any use of tobacco or nicotine chewing gum, build, blood pressure, blood lipids, liver-function test findings, aviation, participation in hazardous sports/avocations, occupation, motor vehicle record history, and a requirement of a lack of ratable conditions that result in more than 10 or 20 debits for any impairment. "Hard" indicators (i.e., objective, measurable, verifiable) that produce predictable results should be used to determine the risk, rather than "soft" indicators, such as frequency of exercise or eating habits. Thus, preferred nonsmoker products usually have a minimum policy size that corresponds to the company's paramedical/blood-testing limits.

Unfortunately, no industry mortality study is available on preferred-versus-nonpreferred classifications. There may never be such a study that is useful. Unlike splitting aggregate products into smoker/nonsmoker, in which the industry generally agreed on who qualified as a nonsmoker, creativity flourishes with little consensus on what constitutes a preferred risk. As such, the likelihood of developing credible, homogeneous, industrywide preferred nonsmoker mortality data with respect to certain qualification criteria is unlikely. Even the latest nonsmoker/smoker industry mortality studies are confounded by a disproportionate number of companies with preferred nonsmokers in their "nonsmoker" experience, thus skewing the nonsmoker mortality downward.

What, then, can you use to set mortality assumptions? If you start with standard nonsmoker mortality, the percentage of applicants to fall into the preferred classification and mortality relationships between residual nonsmokers and preferred nonsmokers, you can simply solve two simultaneous equations and set the mortality assumptions. The first two pieces (standard nonsmoker mortality and the percentage of applicants falling into the preferred classification) are the easier assumptions. Possible resources to help determine the preferred/residual relationship would include protective value studies of various underwriting requirements and certain impairment mortality studies and epidemiologic studies such as the Framingham Heart Study.

In estimating the mortality influence of selection criteria, it may be challenging to extrapolate from cause-specific mortality to all-cause mortality. For example, it's generally recognized that low levels of total serum cholesterol are associated with relatively low coronary disease mortality. However, it may not be as well recognized that the low coronary mortality may be counterbalanced by relatively high cancer mortality.

For a given set of criteria, there will probably be marked differences in the residual and preferred mortality by age. For example, if the criteria to become preferred are heavily weighted in evaluating cardiovascular elements, older people will have a higher residual-to-preferred mortality ratio than younger people. Conversely, if the criteria discriminate more on accidental and other violent deaths, the residual-to-preferred mortality ratio will be greater at the young ages than at the older ages.

PROBLEM

So what's the problem? As you are keenly aware, preferred products do not all share the same criteria. In trying to underwrite and price preferred products, we take the standard mortality curve and split it into two distinct groups: preferred and residual, as shown in Chart 2.

Even if we could underwrite and price a preferred product perfectly, an open market can cause us to not meet our mortality or pricing objectives. For example, if your company introduced a preferred product as shown in Chart 2, another company could design a more select preferred product, with a lower percentage qualifying for preferred, and all other things being equal, have a more attractive price. The healthiest of your preferred applicants would go to your competitor, and you would retain the least healthy of your preferred applicants. With the healthiest preferreds excluded, your mortality would no longer be the mean of what you thought that you were going to receive.

Another competitor could come out with a product that is less stringent than yours, meaning that a greater percentage would qualify as preferred. As such, the healthiest of your standard rate applicants would be drawn to that competitor's preferred product and you'd be left with the least healthy of your standard applicants and again, you would not meet your mortality expectations. The root of this problem is competition, an open market, and differing preferred criteria.

SOLUTION

The ultimate preferred product is a potential solution. With the ultimate preferred product, semihomogenous groupings no longer exist. The underwriting action would not assign a classification such as standard nonsmoker or preferred nonsmoker, but a mortality score. This mortality score would then be translated to the price or internal cost of insurance.

Consider the possibilities. No longer would there be subsidization of borderline standard or borderline preferreds. No longer would underwriters be pressured to give one more "point" to be preferred. Competition could increasingly focus on underwriting assessment, not simply price. Refinements in underwriting development could immediately change future "scores" and hence the price. Scary? Exciting? Yes!

Of course, various concerns also surface, such as the ability to produce rate books with price ranges, administrative concerns, or various other regulatory/filing questions. Probably the greatest challenge is the need for extremely precise and consistent underwriting assessments. The ability to achieve this may rely heavily upon the advantages offered by a knowledge-based system for underwriting.

To help us better understand how this kind of underwriting could be done through such a system, our next panelist is from a company that has developed and marketed such a system. Dr. Richard Braun is second vice president and medical director of Lincoln National Risk Management. This company currently markets the life underwriting system, an individual medical expense underwriting system, and will be unveiling, in the future, a life and disability income claims system. Lincoln National Risk Management has currently licensed its underwriting systems to 38 clients, with 16 already utilizing the system to underwrite cases.

Dr. Braun's credentials are long and impressive. He received his medical degree from the University of Maryland, and he is board certified in internal medicine and insurance medicine. He is a Fellow of the Life Management Institute (FLMI). He serves on the Executive Council of the American Academy of Insurance Medicine (AATM), on the Life Underwriting Education Committee, and on the ACLI medical section's Genetic Issues Committee. He was recently named chairman of the Liaison Committee for Intercompany Studies between the Society of Actuaries, the Home Office Life Underwriters Association (HOLUA), the Institute of Home Office Underwriters (IHOU), and the AAIM.

DR. RICHARD BRAUN: Fine-tuning of risk assessment, as mentioned in Mr. Keller's presentation, is certainly one of the benefits of knowledge-based systems, and we will come back to it. But, before we do that, I want to present some background to provide a frame of reference for the discussion. I have worked on Lincoln National Risk Management's patented underwriting system full-time for the past 3 1/2 years and two years prior to that. It has been very exciting to see the explosion of activity and interest in knowledge-based systems during that time. In the last few years, the attitude has changed from healthy skepticism to acceptance of knowledge-based underwriting systems as a competitive advantage. I would like to present my perspective on how knowledge-based systems are changing the risk appraisal process and where I see things headed in the future.

One of the first things that you must realize is that the future in some companies is the present in others. In other words, some companies have been working on implementing knowledge-based systems in the underwriting process and are in production while other companies are still evaluating their options. But I would hope that those of you who are utilizing this technology will benefit from this discussion by my references to current trends. You should also be aware that knowledge-based systems are changing the face not only of insurance companies, but of many businesses from accounting to retailing.

I would like to make this as practical as possible, so I will focus on business needs and how knowledge-based systems can address these needs. The implementation of knowledge-based systems is a process that needs to be coordinated with business goals. The following is a list of needs found in many insurance organizations, followed by an individual discussion of that need: reduce expenses and increase efficiency (work smarter, not harder); improve customer service; improve the quality of decisions; reduce or eliminate errors; increase employee satisfaction; and increase management information. There are organizational and cultural changes associated with the implementation of knowledge-based systems that cause initial trepidation, as

any change to an organization does. Resolve and good planning are required to implement these changes effectively.

The need to reduce expenses and increase efficiency is a constant in any business. According to the 1992 *Life Insurance Fact Book*, the life insurance dollar is spent as follows: 58.6% to benefit payments; 23.8% to additions to reserves; 2.2% to special reserves; 4.5% as commissions to agents; 7% as home and field office expenses; and 3.9% as taxes and dividends.

Knowledge-based systems reduce expenses primarily in two areas. First, the largest potential saving is in the area of benefit payments. Expert impairment modules bring consistency and expertise to the underwriting of medical risks, resulting in a reduction in the largest expense category. Because the majority of company revenue goes to pay benefits, a small improvement in a company's mortality results should help the bottom line significantly. Mortality savings are achieved through the use of knowledge-based systems to reduce oversights. Underwriters occasionally have "bad days," and minor errors in reinsurance coverage or the assessment of an impairment can result in large claims for the company. Proper implementation of knowledge-based systems will reduce the possibility of inadvertent mistakes, resulting in improved mortality experience.

Consistency in the risk appraisal process is another vital benefit of knowledge-based systems. Five different underwriters, underwriting the same case, using the same expert impairment module, with the same company-specific mortality conversion, should arrive at the same appraisal of the risk. This allows a company to adjust the assessment of that risk and be assured that the changes will be uniformly implemented. Most importantly, the top underwriting directors in the company control and direct the process, ensuring that underwriting policy is in line with company goals. Experienced underwriters can also be given the flexibility to make business decisions, and these decisions can be tracked and studied. Expert impairment modules are well recognized as training tools that teach the proper approach to a particular impairment. Utilization of "expert systems" in general is well accepted as a method of elevating the quality of the decisions of the user to the level of the experts who participated in the design of the system. More experienced underwriters get the benefit of getting a second opinion from the impairment module on complex or large-amount cases. And finally, the risk appraisal process is improved by the more precise assessment of risk that was mentioned by Mr. Keller in the earlier presentation. Knowledge-based systems not only can assess the risk more precisely, but can convert that risk to a rating appropriate for products having different pricing structures and associated benefits.

Second, the introduction of knowledge-based systems acts as a catalyst for the reengineering of the new business process, thereby reducing home-office expenses. Companies are collecting the entire application as data. This allows them to automate simple decisions, integrate existing systems so that a support person can handle many processes from a single workstation, and reduce the number of people who must handle an application. A percentage of case-approval decisions are made by the system, allowing professional underwriters to work more efficiently on the more complex cases. And requirements ordering is automated, reducing the expenses from the field by eliminating unnecessary requirements. In some new business

organizations, there has been a gradual buildup of procedural processes and interactions with systems that has gradually diffused the focus away from customers and onto procedures. Knowledge-based systems that are well planned and implemented offer the opportunity to refocus on the customers and the vital relationships on which our business depends. We are well aware that employees are the business, and any implementation should have the goal of providing a challenge to the employee and rewards commensurate with effort. The knowledge-based systems should assume the bulk of the "drudgery" work and leave the employee with the "exceptions," the challenging cases that require some problem solving. And, as personnel expenses are reduced, the remaining people should share in greater rewards for working more productively.

If you view the producer force as customers of the new business area, you can focus in on improving service to the producer. Electronic applications collect application information as data, and resident edits act to eliminate sending applications back due to errors or omissions. Field processing allows immediate feedback as to requirements and likelihood of approval. Electronic data collection also allows for the complete collection of information through the pyramid approach to collecting data and impairment questionnaires when needed. E-mail and electronic statuting of cases are services that save valuable time for the producers and make them feel more connected with the home office. And quicker turnaround time in issuing policies improves the likelihood that the policy will be placed and rewards the producer for securing the business. According to the 1993 Life Office Management Association (LOMA) survey of service turnaround times as reported in the *Resource*, the issue of a fully underwritten case takes approximately 36 days. Jet issue takes 10-12 days. By utilizing technology and knowledge-based systems, the fully underwritten case turnaround can be reduced to approximately 20 days. And jet issue could be reduced to one day. By reengineering the new business process to take full advantage of the knowledge-based technology, the fully underwritten case could be underwritten in approximately 10-11 days. The limiting component will be the time that it takes to receive requirements.

We can review the benefits of knowledge-based systems by reviewing the components of the system and associating the benefits with the component. Data entry in the hands of the producer allows complete collection of information and editing to ensure complete and accurate information. Screening and initial underwriting provide requirements, ordering, and automated underwriting approval of appropriate cases, thereby freeing the underwriters to concentrate their considerable skills on more complex cases and producer relationship building. Process requirements is a system component to allow the tracking of requirements and the entry of data from requirements that are not sent as data. The manual entry of data from requirements should be greatly reduced or eliminated as the industry moves toward electronic data interchange (EDI) as the preferred method of reporting requirement results. The workflow management system acts as the catalyst for reengineering the processes of the new business work flow and reduces the number of hands that come into contact with a new application.

Information display and the impairment underwriting system are underwriting tools that provide training in risk appraisal and consistency and improved accuracy of risk selection. And finally, the management information and control component provides

the ability to manage underwriting policy and study the effect of that policy on the new business being written.

Some of the challenges that face us in the development of knowledge-based systems that perform risk appraisal can be categorized into two areas. First, processing concepts such as occupation, avocation, or illness require large databases of possibilities associated with a thorough knowledge of their effect on risk appraisal. And second, impairment profiles or frames have already been developed, but they will continue to be enhanced to store the essential information (associated with a concept) that is needed in the risk-appraisal process.

We covered a lot about trends during our discussion of benefits of knowledge based systems, but I would like to focus on four areas in which current activity will result in significant industry changes during the next few years. First, more requirements will be received as data. Notebook computing power is cheap and is getting cheaper. Custom data collection, data entry by a vendor, and speed of delivery will be significant competitive advantages to requirement vendors. All of these facts indicate that the trend will be toward receiving and processing requirement data automatically. EDI is already a prerequisite to doing business in auto manufacturing and financial services. Everything from blood-profile results to urinalysis results can currently be received as data. Eventually, electrocardiograms and attending physician's statements may even come in as data (especially if current proposed changes to uniform reporting of insurance claims in the health care system come to fruition).

Second, there will be a continual improvement in the use of the data being collected. As the focus moves away from implementation of knowledge-based systems toward effective use of the data collected in these systems, the data will be processed into information to better study all aspects of the business. Examples could include case cost per underwriter, impairment mix by producer, proposed insured's income by product, etc.

Third, the automation of the procedures and processes will provide better customer service and ever improving turnaround time. And finally, the processing power will be distributed to interface with the customer to provide improved data collection and decision-making power at the point of event, resulting in improved placement rates.

It could be stated that there are three "functions" associated with most insurance sales. The sales function is focused on locating a prospect and selling the person on the appropriate product. The administrative support function ensures that the necessary legal and administrative requirements are met in the application process. And the risk-appraisal function assumes responsibility for equitably coordinating risk with pricing to keep the company profitable. Electronic applications will be the standard in the future. Knowledge-based systems will provide the sales producer with administrative and risk-selection support, and only complex cases or cases with outstanding requirements will require consideration by the home office.

DR. WARREN L. KLEINSASSER: I thought I would talk about a couple of specific laboratory tools that have come along in the recent past to assist the underwriter.

A couple of years ago, a tumor marker conference was sponsored by and for the industry and was held in Bethesda, Maryland. And at that time, many people were somewhat down on the tumor markers and their use in the underwriting process. Lo and behold, during the last two years, due to developments in clinical medicine, we've been almost forced, in many cases, to begin using a tumor marker -- prostate-specific antigen (PSA). I'd like to talk a little bit about that. And then I'd like to follow with some discussion of alcohol markers, because I think these things will be coming along very quickly. Many underwriters are already using them to some extent.

Prostate cancer screening, as you're probably well aware, has become almost a *cause celebre*. You see advertisements in papers that talk about free prostate cancer clinics, where you can go in and get your test done at no charge. These results probably will not end up in your regular medical record, and they very well could be a basis for antiselection. In fact, we have seen some specific cases that have amounted to millions of dollars in insurance applications and obvious antiselection has been involved. The reason for this is that prostate cancer is the most common nonskin cancer in men. And even though you have heard the statement, "Men die with, but not of, prostate cancer," it is the second leading cause of male cancer deaths in the United States. The reason you hear the previous statement is that so many more people have it than die of it. But nonetheless, it is the second leading cause of male cancer deaths.

The incidence over age 50 is said to be about 30%. If you get up into the 80-year range, it approaches 80-85%. This data is based on autopsies, but autopsies don't necessarily reflect the clinical spectrum of disease, because most of the autopsy tumors are smaller than is thought to be significant. About 5% of autopsied tumors are in the potentially significant range of 0.5-3.0 cms in size. This is the size that is potentially curable. These comprise about 20% of cancer-screening series and only about 5% of autopsy series.

One of the reasons men need something other than a digital rectal examination to assess prostate cancer is because the prostate is located in such a position that it is on both sides of, in front of, and in back of the urethra. And it cannot be reached for the most part by the examining finger. About 70% of prostate cancers cannot be reached with the digital rectal examination. And that's why you need some marker other than a physical examination.

The problem with PSA is that it's not prostate cancer specific. It is prostate specific but not cancer specific. It can be elevated in prostatic cancer and in prostatic hypertrophy and even in acute urinary retention or urinary infection. There is good recent evidence that physical examination, a digital rectal exam, has no real apparent effect on the value. So it can be drawn at the same time as an examination.

Originally, the data that came out was not very impressive for PSA. An article published by the American Cancer Society in 1989 said that for people who got as far as prostate surgery because of symptoms and findings, the positive predictive value of PSA was only in the 28-35% range. This would mean that in the asymptomatic crowd, it probably would have a positive predictive value in the 5-10% range.

On the other side of the coin, it's also known that as high as 48% of prostate cancer will have normal values. Four is considered the upper limit of normal for PSA by test. And almost half of the prostate cancers can have normal values. So it would tend to miss a lot of cancers, which doesn't sound very good.

William J. Catalona's study in the *New England Journal of Medicine* showed that 41% of the patients with values just above 4 (in the 4-10 range) already had extracapsular extension of the tumor. That means that they were not in an optimal situation for cure when treated. And 10 is the limit that some companies within the insurance industry are using for cutoff. So you can see that they are accepting some risks. The other side of that coin is that if they didn't test, they wouldn't even know that the risk was there. So they'd be missing it totally.

An interesting study compared patients to find out how many could be treated surgically for cure. Between 1974 and 1984, the study found that 42.5% could not be treated for cure. Of those, only 6.2% had a PSA test. That data was compared from 1990 in which that number had dropped to 32%. But by then, PSA tests had increased; over 70% of patients had them, which is indirect evidence that PSA may be of value in catching disease processes earlier, when they are more treatable.

How good is the test? Catalona discovered that with a value of over 4, about 27% of the group of 1,600 supposedly healthy men over age 50, did have a prostate cancer when followed to completion. If you take a PSA value over 10 that percentage rises to 60%, meaning there is still about a 40% false-positive rate. So it is not a perfect test. In some respects, it is similar to mammography in women. Mammography is, even though touted widely, not very sensitive or specific. Only about 10% of the lesions found on mammography, when taken to surgery, prove to be cancerous. On the other hand, mammography tends to miss about 10-15% of cancers. So it is not perfect either.

While PSA is not a perfect test, it has come a long way, and because of data from Catalona and others, it has been increasingly used. Pathologists tell us that the number of people using it is up hundreds of percent from what it was just two years ago. We had a case in which a patient had a value of 53. The medical director wrote a letter to this man saying that we had some information to transmit to his doctor. He must have gone directly from the mailbox to the telephone, because within 48 hours after sending the letter, he called the medical director asking, "Was it my PSA? I've had it done twice in the last two weeks, and it was 54 and 52." Well, that is an obvious case of antiselection.

Because of the problems with interpreting PSA, it is being interpreted in a couple of different ways. One is to measure the size of the prostate gland on transrectal ultrasound (TRUS). The amount of PSA that is in normal tissue versus the amount that is in cancerous tissue is then known, and you can have a formula. Then you take the PSA and divide it by the volume of the prostate to come up with a figure. If that figure is over 0.15, there is a high risk of cancer, and if it's below that, or certainly below 0.10, there is a very low risk.

This seems to work well in discriminating cancer from noncancer. But the problem is, measuring of the prostate size with TRUS is not a good science yet. That may be

one way of doing it, but there is another way of looking at PSA, and that's called PSA velocity. Someone found that five years before there was any diagnosis of cancer, all the values were indistinguishable between benign and prostatic tissue for PSA. But those who subsequently went on to have a cancer had increases of 0.75 micrograms per liter per year; or, in one other study, an increase of 20% per year. And in benign prostatic hypertrophy (BPH), the specificity was 90-100% for controls. This is interesting because, even looking at values in the normal range, they found that if that 0.75 were there per year or there was a 20% increase, one was at high risk for cancer. If someone had a value of 2, and if he went from 2 to 3 within the year, it was something to be quite concerned about. I suspect PSA velocity is something underwriters will be looking at, because pathologists are now beginning to give serial values of this on medical records, simply for this reason.

So, this is something that underwriters have begun to look at, and many companies are now ordering PSA tests, especially for men over age 50, and especially for larger-amount cases. And, of course, what's large amount to one company is obviously different than what it is for other companies.

There are some other reasons. The American Cancer Society, the American Radiologic Society, the Urological Society of America, and the American Society of Clinical Oncologists have recommended that men over 50 should a digital rectal exam and a PSA test done annually. So this is going to become even more of an antiselection factor in the very near future.

There are some questions from an underwriting point of view. What cutoff are you going to use? Are you going to use 10, in which case you'll miss well over half of the cancers? A study dealing with bone scans revealed no positive bone scans in 1,300 cases if a cutoff of 8 were used, and only about 0.5 of 1% of positive scans if 10 were used as the cutoff. So underwriters hope that if they get values between 4 and 10 and alert clients to these values, the clients will then go back to their physicians for an examination and any appropriate treatment, and they will not only have helped that person by discovering something early but they will also ease their risk somewhat from an underwriting point of view. I think that's the reasoning that goes into using values up to 10.

What do you do about abnormal values? Even if you ignore the 4-10 range and take the case at standard, I think you still have an obligation to let that person and/or his physician know about that value so that a workup can be done. The same applies to deferred or declined cases. If a person has had cancer surgery, the PSA value should really be down to 0 and should remain there. If it starts coming back up, you have a recurrence on your hands.

So that's how underwriters are using PSA. I also want to talk briefly about alcohol markers. As we all know, the goal of underwriting is basically to counter antiselection and avoid overpricing (properly categorize the risk), but certainly to avoid unnecessary declinations. I would pose that, with the way we've been underwriting alcohol questions in the past, we've probably thrown the baby out with the bath in many situations. And thrown out some good business, as well. The use of laboratory data really should be a two-way street. The Centers for Disease Control (CDC) data that was published in July 1993 shows the ten leading causes of death for men aged

25-44. AIDS is coming up from the bottom. We do a good job of underwriting that, with the testing that we do. We also do a good job of underwriting heart disease by looking at cholesterol levels, electrocardiogram results, and family histories. However, if you look at the ten leading causes of death, you'll see unintentional injuries or trauma at the top of the list. Then you see cancer, suicide, homicide, chronic liver disease, cerebral vascular disease, and the last is diabetes mellitus. All of these either are caused by or are affected by heavy alcohol use.

Obviously then, alcohol becomes an important underwriting issue. It's also an important financial issue. It's estimated that it will cost the United States $150 billion in 1995 in terms of lost productivity, health care, and so on. A third of all acute-care patients in hospitals have alcohol-related problems. And if you look at the causes of death in trauma, you'll find that they range from homicide down to narcotics and drownings. It's interesting that they're talking about laws for regulating how much alcohol boat drivers can have. But also now in some states, including Minnesota, they're talking about laws regulating the amount of alcohol a boat passenger can have. This is because most drownings that occur during boating excursions happen to people who fall overboard and aren't sober enough to swim.

So how effective is our trap for catching the chronic alcohol abuser? In the past, as you know, we've used inspections and attending physicians' reports. The old saying about attending physicians is, "If you wish to drink, find a physician who drinks more than you do." Examiners haven't told us much about drinking since we've gone to paramedical exams, because they don't feel the liver and they don't look for spider angiomas, otherwise known as liver spots. And the only people who admit to drinking are those who have quit. So we went to laboratory testing in the 1970s and looked primarily at the liver enzymes gamma-glutamyl transpeptidase (GGT), asparate transaminase (AST), and alanine transaminase (ALT).

There are many problems with those liver enzymes; they are seen in many different tissues. In fact, some of them, AST for instance, are used to diagnose heart disease. But you can also find them in red cells and in skeletal muscle. Heavy exercise can raise liver enzyme levels. GGT is also found in a number of different systems. And their levels can be elevated in the circulatory system for several reasons. Probably one of the biggest reasons is overproduction of enzymes due to medications affecting AST, many of which are over the counter; there is everything from Tylenol to aspirin to birth control pills, ibuprofen, Retin A, vitamin A, niacin, some of the antiinflammatories, calcium channel blockers, and lipid-lowering agents. Many common things can cause elevation. You have almost the same type of list for ALT as you have for AST. There is also a long list for GGT, including many of the same over-the-counter drugs. The problem with liver enzymes is that they have a very low sensitivity and low specificity. If you calculate a positive predictive value in a population of 8% heavy drinkers, you'll find a positive predictive value in the range of only 10-15%. This implies that seven of eight cases with elevated liver enzyme levels are probably not due to alcohol. So we need a better souse trap.

We've discussed liver enzymes and decided they're not real good. We've thrown the baby out with the bath. I'm not going to spend a lot of time on hemoglobin acetaldehyde-associated proteins (HAA) and lysosomal enzymes except to say that there are many associated problems, particularly with lysosomal enzymes and false-positive

results. Extremely wide variances occur from one day to the next within the same person. There are data (I'm not going into detail on HAA) that show that at least 50% of cases would not be picked up. The industry is using a 10.4 cutoff, which is extremely conservative, and from Charles M. Peterson's data, that would have meant HAA was only about 10% sensitive. He's the patent holder on the test, and, I suspect, does it well. So we at our lab are not convinced that HAA is very sensitive. O. Niemala reports that HAA was only present in 63% of women who gave birth to children with fetal alcohol syndrome. Pekka Sillanaukee also did not find it to be more than 50% sensitive.

The other side of the coin is that Niemala and Sillanaukee both found that it could be increased from one bout of drinking. So if you go out to dinner tonight and have too many drinks, don't get your blood drawn until 48 hours have passed if you're going to have an HAA test.

We decided that we would look further for a marker, and we did. We think we've found it in something called carbohydrate-deficient transferrin (CDT) or desialotransferrin (DST). These are interchangeable terms in medical literature. It has been investigated by 20 different organizations around the world, and all have published on it. Virtually all of them come to similar conclusions: the sensitivities usually vary from 82% to 90% and the specificity is from 97% to 99% and is far better than any other reported marker. I'm going to run through them quickly.

Basically, the CDT rises if a person has 60-80 grams of alcohol, that's four or five drinks daily, for usually up to three weeks. A small female can raise her CDT level on three drinks a day for as little as one week, but that's a lot of alcohol for a small female. This is the same range of alcohol consumption in which cirrhosis develops if drinking is prolonged. CDT is a stable marker. It remains elevated for two to four weeks after cessation of heavy drinking. There is good evidence in the literature that the liver enzymes can go up and down in a matter of 48-72 hours, so enzymes are not very stable.

I mentioned the independent verification by so many different authors. Look especially at the specificities reported by all of these. Helena Stibler discovered CDT back in the 1970s, specificity of 99%; A. Kapur, 97%; Ursula Behrens tested it across different racial and ethnic populations and found 97% specificity; Ian Kwoh-Gain, 97%; and O. Vesterberg, 97%. To quote Raymond F. Anton, M.D., who is working at the University of South Carolina with the National Institute on Alcohol and Alcohol Abuse, "It's the surest test so far for spotting heavy drinkers." Our laboratory checked it in an alcohol population under treatment and found that it picked up over three times as many cases as did GGT.

If you calculate the positive predictive value when CDT is used as a reflex tool from elevated liver enzymes, it will have a positive predictive value in the range of 95%. But agents love it also because it has a negative predictive value of about 97.5%, even with elevated liver enzymes. This means that the likelihood of detecting a chronic, heavy alcohol user is about 1 in 40 if the test is negative.

Incidentally, we've developed a new methodology that is more cost effective than the original. It is very much like HIV testing; we are now using an enzyme-linked

immunosorbent assay (ELISA) test, which is confirmed by a Western blot. Other labs are not confirming it. We are using the ELISA/Western blot combination, and we think it's highly specific. There are a few other causes for elevations: primary biliary cirrhosis, which is a disease underwriters would want to know about anyway; heavy exposure to organic solvents, such as cleaning fluids, on a chronic basis; 1-2% of nonalcoholic liver disease; and a few rare genetic disorders in which it goes up. One occurs about 1 in 500 people. The other occurs in about 1 in 800 people. But most of those cases should have normal liver enzymes.

If you have a normal CDT test result in the face of abnormal liver enzymes, you still have somewhat of a dilemma from an underwriting standpoint. So we have gone through a little mental arithmetic here in a way. Because underwriting is a matter of probabilities, what is the differential diagnosis of what's left? What's significant from an underwriting point of view? We think hepatitis testing would follow from this. If you take insurance applicants with elevated liver enzymes, about 5% of them will either be positive for hepatitis B or C. And this is probably chronic hepatitis. Chronic hepatitis does carry some increased mortality risk, which is significant. Some experts say as many as a third of these people are dead within ten years, while others say it's not quite that bad. But there is debate going on.

So we set up a testing algorithm. With abnormal AST, ALT, or GGT, we proceed to CDT testing. If the CDT test results are positive, we simply report that because of the likelihood of heavy alcohol usage. If it's negative, we go to the hepatitis testing. If either one of those is positive, it is assumed that the hepatitis risk is involved. If it's negative, then one must go through the mental exercise of looking at what might have caused the enzyme elevations in terms of medications as we discussed, exercise, etc. One can go through a list of the differential diagnosis of elevated ALT, AST, and GGT and, from the information you already have, rule out most of these things, or they're so extremely remote that they're very unlikely.

From the list for ALT elevations, with abetalipoproteinemia, one should be able to see some other kind of lipid abnormality on the blood tests, such as a very low cholesterol level. Actinomycosis is very unlikely and even if present, is treatable. We've tested for AIDS and for alcoholism. There should be a respiratory history with alpha-1-antitrypsin deficiency, or early death in one of the parents from respiratory disease. Amoebiasis is very unlikely in someone who hasn't recently been to Asia, and so on.

One can go through this whole list of differential diagnoses. My point in saying this is that, having gone through this exercise, you can then become more competitive in your underwriting decision. The more competitive you become, obviously, the more applications that will be placed, which leads to more premium dollars and more profitability.

So this is how I would suggest using alcohol indicators to be more competitive in the underwriting of alcohol use. And we have previously been using just liver enzymes. That's a quick summary of two of the tests that are already in the works with regard to underwriting.

MR. ROBERT A. GABRIEL: With all of the risk-assessment indicators available, I'd like to know if any of the panelists believe that sex distinction may not be necessary to adequately assess a risk. Isn't there a high correlation between a person's sex and indicators such as blood pressure, liver enzymes, triglycerides, cholesterol, and glucose levels? If this is true, then sex may actually be redundant (even counterindicative) in the risk-evaluation process.

DR. BRAUN: I would agree that some of the mortality difference between the sexes can be related to the indicators mentioned in the question. Not all of the information mentioned is collected in every case, making sex important in evaluating mortality. Even when evaluating the results of an underwriting requirement, sex is important. For example, if you are using conditional probability to evaluate the same elevated liver enzyme levels in two young people, the probability of alcohol abuse would be higher in the male than in the female, due to the underlying prevalence of alcoholism in males. It does not necessarily follow that the female alcohol abuser has a proportionally greater mortality risk than the male alcohol abuser. I would suggest that sex distinction is still an important determinant of mortality risk.

MR. NIGH: My response would be just in regard to the product pricing. You expect a longer mortality in women than in men, so it would seem to me that you would need to know from that. I know there are unisex states, but the insurance industry traditionally fought that, right? I would agree with Warren. Some things, like coronary artery disease in women, are worse. We don't generally underwrite it that way, because a lower percentage of women have coronary artery disease early, but if they do have it early, their mortality is a lot worse. So, yes, it's certainly helpful. I'm not sure if that answers your question, but that would be my response.

MR. ROBERT C. PHILLIPS: I actually have three questions. One is for Dr. Kleinsasser. Could you say something about the saliva test we're hearing so much about? Has it disappeared off the screen because of the Food and Drug Administration (FDA)? The second question is for Dr. Braun about the mortality rate that you mentioned. Was that for all years, or was that in the first year of mortality after issue, after the change was made? Also, to ensure consistency, does the expert underwriting system depend to a large extent on procedures such as a doctor's exam as opposed to the nonmedical applications sent in by agents?

DR. KLEINSASSER: I can answer the saliva question quickly. I think you're all aware that the FDA had a hearing last December in which it considered the question of saliva, especially with regard to HIV testing. It sent it back, basically to start over again with regard to clinical studies and so on. And it set certain necessary criteria that were not met by the manufacturer at that time; things like being able to validate that you had an adequate and appropriate specimen at the time of collection and so on. The data presented were somewhat questionable. I do know that one of the manufacturers is back trying to get a collection kit approved by the FDA and is in the process of doing new studies. I am unaware that the company is coordinating with a manufacturer of an HIV kit as part of the study, and it's our understanding that a kit be approved in addition to the collection device. So that raises some problems.

I know that we are working with a major manufacturer that will be doing studies shortly on trying to get a device and a kit approved for saliva testing. But it's our

best guess that this is at least a couple of years or so down the line before there will be any approval on saliva. In addition, I do know that the FDA went to one of the saliva kit manufacturers recently and told it that it could not even do testing, forget human immunodeficiency virus (HIV), for any drugs of abuse, which would, of course, include cocaine. It was also told to stop distributing collection kits for that purpose. So FDA is cracking down on more than just HIV.

DR. BRAUN: Regarding the first part of the question, the 7% improvement was for the first year. The study was done the year after the system was implemented Regarding the second part, there are really two components to the consistency offered by the system. First, the up-front portion offers consistency in the workup and on actions on cases based on tables that the client company completes. The client company decides which underwriting requirements to build into the system. The expert impairment modules request a certain minimum amount of data; for example, electrocardiogram test results and an attending physician's statement on a coronary case. Without the minimum requirements, the system may recommend underwriting action, but the recommendation is tentative, based on the lack of information. It is then left up to the underwriter to get the information or override the recommendation and take an action without the minimum data.