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IMPACT OF AIDS ON COMPANY OPERATIONS

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- o Extent of the epidemic
- o Underwriting
- o Product pricing concerns
- o Marketing
- o Social responsibility

MR. MICHAEL J. COWELL: It was quite fashionable as recently as ten years ago for people to tell us that in the life insurance industry, in particular, we didn't worry about things like mortality and morbidity anymore. Our industry was just becoming one huge spread banking operation. Judging from the way a lot of our members were flocking to Wall Street, it was easy to understand that. But there were a few of us who didn't quite go along with that and we more or less stuck to our knitting and maybe it was well that we did, because when this epidemic came along I think we were ready with the analytical tools to handle it. Handle it as best we can, that is, in what is a very uncertain environment. In Chicago I related the experience I had at the annual meeting in Montreal last year when we had a panel discussion something like this. Interestingly, it happened to be on October 19th. Everybody knows what October 19th was. I guess I was sort of amused the following day to go to some of the sessions on the actuary's responsibility in investments and I was looking at these models of C-1 risk showing the probability of a 10 or 15% loss of stock value being something like one in a thousand. So I was thinking, maybe those of us who stuck to our knitting, who stayed on the problem of mortality and morbidity trends, maybe we weren't so far off the mark.

Unquestionably, the AIDS epidemic, as it's called, or the epidemic of Human Immunodeficiency Virus (HIV), as some of us refer to it, is the most serious epidemic that we have faced in our experience. Our panelists are going to discuss why it is serious and why it is unique.

So let me start by introducing the first member of our panel. Nancy Wing, M.D., is a graduate of Chapel Hill and did her medical studies at the Medical College of Virginia. She interned in neurology and clinical medicine and in addition to her extensive medical clinical background, she has spent twelve years in the life insurance industry. She is currently medical director of the American Life Insurance Company in Wilmington, Delaware. She is very active

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on her own company's task force to study the impact of AIDS on the company's operations. Nancy Wing will describe the natural history of AIDS and some of the impact on underwriting.

DR. NANCY J. WING: Talking about the natural history of AIDS you have to be very flexible because month by month new information is discovered and there is a shift in what we understand. However, over the less than seven years that this country has recognized it, since June of 1981, there has emerged a pattern that shows we have a progressive disease virus on our hands. Early in June of 1981, CDC, the Centers for Disease Control, the Epidemiology Arm of U.S. Public Health, got five cases in from Los Angeles of young homosexual men who had *Pneumocystis carinii* pneumonia. CDC didn't understand what they had, but before they could ponder very long, they got seven cases from New York. Again, young homosexual males. This time, they showed Kaposi's sarcoma, which is an elderly man's disease with Mediterranean heritage, not usually seen in young people.

CDC was rapidly able to determine that what these people had in common was an acquired immune deficiency. It did not appear to be a single disease process and so it was called a syndrome. Therefore, we have the Acquired Immune Deficiency Syndrome, AIDS, that causes disease.

What has developed are periods that you can break down to track what is going on in the AIDS process. I'm going to go over these briefly now and then later on in more detail. Time zero is recognized as the point that an individual becomes infected. The window period follows, the latency period follows, the symptomatic period follows, and it is becoming apparent that death ensues. As we progress from year death ensues not in the 5-10% that we originally thought, but now the belief is that it's 95% and perhaps only a few individuals do not follow this pattern; that has not been concluded. It appears to be that greater than 95%, perhaps 100% of AIDS patients, go through this scenario.

Further, it has been recognized that there are three major ways in which this virus is transmitted -- sexual contact, blood/blood products, and infected mother to infant.

Sexual Contact: The important part of understanding the sexual contact is that it is between partners: an infected individual with a non-infected individual, whether it is male to female, female to male, male to male, or female to female. Our society first recognized the third one, male to male. There is a disproportionate lingering belief that that is the major way of transmission. That is no longer believed to be true among epidemiologists, among medical people. Part of our ability to say that this is not true is what we saw in our society identifying male to male; you have to look at the natural history of the epidemiology in countries which have had this disease much longer than we have. Then we get into what has been called the African pattern and the U.S. pattern. The African pattern is three to one, male to female. There the epidemic is believed to have been active since some time in the mid 1950s and when it was brought to light in the early 1980s, we in the U.S. realized that the epidemic in Africa was recognized from the beginning to be a one to one, male to female pattern. Haiti is another place in which it was recognized to be one to one from the beginning. However, when we look at the Caribbean as a whole, statistics now show that it has gone from twenty males to one female to three males to one female. The pattern, in other words, is moving towards what we have traditionally called the African pattern. There is no reason to believe that this will not occur in our

country, given the progression and the length of time, as we progress through the epidemic. Again I want to emphasize, the risk arises from sexual contact with an infected individual to an uninfected individual. The sexual contact can be oral, vaginal, or anal. It is not only male homosexuals with anal intercourse. We have been led to believe this, and this belief still persists in some areas. It is not true.

Blood and Blood Products: We have also identified, in our society, the intravenous (IV) drug user. In many other societies, that is not the most common spread of the infection when we come to blood and blood products. Again I go back to Africa and a society in which some of the countries have $1 per capita per annum spent on medical costs. And the result of that is, they reuse disposable equipment. I have talked to medical directors in two or three different Third World countries and the way this happens is very interesting. One doctor I talked to who actually worked for two years in a Third World country talked about the infants with diarrhea. They are laid on a counter, there is a rack above and the family must bring in a sterile saline solution or Ringer's solution that they are going to give the infant. The mother must go to the pharmacy to buy the solution and bring it in to the doctor. She lays her infant on this counter, the doctors pulls a needle out of the infant that's on the counter and the next mother puts her child down. They use a new solution bottle but they use the same tubing and the same needle. This is because they can't afford and do not have the disposable tubing and needles like we have in this country. So these needles come out of one child and go to the next child. Children in those Third World countries, particularly the areas in which there is malaria, diarrhea, and other debilitating diseases, are given fresh blood transfusions. So you have an infant who has received a fresh blood transfusion that is contaminated and put on this counter, the needle is withdrawn from one infant and put into the next infant. This is a means that has been recognized but not discussed freely, even by the World Health Organization. They have said this is a possibility. They talk to the senior medical people of these countries, and again I've talked to some of the senior medical people up on the administrative health level, and they'll say, "No, we don't do that in this country. We do not reuse disposable needles."

Another area of spread that we don't think of in this country is rituals. One ritual, for instance, occurs in countries where they line up teenage males going through puberty. They have ceremonies in which they take instruments and mark their face and mark their chests as they are entering manhood. They use the same instruments on a group of young men. In our own country, contaminated needles for tattoos, piercing ears or transfusions were tagged with the spread of the disease up until May or June of 1985. During the twelve months prior to the testing of the blood supply, it was estimated that seven thousand three hundred individuals were infected. At this time we believe only four hundred individuals per twelve months are being infected by transfusions.

Between 1978 and 1985 when we had the ability to identify the virus and the antibodies, which cleaned up our blood supply, we were the major manufacturer and exporter of Factor VIII which is the treatment for hemophilia. We exported that product to the world. I have talked to the medical directors who report an increase in AIDS in hemophiliacs. In our country between 75% and 90% of our hemophiliacs who are Factor VIII dependent are infected. In Trinidad, the Caribbean, I talked to a World Health Organization epidemiologist. The tradition in that island is to treat the hemophiliacs with fresh blood, and their

hemophiliacs are not infected. But the consequences of Factor VIII worldwide are really not known yet.

There has been a case in which frozen semen was artificially inseminated, and the child was born with AIDS. Organ transplants are also a source, although not common in our society.

The third way of virus transmission is mother to infant. In our country, one of the most rapidly growing categories is the increase in infants born with AIDS.

Following the point of infection there is what we call a window period. It is considered to be six to twelve weeks. There are other studies that say it's much longer, but those studies have not been confirmed. During this window period the individual is infected, is infectious and is carrying the virus.

During this window period there develops a flu-like illness, frequently indistinguishable from the flu that we know, headache, fever, nausea. It can be like infectious mononucleosis in which there is a severe sore throat with or without lymph involvement. It could last three to ten days. During this six to twelve weeks, serum conversion occurs. This is when the virus has created the antibodies in an attempt to defend the body against the invasion of this virus. The antibodies are the basis for the testing that we do, the enzyme-linked immuncabsorbent assay (ELISA) and Western Blot Test, for the presence of these antibodies. One goes through the window period in a relatively short time and the individual is most likely unaware that he has been infected with the AIDS virus.

Following the window period, we go into the latency period in which the individual remains asymptomatic. This period can extend as short as two years, or as long as ten years. I read an article within the last couple of weeks in which an individual in San Francisco who was involved in one of the early studies which helped us with the epidemiology initially, had serum that was frozen from a study that was done in 1972-1974 on the prevalence of Hepatitis B among adult homosexuals in San Francisco. This is where a lot of the original work was done to understand what was going on with this virus. One of the individuals who had not shown AIDS, who was seropositive back in 1972, has developed AIDS in 1988. So that graduates the period out now, in one case, to 16 years, although the latency period or asymptomatic period is believed to average five years. During a latency period, the T cell or the captain of the immune system, which is a very key element in the body's immune system, is being invaded by this virus and the immune compromise begins. The individual is still healthy and still asymptomatic but the virus is at work, compromising the immune system during this period. The virus has been found in the T cells, the brain cells, rectal mucosa, and recently in the bone marrow. There is no reason to believe that this will be the end. It will probably be identified in other tissues of the body as time goes on. So the virus now is unknown to the individual but is doing its damage.

From there we go into the symptomatic period. The average time for going through this period is five years. However, I have reviewed a claim in which an individual was perfectly healthy. He went to a doctor with a two week history of not feeling well, a little weight loss and some diarrhea. The doctor put him in a hospital. Two weeks later he was dead. The diagnosis was AIDS. So that was a four-week history, going right straight through asymptomatic to death. There are individuals who were identified in 1981 as carrying the AIDS

virus since 1978, who are still living ten years later. However, their mortality is over 93%. I'm talking two extremes.

As you proceed through the symptomatic period, frequently the first thing that's noticed is an increase in lymph glands. Note these two areas: Persistence for more than three months and abnormal cervical, axillary, superclavicular, and inguinal lymph nodes. The lymphadenopathy usually persists throughout the rest of the disease. Skin lesions begin to develop and the patients develop thrush. Then they begin to develop chronic fatigue, chronic weight loss, night sweats, and chronic diarrhea. Historically it was thought that you have to go through AIDS-related complex (ARC) which then develops into full-blown AIDS. Now we know, with the new definition from the CDC, that you can go from the HIV wasting syndrome all the way to death without ever developing opportunistic infections. When you move through the ARC to full-blown AIDS, the life expectancy now is considered to be two years.

If the individual develops HIV dementia, it means the virus is doing its damage primarily in the brain cells. These are, well, they're all tragic, but this group of individuals is particularly tragic in the sense that early on they lose their cognitive abilities, they lose their ability for judgment, attention span, multiple tasks, memory, short memory, and then they rapidly move into chronic apathy, at which point some of these individuals die in fetal position. They become so apathetic they won't eat, they won't move, they won't function. Life expectancies once the diagnosis of HIV dementia is made are four to five months. I have mentioned the HIV wasting syndrome in which the individuals go from developing ARC and die.

Opportunistic infections: We're talking about *Pneumocystis carinii* pneumonia, toxoplasmosis, or any infection that you and I with healthy immune systems can handle; these individuals cannot. Malignancies occur, the most well-known one of which is Kaposi's sarcoma, or lymphoma of the central nervous system. Whether we're talking about the United States or talking about global, these numbers are different. AIDS in the United States officially right now is sixty thousand, with 20% underreporting, it is believed to be up into the seventies. There are 8-10 recognized ARCs for every one AIDS. We have over a quarter of a million ARCs in our country. The figure that is still quoted by CDC for the HIV infection is 1.5 million. That figure has held steady now for two years. It's not realistic in my opinion. However, continue to call it 1.5, and I understand the SOA has done studies showing that it is still 1.5.

I'm going to comment just briefly on the underwriting. When we put our questions in, you can see that we're only aiming for the top of the pyramid. We're only trying to identify those who have gone from the bottom of that pyramid to the top; those who are symptomatic and late in this disease process; those who have developed AIDS or ARC or symptoms that we can try to identify. As to the HIV infection, we're accepting at our published age and amount and we are trying to identify seropositives by our antibody studies. We are currently doing nothing for the high-risk patients; we're doing nothing for the bulk of the people who come in under our published limits.

In 1988 the World Health Organization's estimate is at 200,000 and they are estimating one million cases within three years. There are a couple of statistics that I thought were interesting. In the 16 weeks April 3, 1988, we had nine hundred and thirty seven new cases reported to CDC. From 1983 to 1987, the median new cases in the 16th week alone were one hundred fifty three.

Cumulative from the first case reported through the first 16 weeks of 1988 is 9,560 with one year ago cumulative 6,081; the median is 2,027.

MR. COWELL: Our next speaker is John Dinius who is an actuary of Aetna Life in Hartford, Connecticut. John is responsible for individual life pricing. He's been extremely active in this whole investigation of AIDS data and information collected from the industry. The ACLI, as most of you know, has an AIDS task force that John has been serving on. John is going to discuss the methods for projecting the epidemic from both a population and insurance standpoint. He's going to discuss actuarial estimates and particularly what we know and what we don't know about this epidemic.

MR. JOHN B. DINIUS: To continue our discussion of AIDS and life insurance I'd like to talk about actuarial aspects of the AIDS problem and actuarial responsibilities in dealing with AIDS issues. Most of you have probably read Mike Cowell and Walter Hoskins' excellent report on this subject, which was published by the Society last August and is included in the recently issued SOA *AIDS Task Force Report*. I will be reviewing some of the concepts in that paper, because it may have been awhile since you read it, and because these concepts form the foundation for actuarial analysis of AIDS. Following that, I'll discuss some methods of performing actuarial analyses. Finally, I'd like to comment on the availability and accuracy of AIDS-related data.

What I want to emphasize are the actuarial responsibilities you may be called on to fulfill in regard to AIDS. In general, these involve quantifying some aspect of the epidemic and its impact on your company. Examples of these areas of responsibility include developing claim projections and measuring the impact of AIDS claims on earnings; pricing new business; adjusting rates or dividends for existing business; setting up AIDS reserves; and analyzing underwriting policy for AIDS, in particular setting blood testing limits.

To perform any of these analyses, it is first necessary to project the extent of the epidemic. As explained in the Cowell-Hoskins paper, this is a three-step process. The first step is to model the spread of the AIDS virus in the population, developing estimates of the number of people becoming infected each year. The second step is to estimate the number of infected individuals whose conditions will progress to full-blown AIDS each year. The third step is to estimate the number of persons with AIDS who will die each year.

The second and third steps involve concepts that are already familiar to actuaries, so I'll discuss only the first step in the projection process. This step, projecting the spread of the infection, involves concepts and techniques that are not part of the actuary's bag of tricks. Mike and Walter borrowed this part of their projection model from the field of epidemiology. I'll just summarize the central concept that drives this model.

With that as background, we can look at the basic equation for the spread of the epidemic:

$$\frac{dp_t}{d_t} = a_t \cdot p_t \cdot (1 - p_t)$$

p_t represents the fraction of the at-risk population already infected as of time t. a_t is the infectivity factor at time t. This factor is a proportionality constant

for the rate at which the virus spreads from one individual to another. Its value depends on the extent of at-risk activity and the ease or difficulty with which the infection is passed.

This equation says that the rate of change in the fraction of individuals infected equals the product of three factors. The first factor is the infectivity date, a_t. The rate of spread is also proportional to p_t, the fraction of the population already infected. Finally, it is proportional to $(1-p_t)$, the proportion of the population that is not yet infected. The reason for this becomes apparent when you consider that the spread of the infection depends on the interaction between infected and uninfected individuals. Consequently, the fraction of people not infected enters the equation in exactly the same way as the fraction infected.

Graph 1 shows the spread of the infection based on the Cowell-Hoskins projections. This curve has the S shape that is characteristic of the spread of an epidemic. (Actually I think of it as being more like an integral sign, rather than an S.) This indicates that there is near-exponential growth in the early years of the epidemic, that the rate of growth reaches a maximum when half of the population is infected, and that the rate of spread tapers off as the number infected approaches 100% of the at-risk population.

Although the Cowell-Hoskins model does an excellent job of reproducing the course of the AIDS epidemic to date, it uses many simplifications in order to reduce the problem to manageable proportions. Some of the simplifying assumptions that were used can be described as shortcomings, but they are shortcomings only if we imagine that we can model the epidemic with extreme precision. Since the available data don't permit us to have a great deal of precision, it's quite appropriate to make these simplifications.

The model assumes a constant number of individuals at risk for infection, that is, engaging in at-risk activities. In practice, this number will change over time due to natural changes in the population, and due to the effect of AIDS education efforts on the practices of at-risk individuals.

The model also assumes that there is one homogeneous risk group, whereas actually there are two primary risk groups at present: IV drug abusers and male homosexuals or bisexuals. There are also secondary risk groups, including sexual partners of those in the primary risk groups. It would be extremely difficult to model the different levels of infectivity for interaction within and between each of these various risk groups. Cowell and Hoskins concluded that growth of the epidemic can be adequately described, at least for the next several years, without differentiating these risk groups. That situation could change dramatically if we learn that there has already been significant spread of the virus to non-IV-drug-abusing heterosexuals.

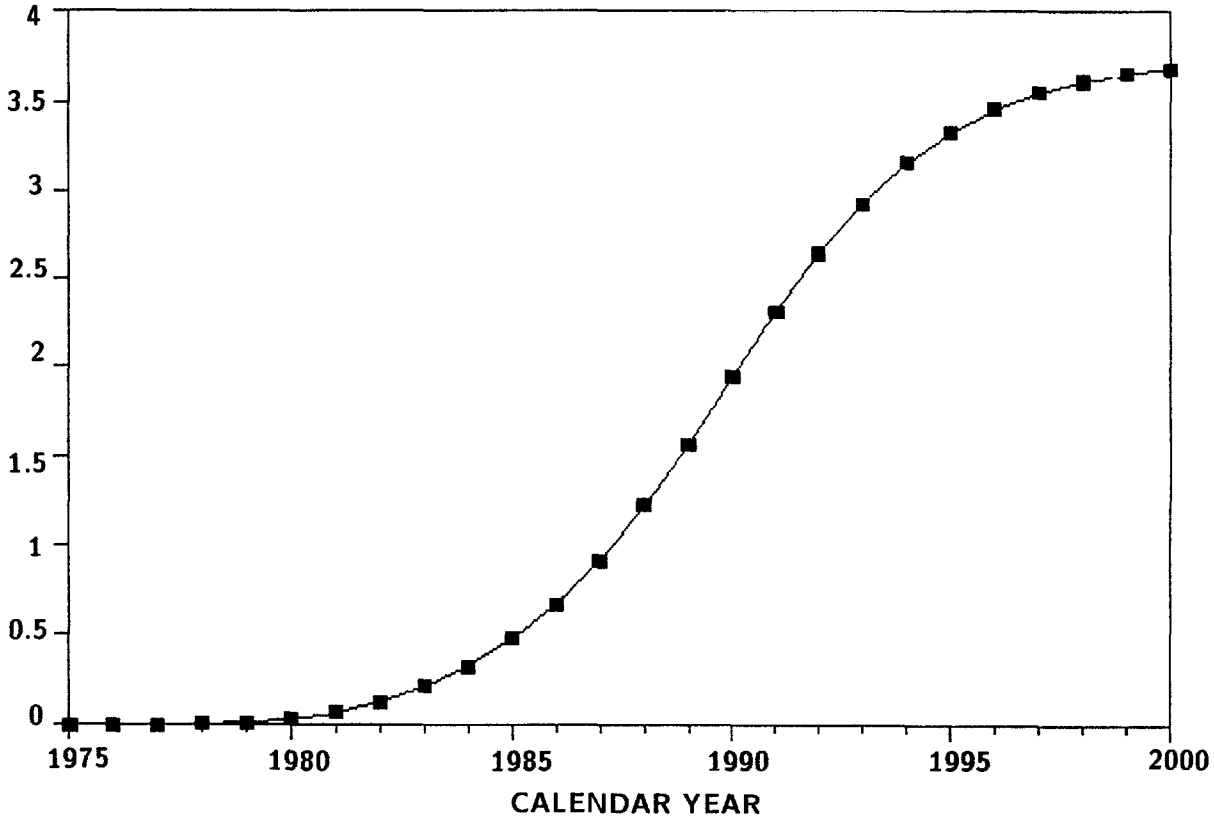
The Cowell-Hoskins model also does not reflect variation in the extent of at-risk activity among different members of the at-risk groups. Clearly some individuals are more active, and therefore at greater risk, than others. However, the model uses one overall average infectivity factor for each calendar year.

Also, it has been learned that an individual's infectivity, that is his ability to infect others, varies by duration since infection. However, this model tracks only average infectivity for the entire at-risk population.

GRAPH 1

CUMULATIVE HIV INFECTIONS IN U.S.

As Projected by Cowell and Hoskins



Finally, it is inevitable that geography and social factors will play a role in the spread of AIDS. In fact, if we didn't have modern air transportation, the AIDS epidemic might better be tracked as a series of epidemics in various cities, rather than a single epidemic spreading among all at-risk individuals in the U.S. At the current state of the art, however, the epidemic can be adequately modeled at the national level without consideration of geographic factors.

To review, modeling the spread of the infection is the first step. Once we've projected the number of individuals becoming infected in each calendar year, we can project the number of cases of AIDS by applying probabilities of progression to AIDS based on time since the initial infection. Finally, we can apply appropriate mortality rates to the numbers of new AIDS cases by calendar year to produce estimated AIDS deaths by calendar year.

Having developed a projection, we need to adjust the parameters used in that projection so that our estimate of AIDS cases and deaths for past years will agree with the actual cases and deaths reported by the CDC in their weekly reports. Once we've validated our projection to these reported data we can use the projection to address insurance concerns.

First let's take the problem of projecting the volume of AIDS claims for an individual company. I suggest that you take this problem in three steps. First, we've already projected the epidemic. Next, we need to use our projection to develop industry-wide claim estimates. Industry-wide figures are needed in order to have a statistically significant past claim experience. Finally, we will convert the industry-wide figures into estimates for an individual company.

Let's assume that we're considering individual life insurance, which happens to be my area of specialization. We can develop claim projections for the industry by estimating the percentage of AIDS deaths that will result in claims and the average death benefit for these claims. The ACLI and the Health Insurance Association of America (HIAA) conducted a survey of 1986 AIDS claims for the major lines of business and published the results of that survey at the end of 1987. These results include the number of AIDS claims, the average size of these claims, and the volume of AIDS claims as a percentage of total claims. If we project for future years the percent of AIDS deaths that become insurance claims, and the average size of these claims, it is relatively simple to convert our projected population deaths into claim costs for the industry.

After projecting claims for the industry, there are several possible approaches to projecting claims for your own company. One is to use the ratio of AIDS claims to total claims for the industry and apply it to your company's anticipated claims excluding AIDS. This approach, which doesn't really require a projection of the epidemic or industry-wide claims, may be appropriate for short-term projections, but it is not likely to be accurate for longer-term projections. The ratio of AIDS claims to total claims can't be extrapolated more than a few years without considering the anticipated path of the epidemic itself.

A more appropriate method for longer-term projections is to consider your company's market share for the line of business that you're considering, and take that proportion of the projected industry-wide AIDS claims.

Of course, either of these approaches will require adjustments to reflect the differences between your company's situation and the average for the industry.

For example, the distribution of business by age and sex will affect results. If your company's business is concentrated among males at ages under fifty, your estimate should be adjusted upward. Similar adjustments should be made for other factors, such as geographical distribution, testing limits, etc., to arrive at a final estimate for future AIDS claims.

Next let's consider how you might reflect AIDS in pricing a new product, or adjusting rates or dividends for existing business. To do this you need a set of mortality rates that includes the effect of AIDS. I suggest you think in terms of basic mortality assumptions plus an additional number of deaths per thousand for AIDS. These additional deaths per thousand will vary by issue year as well as by age, sex and duration. How do we develop these extra AIDS-related deaths?

Having already developed a projection of the epidemic, we have estimates of the number of new infections in each calendar year. Since we're going to price one age (or one age group) at a time, we need a distribution of these infections by age and sex. The distribution of AIDS cases by age and sex has been relatively stable over time, so it's reasonable for us to assume that future cases will have a similar distribution. This information can be found in the CDC weekly report. Remember, however, that the infection occurs on the average about eight years before AIDS is diagnosed, so the age distribution for *infections* will be approximately eight years younger than the age distribution for AIDS *cases*.

The next step is to express these infections as a proportion of the total population in each age and sex category. This gives us the fraction of individuals in that category who become infected each year.

Suppose we're pricing males at issue age twenty-five for business sold in 1989, and that we've estimated the fraction of this cohort (i.e., males born in 1964) becoming infected in each calendar year. We can apply rates of progression to AIDS and mortality rates for persons with AIDS to calculate the fraction dying of AIDS in each calendar year. This can then be expressed as deaths per 1000 at each duration, giving us a set of extra mortality rates for AIDS.

Several adjustments must still be made to these mortality rates, however. For example, we haven't allowed for the effect of underwriting and blood testing. If we plan to test all applicants for HIV antibodies, we can ignore infections that occurred prior to the year of issue, since those individuals would be declined, assuming the tests were 100% accurate.

We also haven't accounted for the effect of self-selection. We simply assumed that our applicants are a representative cross section of Americans in a particular age and sex category. We now need to reflect on the non-random nature of the insurance buying process. Part of this effect arises from the geographical distribution of a company's sales. However, we also need to reflect on the relative likelihood of purchases by at-risk individuals in comparison to the total population. Considering the two primary at-risk groups, IV drug abusers and male homosexuals or bisexuals, their historical propensity to purchase life insurance has probably been lower than average. Drug abusers have other things to do with their money, and single males are less likely to need financial protection against premature death.

This historical pattern probably changed, however, at least in the case of homosexuals and bisexuals, as the nature of AIDS became publicized in the early

1980s. It is likely that there has been at least some degree of antiselection by at-risk individuals in terms of frequency and/or amount of insurance purchases. There do not appear to be any published data on the extent of this self-selection but I recommend estimating and applying a "selection factor" to the extra AIDS mortality rates (which assumed a random sample of lives). This selection factor should reflect the relative propensity, in terms of frequency and amount, for at-risk individuals to buy insurance during the particular issue year being priced.

A final adjustment that should be considered is to reflect the lower probability of lapsation for at-risk individuals, especially after they become infected. This has the effect, over time, of further increasing the proportion of insureds who are infected with AIDS.

The result of all this calculating and adjusting is a set of AIDS mortality rates to be added to your basic mortality assumptions for a particular issue age and year of issue. These assumptions can then be used in the initial pricing process or in the process of adjusting rates and dividends for inforce business.

Another AIDS-related issue that actuaries will be expected to address is the matter of special reserves for AIDS. Ardian Gill is going to talk about AIDS reserves so I'll leave that topic to him.

The final actuarial issue I'd like to address involves the matter of setting blood testing limits. Probably many of you have already been involved in this issue as there seems to have been more activity in this area than in pricing and reserving for AIDS. The basic concept is that the cost of testing applicants for AIDS should not exceed the mortality savings anticipated from identifying infected individuals. The testing cost should be equal to *or less than* the mortality savings. We can estimate that the mortality savings is equal to the fraction of the applicant group that is infected times half the face amount of insurance on the group. I use half the face amount because Cowell and Hoskins estimated that the extra cost of mortality per person newly infected with AIDS is a little over $500 per $1000 of insurance. So the savings for each individual who is declined due to a positive test is roughly half the face amount.

Using this information, we can compute the minimum face amount for which AIDS testing is cost-justified. This amount is equal to twice the cost of a test, divided by the fraction of the applicants who are infected. The process of projecting the epidemic gave us information on the fraction of the population that is infected. The corresponding fraction for your insurance applicants depends on effects such as geography and self-selection which I discussed earlier. It is also likely to be affected by the level of your testing limit and how that limit compares with other companies' limits. Thus, competitive considerations play a role in setting your testing limit.

Now, I'd like to discuss what we know and don't know about AIDS-related numbers. I'm talking now about the availability and accuracy of historical data for the AIDS epidemic and AIDS-related claims. As far as the epidemic is concerned there are three categories of information that are of interest: the number of infections, the number of diagnosed AIDS cases, and the number of AIDS-related deaths. Ideally, we would like to have accurate figures for each of these categories by calendar year. The CDC has a weekly report that provides information on the number of AIDS cases and deaths in the U.S. population. It is sometimes said that these figures should be increased by 20% to reflect cases

that are not being reported to the CDC. However, there is no way of knowing for sure how large the undercount may be.

The CDC does not attempt to track infections. In fact, it would be impossible to track the number of infections in the U.S. population because a large proportion of the people who are infected have never been tested for the virus and don't realize they are infected. Unfortunately, CDC figures for cases and deaths are not very useful for estimating the number of infected individuals. The cases and deaths that are being reported currently were probably caused by infections that occurred five or ten years ago. We know a great deal about the number of people infected then, but we can deduce very little from these data about how the infection has spread in the last five years or about how many people may be infected today.

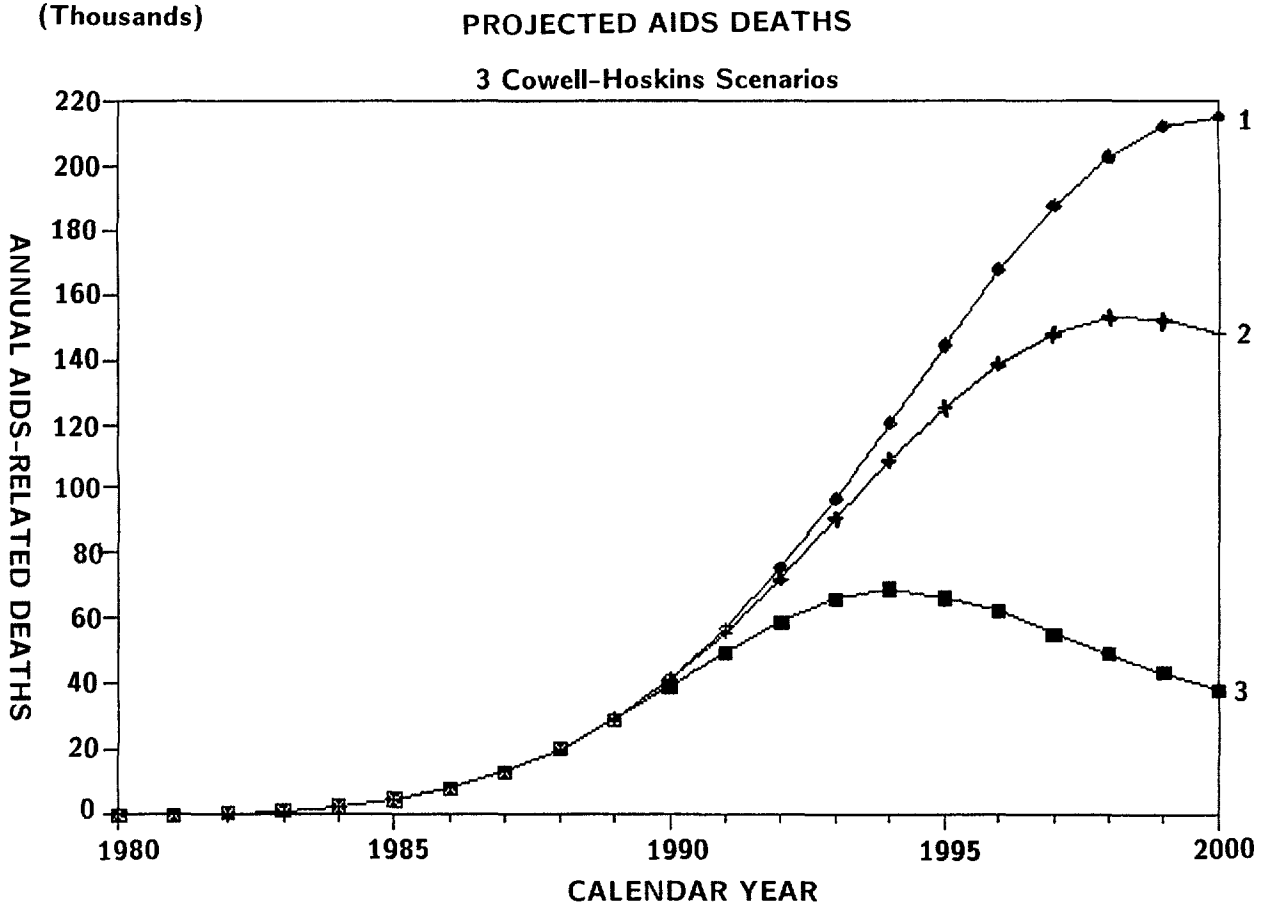
There are several efforts currently underway by the government and the medical community to determine the fraction of the population that is infected, but it will be several years before the results are available. In the interim, we can project AIDS cases and deaths for the next several years with reasonable accuracy by applying the Cowell-Hoskins techniques to available data. However, projections beyond about five years become speculative because they rely heavily on assumptions about recent infections, for which we don't have reliable information. As an illustration of this, consider Graph 2 that shows past and future AIDS deaths based on three different projections by Cowell and Hoskins. All three scenarios are consistent for past years and are very close together for the next few years. But it's the period after that where there's a great deal of uncertainty and they diverge significantly based on different assumptions made for recent and future spread of the virus. I might also note that all of these assume there will not be significant spread to the heterosexual population.

Turning now to insurance claim experience, we need to keep in mind that the accuracy of available historical data in this area depends on our ability to identify which claims are AIDS related. Some industry experts estimate that we are identifying only about 50% of the claims that are actually caused by AIDS. The others slip through the cracks. A large part of this is due to the fact that people don't die of AIDS. They die of an opportunistic infection that they couldn't resist because of their immune system deficiency. Consequently, the cause of death is generally not reported as "AIDS."

Probably the best industry-wide information on the volume of AIDS claims (*identified* AIDS claims, that is) comes from the joint ACLI-HIAA survey of AIDS claims paid during 1986. The results of that survey were published at the end of 1987. There will be ongoing surveys every six months to identify trends in AIDS claims. These data should be very useful for developing more accurate projections of AIDS claims.

In summary, we should be able, over the next several years, to reduce the confidence intervals for our projections of both the AIDS epidemic and AIDS claims. But I urge you not to wait for better numbers. Even if your company doesn't plan to take any action now, you should go ahead and start your analysis. It will give you an idea of the impact of AIDS on your company. It will allow you to start educating your management as to the impact of AIDS and your alternatives in responding to it. And finally, it will give you experience in working with these techniques so that you will be prepared to take the appropriate actions at the appropriate time.

GRAPH 2


(Thousands)
PROJECTED AIDS DEATHS
3 Cowell-Hoskins Scenarios
ANNUAL AIDS-RELATED DEATHS
220
200
180
160
140
120
100
80
60
40
20
0
1980
1985
1990
1995
2000
CALENDAR YEAR
1
2
3

MR. COWELL: You referred to shortcomings of our paper.

MR. DINIUS: You pointed them out to me.

MR. COWELL: Yes, well I think the major shortcoming, as I look back at it a year later, was that we published any numbers at all. We went to great lengths to point out that the principal intent of our report, the one that Walter and I wrote, was to understand the methodologies not to come up with a single point estimate. Nevertheless, the first thing that people discuss when they meet out in the corridors is what is your point estimate of the number of people infected and the dollar impact.

I alluded earlier to the symposium in Chicago a couple of weeks ago. I think it is a tribute to the SOA that we do know at least where we are going on this issue. We have a lot of people involved. We had a number of people outside our profession comment on the progress which has been made within the actuarial profession in understanding this epidemic and its impact. This is coming from doctors, public health workers, and so forth. I think that when people ask on the issue "Where were the actuaries," we can say when it came to this issue, "We were here."

Our next speaker is substituting for one that dropped out on us. I think again that it is an indication of the availability of people who are aware of this subject that on very short notice Ardian Gill agreed to come speak to us. Ardian is chairman of his own consulting firm, Gill & Roeser in New York City, a company that specializes in reinsurance. He was previously Chief Financial Officer and Chief Actuary of Mutual of New York. Ardian has some very interesting comments regarding the potential of this epidemic, at least in reinsurance, and he will also address, as John indicated, some of the solvency reserve issues.

MR. ARDIAN C. GILL: First let me cover what I will not talk about. I'm not going to talk about testing for HIV, or repricing new business, except that I'd like to make one comment on new business in passing. At Chicago, during the symposium, there was some talk about exclusions of deaths from HIV. As far as I know, there are only two exclusions that are permitted by state laws. These are war and aviation. It's contrary to all of the history of medical underwriting to try to exclude death claims from a particular disease. It would probably just substitute legal costs for mortality costs in trying to enforce such an exclusion. To my mind this is not an adequate defense.

As Mike said, I would like to talk about solvency, reserves, and reinsurance and their place in the AIDS picture. More specifically, I want to talk about locking the barn now that the horse is stolen; that is, about the current inforce and the HIV infections that are already there.

Now what can you do about them? Well clearly, you can do nothing about the infections, there they are. But you can do something about the costs, or at least some of the uncertainties of managing that cost or recognizing it now in your financial statements or financial projections.

So to look at what you have already insured, I'll first make this assumption, which I think is the current medical consensus, that anyone infected with the HIV will proceed to death from that or a related cause. As Dr. Redfield said in Chicago, "the AIDS epidemic has already happened." With respect to your inforce, that is of course true.

Now Mike admonished us not to use his single point estimate, but I did it anyway. By using his paper, we calculated 1.14% as the average infection rate in current inforce, or 11 plus deaths per thousand. In other words, take your inforce and multiply it by 11 deaths per thousand and that is the future death claims cost from this disease that you can expect, without any new infections. That is, and it can't be emphasized too much, it's the infections you must concentrate on in determining your exposure and liability, *not* current AIDS *deaths*. Deaths are only running 2 to 3% of your normal deaths, and it is likely to be brushed away as trivial, by your CEO or your management. It's like what the Victorian maid said to her mistress. "But ma'am it's only a very *tiny* baby." But what we have here is a very vigorous adolescent.

The individual companies will vary from this eleven per thousand that we got out of Mike's paper because of several factors (John mentioned some of them in more detail): age and sex, geography, the mix of business, the maturity of the business, and the distribution system. We had 22 companies complete a questionnaire on all items except distribution. Table 1 shows the results of introducing these variables. The extra deaths per thousand on average came out to 11.4, so we felt pretty good at least about the distribution. You can see that the low companies are down around four per thousand, but the high companies at the upper end of the range have over 32 deaths per thousand, or nearly three times the average. I then calculated for the same companies the 1986 normal deaths per thousand, and that's the middle column. The final column is simply the multiple of AIDS deaths to normal deaths. So, one way of looking at this is to look at how your deaths were running in the last year or two, multiply by 4.8 or 5 if you think you're an average company, or some other number if you think you deviate from the average. As you can see, it's a nontrivial result.

TABLE 1

AIDS Mortality

	Extra Deaths Per M	Normal Deaths Per M	AIDS Multiple of Normal
Low Companies (1)	3.7	2.8	1.3X
(2)	4.1	3.1	1.3X
High Companies (1)	32.4	0.9	35.6X
(2)	20.6	0.9	23.0X
All Companies Average	11.4	2.4	4.8X

Now what about solvency. Table 2 translates the expected deaths, according to the model, from the current inforce to a percent of surplus. The average is on the bottom row. In five years the average company will pay out 18% of its surplus in AIDS claims, around half of its 1986 surplus in ten years, and ultimately 87% of its current surplus. Of course the surplus will grow, but this is an indication of the level of the cost. The same high and low companies are rather startling, because they range from a low of 22% all the way up to over 1500% of the 1986 surplus.

TABLE 2

AIDS Claims and Surplus

Claims as a Percent of 1986 Surplus

	5 Years	10 Years	Ultimate
Low Companies (1)	6%	17%	30%
(2)	4	12	22
High Companies (1)	313	900	1548
(2)	202	580	998
All Companies Average	18	51	87

This of course is not discounted. On Table 3, I translate this into what that would be as a reserve, using an assumed 9% interest rate and a 34% tax rate, assuming it is not a tax effective reserve. So this reduces the ultimate cost to 52% of surplus on average and 46% if you get a tax deduction for it, (if the law were changed). Again the range is enormous, from only 13% of surplus, all the way up to over 900% if it's not tax effective. So, I think we can say the *average company has not had its solvency threatened by the AIDS epidemic so far*, but there will certainly be companies that will require new capital or dividend changes, state guarantee funds may be called upon. Even the average company will have some serious surplus erosion.

TABLE 3

AIDS Catastrophe Reserves

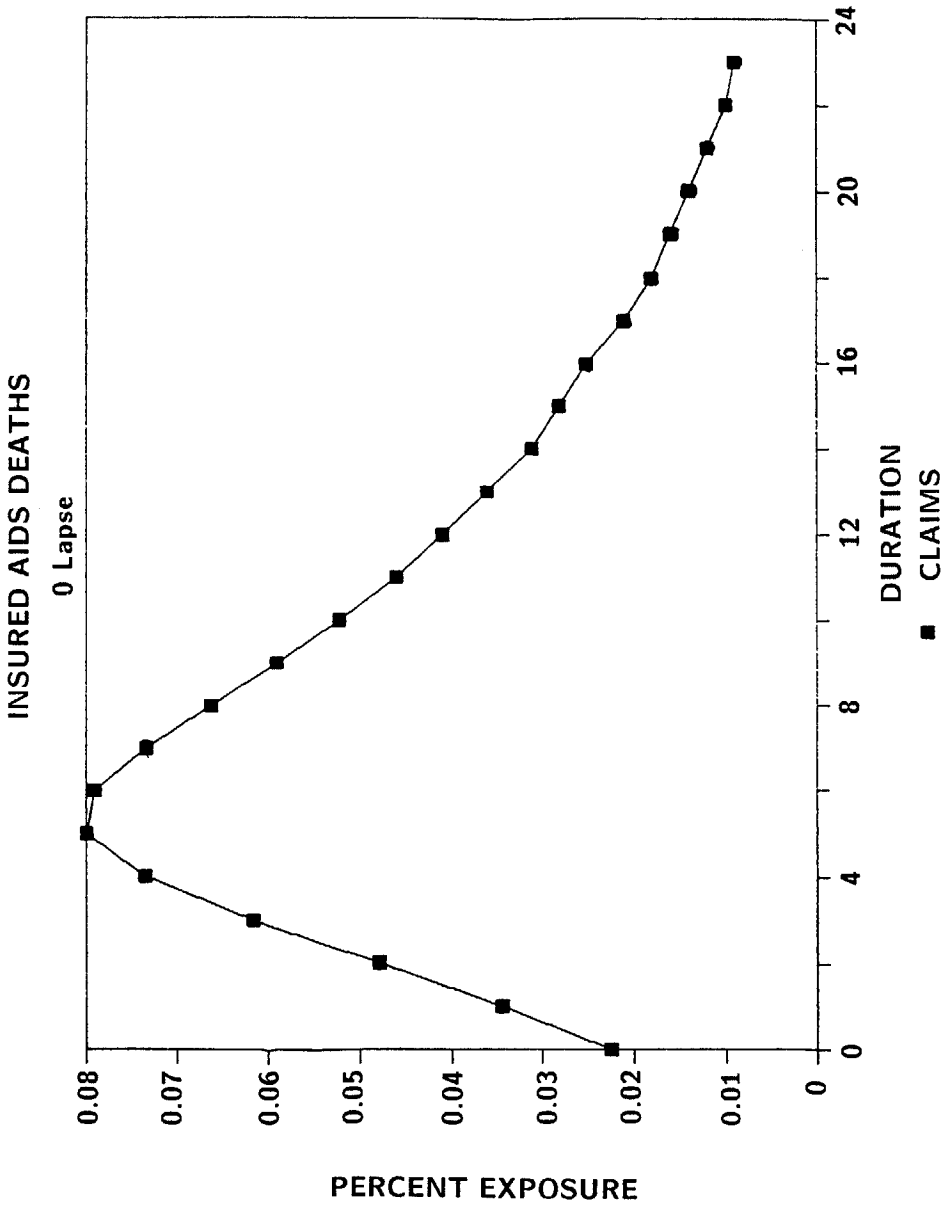
Reserves as a Percent of 1986 Surplus

	No Tax Benefit	Tax Effective
Low Companies (1)	18%	16%
(2)	13	11
High Companies (1)	925	811
(2)	596	523
All Companies Average	52	46

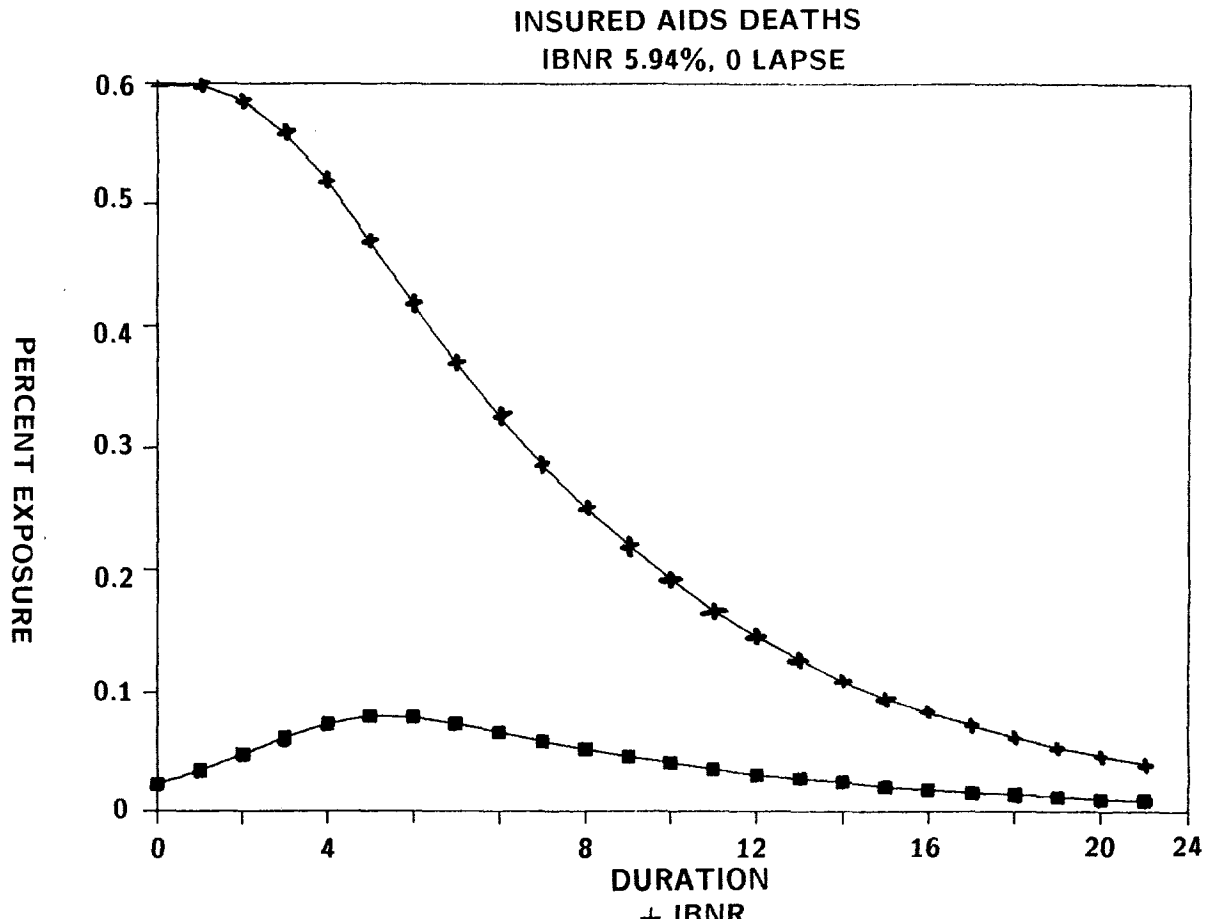
Shifting now to reserves, let's see how they behave. Graph 3 is just the claims curve from deaths in the current inforce. I've related this to the total exposure, so the maximum in any one year is 8% of the exposure. Again we're using the Cowell-Hoskins curve. It's an unusual impairment curve. If you were trying to underwrite it as a substandard risk, I'm not sure how you'd price it.

Graph 4 is just basic steps to combine it with the life reserve. The bottom curve is the same claims curve, with the scale changed, and the upper curve is the claim reserve curve (IBNR) for an infected group in the current inforce population.

GRAPH 3


INSURED AIDS DEATHS
0 Lapse
PERCENT EXPOSURE
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
4
8
12
16
20
24
DURATION
CLAIMS

GRAPH 4


INSURED AIDS DEATHS
IBNR 5.94%, 0 LAPSE
PERCENT EXPOSURE
0.6
0.5
0.4
0.3
0.2
0.1
0
0
4
8
12
16
20
24
DURATION
+ IBNR

Graph 5 looks at the whole life reserve for the infected group, compared with the 1980 CSO reserve at age 35. Graph 6 truncates the curve to 13 years.

Graph 7 combines the 1980 CSO qx with the qx for HIV infections using a 2% infection rate at age 35. I don't know whether this is right or wrong. It compares reasonably well with the 1.14% average at all ages, and yet Dr. Redfield gave us Army statistics that there are only 1.9 per thousand infected among servicemen tested, so that we see that there are a lot of uncertainties in these projections. Interestingly, the HIV adjusted reserve curve is lower than the 1980 CSO curve, because it assumes that you have a higher net premium which must come, of course, from surplus, or from dividend reductions, or from profits. So to follow statutory accounting you now set up a deficiency reserve. We have shown that on Graph 8. The top curve is the final reserve, including the deficiency reserve, the middle curve is the 1980 CSO, the lower curve is the unadjusted whole life reserve with HIV infections but without the deficiency reserve. The total reserve compares with the 1980 CSO as follows. It is 225% of 1980 CSO at the first duration, 120% in year five, and grades down to about 105% in year ten. In Chicago, Bill Koenig gave some reserve figures for age 25. He says that at that age, 40% of the Cowell population HIV is covered by 1958 CSO without any antiselection adjustment. The 1980 CSO covers only 20% of the Cowell population infections, with some adjustment for antiselection.

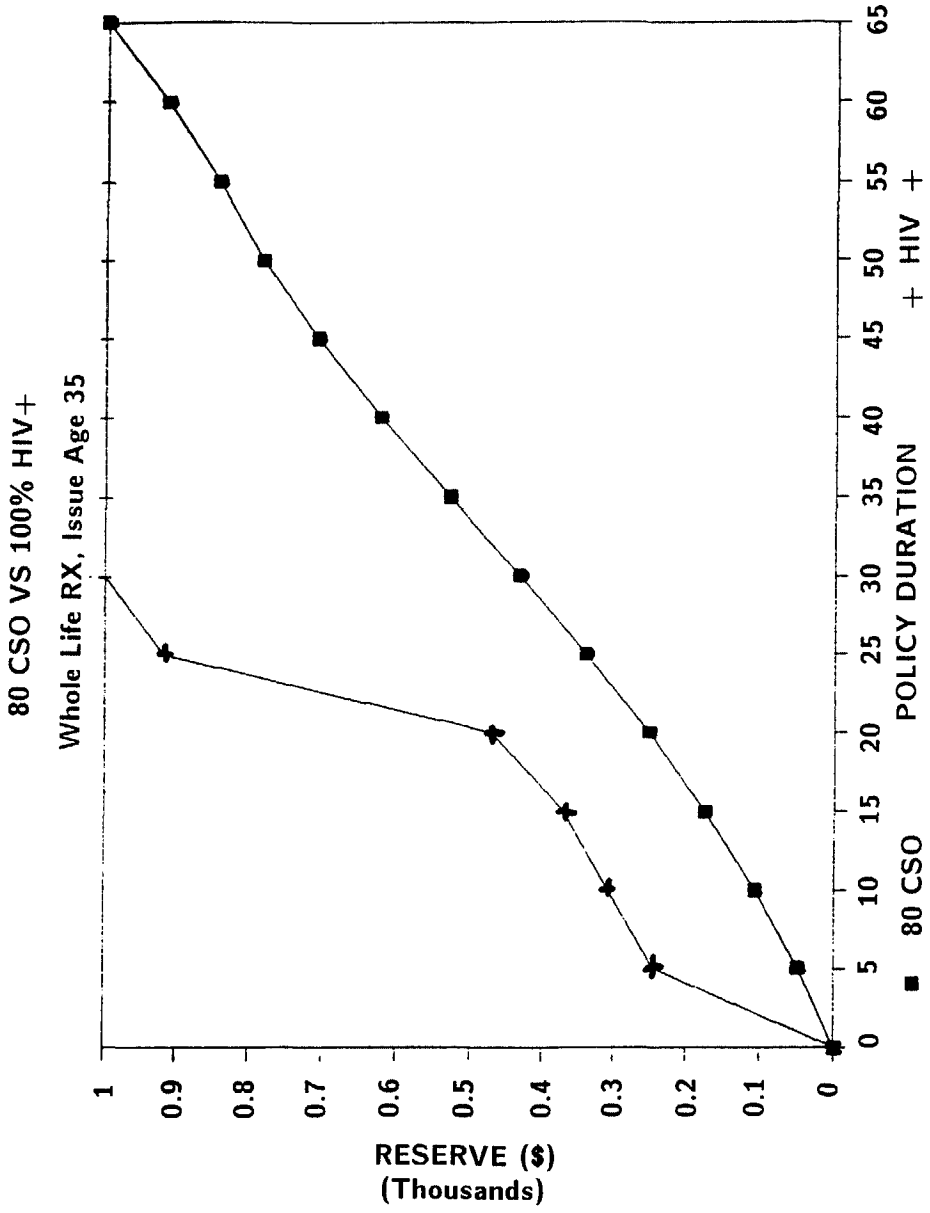
Moving now to what we might do about it, I'll refer to Company X to use it for later illustration. This is a company that has an assumed AIDS death rate of ten per thousand, has a billion inforce, and its exposure is therefore $10 million. Using the same 9%, 34% tax effective, the current present value of the $10 million exposure is $6 million. This is the reserve that you would set up now if you wanted fully to protect yourself against the exposures of Company X on its inforce. Harry Panjer wrote a paper that's just been published, using primarily Frankfurt data as opposed to CDC data, with a more rapid progression through the stages of the illness. If you use the Panjer results, rather than the Cowell results, you'll get a reserve here of $6.9 million, that's about a 15% difference in present values. Both projections assume, I think, about 1.25 million infected individuals in the general population. And as Dr. Wing has indicated, that may or may not be correct.

What are the alternatives for our mythical company? First of all you can do nothing. This is called the pay-as-you-go or the default option. You can set up a reserve without any tax relief, or you can purchase reinsurance.

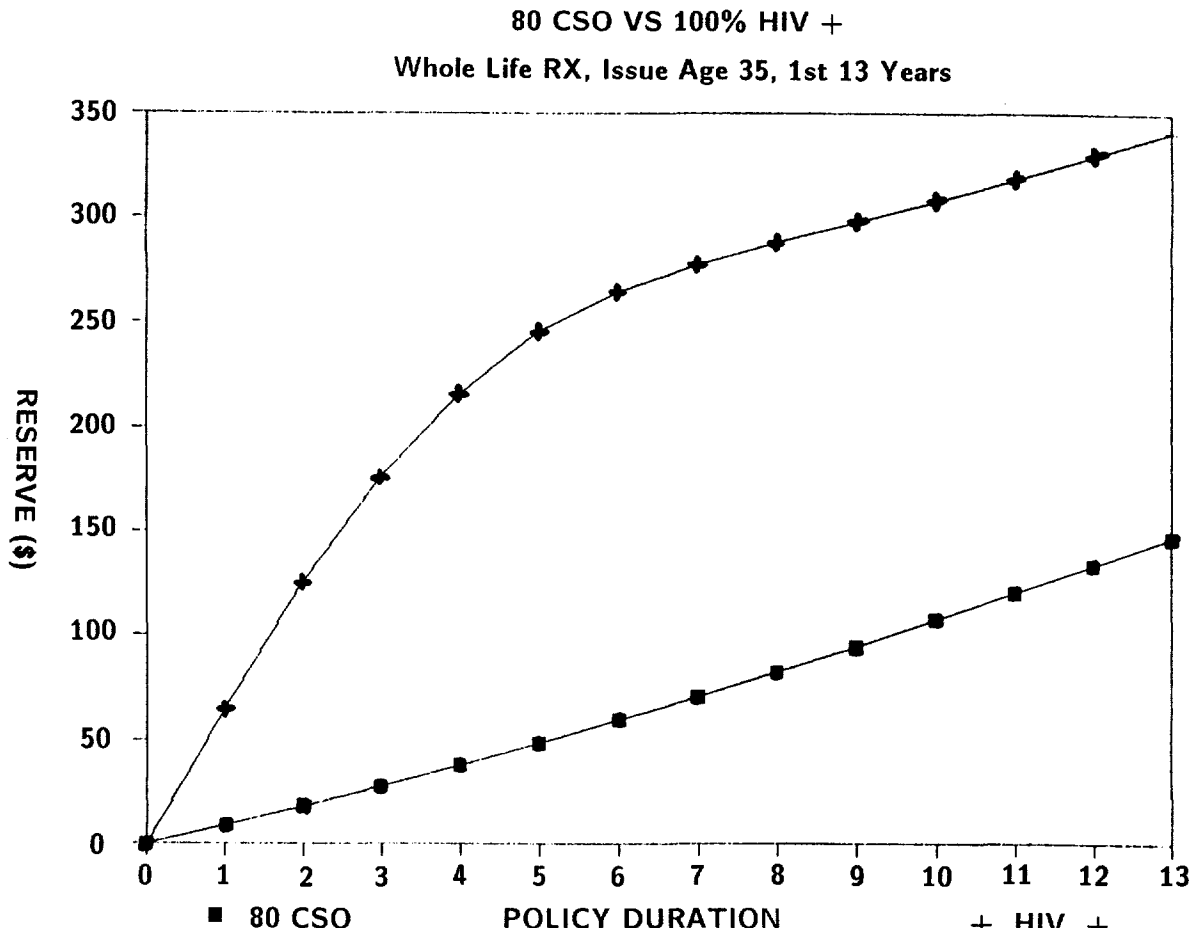
The types of reinsurance you can buy are abnormal stop-loss, which some of you may have already purchased for non-AIDS reasons. Here the reinsurer will attach at the point where your mortality exceeds, say, 115% of expected mortality based on recent results, and they might pay the excess over 115% up to, say, 130% with maybe a dollar limit. You could buy an AIDS-specific stop-loss, where if the AIDS claims are in excess of, say, 4% of your non-AIDS-related deaths, they'll pick up at that point, then with a dollar limit they'll pay the excess AIDS costs. These two are probably not worth purchasing. The price seems high, the attachment points are high, the liability is limited. And when that claim curve we saw begins to accelerate, the coverage will probably become unavailable. It's a one-year-at-a-time coverage.

Or you can join a catastrophe coverage program which utilizes a consortium of foreign reinsurers. I'll describe quickly how that works. In the way of background, in any insurance program, the reinsurer expects to make a profit.

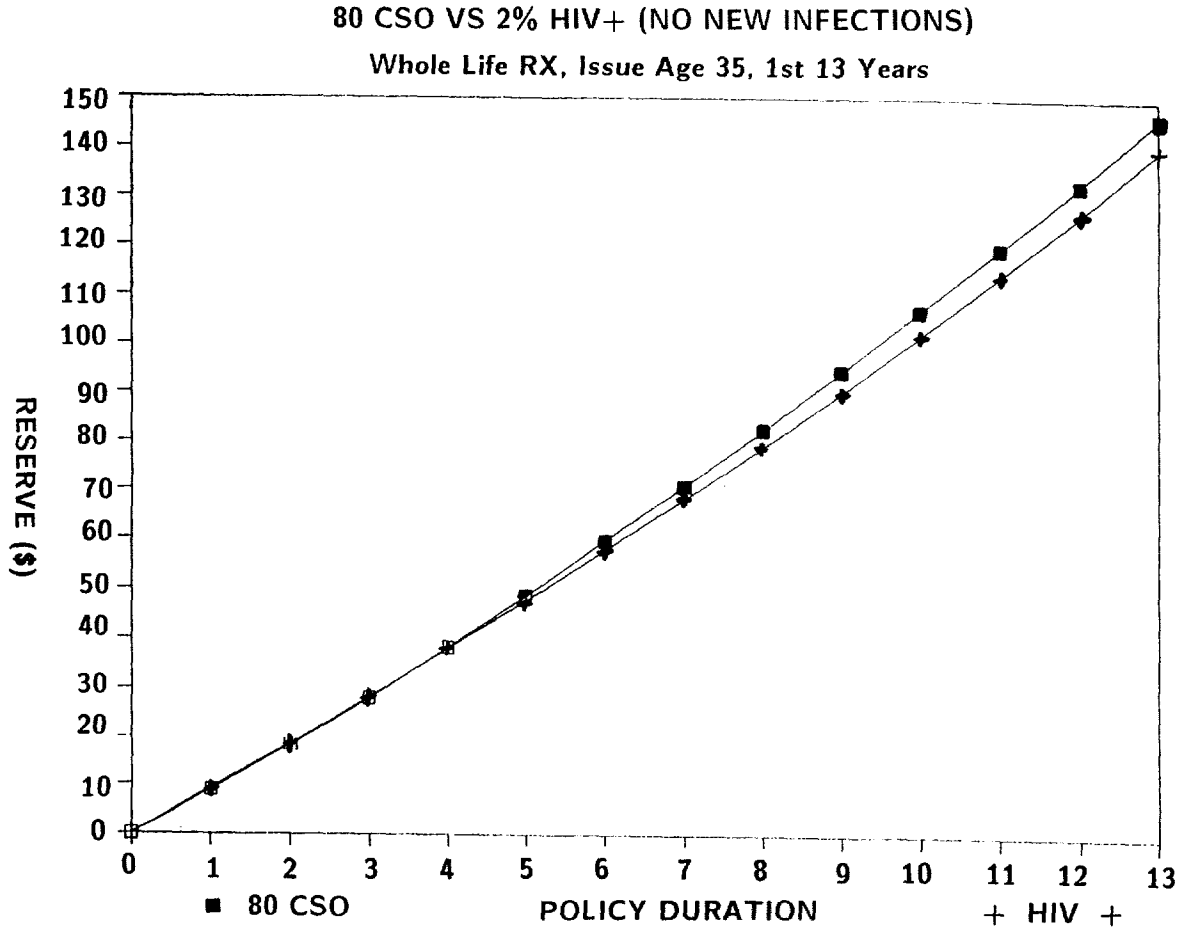
GRAPH 5


80 CSO VS 100% HIV+
Whole Life RX, Issue Age 35
RESERVE ($)
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
5
10
15
20
25
30
35
40
45
50
55
60
65
POLICY DURATION
■ 80 CSO
+ HIV +

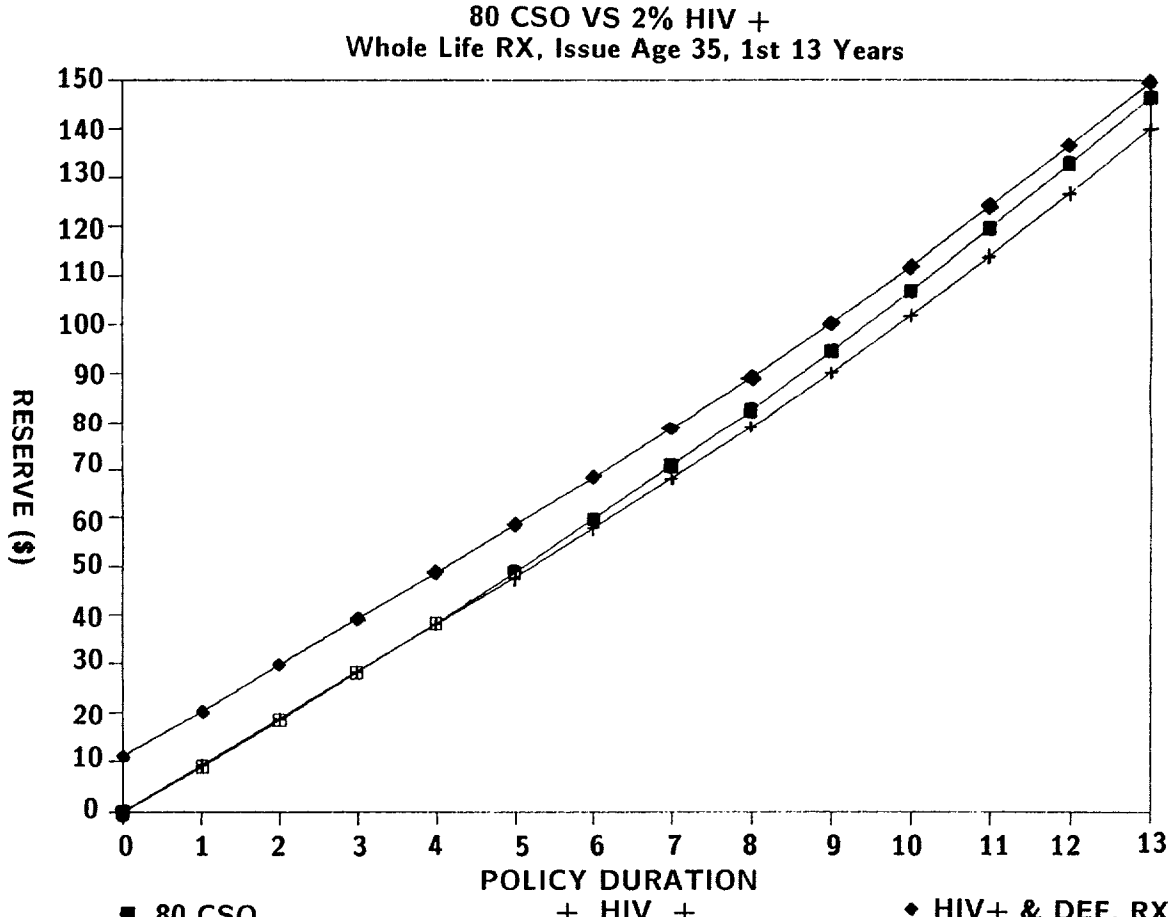
GRAPH 6


80 CSO VS 100% HIV +
Whole Life RX, Issue Age 35, 1st 13 Years
RESERVE ($)
350
300
250
200
150
100
50
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13
■ 80 CSO
POLICY DURATION
+ HIV +

GRAPH 7


80 CSO VS 2% HIV+ (NO NEW INFECTIONS)
Whole Life RX, Issue Age 35, 1st 13 Years
RESERVE ($)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13
■ 80 CSO
POLICY DURATION
+ HIV +

GRAPH 8


80 CSO VS 2% HIV +
Whole Life RX, Issue Age 35, 1st 13 Years
RESERVE ($)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13
POLICY DURATION
■ 80 CSO
+ HIV +
◆ HIV+ & DEF. RX

There's no exception here; each class of reinsurance is expected to pay its own claims over time, so the reinsurer has a couple of functions: It irons out the fluctuations, and in that capacity it expects to get its profit back from the company itself. Or it can reinsure the catastrophe cover; in that event it expects the whole class, or all the companies insured, to cause it to recover its losses. In this catastrophe program you have the same thing. The companies, as a class, are expected to pay their own claims according to the Cowell projection and the premium is based on that. The reinsurer has the same two functions. He pays for the fluctuations and he hopes to get it back, and he also reinsures the risk of early payout which is the catastrophe that is reinsured here.

Finally there is some spreading of the risk among the program members through pooling. A claim rate is set for each company through the model, the same model I used for those 22 companies that I discussed in the beginning. A single premium is paid to a European consortium and the claims are reported for maybe four years without any cash recovery. The reason for that is to avoid anti-selection where early years claims are excessive in relation to four-year total claims, to avoid somebody dumping claims into the pool. The exception to this is if you hit your claim limit within that period of time, you'll be paid off. In about six years the companies are expected to commute. I don't mean they're going to go to work on the subway, I mean they're going to settle out the treaties. This is a Casualty term. The term is they "commute to the then reserve." So all the claims that have been reported up to that point will be paid and the reserve or the IBNR (Incurred But Not Reported) Reserve will be calculated, and that will be paid, provided you haven't exceeded the limit. The unused limit will be pooled against those who have claims in excess of their limits. If there is anything left, it will be 98% refunded.

So the process is: a questionnaire is completed, with the four factors I mentioned. With model results we calculate the total expected exposure of that company. There is a 60% limit of that exposure. The reinsurer pays 100% of the claims up to that 60% overall limit. The mythical Company X, with 6 million claims limit, has a premium of about $3.8 million. On Table 4, we see that in four years it reports about $4 million in claims and has an IBNR of $1.7 million, for a total of $5.7 million. The overall limit is $6 million, so there is $300,000 left and that will be aggregated with all of the other companies in the program at that point. We then throw in your claims that are in excess of the limit, and the underages (savings) that were aggregated will be pooled against all those overages.

TABLE 4

Company X

AIDS Exposure

Assumptions	In Force	$ 1.0B
	Exposure Factor	10/M
	Exposure	$10.0M
	Claim Limit	$ 6.0M
	Single Premium	$ 3.8M
	Claims Reported	$ 4.0M
	IBNR	$ 1.7M
	April 1995 Recovery	$ 5.7M

So what does this program do for you. It isolates and identifies a significant part of your AIDS liability on your current inforce. There are options to cover future issues and future infections. It provides a financial plan for dealing with the identified portion and it hedges the catastrophe risk of early progression to death. It reduces your cost if a tax effect can be achieved, which we believe it can. There is only a small downside risk of *frictional* reinsurance costs if you do not get the tax effect. It helps you average out with similar companies.

So, just to summarize, in terms of solvency, our first topic, there is some concern about individual companies, but on average, the industry looks to be in pretty good shape. In terms of reserves, the catastrophe type of reserve is probably preferable to trying to massage the basic reserves. And finally, reinsurance seems to have some significant advantages over simple reserving. The Institute of Actuaries working party in Great Britain did suggest that you reserve for the most optimistic scenario (that is, reserve or reinsure), and that you examine your resources for the most likely or the most pessimistic scenario, I think they recommended that you build reserves to the middle projection.

MR. COWELL: I'm going to direct the first question to Dr. Wing. You commented that you feel the CDC estimate of 1.5 million HIV infected people was unrealistic. Would you comment as to whether you feel this number should be higher or lower.

DR. WING: Higher. The reason I believe it is higher, that figure was first set in June of 1986. We are almost to June of 1988, two years later. One report I read, and it's frightening if you believe it, said that we have 1200 infections occurring daily. You compute that out and the figures are staggering. That was after the report of one to 1.5 million that came out in June of 1986. There's no reason to believe that we hit zero at that time and no further infections have occurred. The answer to the question is, I think it's more. I have seen reports of three million. I have seen estimates at five million. It is just not realistic to me, knowing the natural history of the spread of the disease, to think it has hit a static level and held there for two years.

MR. COWELL: The second question relates closely to this and that is, you cited the average progression from HIV infection to AIDS as averaging five years. John used eight years. Would you like to comment on this because I'm going to progress this question into the relationship between the number of infections and the average progression time.

DR. WING: If I said five years for the entire progression, from time zero to death, I certainly didn't mean that. It's eight years. Five years average through the latency period. Historically it has been said two years through the symptomatic period, which now is believed to be more like 13 months. I'm still a year short from the other figure, but all of the answers are not known yet. Seven to eight years, seven to eight and a half years.

MR. COWELL: I guess its the height of impropriety, or lack of humility, when you start quoting from your own paper. But Walter and I identified basically from the combination of looking at Frankfurt and CDC progressions, a mean progression of 2-1/4 years from the initial infection to first stage, Lymphadenopathy Syndrome (LAS), and another 2-3/4 years from LAS to ARC, and another 4 years from ARC to AIDS. This is a mean time, of course. Those all add up to nine years, and then another two years to death. I would say that since we published, we have acknowledged, the pitfalls of trying to make

projections based on single point estimates. I think the data that are available in the last year or two show that the progression time varies vastly. There are some subpopulations in which it is five years, others in which it is eight. Nancy gave us one instance in which it took someone 16 years to progress from initial infection to full clinical AIDS.

I know we have in the audience here somebody whose work I regard as really the state of the art in the whole question of the epidemiology, the spread and estimating the numbers and that's Harry Panjer from the University of Waterloo. Would you like to comment briefly on your observations relating to the difficulty of projecting the progression time and the implications that this has for estimating the number of infecteds?

MR. HARRY H. PANJER: First of all, Mike's question related to estimating what he calls progression rates. This is what I refer to as the incubation period, that is the time from either infection or seroconversion up to the time of full-blown clinical AIDS. Dr. Wing referred to the Latency Period, that is the time period from infection up to the time in which symptoms appear, also referred to as the Asymptomatic Period. Also Dr. Wing referred to the Symptomatic Period, as being the time up to full clinical AIDS. I think that was your definition, wasn't it?.

DR. WING: Symptomatic to death.

MR. PANJER: Symptomatic to death. And in fact the average there was about ten years, wasn't it?

DR. WING: You see I'm not an actuary, so I don't zero in on these numbers because these things vary so from four weeks to 16 years.

MR. PANJER: Yes, there's great variation in these numbers. Now in terms of Mike's question, with respect to obtaining estimates, the samples on which the estimates are based are all relatively small. One of the difficulties in doing estimates based on the kind of data that are available is that observations are only available on the number of people who have developed full-blown AIDS; they are not available on persons who are HIV positive. So clinical trials are not generally available. So prospective studies generally are not available to develop estimates or distributions for the progression rates. The Frankfurt study is one of the few studies in which persons who identified themselves as possibly being at risk, were diagnosed at a particular stage, and were tracked through time. The information based on CDC data and some of the San Francisco data is retrospective in nature and the statistical techniques that are used require simultaneous estimation of the numbers of infections, in the past, and the incubation period. Statistically it is very difficult to distinguish between a large number of infections and a long incubation period or a small number of infections and a short incubation period. They can both result in the same number of observed cases. As a consequence, standard errors on the estimates of the incubation period are generally very large. I don't recall the exact values of standard errors for the mean values in the study I did. Many of you will have seen that paper. So the main point again is that many of these studies are retrospective, rather than prospective, so the precision of the estimate is much lower.

MR. COWELL: I think the point here has to be made that we just don't know how many HIV-positive people are out there. We've got estimates. The CDC

says 900,000 to 1,400,000. Walter Hoskins and I said about a million. Some of the analysis that Harry has done shows that, based on an assumption of like an eight-year mean progression, the number can be anywhere from 1 million to 2 million, with about equal likelihood. Is that right Harry?

MR. PANJER: I can answer that. In the material that I presented in Chicago, I have examined the assumption of exponential growth of the epidemic, as well as the incubation period models. I used statistical estimation techniques to estimate the number of HIV cases.

Based on incubation period models that have been documented in the scientific, or medical literature (that's not to suggest that medical literature is not scientific), some of the literature has documented a mean incubation period of roughly 6.4 years; other studies are up to 8 or 9 years. Now in some of those the standard deviation of the distribution was given; the standard deviation typically runs from from less than three to four years. When you put those numbers together, using various incubation period models, one can easily come up with a number of a half million HIV infections in the U.S.; that is the lowest number, the largest is 1-1/2 million. The number is extremely sensitive to the distributional assumption for the incubation period. If you change the average of the incubation period by 30%, you change the estimate of HIV infecteds by about 100%. So it's extremely sensitive. In effect you're fitting the early part of the growth curve, and a small change in the early part of the growth curve could suggest a large change in the right hand side of that distribution. Now the number is also very sensitive to the standard deviation. Keeping the mean fixed, if you spread out the distribution, you come up with a different conclusion. So it's very easy to come up with quite a wide range of estimates. There are a number of studies going on now in various parts of Canada and the U.S. where they are trying to pin down those numbers. Some of those people are at my own University, working with people in San Francisco. They are very reluctant to say anything about the incubation period model, beyond the elapsed time of the observation in the study, which is about six or seven years. Their numbers are very consistent with the other numbers we have heard, which is about 30 to 40% after five or six years. The numbers that we generally see in the literature are confirming the fact that we are probably in the ballpark.

Another comment I was going to make was regarding exponential growth. I've been working on testing the assumption of exponential growth in the early part of the epidemic. John Dinius referred to the basic differential equation that drives exponential growth. It is not borne out by CDC data, it is not borne out by Canadian data, and it is not borne out by Australian data. I believe the basic reason is there is significant heterogeneity in the population. That is, the different subgroups have different behavior in terms of the frequency and rate of spread of the disease among the various subgroups of the population. So rather than having exponential growth, we have a mixture of exponentials, some of which are much longer than others. The growth rate is much slower than fitting an exponential would give. So if you fit an exponential curve to the CDC data, or at least fit it in combination with the incubation period models from the CDC data, you would probably in the short term overestimate the number of future infections. This is because the exponential curve grows too fast, therefore it's above the observed data at the beginning and at the end, and below in the middle. A study done in Los Alamos suggested it is more like a polynomial, the growth of a polynomial with a power of 2.5. I have been using maximum likelihood techniques over the weekend with polynomial models and observed, based on Canadian data, that a polynomial model with a power of about 3 fits the

data extremely well. That is, one cannot reject the hypothesis that it is a polynomial growth model. One *can* reject the hypothesis that it is an exponential growth model, so it seems to be growing at a slower rate. That, however, only tells us something about the past, it doesn't tell us very much about the future. We still can't talk about the ultimate level very definitively.

MR. COWELL: I see we're in danger of falling into the trap that I mentioned earlier of spending all our time worrying about this number that we can't pin down, and it is frustrating. I realize we as actuaries are accustomed to dealing with precision and pinpointing everything to fifteen decimal places. To have to admit that it's between a half million and a million and a half, not only can we not pin the number down but we can demonstrate quite scientifically that that number can't be pinned down. So, that's the frustration. However, as I testified in December before the President's commission on HIV, from the standpoint of public policy, and that was the issue there, and I would say the same thing from the standpoint of managing this epidemic within the industry or within your company, or for your client. The important thing at this moment isn't whether there's a half a million or seven hundred and fifty thousand or a million or a million and a half people out there who are infected. We do know the deaths with reasonable certainty. Rather it is coming up with policies and procedures based on the limited data we have. Not, as John said earlier, waiting for better data that are simply going to take a long time to emerge and by the time they do emerge a lot of these problems may have overwhelmed us.

So let's get off of the numbers for a minute. There are a lot of questions that people raised that are interesting from a claims standpoint. Dr. Wing, have you noticed any increase in accidental deaths, and I would add to that suicides, that are attributable to HIV infection?

DR. WING: I know that there are reports out that the suicide rate in AIDS patients has gone up 66%. As far as picking it up in claims. I agree with whoever said that we are letting 50% of the claims go through the crack; we are not identifying all AIDS claims.

MR. COWELL: Also, I'll start this one out with you Nancy and I will ask the other panelists if they'd like to comment. You seem to anticipate some movement of the epidemic into the heterosexual, non-IV-drug-using population. Following the situation in Africa, where the epidemic is believed to have had its origin, would you comment on the impact of this spread from the standpoint of your perspective -- underwriting -- and then I will ask John and Ardian if they would comment from the perspective of pricing and reserving and other actuarial responsibilities.

DR. WING: Well, I thought I heard two questions. My thoughts about the spread to heterosexuals and underwriting. I was talking, I think, to John about an observation I made in underwriting. We have been testing since November of 1985 and I review all of the positive HIV testing and the abnormal T cells that come into our office relating back to the underwriting file. And until two to three weeks ago I had never seen a female HIV positive or abnormal T cell. And in the last two to three weeks I have seen four. Now statistically I don't know if that's important but it certainly struck me when I have looked at them consistently and then all of a sudden, bingo, I've got four.

The spread to the heterosexual. As a physician, I think back to the 1970s when the topic was genital herpes, and we're talking about modifying behavior. And

there certainly was enough discussion on that and there was enough fear concerning herpes that we should have modified behavior. The official reported cases of herpes was ten million. Now I know we were talking about a discomfort and not death, but human nature being what it is, my sense is that education is going to affect some individuals but because the risk is an infected person to a noninfected person, and your risk factor goes up with exposure, number of encounters of that type, that that in itself is not going to change basic human nature. That is one reason in addition to the natural history of the disease that we have seen in Africa, we do see moving into the Caribbean, and in my opinion, we will see it in this country. It is not the unknown factor that you keep reading 'we just don't know if it's going into the heterosexual population.' My feeling is, we *do* know it's going into the heterosexual population. It is going to be there. What we have seen today is what was infected almost a decade ago. What we see a decade out is going to be a totally different picture. The ones that have risen to the top of the pyramid. The full-blown ARCs or deaths. That's my opinion. I don't think I'm in isolation with that opinion, but it is not in the reports. I mean, it's not in many of the reports.

MR. COWELL: John, would you like to comment how you would manage differently as an actuary who is pricing or as an actuary concerned with solvency, based on Dr. Wing's comments or your knowledge of the spread beyond the major risk groups?

MR. DINIUS: As far as whether it's happening, I would only echo Dr. Wing's comments that the CDC numbers tell us who has developed AIDS and this relates to infections that occurred five or more years ago; we don't know how it spread in the last five years. That's a matter of medicine and behavior and not hard statistical data. As far as applying it to insurance situations, I'd just say that it's going to be much more difficult to model as we add other risk groups where there is significant spread. It's going to be even more complicated than what Harry just indicated about trying to model this situation that we have so far.

MR. COWELL: Ardian, would you like to comment?

MR. GILL: Yes. The figures that Dr. Redfield gave in Chicago, which I have with me, are interesting in this context of the spread through the heterosexual, and particularly the female population. The overall prevalence of infection amongst applicants for the armed services was 1.5 per thousand with a ratio of infected males to infected females of 2.6 to 1. But at age eighteen, the prevalences were 0.5 per thousand for males and 0.3 per thousand for females. So, there is a point where the females are going to catch up. Also in his figures, some 46% of those infected were married. It's a truism that if you have sex with an HIV-positive individual, you'll probably become HIV positive yourself at least over time. The spread in Africa, as I understand it, has been largely through the female prostitutes and heterosexual sex. I don't know why we would expect anything different here.

I don't know how to translate this into reserves or pricing except to say what you probably have is more discount in the reserves for the female insureds than for males.

MR. COWELL: Let's stay with Ardian, on another interesting aspect of product pricing, more in design, that is closely related. One of you raised the issue as to why we are so insistent, particularly here in the U.S. that AIDS exclusion riders won't work, when they are being explored in other parts of the world.

MR. GILL: This question is from Les Webb of Victory in London and maybe Les will jump up and comment further. This is very sketchy but he says, "Three out of the top six term insurance writers in the U.K. have made substantial increases in their rates. At the extreme end of the spectrum, that is male age thirty for fifteen- or twenty-year term, the increases have ranged from 130-160%. One company, the Commercial Union, one of our largest, has not only increased its rates by these types of margins, but has brought out an alternative term contract with a 25% increase but with an AIDS exclusion. Ardian opined that it was not feasible to have an AIDS exclusion in the U.S., but if the exclusion said anyone who was HIV positive at the time of death could it be used?"

My feeling is "No." It's just not permitted by state law, legally, technically, and morally, especially if you are offering the alternative of a contract with full cover, but at a higher rate. I'm not an attorney, and if any attorneys here want to comment, fine. Or Les, you may want to comment on the laws in the U.K. that permit this exclusion. I don't believe even in the U.K. in the past you have ever had an exclusion for a death related to a particular disease, have you?

MR. COWELL: This is Les Webb of Victory Reinsurance.

MR. LESLIE E. WEBB*: We've always had a lot more exclusions on disability contracts, of course, Long-Term Disability (LTD). And, of course it wasn't so long ago on LTD that we had sexually transmitted disease exclusions. In fact the AIDS exclusions have moved into the disability and medical expenses area far quicker than they have into the life insurance. In fact, as far as I'm aware, all medical expense contracts in the U.K. now effectively have an AIDS exclusion in them. The LTD market has moved exactly that way and there's a lot of discussion going on about the wording of that exclusion at the moment and this one is the hot favorite about not having been defined necessarily as having AIDS at the time of claim, but being HIV positive, because that is an all-embracing way of picking it up. Now I'm not actually aware yet of how the Commercial Union exclusion is worded. I've been in the States now for ten days. It came out about three or four days before I left the U.K. so I haven't had the opportunity of seeing exactly how they're wording it. But we've been going through a lot of soul searching over the last year or so about whether AIDS exclusions are ethical, let alone legal. Everybody has been saying "No, we're in business to pay death claims. We shouldn't discriminate in this way. If we're going to do something about it, we should adjust the price," and that's what most companies have done. But a year ago, I don't think anybody appreciated just what that increase in price was going to be. And if .you're talking about twenty-year-olds, thirty-year-olds for level term contracts, the new price has got to be double or triple what the old price was, if you're on a guaranteed premium rate product. So once companies have made that move and started increasing their rates by 100%, 200% down in that age range, there's an awful lot of people who are going to say "I'll take a contract with an AIDS exclusion on it. I don't want to pay those kinds of prices. Give me a contract with an AIDS exclusion on it." Now, that still leaves the company in a dilemma if it just puts AIDS exclusions into its contracts, blanket across the board because they're inevitably going to get some people who are going to catch AIDS through some innocent circumstances, if I can use that phraseology. But the Commercial Union has done an

* Mr. Webb, not a member of the Society, is U.K. Life Marketing Manager with Victory Reinsurance Company, Ltd., in London, England.

interesting thing. They've given people the option. You can either have this new double rated contract with full cover, or you can have a contract at a much cheaper rate with the AIDS exclusion in it.

Another interesting thing will be when a claim arises on one of the contracts with the AIDS exclusion in it. We have in the U.K. now the Financial Services Act, which only took effect about two weeks ago. One of the ramifications of that Act is that any salesman has got to give best advice. Now if he sold a contract that had an AIDS exclusion in it, and then the insured died from AIDS,

I can see him getting dragged into court and the court saying "you sold him the wrong contract." But the Commercial Union has covered that because they're offering both contracts and as long as the agent and the broker say to the insured "well, which one do you want? Do you want the one that's at this rate or do you want one that's 75% cheaper with an AIDS exclusion on it?" If the choice is left to the insured, I can see that going through courts quite easily in the U.K. I'm talking strictly from U.K. practice, I know things are totally different with the legal system over here. I'm just giving a perspective from the other side of the pond.

MR. GILL: Thanks Les.

MR. COWELL: That's an interesting perspective. I see Ardian wants to make just one comment as a follow up on that.

MR. GILL: And so does Nancy. If I were the Commercial Union actuary, I'd worry about the group buying the one without the exclusion. I didn't mean to imply you couldn't have AIDS exclusions on disability or medical care, Les; we've had them here.

DR. WING: I'd like to make a comment on the way different cultures react. We are in the Middle East, in Kuwait, Saudi Arabia, that area. We were putting in our testing limits. Most of the insurance buying population there are expatriates, and if an expatriate is found to be HIV positive, he is deported. People there are asking for policies with AIDS exclusions, so that they do not have to take the HIV testing.

We are also in New Zealand. Our claims people there found a disability and they immediately put AIDS exclusion in the disability. We have put it in our personal annuity products and it currently is going in our life products in New Zealand by choice of the local insurance industry and the total circumstances. The policy owners do not want to pay for it. The government understands it. It is just wherever in the world this is going in and what is the mind set behind it. Whether you're an expatriate and you don't want to be deported, so let's exclude it or whether the government says, "Yes, we need to protect the policyholders as well as the infected, so yes we'll exclude it."

MR. COWELL: That's interesting, Nancy. I would like to give an additional reason about the New Zealand situation. At the Association of Life Insurance Medical Directors Meeting last October, I was the only actuary among the doctors and they were talking about AIDS exclusion riders. One medical director from New Zealand piped up and said exactly what you said, "We have AIDS exclusion riders in New Zealand." She was asked how you can make them work. She said, "In New Zealand, all of our doctors and all of our lawyers are honest."

Maybe that brings us to a stopping point. The last item on the agenda was social responsibility and I'm going to make a couple of quick comments trying to tie some of the points that have just been discussed together. The industry, as I suggested earlier, and the actuarial profession in particular, I think has certainly taken a position, has stood up, we've been counted on this issue, and I think people recognize that we are at least aware of the problem; we don't know all of the solutions. I think the most immediate responsibility that we have as an industry is of course to pay our claims honestly and I think we're all doing that. One of the concerns that I've had in this whole area of AIDS exclusion riders is the image that we create of an industry that is trying to avoid paying claims and certainly the United States, maybe to a lesser extent in Canada or New Zealand or Britain, but certainly in the United States, the insurance industry does not have the best public image and there is a perception or a misperception among a lot of public that we spend all our time trying to avoid claims. Now a lot of this is what happens in automobile and homeowners cases, but it spills over to life and health insurance. The major concern by the high-risk populations to date on all testing issues has really not been so much life insurance, although it certainly has recently been an issue, it's rather been the availability of health insurance. And this is an area that I think we're going to have to address more seriously. Most of our work to date has been on life insurance. There are indications, however, that in disability income and group health insurance that AIDS claims and claims resulting from complication of HIV infections are on the increase. So I think we're going to have to spend more time as a profession and as an industry in addressing these issues.

The last two comments that I would make in the social responsibility area go to the points of education and I alluded earlier that a number of comments had been made that the SOA has been right there with the numbers, with the issues, and we've provided, I think, an important balance between those people who were saying, that "This is the end of the world, this is a terrible catastrophe, we're all going to go bankrupt," and on the other side, "Don't worry about it, stick your head in the sand and it'll go away." And as I've argued in a number of situations where it was largely not insurance or actuarial people, I think the insurance industry is in an interesting position in which it's clearly to our disadvantage to overestimate this problem or to underestimate it. If we overestimate it we scare our markets, we scare our policyholders, we scare our stockholders. If we underestimate it, then we scare the regulators. Certainly as actuaries we have this responsibility of substituting facts for appearances and demonstrations for impressions, and we have a responsibility to try to call this epidemic as closely as we can. If we cannot come down with pinpoint precision then at least we should say so. I think we've been doing just that.

Lastly, again on the education point, I do think we have the responsibility to communicate our message as we're doing here and in discussions like this within the industry and outside the industry, to our policyholders, our stockholders, to the media, to legislators, and to regulators. The AIDS epidemic hasn't done anything very good. It has made a lot of us, as I started out saying, aware of the importance of studying mortality and morbidity. We are not just a spread banking operation. There is a serious C-2 risk here. We have an obligation not only to measure and to manage it, which is our basic responsibility as actuaries, but also to communicate it. We need to communicate it clearly to the public at large because it goes to the heart of risk classification and our prerogative as a profession that essentially serves a free market insurance operation.