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**U.S. GENERAL POPULATION PROJECTED
AIDS MORTALITY RATES**

SOCIETY OF ACTUARIES COMMITTEE ON HIV RESEARCH*

INTRODUCTION

AIDS (Acquired Immune Deficiency Syndrome) is a serious problem for the life and health insurance industry. Surveys conducted by the American Council of Life Insurance (ACLI) suggest that about \$2 billion of AIDS-related claims have already been paid by U.S. life and health insurers.

Yet current and historical claims data do not indicate what the eventual toll will be. Based on the projections we are publishing here, the total number of cumulative AIDS deaths through the year 2000 could be 12 to 24 times the cumulative AIDS deaths through 1988. The cumulative number of AIDS deaths through 2010 could be 15 to 55 times as great as the number through 1988.

AIDS progresses slowly; estimates are that the median period of progression from HIV (Human Immunodeficiency Virus) infection to AIDS diagnosis is between 8 and 12 years. Part of the AIDS epidemic is already "locked in," consisting of people already HIV-infected. Our projections range from 0.7 million to 1.9 million U.S. individuals infected as of the end of 1988. Another large part of the epidemic will be those who become infected in the future. For both parts of the epidemic, the slow progression rates to AIDS mean that it will be years until the actual magnitude of this problem is known.

These trends are important to actuaries. Actuaries take account of AIDS in setting assumptions for pricing new and existing products and in designing the features of new products. Actuaries take account of AIDS in evaluating and establishing underwriting standards and marketing practices for new business issues. Actuaries take account of AIDS in establishing reserves and evaluating surplus requirements, which make provision for the ongoing financial health of the company.

As shown by the above statistics, it is difficult to consider the effect that AIDS may have in the future. The effect cannot be determined only by studies of past experience. Instead, the actuary needs to investigate the effect of various projections based on mathematical models of the epidemic.

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In this paper, three projections of the future of the AIDS epidemic are presented. Our intention is that these projections will establish a basis to assist actuaries in the activities listed above.

There is a broad range of AIDS cases and deaths in our three projections. We believe that these projections present a reasonably likely range for the future course of the AIDS epidemic in the U.S. However, we cannot know if this range of projections will contain the actual future course of the AIDS epidemic. Certainly, that eventual course could be lower than our "low" scenario or higher than our "high" scenario.

We believe, however, that these three scenarios provide a practical basis for use by actuaries in investigating the financial impact of AIDS for life and health insurance. We hope that actuaries will use these projections, in addition to their own projections, to fulfill their professional obligations in the various areas referred to above.

It was our goal to make our projections of practical use by going beyond the basic projection of future AIDS cases and deaths. Thus we have also developed general population AIDS mortality rates related to our three scenarios.

To make our results more useful, we have separated our projections of AIDS cases and deaths by groups of years of infection. In that way, our results can be adjusted to remove the effects of cases not included in a particular insured population because of HIV testing at the time of issue. For example, business tested before issue in 1989 probably excluded almost all individuals who were infected in 1988 or earlier.

CONTRIBUTORS TO THIS WORK

SOA Committee on HIV Research

This paper has been prepared by the Society of Actuaries (SOA) Committee on HIV Research. We are: Arthur L. Baldwin III, Richard L. Bergstrom, Daniel F. Case, Michael J. Cowell, John B. Dinius, Walter H. Hoskins, Donald B. Maier, Richard M. Mathes, Harry H. Panjer, Thomas W. Reese (Chairperson), Paul J. Sulek, Harry A. Woodman, and Michael L. Zurcher.

Our committee was formed in 1988 to:

Monitor and report data regarding the prevalence of HIV and AIDS, both from a population standpoint and that of the insurance industry, and be involved in developing models for the spread of the epidemic.

Harry Woodman chaired this committee during 1988. Tom Reese became chairperson in January 1989.

A Joint Modeling Effort

The three projected scenarios are the product of a joint effort among three groups that needed to make such projections for their work. Besides the SOA Committee on HIV Research, which undertook to develop this report to publish these results, the work was a combined effort involving the SOA Task Force on the Financial Implications of AIDS and the ACLI/HIAA Ad Hoc Group on AIDS Data.

In particular, a subgroup was responsible for producing the three projections and the related mortality rates. Members of the subgroup were: David J. Christianson, John B. Dinius, Walter H. Hoskins, Harry H. Panjer, and Thomas W. Reese.

ACLI/HIAA Ad Hoc Group on AIDS Data

The ACLI/HIAA Group needed to project AIDS cases and deaths in order to develop projected AIDS claims for the life and health industry. It was this group that developed the three scenarios of AIDS cases through the year 2000 that we used as the basis for the projections being published here. This modeling work was led by John B. Dinius, assisted by Walter H. Hoskins and Mark D. Biglow.

In developing these scenarios, the group analyzed past reported AIDS case data and adjusted it from a reported to an incurred basis. This information was used with the CDC's projection of future AIDS cases to develop a benchmark for use in calibrating AIDS case projections. See Appendixes K and L.

After discussing and coordinating ideas within our modeling subgroup, the ACLI/HIAA modeling group chose three sets of progression rates from HIV infection to AIDS diagnosis. They then used these progression rates to develop three alternative scenarios of HIV infections, AIDS cases, and deaths that fit well with (adjusted) past reported and (adjusted) CDC projected AIDS cases.

For this work, mortality rates were not calculated. Instead, the modeled growth of the epidemic was applied to estimated 1987 AIDS claims (based on an industry-wide survey) to project future industry AIDS claims.

SOA Task Force on the Financial Implications of AIDS

This group was formed in mid 1988 to "...examine and report on the principles and techniques for the financial recognition of AIDS for insurance companies... ." As part of that effort, projected AIDS mortality rates were required.

The Task Force thus solicited help from our Committee as well as coordination with the work being done by the ACLI/HIAA Group. The modeling subgroup identified above was a cross-section of these three related groups.

The Task Force played a key role in developing the projections and the resulting mortality rates. This work was fully discussed at several meetings of the Task Force. The Task Force members are: Robert W. Beal, David J. Christianson (Chairperson), Harold J. Deutscher, Ardian C. Gill, William C. Koenig, Thomas W. Reese, and Paul E. Sarnoff.

Other Contributors

We are particularly grateful to David M. Holland, who has apparently not lost any of his enthusiasm for working with this subject since he completed chairing the SOA AIDS Task Force in early 1988. His important contributions are discussed at various points in the report.

Another helpful contributor was Barbara J. Lautzenheiser, who also has not lost her long-term interest in this subject.

Our efforts were greatly helped by the excellent cooperation we received from staff members of the Centers for Disease Control (CDC) in Atlanta. John Karon and Owen Devine, key members of the CDC's AIDS modeling staff, were very helpful in explaining the basis for the AIDS case projections that have been published by the CDC. They were even so kind as to attend one of our meetings, held in Atlanta, to discuss their modeling efforts. We express our thanks for this valuable support and for their continued efforts to provide us with needed data and understanding.

BUILDING ON PAST WORK

Our efforts have been made easier by some pioneering efforts that have helped to pave the way for the modeling work we are describing here. Some of the more significant past contributions are described below.

Cowell/Hoskins

The August 1987 paper, "AIDS, HIV Mortality and Life Insurance" by Michael J. Cowell and Walter H. Hoskins, broke ground for us in several aspects. First, this significant work applied to the HIV epidemic a classical epidemiological model of the spread of infection through an "at risk" population, that is, the population assumed to be most at risk for HIV infection. We have continued the use of this basic model for infection spread in our updated model.

The Cowell/Hoskins paper also developed a methodology of using a set of rates of progression from HIV infection to AIDS diagnosis to produce modeled AIDS cases from assumed new infections. Applying a set of progression rates to modeled HIV infections produces modeled year-by-year new AIDS cases.

Under this “back calculation” modeling method (defined later, in the Modeling Approach section), different sets of parameters in the formula for year-by-year infections are experimented with until a pattern is developed that produces modeled AIDS cases consistent with observed results. Our updated model continues to use this approach.

Further, the Cowell/Hoskins paper was the first to derive a set of mortality rates that applied from the time of AIDS diagnosis. These mortality rates, applied to the modeled AIDS cases, produce modeled year-by-year AIDS deaths. We have updated the AIDS mortality rates study using the same techniques introduced by Cowell and Hoskins.

Holland Papers

Two papers written by David M. Holland developed a practical way to produce age-specific AIDS mortality rates from projected total-population AIDS deaths. In “Observations on the Human Immunodeficiency Virus Epidemic and Managing Uncertainty in Insurance” (August 1988) and “The HIV Epidemic and Topics for the U.S. Valuation Actuary” (October 1988), Holland developed the technique of distributing modeled AIDS deaths into five-year age groups based on the historical distribution of AIDS cases by age at death.

This practical method yields an easy-to-apply, yet reliable division of AIDS cases into age cells that can be used for calculating age-specific AIDS mortality rates. We have adopted Holland’s method in the calculation of our mortality rates.

Among the other important contributions of Holland’s papers was the publication of data regarding the distribution of AIDS deaths by age. This information has not yet been made available directly from the CDC. These data were derived from tabulations made by the Office of the Actuary of the Social Security Administration. The figures are reproduced in Appendix M.

Institute of Actuaries (U.K.) and Canadian Institute of Actuaries

While we have taken somewhat different approaches from those used by these actuarial bodies in the U.K. and Canada, we have benefited greatly

from their work. We have compared our calculated AIDS mortality rates to theirs in Appendix F.

WHAT WE KNOW; WHAT WE DON'T KNOW

Our knowledge about AIDS ranges from aspects of the epidemic that we know quite a bit about to aspects that we can only guess at. Even where our knowledge is most complete, there are major deficiencies in our understanding.

Probably the most measurable aspects of AIDS by traditional actuarial standards are the mortality rates after the time of AIDS diagnosis. These rates can be determined from the CDC's periodic reporting of AIDS cases, which includes information about AIDS case deaths.

A statistic that seems solid on the surface is the number of historical AIDS cases that we can use to track trends in the epidemic. However, we only know of the cases that have been reported. We do not have full knowledge about the actual number of cases that there have been through any past point in time. Delays in reporting understate the cases reported for past periods. Problems with underreporting will keep us from ever knowing all the cases. Changes in the case definition, and the restrictions of the definition, make it difficult to adjust past numbers to estimate actual historical cases.

We know a little about the rate of progression from HIV infection to the time of AIDS diagnosis. We will probably never know this very well, however, because we don't know when the infection occurred for the vast majority of persons with AIDS. Further, the rates may vary considerably for different categories of infected individuals. Also, with advances in medical treatment and education, progression rates are likely to change over time.

We can derive plausible ranges of past infection patterns by modeling estimated historical AIDS cases. The same process also produces estimates of the number of people who are currently infected with HIV.

We have no way to know, however, the course of future infections. Even our knowledge about the size of the various potential at-risk groups is extremely limited. The best we can do is to develop reasonable scenarios.

MODELING APPROACH

Our AIDS projections used a "back calculation" modeling approach. That is, we developed a set of annual HIV infections that produced a reasonable number of annual AIDS cases when progression rates from HIV infection to AIDS diagnosis were applied.

The basic modeling approach follows these steps:

1. Estimate the progression rates from HIV infection to AIDS diagnosis.
2. Develop a trend of HIV infections that produces a reasonable pattern of modeled AIDS case diagnoses over the period of the epidemic.
3. Apply assumed mortality rates after AIDS diagnosis to estimate AIDS deaths from the modeled AIDS cases.
4. Divide those deaths into sex and attained age cells based on historical divisions of total AIDS deaths.
5. Calculate general population AIDS mortality rates by dividing the annual AIDS deaths in each sex/age cell by the estimated U.S. population in that cell. Graduation methods are then used to calculate AIDS mortality rates for every age.

In step 2 above, progression rates from HIV infection to AIDS diagnosis are used to calculate the AIDS cases that result from the trial set of HIV infections. To the extent that these resulting projected AIDS cases appear to be inappropriate, infection parameters are adjusted for use in a new test. This process is continued until modeled AIDS cases meet guidelines established for calibrating the model (discussed in a later section).

ESTIMATES OF MODELING PARAMETERS

Progression Rates

Among the past estimates of progression rates from HIV infection to AIDS diagnosis have been the Cowell/Hoskins and Panjer estimates from the Frankfurt data and the Cowell/Hoskins progression rates derived from the San Francisco City Clinic (SFCC) study data. It was this last set of rates that was used to make the Cowell/Hoskins projections.

The SFCC study has been updated in 1988, and “best-estimate” and “95 percent confidence interval” boundaries of these progression rates have been published. Appendix G shows how we developed three sets of Weibull function progression rates. One set (“slow”) approximates the lower SFCC 95 percent confidence interval boundary; another set (“expected”) approximates the “best estimate” rates; and the third set (“fast”) approximates the upper 95 percent confidence interval boundary.

Mortality Rates after AIDS Diagnosis

Cowell and Hoskins used the data from the end of the first quarter 1987 CDC *Weekly Surveillance Report* (WSR) to develop their estimate of mortality rates from the time of AIDS diagnosis: 45 percent in the first two years, 35 percent in the third year, and 25 percent thereafter. Those assumed rates fit that set of data fairly well.

Appendix H shows the derivation of a new set of mortality rates after AIDS diagnosis. The original Cowell/Hoskins rates were used for AIDS cases diagnosed in 1985 or earlier. For cases diagnosed after 1985, we assumed the mortality rate is 40 percent for the first two years after diagnosis, 35 percent for the third year, and 25 percent thereafter.

MODELING THE SPREAD OF HIV INFECTIONS

Macro Model

We do not know the rate at which HIV infections have spread through the at-risk population in the past, let alone the course of future spread. However, we can use modeling to generate scenarios for infection spread that are consistent with the results we have observed, that is, AIDS cases reported to date.

All methods to attempt such modeling present serious obstacles. A "micro" type model that attempts to deal with various divisions of the at-risk population, and the risk behavior within and among these divisions, would present the need for making additional assumptions that cannot be tested by external data. The uncertainties involved would include not only the AIDS case projection itself but also the uncertainties in adapting that projection to the insured population. Because of these uncertainties, it is doubtful that this level of detail would produce results any more reliable than for the macro-type model we have used.

Thus we have continued the Cowell/Hoskins approach of modeling the spread of infections through one combined "at-risk" population. This type of model requires fewer assumptions, and modeled results can be compared to the CDC's projection of total AIDS cases.

Infection Model

We projected the HIV infection trend by experimenting with different patterns and levels of past infections until a reasonable pattern of annual infections was found that produced AIDS cases consistent with our modeling goals (modeling goals are discussed in the next section).

To model the spread of infection through our defined at-risk population, we used the logistic formula described by Cowell/Hoskins: that is, the rate of infection spread is proportional to the product of the fraction of the at-risk population that is infected and the fraction that is not infected. The rate of spread is equal to this product times an infection factor.

What is the value of this infection factor (we have called it “alpha”)? We simply experimented with different values until the resulting modeled AIDS cases approximated observed AIDS cases. This is a back-calculation modeling technique.

The value of alpha will naturally decrease over time, even without the effect that education has on changes in at-risk group behavior. This occurs because the at-risk group is not a homogeneous population. Instead, the at-risk population is made up of smaller at-risk “subgroups,” each with a different pattern and rate of infection spread. The infection runs rapidly through some of these subgroups. As these subpopulations become more saturated with HIV infection, the rate of infection spread, as compared to that of the larger total at-risk population, decreases.

Appendix I discusses our infection spread approach in more detail.

At-Risk Population

What is the size of the at-risk population? There is no clear definition of who should be counted in this group. Due to the effects of education, the at-risk population has likely decreased in size over the past few years. On the other hand, the size of the at-risk population would be very large if we included everyone who could theoretically become HIV-infected, for example, in a widespread heterosexual epidemic.

Practically, the size of the assumed at-risk population has little effect on the eventual model results. Different at-risk population sizes will simply result in different infection spread formula parameters being developed that fit with observed AIDS case results. Similar results will be produced with a larger group with lower rates of infection spread or with a smaller group assuming faster spread.

Thus the size of the at-risk population is not a critical assumption. We know that the actual population at some risk of HIV infection is much larger than what we used. We also know that there are at-risk population subgroups that are much more saturated than the larger group that we assumed.

The at-risk population used in our model is 4 million people. This is simply the 3.75 million of the Cowell/Hoskins model, rounded to the nearest million.

Appendix J discusses methods of estimating the at-risk population.

Adding to the At-Risk Population

As our defined at-risk population becomes saturated with HIV infections, new infections decline and eventually cease. Unless there is a vaccine against

HIV, we know this won't happen. New lives will enter the at-risk group, due to such factors as younger generations reaching the age of sexual activity and the spread of infections to "less" at-risk populations.

Given the many uncertainties that already exist in making long-range AIDS projections, we could find no theoretical basis for modeling additions to the at-risk population. Instead, we assumed that the modeled annual number of new HIV infections would remain level after the year 2000.

This leveling of new HIV infections has the effect of expanding the originally assumed "at-risk" population. Indeed, our "high" scenario produces cumulative infections that exceed the original 4 million at-risk number by the year 2006.

We have no sound theoretical reason for choosing the year 2000 to begin this leveling off. We chose that year because that is the last year that was shown in the Cowell/Hoskins and the ACLI-HIAA projections. Leveling off the infections at this point seems a more reasonable means of extending the projections than letting the normal model continue.

Accounting for At-Risk Population Deaths

Another modification that could be made to our infection model is to recognize that HIV-infected persons will stop infecting others at some point in the progression of the disease.

Some modelers have assumed that infectivity stops at the time of AIDS diagnosis. This is a simplifying assumption used as an alternative to modeling changes in infectivity and behavior as the disease progresses.

Thus the logistic equation for generating new infections could be modified to calculate the infected portion of the population excluding those who have progressed to AIDS. We would then be using an at-risk population that declines as the epidemic progresses.

We felt that such refinements were not warranted at this time. We would simply have used higher infection factors with this modified formula in order to obtain annual new infections that produced reasonable results. Our techniques were only designed to produce reasonably smooth results that seem consistent with the probable course of actual HIV infections. Thus we continued to use the HIV infection spread model used by Cowell and Hoskins, modifying the formula parameters to calibrate our model, as explained in the next section.

CALIBRATING THE MODEL

Through a simple macro back-calculation model, we are seeking to approximate the combined effects of a collection of complicated processes. How do we know that our model is reasonable?

Reproducing Historical Cases

The first reasonability test that the model must pass is to approximately reproduce the estimated past history of the spread of AIDS. Thus our model must produce AIDS cases for prior periods that are consistent with those reported to the CDC.

There are three main complications in any comparison to historical reporting:

1. *Reporting Delays.* Some AIDS cases that have already met the requirements for diagnosis have not been reported yet. Future reporting will add many more AIDS cases that occurred in 1988, 1987, 1986, and even earlier.
2. *Underreporting.* Many AIDS cases will never be reported to the CDC.
3. *Definition Problems.* A person is diagnosed as having AIDS (rather than only being infected with HIV) when the CDC AIDS surveillance definition is satisfied. Because of the strictness of the definition, there are some HIV-related deaths that occur before the official AIDS "diagnosis" could have been made.

Further, the CDC surveillance definition has been revised several times, with the most recent change affecting cases reported beginning in September 1987. Each change in definition has increased the number of cases that may be classified as "AIDS."

Appendix K discusses the AIDS cases reported to the CDC through the end of 1988 and how adjustments should be made to account for reporting delays, underreporting, and definition problems.

Reproducing the CDC's Projections

Reproducing past AIDS cases, however, is not a complete guide for evaluating future projections. First, past cases constitute only a small fraction of the AIDS epidemic. There are relatively few AIDS cases reported to date; these were infected many years ago in the early stages of the epidemic. Second, the number of cases in the more recent past is still quite uncertain due to the effects of reporting delays.

A second reasonability test we can apply is that the model must produce results consistent with other "reliable" projections. What can serve as our benchmark for this purpose?

No one can accurately predict the number of AIDS cases in "distant" future years. In the shorter term, future AIDS cases can be projected with

some degree of confidence over a small number of years by observing trends in the number of cases being diagnosed and reported. The CDC has published such a projection of AIDS cases through 1992.

Even over this short time period, the uncertainty of the projection is tremendous. Even using only a two-thirds confidence interval, the CDC has estimated that the number of AIDS cases diagnosed in 1992 will be between 13,000 and 119,000.

In spite of this uncertainty, the CDC's published projection is the most reasonable benchmark we have for calibrating our modeled results. Thus our models have been developed to be reasonably consistent with the CDC's projections through 1992, in addition to reproducing (adjusted) past results.

Appendix L discusses the CDC's projections and how our model fits these forecasts.

THREE PROJECTIONS

Sensitivity to Progression Rates

We used a back-calculation modeling method; that is, we hypothesized historical HIV infections that result in a reasonable model for past and short-range future AIDS cases. The most critical modeling assumption is the rate of progression from HIV infection to AIDS.

A low projection of future AIDS cases results from assuming fast progression rates. That is, the number of AIDS cases we have seen reported, and expect to see in the next few years, is produced by a relatively low number of infected individuals who progress to AIDS relatively quickly.

Alternatively, assuming slow progression rates produces a high projection of future AIDS cases. With slower progression, we must hypothesize a larger infected population that is producing the observed cases. That larger infected population will eventually produce more AIDS cases than in the low scenario in which a smaller infected population is progressing to AIDS faster.

High, Middle, and Low Scenarios

Thus we developed a low AIDS scenario using the fast progression rates, a middle scenario using our best estimate of expected progression rates, and a high scenario using slow progression rates. These three sets of progression rates are discussed in Appendix G.

The pattern of HIV infections for the middle scenario was constructed to match the (adjusted) CDC projections closely. This scenario results in a

modeled 1.0 million HIV-infected individuals at the end of 1988. This scenario peaks at about 86,000 AIDS deaths in 1999, with 1.6 million AIDS deaths cumulative through 2010. The results of the middle scenario are contained in Appendix A.

The high scenario was developed to reproduce observed results with a larger infected population, resulting in more eventual AIDS cases and deaths. The pattern of infections was constructed to trend higher than the CDC projections by the later years of the CDC projection. This scenario produces 1.9 million cumulative infections by the end of 1988. Modeled annual AIDS deaths peak at about 177,000 in 2003, with 2.9 million cumulative AIDS deaths through 2010. The results of the "high" scenario are contained in Appendix B.

The low scenario was developed to reproduce observed results with a smaller infected population. This scenario produces 0.7 million cumulative infections by the end of 1988. Modeled annual AIDS deaths peak at about 58,000 in 1995, with 0.8 million cumulative AIDS deaths through 2010. The results of the low scenario are contained in Appendix C.

Appendix E compares the results of the three projection scenarios.

AIDS MORTALITY RATES

Appendixes A, B, C, and D contain calculated AIDS mortality rates per 1,000 U.S. population, which includes both HIV-infected and non-HIV-infected individuals. If a subpopulation has the same percentage of HIV-infected individuals as the general population, these rates would be applied to the number of thousands of individuals in the subpopulation to forecast AIDS deaths within that subpopulation.

Division into Gender and Age Groups

More detailed models could be constructed that would divide the at-risk population into various gender and age subgroups. Each subgroup could be modeled to have different rates of incidence of infection, progression rates, and mortality rates after AIDS diagnosis. As discussed earlier, however, such a complicated model could not be tested in detail against available data.

Instead, we used reported AIDS deaths by gender and age group to break down our modeled total population AIDS deaths into gender and age subgroups.

First, we divided our projected AIDS deaths into males (90 percent) and females (10 percent). It is important to note that this is a different approach than has been used by some others. For example, the AIDS mortality rates

developed by Holland are based on the Cowell/Hoskins AIDS deaths being allocated 100 percent to males. This difference should be noted in comparing these AIDS mortality rates to ours.

Second, we separated these male or female deaths into five-year age groups, using distribution percentages consistent with deaths reported through the second quarter of 1988.

Appendix M discusses the development of assumptions for splitting the total projected AIDS deaths by gender and into age groups. The assumptions are documented in each scenario report (Appendixes A, B, and C).

Calculation of Mortality Rates

To obtain mortality rates, we divided the projected AIDS deaths in each sex/age group by the projected U.S. population in that group for the appropriate calendar year. These projected population figures are taken from the U.S. Department of Commerce report Series P-25, No. 1017: "Projections of the Population of States by Age, Sex, and Race: 1988 to 2010."

This report projected the U.S. population as of 1986, 1990, 1995, 2000, 2005, and 2010. For other years before 2010, linear interpolation was used between the projected population figures. The population figures were assumed to remain constant after 2010.

Mortality Rates Comparison

Each of Appendixes A, B, and C shows the U.S. general population male AIDS mortality rates associated with each of our three scenarios.

Appendix D shows the female AIDS mortality rates associated with our middle scenario. Only the mortality rates are shown for this report, since the projection of HIV infections and AIDS cases and deaths is the same as that contained in Appendix A. The only changes in the calculation of female AIDS mortality rates were the use of the 10 percent of our modeled AIDS deaths that are assumed to be female, the use of female age distribution assumptions, and the use of female U.S. general population projections.

Appendix F compares the U.S. general population male AIDS mortality rates among our three scenarios. Included also are comparisons to some of the male AIDS mortality rates projected by the Institute of Actuaries (U.K.), the Canadian Institute of Actuaries, and David M. Holland.

No Increase for Underreporting

Our models are "calibrated" to past reported cases and CDC projected cases that do not include an increase for AIDS cases that will never be

reported. Thus we decreased the CDC's AIDS projections to remove the 10 percent adjustment for underreporting included by the CDC.

Thus our models are based on the numbers of AIDS cases that will eventually be reported. This is different than the approach taken by Cowell and Hoskins, who compared their modeled results to the CDC's projected numbers without removing any increase for underreporting. (The CDC projections available for that study did not contain enough documentation to consider any such adjustment.)

Long-Range "Distortion"

There is some minor long-range distortion produced by our calculation method. In the short term, it has been shown that the distribution of AIDS deaths by age is relatively stable. In the long term, however, there will likely be some changes in the distribution of AIDS deaths by age.

There will be some trend toward older ages, due to the fact that the current AIDS cases consist mainly of those individuals who progressed to AIDS relatively early after infection. The individuals progressing to AIDS later, and who will thus be diagnosed with AIDS at relatively older ages, will become an increasingly larger proportion of the observed cases.

Also, effects of drugs and medical treatments will likely have some effect of shifting AIDS deaths to older ages. Further, demographic patterns in the population will affect the AIDS deaths age distribution in future years.

The resulting distortion does not appear to be serious, however—it simply shifts some deaths from some ages to others—and is not important to overall financial projections. Further, the distortion is minor compared to the uncertainties involved in the projection of future HIV infections. Thus we did not correct for this effect.

Split by Year of Infection

The modeled AIDS deaths in Table 4 of each of Appendixes A, B, and C are shown separately by year of infection. In this way, our calculated mortality rates can be adjusted for the effects of HIV blood testing at issue.

For example, consider a block of in-force life insurance coverage on males age 35 in 1999. Table A6 shows that the general population AIDS mortality rate for this case is 1.752 additional deaths per 1,000 lives. However, this rate applies only if the population has a normal proportion of HIV-infected lives from each past year of infection.

If this business was issued during 1989 and 70 percent of the coverage amount was HIV-tested, the deaths corresponding to nearly 70 percent of

the HIV infections before 1989 should have been eliminated by the HIV test. Thus the AIDS mortality rate should be decreased.

This reduction can be estimated by using the annual AIDS deaths data in Table A4. Of the 1999 AIDS deaths, 60,486 (36,151 plus 9,070 plus 8,250 plus 7,015) come from lives infected before issue in 1989. Similarly, 25,690 (6,251 plus 5,440 plus 13,999) come from lives infected after issue in 1989. Because 70 percent of the lives already infected by mid-1989 would have been eliminated because 70 percent of the coverage was HIV-tested, the 1999 AIDS deaths related to this coverage would be only:

30 percent (100 percent minus 70 percent) of the 60,486 deaths from individuals already infected at issue, plus 100 percent of the 25,690 deaths from individuals infected after issue, equals 43,836 deaths.

The 1999 AIDS mortality rate should be the normal 1.752 deaths per thousand times the ratio of these 43,836 deaths to the total 86,176 AIDS deaths in 1999. Thus the applicable AIDS mortality rate should be reduced to 0.891 deaths per thousand for this business.

For the convenience of actuaries using the AIDS mortality rates, an alternative set of AIDS mortality rates is included as Table 14 of each of Appendixes A, B, C, and D. Each alternative set excludes the deaths from individuals infected with HIV before 1989. These alternative sets of AIDS mortality rates would be applicable to business that was 100 percent HIV-tested in 1989.

USING THE AIDS MORTALITY RATES

These are U.S. general population AIDS mortality rates. Care must be taken in using these rates to calculate financial values related to insured populations.

The use of AIDS mortality rates in calculating insurance financial values is part of the work being done by the Society of Actuaries Task Force on the Financial Implications of AIDS. Their report gives practical tips about the transformation of these general population AIDS mortality rates to rates applicable to a particular insured population.

We list here some of the more important factors that actuaries should consider in applying these rates:

1. *Insured Population vs. General Population.* The class of insureds is not drawn uniformly from the general population. Certain key groups most at risk of AIDS are likely to be underrepresented in the insured population (in the absence of antiselection).

For example, intravenous drug abusers are not likely to be purchasers of insurance products because of their lifestyle. Hemophiliacs and some blood transfusion cases

are likely to purchase less individual life insurance because their health conditions preclude them from meeting normal underwriting standards.

2. *HIV Testing.* Beginning in late 1985, the use of HIV-sensitive blood tests in underwriting has increased, so that today a substantial proportion of new individual life insurance issued is tested for HIV infection. For tested business, AIDS deaths from individuals already infected at the time of issue should be largely eliminated.
3. *Antiselection.* There have been many reports about the occurrence of antiselection, where the individual's knowledge about the AIDS risk causes him or her to seek additional insurance coverage. Antiselection could be a significant factor for business issued before HIV testing limits were decreased to current levels and for current business issued for amounts of insurance less than the testing limits.
4. *Geographic Variation.* The AIDS epidemic has not been distributed uniformly across the U.S. Certain states have a far higher incidence of AIDS cases than others. Large metropolitan areas have a higher incidence than rural areas.

Much of what is currently seen as geographic differences may tend to level out as the epidemic spreads relatively faster in those areas where it started later. However, the incidence will likely never become uniform over all states.

5. *Marketing Methods and Products.* Various companies have widely different approaches to marketing their products and underwriting risks. Further, various types and designs of products will have different potential for adverse AIDS experience. The characteristics of each different block of business must be taken into account.
6. *Lapses.* A person who knows he or she is at risk for AIDS is less likely to let coverage lapse than other insureds. Thus the effect of AIDS mortality on a block of business can worsen as the proportion of at-risk individuals increases over time.

FUTURE REVISIONS

At the time of this publication, fewer than 100,000 U.S. AIDS cases have been reported. This is only a fraction of the eventual AIDS cases, which are expected to exceed one million by a substantial amount. We are still in the early part of the AIDS epidemic.

Being in the early years of the epidemic, there are many things that we do not know yet. This report is based on the best knowledge we have available to us today. We know, however, that important aspects of the epidemic will become known more clearly in future years.

One important aspect of obtaining that future knowledge will be for actuaries to monitor AIDS reporting trends to compare them with our modeled scenarios. To assist in that effort, we have included as Appendix N a paper written by Daniel F. Case.

We expect, and encourage, that others will do future research that will result in projections different than those we have presented here. Until the

time that those projections are available, we hope that actuaries will be helped in their work by our report.

APPENDIX A

"MIDDLE" PROJECTION REPORT WITH MALE MORTALITY RATES

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AIDS Model Assumption Summary

Infection Spread: 4,000,000 at risk, middle scenario to match CDC
 Progression Rates: Weibull, median 10 years, alpha 2.1
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher
 Age/Sex Splits: 90% male, distribute all cases among ages 15-79
 Included Deaths: 100% of all years' infections.

TABLE A1
SUMMARY OF INFECTIONS AND CASES FOR MIDDLE SCENARIO
AT-RISK GROUP POPULATION: 4,000,000

Year <i>t</i>	<i>a</i> [<i>t</i>]	HIV Infections		AIDS Cases		CDC Smoothed/ Projected Cumulative
		Modeled New	Modeled Cumulative	Modeled New	Modeled Cumulative	
1975		122	122	0	0	
1976	1.400	373	495	1	1	
1977	1.290	1,302	1,797	4	5	
1978	1.141	3,819	5,616	18	22	
1979	1.022	9,945	15,561	61	83	
1980	0.915	23,083	38,645	185	268	
1981	0.810	47,190	85,835	503	771	348
1982	0.750	91,624	177,459	1,236	2,007	1,371
1983	0.660	152,215	329,673	2,788	4,795	4,227
1984	0.490	181,803	511,476	5,777	10,572	10,059
1985	0.330	166,097	677,573	10,740	21,311	21,016
1986	0.230	139,431	817,005	17,702	39,013	39,131
1987	0.180	123,252	940,257	26,219	65,232	67,107
1988	0.140	104,395	1,044,651	35,724	100,956	102,398
1989	0.120	95,234	1,139,886	45,644	146,600	147,535
1990	0.105	87,475	1,227,361	55,433	202,033	202,664
1991	0.087	75,233	1,302,594	64,644	266,677	267,401
1992	0.072	64,021	1,366,615	72,873	339,549	340,841
1993	0.067	60,904	1,427,519	79,765	419,315	
1994	0.061	56,478	1,483,996	85,105	504,420	
1995	0.056	52,639	1,536,635	88,815	593,235	
1996	0.052	49,496	1,586,131	90,905	684,140	
1997	0.048	46,165	1,632,296	91,470	775,610	
1998	0.046	44,626	1,676,922	90,670	866,280	
1999	0.044	42,998	1,719,919	88,710	954,990	
2000	0.042	41,292	1,761,211	85,833	1,040,824	
2001		41,292	1,802,503	82,282	1,123,105	
2002		41,292	1,843,794	78,294	1,201,399	
2003		41,292	1,885,086	74,095	1,275,493	
2004		41,292	1,926,378	69,878	1,345,371	
2005		41,292	1,967,670	65,799	1,411,170	
2006		41,292	2,008,961	61,974	1,473,144	
2007		41,292	2,050,253	58,482	1,531,625	
2008		41,292	2,091,545	55,370	1,586,995	
2009		41,292	2,132,836	52,656	1,639,651	
2010		41,292	2,174,128	50,335	1,689,986	
2011		41,292	2,215,420	48,389	1,738,375	
2012		41,292	2,256,711	46,785	1,785,160	
2013		41,292	2,298,003	45,485	1,830,646	
2014		41,292	2,339,295	44,450	1,875,095	
2015		41,292	2,380,586	43,637	1,918,733	
2016		41,292	2,421,878	43,010	1,961,743	
2017		41,292	2,463,170	42,534	2,004,277	
2018		41,292	2,504,461	42,177	2,046,453	
2019		41,292	2,545,753	41,914	2,088,367	

TABLE A2
ANNUAL NEW AIDS CASES PROJECTIONS FOR MIDDLE SCENARIO

Year	Infected in Year						Total	
	Before 1986	1986	1987	1988	1989	1990		After 1990
1975.....	0	0	0	0	0	0	0	0
1976.....	1	0	0	0	0	0	0	1
1977.....	4	0	0	0	0	0	0	4
1978.....	18	0	0	0	0	0	0	18
1979.....	61	0	0	0	0	0	0	61
1980.....	185	0	0	0	0	0	0	185
1981.....	503	0	0	0	0	0	0	503
1982.....	1,236	0	0	0	0	0	0	1,236
1983.....	2,788	0	0	0	0	0	0	2,788
1984.....	5,777	0	0	0	0	0	0	5,777
1985.....	10,740	0	0	0	0	0	0	10,740
1986.....	17,702	0	0	0	0	0	0	17,702
1987.....	25,454	766	0	0	0	0	0	26,219
1988.....	32,560	2,487	677	0	0	0	0	35,724
1989.....	38,622	4,250	2,198	573	0	0	0	45,644
1990.....	43,375	5,917	3,756	1,862	523	0	0	55,433
1991.....	46,657	7,396	5,230	3,182	1,699	480	0	64,644
1992.....	48,411	8,617	6,538	4,430	2,903	1,560	413	72,873
1993.....	48,678	9,531	7,617	5,538	4,041	2,666	1,693	79,765
1994.....	47,582	10,112	8,425	6,452	5,052	3,712	3,769	85,105
1995.....	45,317	10,357	8,939	7,136	5,886	4,640	6,540	88,815
1996.....	42,120	10,283	9,155	7,571	6,510	5,406	9,860	90,905
1997.....	38,252	9,926	9,090	7,754	6,907	5,980	13,562	91,470
1998.....	33,976	9,335	8,774	7,699	7,074	6,344	17,468	90,670
1999.....	29,537	8,566	8,252	7,432	7,023	6,497	21,403	88,710
2000.....	25,146	7,679	7,572	6,989	6,780	6,451	25,217	85,833
2001.....	20,974	6,730	6,788	6,414	6,376	6,227	28,773	82,282
2002.....	17,146	5,771	5,949	5,749	5,851	5,856	31,971	78,294
2003.....	13,742	4,844	5,101	5,039	5,245	5,374	34,749	74,095
2004.....	10,801	3,983	4,282	4,321	4,597	4,817	37,077	69,878
2005.....	8,326	3,208	3,521	3,627	3,942	4,222	38,953	65,799
2006.....	6,296	2,532	2,836	2,982	3,309	3,621	40,398	61,974
2007.....	4,671	1,959	2,238	2,402	2,720	3,039	41,452	58,482
2008.....	3,400	1,486	1,732	1,896	2,191	2,499	42,166	55,370
2009.....	2,429	1,105	1,314	1,467	1,729	2,012	42,599	52,656
2010.....	1,703	806	977	1,113	1,338	1,588	42,810	50,335
2011.....	1,171	577	713	828	1,015	1,229	42,857	48,389
2012.....	791	405	510	604	755	932	42,789	46,785
2013.....	524	279	358	432	551	693	42,649	45,485
2014.....	341	188	246	303	394	506	42,472	44,450
2015.....	218	125	166	209	276	362	42,282	43,637
2016.....	136	81	110	141	190	254	42,098	43,010
2017.....	84	52	72	93	128	175	41,930	42,534
2018.....	51	32	46	61	85	118	41,784	42,177
2019.....	30	20	29	39	55	78	41,663	41,914

Infection Spread: 4,000,000 at risk, middle scenario to match CDC.
Progression Rates: Weibull, median 10 years, alpha 2.1.

TABLE A3

CUMULATIVE NEW AIDS CASES PROJECTIONS FOR MIDDLE SCENARIO

Year	Infected in Year							Total
	Before 1986	1986	1987	1988	1989	1990	After 1990	
1975.....	0	0	0	0	0	0	0	0
1976.....	1	0	0	0	0	0	0	1
1977.....	5	0	0	0	0	0	0	5
1978.....	22	0	0	0	0	0	0	22
1979.....	83	0	0	0	0	0	0	83
1980.....	268	0	0	0	0	0	0	268
1981.....	771	0	0	0	0	0	0	771
1982.....	2,007	0	0	0	0	0	0	2,007
1983.....	4,795	0	0	0	0	0	0	4,795
1984.....	10,572	0	0	0	0	0	0	10,572
1985.....	21,311	0	0	0	0	0	0	21,311
1986.....	39,013	0	0	0	0	0	0	39,013
1987.....	64,467	766	0	0	0	0	0	65,232
1988.....	97,027	3,253	677	0	0	0	0	100,956
1989.....	135,649	7,502	2,875	573	0	0	0	146,600
1990.....	179,024	13,419	6,632	2,435	523	0	0	202,033
1991.....	225,680	20,816	11,862	5,617	2,222	480	0	266,677
1992.....	274,091	29,433	18,400	10,047	5,124	2,041	413	339,549
1993.....	322,769	38,964	26,018	15,585	9,166	4,707	2,107	419,315
1994.....	370,352	49,076	34,443	22,037	14,217	8,419	5,876	504,420
1995.....	415,669	59,433	43,382	29,173	20,103	13,059	12,416	593,235
1996.....	457,788	69,716	52,536	36,744	26,613	18,465	22,276	684,140
1997.....	496,040	79,642	61,626	44,498	33,520	24,445	35,839	775,610
1998.....	530,016	88,977	70,400	52,197	40,594	30,789	53,306	866,280
1999.....	559,553	97,543	78,652	59,629	47,617	37,286	74,710	954,990
2000.....	584,699	105,222	86,224	66,618	54,397	43,738	99,926	1,040,824
2001.....	605,673	111,951	93,012	73,032	60,773	49,965	128,699	1,123,105
2002.....	622,819	117,722	98,961	78,781	66,624	55,821	160,670	1,201,399
2003.....	636,561	122,567	104,062	83,820	71,868	61,195	195,419	1,275,493
2004.....	647,362	126,550	108,345	88,141	76,465	66,013	232,496	1,345,371
2005.....	655,688	129,757	111,865	91,768	80,407	70,235	271,450	1,411,170
2006.....	661,984	132,289	114,701	94,750	83,716	73,855	311,848	1,473,144
2007.....	666,655	134,248	116,939	97,152	86,436	76,895	353,300	1,531,625
2008.....	670,056	135,734	118,671	99,047	88,627	79,393	395,466	1,586,995
2009.....	672,485	136,840	119,984	100,514	90,356	81,406	438,066	1,639,651
2010.....	674,188	137,646	120,961	101,627	91,694	82,994	480,876	1,689,986
2011.....	675,359	138,223	121,674	102,454	92,709	84,223	523,733	1,738,375
2012.....	676,150	138,627	122,184	103,058	93,464	85,156	566,522	1,785,160
2013.....	676,674	138,906	122,541	103,490	94,015	85,849	609,171	1,830,646
2014.....	677,015	139,094	122,788	103,793	94,409	86,355	651,643	1,875,095
2015.....	677,233	139,218	122,954	104,001	94,685	86,717	693,925	1,918,733
2016.....	677,369	139,299	123,064	104,142	94,875	86,970	736,023	1,961,743
2017.....	677,453	139,351	123,136	104,235	95,004	87,145	777,953	2,004,277
2018.....	677,503	139,383	123,181	104,296	95,089	87,263	819,737	2,046,453
2019.....	677,534	139,403	123,210	104,335	95,144	87,341	861,400	2,088,367
Left	40	28	42	60	90	134	456,992	457,386
Pct	0.01%	0.02%	0.03%	0.06%	0.09%	0.15%	34.66%	17.97%

Infection Spread: 4,000,000 at risk, middle scenario to match CDC.

Progression Rates: Weibull, median 10 years, alpha 2.1.

TABLE A4
ANNUAL AIDS DEATHS PROJECTIONS FOR MIDDLE SCENARIO

Year	Infected in Year							Total
	Before 1986	1986	1987	1988	1989	1990	After 1990	
1975.....	0	0	0	0	0	0	0	0
1976.....	0	0	0	0	0	0	0	0
1977.....	1	0	0	0	0	0	0	1
1978.....	6	0	0	0	0	0	0	6
1979.....	22	0	0	0	0	0	0	22
1980.....	71	0	0	0	0	0	0	71
1981.....	203	0	0	0	0	0	0	203
1982.....	523	0	0	0	0	0	0	523
1983.....	1,232	0	0	0	0	0	0	1,232
1984.....	2,673	0	0	0	0	0	0	2,673
1985.....	5,280	0	0	0	0	0	0	5,280
1986.....	8,801	0	0	0	0	0	0	8,801
1987.....	13,583	173	0	0	0	0	0	13,756
1988.....	19,482	798	153	0	0	0	0	20,432
1989.....	25,526	1,862	705	129	0	0	0	28,223
1990.....	31,107	3,151	1,646	597	118	0	0	36,620
1991.....	35,926	4,499	2,786	1,394	545	108	0	45,258
1992.....	39,754	5,794	3,977	2,360	1,272	501	93	53,750
1993.....	42,445	6,959	5,122	3,368	2,153	1,168	510	61,724
1994.....	43,939	7,933	6,152	4,338	3,073	1,977	1,446	68,858
1995.....	44,254	8,672	7,012	5,210	3,957	2,822	2,974	74,902
1996.....	43,476	9,152	7,666	5,939	4,753	3,635	5,076	79,697
1997.....	41,745	9,369	8,090	6,493	5,418	4,366	7,685	83,166
1998.....	39,238	9,333	8,282	6,853	5,923	4,977	10,700	85,305
1999.....	36,151	9,070	8,250	7,015	6,251	5,440	13,999	86,176
2000.....	32,685	8,614	8,017	6,988	6,399	5,742	17,450	85,895
2001.....	29,026	8,010	7,615	6,791	6,375	5,878	20,925	84,619
2002.....	25,343	7,300	7,080	6,450	6,195	5,855	24,302	82,525
2003.....	21,772	6,529	6,453	5,997	5,884	5,690	27,482	79,807
2004.....	18,420	5,736	5,771	5,466	5,471	5,404	30,386	76,655
2005.....	15,360	4,954	5,070	4,888	4,986	5,025	32,963	73,246
2006.....	12,634	4,211	4,379	4,294	4,459	4,580	35,182	69,739
2007.....	10,258	3,525	3,722	3,709	3,918	4,096	37,036	66,265
2008.....	8,231	2,910	3,116	3,153	3,384	3,598	38,536	62,928
2009.....	6,531	2,369	2,572	2,640	2,876	3,108	39,707	59,804
2010.....	5,131	1,905	2,094	2,178	2,408	2,642	40,585	56,944
2011.....	3,994	1,515	1,684	1,774	1,987	2,212	41,213	54,379
2012.....	3,084	1,192	1,339	1,427	1,618	1,825	41,633	52,117
2013.....	2,364	929	1,053	1,134	1,301	1,486	41,888	50,157
2014.....	1,802	718	821	892	1,035	1,195	42,019	48,482
2015.....	1,366	550	634	695	814	950	42,060	47,070
2016.....	1,032	420	487	537	634	748	42,039	45,896
2017.....	177	318	371	412	490	583	41,981	44,932
2018.....	583	240	281	314	376	450	41,902	44,147
2019.....	437	181	212	238	287	345	41,816	43,517

Infection Spread: 4,000,000 at risk, middle scenario to match CDC.

Progression Rates: Weibull, median 10 years, alpha 2.1.

Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.

TABLE A5
 CUMULATIVE AIDS DEATHS PROJECTIONS FOR MIDDLE SCENARIO

Year	Infected in Year							Total
	Before 1986	1986	1987	1988	1989	1990	After 1990	
1975	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0
1977	1	0	0	0	0	0	0	1
1978	8	0	0	0	0	0	0	8
1979	30	0	0	0	0	0	0	30
1980	101	0	0	0	0	0	0	101
1981	304	0	0	0	0	0	0	304
1982	827	0	0	0	0	0	0	827
1983	2,059	0	0	0	0	0	0	2,059
1984	4,732	0	0	0	0	0	0	4,732
1985	10,013	0	0	0	0	0	0	10,013
1986	18,814	0	0	0	0	0	0	18,814
1987	32,397	173	0	0	0	0	0	32,570
1988	51,879	970	153	0	0	0	0	53,002
1989	77,450	2,832	858	129	0	0	0	81,225
1990	108,512	5,984	2,504	727	118	0	0	117,844
1991	144,439	10,483	5,290	2,121	663	108	0	163,102
1992	184,193	16,277	9,266	4,480	1,935	609	93	216,852
1993	226,638	23,236	14,388	7,848	4,087	1,777	603	278,577
1994	270,577	31,168	20,539	12,187	7,160	3,754	2,049	347,434
1995	314,831	39,840	27,552	17,397	11,117	6,576	5,023	422,336
1996	358,306	48,993	35,217	23,336	15,870	10,211	10,099	502,033
1997	400,051	58,361	43,308	29,829	21,289	14,577	17,784	585,199
1998	439,289	67,694	51,589	36,682	27,212	19,554	28,484	670,504
1999	475,440	76,764	59,839	43,696	33,463	24,994	42,483	756,680
2000	508,125	85,378	67,856	50,684	39,862	30,736	59,933	842,576
2001	537,151	93,388	75,471	57,475	46,237	36,614	80,858	927,194
2002	562,494	100,689	82,552	63,924	52,431	42,469	105,160	1,009,720
2003	584,266	107,217	89,005	69,921	58,315	48,159	132,642	1,089,527
2004	602,687	112,953	94,776	75,387	63,786	53,564	163,028	1,166,182
2005	618,047	117,907	99,846	80,276	68,772	58,589	195,991	1,239,428
2006	630,680	122,118	104,226	84,570	73,232	63,169	231,172	1,309,167
2007	640,939	125,644	107,948	88,279	77,149	67,265	268,208	1,375,432
2008	649,169	128,554	111,065	91,432	80,533	70,863	306,744	1,438,360
2009	655,701	130,923	113,637	94,072	83,409	73,971	346,451	1,498,163
2010	660,831	132,828	115,731	96,250	85,817	76,613	387,036	1,555,108
2011	664,825	134,343	117,415	98,024	87,805	78,825	428,249	1,609,486
2012	667,909	135,535	118,754	99,451	89,423	80,651	469,881	1,661,604
2013	670,273	136,464	119,808	100,585	90,724	82,137	511,770	1,711,760
2014	672,075	137,181	120,629	101,477	91,759	83,332	553,789	1,760,242
2015	673,441	137,732	121,263	102,173	92,573	84,283	595,848	1,807,312
2016	674,473	138,151	121,750	102,710	93,207	85,030	637,887	1,853,208
2017	675,249	138,469	122,120	103,122	93,697	85,613	679,868	1,898,140
2018	675,833	138,710	122,402	103,436	94,073	86,063	721,771	1,942,288
2019	676,270	138,891	122,614	103,674	94,360	86,409	763,587	1,985,804
Left	1,303	541	638	720	874	1,066	554,806	559,949
Pct	0.19%	0.39%	0.52%	0.69%	0.92%	1.22%	42.08%	22.00%

Infection Spread: 4,000,000 at risk, middle scenario to match CDC.
 Progression Rates: Weibull, median 10 years, alpha 2.1.
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.

TABLE A6

MALE GENERAL POPULATION AIDS MORTALITY RATES PER THOUSAND LIVES FOR MIDDLE SCENARIO

Calendar Year	Attained Age in 1986																		
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1986...			0.000	0.000	0.000	0.003	0.007	0.012	0.016	0.021	0.026	0.037	0.052	0.069	0.086	0.102	0.119	0.137	0.154
1987...			0.000	0.000	0.004	0.011	0.019	0.026	0.034	0.041	0.060	0.083	0.109	0.136	0.161	0.186	0.212	0.238	0.261
1988...		0.000	0.000	0.006	0.017	0.029	0.040	0.051	0.062	0.090	0.125	0.164	0.204	0.240	0.276	0.314	0.350	0.381	0.404
	Attained Age in 1989																		
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
1989...	0.000	0.000	0.008	0.024	0.040	0.056	0.072	0.088	0.127	0.176	0.230	0.285	0.334	0.382	0.431	0.477	0.518	0.548	0.568
1990...	0.000	0.011	0.032	0.054	0.075	0.096	0.118	0.169	0.233	0.303	0.374	0.437	0.497	0.556	0.612	0.661	0.698	0.723	0.739
1991...	0.014	0.040	0.067	0.094	0.121	0.147	0.213	0.295	0.385	0.474	0.554	0.627	0.699	0.766	0.823	0.866	0.892	0.907	0.910
1992...	0.049	0.081	0.113	0.145	0.177	0.257	0.358	0.469	0.578	0.674	0.760	0.844	0.921	0.985	1.032	1.059	1.071	1.068	1.055
1993...	0.094	0.131	0.169	0.206	0.301	0.422	0.554	0.683	0.794	0.892	0.986	1.071	1.140	1.189	1.215	1.222	1.213	1.192	1.162
1994...	0.148	0.191	0.233	0.343	0.483	0.635	0.783	0.910	1.018	1.120	1.210	1.282	1.332	1.355	1.356	1.338	1.308	1.270	1.218
1995...	0.210	0.257	0.381	0.539	0.711	0.877	1.017	1.133	1.241	1.333	1.406	1.454	1.473	1.466	1.440	1.401	1.355	1.297	1.221
1996...	0.273	0.407	0.577	0.763	0.944	1.096	1.225	1.346	1.450	1.533	1.585	1.602	1.589	1.553	1.503	1.448	1.379	1.292	1.197
1997...	0.426	0.606	0.804	0.996	1.159	1.299	1.432	1.548	1.639	1.695	1.710	1.689	1.643	1.582	1.516	1.438	1.341	1.236	1.134
1998...	0.626	0.832	1.033	1.204	1.354	1.499	1.626	1.724	1.783	1.795	1.766	1.709	1.637	1.561	1.474	1.368	1.255	1.145	1.053
1999...	0.849	1.056	1.233	1.391	1.545	1.682	1.787	1.849	1.857	1.819	1.752	1.668	1.583	1.489	1.375	1.255	1.140	1.043	0.967
2000...	1.064	1.246	1.411	1.573	1.718	1.829	1.893	1.896	1.850	1.772	1.678	1.584	1.483	1.364	1.238	1.119	1.019	0.942	0.879
2001...	1.227	1.392	1.557	1.706	1.821	1.888	1.896	1.855	1.782	1.691	1.598	1.495	1.370	1.238	1.113	1.008	0.927	0.860	0.803
2002...	1.361	1.527	1.677	1.796	1.865	1.877	1.842	1.774	1.688	1.597	1.493	1.364	1.227	1.096	0.987	0.903	0.834	0.774	0.721
2003...	1.484	1.635	1.755	1.828	1.844	1.815	1.753	1.672	1.584	1.478	1.347	1.205	1.070	0.958	0.872	0.801	0.740	0.686	0.632
2004...	1.584	1.705	1.779	1.799	1.776	1.721	1.646	1.561	1.455	1.321	1.176	1.038	0.923	0.836	0.764	0.703	0.648	0.595	0.544
2005...	1.647	1.723	1.746	1.730	1.682	1.612	1.531	1.426	1.291	1.143	1.002	0.886	0.798	0.725	0.664	0.610	0.558	0.508	0.463
2006...	1.639	1.665	1.654	1.613	1.551	1.477	1.379	1.250	1.110	0.975	0.864	0.777	0.705	0.642	0.586	0.533	0.483	0.438	0.399
2007...	1.585	1.579	1.544	1.489	1.422	1.330	1.209	1.077	0.948	0.841	0.756	0.683	0.620	0.562	0.508	0.458	0.414	0.375	0.341
2008...	1.506	1.477	1.429	1.368	1.283	1.169	1.044	0.922	0.819	0.736	0.663	0.598	0.539	0.484	0.435	0.390	0.352	0.319	0.291
2009...	1.415	1.373	1.317	1.238	1.132	1.013	0.897	0.798	0.717	0.644	0.577	0.517	0.462	0.412	0.369	0.331	0.298	0.271	0.250
2010...	1.321	1.271	1.198	1.098	0.986	0.875	0.780	0.700	0.626	0.559	0.497	0.442	0.392	0.349	0.312	0.280	0.253	0.233	0.221
2011...	1.214	1.144	1.049	0.942	0.836	0.745	0.669	0.598	0.534	0.475	0.422	0.374	0.333	0.298	0.267	0.241	0.223	0.211	0.203
2012...	1.096	1.005	0.902	0.801	0.714	0.641	0.573	0.512	0.455	0.404	0.359	0.319	0.285	0.256	0.231	0.213	0.202	0.195	0.188
2013...	0.967	0.869	0.771	0.687	0.617	0.552	0.492	0.438	0.389	0.345	0.307	0.274	0.246	0.223	0.205	0.195	0.188	0.181	0.173
2014...	0.840	0.745	0.664	0.596	0.533	0.476	0.423	0.376	0.334	0.297	0.265	0.238	0.215	0.198	0.188	0.181	0.175	0.167	0.156
2015...	0.724	0.645	0.579	0.518	0.462	0.411	0.365	0.324	0.288	0.258	0.231	0.209	0.193	0.183	0.176	0.170	0.162	0.152	0.141
2016...	0.629	0.564	0.505	0.450	0.401	0.356	0.316	0.281	0.251	0.225	0.204	0.188	0.178	0.172	0.166	0.158	0.148	0.137	0.126
2017...	0.552	0.494	0.441	0.392	0.348	0.309	0.275	0.246	0.221	0.199	0.184	0.174	0.168	0.162	0.155	0.145	0.134	0.123	0.113
2018...	0.486	0.433	0.386	0.342	0.304	0.271	0.242	0.217	0.196	0.181	0.171	0.165	0.160	0.152	0.142	0.132	0.121	0.111	0.102
2019...	0.427	0.380	0.337	0.300	0.267	0.238	0.214	0.193	0.178	0.169	0.163	0.157	0.150	0.140	0.130	0.120	0.110	0.101	0.093

Infection Spread: 4,000,000 at risk, middle scenario to match CDC.

Progression Rates: Weibull, median 10 years, alpha 2.1.

Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.

Age/Sex Splits: 90% male, distribute all cases among ages 15-79.

Included Deaths: 100% of all years' infections.

TABLE A6—Continued

Calendar Year	Attained Age in 1986																		
	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
1986...	0.170	0.181	0.188	0.192	0.193	0.192	0.191	0.188	0.183	0.177	0.170	0.163	0.157	0.149	0.142	0.134	0.125	0.116	0.107
1987...	0.277	0.288	0.294	0.296	0.295	0.292	0.286	0.277	0.265	0.253	0.241	0.231	0.221	0.210	0.199	0.188	0.175	0.161	0.147
1988...	0.419	0.428	0.431	0.430	0.425	0.415	0.398	0.378	0.357	0.339	0.324	0.310	0.297	0.283	0.268	0.251	0.232	0.213	0.195
	Attained Age in 1989																		
	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
1989...	0.580	0.585	0.584	0.576	0.559	0.533	0.502	0.471	0.445	0.425	0.408	0.391	0.375	0.356	0.335	0.311	0.287	0.264	0.244
1990...	0.745	0.744	0.733	0.709	0.672	0.628	0.585	0.550	0.524	0.504	0.485	0.467	0.445	0.420	0.392	0.363	0.336	0.312	0.294
1991...	0.903	0.887	0.856	0.810	0.757	0.704	0.661	0.628	0.600	0.575	0.550	0.523	0.493	0.460	0.428	0.398	0.371	0.351	0.334
1992...	1.032	0.994	0.939	0.877	0.815	0.763	0.723	0.687	0.655	0.624	0.592	0.557	0.521	0.486	0.453	0.425	0.403	0.386	0.371
1993...	1.116	1.053	0.982	0.913	0.853	0.805	0.763	0.724	0.687	0.649	0.610	0.572	0.534	0.500	0.470	0.448	0.431	0.417	0.401
1994...	1.148	1.070	0.993	0.927	0.872	0.823	0.778	0.735	0.693	0.651	0.610	0.572	0.537	0.507	0.484	0.468	0.455	0.440	0.419
1995...	1.137	1.055	0.983	0.923	0.867	0.816	0.769	0.723	0.679	0.637	0.598	0.563	0.533	0.511	0.496	0.484	0.471	0.451	0.422
1996...	1.104	1.024	0.958	0.900	0.846	0.796	0.747	0.699	0.653	0.609	0.571	0.539	0.516	0.502	0.492	0.480	0.461	0.433	0.400
1997...	1.047	0.977	0.916	0.861	0.809	0.759	0.707	0.657	0.611	0.569	0.535	0.513	0.500	0.491	0.480	0.463	0.437	0.405	0.372
1998...	0.979	0.916	0.861	0.809	0.757	0.704	0.652	0.603	0.559	0.524	0.502	0.489	0.482	0.473	0.458	0.433	0.404	0.372	0.340
1999...	0.903	0.848	0.797	0.745	0.691	0.637	0.586	0.542	0.507	0.484	0.473	0.467	0.460	0.446	0.424	0.397	0.367	0.338	0.309
2000...	0.825	0.775	0.724	0.670	0.615	0.564	0.519	0.484	0.462	0.452	0.448	0.442	0.430	0.409	0.385	0.358	0.331	0.304	0.279
2001...	0.751	0.698	0.644	0.591	0.541	0.498	0.463	0.441	0.429	0.422	0.415	0.402	0.383	0.360	0.336	0.312	0.288	0.264	0.240
2002...	0.667	0.613	0.562	0.514	0.473	0.439	0.416	0.403	0.394	0.386	0.373	0.355	0.335	0.313	0.292	0.270	0.249	0.227	0.206
2003...	0.579	0.530	0.485	0.446	0.413	0.390	0.376	0.366	0.357	0.344	0.327	0.309	0.290	0.271	0.252	0.233	0.213	0.194	0.175
2004...	0.497	0.454	0.418	0.387	0.364	0.349	0.339	0.329	0.316	0.301	0.284	0.267	0.250	0.233	0.216	0.199	0.182	0.165	0.149
2005...	0.424	0.389	0.360	0.338	0.323	0.312	0.302	0.290	0.275	0.260	0.245	0.230	0.215	0.200	0.185	0.170	0.155	0.140	0.125
2006...	0.365	0.336	0.314	0.299	0.289	0.280	0.268	0.253	0.239	0.224	0.209	0.194	0.181	0.167	0.154	0.141	0.128	0.115	0.101
2007...	0.312	0.291	0.277	0.268	0.259	0.247	0.233	0.219	0.204	0.189	0.176	0.163	0.151	0.140	0.128	0.117	0.105	0.093	0.082
2008...	0.270	0.257	0.248	0.239	0.229	0.215	0.201	0.186	0.172	0.159	0.148	0.137	0.127	0.116	0.107	0.096	0.086	0.076	0.066
2009...	0.238	0.229	0.222	0.211	0.198	0.184	0.170	0.157	0.145	0.134	0.124	0.115	0.106	0.098	0.089	0.079	0.070	0.062	0.055
2010...	0.213	0.206	0.196	0.183	0.170	0.156	0.143	0.132	0.122	0.113	0.105	0.097	0.090	0.082	0.073	0.065	0.058	0.051	0.048
2011...	0.197	0.187	0.175	0.162	0.149	0.137	0.126	0.117	0.108	0.101	0.093	0.086	0.078	0.070	0.062	0.055	0.049	0.046	0.043
2012...	0.180	0.168	0.156	0.143	0.131	0.121	0.112	0.104	0.097	0.089	0.082	0.075	0.067	0.059	0.053	0.047	0.044	0.041	0.038
2013...	0.162	0.150	0.138	0.126	0.116	0.108	0.100	0.093	0.086	0.079	0.072	0.064	0.057	0.051	0.045	0.042	0.040	0.037	0.034
2014...	0.145	0.133	0.122	0.112	0.104	0.097	0.090	0.083	0.077	0.070	0.062	0.055	0.049	0.044	0.041	0.038	0.036	0.033	0.030
2015...	0.129	0.119	0.109	0.101	0.094	0.087	0.080	0.074	0.068	0.060	0.054	0.048	0.042	0.040	0.037	0.035	0.032	0.029	0.027
2016...	0.116	0.106	0.098	0.091	0.085	0.078	0.073	0.066	0.059	0.052	0.046	0.041	0.039	0.036	0.034	0.031	0.029	0.026	0.023
2017...	0.104	0.096	0.089	0.083	0.077	0.071	0.064	0.058	0.051	0.045	0.040	0.038	0.035	0.033	0.030	0.028	0.025	0.023	
2018...	0.095	0.088	0.082	0.075	0.070	0.063	0.057	0.050	0.045	0.040	0.037	0.035	0.032	0.030	0.027	0.025	0.023		
2019...	0.087	0.081	0.074	0.069	0.062	0.056	0.050	0.044	0.039	0.037	0.034	0.032	0.029	0.027	0.025	0.022			

Infection Spread: 4,000,000 at risk, middle scenario to match CDC.
 Progression Rates: Weibull, median 10 years, alpha 2.1.
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.
 Age/Sex Splits: 90% male, distribute all cases among ages 15–79.
 Included Deaths: 100% of all years' infections.

TABLE A6-Continued

Calendar Year	Attained Age in 1986																	
	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
1986...	0.097	0.088	0.080	0.073	0.068	0.063	0.058	0.053	0.048	0.044	0.039	0.035	0.031	0.028	0.025	0.023	0.020	0.018
1987...	0.134	0.123	0.113	0.105	0.098	0.091	0.084	0.077	0.069	0.062	0.055	0.049	0.043	0.039	0.035	0.031	0.028	0.025
1988...	0.180	0.167	0.156	0.146	0.137	0.127	0.116	0.104	0.093	0.082	0.073	0.065	0.058	0.051	0.045	0.041	0.036	0.032
	Attained Age in 1989																	
	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
1989...	0.228	0.215	0.203	0.191	0.178	0.163	0.146	0.130	0.114	0.101	0.089	0.079	0.071	0.062	0.055	0.049	0.043	0.038
1990...	0.278	0.265	0.250	0.234	0.214	0.193	0.170	0.149	0.131	0.116	0.103	0.091	0.079	0.071	0.062	0.054	0.048	0.042
1991...	0.319	0.304	0.286	0.263	0.237	0.211	0.186	0.164	0.145	0.128	0.113	0.099	0.088	0.077	0.067	0.059	0.051	0.045
1992...	0.355	0.335	0.310	0.281	0.251	0.222	0.196	0.174	0.154	0.136	0.118	0.104	0.091	0.079	0.069	0.060	0.053	0.050
1993...	0.380	0.353	0.322	0.289	0.257	0.228	0.203	0.179	0.158	0.137	0.120	0.104	0.090	0.078	0.068	0.060	0.056	0.053
1994...	0.391	0.358	0.323	0.288	0.257	0.229	0.203	0.178	0.154	0.134	0.116	0.100	0.087	0.075	0.065	0.062	0.058	0.054
1995...	0.388	0.352	0.316	0.283	0.253	0.223	0.195	0.168	0.146	0.126	0.109	0.093	0.080	0.070	0.066	0.062	0.058	0.054
1996...	0.365	0.330	0.297	0.267	0.237	0.208	0.181	0.157	0.136	0.117	0.100	0.086	0.074	0.070	0.066	0.061	0.057	0.053
1997...	0.338	0.306	0.276	0.246	0.217	0.190	0.166	0.144	0.124	0.106	0.090	0.077	0.073	0.068	0.063	0.058	0.054	0.049
1998...	0.310	0.281	0.252	0.223	0.196	0.172	0.149	0.128	0.109	0.093	0.079	0.074	0.069	0.064	0.059	0.054	0.049	0.044
1999...	0.282	0.254	0.226	0.199	0.175	0.153	0.131	0.112	0.094	0.080	0.075	0.070	0.064	0.059	0.053	0.048	0.042	
2000...	0.252	0.225	0.200	0.176	0.154	0.132	0.112	0.094	0.080	0.074	0.069	0.063	0.058	0.052	0.046	0.041		
2001...	0.216	0.193	0.171	0.150	0.130	0.110	0.093	0.080	0.074	0.068	0.063	0.057	0.051	0.046	0.040			
2002...	0.185	0.165	0.145	0.126	0.108	0.092	0.078	0.073	0.067	0.061	0.056	0.050	0.044	0.038				
2003...	0.157	0.139	0.121	0.104	0.089	0.076	0.071	0.065	0.059	0.054	0.048	0.042	0.037					
2004...	0.132	0.116	0.100	0.086	0.074	0.068	0.063	0.057	0.052	0.046	0.041	0.035						
2005...	0.110	0.095	0.082	0.071	0.066	0.060	0.055	0.049	0.044	0.039	0.033							
2006...	0.088	0.077	0.067	0.062	0.057	0.052	0.047	0.042	0.037	0.032								
2007...	0.071	0.062	0.058	0.054	0.049	0.045	0.040	0.036	0.032									
2008...	0.058	0.054	0.050	0.047	0.043	0.039	0.035	0.031										
2009...	0.051	0.048	0.044	0.040	0.037	0.033	0.030											
2010...	0.045	0.042	0.039	0.035	0.032	0.029												
2011...	0.040	0.037	0.034	0.031	0.028													
2012...	0.035	0.032	0.030	0.027														
2013...	0.031	0.028	0.026															
2014...	0.027	0.025																
2015...	0.024																	
2016...																		
2017...																		
2018...																		
2019...																		

Infection Spread: 4,000,000 at risk, middle scenario to match CDC.
 Progression Rates: Weibull, median 10 years, alpha 2.1.
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.
 Age/Sex Splits: 90% male, distribute all cases among ages 15-79.
 Included Deaths: 100% of all years' infections.

TABLE A7

WEIBULL FUNCTION AIDS PROGRESSION RATES FOR MIDDLE SCENARIO

2.1 Alpha 0.0840 Lambda 10 Median Year					
Years from HIV Infection	Annual Rate of Progress to AIDS	Cumulative Progressed to AIDS Diagnosis	Annual Progressed to AIDS Diagnosis	Years from HIV Infection	Assumed Annual Progressed to AIDS Diagnosis
				0	0.00%
1	0.55%	0.55%	0.55%	1	0.55
2	1.79	2.33	1.78	2	1.78
3	3.12	5.38	3.05	3	3.05
4	4.48	9.62	4.24	4	4.24
5	5.87	14.93	5.30	5	5.30
6	7.26	21.11	6.18	6	6.18
7	8.66	27.95	6.84	7	6.84
8	10.07	35.20	7.25	8	7.25
9	11.46	42.63	7.43	9	7.43
10	12.85	50.00	7.37	10	7.37
11	14.24	57.12	7.12	11	7.12
12	15.61	63.81	6.70	12	6.70
13	16.98	69.96	6.14	13	6.14
14	18.33	75.46	5.51	14	5.51
15	19.67	80.29	4.83	15	4.83
16	21.00	84.43	4.14	16	4.14
17	22.32	87.90	3.47	17	3.47
18	23.62	90.76	2.86	18	2.86
19	24.90	93.06	2.30	19	2.30
20	26.17	94.88	1.82	20	1.82
21	27.43	96.28	1.40	21	1.40
22	28.67	97.35	1.07	22	1.07
23	29.90	98.14	0.79	23	0.79
24	31.10	98.72	0.58	24	0.58
25	32.30	99.13	0.41	25	0.41
26	33.48	99.42	0.29	26	0.29
27	34.64	99.62	0.20	27	0.20
28	35.78	99.76	0.13	28	0.13
29	36.91	99.85	0.09	29	0.09
30	38.03	99.91	0.06	30	0.06
31	39.12	99.94	0.04	31	0.04
32	40.21	99.97	0.02	32	0.02
33	41.27	99.98	0.01	33	0.01
34	42.32	99.99	0.01	34	0.01
35	43.36	99.99	0.01	35	0.01
36	44.38	100.00	0.00	36	0.00
37	45.38	100.00	0.00	37	0.00
38	46.37	100.00	0.00	38	0.00
39	47.34	100.00	0.00	39	0.00
40	48.30	100.00	0.00	40	0.00
41	49.24	100.00	0.00	41	0.00
42	50.17	100.00	0.00	42	0.00
43	51.08	100.00	0.00	43	0.00
44	51.98	100.00	0.00	44	0.00

Cumulative progressed at year $T = e [- (\text{Lambda} \times T) \text{Alpha}]$.
 Lambda is used to achieve median survival at end of year chosen.

TABLE A8
ASSUMED MORTALITY AFTER AIDS DIAGNOSIS
FOR MIDDLE SCENARIO

Years after Diagnosis	Death Rates after AIDS Diagnosis			
	Diagnosed before 1986		Diagnosed after 1985	
	Annual	Cumulative	Annual	Cumulative
1	45.00%	45.00%	40.00%	40.00%
2	45.00	69.75	40.00	64.00
3	35.00	80.34	35.00	76.60
4	25.00	85.25	25.00	82.45
5	25.00	88.94	25.00	86.84
6	25.00	91.70	25.00	90.13
7	25.00	93.78	25.00	92.60
8	25.00	95.33	25.00	94.45
9	25.00	96.50	25.00	95.84
10+	25.00	97.38	25.00	96.88

(Average AIDS case is diagnosed 0.5 of the way through calendar year of diagnosis.)

TABLE A9
ASSUMPTIONS FOR DIVIDING CASES
TO CALCULATE MORTALITY RATES
FOR MIDDLE SCENARIO

Age Group	Age Distribution Percentages	
	Male	Female
15-19	0.3%	0.8%
20-24	3.3	5.9
25-29	14.2	21.6
30-34	23.7	27.2
35-39	22.3	18.6
40-44	14.5	8.3
45-49	9.2	4.2
50-54	5.3	2.9
55-59	3.6	2.7
60-64	2.0	2.7
65-69	1.0	2.3
70-74	0.4	1.7
75-79	0.2	1.1
Total	100.0%	100.0%

Sex Category Code: M (M or F, for Male or Female)

Sex Category Pct:

Male	Female
90.00%	10.00%

TABLE A10
ASSUMPTIONS FOR INCLUDING DEATHS
IN MORTALITY CALCULATIONS
FOR MIDDLE SCENARIO

Inclusion Factors for Cases Infected
100.00% before 1986
100.00% infected 1986
100.00% infected 1987
100.00% infected 1988
100.00% infected 1989
100.00% infected 1990
100.00% after 1990

TABLE A11
U.S. GENERAL POPULATION PROJECTIONS (IN THOUSANDS) FOR MIDDLE SCENARIO

Ages	1986	1990	1995	2000	2005	2010
Male						
15-19	9,483	8,865	8,944	9,735	9,928	9,605
20-24	10,232	9,244	8,647	8,706	9,470	9,648
25-29	11,026	10,708	9,416	8,808	8,847	8,595
30-34	10,367	11,195	10,987	9,680	9,070	9,108
35-39	9,256	10,026	11,092	10,882	9,599	8,991
40-44	7,030	8,691	9,944	10,995	10,792	9,527
45-49	5,817	6,809	8,580	9,822	10,871	10,677
50-54	5,260	5,590	6,705	8,467	9,706	10,748
55-59	5,359	5,070	5,386	6,478	8,195	9,403
60-64	5,097	5,032	4,763	5,078	6,126	7,770
65-69	4,377	4,655	4,603	4,382	4,705	5,695
70-74	3,268	3,516	3,873	3,860	3,702	3,996
75-79	2,197	2,413	2,668	2,971	2,994	2,894
0+	117,360	121,775	126,654	130,722	134,390	137,865
Female						
15-19	9,128	8,516	8,585	9,340	9,512	9,198
20-24	10,185	9,238	8,629	8,688	9,432	9,599
25-29	10,984	10,678	9,424	8,804	8,850	9,590
30-34	10,407	11,147	10,937	9,661	9,034	9,082
35-39	9,467	10,146	11,105	10,890	9,627	9,002
40-44	7,316	8,964	10,125	11,074	10,863	9,612
45-49	6,110	7,132	8,903	10,057	11,005	10,799
50-54	5,627	5,948	7,102	8,870	10,029	10,976
55-59	5,909	5,552	5,842	6,981	8,722	9,856
60-64	5,865	5,708	5,333	5,620	6,720	8,401
65-69	5,285	5,596	5,453	5,109	5,402	6,467
70-74	4,396	4,605	5,001	4,892	4,602	4,880
75-79	3,432	3,691	3,939	4,311	4,251	4,020
0+	123,718	128,116	132,965	137,025	140,695	144,190

Notes

CDC projection data, used to calibrate the model, are the set developed by the ACLI/HIAA ad hoc group on AIDS data. The data through 1987 are CDC reported results, adjusted for reporting delays and for smoothness. The projected data are the CDC's projection updated in early 1988, reduced to eliminate the 10 percent increase made by the CDC to account for cases that will never be reported.

Three sets of progression rates (from HIV infection to AIDS diagnosis) have been developed by the ACLI/HIAA Ad Hoc Group on AIDS data. Each is based on the Weibull function shown in Table A7 having the following parameters:

Alpha	Median Year	Name	Set to Approximate
2.5	12 yrs	"Slow"	CDC 95% confidence lower bound
2.1	10	"Expected"	SFCC/CDC study best estimate rates
2.2	8	"Fast"	CDC 95% confidence upper bound

Mortality rates after AIDS diagnosis are based on the assumption that all cases are diagnosed in the middle of the calendar year. The annual death rates after AIDS diagnosis are converted to calendar year rates by assuming that the half-year rate is the square root of the annual rate.

Once AIDS deaths have been modeled, they are split by sex and then into five-year age groups. The age group percentages are derived from the distribution by age at death for AIDS deaths reported in the U.S. through the second quarter of 1988. These sex/age cells of modeled AIDS deaths are the numerator for the mortality rate calculations.

The AIDS deaths included in the calculation of AIDS mortality rates are adjusted by the "Infection Year Inclusion Factors." These factors reflect HIV-testing at the time of issue. For example, new issues that are HIV-tested should produce AIDS mortality results consistent with calculations made excluding the deaths from those infected prior to the year of issue.

AIDS mortality rates are calculated assuming the U.S. population projection contained in the U.S. Dept. of Commerce report Series P-25, No. 1017: "Projections of the Population of States by Age, Sex, and Race: 1988 to 2010." Linear interpolation is used to estimate the population between the projection years shown in the population assumptions. Stationary population is assumed after 2010.

TABLE A12

CALCULATION FOR INFECTION SPREAD FOR MIDDLE SCENARIO

Year <i>t</i>	<i>a</i> [<i>t</i>]	$1 - e(-a[t])$	delta <i>p</i> [<i>t</i>]	<i>p</i> [<i>t</i>]
1975				0.00305%
1976	1.400	0.75340	0.00009	0.01
1977	1.290	0.72475	0.00032	0.04
1978	1.141	0.68037	0.00095	0.14
1979	1.022	0.64001	0.00248	0.39
1980	0.915	0.59965	0.00577	0.97
1981	0.810	0.55514	0.01179	2.15
1982	0.750	0.52763	0.02290	4.44
1983	0.660	0.48314	0.03805	8.24
1984	0.490	0.38737	0.04545	12.79
1985	0.330	0.28107	0.04152	16.94
1986	0.230	0.20546	0.03485	20.43
1987	0.180	0.16472	0.03081	23.51
1988	0.140	0.13064	0.02609	26.12
1989	0.120	0.11307	0.02380	28.50
1990	0.105	0.09967	0.02186	30.68
1991	0.087	0.08332	0.01880	32.56
1992	0.072	0.06946	0.01600	34.17
1993	0.067	0.06480	0.01522	35.69
1994	0.061	0.05917	0.01411	37.10
1995	0.056	0.05446	0.01315	38.42
1996	0.052	0.05067	0.01237	39.65
1997	0.048	0.04686	0.01154	40.81
1998	0.046	0.04495	0.01115	41.92
1999	0.044	0.04304	0.01074	43.00
2000	0.042	0.04113	0.01032	44.03
2001			0.01032	45.06
2002			0.01032	46.09
2003			0.01032	47.13
2004			0.01032	48.16
2005			0.01032	49.19
2006			0.01032	50.22
2007			0.01032	51.26
2008			0.01032	52.29
2009			0.01032	53.32
2010			0.01032	54.35
2011			0.01032	55.39
2012			0.01032	56.42
2013			0.01032	57.45
2014			0.01032	58.48
2015			0.01032	59.51
2016			0.01032	60.55
2017			0.01032	61.58
2018			0.01032	62.61
2019			0.01032	63.64

Note: The number of annual infections is held level beginning in 2000.

$a[t]$ = Assumed annual infection factor
 $p[t]$ = Percent of at-risk population infected
 $\text{delta } p[t] = \frac{\{1 - e(-a[t])\} \times p[t-1] \times (1 - p[t-1])}{1 - \{1 - e(-a[t])\} \times (1 - p[t-1])}$

TABLE A13

Calculations to convert mortality rates after AIDS diagnosis
to calendar-year basis for convolution table for middle scenario

Calendar Years from Diagnosis	Cases Diagnosed before 1986:				Cases Diagnosed after 1985:			
	Death Rate	Alive End of Year	Percentage Dead during Year	Total Percentage Dead	Death Rate	Alive End of Year	Percentage Dead during Year	Total Percentage Dead
0.....	25.84%	74.16%	25.84%	25.84%	22.54%	77.46%	22.54%	22.54%
1.....	45.00	40.79	33.37	59.21	40.00	46.48	30.98	53.52
2.....	40.21	24.39	16.40	75.61	37.55	29.02	17.45	70.98
3.....	30.18	17.03	7.36	82.97	30.18	20.26	8.76	79.74
4.....	25.00	12.77	4.26	87.23	25.00	15.20	5.07	84.80
5.....	25.00	9.58	3.19	90.42	25.00	11.40	3.80	88.60
6.....	25.00	7.18	2.39	92.82	25.00	8.55	2.85	91.45
7.....	25.00	5.39	1.80	94.61	25.00	6.41	2.14	93.59
8.....	25.00	4.04	1.35	95.96	25.00	4.81	1.60	95.19
9.....	25.00	3.03	1.01	96.97	25.00	3.61	1.20	96.39
10.....	25.00	2.27	0.76	97.73	25.00	2.71	0.90	97.29
11.....	25.00	1.70	0.57	98.30	25.00	2.03	0.68	97.97
12.....	25.00	1.28	0.43	98.72	25.00	1.52	0.51	98.48
13.....	25.00	0.96	0.32	99.04	25.00	1.14	0.38	98.86
14.....	25.00	0.72	0.24	99.28	25.00	0.86	0.29	99.14
15.....	25.00	0.54	0.18	99.46	25.00	0.64	0.21	99.36
16.....	25.00	0.40	0.13	99.60	25.00	0.48	0.16	99.52
17.....	25.00	0.30	0.10	99.70	25.00	0.36	0.12	99.64
18.....	25.00	0.23	0.08	99.77	25.00	0.27	0.09	99.73
19.....	25.00	0.17	0.06	99.83	25.00	0.20	0.07	99.80
20.....	25.00	0.13	0.04	99.87	25.00	0.15	0.05	99.85
21.....	25.00	0.10	0.03	99.90	25.00	0.11	0.04	99.89
22.....	25.00	0.07	0.02	99.93	25.00	0.09	0.03	99.91
23.....	25.00	0.05	0.02	99.95	25.00	0.06	0.02	99.94
24.....	25.00	0.04	0.01	99.96	25.00	0.05	0.02	99.95
25.....	25.00	0.03	0.01	99.97	25.00	0.04	0.01	99.96
26.....	25.00	0.02	0.01	99.98	25.00	0.03	0.01	99.97
27.....	25.00	0.02	0.01	99.98	25.00	0.02	0.01	99.98
28.....	25.00	0.01	0.00	99.99	25.00	0.02	0.01	99.98
29.....	25.00	0.01	0.00	99.99	25.00	0.01	0.00	99.99
30.....	25.00	0.01	0.00	99.99	25.00	0.01	0.00	99.99
31.....	25.00	0.01	0.00	99.99	25.00	0.01	0.00	99.99
32.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
33.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
34.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
35.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
36.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
37.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
38.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
39.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
40.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
41.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
42.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
43.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
44.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
Total ...			100.00%				100.00%	

The population AIDS mortality rates are assumed to apply to the central age in each five-year age group. Mortality rates for other ages are then determined using the "Karup King" interpolation method. Linear interpolation (never less than zero) is used for ages under 22 and over 72.

Alternative Mortality Rates Exhibit

Table A14 presents another set of mortality rates. The only change in assumptions is the use of the different infection year inclusion factors shown below:

- 0.00% before 1986
- 0.00% infected 1986
- 0.00% infected 1987
- 0.00% infected 1988
- 100.00% infected 1989
- 100.00% infected 1990
- 100.00% after 1990.

TABLE A14

MALE GENERAL POPULATION AIDS MORTALITY RATES PER THOUSAND LIVES FOR MIDDLE SCENARIO

Calendar Year	Attained Age in 1986																		
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1986...			0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1987...			0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1988...		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Attained Age in 1989																		
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
1989...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1990...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002
1991...	0.000	0.001	0.001	0.001	0.002	0.002	0.003	0.004	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.012	0.013	0.013	0.013
1992...	0.002	0.003	0.004	0.005	0.006	0.009	0.012	0.016	0.020	0.023	0.026	0.029	0.032	0.034	0.036	0.037	0.037	0.037	0.037
1993...	0.006	0.008	0.010	0.013	0.019	0.026	0.034	0.042	0.049	0.055	0.061	0.066	0.071	0.074	0.075	0.076	0.075	0.074	0.072
1994...	0.014	0.018	0.022	0.032	0.046	0.060	0.074	0.086	0.096	0.106	0.114	0.121	0.126	0.128	0.128	0.126	0.123	0.120	0.115
1995...	0.027	0.034	0.050	0.070	0.093	0.114	0.132	0.148	0.162	0.174	0.183	0.189	0.192	0.191	0.188	0.182	0.176	0.169	0.159
1996...	0.046	0.069	0.098	0.129	0.159	0.185	0.207	0.227	0.245	0.259	0.268	0.271	0.268	0.262	0.254	0.245	0.233	0.218	0.202
1997...	0.089	0.127	0.169	0.209	0.243	0.273	0.301	0.325	0.344	0.356	0.359	0.355	0.345	0.332	0.319	0.302	0.282	0.260	0.238
1998...	0.159	0.211	0.262	0.305	0.343	0.379	0.412	0.437	0.452	0.454	0.447	0.433	0.414	0.395	0.373	0.346	0.318	0.290	0.267
1999...	0.253	0.315	0.368	0.415	0.461	0.501	0.533	0.551	0.553	0.542	0.522	0.497	0.472	0.444	0.410	0.374	0.340	0.311	0.288
2000...	0.367	0.429	0.486	0.542	0.592	0.630	0.652	0.653	0.637	0.610	0.578	0.546	0.511	0.470	0.427	0.386	0.351	0.325	0.303
2001...	0.481	0.546	0.611	0.669	0.714	0.740	0.743	0.727	0.699	0.663	0.627	0.586	0.537	0.486	0.436	0.395	0.363	0.337	0.315
2002...	0.599	0.672	0.739	0.791	0.822	0.827	0.811	0.782	0.744	0.704	0.657	0.601	0.540	0.483	0.435	0.398	0.367	0.341	0.317
2003...	0.726	0.800	0.859	0.894	0.902	0.888	0.858	0.818	0.775	0.723	0.659	0.590	0.524	0.469	0.427	0.392	0.362	0.336	0.309
2004...	0.853	0.918	0.957	0.968	0.956	0.926	0.886	0.840	0.783	0.711	0.633	0.559	0.497	0.450	0.411	0.378	0.349	0.320	0.293
2005...	0.966	1.011	1.025	1.015	0.987	0.946	0.899	0.837	0.757	0.671	0.588	0.520	0.468	0.426	0.390	0.358	0.327	0.298	0.272
2006...	1.039	1.056	1.049	1.023	0.984	0.936	0.874	0.793	0.704	0.618	0.548	0.493	0.447	0.407	0.372	0.338	0.306	0.278	0.253
2007...	1.078	1.073	1.050	1.012	0.966	0.904	0.822	0.732	0.645	0.572	0.514	0.465	0.421	0.382	0.346	0.312	0.281	0.255	0.232
2008...	1.089	1.069	1.034	0.989	0.928	0.846	0.755	0.667	0.592	0.532	0.479	0.432	0.390	0.350	0.314	0.282	0.255	0.230	0.210
2009...	1.081	1.049	1.006	0.946	0.865	0.774	0.685	0.610	0.548	0.492	0.441	0.395	0.353	0.315	0.282	0.253	0.228	0.207	0.191
2010...	1.059	1.019	0.960	0.880	0.790	0.701	0.625	0.561	0.502	0.448	0.399	0.354	0.314	0.280	0.250	0.224	0.203	0.187	0.177
2011...	1.014	0.955	0.876	0.786	0.698	0.622	0.558	0.500	0.446	0.397	0.352	0.313	0.278	0.248	0.223	0.202	0.186	0.176	0.170
2012...	0.948	0.869	0.781	0.693	0.617	0.554	0.496	0.442	0.394	0.350	0.310	0.276	0.247	0.221	0.200	0.184	0.175	0.169	0.163
2013...	0.862	0.774	0.687	0.612	0.549	0.492	0.438	0.390	0.346	0.308	0.274	0.244	0.219	0.198	0.183	0.173	0.167	0.162	0.154
2014...	0.766	0.680	0.606	0.544	0.487	0.434	0.386	0.343	0.305	0.271	0.242	0.217	0.196	0.181	0.172	0.166	0.160	0.152	0.143
2015...	0.674	0.600	0.539	0.482	0.430	0.383	0.340	0.302	0.269	0.240	0.215	0.194	0.179	0.170	0.164	0.158	0.151	0.141	0.131
2016...	0.595	0.534	0.478	0.426	0.379	0.337	0.299	0.266	0.238	0.213	0.193	0.178	0.168	0.162	0.157	0.150	0.140	0.130	0.119
2017...	0.529	0.474	0.423	0.376	0.334	0.296	0.264	0.236	0.211	0.191	0.176	0.167	0.161	0.156	0.148	0.139	0.129	0.118	0.108
2018...	0.470	0.419	0.373	0.331	0.294	0.262	0.234	0.210	0.190	0.175	0.166	0.160	0.154	0.147	0.138	0.128	0.117	0.108	0.099
2019...	0.417	0.371	0.329	0.292	0.260	0.232	0.208	0.188	0.174	0.165	0.159	0.153	0.146	0.137	0.127	0.117	0.107	0.098	0.091

Infection Spread: 4,000,000 at risk, middle scenario to match CDC.

Progression Rates: Weibull, median 10 years, alpha 2.1.

Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.

Age/Sex Splits: 90% male, distribute all cases among ages 15-79.

Included Deaths: 100% of infections after 1988.

TABLE A14—Continued

Calendar Year	Attained Age in 1986																		
	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
1986...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1987...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1988...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Attained Age in 1989																		
	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
1989...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1990...	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001
1991...	0.013	0.013	0.012	0.012	0.011	0.010	0.010	0.009	0.009	0.008	0.008	0.008	0.007	0.007	0.006	0.006	0.005	0.005	0.005
1992...	0.036	0.034	0.033	0.030	0.028	0.026	0.025	0.024	0.023	0.022	0.021	0.019	0.018	0.017	0.016	0.015	0.014	0.013	0.013
1993...	0.069	0.065	0.061	0.057	0.053	0.050	0.047	0.045	0.043	0.040	0.038	0.035	0.033	0.031	0.029	0.028	0.027	0.026	0.025
1994...	0.108	0.101	0.094	0.087	0.082	0.078	0.073	0.069	0.065	0.061	0.058	0.054	0.051	0.048	0.046	0.044	0.043	0.041	0.040
1995...	0.148	0.137	0.128	0.120	0.113	0.106	0.100	0.094	0.088	0.083	0.078	0.073	0.069	0.067	0.065	0.063	0.061	0.059	0.055
1996...	0.187	0.173	0.162	0.152	0.143	0.134	0.126	0.118	0.110	0.103	0.096	0.091	0.087	0.085	0.083	0.081	0.078	0.073	0.068
1997...	0.220	0.205	0.192	0.181	0.170	0.159	0.149	0.138	0.128	0.120	0.112	0.108	0.105	0.103	0.101	0.097	0.092	0.085	0.078
1998...	0.248	0.232	0.218	0.205	0.192	0.178	0.165	0.153	0.142	0.133	0.127	0.124	0.122	0.120	0.116	0.110	0.102	0.094	0.086
1999...	0.269	0.253	0.238	0.222	0.206	0.190	0.175	0.162	0.151	0.144	0.141	0.139	0.137	0.133	0.126	0.118	0.110	0.101	0.092
2000...	0.284	0.267	0.249	0.231	0.212	0.194	0.179	0.167	0.159	0.156	0.154	0.152	0.148	0.141	0.133	0.123	0.114	0.105	0.096
2001...	0.294	0.274	0.252	0.232	0.212	0.195	0.182	0.173	0.168	0.165	0.163	0.158	0.150	0.141	0.132	0.122	0.113	0.104	0.094
2002...	0.294	0.270	0.247	0.227	0.208	0.193	0.183	0.177	0.174	0.170	0.164	0.156	0.147	0.138	0.128	0.119	0.110	0.100	0.091
2003...	0.283	0.259	0.237	0.218	0.202	0.191	0.184	0.179	0.175	0.169	0.160	0.151	0.142	0.133	0.123	0.114	0.104	0.095	0.086
2004...	0.267	0.245	0.225	0.208	0.196	0.188	0.182	0.177	0.170	0.162	0.153	0.144	0.135	0.126	0.116	0.107	0.098	0.089	0.080
2005...	0.249	0.228	0.211	0.198	0.189	0.183	0.177	0.170	0.161	0.153	0.144	0.135	0.126	0.117	0.108	0.100	0.091	0.082	0.073
2006...	0.231	0.213	0.199	0.190	0.183	0.177	0.170	0.161	0.151	0.142	0.132	0.123	0.115	0.106	0.098	0.089	0.081	0.073	0.064
2007...	0.212	0.198	0.188	0.182	0.176	0.168	0.159	0.149	0.139	0.129	0.120	0.111	0.103	0.095	0.087	0.079	0.072	0.063	0.056
2008...	0.195	0.186	0.179	0.173	0.165	0.155	0.145	0.135	0.125	0.115	0.107	0.099	0.092	0.084	0.077	0.070	0.062	0.055	0.048
2009...	0.182	0.175	0.169	0.162	0.152	0.141	0.130	0.120	0.111	0.102	0.095	0.888	0.881	0.075	0.068	0.060	0.053	0.047	0.042
2010...	0.171	0.165	0.157	0.147	0.136	0.125	0.115	0.106	0.098	0.091	0.085	0.078	0.072	0.065	0.059	0.052	0.046	0.041	0.039
2011...	0.164	0.156	0.146	0.136	0.125	0.114	0.105	0.097	0.090	0.084	0.077	0.072	0.065	0.058	0.052	0.046	0.041	0.038	0.036
2012...	0.155	0.145	0.135	0.124	0.114	0.104	0.097	0.090	0.083	0.077	0.071	0.065	0.058	0.051	0.046	0.041	0.038	0.036	0.033
2013...	0.144	0.133	0.123	0.113	0.103	0.096	0.089	0.083	0.076	0.071	0.064	0.057	0.051	0.045	0.040	0.038	0.035	0.033	0.030
2014...	0.132	0.122	0.111	0.103	0.095	0.088	0.082	0.075	0.070	0.063	0.057	0.050	0.045	0.040	0.037	0.035	0.032	0.030	0.028
2015...	0.120	0.110	0.102	0.094	0.087	0.081	0.075	0.069	0.063	0.056	0.050	0.044	0.039	0.037	0.035	0.032	0.030	0.027	0.025
2016...	0.109	0.101	0.093	0.086	0.080	0.074	0.069	0.062	0.056	0.050	0.044	0.039	0.037	0.034	0.032	0.029	0.027	0.025	0.022
2017...	0.100	0.092	0.086	0.080	0.073	0.068	0.062	0.055	0.049	0.043	0.039	0.036	0.034	0.032	0.029	0.027	0.024	0.022	
2018...	0.092	0.085	0.079	0.073	0.068	0.061	0.055	0.049	0.043	0.038	0.036	0.034	0.031	0.029	0.027	0.024	0.022		
2019...	0.085	0.079	0.072	0.067	0.061	0.055	0.048	0.043	0.038	0.036	0.034	0.031	0.029	0.026	0.024	0.022			

Infection Spread: 4,000,000 at risk, middle scenario to match CDC.
 Progression Rates: Weibull, median 10 years, alpha 2.1.
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.
 Age/Sex Splits: 90% male, distribute all cases among ages 15-79.
 Included Deaths: 100% of infections after 1988.

TABLE A14—Continued

Calendar Year	Attained Age in 1986																	
	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
1986...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1987...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1988...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Attained Age in 1989																	
	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
1989...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1990...	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1991...	0.005	0.004	0.004	0.004	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001
1992...	0.012	0.012	0.011	0.010	0.009	0.008	0.007	0.006	0.005	0.005	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002
1993...	0.024	0.022	0.020	0.018	0.016	0.014	0.013	0.011	0.010	0.008	0.007	0.006	0.006	0.005	0.004	0.004	0.003	0.003
1994...	0.037	0.034	0.030	0.027	0.024	0.022	0.019	0.017	0.014	0.013	0.011	0.009	0.008	0.007	0.006	0.006	0.005	0.005
1995...	0.051	0.046	0.041	0.037	0.033	0.029	0.025	0.022	0.019	0.016	0.014	0.012	0.010	0.009	0.009	0.008	0.008	0.007
1996...	0.062	0.056	0.050	0.045	0.040	0.035	0.031	0.027	0.023	0.020	0.017	0.015	0.013	0.012	0.011	0.010	0.010	0.009
1997...	0.071	0.064	0.058	0.052	0.046	0.040	0.035	0.030	0.026	0.022	0.019	0.016	0.015	0.014	0.013	0.012	0.011	0.010
1998...	0.079	0.071	0.064	0.057	0.050	0.043	0.038	0.032	0.028	0.024	0.020	0.019	0.018	0.016	0.015	0.014	0.012	0.011
1999...	0.084	0.076	0.067	0.059	0.052	0.046	0.039	0.033	0.028	0.024	0.022	0.021	0.019	0.017	0.016	0.014	0.013	
2000...	0.087	0.078	0.069	0.061	0.053	0.046	0.039	0.033	0.028	0.026	0.024	0.022	0.020	0.018	0.016	0.014		
2001...	0.085	0.076	0.067	0.059	0.051	0.043	0.037	0.031	0.029	0.027	0.025	0.022	0.020	0.018	0.016			
2002...	0.081	0.073	0.064	0.055	0.047	0.040	0.034	0.032	0.029	0.027	0.024	0.022	0.019	0.017				
2003...	0.077	0.068	0.059	0.051	0.043	0.037	0.035	0.032	0.029	0.026	0.024	0.021	0.018					
2004...	0.071	0.062	0.054	0.046	0.040	0.037	0.034	0.031	0.028	0.025	0.022	0.019						
2005...	0.065	0.056	0.048	0.042	0.039	0.035	0.032	0.029	0.026	0.023	0.019							
2006...	0.056	0.049	0.042	0.039	0.036	0.033	0.030	0.027	0.024	0.021								
2007...	0.048	0.042	0.039	0.036	0.033	0.030	0.027	0.024	0.021									
2008...	0.042	0.039	0.037	0.034	0.031	0.028	0.025	0.022										
2009...	0.039	0.036	0.034	0.031	0.028	0.026	0.023											
2010...	0.036	0.033	0.031	0.028	0.026	0.023												
2011...	0.033	0.031	0.028	0.026	0.023													
2012...	0.031	0.028	0.026	0.023														
2013...	0.028	0.025	0.023															
2014...	0.025	0.023																
2015...	0.022																	
2016...																		
2017...																		
2018...																		
2019...																		

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Infection Spread: 4,000,000 at risk, middle scenario to match CDC.
 Progression Rates: Weibull, median 10 years, alpha 2.1.
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.
 Age/Sex Splits: 90% male, distribute all cases among ages 15-79.
 Included Deaths: 100% of infections after 1988.

APPENDIX B

“HIGH” PROJECTION REPORT WITH MALE MORTALITY RATES

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AIDS Model Assumption Summary

Infection Spread: 4,000,000 at risk, high scenario to match CDC
 Progression Rates: Weibull, median 12 years, alpha 2.5
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher
 Age/Sex Splits: 90% male, distribute all cases among ages 15-79
 Included Deaths: 100% of all years' infections.

TABLE B1
SUMMARY OF INFECTIONS AND CASES FOR HIGH SCENARIO
AT-RISK GROUP POPULATION: 4,000,000

Year <i>t</i>	<i>a</i> (<i>t</i>)	HIV Infections		AIDS Cases		CDC Smoothed/ Projected Cumulative
		Modeled New	Modeled Cumulative	Modeled New	Modeled Cumulative	
1975		220	220	0	0	
1976	1.480	746	966	0	0	
1977	1.290	2,542	3,508	2	3	
1978	1.180	7,886	11,394	11	14	
1979	1.080	21,973	33,366	42	56	
1980	1.000	56,051	89,418	139	196	
1981	0.880	119,568	208,986	415	611	348
1982	0.760	212,800	421,785	1,120	1,731	1,371
1983	0.540	251,191	672,977	2,712	4,443	4,227
1984	0.415	264,988	937,965	5,772	10,214	10,059
1985	0.330	257,148	1,195,113	10,761	20,975	21,016
1986	0.280	246,954	1,442,067	17,958	38,933	39,131
1987	0.250	237,593	1,679,660	27,438	66,371	67,107
1988	0.230	227,285	1,906,945	39,103	105,474	102,398
1989	0.215	214,782	2,121,727	52,704	158,179	147,535
1990	0.205	202,271	2,323,998	67,855	226,034	202,664
1991	0.200	191,020	2,515,018	84,052	310,085	267,401
1992	0.200	181,461	2,696,479	100,712	410,798	340,841
1993	0.200	169,287	2,865,766	117,222	528,020	
1994	0.200	155,283	3,021,049	132,974	660,994	
1995	0.200	140,246	3,161,295	147,399	808,393	
1996	0.200	124,901	3,286,196	159,995	968,388	
1997	0.200	109,854	3,396,050	170,362	1,138,750	
1998	0.200	95,563	3,491,614	178,215	1,316,965	
1999	0.200	82,339	3,573,953	183,399	1,500,364	
2000	0.200	70,362	3,644,315	185,884	1,686,248	
2001		70,362	3,714,677	185,758	1,872,006	
2002		70,362	3,785,039	183,217	2,055,223	
2003		70,362	3,855,401	178,572	2,233,794	
2004		70,362	3,925,762	172,199	2,405,993	
2005		70,362	3,996,124	164,506	2,570,499	
2006		70,362	4,066,486	155,905	2,726,404	
2007		70,362	4,136,848	146,789	2,873,193	
2008		70,362	4,207,210	137,518	3,010,711	
2009		70,362	4,277,572	128,400	3,139,111	
2010		70,362	4,347,934	119,693	3,258,804	
2011		70,362	4,418,296	111,592	3,370,395	
2012		70,362	4,488,658	104,236	3,474,632	
2013		70,362	4,559,020	97,712	3,572,344	
2014		70,362	4,629,382	92,053	3,664,396	
2015		70,362	4,699,744	87,252	3,751,648	
2016		70,362	4,770,105	83,267	3,834,915	
2017		70,362	4,840,467	80,034	3,914,949	
2018		70,362	4,910,829	77,467	3,992,416	
2019		70,362	4,981,191	75,475	4,067,891	

TABLE B2
ANNUAL NEW AIDS CASES PROJECTIONS FOR HIGH SCENARIO

Year	Infected in Year							Total
	Before 1986	1986	1987	1988	1989	1990	After 1990	
1975	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0
1977	2	0	0	0	0	0	0	2
1978	11	0	0	0	0	0	0	11
1979	42	0	0	0	0	0	0	42
1980	139	0	0	0	0	0	0	139
1981	415	0	0	0	0	0	0	415
1982	1,120	0	0	0	0	0	0	1,120
1983	2,712	0	0	0	0	0	0	2,712
1984	5,772	0	0	0	0	0	0	5,772
1985	10,761	0	0	0	0	0	0	10,761
1986	17,958	0	0	0	0	0	0	17,958
1987	27,095	343	0	0	0	0	0	27,438
1988	37,183	1,591	330	0	0	0	0	39,103
1989	47,500	3,358	1,530	316	0	0	0	52,704
1990	57,413	5,449	3,231	1,464	298	0	0	67,855
1991	66,338	7,716	5,242	3,091	1,383	281	0	84,052
1992	73,762	10,023	7,424	5,015	2,921	1,303	265	100,712
1993	79,275	12,231	9,643	7,102	4,739	2,751	1,482	117,222
1994	82,597	14,211	11,767	9,224	6,711	4,463	4,001	132,974
1995	83,598	15,847	13,672	11,257	8,717	6,320	7,988	147,399
1996	82,309	17,046	15,246	13,079	10,637	8,209	13,469	159,995
1997	78,909	17,745	16,400	14,585	12,359	10,018	20,346	170,362
1998	73,709	17,919	17,073	15,688	13,782	11,639	28,405	178,215
1999	67,112	17,576	17,239	16,332	14,825	12,979	37,335	183,399
2000	59,576	16,765	16,910	16,491	15,433	13,961	46,747	185,884
2001	51,567	15,559	16,129	16,177	15,584	14,534	56,207	185,758
2002	43,522	14,057	14,970	15,430	15,287	14,676	65,276	183,217
2003	35,813	12,364	13,524	14,320	14,581	14,396	73,573	178,572
2004	28,729	10,590	11,896	12,937	13,532	13,731	80,783	172,199
2005	22,463	8,832	10,188	11,379	12,225	12,744	86,674	164,506
2006	17,115	7,171	8,497	9,746	10,753	11,513	91,109	155,905
2007	12,704	5,668	6,899	8,128	9,210	10,127	94,053	146,789
2008	9,184	4,360	5,453	6,600	7,681	8,674	95,566	137,518
2009	6,465	3,264	4,195	5,217	6,237	7,234	95,790	128,400
2010	4,429	2,377	3,140	4,013	4,930	5,873	94,931	119,693
2011	2,952	1,683	2,286	3,004	3,792	4,642	93,231	111,592
2012	1,914	1,158	1,619	2,187	2,839	3,571	90,947	104,236
2013	1,207	775	1,115	1,549	2,067	2,673	88,326	97,712
2014	740	504	746	1,066	1,464	1,947	85,587	92,053
2015	440	318	485	713	1,008	1,378	82,909	87,252
2016	255	195	306	464	674	949	80,425	83,267
2017	143	116	188	293	438	635	78,222	80,034
2018	78	67	112	179	277	413	76,342	77,467
2019	41	37	64	107	170	260	74,796	75,475

Infection Spread: 4,000,000 at risk, high scenario to match CDC.
Progression Rates: Weibull, median 12 years, alpha 2.5.

TABLE B3

CUMULATIVE NEW AIDS CASES PROJECTIONS FOR HIGH SCENARIO

Year	Infected in Year							Total
	Before 1986	1986	1987	1988	1989	1990	After 1990	
1975....	0	0	0	0	0	0	0	0
1976....	0	0	0	0	0	0	0	0
1977....	3	0	0	0	0	0	0	3
1978....	14	0	0	0	0	0	0	14
1979....	56	0	0	0	0	0	0	56
1980....	196	0	0	0	0	0	0	196
1981....	611	0	0	0	0	0	0	611
1982....	1,731	0	0	0	0	0	0	1,731
1983....	4,443	0	0	0	0	0	0	4,443
1984....	10,214	0	0	0	0	0	0	10,214
1985....	20,975	0	0	0	0	0	0	20,975
1986....	38,933	0	0	0	0	0	0	38,933
1987....	66,028	343	0	0	0	0	0	66,371
1988....	103,211	1,934	330	0	0	0	0	105,474
1989....	150,711	5,292	1,860	316	0	0	0	158,179
1990....	208,124	10,740	5,091	1,780	298	0	0	226,034
1991....	274,463	18,457	10,333	4,870	1,682	281	0	310,085
1992....	348,225	28,479	17,757	9,885	4,602	1,584	265	410,798
1993....	427,500	40,710	27,400	16,987	9,341	4,334	1,748	528,020
1994....	510,097	54,921	39,167	26,211	16,052	8,797	5,749	660,994
1995....	593,695	70,767	52,839	37,468	24,769	15,117	13,737	808,393
1996....	676,004	87,813	68,085	50,547	35,407	23,326	27,206	968,388
1997....	754,914	105,558	84,485	65,131	47,766	33,344	47,552	1,138,750
1998....	828,623	123,477	101,557	80,819	61,548	44,984	75,957	1,316,965
1999....	895,735	141,053	118,797	97,151	76,373	57,963	113,292	1,500,364
2000....	955,310	157,818	135,707	113,642	91,807	71,924	160,039	1,686,248
2001....	1,006,877	173,377	151,836	129,819	107,391	86,459	216,246	1,872,006
2002....	1,050,399	187,434	166,806	145,249	122,678	101,135	281,523	2,055,223
2003....	1,086,212	199,798	180,330	159,569	137,259	115,532	355,096	2,233,794
2004....	1,114,941	210,388	192,225	172,506	150,791	129,263	435,879	2,405,993
2005....	1,137,404	219,219	202,414	183,885	163,016	142,007	522,553	2,570,499
2006....	1,154,519	226,390	210,910	193,631	173,770	153,520	613,662	2,726,404
2007....	1,167,223	232,058	217,809	201,760	182,980	163,647	707,715	2,873,193
2008....	1,176,407	236,418	223,263	208,359	190,661	172,321	803,281	3,010,711
2009....	1,182,872	239,682	227,458	213,576	196,898	179,555	899,071	3,139,111
2010....	1,187,301	242,059	230,598	217,589	201,827	185,428	994,002	3,258,804
2011....	1,190,253	243,742	232,884	220,593	205,619	190,071	1,087,234	3,370,395
2012....	1,192,168	244,900	234,503	222,780	208,458	193,642	1,178,181	3,474,632
2013....	1,193,375	245,675	235,618	224,329	210,525	196,315	1,266,507	3,572,344
2014....	1,194,115	246,179	236,363	225,395	211,989	198,262	1,352,094	3,664,396
2015....	1,194,555	246,497	236,848	226,108	212,996	199,640	1,435,003	3,751,648
2016....	1,194,810	246,692	237,154	226,572	213,670	200,589	1,515,428	3,834,915
2017....	1,194,953	246,808	237,342	226,865	214,108	201,224	1,593,650	3,914,949
2018....	1,195,031	246,875	237,453	227,044	214,385	201,636	1,669,992	3,992,416
2019....	1,195,072	246,912	237,517	227,151	214,555	201,897	1,744,787	4,067,891
Left	41	41	76	134	228	374	912,406	913,300
Pct	0.00%	0.02%	0.03%	0.06%	0.11%	0.18%	34.34%	18.33%

Infection Spread: 4,000,000 at risk, high scenario to match CDC.

Progression Rates: Weibull, median 12 years, alpha 2.5.

TABLE B4
ANNUAL AIDS DEATHS PROJECTIONS FOR HIGH SCENARIO

Year	Infected in Year							Total
	Before 1986	1986	1987	1988	1989	1990	After 1990	
1975	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0
1977	1	0	0	0	0	0	0	1
1978	4	0	0	0	0	0	0	4
1979	15	0	0	0	0	0	0	15
1980	52	0	0	0	0	0	0	52
1981	162	0	0	0	0	0	0	162
1982	454	0	0	0	0	0	0	454
1983	1,155	0	0	0	0	0	0	1,155
1984	2,618	0	0	0	0	0	0	2,618
1985	5,257	0	0	0	0	0	0	5,257
1986	8,850	0	0	0	0	0	0	8,850
1987	14,025	77	0	0	0	0	0	14,103
1988	21,071	465	74	0	0	0	0	21,610
1989	29,264	1,310	447	71	0	0	0	31,092
1990	37,982	2,576	1,260	428	67	0	0	42,313
1991	46,757	4,170	2,479	1,205	404	63	0	55,078
1992	55,096	5,989	4,012	2,371	1,139	381	60	69,047
1993	62,537	7,926	5,762	3,838	2,241	1,073	416	83,793
1994	68,678	9,874	7,626	5,512	3,627	2,110	1,408	98,834
1995	73,203	11,720	9,500	7,295	5,208	3,416	3,322	113,664
1996	75,904	13,361	11,276	9,088	6,894	4,905	6,353	127,780
1997	76,697	14,704	12,855	10,787	8,588	6,492	10,589	140,712
1998	75,623	15,679	14,147	12,297	10,194	8,087	16,023	152,051
1999	72,836	16,241	15,085	13,533	11,620	9,600	22,551	161,467
2000	68,585	16,373	15,625	14,431	12,789	10,943	29,980	168,726
2001	63,189	16,087	15,752	14,948	13,637	12,044	38,040	173,696
2002	57,001	15,424	15,478	15,069	14,125	12,842	46,408	176,347
2003	50,378	14,444	14,840	14,806	14,240	13,302	54,742	176,752
2004	43,655	13,221	13,896	14,196	13,992	13,410	62,710	175,081
2005	37,118	11,840	12,720	13,293	13,415	13,177	70,014	171,577
2006	30,991	10,380	11,391	12,168	12,562	12,633	76,409	166,535
2007	25,435	8,917	9,987	10,897	11,499	11,830	81,715	160,279
2008	20,540	7,512	8,579	9,553	10,297	10,829	85,829	153,140
2009	16,341	6,212	7,227	8,207	9,028	9,698	88,728	145,441
2010	12,826	5,049	5,977	6,914	7,755	8,502	90,459	137,481
2011	9,946	4,038	4,858	5,718	6,533	7,304	91,130	129,525
2012	7,632	3,182	3,885	4,647	5,403	6,153	90,896	121,798
2013	5,806	2,475	3,061	3,716	4,391	5,088	89,941	114,479
2014	4,386	1,903	2,381	2,929	3,512	4,135	88,456	107,703
2015	3,296	1,450	1,831	2,278	2,767	3,307	86,630	101,559
2016	2,467	1,096	1,395	1,752	2,153	2,606	84,629	96,098
2017	1,843	824	1,054	1,334	1,655	2,027	82,596	91,334
2018	1,375	617	792	1,009	1,261	1,559	80,637	87,250
2019	1,026	460	593	758	953	1,187	78,831	83,808

Infection Spread: 4,000,000 at risk, high scenario to match CDC.
 Progression Rates: Weibull, median 12 years, alpha 2.5.
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.

TABLE B5
CUMULATIVE AIDS DEATHS PROJECTIONS FOR HIGH SCENARIO

Year	Infected in Year							Total
	Before 1986	1986	1987	1988	1989	1990	After 1990	
1975	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0
1977	1	0	0	0	0	0	0	1
1978	5	0	0	0	0	0	0	5
1979	20	0	0	0	0	0	0	20
1980	72	0	0	0	0	0	0	72
1981	233	0	0	0	0	0	0	233
1982	688	0	0	0	0	0	0	688
1983	1,843	0	0	0	0	0	0	1,843
1984	4,461	0	0	0	0	0	0	4,461
1985	9,718	0	0	0	0	0	0	9,718
1986	18,569	0	0	0	0	0	0	18,569
1987	32,594	77	0	0	0	0	0	32,671
1988	53,665	542	74	0	0	0	0	54,282
1989	82,929	1,852	522	71	0	0	0	85,373
1990	120,911	4,428	1,782	499	67	0	0	127,686
1991	167,667	8,598	4,260	1,704	471	63	0	182,765
1992	222,763	14,587	8,272	4,075	1,610	444	60	251,812
1993	285,300	22,513	14,034	7,913	3,851	1,517	476	335,605
1994	353,978	32,387	21,660	13,425	7,478	3,627	1,884	434,439
1995	427,181	44,108	31,160	20,720	12,687	7,042	5,206	548,103
1996	503,085	57,469	42,436	29,808	19,580	11,948	11,559	675,883
1997	579,782	72,173	55,290	40,595	28,168	18,440	22,148	816,596
1998	655,405	87,852	69,437	52,892	38,362	26,527	38,171	968,646
1999	728,241	104,094	84,523	66,425	49,982	36,127	60,723	1,130,113
2000	796,826	120,466	100,148	80,855	62,771	47,071	90,702	1,298,839
2001	860,015	136,554	115,900	95,803	76,408	59,114	128,742	1,472,536
2002	917,015	151,978	131,378	110,872	90,533	71,957	175,150	1,648,883
2003	967,394	166,422	146,218	125,678	104,773	85,259	229,892	1,825,635
2004	1,011,049	179,643	160,114	139,874	118,765	98,670	292,603	2,000,716
2005	1,048,166	191,483	172,834	153,167	132,179	111,846	362,617	2,172,293
2006	1,079,157	201,863	184,225	165,335	144,741	124,480	439,026	2,338,827
2007	1,104,592	210,780	194,212	176,232	156,240	136,310	520,740	2,499,106
2008	1,125,132	218,292	202,791	185,785	166,538	147,139	606,570	2,652,246
2009	1,141,473	224,504	210,018	193,992	175,566	156,837	695,298	2,797,688
2010	1,154,299	229,553	215,995	200,906	183,321	165,339	785,757	2,935,169
2011	1,164,245	233,591	220,852	206,623	189,854	172,642	876,886	3,064,694
2012	1,171,877	236,773	224,737	211,270	195,257	178,795	967,782	3,186,492
2013	1,177,683	239,248	227,798	214,986	199,648	183,883	1,057,723	3,300,970
2014	1,182,069	241,151	230,180	217,915	203,160	188,019	1,146,179	3,408,673
2015	1,185,365	242,601	232,011	220,193	205,928	191,326	1,232,809	3,510,232
2016	1,187,832	243,697	233,406	221,945	208,080	193,932	1,317,439	3,606,330
2017	1,189,675	244,520	234,460	223,279	209,736	195,959	1,400,034	3,697,664
2018	1,191,050	245,137	235,252	224,288	210,997	197,518	1,480,672	3,784,914
2019	1,192,076	245,597	235,846	225,046	211,950	198,706	1,559,502	3,868,722
Left	3,037	1,356	1,748	2,239	2,832	3,565	1,097,691	1,112,469
Pct	0.25%	0.55%	0.74%	0.99%	1.32%	1.76%	41.31%	22.33%

Infection Spread: 4,000,000 at risk, high scenario to match CDC.
 Progression Rates: Weibull, median 12 years, alpha 2.5.
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.

TABLE B6

MALE GENERAL POPULATION AIDS MORTALITY RATES PER THOUSAND LIVES FOR HIGH SCENARIO

Calendar Year	Attained Age in 1986																		
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1986...			0.000	0.000	0.000	0.003	0.007	0.012	0.016	0.021	0.026	0.038	0.052	0.069	0.086	0.103	0.119	0.138	0.155
1987...			0.004	0.004	0.004	0.012	0.019	0.027	0.034	0.042	0.061	0.085	0.112	0.139	0.165	0.190	0.218	0.244	0.267
1988...		0.000	0.000	0.006	0.018	0.030	0.042	0.054	0.066	0.096	0.133	0.174	0.215	0.254	0.292	0.332	0.370	0.403	0.428
	Attained Age in 1989																		
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
1989...	0.000	0.000	0.009	0.027	0.045	0.062	0.080	0.097	0.140	0.194	0.254	0.313	0.368	0.421	0.475	0.526	0.570	0.604	0.626
1990...	0.000	0.013	0.037	0.062	0.087	0.111	0.136	0.195	0.269	0.350	0.432	0.505	0.574	0.643	0.708	0.764	0.806	0.835	0.853
1991...	0.017	0.049	0.082	0.114	0.147	0.179	0.259	0.359	0.468	0.577	0.674	0.763	0.851	0.932	1.002	1.053	1.086	1.104	1.108
1992...	0.062	0.104	0.145	0.186	0.228	0.331	0.460	0.603	0.743	0.866	0.977	1.085	1.183	1.266	1.325	1.360	1.375	1.373	1.355
1993...	0.127	0.178	0.229	0.280	0.409	0.573	0.752	0.927	1.078	1.211	1.339	1.454	1.548	1.615	1.650	1.659	1.647	1.618	1.577
1994...	0.213	0.274	0.335	0.492	0.693	0.912	1.124	1.306	1.461	1.608	1.737	1.841	1.912	1.945	1.946	1.921	1.878	1.823	1.748
1995...	0.319	0.390	0.578	0.817	1.079	1.331	1.543	1.720	1.883	2.023	2.134	2.207	2.235	2.225	2.186	2.126	2.057	1.967	1.852
1996...	0.438	0.652	0.925	1.224	1.513	1.757	1.964	2.157	2.325	2.457	2.541	2.569	2.547	2.490	2.410	2.321	2.211	2.071	1.919
1997...	0.720	1.026	1.360	1.685	1.960	2.198	2.423	2.620	2.773	2.868	2.893	2.858	2.780	2.677	2.565	2.433	2.269	2.091	1.919
1998...	1.117	1.484	1.841	2.147	2.414	2.671	2.897	3.073	3.179	3.199	3.148	3.047	2.918	2.783	2.628	2.439	2.236	2.042	1.876
1999...	1.591	1.978	2.311	2.607	2.895	3.151	3.349	3.464	3.479	3.409	3.285	3.125	2.967	2.790	2.577	2.351	2.135	1.954	1.811
2000...	2.091	2.448	2.771	3.089	3.374	3.594	3.718	3.725	3.635	3.481	3.295	3.112	2.914	2.679	2.432	2.199	2.003	1.851	1.727
2001...	2.518	2.858	3.197	3.501	3.739	3.876	3.892	3.808	3.657	3.471	3.281	3.069	2.813	2.542	2.285	2.069	1.903	1.766	1.649
2002...	2.907	3.262	3.584	3.837	3.986	4.012	3.937	3.791	3.607	3.413	3.189	2.914	2.621	2.342	2.109	1.929	1.781	1.655	1.540
2003...	3.287	3.622	3.868	4.048	4.083	4.019	3.882	3.703	3.508	3.274	2.982	2.669	2.370	2.121	1.931	1.774	1.640	1.519	1.400
2004...	3.617	3.893	4.063	4.108	4.056	3.931	3.759	3.565	3.324	3.018	2.687	2.371	2.109	1.910	1.745	1.606	1.481	1.360	1.242
2005...	3.858	4.035	4.091	4.051	3.939	3.777	3.587	3.341	3.023	2.677	2.347	2.075	1.869	1.699	1.556	1.429	1.307	1.190	1.085
2006...	3.913	3.977	3.950	3.852	3.704	3.527	3.292	2.986	2.651	2.329	2.062	1.856	1.683	1.533	1.400	1.273	1.153	1.047	0.952
2007...	3.834	3.818	3.735	3.602	3.438	3.217	2.925	2.604	2.293	2.033	1.829	1.653	1.499	1.360	1.230	1.109	1.001	0.906	0.825
2008...	3.664	3.595	3.478	3.328	3.121	2.846	2.540	2.243	1.992	1.790	1.613	1.455	1.311	1.179	1.058	0.950	0.856	0.775	0.707
2009...	3.441	3.338	3.203	3.011	2.753	2.464	2.182	1.941	1.743	1.565	1.404	1.258	1.124	1.003	0.897	0.804	0.725	0.658	0.609
2010...	3.190	3.069	2.892	2.651	2.381	2.113	1.883	1.690	1.513	1.349	1.201	1.066	0.947	0.842	0.752	0.675	0.610	0.563	0.533
2011...	2.891	2.725	2.498	2.243	1.991	1.774	1.593	1.425	1.271	1.131	1.004	0.892	0.794	0.709	0.636	0.575	0.530	0.503	0.485
2012...	2.562	2.349	2.109	1.872	1.668	1.498	1.340	1.195	1.064	0.945	0.839	0.746	0.666	0.598	0.541	0.499	0.473	0.456	0.440
2013...	2.208	1.982	1.760	1.568	1.408	1.259	1.124	1.000	0.888	0.788	0.701	0.626	0.562	0.508	0.469	0.444	0.428	0.414	0.394
2014...	1.865	1.656	1.475	1.324	1.185	1.057	0.941	0.835	0.742	0.660	0.589	0.529	0.478	0.441	0.418	0.403	0.389	0.371	0.347
2015...	1.561	1.391	1.249	1.117	0.997	0.887	0.788	0.699	0.622	0.556	0.499	0.451	0.416	0.394	0.380	0.367	0.350	0.327	0.303
2016...	1.316	1.182	1.057	0.943	0.839	0.745	0.662	0.589	0.526	0.472	0.426	0.393	0.373	0.359	0.347	0.331	0.310	0.287	0.264
2017...	1.123	1.005	0.896	0.798	0.708	0.629	0.560	0.500	0.449	0.405	0.374	0.354	0.342	0.330	0.315	0.294	0.273	0.251	0.230
2018...	0.960	0.856	0.762	0.677	0.601	0.535	0.477	0.428	0.387	0.357	0.339	0.326	0.315	0.301	0.281	0.260	0.240	0.220	0.202
2019...	0.823	0.732	0.650	0.577	0.514	0.459	0.412	0.372	0.343	0.325	0.314	0.303	0.289	0.270	0.250	0.230	0.211	0.194	0.180

Infection Spread: 4,000,000 at risk, high scenario to match CDC.

Progression Rates: Weibull, median 12 years, alpha 2.5.

Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.

Age/Sex splits: 90% male, distribute all cases among ages 15-79.

Included Deaths: 100% of all years' infections.

TABLE B6—Continued

Calendar Year	Attained Age in 1986																		
	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
1986...	0.171	0.182	0.189	0.193	0.194	0.193	0.192	0.189	0.184	0.178	0.171	0.164	0.157	0.150	0.142	0.134	0.126	0.117	0.107
1987...	0.284	0.295	0.301	0.303	0.303	0.300	0.293	0.284	0.272	0.259	0.247	0.237	0.226	0.215	0.204	0.193	0.180	0.165	0.151
1988...	0.444	0.453	0.456	0.455	0.450	0.439	0.421	0.400	0.378	0.359	0.343	0.328	0.314	0.299	0.283	0.265	0.246	0.226	0.207
	Attained Age in 1989																		
	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
1989...	0.639	0.645	0.643	0.635	0.616	0.587	0.553	0.519	0.490	0.468	0.449	0.431	0.413	0.392	0.369	0.343	0.316	0.291	0.269
1990...	0.861	0.859	0.847	0.819	0.776	0.726	0.676	0.635	0.606	0.582	0.561	0.539	0.515	0.485	0.452	0.419	0.388	0.361	0.339
1991...	1.099	1.080	1.042	0.986	0.921	0.857	0.804	0.764	0.730	0.700	0.669	0.637	0.600	0.560	0.521	0.484	0.452	0.427	0.407
1992...	1.326	1.277	1.206	1.126	1.047	0.980	0.928	0.883	0.842	0.802	0.761	0.716	0.669	0.624	0.582	0.546	0.517	0.495	0.476
1993...	1.515	1.430	1.334	1.239	1.158	1.093	1.036	0.983	0.932	0.881	0.829	0.776	0.725	0.679	0.639	0.608	0.585	0.565	0.544
1994...	1.648	1.536	1.426	1.331	1.252	1.182	1.117	1.055	0.995	0.935	0.876	0.821	0.771	0.727	0.695	0.672	0.653	0.631	0.602
1995...	1.725	1.600	1.492	1.400	1.316	1.239	1.166	1.097	1.030	0.966	0.906	0.854	0.809	0.775	0.753	0.735	0.714	0.684	0.640
1996...	1.770	1.642	1.537	1.443	1.357	1.276	1.198	1.121	1.047	0.977	0.915	0.864	0.827	0.805	0.788	0.769	0.739	0.694	0.642
1997...	1.772	1.653	1.549	1.456	1.369	1.284	1.197	1.112	1.033	0.963	0.906	0.867	0.845	0.830	0.813	0.783	0.739	0.686	0.629
1998...	1.745	1.633	1.534	1.442	1.350	1.255	1.162	1.074	0.997	0.934	0.894	0.872	0.859	0.844	0.815	0.772	0.720	0.664	0.607
1999...	1.693	1.590	1.494	1.396	1.295	1.194	1.099	1.015	0.949	0.907	0.887	0.875	0.862	0.836	0.794	0.743	0.689	0.633	0.580
2000...	1.621	1.523	1.422	1.315	1.208	1.108	1.020	0.951	0.908	0.888	0.879	0.868	0.844	0.804	0.756	0.703	0.650	0.598	0.547
2001...	1.542	1.434	1.322	1.212	1.111	1.022	0.951	0.904	0.880	0.866	0.851	0.825	0.785	0.740	0.690	0.640	0.591	0.543	0.493
2002...	1.426	1.310	1.200	1.099	1.011	0.939	0.889	0.861	0.843	0.825	0.797	0.759	0.715	0.670	0.623	0.577	0.532	0.486	0.439
2003...	1.283	1.173	1.074	0.987	0.915	0.864	0.833	0.812	0.791	0.763	0.725	0.685	0.642	0.600	0.557	0.515	0.472	0.430	0.388
2004...	1.134	1.038	0.954	0.883	0.831	0.797	0.774	0.751	0.722	0.686	0.649	0.610	0.571	0.533	0.494	0.455	0.415	0.377	0.340
2005...	0.993	0.912	0.843	0.791	0.756	0.731	0.707	0.678	0.644	0.609	0.574	0.539	0.504	0.469	0.433	0.398	0.363	0.328	0.293
2006...	0.871	0.801	0.749	0.715	0.690	0.668	0.640	0.605	0.570	0.534	0.499	0.464	0.431	0.399	0.367	0.336	0.306	0.274	0.242
2007...	0.755	0.704	0.670	0.647	0.626	0.598	0.564	0.529	0.493	0.458	0.425	0.395	0.366	0.338	0.309	0.283	0.255	0.226	0.198
2008...	0.657	0.624	0.602	0.582	0.556	0.523	0.488	0.453	0.419	0.388	0.359	0.333	0.308	0.283	0.260	0.235	0.209	0.184	0.161
2009...	0.578	0.558	0.539	0.514	0.482	0.448	0.414	0.381	0.352	0.326	0.302	0.281	0.258	0.238	0.216	0.192	0.170	0.150	0.133
2010...	0.514	0.497	0.474	0.443	0.410	0.378	0.346	0.318	0.295	0.274	0.255	0.234	0.217	0.197	0.177	0.157	0.139	0.124	0.116
2011...	0.468	0.446	0.417	0.387	0.356	0.326	0.300	0.278	0.258	0.240	0.221	0.205	0.186	0.166	0.148	0.131	0.117	0.109	0.102
2012...	0.420	0.392	0.364	0.335	0.307	0.282	0.261	0.243	0.226	0.208	0.192	0.175	0.157	0.139	0.123	0.110	0.103	0.096	0.089
2013...	0.369	0.342	0.314	0.288	0.265	0.245	0.228	0.212	0.195	0.181	0.164	0.147	0.131	0.116	0.103	0.097	0.090	0.084	0.078
2014...	0.321	0.296	0.271	0.250	0.231	0.214	0.199	0.184	0.170	0.154	0.138	0.123	0.109	0.097	0.091	0.085	0.079	0.073	0.067
2015...	0.279	0.256	0.235	0.218	0.202	0.188	0.173	0.160	0.146	0.131	0.116	0.103	0.091	0.086	0.080	0.074	0.069	0.063	0.058
2016...	0.242	0.223	0.206	0.191	0.178	0.164	0.152	0.138	0.124	0.110	0.097	0.087	0.081	0.076	0.070	0.065	0.060	0.054	0.049
2017...	0.212	0.196	0.182	0.169	0.156	0.144	0.131	0.117	0.104	0.092	0.082	0.077	0.072	0.067	0.062	0.057	0.052	0.047	0.042
2018...	0.187	0.174	0.162	0.149	0.138	0.125	0.112	0.100	0.088	0.079	0.074	0.069	0.064	0.059	0.054	0.049	0.045		
2019...	0.167	0.155	0.143	0.132	0.120	0.108	0.096	0.085	0.076	0.071	0.066	0.061	0.057	0.052	0.047	0.043			

Infection Spread: 4,000,000 at risk, high scenario to match CDC.
 Progression Rates: Weibull, median 12 years, alpha 2.5.
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.
 Age/Sex Splits: 90% male, distribute all cases among ages 15-79.
 Included Deaths: 100% of all years' infections.

TABLE B6—Continued

Calendar Year	Attained Age in 1986																	
	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
1986...	0.098	0.088	0.080	0.074	0.068	0.063	0.058	0.054	0.049	0.044	0.039	0.035	0.031	0.028	0.025	0.023	0.020	0.018
1987...	0.138	0.126	0.116	0.108	0.101	0.094	0.086	0.079	0.071	0.063	0.056	0.050	0.045	0.040	0.036	0.032	0.029	0.025
1988...	0.190	0.176	0.165	0.155	0.145	0.134	0.123	0.110	0.098	0.087	0.077	0.068	0.061	0.054	0.048	0.043	0.038	0.033
	Attained Age in 1989																	
	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
1989...	0.252	0.237	0.224	0.211	0.196	0.179	0.161	0.143	0.126	0.111	0.098	0.087	0.078	0.068	0.061	0.054	0.047	0.041
1990...	0.322	0.306	0.289	0.270	0.248	0.222	0.197	0.172	0.151	0.134	0.118	0.105	0.091	0.082	0.072	0.063	0.055	0.049
1991...	0.389	0.370	0.348	0.320	0.289	0.257	0.226	0.199	0.176	0.156	0.138	0.120	0.107	0.093	0.081	0.071	0.063	0.055
1992...	0.456	0.431	0.398	0.361	0.322	0.285	0.252	0.224	0.198	0.175	0.152	0.134	0.117	0.102	0.088	0.077	0.068	0.064
1993...	0.516	0.479	0.437	0.392	0.348	0.310	0.275	0.244	0.214	0.185	0.163	0.142	0.123	0.106	0.092	0.081	0.076	0.072
1994...	0.561	0.514	0.463	0.414	0.369	0.329	0.291	0.255	0.220	0.193	0.167	0.144	0.124	0.107	0.094	0.088	0.083	0.078
1995...	0.589	0.534	0.479	0.430	0.384	0.339	0.296	0.256	0.222	0.192	0.165	0.142	0.122	0.106	0.100	0.094	0.088	0.082
1996...	0.585	0.529	0.477	0.428	0.380	0.334	0.289	0.252	0.218	0.188	0.161	0.138	0.119	0.112	0.105	0.098	0.091	0.084
1997...	0.572	0.518	0.467	0.417	0.368	0.321	0.281	0.243	0.209	0.179	0.152	0.131	0.123	0.115	0.107	0.099	0.091	0.083
1998...	0.553	0.501	0.449	0.398	0.349	0.306	0.266	0.229	0.195	0.166	0.142	0.133	0.123	0.114	0.105	0.096	0.087	0.078
1999...	0.528	0.475	0.423	0.374	0.328	0.286	0.246	0.209	0.177	0.150	0.140	0.130	0.120	0.110	0.100	0.090	0.080	
2000...	0.495	0.443	0.393	0.347	0.303	0.260	0.220	0.186	0.157	0.146	0.135	0.124	0.113	0.102	0.091	0.080		
2001...	0.444	0.397	0.352	0.309	0.266	0.227	0.192	0.163	0.152	0.140	0.128	0.117	0.105	0.093	0.082			
2002...	0.395	0.352	0.310	0.269	0.230	0.196	0.167	0.155	0.143	0.131	0.119	0.107	0.094	0.082				
2003...	0.348	0.308	0.268	0.231	0.197	0.169	0.157	0.144	0.132	0.119	0.107	0.094	0.082					
2004...	0.302	0.265	0.228	0.196	0.169	0.156	0.143	0.131	0.118	0.105	0.093	0.080						
2005...	0.258	0.224	0.193	0.167	0.154	0.141	0.129	0.116	0.103	0.090	0.078							
2006...	0.211	0.183	0.159	0.148	0.136	0.124	0.113	0.101	0.089	0.077								
2007...	0.172	0.151	0.140	0.130	0.119	0.108	0.098	0.087	0.076									
2008...	0.142	0.133	0.123	0.113	0.104	0.094	0.084	0.075										
2009...	0.124	0.116	0.107	0.098	0.090	0.081	0.073											
2010...	0.109	0.101	0.093	0.086	0.078	0.070												
2011...	0.095	0.088	0.081	0.073	0.066													
2012...	0.083	0.076	0.069	0.062														
2013...	0.071	0.065	0.058															
2014...	0.061	0.055																
2015...	0.052																	
2016...																		
2017...																		
2018...																		
2019...																		

Infection Spread: 4,000,000 at risk, high scenario to match CDC.
 Progression Rates: Weibull, median 12 years, alpha 2.5.
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.
 Age/Sex Splits: 90% male, distribute all cases among ages 15-79.
 Included Deaths: 100% of all years' infections.

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TABLE B7

WEIBULL FUNCTION AIDS PROGRESSION RATES FOR HIGH SCENARIO

2.5 Alpha 0.0720 Lambda 10 Median Year					
Years from HIV Infection	Annual Rate of Progress to AIDS	Cumulative Progressed to AIDS Diagnosis	Annual Progressed to AIDS Diagnosis	Years from HIV Infection	Assumed Annual Progressed to AIDS Diagnosis
1	0.14%	0.14%	0.14%	0	0.00%
2	0.65	0.78	0.64	1	0.14
3	1.37	2.14	1.36	2	0.64
4	2.25	4.35	2.21	3	1.36
5	3.27	7.47	3.12	4	2.21
6	4.39	11.53	4.06	5	3.12
7	5.60	16.48	4.95	6	4.06
8	6.89	22.24	5.75	7	4.95
9	8.25	28.66	6.42	8	5.75
10	9.67	35.56	6.90	9	6.42
11	11.15	42.74	7.19	10	6.90
12	12.67	50.00	7.26	11	7.19
13	14.23	57.12	7.12	12	7.26
14	15.83	63.91	6.79	13	7.12
15	17.46	70.21	6.30	14	6.79
16	19.10	75.90	5.69	15	6.30
17	20.77	80.91	5.01	16	5.69
18	22.46	85.19	4.29	17	5.01
19	24.15	88.77	3.58	18	4.29
20	25.86	91.67	2.90	19	3.58
21	27.56	93.97	2.30	20	2.90
22	29.27	95.73	1.77	21	2.30
23	30.98	97.06	1.32	22	1.77
24	32.68	98.02	0.96	23	1.32
25	34.38	98.70	0.68	24	0.96
26	36.07	99.17	0.47	25	0.68
27	37.74	99.48	0.31	26	0.47
28	39.41	99.69	0.20	27	0.31
29	41.05	99.82	0.13	28	0.20
30	42.69	99.89	0.08	29	0.13
31	44.30	99.94	0.05	30	0.08
32	45.89	99.97	0.03	31	0.05
33	47.46	99.98	0.02	32	0.03
34	49.01	99.99	0.01	33	0.02
35	50.54	100.00	0.00	34	0.01
36	52.04	100.00	0.00	35	0.00
37	53.52	100.00	0.00	36	0.00
38	54.97	100.00	0.00	37	0.00
39	56.39	100.00	0.00	38	0.00
40	57.79	100.00	0.00	39	0.00
41	59.15	100.00	0.00	40	0.00
42	60.49	100.00	0.00	41	0.00
43	61.81	100.00	0.00	42	0.00
44	63.09	100.00	0.00	43	0.00
				44	0.00

Cumulative progressed at year $T = e [- (\text{Lambda} \times T) \text{Alpha}]$.
 Lambda is used to achieve median survival at end of year chosen.

TABLE B8
ASSUMED MORTALITY AFTER AIDS DIAGNOSIS
FOR HIGH SCENARIO

Years after Diagnosis	Death Rates after AIDS Diagnosis			
	Diagnosed before 1986		Diagnosed after 1985	
	Annual	Cumulative	Annual	Cumulative
1	45.00%	45.00%	40.00%	40.00%
2	45.00	69.75	40.00	64.00
3	35.00	80.34	35.00	76.60
4	25.00	85.25	25.00	82.45
5	25.00	88.94	25.00	86.84
6	25.00	91.70	25.00	90.13
7	25.00	93.78	25.00	92.50
8	25.00	95.33	25.00	94.45
9	25.00	96.50	25.00	95.84
10+	25.00	97.38	25.00	96.88

(Average AIDS case is diagnosed 0.5 of the way through calendar year of diagnosis.)

TABLE B9
ASSUMPTIONS FOR DIVIDING CASES
TO CALCULATE MORTALITY RATES
FOR HIGH SCENARIO

Age Group	Age Distribution Percentages	
	Male	Female
15-19	0.3%	0.8%
20-24	3.3	5.9
25-29	14.2	21.6
30-34	23.7	27.2
35-39	22.3	18.6
40-44	14.5	8.3
45-49	9.2	4.2
50-54	5.3	2.9
55-59	3.6	2.7
60-64	2.0	2.7
65-69	1.0	2.3
70-74	0.4	1.7
75-79	0.2	1.1
Total	100.0%	100.0%

Sex Category Code: M (M or F, for Male or Female)

Sex Category Pct: Male Female
 90.00% 10.00%

TABLE B10
ASSUMPTIONS FOR INCLUDING DEATHS
IN MORTALITY CALCULATIONS
FOR HIGH SCENARIO

Inclusion Factors for Cases Infected
100.00% before 1986
100.00% infected 1986
100.00% infected 1987
100.00% infected 1988
100.00% infected 1989
100.00% infected 1990
100.00% after 1990

TABLE B11
U.S. GENERAL POPULATION PROJECTIONS (IN THOUSANDS) FOR HIGH SCENARIO

Ages	1986	1990	1995	2000	2005	2010
Male						
15-19	9,483	8,865	8,944	9,735	9,928	9,605
20-24	10,232	9,244	8,647	8,706	9,470	9,648
25-29	11,026	10,708	9,416	8,808	8,847	9,595
30-34	10,367	11,195	10,987	9,680	9,070	9,108
35-39	9,256	10,026	11,092	10,882	9,599	8,991
40-44	7,030	8,691	9,944	10,995	10,792	9,527
45-49	5,817	6,809	8,580	9,822	10,871	10,677
50-54	5,260	5,590	6,705	8,467	9,706	10,748
55-59	5,359	5,070	5,386	6,478	8,195	9,403
60-64	5,097	5,032	4,763	5,078	6,126	7,770
65-69	4,377	4,655	4,603	4,382	4,705	5,695
70-74	3,268	3,516	3,873	3,860	3,702	3,996
75-79	2,197	2,413	2,668	2,971	2,994	2,894
0+	117,360	121,775	126,654	130,722	134,390	137,865
Female						
15-19	9,128	8,516	8,585	9,340	9,512	9,198
20-24	10,185	9,238	8,629	8,688	9,432	9,599
25-29	10,984	10,678	9,424	8,804	8,850	9,590
30-34	10,407	11,147	10,937	9,661	9,034	9,082
35-39	9,467	10,146	11,105	10,890	9,627	9,002
40-44	7,316	8,964	10,125	11,074	10,863	9,612
45-49	6,110	7,132	8,903	10,057	11,005	10,799
50-54	5,627	5,948	7,102	8,870	10,029	10,976
55-59	5,909	5,552	5,842	6,981	8,722	9,856
60-64	5,865	5,708	5,333	5,620	6,720	8,401
65-69	5,285	5,596	5,453	5,109	5,402	6,467
70-74	4,396	4,605	5,001	4,892	4,602	4,880
75-79	3,432	3,691	3,939	4,311	4,251	4,020
0+	123,718	128,116	132,965	137,025	140,695	144,190

Notes

CDC projection data, used to calibrate the model, are the set developed by the ACLI/HIAA Ad Hoc Group on AIDS data. The data through 1987 are CDC reported results, adjusted for reporting delays and for smoothness. The projected data are the CDC's projection updated in early 1988, reduced to eliminate the 10 percent increase made by the CDC to account for cases that will never be reported.

Three sets of progression rates (from HIV infection to AIDS diagnosis) have been developed by the ACLI/HIAA ad hoc group on AIDS data. Each is based on the Weibull function shown in Table B7, having the following parameters:

Alpha	Median Year	Name	Set to Approximate
2.5	12 yrs	"Slow"	CDC 95% confidence lower bound
2.1	10	"Expected"	SFCC/CDC study best estimate rates
2.2	8	"Fast"	CDC 95% confidence upper bound

Mortality rates after AIDS diagnosis are based on the assumption that all cases are diagnosed in the middle of the calendar year. The annual death rates after AIDS diagnosis are converted to calendar year rates by assuming that the half-year rate is the square root of the annual rate.

Once AIDS deaths have been modeled, they are split by sex and then into five-year age groups. The age group percentages are derived from the distribution by age at death for AIDS deaths reported in the U.S. through the second quarter of 1988. These sex/age cells of modeled AIDS deaths are the numerator for the mortality rate calculations.

The AIDS deaths included in the calculation of AIDS mortality rates are adjusted by the "Infection Year Inclusion Factors." These factors reflect HIV-testing at the time of issue. For example, new issues that are HIV tested should produce AIDS mortality results consistent with calculations made excluding the deaths from those infected prior to the year of issue.

AIDS mortality rates are calculated assuming the U.S. population projection contained in the U.S. Dept. of Commerce report Series P-25, No. 1017: "Projections of the Population of States by Age, Sex, and Race: 1988 to 2010." Linear interpolation is used to estimate the population between the projection years shown in the population assumptions. Stationary population is assumed after 2010.

TABLE B12

CALCULATION FOR INFECTION SPREAD FOR HIGH SCENARIO

Year t	$a[t]$	$1 - \delta(-a[t])$	delta $p[t]$	$p[t]$
1975.....				0.00305%
1976.....	1.480	0.77236	0.00018	0.02
1977.....	1.290	0.72472	0.00063	0.09
1978.....	1.180	0.69272	0.00197	0.28
1979.....	1.080	0.66040	0.00549	0.83
1980.....	1.000	0.63212	0.01401	2.24
1981.....	0.880	0.58521	0.02989	5.22
1982.....	0.760	0.53233	0.05319	10.54
1983.....	0.540	0.41725	0.06279	16.82
1984.....	0.415	0.33965	0.06624	23.45
1985.....	0.330	0.28107	0.06428	29.88
1986.....	0.280	0.24421	0.06173	36.05
1987.....	0.250	0.22119	0.05939	41.99
1988.....	0.230	0.20546	0.05682	47.67
1989.....	0.215	0.19345	0.05369	53.04
1990.....	0.205	0.18535	0.05056	58.10
1991.....	0.200	0.18126	0.04775	62.88
1992.....	0.200	0.18126	0.04536	67.41
1993.....	0.200	0.18126	0.04232	71.64
1994.....	0.200	0.18126	0.03882	75.53
1995.....	0.200	0.18126	0.03506	79.03
1996.....	0.200	0.18126	0.03122	82.15
1997.....	0.200	0.18126	0.02746	84.90
1998.....	0.200	0.18126	0.02389	87.29
1999.....	0.200	0.18126	0.02058	89.35
2000.....	0.200	0.18126	0.01759	91.11
2001.....			0.01759	92.87
2002.....			0.01759	94.63
2003.....			0.01759	96.39
2004.....			0.01759	98.14
2005.....			0.01759	99.90
2006.....			0.01759	101.66
2007.....			0.01759	103.42
2008.....			0.01759	105.18
2009.....			0.01759	106.94
2010.....			0.01759	108.70
2011.....			0.01759	110.46
2012.....			0.01759	112.22
2013.....			0.01759	113.98
2014.....			0.01759	115.73
2015.....			0.01759	117.49
2016.....			0.01759	119.25
2017.....			0.01759	121.01
2018.....			0.01759	122.77
2019.....			0.01759	124.53

Note: The number of annual infections is held level beginning in 2000.

$a[t]$ = Assumed annual infection factor

$p[t]$ = Percent of at-risk population infected

$$\text{delta } p[t] = \frac{\{1 - \delta(-a[t])\} \times p[t-1] \times (1 - p[t-1])}{1 - \{1 - \delta(-a[t])\} \times (1 - p[t-1])}$$

TABLE B13

CALCULATIONS TO CONVERT MORTALITY RATES AFTER AIDS DIAGNOSIS
TO CALENDAR-YEAR BASIS FOR CONVOLUTION TABLE FOR HIGH SCENARIO

Calendar Years from Diagnosis	Cases Diagnosed before 1986:				Cases Diagnosed after 1985:			
	Death Rate	Alive End of Year	Percentage Dead during Year	Total Percentage Dead	Death Rate	Alive End of Year	Percentage Dead during Year	Total Percentage Dead
0.....	25.84%	74.16%	25.84%	25.84%	22.54%	77.46%	22.54%	22.54%
1.....	45.00	40.79	33.37	59.21	40.00	46.48	30.98	53.52
2.....	40.21	24.39	16.40	75.61	37.55	29.02	17.45	70.98
3.....	30.18	17.03	7.36	82.97	30.18	20.26	8.76	79.74
4.....	25.00	12.77	4.26	87.23	25.00	15.20	5.07	84.80
5.....	25.00	9.58	3.19	90.42	25.00	11.40	3.80	88.60
6.....	25.00	7.18	2.39	92.82	25.00	8.55	2.85	91.45
7.....	25.00	5.39	1.80	94.61	25.00	6.41	2.14	93.59
8.....	25.00	4.04	1.35	95.96	25.00	4.81	1.60	95.19
9.....	25.00	3.03	1.01	96.97	25.00	3.61	1.20	96.39
10.....	25.00	2.27	0.76	97.73	25.00	2.71	0.90	97.29
11.....	25.00	1.70	0.57	98.30	25.00	2.03	0.68	97.97
12.....	25.00	1.28	0.43	98.72	25.00	1.52	0.51	98.48
13.....	25.00	0.96	0.32	99.04	25.00	1.14	0.38	98.86
14.....	25.00	0.72	0.24	99.28	25.00	0.86	0.29	99.14
15.....	25.00	0.54	0.18	99.46	25.00	0.64	0.21	99.36
16.....	25.00	0.40	0.13	99.60	25.00	0.48	0.16	99.52
17.....	25.00	0.30	0.10	99.70	25.00	0.36	0.12	99.64
18.....	25.00	0.23	0.08	99.77	25.00	0.27	0.09	99.73
19.....	25.00	0.17	0.06	99.83	25.00	0.20	0.07	99.80
20.....	25.00	0.13	0.04	99.87	25.00	0.15	0.05	99.85
21.....	25.00	0.10	0.03	99.90	25.00	0.11	0.04	99.89
22.....	25.00	0.07	0.02	99.93	25.00	0.09	0.03	99.91
23.....	25.00	0.05	0.02	99.95	25.00	0.06	0.02	99.94
24.....	25.00	0.04	0.01	99.96	25.00	0.05	0.02	99.95
25.....	25.00	0.03	0.01	99.97	25.00	0.04	0.01	99.96
26.....	25.00	0.02	0.01	99.98	25.00	0.03	0.01	99.97
27.....	25.00	0.02	0.01	99.98	25.00	0.02	0.01	99.98
28.....	25.00	0.01	0.00	99.99	25.00	0.02	0.01	99.98
29.....	25.00	0.01	0.00	99.99	25.00	0.01	0.00	99.99
30.....	25.00	0.01	0.00	99.99	25.00	0.01	0.00	99.99
31.....	25.00	0.01	0.00	99.99	25.00	0.01	0.00	99.99
32.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
33.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
34.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
35.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
36.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
37.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
38.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
39.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
40.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
41.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
42.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
43.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
44.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
Total ...		100.00%				100.00%		

The population AIDS mortality rates are assumed to apply to the central age in each five-year age group. Mortality rates for other ages are then determined using the "Karup King" interpolation method. Linear interpolation (never less than zero) is used for ages under 22 and over 72.

Alternative Mortality Rates Exhibit

Table B14 presents another set of mortality rates. The only change in assumptions is the use of the different infection year inclusion factors shown below:

0.00% before 1986
0.00% infected 1986
0.00% infected 1987
0.00% infected 1988
100.00% infected 1989
100.00% infected 1990
100.00% after 1990.

TABLE B14

MALE GENERAL POPULATION AIDS MORTALITY RATES PER THOUSAND LIVES FOR HIGH SCENARIO

Calendar Year	Attained Age in 1986																		
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1986...			0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1987...			0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1988...		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Attained Age in 1989																		
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
1989...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1990...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
1991...	0.000	0.000	0.001	0.001	0.001	0.002	0.002	0.003	0.004	0.005	0.006	0.006	0.007	0.008	0.009	0.009	0.009	0.009	0.009
1992...	0.001	0.002	0.003	0.004	0.005	0.008	0.011	0.014	0.017	0.020	0.022	0.025	0.027	0.029	0.030	0.031	0.031	0.031	0.031
1993...	0.006	0.008	0.010	0.012	0.018	0.025	0.033	0.041	0.048	0.054	0.060	0.065	0.069	0.072	0.073	0.074	0.073	0.072	0.070
1994...	0.015	0.020	0.024	0.036	0.050	0.066	0.081	0.094	0.106	0.116	0.126	0.133	0.138	0.141	0.141	0.139	0.136	0.132	0.126
1995...	0.034	0.041	0.061	0.086	0.113	0.140	0.162	0.181	0.198	0.213	0.224	0.232	0.235	0.234	0.230	0.223	0.216	0.207	0.195
1996...	0.062	0.093	0.131	0.174	0.215	0.250	0.279	0.306	0.330	0.349	0.361	0.365	0.362	0.354	0.342	0.330	0.314	0.294	0.273
1997...	0.131	0.187	0.248	0.307	0.358	0.401	0.442	0.478	0.506	0.523	0.528	0.521	0.507	0.488	0.468	0.444	0.414	0.381	0.350
1998...	0.252	0.335	0.415	0.484	0.548	0.603	0.654	0.693	0.717	0.722	0.710	0.687	0.658	0.628	0.593	0.550	0.504	0.461	0.423
1999...	0.431	0.536	0.626	0.707	0.785	0.854	0.908	0.939	0.943	0.924	0.890	0.847	0.804	0.756	0.698	0.637	0.579	0.530	0.491
2000...	0.666	0.779	0.882	0.984	1.074	1.144	1.184	1.186	1.157	1.108	1.049	0.991	0.928	0.853	0.774	0.700	0.638	0.589	0.550
2001...	0.924	1.048	1.173	1.284	1.372	1.422	1.428	1.397	1.342	1.273	1.204	1.126	1.032	0.933	0.838	0.759	0.698	0.648	0.605
2002...	1.210	1.357	1.491	1.596	1.659	1.669	1.638	1.578	1.501	1.420	1.327	1.213	1.091	0.974	0.877	0.803	0.741	0.689	0.641
2003...	1.530	1.686	1.810	1.884	1.901	1.871	1.807	1.724	1.633	1.524	1.388	1.242	1.103	0.988	0.899	0.826	0.763	0.707	0.652
2004...	1.862	2.004	2.091	2.115	2.088	2.023	1.935	1.835	1.711	1.553	1.383	1.220	1.086	0.983	0.898	0.827	0.762	0.700	0.639
2005...	2.172	2.272	2.303	2.281	2.218	2.127	2.020	1.881	1.702	1.507	1.321	1.168	1.052	0.957	0.876	0.805	0.736	0.670	0.611
2006...	2.387	2.426	2.410	2.350	2.260	2.152	2.008	1.822	1.617	1.421	1.258	1.132	1.027	0.936	0.854	0.777	0.704	0.638	0.581
2007...	2.512	2.502	2.448	2.361	2.253	2.108	1.917	1.707	1.503	1.333	1.199	1.083	0.982	0.891	0.806	0.727	0.656	0.594	0.540
2008...	2.559	2.511	2.429	2.325	2.180	1.988	1.774	1.566	1.391	1.250	1.126	1.016	0.916	0.823	0.739	0.664	0.598	0.542	0.494
2009...	2.542	2.466	2.367	2.225	2.034	1.821	1.612	1.434	1.288	1.156	1.037	0.929	0.830	0.741	0.663	0.594	0.536	0.486	0.450
2010...	2.476	2.382	2.245	2.058	1.848	1.640	1.462	1.312	1.174	1.047	0.932	0.828	0.735	0.654	0.584	0.524	0.474	0.437	0.414
2011...	2.343	2.208	2.024	1.818	1.614	1.438	1.291	1.155	1.030	0.917	0.814	0.723	0.643	0.574	0.515	0.466	0.430	0.407	0.393
2012...	2.155	1.976	1.774	1.575	1.403	1.260	1.127	1.006	0.895	0.795	0.706	0.628	0.561	0.503	0.455	0.419	0.398	0.383	0.370
2013...	1.917	1.722	1.528	1.362	1.222	1.094	0.976	0.868	0.771	0.685	0.609	0.544	0.488	0.441	0.407	0.386	0.372	0.359	0.343
2014...	1.664	1.477	1.316	1.182	1.057	0.943	0.839	0.745	0.662	0.589	0.526	0.472	0.427	0.393	0.373	0.360	0.347	0.331	0.310
2015...	1.425	1.270	1.140	1.020	0.910	0.810	0.719	0.638	0.568	0.507	0.455	0.411	0.379	0.360	0.347	0.335	0.319	0.299	0.277
2016...	1.224	1.099	0.983	0.877	0.781	0.693	0.616	0.548	0.489	0.439	0.397	0.366	0.347	0.334	0.323	0.308	0.288	0.267	0.246
2017...	1.061	0.949	0.847	0.753	0.669	0.594	0.529	0.472	0.424	0.383	0.353	0.335	0.323	0.312	0.297	0.278	0.258	0.237	0.217
2018...	0.918	0.819	0.729	0.647	0.575	0.511	0.457	0.410	0.370	0.342	0.324	0.312	0.302	0.288	0.269	0.249	0.229	0.210	0.193
2019...	0.795	0.707	0.628	0.558	0.496	0.443	0.398	0.359	0.331	0.314	0.303	0.293	0.279	0.261	0.242	0.222	0.204	0.188	0.174

Infection Spread: 4,000,000 at risk, high scenario to match CDC.

Progression Rates: Weibull, median 12 years, alpha 2.5.

Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.

Age/Sex Splits: 90% male, distribute all cases among ages 15-79.

Included Deaths: 100% of infections after 1988.

TABLE B14—Continued

Calendar Year	Attained Age in 1986																		
	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
1986...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1987...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1988...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Attained Age in 1989																		
	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
1989...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1990...	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
1991...	0.009	0.009	0.009	0.008	0.008	0.007	0.007	0.006	0.006	0.006	0.006	0.005	0.005	0.005	0.004	0.004	0.004	0.004	0.003
1992...	0.030	0.029	0.028	0.026	0.024	0.022	0.021	0.020	0.019	0.018	0.017	0.016	0.015	0.014	0.013	0.012	0.012	0.011	0.011
1993...	0.067	0.064	0.059	0.055	0.052	0.049	0.046	0.044	0.041	0.039	0.037	0.035	0.032	0.030	0.028	0.027	0.026	0.025	0.024
1994...	0.119	0.111	0.103	0.096	0.091	0.085	0.081	0.076	0.072	0.068	0.063	0.059	0.056	0.053	0.050	0.049	0.047	0.046	0.043
1995...	0.181	0.168	0.157	0.147	0.138	0.130	0.123	0.115	0.108	0.102	0.095	0.090	0.085	0.081	0.079	0.077	0.075	0.072	0.067
1996...	0.251	0.233	0.218	0.205	0.193	0.181	0.170	0.159	0.149	0.139	0.130	0.123	0.118	0.114	0.112	0.109	0.105	0.099	0.091
1997...	0.323	0.302	0.283	0.266	0.250	0.234	0.218	0.203	0.188	0.176	0.165	0.158	0.154	0.151	0.148	0.143	0.135	0.125	0.115
1998...	0.394	0.368	0.346	0.325	0.305	0.283	0.262	0.242	0.225	0.211	0.202	0.197	0.194	0.190	0.184	0.174	0.162	0.150	0.137
1999...	0.459	0.431	0.405	0.379	0.351	0.324	0.298	0.275	0.257	0.246	0.240	0.237	0.234	0.227	0.215	0.202	0.187	0.172	0.157
2000...	0.516	0.485	0.453	0.419	0.385	0.353	0.325	0.303	0.289	0.283	0.280	0.276	0.269	0.256	0.241	0.224	0.207	0.190	0.174
2001...	0.566	0.526	0.485	0.445	0.408	0.375	0.349	0.332	0.323	0.318	0.312	0.303	0.288	0.271	0.253	0.235	0.217	0.199	0.181
2002...	0.593	0.545	0.499	0.457	0.421	0.391	0.370	0.358	0.351	0.343	0.332	0.316	0.298	0.279	0.259	0.240	0.221	0.202	0.183
2003...	0.597	0.546	0.500	0.460	0.426	0.402	0.388	0.378	0.368	0.355	0.338	0.319	0.299	0.279	0.260	0.240	0.220	0.200	0.181
2004...	0.584	0.534	0.491	0.454	0.428	0.410	0.398	0.387	0.372	0.353	0.334	0.314	0.294	0.274	0.254	0.234	0.214	0.194	0.175
2005...	0.559	0.513	0.475	0.446	0.426	0.411	0.398	0.382	0.363	0.343	0.323	0.304	0.284	0.264	0.244	0.224	0.204	0.185	0.165
2006...	0.531	0.489	0.457	0.436	0.421	0.407	0.390	0.369	0.348	0.326	0.304	0.283	0.263	0.244	0.224	0.205	0.187	0.167	0.148
2007...	0.495	0.461	0.439	0.424	0.410	0.392	0.370	0.347	0.323	0.300	0.279	0.259	0.240	0.221	0.203	0.185	0.167	0.148	0.130
2008...	0.459	0.436	0.421	0.407	0.389	0.365	0.341	0.316	0.293	0.271	0.251	0.233	0.215	0.198	0.182	0.164	0.146	0.128	0.113
2009...	0.427	0.412	0.398	0.380	0.356	0.331	0.306	0.282	0.260	0.241	0.223	0.207	0.191	0.176	0.159	0.142	0.126	0.111	0.098
2010...	0.399	0.386	0.368	0.344	0.319	0.293	0.269	0.247	0.229	0.212	0.198	0.182	0.169	0.153	0.137	0.122	0.108	0.096	0.090
2011...	0.380	0.362	0.338	0.313	0.288	0.264	0.243	0.225	0.209	0.194	0.179	0.166	0.151	0.135	0.120	0.106	0.095	0.089	0.083
2012...	0.353	0.330	0.306	0.281	0.258	0.237	0.220	0.204	0.190	0.175	0.162	0.147	0.132	0.117	0.104	0.092	0.087	0.081	0.075
2013...	0.320	0.297	0.273	0.250	0.230	0.213	0.198	0.184	0.170	0.157	0.143	0.128	0.113	0.100	0.090	0.084	0.078	0.073	0.067
2014...	0.287	0.264	0.242	0.223	0.206	0.191	0.178	0.164	0.152	0.138	0.124	0.110	0.097	0.087	0.081	0.076	0.070	0.065	0.060
2015...	0.255	0.234	0.215	0.199	0.185	0.172	0.158	0.147	0.133	0.119	0.106	0.094	0.084	0.078	0.073	0.068	0.063	0.058	0.052
2016...	0.225	0.207	0.192	0.178	0.166	0.152	0.141	0.128	0.115	0.102	0.090	0.081	0.076	0.071	0.066	0.061	0.056	0.051	0.046
2017...	0.200	0.185	0.172	0.160	0.147	0.136	0.124	0.111	0.098	0.087	0.078	0.073	0.068	0.063	0.058	0.054	0.049	0.044	
2018...	0.179	0.166	0.155	0.142	0.132	0.120	0.107	0.095	0.084	0.075	0.071	0.066	0.061	0.057	0.052	0.047	0.043		
2019...	0.161	0.150	0.138	0.128	0.116	0.104	0.092	0.082	0.073	0.068	0.064	0.059	0.055	0.050	0.046	0.041			

Infection Spread: 4,000,000 at risk, high scenario to match CDC.
 Progression rates: Weibull, median 12 years, alpha 2.5.
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.
 Age/Sex Splits: 90% male, distribute all cases among ages 15-79.
 Included Deaths: 100% of infections after 1988.

TABLE B14—Continued

Calendar Year	Attained Age in 1986																	
	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
1986...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1987...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1988...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Attained Age in 1989																	
	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
1989...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1990...	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1991...	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
1992...	0.010	0.010	0.009	0.008	0.007	0.007	0.006	0.005	0.005	0.004	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.001
1993...	0.023	0.021	0.019	0.017	0.016	0.014	0.012	0.011	0.010	0.008	0.007	0.006	0.005	0.005	0.004	0.004	0.003	0.003
1994...	0.041	0.037	0.033	0.030	0.027	0.024	0.021	0.018	0.016	0.014	0.012	0.010	0.009	0.008	0.007	0.006	0.006	0.006
1995...	0.062	0.056	0.050	0.045	0.040	0.036	0.031	0.027	0.023	0.020	0.017	0.015	0.013	0.011	0.010	0.010	0.009	0.009
1996...	0.083	0.075	0.068	0.061	0.054	0.047	0.041	0.036	0.031	0.027	0.023	0.020	0.017	0.016	0.015	0.014	0.013	0.012
1997...	0.104	0.095	0.085	0.076	0.067	0.059	0.051	0.044	0.038	0.033	0.028	0.024	0.022	0.021	0.019	0.018	0.017	0.015
1998...	0.125	0.113	0.101	0.090	0.079	0.069	0.060	0.052	0.044	0.037	0.032	0.030	0.028	0.026	0.024	0.022	0.020	0.018
1999...	0.143	0.129	0.115	0.101	0.089	0.078	0.067	0.057	0.048	0.041	0.038	0.035	0.033	0.030	0.027	0.024	0.022	
2000...	0.158	0.141	0.125	0.110	0.096	0.083	0.070	0.059	0.050	0.047	0.043	0.040	0.036	0.033	0.029	0.026		
2001...	0.163	0.145	0.129	0.113	0.098	0.083	0.070	0.060	0.056	0.051	0.047	0.043	0.039	0.034	0.030			
2002...	0.164	0.146	0.129	0.112	0.096	0.081	0.070	0.065	0.059	0.054	0.049	0.044	0.039	0.034				
2003...	0.162	0.143	0.125	0.107	0.092	0.079	0.073	0.067	0.061	0.055	0.050	0.044	0.038					
2004...	0.156	0.136	0.118	0.101	0.087	0.080	0.074	0.067	0.061	0.054	0.048	0.041						
2005...	0.145	0.126	0.108	0.094	0.087	0.080	0.072	0.065	0.058	0.051	0.044							
2006...	0.129	0.112	0.097	0.090	0.083	0.076	0.069	0.061	0.054	0.047								
2007...	0.113	0.099	0.092	0.085	0.078	0.071	0.064	0.057	0.050									
2008...	0.099	0.093	0.086	0.079	0.072	0.066	0.059	0.052										
2009...	0.092	0.086	0.079	0.073	0.066	0.060	0.054											
2010...	0.084	0.078	0.072	0.066	0.060	0.054												
2011...	0.077	0.071	0.065	0.059	0.054													
2012...	0.069	0.064	0.058	0.052														
2013...	0.062	0.056																
2014...	0.054	0.049																
2015...	0.047																	
2016...																		
2017...																		
2018...																		
2019...																		

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Infection Spread: 4,000,000 at risk, middle scenario to match CDC.
 Progression Rates: Weibull, median 12 years, alpha 2.5.
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.
 Age/Sex Splits: 90% male, distribute all cases among ages 15-79.
 Included Deaths: 100% of infections after 1988.

APPENDIX C

“LOW” PROJECTION REPORT WITH MALE MORTALITY RATES

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AIDS Model Assumption Summary

Infection Spread: 4,000,000 at risk, low scenario to match CDC
 Progression Rates: Weibull, median 8 years, alpha 2.2
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher
 Age/Sex Splits: 90% male, distribute all cases among ages 15-79
 Included Deaths: 100% of all years' infections.

TABLE C1
 SUMMARY OF INFECTIONS AND CASES FOR LOW SCENARIO
 AT-RISK GROUP POPULATION: 4,000,000

Year <i>t</i>	<i>a(t)</i>	HIV Infections		AIDS Cases		CDC Smoothed/ Projected Cumulative
		Modeled New	Modeled Cumulative	Modeled New	Modeled Cumulative	
1975.....		296	296	0	0	
1976.....	1.030	533	829	2	2	
1977.....	0.940	1,293	2,122	11	13	
1978.....	0.850	2,839	4,960	36	49	
1979.....	0.840	6,511	11,471	95	144	
1980.....	0.830	14,738	26,209	232	377	
1981.....	0.820	32,807	59,016	545	922	348
1982.....	0.810	71,249	130,265	1,252	2,174	1,371
1983.....	0.600	100,904	231,169	2,820	4,994	4,227
1984.....	0.480	129,573	360,742	5,875	10,869	10,059
1985.....	0.330	123,949	484,691	10,924	21,793	21,016
1986.....	0.220	101,784	586,475	18,121	39,914	39,131
1987.....	0.150	79,119	665,593	26,989	66,903	67,107
1988.....	0.083	47,335	712,928	36,671	103,574	102,398
1989.....	0.056	33,401	746,330	46,111	149,685	147,535
1990.....	0.034	20,861	767,191	54,274	203,959	202,664
1991.....	0.020	12,477	779,668	60,415	264,374	267,401
1992.....	0.010	6,296	785,964	64,053	328,427	340,841
1993.....	0.006	3,796	789,760	65,012	393,439	
1994.....	0.005	3,174	792,934	63,409	456,849	
1995.....	0.004	2,546	795,480	59,618	516,467	
1996.....	0.003	1,914	797,394	54,176	570,643	
1997.....	0.002	1,278	798,671	47,679	618,322	
1998.....	0.001	639	799,311	40,711	659,034	
1999.....	0.001	640	799,951	33,776	692,810	
2000.....	0.001	640	800,591	27,267	720,076	
2001.....		640	801,231	21,453	741,529	
2002.....		640	801,871	16,481	758,011	
2003.....		640	802,511	12,391	770,402	
2004.....		640	803,151	9,144	779,546	
2005.....		640	803,792	6,649	786,196	
2006.....		640	804,432	4,790	790,985	
2007.....		640	805,072	3,443	794,428	
2008.....		640	805,712	2,492	796,920	
2009.....		640	806,352	1,839	798,759	
2010.....		640	806,992	1,400	800,160	
2011.....		640	807,633	1,112	801,272	
2012.....		640	808,273	927	802,199	
2013.....		640	808,913	811	803,011	
2014.....		640	809,553	740	803,751	
2015.....		640	810,193	697	804,448	
2016.....		640	810,833	672	805,120	
2017.....		640	811,474	657	805,777	
2018.....		640	812,114	649	806,427	
2019.....		640	812,754	645	807,072	

TABLE C2
ANNUAL NEW AIDS CASES PROJECTIONS FOR LOW SCENARIO

Year	Infected in Year							Total
	Before 1986	1986	1987	1988	1989	1990	After 1990	
1975	0	0	0	0	0	0	0	0
1976	2	0	0	0	0	0	0	2
1977	11	0	0	0	0	0	0	11
1978	36	0	0	0	0	0	0	36
1979	95	0	0	0	0	0	0	95
1980	232	0	0	0	0	0	0	232
1981	545	0	0	0	0	0	0	545
1982	1,252	0	0	0	0	0	0	1,252
1983	2,820	0	0	0	0	0	0	2,820
1984	5,875	0	0	0	0	0	0	5,875
1985	10,924	0	0	0	0	0	0	10,924
1986	18,121	0	0	0	0	0	0	18,121
1987	26,264	725	0	0	0	0	0	26,989
1988	33,545	2,563	563	0	0	0	0	36,671
1989	39,233	4,549	1,992	337	0	0	0	46,111
1990	42,892	6,417	3,536	1,192	238	0	0	54,274
1991	44,341	7,982	4,988	2,115	841	149	0	60,415
1992	43,648	9,110	6,204	2,984	1,493	525	89	64,053
1993	41,095	9,727	7,081	3,712	2,106	932	359	65,012
1994	37,113	9,820	7,561	4,237	2,619	1,315	743	63,409
1995	32,215	9,434	7,634	4,524	2,990	1,636	1,186	59,618
1996	26,914	8,659	7,333	4,567	3,192	1,867	1,643	54,176
1997	21,660	7,615	6,731	4,387	3,223	1,994	2,069	47,679
1998	16,805	6,427	5,919	4,027	3,096	2,013	2,425	40,711
1999	12,573	5,213	4,996	3,541	2,842	1,934	2,677	33,776
2000	9,075	4,068	4,052	2,989	2,499	1,775	2,809	27,267
2001	6,320	3,055	3,162	2,425	2,109	1,561	2,822	21,453
2002	4,247	2,209	2,374	1,892	1,711	1,317	2,732	16,481
2003	2,754	1,538	1,717	1,421	1,335	1,068	2,559	12,391
2004	1,723	1,032	1,196	1,027	1,002	834	2,330	9,144
2005	1,040	667	802	715	725	626	2,074	6,649
2006	606	415	519	480	505	453	1,813	4,790
2007	340	249	323	310	339	315	1,566	3,443
2008	184	144	194	193	219	212	1,347	2,492
2009	96	80	112	116	136	137	1,161	1,839
2010	49	43	62	67	82	85	1,012	1,400
2011	24	22	33	37	47	51	897	1,112
2012	11	11	17	20	26	30	812	927
2013	5	5	9	10	14	16	752	811
2014	2	2	4	5	7	9	710	740
2015	1	1	2	2	4	5	683	697
2016	0	0	1	1	2	2	665	672
2017	0	0	0	1	1	1	654	657
2018	0	0	0	0	0	1	648	649
2019	0	0	0	0	0	0	644	645

Infection Spread: 4,000,000 at risk, low scenario to match CDC.
 Progression Rates: Weibull, median 8 years, alpha 2.2.

TABLE C3
CUMULATIVE NEW AIDS CASES PROJECTIONS FOR LOW SCENARIO

Year	Infected in Year							Total
	Before 1986	1986	1987	1988	1989	1990	After 1990	
1975	0	0	0	0	0	0	0	0
1976	2	0	0	0	0	0	0	2
1977	13	0	0	0	0	0	0	13
1978	49	0	0	0	0	0	0	49
1979	144	0	0	0	0	0	0	144
1980	377	0	0	0	0	0	0	377
1981	922	0	0	0	0	0	0	922
1982	2,174	0	0	0	0	0	0	2,174
1983	4,994	0	0	0	0	0	0	4,994
1984	10,869	0	0	0	0	0	0	10,869
1985	21,793	0	0	0	0	0	0	21,793
1986	39,914	0	0	0	0	0	0	39,914
1987	66,178	725	0	0	0	0	0	66,903
1988	99,723	3,287	563	0	0	0	0	103,574
1989	138,957	7,836	2,555	337	0	0	0	149,685
1990	181,849	14,253	6,091	1,529	238	0	0	203,959
1991	226,190	22,234	11,079	3,644	1,079	149	0	264,374
1992	269,838	31,344	17,283	6,628	2,571	674	89	328,427
1993	310,932	41,072	24,364	10,340	4,677	1,606	448	393,439
1994	348,046	50,892	31,926	14,577	7,296	2,921	1,191	456,849
1995	380,261	60,326	39,559	19,101	10,286	4,557	2,377	516,467
1996	407,175	68,985	46,893	23,668	13,478	6,424	4,020	570,643
1997	428,835	76,600	53,624	28,055	16,701	8,418	6,090	618,322
1998	445,640	83,027	59,543	32,082	19,797	10,430	8,514	659,034
1999	458,213	88,241	64,539	35,623	22,638	12,364	11,191	692,810
2000	467,288	92,308	68,591	38,612	25,137	14,139	14,000	720,076
2001	473,608	95,363	71,753	41,037	27,246	15,699	16,823	741,529
2002	477,855	97,572	74,127	42,929	28,957	17,017	19,554	758,011
2003	480,609	99,110	75,844	44,349	30,292	18,085	22,113	770,402
2004	482,332	100,142	77,040	45,376	31,294	18,919	24,443	779,546
2005	483,372	100,809	77,842	46,092	32,019	19,545	26,517	786,196
2006	483,978	101,224	78,361	46,572	32,524	19,998	28,330	790,985
2007	484,318	101,473	78,684	46,882	32,863	20,313	29,896	794,428
2008	484,503	101,618	78,877	47,075	33,081	20,524	31,242	796,920
2009	484,599	101,698	78,989	47,191	33,218	20,661	32,404	798,759
2010	484,648	101,741	79,052	47,258	33,300	20,746	33,416	800,160
2011	484,671	101,763	79,085	47,295	33,347	20,797	34,313	801,272
2012	484,682	101,774	79,102	47,315	33,373	20,827	35,125	802,199
2013	484,687	101,779	79,111	47,326	33,387	20,843	35,877	803,011
2014	484,689	101,782	79,115	47,331	33,395	20,852	36,587	803,751
2015	484,690	101,783	79,117	47,333	33,398	20,857	37,269	804,448
2016	484,691	101,783	79,118	47,334	33,400	20,859	37,935	805,120
2017	484,691	101,784	79,118	47,335	33,401	20,860	38,589	805,777
2018	484,691	101,784	79,118	47,335	33,401	20,861	39,237	806,427
2019	484,691	101,784	79,119	47,335	33,401	20,861	39,881	807,072
Left	0	0	0	0	0	0	5,682	5,682
Pct	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	12.47%	0.70%

Infection Spread: 4,000,000 at risk, low scenario to match CDC.
 Progression Rates: Weibull, median 8 years, alpha 2.2.

TABLE C4
ANNUAL AIDS DEATHS PROJECTIONS FOR LOW SCENARIO

Year	Infected in Year						After 1990	Total
	Before 1986	1986	1987	1988	1989	1990		
1975..	0	0	0	0	0	0	0	0
1976..	1	0	0	0	0	0	0	1
1977..	4	0	0	0	0	0	0	4
1978..	13	0	0	0	0	0	0	13
1979..	39	0	0	0	0	0	0	39
1980..	99	0	0	0	0	0	0	99
1981..	237	0	0	0	0	0	0	237
1982..	553	0	0	0	0	0	0	553
1983..	1,259	0	0	0	0	0	0	1,259
1984..	2,719	0	0	0	0	0	0	2,719
1985..	5,372	0	0	0	0	0	0	5,372
1986..	8,980	0	0	0	0	0	0	8,980
1987..	13,938	163	0	0	0	0	0	14,101
1988..	20,050	802	127	0	0	0	0	20,979
1989..	29,161	1,946	624	76	0	0	0	28,806
1990..	31,462	3,366	1,512	373	54	0	0	36,767
1991..	35,512	4,842	2,617	905	263	33	0	44,173
1992..	38,030	6,202	3,764	1,566	639	164	20	50,385
1993..	38,918	7,319	4,821	2,252	1,105	399	108	54,922
1994..	38,250	8,103	5,689	2,884	1,589	690	294	57,499
1995..	36,240	8,509	6,299	3,404	2,035	992	568	58,046
1996..	33,199	8,535	6,614	3,768	2,402	1,271	903	56,693
1997..	29,482	8,220	6,635	3,957	2,659	1,500	1,269	53,722
1998..	25,439	7,629	6,389	3,969	2,792	1,661	1,632	49,511
1999..	21,376	6,844	5,930	3,823	2,801	1,744	1,960	44,478
2000..	17,533	5,952	5,320	3,548	2,697	1,749	2,226	39,025
2001..	14,071	5,031	4,627	3,183	2,503	1,685	2,410	33,510
2002..	11,078	4,143	3,911	2,768	2,246	1,563	2,506	28,215
2003..	8,580	3,334	3,221	2,340	1,953	1,403	2,515	23,345
2004..	6,555	2,628	2,592	1,927	1,651	1,220	2,450	19,022
2005..	4,955	2,036	2,043	1,550	1,360	1,031	2,324	15,300
2006..	3,717	1,555	1,583	1,222	1,094	849	2,157	12,177
2007..	2,773	1,175	1,209	947	863	683	1,966	9,616
2008..	2,064	880	913	723	668	539	1,769	7,556
2009..	1,534	656	684	546	510	417	1,578	5,926
2010..	1,140	488	510	409	386	319	1,402	4,654
2011..	849	362	379	305	289	241	1,247	3,672
2012..	633	269	282	227	215	180	1,116	2,922
2013..	472	200	209	168	160	134	1,007	2,352
2014..	353	149	156	125	119	100	920	1,922
2015..	264	111	116	93	88	74	852	1,599
2016..	198	83	87	69	66	55	799	1,357
2017..	148	62	65	52	49	41	759	1,176
2018..	111	47	48	39	37	31	729	1,041
2019..	83	35	36	29	27	23	706	940

Infection Spread: 4,000,000 at risk, low scenario to match CDC.
 Progression Rates: Weibull, median 8 years, alpha 2.2.
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.

TABLE C5
 CUMULATIVE AIDS DEATHS PROJECTIONS FOR LOW SCENARIO

Year	Infected in Year							Total
	Before 1986	1986	1987	1988	1989	1990	After 1990	
1975.....	0	0	0	0	0	0	0	0
1976.....	1	0	0	0	0	0	0	1
1977.....	4	0	0	0	0	0	0	4
1978.....	18	0	0	0	0	0	0	18
1979.....	56	0	0	0	0	0	0	56
1980.....	155	0	0	0	0	0	0	155
1981.....	392	0	0	0	0	0	0	392
1982.....	945	0	0	0	0	0	0	945
1983.....	2,203	0	0	0	0	0	0	2,203
1984.....	4,922	0	0	0	0	0	0	4,922
1985.....	10,293	0	0	0	0	0	0	10,293
1986.....	19,273	0	0	0	0	0	0	19,273
1987.....	33,211	163	0	0	0	0	0	33,374
1988.....	53,260	966	127	0	0	0	0	54,353
1989.....	79,421	2,911	751	76	0	0	0	83,159
1990.....	110,883	6,278	2,263	449	54	0	0	119,926
1991.....	146,395	11,120	4,880	1,354	317	33	0	164,099
1992.....	184,426	17,322	8,644	2,919	955	198	20	214,484
1993.....	223,344	24,640	13,465	5,171	2,060	597	128	269,406
1994.....	261,594	32,743	19,154	8,056	3,649	1,287	423	326,905
1995.....	297,833	41,252	25,452	11,459	5,684	2,279	991	384,951
1996.....	331,032	49,788	32,066	15,227	8,086	3,550	1,894	441,644
1997.....	360,514	58,008	38,701	19,185	10,745	5,050	3,163	495,366
1998.....	385,953	65,636	45,090	23,154	13,537	6,711	4,796	544,877
1999.....	407,329	72,480	51,020	26,977	16,338	8,455	6,756	589,355
2000.....	424,862	78,432	56,340	30,524	19,036	10,204	8,981	628,381
2001.....	438,934	83,463	60,967	33,707	21,539	11,889	11,391	661,890
2002.....	450,012	87,606	64,878	36,475	23,785	13,452	13,897	690,106
2003.....	458,592	90,940	68,098	38,815	25,738	14,855	16,412	713,451
2004.....	465,147	93,569	70,690	40,742	27,389	16,075	18,862	732,473
2005.....	470,102	95,605	72,733	42,292	28,749	17,106	21,186	747,773
2006.....	473,819	97,161	74,316	43,515	29,843	17,955	23,342	759,951
2007.....	476,592	98,335	75,525	44,462	30,706	18,639	25,309	769,567
2008.....	478,656	99,216	76,438	45,185	31,374	19,177	27,078	777,123
2009.....	480,190	99,872	77,122	45,731	31,884	19,595	28,656	783,050
2010.....	481,330	100,359	77,632	46,141	32,270	19,913	30,058	787,703
2011.....	482,179	100,722	78,011	46,446	32,559	20,154	31,305	791,376
2012.....	482,811	100,991	78,293	46,673	32,774	20,335	32,421	794,297
2013.....	483,284	101,191	78,502	46,841	32,934	20,469	33,428	796,649
2014.....	483,637	101,340	78,658	46,966	33,053	20,569	34,349	798,572
2015.....	483,901	101,452	78,774	47,060	33,141	20,643	35,201	800,171
2016.....	484,098	101,535	78,860	47,129	33,207	20,698	36,000	801,528
2017.....	484,247	101,597	78,925	47,181	33,256	20,739	36,759	802,704
2018.....	484,358	101,644	78,974	47,219	33,292	20,770	37,487	803,745
2019.....	484,441	101,679	79,010	47,248	33,320	20,793	38,194	804,684
Left	250	105	109	87	82	68	7,370	8,069
Pct	0.05%	0.10%	0.14%	0.18%	0.24%	0.33%	16.17%	0.99%

Infection Spread: 4,000,000 at risk, low scenario to match CDC.
 Progression Rates: Weibull, median 8 years, alpha 2.2.
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.

TABLE C6

MALE GENERAL POPULATION AIDS MORTALITY RATES PER THOUSAND LIVES FOR LOW SCENARIO

Calendar Year	Attained Age in 1986																		
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1986...			0.000	0.000	0.000	0.003	0.007	0.012	0.017	0.021	0.026	0.038	0.053	0.070	0.087	0.104	0.121	0.140	0.157
1987...			0.000	0.000	0.004	0.012	0.019	0.027	0.034	0.042	0.061	0.085	0.112	0.139	0.165	0.190	0.218	0.244	0.267
1988...		0.000	0.000	0.006	0.018	0.029	0.041	0.052	0.064	0.093	0.129	0.169	0.209	0.247	0.284	0.322	0.359	0.391	0.415
	Attained Age in 1989																		
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
1989...	0.000	0.000	0.009	0.025	0.041	0.058	0.074	0.090	0.130	0.180	0.235	0.290	0.341	0.390	0.440	0.487	0.528	0.559	0.580
1990...	0.000	0.011	0.033	0.054	0.075	0.097	0.118	0.170	0.234	0.305	0.375	0.439	0.499	0.559	0.615	0.664	0.701	0.726	0.742
1991...	0.013	0.039	0.066	0.092	0.118	0.144	0.208	0.288	0.375	0.463	0.540	0.612	0.682	0.748	0.803	0.845	0.871	0.885	0.888
1992...	0.045	0.076	0.106	0.136	0.166	0.241	0.336	0.440	0.542	0.632	0.713	0.791	0.863	0.924	0.967	0.993	1.004	1.002	0.989
1993...	0.083	0.117	0.150	0.184	0.268	0.375	0.493	0.607	0.707	0.794	0.878	0.953	1.015	1.058	1.081	1.087	1.079	1.060	1.033
1994...	0.124	0.159	0.195	0.286	0.403	0.530	0.654	0.760	0.850	0.935	1.010	1.071	1.112	1.131	1.132	1.118	1.093	1.061	1.017
1995...	0.163	0.199	0.295	0.417	0.551	0.680	0.788	0.878	0.961	1.033	1.090	1.127	1.142	1.136	1.116	1.086	1.050	1.005	0.946
1996...	0.194	0.289	0.411	0.543	0.671	0.780	0.871	0.957	1.032	1.090	1.127	1.140	1.130	1.105	1.069	1.030	0.981	0.919	0.851
1997...	0.275	0.392	0.519	0.643	0.748	0.839	0.925	1.000	1.059	1.095	1.105	1.091	1.061	1.022	0.979	0.929	0.866	0.798	0.733
1998...	0.364	0.483	0.600	0.699	0.786	0.870	0.943	1.001	1.035	1.042	1.025	0.992	0.950	0.906	0.856	0.794	0.728	0.665	0.611
1999...	0.438	0.545	0.637	0.718	0.798	0.868	0.923	0.954	0.958	0.939	0.904	0.861	0.817	0.768	0.710	0.648	0.588	0.538	0.499
2000...	0.484	0.566	0.641	0.715	0.780	0.831	0.860	0.860	0.841	0.805	0.762	0.720	0.674	0.620	0.563	0.509	0.463	0.428	0.399
2001...	0.486	0.551	0.617	0.675	0.721	0.748	0.751	0.735	0.706	0.670	0.633	0.592	0.543	0.490	0.441	0.399	0.367	0.341	0.318
2002...	0.465	0.522	0.573	0.614	0.638	0.642	0.630	0.607	0.577	0.546	0.510	0.466	0.419	0.375	0.337	0.309	0.285	0.265	0.246
2003...	0.434	0.478	0.513	0.535	0.539	0.531	0.513	0.489	0.463	0.432	0.394	0.352	0.313	0.280	0.255	0.234	0.217	0.201	0.185
2004...	0.393	0.423	0.441	0.446	0.441	0.427	0.408	0.387	0.361	0.328	0.292	0.258	0.229	0.207	0.190	0.174	0.161	0.148	0.135
2005...	0.344	0.360	0.365	0.361	0.351	0.337	0.320	0.298	0.270	0.239	0.209	0.185	0.167	0.152	0.139	0.127	0.117	0.106	0.097
2006...	0.286	0.291	0.289	0.282	0.271	0.258	0.241	0.218	0.194	0.170	0.151	0.136	0.123	0.112	0.102	0.093	0.084	0.077	0.070
2007...	0.230	0.229	0.224	0.216	0.206	0.193	0.176	0.156	0.138	0.122	0.110	0.099	0.090	0.082	0.074	0.067	0.060	0.054	0.049
2008...	0.181	0.177	0.172	0.164	0.154	0.140	0.125	0.111	0.098	0.088	0.080	0.072	0.065	0.058	0.052	0.047	0.042	0.038	0.035
2009...	0.140	0.136	0.131	0.123	0.112	0.100	0.089	0.079	0.071	0.064	0.057	0.051	0.046	0.041	0.037	0.033	0.030	0.027	0.025
2010...	0.108	0.104	0.098	0.090	0.081	0.072	0.064	0.057	0.051	0.046	0.041	0.036	0.032	0.029	0.025	0.023	0.021	0.019	0.018
2011...	0.082	0.077	0.071	0.064	0.056	0.050	0.045	0.040	0.036	0.032	0.028	0.025	0.023	0.020	0.018	0.016	0.015	0.014	0.014
2012...	0.061	0.056	0.051	0.045	0.040	0.036	0.032	0.029	0.026	0.023	0.020	0.018	0.016	0.014	0.013	0.012	0.011	0.011	0.011
2013...	0.045	0.041	0.036	0.032	0.029	0.026	0.023	0.021	0.018	0.016	0.014	0.013	0.012	0.010	0.010	0.009	0.009	0.009	0.008
2014...	0.033	0.030	0.026	0.024	0.021	0.019	0.017	0.015	0.013	0.012	0.011	0.009	0.009	0.008	0.007	0.007	0.007	0.007	0.006
2015...	0.025	0.022	0.020	0.018	0.016	0.014	0.012	0.011	0.010	0.009	0.008	0.007	0.007	0.006	0.006	0.006	0.006	0.005	0.005
2016...	0.019	0.017	0.015	0.013	0.012	0.011	0.009	0.008	0.007	0.007	0.006	0.006	0.005	0.005	0.005	0.005	0.004	0.004	0.004
2017...	0.014	0.013	0.012	0.010	0.009	0.008	0.007	0.006	0.006	0.005	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.003	0.003
2018...	0.011	0.010	0.009	0.008	0.007	0.006	0.006	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.003	0.003	0.002
2019...	0.009	0.008	0.007	0.006	0.006	0.005	0.005	0.004	0.004	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.002	0.002	0.002

Infection Spread: 4,000,000 at risk, low scenario to match CDC.
 Progression Rates: Weibull, median 8 years, alpha 2.2.
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.
 Age/Sex Splits: 90% male, distribute all cases among ages 15-79.
 Included Deaths: 100% of all years' infections.

TABLE C6—Continued

Calendar Year	Attained Age in 1986																		
	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
1986...	0.173	0.185	0.192	0.196	0.197	0.196	0.195	0.192	0.187	0.181	0.174	0.167	0.160	0.152	0.144	0.136	0.128	0.119	0.109
1987...	0.284	0.295	0.301	0.303	0.303	0.300	0.293	0.284	0.272	0.259	0.247	0.237	0.226	0.215	0.204	0.193	0.180	0.165	0.151
1988...	0.431	0.440	0.443	0.442	0.437	0.426	0.409	0.388	0.367	0.348	0.333	0.319	0.305	0.291	0.275	0.258	0.238	0.219	0.201
	Attained Age in 1989																		
	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
1989...	0.592	0.597	0.596	0.588	0.571	0.544	0.512	0.481	0.454	0.434	0.416	0.399	0.382	0.364	0.341	0.317	0.293	0.270	0.249
1990...	0.748	0.747	0.736	0.712	0.674	0.630	0.587	0.552	0.526	0.506	0.487	0.469	0.447	0.421	0.393	0.365	0.337	0.314	0.295
1991...	0.882	0.866	0.836	0.791	0.739	0.687	0.645	0.613	0.585	0.561	0.537	0.511	0.481	0.449	0.418	0.388	0.362	0.342	0.326
1992...	0.967	0.932	0.880	0.822	0.764	0.715	0.677	0.644	0.614	0.585	0.555	0.522	0.488	0.455	0.425	0.398	0.377	0.362	0.348
1993...	0.993	0.937	0.874	0.812	0.759	0.716	0.679	0.644	0.611	0.578	0.543	0.509	0.475	0.445	0.419	0.398	0.383	0.371	0.357
1994...	0.959	0.893	0.829	0.774	0.729	0.687	0.650	0.614	0.579	0.544	0.510	0.478	0.448	0.423	0.404	0.391	0.380	0.367	0.350
1995...	0.881	0.817	0.762	0.715	0.672	0.633	0.596	0.560	0.526	0.493	0.463	0.436	0.413	0.396	0.385	0.375	0.365	0.349	0.327
1996...	0.785	0.729	0.682	0.640	0.602	0.566	0.532	0.497	0.464	0.434	0.406	0.383	0.367	0.357	0.350	0.341	0.328	0.308	0.285
1997...	0.676	0.631	0.591	0.556	0.523	0.490	0.457	0.425	0.394	0.368	0.346	0.331	0.323	0.317	0.310	0.299	0.282	0.262	0.240
1998...	0.568	0.532	0.500	0.470	0.440	0.409	0.378	0.350	0.325	0.304	0.291	0.284	0.280	0.275	0.266	0.251	0.234	0.216	0.197
1999...	0.466	0.438	0.411	0.385	0.357	0.329	0.303	0.280	0.261	0.250	0.244	0.241	0.238	0.230	0.219	0.205	0.190	0.174	0.160
2000...	0.375	0.352	0.329	0.304	0.279	0.256	0.236	0.220	0.210	0.205	0.203	0.201	0.195	0.186	0.175	0.163	0.150	0.138	0.127
2001...	0.297	0.277	0.255	0.234	0.214	0.197	0.183	0.174	0.170	0.167	0.164	0.159	0.151	0.143	0.133	0.123	0.114	0.105	0.095
2002...	0.228	0.210	0.192	0.176	0.162	0.150	0.142	0.138	0.135	0.132	0.128	0.121	0.114	0.107	0.100	0.092	0.085	0.078	0.070
2003...	0.169	0.155	0.142	0.130	0.121	0.114	0.110	0.107	0.105	0.101	0.096	0.090	0.085	0.079	0.074	0.068	0.062	0.057	0.051
2004...	0.123	0.113	0.104	0.096	0.090	0.087	0.084	0.082	0.078	0.075	0.070	0.066	0.062	0.058	0.054	0.049	0.045	0.041	0.037
2005...	0.089	0.081	0.075	0.071	0.067	0.065	0.063	0.060	0.057	0.054	0.051	0.048	0.045	0.042	0.039	0.035	0.032	0.029	0.026
2006...	0.064	0.059	0.055	0.052	0.050	0.049	0.047	0.044	0.042	0.039	0.036	0.034	0.032	0.029	0.027	0.025	0.022	0.020	0.018
2007...	0.045	0.042	0.040	0.039	0.038	0.036	0.034	0.032	0.030	0.027	0.026	0.024	0.022	0.020	0.019	0.017	0.015	0.014	0.012
2008...	0.032	0.031	0.030	0.029	0.027	0.026	0.024	0.022	0.021	0.019	0.018	0.016	0.015	0.014	0.013	0.012	0.010	0.009	0.008
2009...	0.024	0.023	0.022	0.021	0.020	0.018	0.017	0.016	0.014	0.013	0.012	0.011	0.011	0.010	0.009	0.008	0.007	0.006	0.005
2010...	0.017	0.017	0.016	0.015	0.014	0.013	0.012	0.011	0.010	0.009	0.009	0.008	0.007	0.007	0.006	0.005	0.005	0.004	0.004
2011...	0.013	0.013	0.012	0.011	0.010	0.009	0.009	0.008	0.007	0.007	0.006	0.006	0.005	0.005	0.004	0.004	0.003	0.003	0.003
2012...	0.010	0.009	0.009	0.008	0.007	0.007	0.006	0.006	0.005	0.005	0.005	0.004	0.004	0.003	0.003	0.003	0.002	0.002	0.002
2013...	0.008	0.007	0.006	0.006	0.005	0.005	0.005	0.004	0.004	0.004	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002
2014...	0.006	0.005	0.005	0.004	0.004	0.004	0.004	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001
2015...	0.004	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001
2016...	0.003	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
2017...	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
2018...	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
2019...	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000			

Infection Spread: 4,000,000 at risk, low scenario to match CDC.
 Progression Rates: Weibull, median 8 years, alpha 2.2.
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.
 Age/Sex Splits: 90% male, distribute all cases among ages 15-79.
 Included Deaths: 100% of all years' infections.

TABLE C6—Continued

Calendar Year	Attained Age in 1986																	
	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
1986...	0.099	0.090	0.081	0.075	0.069	0.064	0.059	0.054	0.049	0.044	0.040	0.036	0.032	0.028	0.026	0.023	0.020	0.018
1987...	0.138	0.126	0.116	0.108	0.101	0.094	0.086	0.079	0.071	0.063	0.056	0.050	0.045	0.040	0.036	0.032	0.029	0.025
1988...	0.184	0.171	0.160	0.150	0.141	0.130	0.119	0.107	0.095	0.084	0.075	0.066	0.059	0.053	0.046	0.042	0.037	0.032
	Attained Age in 1989																	
	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
1989...	0.233	0.219	0.207	0.195	0.182	0.166	0.149	0.132	0.117	0.103	0.091	0.081	0.072	0.063	0.057	0.050	0.044	0.038
1990...	0.279	0.266	0.251	0.235	0.215	0.193	0.171	0.150	0.132	0.116	0.103	0.091	0.079	0.071	0.062	0.055	0.048	0.042
1991...	0.312	0.297	0.279	0.257	0.232	0.206	0.181	0.160	0.141	0.125	0.111	0.096	0.086	0.075	0.065	0.057	0.050	0.044
1992...	0.333	0.314	0.290	0.263	0.235	0.208	0.184	0.164	0.145	0.128	0.111	0.098	0.085	0.074	0.065	0.056	0.050	0.047
1993...	0.338	0.314	0.286	0.257	0.228	0.203	0.181	0.160	0.140	0.122	0.107	0.093	0.080	0.070	0.061	0.053	0.050	0.047
1994...	0.326	0.299	0.270	0.241	0.215	0.192	0.169	0.148	0.128	0.112	0.097	0.084	0.072	0.063	0.054	0.051	0.048	0.046
1995...	0.301	0.273	0.245	0.219	0.196	0.173	0.151	0.131	0.113	0.098	0.084	0.072	0.062	0.054	0.051	0.048	0.045	0.042
1996...	0.260	0.235	0.211	0.190	0.168	0.148	0.128	0.112	0.097	0.083	0.071	0.061	0.053	0.050	0.047	0.044	0.040	0.037
1997...	0.218	0.198	0.178	0.159	0.140	0.123	0.107	0.093	0.080	0.068	0.058	0.050	0.047	0.044	0.041	0.038	0.035	0.032
1998...	0.180	0.163	0.146	0.130	0.114	0.100	0.087	0.074	0.063	0.054	0.046	0.043	0.040	0.037	0.034	0.031	0.028	0.025
1999...	0.145	0.131	0.117	0.103	0.090	0.079	0.068	0.058	0.049	0.041	0.039	0.036	0.033	0.030	0.028	0.025	0.022	
2000...	0.114	0.102	0.091	0.080	0.070	0.060	0.051	0.043	0.036	0.034	0.031	0.029	0.026	0.024	0.021	0.019		
2001...	0.086	0.076	0.068	0.060	0.051	0.044	0.037	0.032	0.029	0.027	0.025	0.023	0.020	0.018	0.016			
2002...	0.063	0.056	0.050	0.043	0.037	0.031	0.027	0.025	0.023	0.021	0.019	0.017	0.015	0.013				
2003...	0.046	0.041	0.035	0.030	0.026	0.022	0.021	0.019	0.017	0.016	0.014	0.012	0.011					
2004...	0.033	0.029	0.025	0.021	0.018	0.017	0.016	0.014	0.013	0.011	0.010	0.009						
2005...	0.023	0.020	0.017	0.015	0.014	0.013	0.011	0.010	0.009	0.008	0.007							
2006...	0.015	0.013	0.012	0.011	0.010	0.009	0.008	0.007	0.007	0.006								
2007...	0.010	0.009	0.008	0.008	0.007	0.007	0.006	0.005										
2008...	0.007	0.007	0.006	0.006	0.005	0.005	0.004	0.004										
2009...	0.005	0.005	0.004	0.004	0.004	0.003	0.003											
2010...	0.004	0.003	0.003	0.003	0.003	0.002												
2011...	0.003	0.002	0.002	0.002	0.002													
2012...	0.002	0.002	0.002	0.001														
2013...	0.001	0.001	0.001															
2014...	0.001	0.001																
2015...	0.001																	
2016...																		
2017...																		
2018...																		
2019...																		

Infection Spread: 4,000,000 at risk, low scenario to match CDC.
 Progression Rates: Weibull, median 8 years, alpha 2.2.
 Mortality after Diagnosis: 4%-40%-35%-25%; cases before 1986 higher.
 Age/Sex Splits: 90% male, distribute all cases among ages 15-79.
 Included Deaths: 100% of all years' infections.

TABLE C7

WEIBULL FUNCTION AIDS PROGRESSION RATES FOR LOW SCENARIO

2.2 Alpha 0.1058 Lambda 8 Median Year					
Years from HIV Infection	Annual Rate of Progress to AIDS	Cumulative Progressed to AIDS Diagnosis	Annual Progressed to AIDS Diagnosis	Years from HIV Infection	Assumed Annual Progressed to AIDS Diagnosis
1	0.71%	0.71%	0.71%	0	0.00%
2	2.54	3.23	2.52	1	0.71
3	4.62	7.70	4.47	2	2.52
4	6.83	14.00	6.30	3	4.47
5	9.12	21.84	7.84	4	6.30
6	11.45	30.79	8.95	5	7.84
7	13.81	40.35	9.56	6	8.95
8	16.18	50.00	9.65	7	9.56
9	18.54	59.27	9.27	8	9.65
10	20.89	67.78	8.51	9	9.27
11	23.22	75.26	7.48	10	8.51
12	25.52	81.57	6.31	11	7.48
13	27.80	86.69	5.12	12	6.31
14	30.03	90.69	4.00	13	5.12
15	32.24	93.69	3.00	14	4.00
16	34.40	95.86	2.17	15	3.00
17	36.52	97.37	1.51	16	2.17
18	38.59	98.39	1.01	17	1.51
19	40.62	99.04	0.66	18	1.01
20	42.61	99.45	0.41	19	0.66
21	44.55	99.70	0.24	20	0.41
22	46.44	99.84	0.14	21	0.24
23	48.28	99.92	0.08	22	0.14
24	50.07	99.96	0.04	23	0.08
25	51.82	99.98	0.02	24	0.04
26	53.52	99.99	0.01	25	0.02
27	55.17	100.00	0.01	26	0.01
28	56.78	100.00	0.00	27	0.01
29	58.34	100.00	0.00	28	0.00
30	59.85	100.00	0.00	29	0.00
31	61.32	100.00	0.00	30	0.00
32	62.74	100.00	0.00	31	0.00
33	64.12	100.00	0.00	32	0.00
34	65.46	100.00	0.00	33	0.00
35	66.75	100.00	0.00	34	0.00
36	68.00	100.00	0.00	35	0.00
37	69.22	100.00	0.00	36	0.00
38	70.39	100.00	0.00	37	0.00
39	71.52	100.00	0.00	38	0.00
40	72.62	100.00	0.00	39	0.00
41	73.68	100.00	0.00	40	0.00
42	74.70	100.00	0.00	41	0.00
43	75.69	100.00	0.00	42	0.00
44	76.63	100.00	0.00	43	0.00
				44	0.00

Cumulative progressed at year $T = \hat{e} \left(- (\text{Lambda} \times T) \hat{\text{Alpha}} \right)$.
 Lambda is used to achieve median survival at end of year chosen.

TABLE C10
ASSUMPTIONS FOR INCLUDING DEATHS
IN MORTALITY CALCULATIONS
FOR LOW SCENARIO

Inclusion Factors for Cases Infected
100.00% before 1986
100.00% infected 1986
100.00% infected 1987
100.00% infected 1988
100.00% infected 1989
100.00% infected 1990
100.00% after 1990

TABLE C11
U.S. GENERAL POPULATION PROJECTIONS (IN THOUSANDS) FOR LOW SCENARIO

Ages	1986	1990	1995	2000	2005	2010
Male						
15-19	9,483	8,865	8,944	9,735	9,928	9,605
20-24	10,232	9,244	8,647	8,706	9,470	9,648
25-29	11,026	10,708	9,416	8,808	8,847	8,595
30-34	10,367	11,195	10,987	9,680	9,070	9,108
35-39	9,256	10,026	11,092	10,882	9,599	8,991
40-44	7,030	8,691	9,944	10,995	10,792	9,527
45-49	5,817	6,809	8,580	9,822	10,871	10,677
50-54	5,260	5,590	6,705	8,467	9,706	10,748
55-59	5,359	5,070	5,386	6,478	8,195	9,403
60-64	5,097	5,032	4,763	5,078	6,126	7,770
65-69	4,377	4,655	4,603	4,382	4,705	5,695
70-74	3,268	3,516	3,873	3,860	3,702	3,996
75-79	2,197	2,413	2,668	2,971	2,994	2,894
0+	117,360	121,775	126,654	130,722	134,390	137,865
Female						
15-19	9,128	8,516	8,585	9,340	9,512	9,198
20-24	10,185	9,238	8,629	8,688	9,432	9,599
25-29	10,984	10,678	9,424	8,804	8,850	9,590
30-34	10,407	11,147	10,937	9,661	9,034	9,082
35-39	9,467	10,146	11,105	10,890	9,627	9,002
40-44	7,316	8,964	10,125	11,074	10,863	9,612
45-49	6,110	7,132	8,903	10,057	11,005	10,799
50-54	5,627	5,948	7,102	8,870	10,029	10,976
55-59	5,909	5,552	5,842	6,981	8,722	9,856
60-64	5,865	5,708	5,333	5,620	6,720	8,401
65-69	5,285	5,596	5,453	5,109	5,402	6,467
70-74	4,396	4,605	5,001	4,892	4,602	4,880
75-79	3,432	3,691	3,939	4,311	4,251	4,020
0+	123,718	128,116	132,965	137,025	140,695	144,190

Notes

CDC projection data, used to calibrate the model, are the set developed by the ACLI/HIAA ad hoc group on AIDS data. The data through 1987 are CDC reported results, adjusted for reporting delays and for smoothness. The projected data are the CDC's projection updated in early 1988, reduced to eliminate the 10 percent increase made by the CDC to account for cases that will never be reported.

Three sets of progression rates (from HIV infection to AIDS diagnosis) have been developed by the ACLI/HIAA Ad Hoc Group on AIDS data. Each is based on the Weibull function shown in Table C7, having the following parameters:

Alpha	Median Year	Name	Set to approximate
2.5	12 yrs	"Slow"	CDC 95% confidence lower bound
2.1	10	"Expected"	SFCC/CDC study best estimate rates
2.2	8	"Fast"	CDC 95% confidence upper bound

Mortality rates after AIDS diagnosis are based on the assumption that all cases are diagnosed in the middle of the calendar year. The annual death rates after AIDS diagnosis are converted to calendar year rates by assuming that the half-year rate is the square root of the annual rate.

Once AIDS deaths have been modeled, they are split by sex and then into five-year age groups. The age group percentages are derived from the distribution by age at death for AIDS deaths reported in the U.S. through the second quarter of 1988. These sex/age cells of modeled AIDS deaths are the numerator for the mortality rate calculations.

The AIDS deaths included in the calculation of AIDS mortality rates are adjusted by the "Infection Year Inclusion Factors." These factors reflect HIV-testing at the time of issue. For example, new issues that are HIV tested should produce AIDS mortality results consistent with calculations made excluding the deaths from those infected prior to the year of issue.

AIDS mortality rates are calculated assuming the U.S. population projection contained in the U.S. Dept. of Commerce report Series P-25, No. 1017: "Projections of the Population of States by Age, Sex, and Race: 1988 to 2010." Linear interpolation is used to estimate the population between the projection years shown in the population assumptions. Stationary population is assumed after 2010.

TABLE C12

CALCULATION FOR INFECTION SPREAD FOR LOW SCENARIO

Year t	a[t]	1- $\hat{e}(-a[t])$	delta p[t]	p[t]
1975.....				0.00740%
1976.....	1.030	0.64299	0.00013	0.02
1977.....	0.940	0.60937	0.00032	0.05
1978.....	0.850	0.57258	0.00070	0.12
1979.....	0.840	0.56828	0.00162	0.29
1980.....	0.830	0.56395	0.00368	0.66
1981.....	0.820	0.55956	0.00820	1.48
1982.....	0.810	0.55514	0.01781	3.26
1983.....	0.600	0.45118	0.02522	5.78
1984.....	0.480	0.38121	0.03239	9.02
1985.....	0.330	0.28107	0.03098	12.12
1986.....	0.220	0.19748	0.02544	14.66
1987.....	0.150	0.13929	0.01977	16.64
1988.....	0.083	0.07964	0.01183	17.82
1989.....	0.056	0.05446	0.00835	18.66
1990.....	0.034	0.03342	0.00521	19.18
1991.....	0.020	0.01980	0.00311	19.49
1992.....	0.010	0.00995	0.00157	19.65
1993.....	0.006	0.00598	0.00094	19.74
1994.....	0.005	0.00498	0.00079	19.82
1995.....	0.004	0.00399	0.00063	19.89
1996.....	0.003	0.00299	0.00047	19.93
1997.....	0.002	0.00199	0.00031	19.97
1998.....	0.001	0.00099	0.00015	19.98
1999.....	0.001	0.00099	0.00015	20.00
2000.....	0.001	0.00099	0.00016	20.01
2001.....			0.00016	20.03
2002.....			0.00016	20.05
2003.....			0.00016	20.06
2004.....			0.00016	20.08
2005.....			0.00016	20.09
2006.....			0.00016	20.11
2007.....			0.00016	20.13
2008.....			0.00016	20.14
2009.....			0.00016	20.16
2010.....			0.00016	20.17
2011.....			0.00016	20.19
2012.....			0.00016	20.21
2013.....			0.00016	20.22
2014.....			0.00016	20.24
2015.....			0.00016	20.25
2016.....			0.00016	20.27
2017.....			0.00016	20.29
2018.....			0.00016	20.30
2019.....			0.00016	20.32

Note: The number of annual infections is held level beginning in 2000.

- a[t] = Assumed annual infection factor
- p[t] = Percent of at-risk population infected
- delta p[t] = $\frac{\{1-\hat{e}(-a[t])\} \times p[t-1] \times (1-p[t-1])}{1 - \{1-\hat{e}(-a[t])\} \times (1-p[t-1])}$

TABLE C13

CALCULATIONS TO CONVERT MORTALITY RATES AFTER AIDS DIAGNOSIS
TO CALENDAR-YEAR BASIS FOR CONVOLUTION TABLE FOR LOW SCENARIO

Calendar Years from Diagnosis	Cases Diagnosed before 1986:				Cases Diagnosed after 1985:			
	Death Rate	Alive End of Year	Percentage Dead during Year	Total Percentage Dead	Death Rate	Alive End of Year	Percentage Dead during Year	Total Percentage Dead
0.....	25.84%	74.16%	25.84%	25.84%	22.54%	77.46%	22.54%	22.54%
1.....	45.00	40.79	33.37	59.21	40.00	46.48	30.98	53.52
2.....	40.21	24.39	16.40	75.61	37.55	29.02	17.45	70.98
3.....	30.18	17.03	7.36	82.97	30.18	20.26	8.76	79.74
4.....	25.00	12.77	4.26	87.23	25.00	15.20	5.07	84.80
5.....	25.00	9.58	3.19	90.42	25.00	11.40	3.80	88.60
6.....	25.00	7.18	2.39	92.82	25.00	8.55	2.85	91.45
7.....	25.00	5.39	1.80	94.61	25.00	6.41	2.14	93.59
8.....	25.00	4.04	1.35	95.96	25.00	4.81	1.60	95.19
9.....	25.00	3.03	1.01	96.97	25.00	3.61	1.20	96.39
10.....	25.00	2.27	0.76	97.73	25.00	2.71	0.90	97.29
11.....	25.00	1.70	0.57	98.30	25.00	2.03	0.68	97.97
12.....	25.00	1.28	0.43	98.72	25.00	1.52	0.51	98.48
13.....	25.00	0.96	0.32	99.04	25.00	1.14	0.38	98.86
14.....	25.00	0.72	0.24	99.28	25.00	0.86	0.29	99.14
15.....	25.00	0.54	0.18	99.46	25.00	0.64	0.21	99.36
16.....	25.00	0.40	0.13	99.60	25.00	0.48	0.16	99.52
17.....	25.00	0.30	0.10	99.70	25.00	0.36	0.12	99.64
18.....	25.00	0.23	0.08	99.77	25.00	0.27	0.09	99.73
19.....	25.00	0.17	0.06	99.83	25.00	0.20	0.07	99.80
20.....	25.00	0.13	0.04	99.87	25.00	0.15	0.05	99.85
21.....	25.00	0.10	0.03	99.90	25.00	0.11	0.04	99.89
22.....	25.00	0.07	0.02	99.93	25.00	0.09	0.03	99.91
23.....	25.00	0.05	0.02	99.95	25.00	0.06	0.02	99.94
24.....	25.00	0.04	0.01	99.96	25.00	0.05	0.02	99.95
25.....	25.00	0.03	0.01	99.97	25.00	0.04	0.01	99.96
26.....	25.00	0.02	0.01	99.98	25.00	0.03	0.01	99.97
27.....	25.00	0.02	0.01	99.98	25.00	0.02	0.01	99.98
28.....	25.00	0.01	0.00	99.99	25.00	0.02	0.01	99.98
29.....	25.00	0.01	0.00	99.99	25.00	0.01	0.00	99.99
30.....	25.00	0.01	0.00	99.99	25.00	0.01	0.00	99.99
31.....	25.00	0.01	0.00	99.99	25.00	0.01	0.00	99.99
32.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
33.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
34.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
35.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
36.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
37.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
38.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
39.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
40.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
41.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
42.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
43.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
44.....	25.00	0.00	0.00	100.00	25.00	0.00	0.00	100.00
Total ...			100.00%				100.00%	

The population AIDS mortality rates are assumed to apply to the central age in each five-year age group. Mortality rates for other ages are then determined using the "Karup King" interpolation method. Linear interpolation (never less than zero) is used for ages under 22 and over 72.

Alternative Mortality Rates Exhibit

Table C14 presents another set of mortality rates. The only change in assumptions is the use of the different infection year inclusion factors shown below:

- 0.00% before 1986
- 0.00% infected 1986
- 0.00% infected 1987
- 0.00% infected 1988
- 100.00% infected 1989
- 100.00% infected 1990
- 100.00% after 1990.

TABLE C14

MALE GENERAL POPULATION AIDS MORTALITY RATES PER THOUSAND LIVES FOR LOW SCENARIO

Calendar Year	Attained Age in 1986																		
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1986...			0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1987...			0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1988...		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Attained Age in 1989																		
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
1989...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1990...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
1991...	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.002	0.003	0.003	0.004	0.004	0.005	0.005	0.005	0.006	0.006	0.006	0.006
1992...	0.001	0.001	0.002	0.002	0.003	0.004	0.005	0.007	0.009	0.010	0.012	0.013	0.014	0.015	0.016	0.016	0.016	0.016	0.016
1993...	0.002	0.003	0.004	0.005	0.008	0.011	0.014	0.018	0.021	0.023	0.026	0.028	0.030	0.031	0.032	0.032	0.032	0.031	0.030
1994...	0.006	0.007	0.009	0.013	0.018	0.024	0.029	0.034	0.038	0.042	0.045	0.048	0.050	0.051	0.051	0.050	0.049	0.047	0.046
1995...	0.010	0.012	0.018	0.026	0.034	0.042	0.049	0.054	0.060	0.064	0.068	0.070	0.071	0.070	0.069	0.067	0.065	0.062	0.059
1996...	0.016	0.023	0.033	0.044	0.054	0.063	0.070	0.077	0.083	0.088	0.091	0.092	0.091	0.089	0.086	0.083	0.079	0.074	0.069
1997...	0.028	0.040	0.052	0.065	0.076	0.085	0.093	0.101	0.107	0.111	0.112	0.110	0.107	0.103	0.099	0.094	0.088	0.081	0.074
1998...	0.045	0.059	0.074	0.086	0.097	0.107	0.116	0.123	0.127	0.128	0.126	0.122	0.117	0.111	0.105	0.098	0.089	0.082	0.075
1999...	0.064	0.080	0.093	0.105	0.117	0.127	0.135	0.140	0.140	0.137	0.132	0.126	0.120	0.112	0.104	0.095	0.086	0.079	0.073
2000...	0.083	0.097	0.110	0.122	0.133	0.142	0.147	0.147	0.144	0.138	0.130	0.123	0.115	0.106	0.096	0.087	0.079	0.073	0.068
2001...	0.096	0.109	0.121	0.133	0.142	0.147	0.148	0.145	0.139	0.132	0.125	0.117	0.107	0.097	0.087	0.079	0.072	0.067	0.063
2002...	0.104	0.117	0.128	0.137	0.143	0.144	0.141	0.136	0.129	0.122	0.114	0.104	0.094	0.084	0.076	0.069	0.064	0.059	0.055
2003...	0.109	0.120	0.129	0.134	0.136	0.133	0.129	0.123	0.117	0.109	0.099	0.089	0.079	0.070	0.064	0.059	0.054	0.050	0.047
2004...	0.110	0.118	0.123	0.125	0.123	0.119	0.114	0.108	0.101	0.092	0.082	0.072	0.064	0.058	0.053	0.049	0.045	0.041	0.038
2005...	0.106	0.111	0.112	0.111	0.108	0.104	0.099	0.092	0.083	0.074	0.064	0.057	0.051	0.047	0.043	0.039	0.036	0.033	0.030
2006...	0.096	0.098	0.097	0.095	0.091	0.087	0.081	0.074	0.065	0.057	0.051	0.046	0.041	0.038	0.034	0.031	0.028	0.026	0.023
2007...	0.084	0.084	0.082	0.079	0.075	0.070	0.064	0.057	0.050	0.045	0.040	0.036	0.033	0.030	0.027	0.024	0.022	0.020	0.018
2008...	0.071	0.070	0.068	0.065	0.061	0.055	0.049	0.044	0.039	0.035	0.031	0.028	0.025	0.023	0.021	0.018	0.017	0.015	0.014
2009...	0.059	0.058	0.055	0.052	0.047	0.042	0.038	0.033	0.030	0.027	0.024	0.022	0.019	0.017	0.015	0.014	0.012	0.011	0.010
2010...	0.049	0.047	0.044	0.041	0.036	0.032	0.029	0.026	0.023	0.021	0.018	0.016	0.015	0.013	0.012	0.010	0.009	0.009	0.008
2011...	0.040	0.037	0.034	0.031	0.027	0.024	0.022	0.020	0.017	0.016	0.014	0.012	0.011	0.010	0.009	0.008	0.007	0.007	0.007
2012...	0.032	0.029	0.026	0.023	0.021	0.019	0.017	0.015	0.013	0.012	0.010	0.009	0.008	0.007	0.007	0.006	0.006	0.006	0.005
2013...	0.025	0.023	0.020	0.018	0.016	0.014	0.013	0.011	0.010	0.009	0.008	0.007	0.006	0.006	0.005	0.005	0.005	0.005	0.004
2014...	0.020	0.018	0.016	0.014	0.013	0.011	0.010	0.009	0.008	0.007	0.006	0.006	0.005	0.005	0.004	0.004	0.004	0.004	0.004
2015...	0.016	0.014	0.012	0.011	0.010	0.009	0.008	0.007	0.006	0.006	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.003	0.003
2016...	0.013	0.011	0.010	0.009	0.008	0.007	0.006	0.006	0.005	0.005	0.004	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003
2017...	0.010	0.009	0.008	0.007	0.007	0.006	0.005	0.005	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.002	0.002
2018...	0.009	0.008	0.007	0.006	0.005	0.005	0.004	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.002	0.002	0.002
2019...	0.007	0.007	0.006	0.005	0.005	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002

Infection Spread: 4,000,000 at risk, low scenario to match CDC.

Progression Rates: Weibull, median 8 years, alpha 2.2.

Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.

Age/Sex Splits: 90% male, distribute all cases among ages 15-79.

Included Deaths: 100% of infections after 1988.

TABLE C14—Continued

Calendar Year	Attained Age in 1986																		
	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
1986...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1987...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1988...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Attained Age in 1989																		
	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
1989...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1990...	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
1991...	0.006	0.006	0.006	0.005	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.003	0.003	0.002	0.002	0.002
1992...	0.016	0.015	0.014	0.013	0.012	0.012	0.011	0.011	0.010	0.010	0.009	0.009	0.008	0.007	0.007	0.007	0.006	0.006	0.006
1993...	0.029	0.028	0.026	0.024	0.022	0.021	0.020	0.019	0.018	0.017	0.016	0.015	0.014	0.013	0.012	0.012	0.011	0.011	0.010
1994...	0.043	0.040	0.037	0.035	0.033	0.031	0.029	0.027	0.026	0.024	0.023	0.021	0.020	0.019	0.018	0.017	0.017	0.016	0.016
1995...	0.055	0.051	0.047	0.044	0.042	0.039	0.037	0.035	0.033	0.031	0.029	0.027	0.026	0.025	0.024	0.023	0.023	0.022	0.020
1996...	0.063	0.059	0.055	0.052	0.049	0.046	0.043	0.040	0.037	0.035	0.033	0.031	0.030	0.029	0.028	0.028	0.026	0.025	0.023
1997...	0.068	0.064	0.060	0.056	0.053	0.050	0.046	0.043	0.040	0.037	0.035	0.033	0.032	0.031	0.030	0.028	0.026	0.026	0.024
1998...	0.070	0.065	0.061	0.058	0.054	0.050	0.046	0.043	0.040	0.037	0.036	0.035	0.034	0.034	0.033	0.031	0.029	0.027	0.024
1999...	0.068	0.064	0.060	0.056	0.052	0.048	0.044	0.041	0.038	0.037	0.036	0.035	0.035	0.034	0.033	0.030	0.028	0.025	0.023
2000...	0.064	0.060	0.056	0.052	0.048	0.044	0.040	0.038	0.036	0.035	0.035	0.034	0.033	0.032	0.030	0.028	0.026	0.024	0.022
2001...	0.059	0.054	0.050	0.046	0.042	0.039	0.036	0.034	0.033	0.033	0.032	0.031	0.030	0.028	0.026	0.024	0.022	0.021	0.019
2002...	0.051	0.047	0.043	0.039	0.036	0.034	0.032	0.031	0.030	0.030	0.029	0.027	0.026	0.024	0.022	0.021	0.019	0.017	0.016
2003...	0.043	0.039	0.036	0.033	0.030	0.029	0.028	0.027	0.026	0.025	0.024	0.023	0.021	0.020	0.019	0.017	0.016	0.014	0.013
2004...	0.034	0.032	0.029	0.027	0.025	0.024	0.024	0.023	0.022	0.021	0.020	0.019	0.017	0.016	0.015	0.014	0.013	0.011	0.010
2005...	0.027	0.025	0.023	0.022	0.021	0.020	0.019	0.019	0.018	0.017	0.016	0.015	0.014	0.013	0.012	0.011	0.010	0.009	0.008
2006...	0.021	0.020	0.018	0.018	0.017	0.016	0.016	0.015	0.014	0.013	0.012	0.011	0.011	0.010	0.009	0.008	0.008	0.007	0.006
2007...	0.017	0.015	0.015	0.014	0.014	0.013	0.012	0.012	0.011	0.010	0.009	0.009	0.008	0.007	0.007	0.006	0.006	0.005	0.004
2008...	0.013	0.012	0.012	0.011	0.011	0.010	0.009	0.009	0.008	0.008	0.007	0.006	0.006	0.005	0.005	0.005	0.004	0.004	0.003
2009...	0.010	0.010	0.009	0.009	0.008	0.008	0.007	0.007	0.006	0.006	0.005	0.005	0.004	0.004	0.004	0.003	0.003	0.003	0.002
2010...	0.008	0.008	0.007	0.007	0.006	0.006	0.005	0.005	0.005	0.004	0.004	0.004	0.003	0.003	0.003	0.002	0.002	0.002	0.001
2011...	0.006	0.006	0.006	0.005	0.005	0.004	0.004	0.004	0.004	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.001
2012...	0.005	0.005	0.005	0.004	0.004	0.004	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001
2013...	0.004	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001
2014...	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
2015...	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
2016...	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
2017...	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000
2018...	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000
2019...	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000

Infection Spread: 4,000,000 at risk, low scenario to match CDC.
 Progression Rates: Weibull, median 8 years, alpha 2.2.
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.
 Age/Sex Splits: 90% male, distribute all cases among ages 15-79.
 Included Deaths: 100% of infections after 1988.

TABLE C14—Continued

Calendar Years	Attained Age in 1986																	
	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
1986...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1987...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1988...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Attained Age in 1989																	
	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
1989...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1990...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1991...	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000
1992...	0.005	0.005	0.005	0.004	0.004	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001
1993...	0.010	0.009	0.008	0.008	0.007	0.006	0.005	0.005	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.001	0.001
1994...	0.015	0.013	0.012	0.011	0.010	0.009	0.008	0.007	0.006	0.005	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002
1995...	0.019	0.017	0.015	0.014	0.012	0.011	0.009	0.008	0.007	0.006	0.005	0.004	0.004	0.003	0.003	0.003	0.003	0.003
1996...	0.021	0.019	0.017	0.015	0.014	0.012	0.010	0.009	0.008	0.007	0.006	0.005	0.004	0.004	0.004	0.004	0.003	0.003
1997...	0.022	0.020	0.018	0.016	0.014	0.012	0.011	0.009	0.008	0.007	0.006	0.005	0.005	0.005	0.004	0.004	0.004	0.003
1998...	0.022	0.020	0.018	0.016	0.014	0.012	0.011	0.009	0.008	0.007	0.006	0.005	0.005	0.005	0.004	0.004	0.003	0.003
1999...	0.021	0.019	0.017	0.015	0.013	0.012	0.010	0.008	0.007	0.006	0.006	0.005	0.005	0.004	0.004	0.004	0.003	
2000...	0.020	0.018	0.016	0.014	0.012	0.010	0.009	0.007	0.006	0.006	0.005	0.005	0.004	0.004	0.004	0.003		
2001...	0.017	0.015	0.013	0.012	0.010	0.009	0.007	0.006	0.006	0.005	0.005	0.004	0.004	0.004	0.003			
2002...	0.014	0.013	0.011	0.010	0.008	0.007	0.006	0.006	0.006	0.005	0.004	0.004	0.003	0.003				
2003...	0.012	0.010	0.009	0.008	0.007	0.006	0.005	0.005	0.004	0.004	0.004	0.003	0.003	0.003				
2004...	0.009	0.008	0.007	0.006	0.005	0.005	0.004	0.004	0.004	0.003	0.003	0.002	0.002					
2005...	0.007	0.006	0.005	0.005	0.004	0.004	0.004	0.004	0.003	0.003	0.002	0.002						
2006...	0.005	0.005	0.004	0.004	0.003	0.003	0.003	0.002	0.002	0.002								
2007...	0.004	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.002									
2008...	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.001										
2009...	0.002	0.002	0.002	0.002	0.002	0.001												
2010...	0.002	0.002	0.001	0.001	0.001	0.001												
2011...	0.001	0.001	0.001	0.001	0.001													
2012...	0.001	0.001	0.001	0.001														
2013...	0.001	0.001	0.001															
2014...	0.001	0.001																
2015...	0.001																	
2016...																		
2017...																		
2018...																		
2019...																		

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Infection Spread: 4,000,000 at risk, low scenario to match CDC.
 Progression Rates: Weibull, median 8 years, alpha 2.2.
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.
 Age/Sex Splits: 90% male, distribute all cases among ages 15-79.
 Included Deaths: 100% of infections after 1988.

APPENDIX D

FEMALE AIDS MORTALITY RATES

This appendix shows the female AIDS mortality rates resulting from our middle scenario. Only the pages containing the AIDS mortality rates are shown. The rest of this model report is the same as those shown in Appendix A, except that the sex code has been changed to "F" (female).

Alternative Mortality Rates Exhibit

Table D2 presents another set of mortality rates. The only change in assumptions is the use of the different infection year inclusion factors shown below:

- 0.00% before 1986
- 0.00% infected 1986
- 0.00% infected 1987
- 0.00% infected 1988
- 100.00% infected 1989
- 100.00% infected 1990
- 100.00% after 1990.

TABLE D1

FEMALE GENERAL POPULATION AIDS MORTALITY RATES PER THOUSAND LIVES FOR MIDDLE SCENARIO FOR FEMALES

Calendar Year	Attained Age in 1986																		
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1986...			0.000	0.000	0.000	0.001	0.002	0.003	0.003	0.004	0.005	0.007	0.010	0.013	0.015	0.017	0.019	0.021	0.022
1987...			0.000	0.000	0.001	0.003	0.004	0.005	0.007	0.008	0.011	0.015	0.020	0.024	0.027	0.030	0.032	0.034	0.035
1988...		0.000	0.000	0.002	0.004	0.006	0.008	0.010	0.012	0.017	0.023	0.030	0.036	0.041	0.044	0.047	0.050	0.051	0.052
	Attained Age in 1989																		
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
1989...	0.000	0.000	0.003	0.006	0.009	0.012	0.015	0.018	0.024	0.033	0.042	0.050	0.057	0.061	0.065	0.068	0.070	0.070	0.069
1990...	0.000	0.003	0.007	0.011	0.015	0.019	0.023	0.032	0.043	0.055	0.066	0.074	0.080	0.085	0.088	0.089	0.089	0.087	0.084
1991...	0.004	0.009	0.014	0.019	0.024	0.029	0.040	0.055	0.069	0.083	0.094	0.101	0.106	0.110	0.111	0.111	0.108	0.103	0.096
1992...	0.011	0.017	0.023	0.029	0.035	0.049	0.066	0.085	0.101	0.114	0.122	0.128	0.132	0.133	0.132	0.128	0.122	0.113	0.104
1993...	0.020	0.027	0.034	0.041	0.057	0.078	0.100	0.120	0.134	0.144	0.150	0.153	0.154	0.152	0.147	0.139	0.129	0.118	0.107
1994...	0.030	0.038	0.046	0.065	0.089	0.114	0.137	0.154	0.164	0.170	0.173	0.173	0.171	0.165	0.155	0.142	0.130	0.117	0.105
1995...	0.042	0.051	0.072	0.099	0.127	0.153	0.172	0.183	0.189	0.191	0.190	0.186	0.179	0.168	0.154	0.139	0.125	0.112	0.098
1996...	0.054	0.077	0.106	0.137	0.165	0.185	0.197	0.205	0.207	0.207	0.203	0.195	0.182	0.166	0.149	0.134	0.119	0.104	0.089
1997...	0.081	0.112	0.144	0.174	0.196	0.209	0.217	0.221	0.221	0.217	0.208	0.193	0.176	0.157	0.140	0.125	0.108	0.092	0.078
1998...	0.115	0.150	0.181	0.204	0.218	0.227	0.232	0.232	0.228	0.218	0.202	0.183	0.163	0.145	0.128	0.110	0.094	0.079	0.066
1999...	0.153	0.185	0.208	0.224	0.234	0.240	0.240	0.236	0.226	0.209	0.188	0.166	0.147	0.129	0.111	0.094	0.078	0.066	0.056
2000...	0.186	0.211	0.227	0.238	0.244	0.246	0.242	0.231	0.212	0.190	0.167	0.147	0.129	0.110	0.093	0.077	0.064	0.055	0.048
2001...	0.207	0.224	0.236	0.243	0.245	0.241	0.231	0.213	0.191	0.168	0.148	0.130	0.111	0.093	0.077	0.064	0.054	0.047	0.042
2002...	0.219	0.231	0.238	0.241	0.239	0.228	0.211	0.190	0.168	0.148	0.129	0.111	0.092	0.076	0.062	0.053	0.046	0.041	0.037
2003...	0.224	0.232	0.236	0.234	0.224	0.208	0.187	0.166	0.147	0.128	0.109	0.091	0.074	0.061	0.051	0.044	0.039	0.035	0.032
2004...	0.225	0.229	0.228	0.219	0.203	0.184	0.163	0.144	0.126	0.107	0.089	0.072	0.058	0.049	0.042	0.037	0.033	0.030	0.027
2005...	0.221	0.221	0.213	0.198	0.179	0.160	0.142	0.124	0.105	0.086	0.069	0.056	0.046	0.040	0.035	0.031	0.028	0.025	0.023
2006...	0.210	0.203	0.189	0.172	0.154	0.137	0.120	0.102	0.084	0.068	0.055	0.045	0.039	0.034	0.030	0.027	0.024	0.022	0.021
2007...	0.193	0.180	0.165	0.147	0.131	0.116	0.098	0.081	0.066	0.053	0.044	0.037	0.033	0.029	0.025	0.023	0.021	0.020	0.019
2008...	0.172	0.157	0.141	0.127	0.112	0.095	0.079	0.064	0.052	0.043	0.036	0.031	0.028	0.024	0.021	0.020	0.019	0.018	0.017
2009...	0.151	0.136	0.122	0.108	0.092	0.076	0.062	0.050	0.042	0.035	0.030	0.027	0.023	0.020	0.019	0.017	0.017	0.016	0.016
2010...	0.131	0.118	0.104	0.089	0.074	0.060	0.049	0.041	0.034	0.030	0.026	0.022	0.019	0.018	0.016	0.016	0.015	0.015	0.015
2011...	0.112	0.100	0.085	0.071	0.058	0.047	0.039	0.033	0.028	0.024	0.021	0.018	0.017	0.016	0.015	0.014	0.014	0.014	0.014
2012...	0.095	0.082	0.068	0.055	0.045	0.037	0.032	0.027	0.023	0.020	0.018	0.016	0.015	0.014	0.014	0.013	0.013	0.014	0.014
2013...	0.079	0.065	0.053	0.043	0.036	0.030	0.026	0.023	0.020	0.017	0.015	0.014	0.014	0.013	0.013	0.013	0.013	0.013	0.014
2014...	0.063	0.051	0.042	0.035	0.029	0.025	0.022	0.019	0.016	0.015	0.014	0.013	0.013	0.012	0.012	0.012	0.013	0.013	0.014
2015...	0.050	0.041	0.034	0.028	0.024	0.021	0.018	0.016	0.014	0.014	0.013	0.012	0.012	0.012	0.012	0.012	0.013	0.013	0.014
2016...	0.040	0.033	0.028	0.024	0.021	0.018	0.016	0.014	0.013	0.013	0.012	0.012	0.012	0.012	0.012	0.012	0.013	0.013	0.014
2017...	0.032	0.027	0.023	0.020	0.017	0.015	0.014	0.013	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.013	0.013	0.014
2018...	0.027	0.023	0.020	0.017	0.015	0.014	0.013	0.012	0.012	0.011	0.011	0.012	0.012	0.012	0.012	0.012	0.013	0.013	0.014
2019...	0.023	0.020	0.017	0.015	0.013	0.013	0.012	0.011	0.011	0.011	0.011	0.012	0.012	0.012	0.012	0.013	0.013	0.014	0.014

Infection Spread: 4,000,000 at risk, middle scenario to match CDC.

Progression Rates: Weibull, median 10 years, alpha 2.1.

Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.

Age/Sex Splits: 10% female, distribute all cases among ages 15-79.

Included Deaths: 100% of all years' infections after 1988

TABLE D1—Continued

Calendar Year	Attained Age in 1986																		
	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
1986...	0.023	0.023	0.023	0.022	0.020	0.019	0.017	0.016	0.014	0.013	0.011	0.010	0.009	0.008	0.007	0.007	0.006	0.006	0.005
1987...	0.035	0.035	0.033	0.031	0.029	0.027	0.024	0.022	0.019	0.017	0.015	0.013	0.012	0.011	0.010	0.009	0.008	0.008	0.008
1988...	0.051	0.048	0.045	0.042	0.039	0.035	0.031	0.028	0.024	0.021	0.019	0.017	0.015	0.014	0.013	0.012	0.011	0.011	0.011
	Attained Age in 1989																		
	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
1989...	0.066	0.062	0.057	0.053	0.048	0.042	0.037	0.032	0.027	0.024	0.022	0.020	0.019	0.017	0.016	0.015	0.015	0.014	0.014
1990...	0.079	0.073	0.067	0.061	0.054	0.046	0.039	0.034	0.030	0.027	0.025	0.023	0.022	0.020	0.019	0.019	0.018	0.018	0.018
1991...	0.089	0.081	0.074	0.065	0.056	0.048	0.041	0.036	0.032	0.030	0.027	0.025	0.024	0.023	0.022	0.022	0.021	0.021	0.021
1992...	0.095	0.086	0.075	0.065	0.055	0.047	0.042	0.037	0.034	0.031	0.029	0.027	0.026	0.025	0.025	0.024	0.024	0.024	0.025
1993...	0.096	0.085	0.073	0.062	0.053	0.046	0.041	0.037	0.034	0.032	0.030	0.028	0.028	0.027	0.027	0.027	0.027	0.028	0.029
1994...	0.092	0.079	0.068	0.058	0.050	0.045	0.040	0.037	0.034	0.032	0.030	0.029	0.029	0.029	0.029	0.030	0.031	0.031	0.032
1995...	0.084	0.072	0.061	0.053	0.047	0.042	0.039	0.035	0.033	0.031	0.031	0.031	0.031	0.031	0.032	0.033	0.034	0.035	0.035
1996...	0.075	0.064	0.056	0.049	0.044	0.040	0.037	0.034	0.032	0.031	0.031	0.031	0.031	0.031	0.032	0.033	0.034	0.035	0.037
1997...	0.066	0.057	0.050	0.045	0.041	0.037	0.034	0.033	0.032	0.031	0.031	0.031	0.031	0.032	0.033	0.034	0.036	0.037	0.038
1998...	0.057	0.050	0.045	0.041	0.037	0.034	0.032	0.031	0.031	0.030	0.031	0.031	0.031	0.033	0.034	0.035	0.037	0.038	0.040
1999...	0.049	0.044	0.040	0.037	0.034	0.032	0.030	0.030	0.029	0.030	0.030	0.032	0.033	0.034	0.036	0.038	0.040	0.041	0.042
2000...	0.043	0.039	0.036	0.033	0.031	0.029	0.028	0.028	0.028	0.029	0.030	0.032	0.033	0.035	0.037	0.039	0.040	0.041	0.042
2001...	0.038	0.035	0.032	0.029	0.028	0.027	0.027	0.027	0.028	0.029	0.030	0.031	0.033	0.035	0.036	0.038	0.039	0.040	0.040
2002...	0.033	0.030	0.028	0.027	0.026	0.026	0.026	0.026	0.027	0.028	0.029	0.030	0.032	0.034	0.036	0.037	0.037	0.037	0.037
2003...	0.029	0.027	0.025	0.025	0.024	0.024	0.024	0.024	0.025	0.026	0.027	0.028	0.030	0.032	0.033	0.034	0.035	0.035	0.035
2004...	0.025	0.024	0.023	0.023	0.022	0.023	0.023	0.024	0.025	0.026	0.027	0.029	0.031	0.032	0.033	0.033	0.033	0.033	0.033
2005...	0.022	0.022	0.021	0.021	0.021	0.021	0.022	0.022	0.023	0.024	0.025	0.027	0.028	0.029	0.030	0.031	0.031	0.031	0.031
2006...	0.020	0.020	0.019	0.019	0.020	0.020	0.021	0.022	0.023	0.024	0.026	0.027	0.027	0.028	0.028	0.029	0.029	0.028	0.028
2007...	0.018	0.018	0.018	0.018	0.019	0.019	0.020	0.021	0.022	0.023	0.024	0.025	0.025	0.026	0.026	0.026	0.026	0.026	0.025
2008...	0.017	0.017	0.017	0.018	0.018	0.019	0.020	0.020	0.021	0.022	0.023	0.023	0.024	0.024	0.024	0.024	0.024	0.024	0.023
2009...	0.016	0.016	0.016	0.017	0.017	0.018	0.019	0.019	0.020	0.021	0.021	0.021	0.022	0.022	0.022	0.022	0.022	0.022	0.021
2010...	0.015	0.015	0.016	0.016	0.017	0.017	0.018	0.018	0.019	0.019	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.019
2011...	0.015	0.015	0.015	0.016	0.016	0.017	0.017	0.018	0.018	0.019	0.019	0.019	0.019	0.020	0.019	0.019	0.019	0.018	0.017
2012...	0.014	0.015	0.015	0.016	0.016	0.017	0.017	0.018	0.018	0.018	0.019	0.019	0.019	0.019	0.018	0.018	0.017	0.017	0.016
2013...	0.014	0.015	0.015	0.016	0.016	0.017	0.017	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.017	0.017	0.016	0.015	0.014
2014...	0.014	0.015	0.015	0.016	0.016	0.016	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.016	0.015	0.015	0.014	0.013
2015...	0.014	0.015	0.015	0.016	0.016	0.016	0.017	0.017	0.017	0.017	0.017	0.017	0.016	0.016	0.015	0.014	0.014	0.013	0.012
2016...	0.014	0.015	0.015	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.015	0.015	0.014	0.013	0.013	0.012	0.011
2017...	0.014	0.015	0.015	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.015	0.014	0.014	0.013	0.012	0.012	0.011	0.011
2018...	0.015	0.015	0.015	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.015	0.014	0.013	0.013	0.012	0.011	0.011	0.011	0.011
2019...	0.015	0.015	0.015	0.016	0.016	0.016	0.016	0.016	0.015	0.015	0.014	0.013	0.013	0.012	0.011	0.011	0.011	0.011	0.011

Infection Spread: 4,000,000 at risk, middle scenario to match CDC.
 Progression Rates: Weibull, median 10 years, alpha 2.1.
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.
 Age/Sex Splits: 10% female, distribute all cases among ages 15-79.
 Included Deaths: 100% of infections after 1988.

TABLE D1—Continued

Calendar Year	Attained Age in 1986																	
	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
1986...	0.005	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
1987...	0.007	0.007	0.007	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
1988...	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.009	0.009	0.009	0.009	0.009	0.008	0.008
	Attained Age in 1989																	
	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
1989...	0.014	0.014	0.014	0.014	0.014	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.012	0.012	0.012	0.011	0.011	
1990...	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.017	0.017	0.017	0.016	0.016	0.015	0.015	0.014	0.014	
1991...	0.021	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.021	0.021	0.020	0.019	0.019	0.018	0.018	0.017	0.016	
1992...	0.025	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.025	0.024	0.023	0.022	0.022	0.021	0.020	0.020	0.019	
1993...	0.029	0.030	0.030	0.030	0.031	0.030	0.030	0.029	0.028	0.027	0.026	0.025	0.024	0.023	0.022	0.022	0.021	
1994...	0.033	0.033	0.034	0.034	0.034	0.034	0.033	0.031	0.030	0.029	0.028	0.027	0.026	0.025	0.024	0.023	0.022	
1995...	0.036	0.037	0.038	0.038	0.037	0.036	0.035	0.033	0.032	0.030	0.029	0.028	0.027	0.025	0.025	0.024	0.023	
1996...	0.039	0.040	0.040	0.039	0.038	0.037	0.036	0.034	0.033	0.031	0.030	0.028	0.027	0.026	0.025	0.024	0.023	
1997...	0.041	0.041	0.041	0.040	0.039	0.038	0.036	0.035	0.033	0.032	0.030	0.029	0.027	0.026	0.025	0.024	0.022	
1998...	0.042	0.042	0.041	0.040	0.039	0.037	0.036	0.034	0.033	0.031	0.029	0.028	0.027	0.025	0.024	0.023	0.021	
1999...	0.042	0.041	0.041	0.040	0.038	0.037	0.035	0.033	0.032	0.030	0.028	0.027	0.025	0.024	0.022	0.021	0.019	
2000...	0.041	0.041	0.040	0.039	0.037	0.036	0.034	0.032	0.030	0.028	0.027	0.025	0.024	0.022	0.020	0.019		
2001...	0.039	0.039	0.038	0.036	0.035	0.033	0.031	0.030	0.028	0.027	0.025	0.023	0.022	0.020	0.018			
2002...	0.037	0.036	0.035	0.034	0.033	0.031	0.029	0.028	0.026	0.024	0.023	0.021	0.020	0.018				
2003...	0.035	0.034	0.033	0.032	0.030	0.029	0.027	0.025	0.024	0.022	0.021	0.019	0.017					
2004...	0.032	0.032	0.031	0.029	0.028	0.026	0.025	0.023	0.021	0.020	0.018	0.017						
2005...	0.030	0.029	0.028	0.027	0.025	0.024	0.022	0.021	0.019	0.017	0.016							
2006...	0.027	0.026	0.025	0.024	0.023	0.021	0.020	0.018	0.017	0.015								
2007...	0.025	0.024	0.023	0.021	0.020	0.019	0.018	0.016	0.015									
2008...	0.022	0.021	0.020	0.019	0.018	0.017	0.016	0.015										
2009...	0.020	0.019	0.018	0.017	0.016	0.015	0.014											
2010...	0.018	0.017	0.016	0.016	0.015	0.014												
2011...	0.017	0.016	0.015	0.014	0.013													
2012...	0.015	0.014	0.013	0.013														
2013...	0.014	0.013	0.012															
2014...	0.013	0.012																
2015...	0.011																	
2016...																		
2017...																		
2018...																		
2019...																		

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Infection Spread: 4,000,000 at risk, middle scenario to match CDC.
 Progression Rates: Weibull, median 10 years, alpha 2.1.
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.
 Age/Sex Splits: 10% female, distribute all cases among ages 15-79.
 Included Deaths: 100% of all years' infections.

TABLE D2

FEMALE GENERAL POPULATION AIDS MORTALITY RATES PER THOUSAND LIVES FOR MIDDLE SCENARIO FOR FEMALES

Calendar Year	Attained Age in 1986																		
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1986...			0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1987...			0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1988...		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Attained Age in 1989																		
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
1989...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1990...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1991...	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001
1992...	0.000	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.004	0.004	0.004	0.004	0.005	0.005	0.005	0.004	0.004	0.004	0.004
1993...	0.001	0.002	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.009	0.010	0.010	0.009	0.009	0.009	0.008	0.007	0.007
1994...	0.003	0.004	0.004	0.006	0.008	0.011	0.013	0.015	0.015	0.016	0.016	0.016	0.016	0.016	0.015	0.013	0.012	0.011	0.010
1995...	0.006	0.007	0.009	0.013	0.017	0.020	0.022	0.024	0.025	0.025	0.025	0.024	0.023	0.022	0.020	0.018	0.016	0.015	0.013
1996...	0.009	0.013	0.018	0.023	0.028	0.031	0.033	0.035	0.035	0.035	0.034	0.033	0.031	0.028	0.025	0.023	0.020	0.018	0.015
1997...	0.017	0.023	0.030	0.037	0.041	0.044	0.046	0.046	0.046	0.046	0.044	0.041	0.037	0.033	0.029	0.026	0.023	0.019	0.016
1998...	0.029	0.038	0.046	0.052	0.055	0.058	0.059	0.059	0.058	0.055	0.051	0.046	0.041	0.037	0.032	0.028	0.024	0.020	0.017
1999...	0.045	0.055	0.062	0.067	0.070	0.071	0.072	0.070	0.067	0.062	0.056	0.049	0.044	0.038	0.033	0.028	0.023	0.020	0.017
2000...	0.064	0.073	0.078	0.082	0.084	0.085	0.083	0.079	0.073	0.065	0.058	0.051	0.044	0.038	0.032	0.027	0.022	0.019	0.017
2001...	0.081	0.088	0.092	0.095	0.096	0.095	0.090	0.083	0.075	0.066	0.058	0.051	0.043	0.036	0.030	0.025	0.021	0.018	0.017
2002...	0.096	0.102	0.105	0.106	0.105	0.101	0.093	0.084	0.074	0.065	0.057	0.049	0.041	0.033	0.027	0.023	0.020	0.018	0.016
2003...	0.110	0.114	0.115	0.114	0.110	0.102	0.092	0.081	0.072	0.063	0.053	0.044	0.036	0.030	0.025	0.021	0.019	0.017	0.015
2004...	0.121	0.123	0.123	0.118	0.109	0.099	0.088	0.078	0.068	0.058	0.048	0.039	0.031	0.026	0.022	0.020	0.018	0.016	0.014
2005...	0.130	0.129	0.125	0.116	0.105	0.094	0.083	0.073	0.062	0.051	0.041	0.033	0.027	0.023	0.020	0.018	0.016	0.015	0.014
2006...	0.133	0.128	0.120	0.109	0.097	0.087	0.076	0.065	0.053	0.043	0.035	0.029	0.024	0.021	0.019	0.017	0.015	0.014	0.013
2007...	0.131	0.123	0.112	0.100	0.089	0.079	0.067	0.055	0.045	0.036	0.030	0.025	0.022	0.020	0.017	0.015	0.014	0.013	0.013
2008...	0.124	0.114	0.102	0.092	0.081	0.069	0.057	0.046	0.037	0.031	0.026	0.023	0.020	0.018	0.016	0.014	0.013	0.013	0.012
2009...	0.115	0.104	0.093	0.082	0.070	0.058	0.047	0.038	0.032	0.027	0.023	0.020	0.018	0.016	0.014	0.013	0.013	0.012	0.012
2010...	0.105	0.094	0.084	0.072	0.060	0.048	0.039	0.033	0.028	0.024	0.021	0.018	0.015	0.014	0.013	0.012	0.012	0.012	0.012
2011...	0.094	0.083	0.071	0.059	0.048	0.039	0.033	0.027	0.024	0.020	0.018	0.015	0.014	0.013	0.012	0.012	0.012	0.012	0.012
2012...	0.083	0.071	0.059	0.048	0.039	0.032	0.027	0.023	0.020	0.018	0.015	0.014	0.013	0.012	0.012	0.012	0.012	0.012	0.012
2013...	0.070	0.058	0.047	0.039	0.032	0.027	0.023	0.020	0.017	0.015	0.014	0.013	0.012	0.012	0.011	0.011	0.012	0.012	0.012
2014...	0.058	0.047	0.038	0.032	0.027	0.023	0.020	0.017	0.015	0.014	0.013	0.012	0.012	0.011	0.011	0.012	0.012	0.012	0.012
2015...	0.047	0.038	0.031	0.026	0.023	0.020	0.017	0.015	0.013	0.013	0.012	0.012	0.011	0.011	0.011	0.012	0.012	0.012	0.013
2016...	0.037	0.031	0.026	0.023	0.020	0.017	0.015	0.013	0.012	0.012	0.011	0.011	0.011	0.011	0.011	0.012	0.012	0.012	0.013
2017...	0.031	0.026	0.022	0.019	0.017	0.015	0.013	0.012	0.012	0.011	0.011	0.011	0.011	0.011	0.012	0.012	0.012	0.013	0.013
2018...	0.026	0.022	0.019	0.017	0.015	0.013	0.012	0.012	0.011	0.011	0.011	0.011	0.011	0.011	0.012	0.012	0.012	0.013	0.014
2019...	0.022	0.019	0.017	0.014	0.013	0.012	0.012	0.011	0.011	0.011	0.011	0.011	0.011	0.012	0.012	0.013	0.013	0.014	0.014

Infection Spread: 4,000,000 at risk, middle scenario to match CDC.

Progression Rates: Weibull, median 10 years, alpha 2.1.

Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.

Age/Sex Splits: 10% female, distribute all cases among ages 15-79.

Included Deaths: 100% of infections after 1988.

TABLE D2—Continued

Calendar Year	Attained Age in 1986																	
	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
1986...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1987...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1988...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Attained Age in 1989																	
	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
1989...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1990...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1991...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1992...	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
1993...	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001
1994...	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002
1995...	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003
1996...	0.007	0.007	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.005	0.005	0.005	0.005	0.004	0.004	0.004	0.004	0.004
1997...	0.009	0.009	0.009	0.008	0.008	0.008	0.008	0.007	0.007	0.006	0.006	0.006	0.006	0.005	0.005	0.005	0.005	0.004
1998...	0.011	0.011	0.010	0.010	0.010	0.009	0.009	0.009	0.008	0.008	0.007	0.007	0.007	0.006	0.006	0.006	0.005	0.005
1999...	0.012	0.012	0.012	0.012	0.011	0.011	0.010	0.010	0.009	0.009	0.008	0.008	0.008	0.007	0.007	0.006	0.006	0.006
2000...	0.014	0.014	0.014	0.013	0.013	0.012	0.012	0.011	0.010	0.010	0.009	0.009	0.008	0.008	0.007	0.006		
2001...	0.015	0.015	0.015	0.014	0.014	0.013	0.012	0.011	0.010	0.010	0.009	0.009	0.008	0.008	0.007			
2002...	0.016	0.016	0.016	0.015	0.014	0.014	0.013	0.012	0.011	0.011	0.010	0.009	0.009	0.008				
2003...	0.017	0.017	0.016	0.015	0.015	0.014	0.013	0.012	0.011	0.011	0.010	0.009	0.008					
2004...	0.017	0.017	0.016	0.016	0.015	0.014	0.013	0.012	0.012	0.011	0.010	0.009						
2005...	0.018	0.017	0.017	0.016	0.015	0.014	0.013	0.012	0.011	0.010	0.009							
2006...	0.017	0.017	0.016	0.015	0.014	0.013	0.012	0.012	0.011	0.010								
2007...	0.017	0.016	0.015	0.015	0.014	0.013	0.012	0.011	0.010									
2008...	0.016	0.015	0.015	0.014	0.013	0.012	0.011	0.011										
2009...	0.015	0.015	0.014	0.013	0.012	0.012	0.011											
2010...	0.015	0.014	0.013	0.012	0.012	0.011												
2011...	0.014	0.013	0.012	0.012	0.011													
2012...	0.013	0.012	0.012	0.011														
2013...	0.012	0.012	0.011															
2014...	0.011	0.011																
2015...	0.011																	
2016...																		
2017...																		
2018...																		
2019...																		

Infection Spread: 4,000,000 at risk, middle scenario to match CDC.
 Progression Rates: Weibull, median 10 years, alpha 2.1.
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.
 Age/Sex Splits: 10% female, distribute all cases among ages 15-79.
 Included Deaths: 100% of infections after 1988.

TABLE D2—Continued

Calendar Year	Attained Age in 1986																		
	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
1986...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1987...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1988...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Attained Age in 1989																		
	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
1989...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1990...	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1991...	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1992...	0.003	0.003	0.003	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
1993...	0.006	0.005	0.005	0.004	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
1994...	0.009	0.007	0.006	0.005	0.005	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
1995...	0.011	0.009	0.008	0.007	0.006	0.006	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005
1996...	0.013	0.011	0.009	0.008	0.007	0.007	0.006	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.006	0.006	0.006	0.006	0.006
1997...	0.014	0.012	0.010	0.009	0.009	0.008	0.007	0.007	0.007	0.007	0.006	0.007	0.007	0.007	0.007	0.007	0.008	0.008	0.008
1998...	0.014	0.013	0.011	0.010	0.009	0.009	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.009	0.009	0.009	0.010	0.010	0.010
1999...	0.015	0.013	0.012	0.011	0.010	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.010	0.010	0.011	0.011	0.012	0.012	0.012
2000...	0.015	0.014	0.012	0.011	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.011	0.011	0.012	0.013	0.013	0.014	0.014	0.014
2001...	0.015	0.014	0.012	0.012	0.011	0.011	0.011	0.011	0.011	0.011	0.012	0.012	0.013	0.013	0.014	0.015	0.015	0.016	0.016
2002...	0.015	0.013	0.012	0.012	0.012	0.011	0.011	0.011	0.012	0.012	0.013	0.013	0.014	0.015	0.016	0.016	0.016	0.017	0.016
2003...	0.014	0.013	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.013	0.013	0.014	0.015	0.015	0.016	0.017	0.017	0.017	0.017
2004...	0.013	0.013	0.012	0.012	0.012	0.012	0.012	0.013	0.013	0.014	0.015	0.016	0.017	0.017	0.018	0.018	0.018	0.018	0.018
2005...	0.013	0.013	0.012	0.012	0.012	0.012	0.012	0.013	0.013	0.014	0.015	0.016	0.017	0.017	0.018	0.018	0.018	0.018	0.018
2006...	0.013	0.013	0.012	0.012	0.013	0.013	0.013	0.014	0.015	0.016	0.016	0.017	0.017	0.018	0.018	0.018	0.018	0.018	0.018
2007...	0.013	0.012	0.012	0.013	0.013	0.013	0.014	0.014	0.015	0.016	0.016	0.017	0.017	0.018	0.018	0.018	0.018	0.018	0.017
2008...	0.012	0.012	0.012	0.013	0.013	0.014	0.014	0.015	0.015	0.016	0.016	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
2009...	0.012	0.012	0.012	0.013	0.013	0.014	0.014	0.015	0.015	0.016	0.016	0.016	0.017	0.017	0.017	0.017	0.017	0.016	0.016
2010...	0.012	0.012	0.013	0.013	0.013	0.014	0.014	0.015	0.015	0.015	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.015
2011...	0.012	0.012	0.013	0.013	0.014	0.014	0.015	0.015	0.015	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.015	0.014
2012...	0.012	0.013	0.013	0.014	0.014	0.014	0.015	0.015	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.015	0.014	0.014
2013...	0.013	0.013	0.013	0.014	0.014	0.015	0.015	0.015	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.015	0.014	0.013
2014...	0.013	0.013	0.014	0.014	0.015	0.015	0.015	0.016	0.016	0.016	0.016	0.016	0.016	0.015	0.015	0.014	0.013	0.013	0.012
2015...	0.013	0.014	0.014	0.014	0.015	0.015	0.015	0.016	0.016	0.016	0.016	0.016	0.015	0.015	0.014	0.013	0.013	0.012	0.011
2016...	0.014	0.014	0.014	0.015	0.015	0.015	0.015	0.016	0.016	0.016	0.015	0.015	0.014	0.014	0.013	0.013	0.012	0.011	0.011
2017...	0.014	0.014	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.014	0.014	0.013	0.012	0.012	0.011	0.010	
2018...	0.014	0.014	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.014	0.014	0.013	0.012	0.012	0.011	0.010		
2019...	0.014	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.014	0.014	0.013	0.012	0.012	0.011	0.010			

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Infection Spread: 4,000,000 at risk, middle scenario to match CDC.
 Progression Rates: Weibull, median 10 years, alpha 2.1.
 Mortality after Diagnosis: 40%-40%-35%-25%; cases before 1986 higher.
 Age/Sex Splits: 10% female, distribute all cases among ages 15–79.
 Included Deaths: 100% of infections after 1988.

APPENDIX E
PROJECTION SCENARIOS COMPARISON

Comparison between Scenarios

This appendix presents tables and graphs that compare our three scenarios for the AIDS epidemic:

- Modeled HIV infections
- Modeled AIDS cases
- Modeled AIDS deaths.

In each case, we first compare annual figures and then cumulative figures. Each comparison is shown in both table and graph form.

As we intended, there is a wide range of difference among our three scenarios. The following table compares the annual number of modeled AIDS deaths between models:

Year	Annual AIDS Deaths, Expressed as a Percentage of the Middle Scenario	
	Low Scenario	High Scenario
1989	102%	110%
1994	84	144
1999	52	187
2004	25	228
2009	10	243
2014	4	222
2019	2	193

Apparent Anomalies

The low scenario is intended to match observed results with a smaller HIV-infected population and thus with lower eventual AIDS cases and deaths. This does not mean that the low scenario always models the lowest deaths in every year. The low scenario actually models higher annual AIDS cases than the middle scenario through 1989.

This result occurs because of the assumption of fast progression rates from HIV infection to AIDS diagnosis. Under this scenario, a smaller infected population is producing observed results because they are progressing to AIDS faster. Since they are progressing faster, more AIDS cases are produced in the early years of the model even though there are fewer people infected.

The same kind of result occurs with the high scenario, which projects fewer annual AIDS cases than the middle scenario through 1984. This scenario was developed to reproduce observed cases with a large infected population progressing to AIDS relatively slowly.

Comparison to CDC Projections

Tables E3 and E4 and Graphs E3B and E4B show how our modeled AIDS cases compare to (adjusted) historical reported and (adjusted) CDC projected AIDS cases.

The middle scenario is set to match the CDC data very closely. For the low scenario, annual AIDS cases are lower than the CDC's projections beginning in 1991. For the high scenario, annual AIDS cases are higher than the CDC projections beginning in 1988.

Comparison to Cowell/Hoskins

For the convenience of actuaries who have been working with the Cowell/Hoskins projections, Tables and Graphs E1 through E6 compare our modeled results to projected HIV infections, AIDS cases, and AIDS deaths from Appendix 1 of the August 1987 paper: "AIDS, HIV Mortality and Life Insurance," by Michael J. Cowell and Walter H. Hoskins.

The projection labeled "infection declines" is the Cowell/Hoskins "infection declines to zero by 1997" scenario. The projection labeled "infection continues" is their "infection continues to 100 percent of at-risk group" scenario.

Our scenarios project lower AIDS cases and deaths by the year 2000 than did the Cowell/Hoskins projections. Their "infection continues" projection of AIDS deaths exceeds our high scenario, and their "infection declines" projection exceeds our middle scenario by a large amount.

As a result, general population AIDS mortality rates that are based on the Cowell/Hoskins projections will be significantly higher than the "middle" scenario rates we present here. An important example is the AIDS mortality rates presented by Holland in his two papers in the fall of 1988. These were based on a mathematical function that approximated the Cowell/Hoskins "infection declines" projection. This is the main reason why Holland's AIDS mortality rates are higher than those we present here (see Appendix F).

The reason for the difference between the Cowell/Hoskins projections and our projections can be seen by examining the graphs of modeled AIDS cases

for the period 1985 through 1992. Graphs E3B and E4B show that the Cowell/Hoskins projections model AIDS cases lower than our new projections in earlier years but higher in later years.

This difference occurs because Cowell and Hoskins calibrated their model to the reported AIDS cases and CDC projections that were available in 1987. Compared to the benchmarks we used for these new models, the Cowell/Hoskins model started at a lower level and then trended up at a faster rate, ultimately projecting higher AIDS cases. See Appendix L for more information.

Thus the primary differences between our new models and the Cowell/Hoskins projections are due to new observations of AIDS cases and revisions in CDC projections. We expect that future revisions in these figures will require our projections to be adjusted in a similar fashion.

TABLE E1
COMPARISON OF MODELED ANNUAL HIV INFECTIONS

Year	SOA Committee on HIV Research			Cowell/Hoskins	
	Low	Middle	High	Infection Declines	Infection Continues
1975.....	0	0	0	0	0
1976.....	533	373	746	391	391
1977.....	1,293	1,302	2,542	1,383	1,383
1978.....	2,839	3,819	7,886	4,124	4,124
1979.....	6,511	9,945	21,973	10,284	10,284
1980.....	14,738	23,083	56,051	21,609	21,609
1981.....	32,807	47,190	119,568	38,396	38,396
1982.....	71,249	91,624	212,800	59,129	59,129
1983.....	100,904	152,215	251,191	82,744	82,744
1984.....	129,573	181,803	264,988	110,032	110,032
1985.....	123,949	166,097	257,148	149,488	149,488
1986.....	101,784	139,431	246,954	192,926	192,926
1987.....	79,119	123,252	237,593	248,947	248,947
1988.....	47,335	104,395	227,285	271,873	304,623
1989.....	33,401	95,234	214,782	273,764	349,432
1990.....	20,861	87,475	202,271	256,127	372,330
1991.....	12,477	75,233	191,020	224,621	366,809
1992.....	6,296	64,021	181,461	185,908	334,492
1993.....	3,796	60,904	169,287	145,283	284,197
1994.....	3,174	56,478	155,283	105,836	227,313
1995.....	2,546	52,639	140,246	68,714	173,190
1996.....	1,914	49,496	124,901	33,741	127,130
1997.....	1,278	46,165	109,854	0	90,791
1998.....	639	44,626	95,563	0	63,576
1999.....	640	42,998	82,339	0	43,906
2000.....	640	41,292	70,362	0	30,033
2001.....	640	41,292	70,362		
2002.....	640	41,292	70,362		
2003.....	640	41,292	70,362		
2004.....	640	41,292	70,362		
2005.....	640	41,292	70,362		
2006.....	640	41,292	70,362		
2007.....	640	41,292	70,362		
2008.....	640	41,292	70,362		
2009.....	640	41,292	70,362		
2010.....	640	41,292	70,362		
2011.....	640	41,292	70,362		
2012.....	640	41,292	70,362		
2013.....	640	41,292	70,362		
2014.....	640	41,292	70,362		
2015.....	640	41,292	70,362		
2016.....	640	41,292	70,362		
2017.....	640	41,292	70,362		
2018.....	649	41,292	70,362		
2019.....	640	41,292	70,362		

TABLE E2
COMPARISON OF MODELED ANNUAL HIV INFECTIONS

Year	SOA Committee on HIV Research			Cowell/Hoskins	
	Low	Middle	High	Infection Declines	Infection Continues
1975.....	296	122	220	113	113
1976.....	829	495	966	504	504
1977.....	2,122	1,797	3,508	1,887	1,887
1978.....	4,960	5,616	11,394	6,011	6,011
1979.....	11,471	15,561	33,366	16,295	16,295
1980.....	29,209	38,645	89,418	37,904	37,904
1981.....	59,016	85,835	208,986	76,300	76,300
1982.....	130,265	177,459	421,785	135,429	135,429
1983.....	231,169	329,673	672,977	218,173	218,173
1984.....	360,742	511,476	937,965	328,205	328,205
1985.....	484,691	677,573	1,195,113	477,693	477,693
1986.....	586,475	817,005	1,442,067	670,619	670,619
1987.....	665,593	940,257	1,679,660	919,566	919,566
1988.....	712,928	1,044,651	1,906,945	1,191,439	1,224,189
1989.....	746,330	1,139,886	2,121,727	1,465,203	1,573,621
1990.....	767,191	1,227,361	2,323,998	1,721,330	1,945,951
1991.....	779,668	1,302,594	2,515,018	1,945,951	2,312,760
1992.....	785,964	1,366,615	2,696,479	2,131,859	2,647,252
1993.....	789,760	1,427,519	2,865,766	2,277,142	2,931,449
1994.....	792,934	1,483,996	3,021,049	2,382,978	3,158,762
1995.....	795,480	1,536,635	3,161,295	2,451,692	3,331,952
1996.....	797,394	1,586,131	3,286,196	2,485,433	3,459,082
1997.....	798,671	1,632,296	3,396,050	2,485,433	3,549,873
1998.....	799,311	1,676,922	3,491,614	2,485,433	3,613,449
1999.....	799,951	1,719,919	3,573,953	2,485,433	3,657,355
2000.....	800,591	1,761,211	3,644,315	2,485,433	3,687,388
2001.....	801,231	1,802,503	3,714,677		
2002.....	801,871	1,843,794	3,785,039		
2003.....	802,511	1,885,086	3,855,401		
2004.....	803,151	1,926,378	3,925,762		
2005.....	803,792	1,967,670	3,996,124		
2006.....	804,432	2,008,961	4,066,486		
2007.....	805,072	2,050,253	4,136,848		
2008.....	805,712	2,091,545	4,207,210		
2009.....	806,352	2,132,836	4,277,572		
2010.....	806,992	2,174,128	4,347,934		
2011.....	807,633	2,215,420	4,418,296		
2012.....	808,273	2,256,711	4,488,658		
2013.....	808,913	2,298,003	4,559,020		
2014.....	809,553	2,339,295	4,629,382		
2015.....	810,193	2,380,586	4,699,744		
2016.....	810,833	2,421,878	4,770,105		
2017.....	811,474	2,463,170	4,840,467		
2018.....	812,114	2,504,461	4,910,829		
2019.....	812,754	2,545,753	4,981,191		

TABLE E3
COMPARISON OF MODELED ANNUAL AIDS CASES

Year	SOA Committee on HIV Research			Cowell/Hoskins		CDC
	Low	Middle	High	Infection Declines	Infection Continues	
1975	0	0	0	0	0	
1976	2	1	0	0	0	
1977	11	4	2	3	3	
1978	36	18	11	12	12	
1979	95	61	42	44	44	
1980	232	185	139	140	140	
1981	545	503	415	389	389	348
1982	1,252	1,236	1,120	950	950	1,023
1983	2,820	2,788	2,712	2,069	2,069	2,856
1984	5,875	5,777	5,772	4,070	4,070	5,832
1985	10,924	10,740	10,761	7,343	7,343	10,957
1986	18,121	17,702	17,958	12,334	12,334	18,115
1987	26,989	26,219	27,438	19,510	19,510	27,976
1988	36,671	35,724	39,103	29,318	29,318	35,291
1989	46,111	45,644	52,704	42,073	42,172	45,137
1990	54,274	55,433	67,855	57,807	58,426	55,129
1991	60,415	64,644	84,052	76,204	78,312	64,737
1992	64,053	72,873	100,712	96,487	101,684	73,440
1993	65,012	79,765	117,222	117,307	127,765	
1994	63,409	85,105	132,974	136,681	155,081	
1995	59,618	88,815	147,399	152,324	181,451	
1996	54,176	90,905	159,995	162,613	204,326	
1997	47,679	91,470	170,362	166,872	221,372	
1998	40,711	90,670	178,215	165,155	231,003	
1999	33,776	88,710	183,399	158,143	232,722	
2000	27,267	85,833	185,884	146,971	227,144	
2001	21,453	82,282	185,758			
2002	16,481	78,294	183,217			
2003	12,391	74,095	178,572			
2004	9,144	69,878	172,199			
2005	6,649	65,799	164,506			
2006	4,790	61,974	155,905			
2007	3,443	58,482	146,789			
2008	2,492	55,370	137,518			
2009	1,839	52,656	128,400			
2010	1,400	50,335	119,693			
2011	1,112	48,389	111,592			
2012	927	46,785	104,236			
2013	811	45,485	97,712			
2014	740	44,450	92,053			
2015	697	43,637	87,252			
2016	672	43,010	83,267			
2017	657	42,534	80,034			
2018	649	42,177	77,467			
2019	645	41,914	75,475			

TABLE E4

COMPARISON OF MODELED CUMULATIVE AIDS CASES

Year	SOA Committee on HIV Research			Cowell/Hoskins		CDC
	Low	Middle	High	Infection Declines	Infection Continues	
1975.....	0	0	0	0	0	
1976.....	2	1	0	0	0	
1977.....	13	5	3	3	3	
1078.....	49	22	14	15	15	
1979.....	144	83	56	59	59	
1980.....	377	268	196	199	199	
1981.....	922	771	611	588	588	348
1982.....	2,174	2,007	1,731	1,538	1,538	1,371
1983.....	4,994	4,795	4,443	3,607	3,607	4,227
1984.....	10,869	10,572	10,214	7,677	7,677	10,059
1985.....	21,793	21,311	20,975	15,020	15,020	21,016
1986.....	39,914	39,013	38,933	27,354	27,354	39,131
1987.....	66,903	65,232	66,371	46,864	46,864	67,107
1988.....	103,574	100,956	105,474	76,182	76,182	102,398
1989.....	149,685	146,600	158,179	118,255	118,354	147,535
1990.....	203,959	202,033	226,034	176,062	176,780	202,664
1991.....	264,374	266,677	310,085	252,266	255,092	267,401
1992.....	328,427	339,549	410,798	348,753	356,776	340,841
1993.....	393,439	419,315	528,020	466,060	484,541	
1994.....	456,849	504,420	660,994	602,741	639,622	
1995.....	516,467	593,235	808,393	755,065	821,073	
1996.....	570,643	684,140	968,388	917,678	1,025,399	
1997.....	618,322	775,610	1,138,750	1,084,550	1,246,771	
1998.....	659,034	866,280	1,316,965	1,249,705	1,477,774	
1999.....	692,810	954,990	1,500,364	1,407,848	1,710,496	
2000.....	720,076	1,040,824	1,686,248	1,554,819	1,937,640	
2001.....	741,529	1,123,105	1,872,006			
2002.....	758,011	1,201,399	2,055,223			
2003.....	770,402	1,275,493	2,233,794			
2004.....	779,546	1,345,371	2,405,993			
2005.....	786,196	1,411,170	2,570,499			
2006.....	790,985	1,473,144	2,726,404			
2007.....	794,428	1,531,625	2,873,193			
2008.....	796,920	1,586,995	3,010,711			
2009.....	798,759	1,639,651	3,139,111			
2010.....	800,160	1,689,986	3,258,804			
2011.....	801,272	1,738,375	3,370,395			
2012.....	802,199	1,785,160	3,474,632			
2013.....	803,011	1,830,646	3,572,344			
2014.....	803,751	1,875,095	3,664,396			
2015.....	804,448	1,918,733	3,751,648			
2016.....	805,120	1,961,743	3,834,915			
2017.....	805,777	2,004,277	3,914,949			
2018.....	806,427	2,046,453	3,992,416			
2019.....	807,072	2,088,367	4,067,891			

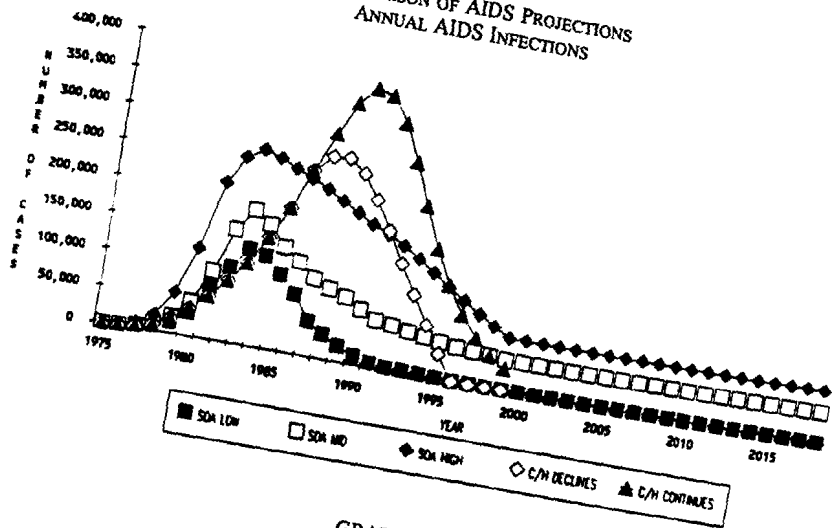
TABLE E5
COMPARISON OF MODELED ANNUAL AIDS DEATHS

Year	SOA Committee on HIV Research			Cowell/Hoskins	
	Low	Middle	High	Infection Declines	Infection Continues
1975.....	0	0	0	0	0
1976.....	1	0	0	0	0
1977.....	4	1	1	1	1
1978.....	13	6	4	7	7
1979.....	39	22	15	22	22
1980.....	99	71	52	76	76
1981.....	237	203	162	215	215
1982.....	553	523	454	541	541
1983.....	1,259	1,232	1,155	1,216	1,216
1984.....	2,719	2,673	2,618	2,470	2,470
1985.....	5,372	5,280	5,257	4,597	4,597
1986.....	8,980	8,801	8,850	7,950	7,950
1987.....	14,101	13,756	14,103	12,923	12,923
1988.....	20,979	20,432	21,610	19,924	19,924
1989.....	28,806	28,223	31,092	29,308	29,352
1990.....	36,767	36,620	42,313	41,279	41,583
1991.....	44,173	45,258	55,078	55,807	56,919
1992.....	50,385	53,750	69,047	72,532	75,463
1993.....	54,922	61,724	83,793	90,679	96,928
1994.....	57,499	68,858	98,834	108,957	120,505
1995.....	58,046	74,902	113,664	125,688	144,809
1996.....	56,693	79,697	127,780	139,284	167,991
1997.....	53,722	83,166	140,712	148,638	188,058
1998.....	49,511	85,305	152,051	153,204	203,289
1999.....	44,478	86,176	161,467	152,976	212,565
2000.....	39,025	85,895	168,726	148,417	215,575
2001.....	33,510	84,619	173,696		
2002.....	28,215	82,525	176,347		
2003.....	23,345	79,807	176,752		
2004.....	19,022	76,655	175,081		
2005.....	15,300	73,246	171,577		
2006.....	12,177	69,739	166,535		
2007.....	9,616	66,265	160,279		
2008.....	7,556	62,928	153,140		
2009.....	5,926	59,804	145,441		
2010.....	4,654	56,944	137,481		
2011.....	3,672	54,379	129,525		
2012.....	2,922	52,117	121,798		
2013.....	2,352	50,157	114,479		
2014.....	1,922	48,482	107,703		
2015.....	1,599	47,070	101,559		
2016.....	1,357	45,896	96,098		
2017.....	1,176	44,932	91,334		
2018.....	1,041	44,147	87,250		
2019.....	940	43,517	83,808		

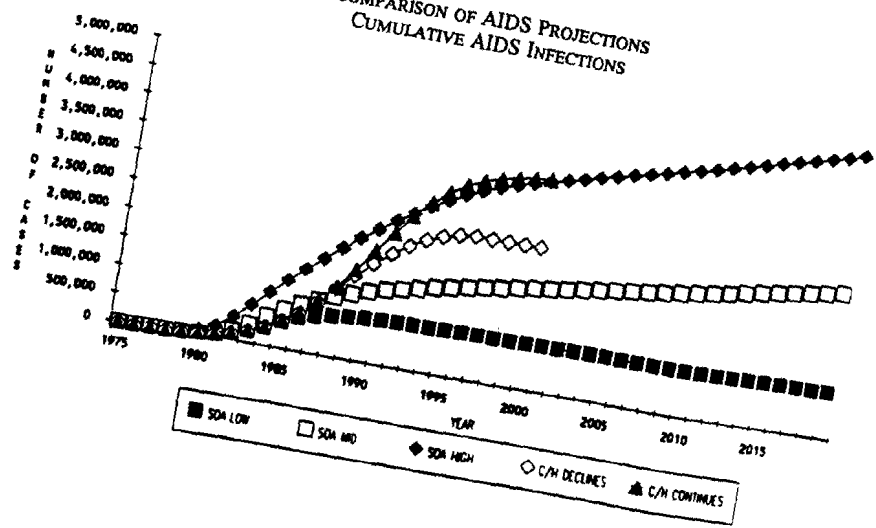
TABLE E6
COMPARISON OF MODELED CUMULATIVE AIDS DEATHS

Year	SOA Committee on HIV Research			Cowell/Hoskins	
	Low	Middle	High	Infection Declines	Infection Continues
1975.....	0	0	0	0	0
1976.....	1	0	0	0	0
1977.....	4	1	1	1	1
1978.....	18	8	5	8	8
1979.....	56	30	20	30	30
1980.....	155	101	72	106	106
1981.....	392	304	233	321	321
1982.....	945	827	688	862	862
1983.....	2,203	2,059	1,843	2,078	2,078
1984.....	4,922	4,732	4,461	4,548	4,548
1985.....	10,293	10,013	9,718	9,145	9,145
1986.....	19,273	18,814	18,569	17,095	17,095
1987.....	33,374	32,570	32,671	30,018	30,018
1988.....	54,353	53,002	54,282	49,942	49,942
1989.....	83,159	81,225	85,373	79,250	79,294
1990.....	119,926	117,844	127,686	120,529	120,877
1991.....	164,099	163,102	182,765	176,336	177,796
1992.....	214,484	216,852	251,812	248,868	253,259
1993.....	269,406	278,577	335,605	339,547	350,187
1994.....	326,905	347,434	434,439	448,504	470,692
1995.....	384,951	422,336	548,103	574,192	615,501
1996.....	441,644	502,033	675,883	713,476	783,492
1997.....	495,366	585,199	816,596	862,114	971,550
1998.....	544,877	670,504	968,646	1,015,318	1,174,839
1999.....	589,355	756,680	1,130,113	1,168,294	1,387,404
2000.....	628,381	842,576	1,298,839	1,316,711	1,602,979
2001.....	661,890	927,194	1,472,536		
2002.....	690,106	1,009,720	1,648,883		
2003.....	713,451	1,089,527	1,825,635		
2004.....	732,473	1,166,182	2,000,716		
2005.....	747,773	1,239,428	2,172,293		
2006.....	759,951	1,309,167	2,338,827		
2007.....	769,567	1,375,432	2,449,106		
2008.....	777,123	1,438,360	2,652,246		
2009.....	783,050	1,498,163	2,797,688		
2010.....	787,703	1,555,108	2,935,169		
2011.....	791,376	1,609,486	3,064,694		
2012.....	794,297	1,661,604	3,186,492		
2013.....	796,649	1,711,760	3,300,970		
2014.....	798,572	1,760,242	3,408,673		
2015.....	800,171	1,807,312	3,510,232		
2016.....	801,528	1,853,208	3,606,330		
2017.....	802,704	1,898,140	3,697,664		
2018.....	803,745	1,942,288	3,784,914		
2019.....	804,684	1,985,804	3,868,722		

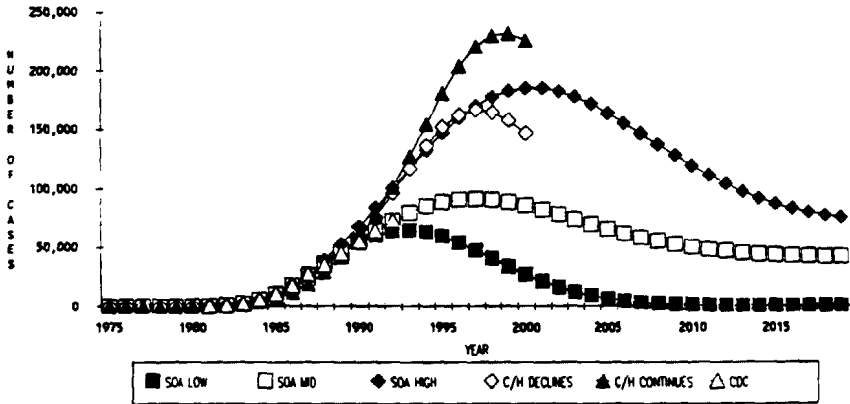
GRAPH E1
COMPARISON OF AIDS PROJECTIONS
ANNUAL AIDS INFECTIONS



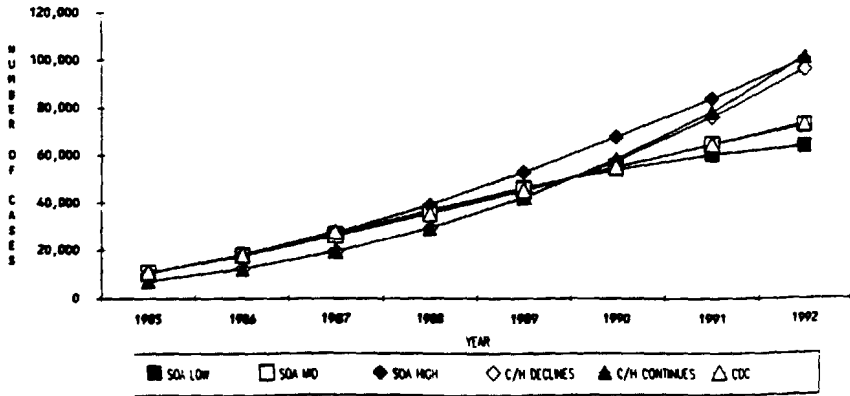
GRAPH E2
COMPARISON OF AIDS PROJECTIONS
CUMULATIVE AIDS INFECTIONS



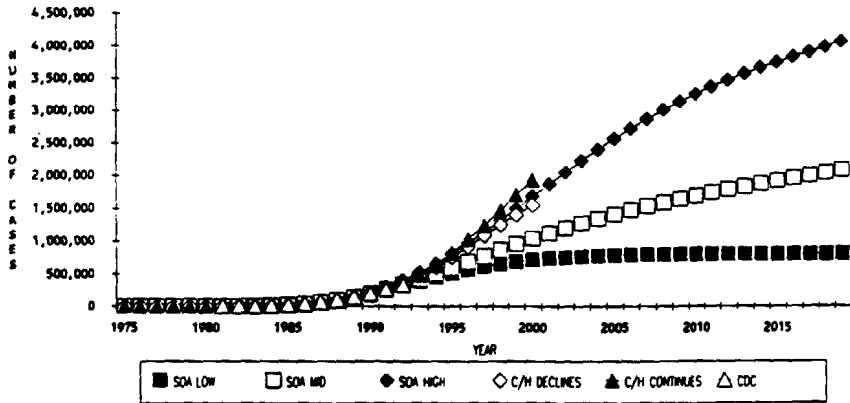
GRAPH E3A
COMPARISON OF AIDS PROJECTIONS
ANNUAL AIDS CASES



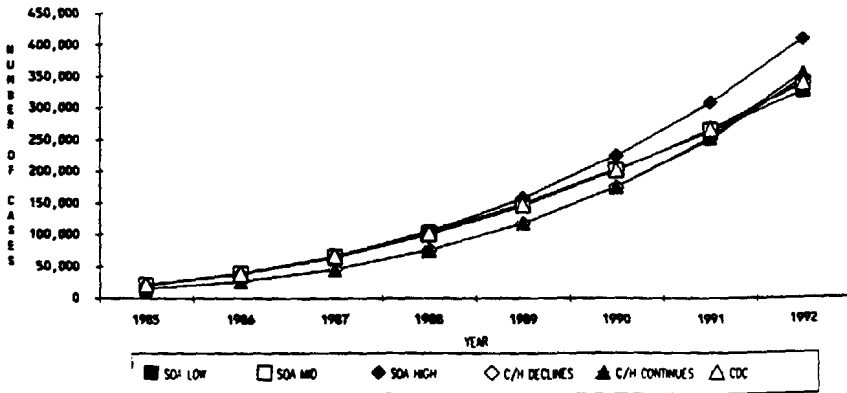
GRAPH E3B
COMPARISON OF AIDS PROJECTIONS
ANNUAL AIDS CASES



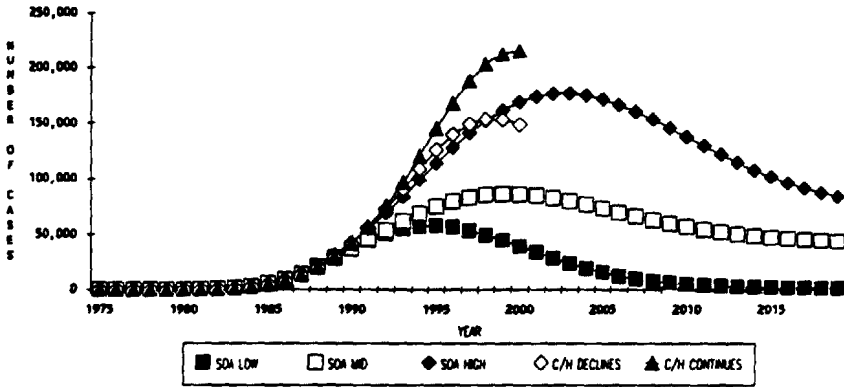
GRAPH E4A
 COMPARISON OF AIDS PROJECTIONS
 CUMULATIVE AIDS CASES



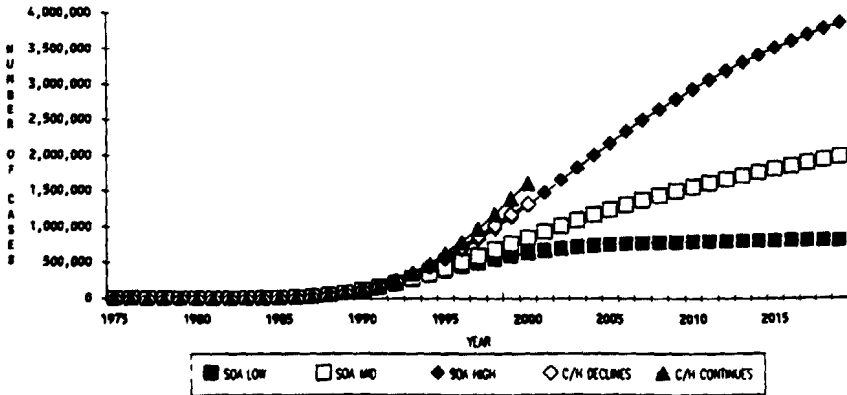
GRAPH E4B
 COMPARISON OF AIDS PROJECTIONS
 CUMULATIVE AIDS CASES



GRAPH E5
COMPARISON OF AIDS PROJECTIONS
ANNUAL AIDS DEATHS



GRAPH E6
COMPARISON OF AIDS PROJECTIONS
CUMULATIVE AIDS DEATHS



APPENDIX F

MORTALITY RATES COMPARISON

Four tables and graphs in this appendix compare the mortality rates resulting from our three scenarios. We also show in the tables a comparison of these rates to the male AIDS mortality rates projected for the U.S. and Canada by the Canadian Institute of Actuaries, for the U.K. by the Institute of Actuaries, and for the U.S. by Holland.

There are a table and a graph for each of male ages 25, 35, 45, and 55 in 1989. The numbers down a column follow each cohort through the years. For example, the 1990 rates apply to ages 26, 36, 46, and 56.

For each of our three scenarios, the relative differences in AIDS mortality rates are the same as the relative differences in projected annual AIDS deaths. This occurs because we use the same assumptions for distributing the AIDS deaths by gender and age for each scenario.

Holland's AIDS Mortality Rates

Our projected male U.S. general population mortality rates are substantially lower than those published by Holland in 1988. This occurs primarily for two reasons:

2. Holland's mortality rates were based on the Cowell/Hoskins "infection declines to zero by 1997" projection of AIDS deaths. As explained in Appendix E, our scenarios project significantly lower AIDS deaths than did the Cowell/Hoskins paper.
2. Holland's rates are based on 100 percent of the Cowell/Hoskins projected AIDS deaths. We allocated 90 percent of our projected AIDS deaths to males.

Canadian Institute of Actuaries

The Canadian Institute of Actuaries published reports in November 1988 that presented projections of U.S. and Canadian general population male AIDS mortality rates. One set of projections assumed that new HIV infections would continue at the modeled 1984 level each year thereafter. This set produces relatively high AIDS mortality rates.

Another set of AIDS mortality rates developed by the CIA assumed that new HIV infections stop after 1988. This set produces relatively low AIDS mortality rates.

We compare here the results of an intermediate set of projections that produces AIDS mortality rates between those of the two projections described above. The intermediate U.S. AIDS mortality rates shown in Tables F1 through F4 assume that HIV infections gradually decrease after 1988.

The CIA U.S. male AIDS mortality rates are considerably higher than our middle scenario rates. For age 45 in 1989, they are roughly the same as for our high scenario. For age 55 in 1989, they are significantly higher than for our high scenario.

The CIA AIDS model is different from ours in several aspects, and a detailed comparison is outside the scope of this report. There are, however, three important differences that should be noted when comparing the CIA results to ours:

1. The CIA model used projected AIDS cases increased by 10 percent to account for underreporting. Our model was developed to project only the cases that will eventually be reported.
2. The CIA model allocated all projected AIDS cases to the calculation of male AIDS mortality rates. Our AIDS mortality rates assumed that 90 percent of modeled AIDS cases are males.
3. The CIA model assumed progression rates from HIV infection to AIDS diagnosis by using a Weibull function with a median of 10 years, just as our middle projection assumed. However, a different "shape" parameter was assumed that produced lower initial progression rates followed by higher later rates. Five, seven, and nine years after HIV infection, the CIA model assumed 12 percent, 25 percent, and 41 percent, respectively, progressed to AIDS. Our middle scenario assumed 15 percent, 28 percent, and 43 percent, respectively, progressed after those periods. This difference in assumed progression rates resulted in more infections hypothesized for the CIA model in order to produce modeled AIDS cases consistent with reported cases.
4. The CIA model was not calibrated to match the CDC's projections. Instead, annual HIV infections were held constant at the 1984 level until they began to be graded down after 1988. This also resulted in higher modeled AIDS cases than for our model.
5. The CIA model assumed higher mortality rates after AIDS diagnosis. After 6, 18, and 30 months after diagnosis, the CIA model assumed that 30 percent, 66 percent, and 83 percent, respectively, of persons with AIDS have died. Our model assumed, for cases diagnosed after 1985, only 23 percent, 54 percent, and 71 percent dead after those periods. The CIA model's higher assumed mortality rates advanced its modeled AIDS mortality, increasing the AIDS mortality rates in the early and middle part of the projection and causing the rates to fall faster in the later part.
6. The CIA model used the Canadian age distribution of AIDS deaths in its calculation of U.S. AIDS mortality rates. Although the distributions appear to be similar, the CIA report assumed the highest age of death from AIDS to be 65. The choice of the upper age limit was made because the monthly report *Surveillance Update: AIDS in Canada* of the Federal Centre for AIDS in Ottawa combines all deaths over age 50 into a single age group and becomes an upper age of 65 that provided the best statistical fit.

The age distribution used in our model spreads the over-age-50 group over a wider age range. The resulting higher concentration, in the CIA work, at the lower end of the over-age-50 group produces higher mortality rates at those ages and lower ones at ages over 65.

The CIA projected substantially lower AIDS male mortality rates for Canada than for the U.S. The methodology used by the CIA Task Force was the same for both the Canadian and U.S. studies. The primary reasons for the estimated lower AIDS mortality rates in Canada versus the U.S. are thought to be:

1. The per-capita incidence of AIDS in the U.S. is almost four times higher than in Canada. This will be directly reflected in the mortality rates in future years since the HIV incidence will also be almost four times greater.
2. The epidemic in Canada is thought to have started about two years later than the epidemic in the U.S. and was at an earlier stage when behavioral changes were assumed in the CIA reports to take place in 1984.

Institute of Actuaries

The Institute of Actuaries AIDS Working Party updated, in March 1989, U.K. AIDS mortality rates originally published in December 1987. The IOA model is based on a system of differential equations describing the transmission of HIV among male homosexuals. Various projections are produced when different values are assumed for:

1. The size of the at-risk population
2. The probabilities of transfer from "at risk" to "clear"
3. The number of new entrants to the at-risk group
4. The probabilities of infection
5. The level of infectivity during the incubation period
6. The probabilities of progression from infection to AIDS
7. The probabilities of mortality from AIDS.

This model is more general than our model, requiring the calibration of more quantities. Further, the IOA projections are applied to the U.K. population, with no comparable use of its model with U.S. data. This makes an analysis of the differences in results quite difficult, and we have not attempted it here.

Tables F1 through F4 include a comparison of the AIDS mortality rates for several of the IOA's projections. The IOA publications show AIDS mortality rates only for certain ages and calendar years. Where data were not shown, the values in the tables shown here were determined by linear interpolation between the values that were available.

We have shown rates for the following IOA projections:

Projection R, a revision of the former Projection F, which was referred to as a "low" projection. The Working Party recommended in 1987 that: "... the assumptions underlying Projection F are sufficiently moderate for it to be essential for insurance companies to have regard to the possibility of an incidence of HIV infection of at least this level ... there is no reason to delay making changes to reserves and to pricing structures to take this into account." The Working Party stated in 1989 that: "We believe that there are still grounds for using Projection R ... for insurance applications, or the not dissimilar Projection T... ."

Projection T, which is the same as Projection Q but assumes faster progression from HIV infection to AIDS diagnosis, modeled by using fewer current HIV infections.

Projection Q, a revision of the former Projection BC, which was referred to as a "moderate" projection.

There are other projections published by the IOA to show sensitivity to various assumptions. Some of these alternative projections produce results significantly lower than the "main" projections described above.

TABLE F1
COMPARISON OF GENERAL POPULATION AIDS MORTALITY (PER THOUSAND)
MALES ATTAINED AGE 25 IN 1989

Year	SOA			Holland H1	CIA		IOA		
	Low	Mid	High		U.S.	Can.	R	T	Q
1989...	0.235	0.230	0.254	0.209	0.35	0.11	0.03	0.03	0.04
1990...	0.375	0.374	0.432	0.366	0.65	0.20	0.05	0.06	0.06
1991...	0.540	0.554	0.674	0.591	1.02	0.31	0.08	0.10	0.11
1992...	0.713	0.760	0.977	0.885	1.42	0.44	0.11	0.13	0.16
1993...	0.878	0.986	1.339	1.262	1.82	0.58	0.19	0.20	0.30
1994...	1.010	1.210	1.737	1.694	2.18	0.69	0.27	0.27	0.41
1995...	1.090	1.406	2.134	2.164	2.46	0.79	0.38	0.37	0.60
1996...	1.128	1.585	2.541	2.638	2.65	0.85	0.50	0.48	0.79
1997...	1.105	1.710	2.893	2.987	2.73	0.88	0.62	0.61	0.99
1998...	1.025	1.766	3.148	3.168	2.71	0.88	0.71	0.75	1.18
1999...	0.904	1.752	3.282	3.146	2.60	0.85	0.78	0.88	1.34
2000...	0.762	1.678	3.295	2.992	2.43	0.79	0.83	1.01	1.46
2001...	0.633	1.598	3.281	2.686	2.20	0.72	0.88	1.15	1.59
2002...	0.510	1.493	3.189	2.334	1.94	0.63	0.82	1.14	1.51
2003...	0.394	1.347	2.982	1.958	1.68	0.55	0.76	1.13	1.41
2004...	0.292	1.176	2.687	1.599	1.42	0.47	0.71	1.17	1.33
2005...	0.209	1.002	2.347	1.281	1.19	0.39	0.67	1.26	1.25
2006...	0.151	0.864	2.062		0.98	0.32	0.64	1.28	1.17
2007...	0.110	0.756	1.829		0.80	0.26	0.54	1.15	0.98
2008...	0.080	0.663	1.613		0.64	0.21	0.46	1.03	0.83
2009...	0.057	0.577	1.404		0.51	0.17	0.39	0.92	0.69
2010...	0.041	0.497	1.201		0.39	0.13	0.32	0.82	0.55
2011...	0.028	0.422	1.004		0.30	0.10			
2012...	0.020	0.359	0.839		0.23	0.07			
2013...	0.014	0.307	0.701		0.17	0.05			
2014...	0.011	0.265	0.589		0.12	0.04			
2015...	0.008	0.231	0.499		0.08	0.03			
2016...	0.006	0.204	0.426		0.06	0.02			
2017...	0.005	0.184	0.374		0.04	0.01			
2018...	0.004	0.171	0.339		0.03	0.01			
2019...	0.004	0.163	0.314						

GRAPH F1
 COMPARISON OF AIDS MORTALITY RATES
 MALE AGE 25 IN 1989

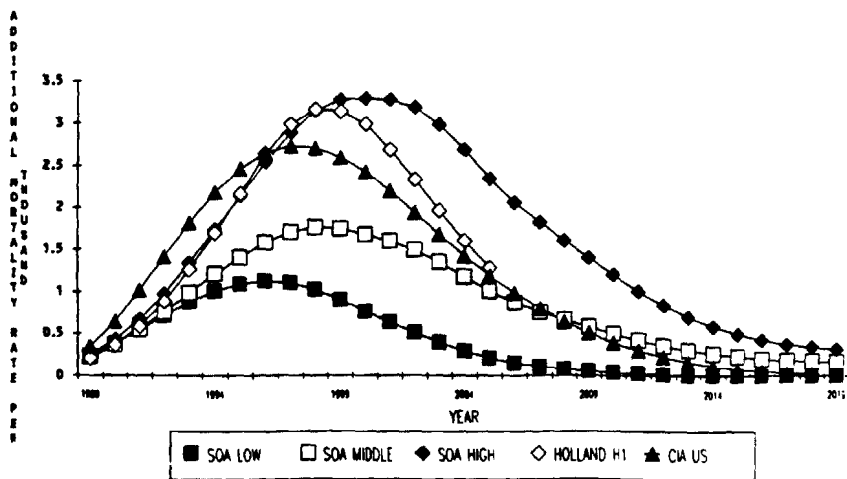


TABLE F2
COMPARISON OF GENERAL POPULATION AIDS MORTALITY (PER THOUSAND)
MALES ATTAINED AGE 35 IN 1989

Year	SOA			Holland	CIA		IOA		
	Low	Mid	High	H1	U.S.	Can.	R	T	Q
1989...	0.597	0.585	0.645	0.635	0.79	0.21	0.09	0.10	0.11
1990...	0.747	0.744	0.859	0.861	0.98	0.26	0.15	0.18	0.20
1991...	0.866	0.887	1.080	1.127	1.16	0.31	0.23	0.30	0.38
1992...	0.932	0.994	1.277	1.401	1.32	0.36	0.38	0.46	0.65
1993...	0.937	1.053	1.430	1.682	1.43	0.39	0.60	0.65	1.03
1994...	0.893	1.070	1.536	1.940	1.51	0.42	0.84	0.87	1.47
1995...	0.817	1.055	1.600	2.147	1.54	0.43	1.06	1.10	1.89
1996...	0.729	1.024	1.642	2.282	1.53	0.43	1.22	1.33	2.21
1997...	0.631	0.977	1.653	2.293	1.48	0.42	1.30	1.54	2.38
1998...	0.532	0.916	1.633	2.215	1.39	0.39	1.32	1.71	2.43
1999...	0.438	0.848	1.590	2.050	1.28	0.36	1.28	1.84	2.37
2000...	0.352	0.775	1.523	1.822	1.16	0.33	1.21	1.91	2.23
2001...	0.277	0.698	1.434	1.583	1.02	0.29	1.10	1.83	1.99
2002...	0.210	0.613	1.310	1.330	0.88	0.25	0.97	1.72	1.75
2003...	0.155	0.530	1.173	1.084	0.75	0.21	0.86	1.64	1.53
2004...	0.113	0.454	1.038	0.862	0.63	0.18	0.76	1.57	1.32
2005...	0.081	0.389	0.912	0.674	0.52	0.15	0.66	1.53	1.15
2006...	0.059	0.336	0.801		0.43	0.12	0.58	1.35	1.00
2007...	0.042	0.291	0.704		0.35	0.10	0.50	1.17	0.85
2008...	0.031	0.257	0.624		0.28	0.08	0.42	1.00	0.71
2009...	0.023	0.229	0.558		0.22	0.06	0.34	0.84	0.57
2010...	0.017	0.206	0.497		0.17	0.05	0.27	0.69	0.43
2011...	0.013	0.187	0.446		0.13	0.04			
2012...	0.009	0.168	0.392		0.10	0.03			
2013...	0.007	0.150	0.342		0.07	0.02			
2014...	0.005	0.133	0.296		0.05	0.02			
2015...	0.004	0.119	0.256		0.04	0.01			
2016...	0.003	0.106	0.223		0.03	0.01			
2017...	0.003	0.096	0.196		0.02	0.01			
2018...	0.002	0.088	0.174		0.01	0.00			
2019...	0.002	0.081	0.155						

GRAPH F2
 COMPARISON OF AIDS MORTALITY RATES
 MALE AGE 35 IN 1989

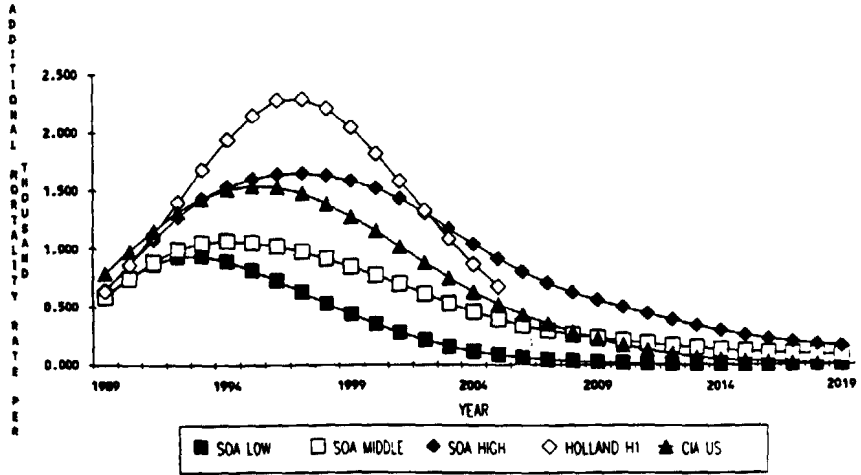


TABLE F3
COMPARISON OF GENERAL POPULATION AIDS MORTALITY (PER THOUSAND)
MALES ATTAINED AGE 45 IN 1989

Year	SOA			Holland H1	CIA		IOA		
	Low	Mid	High		U.S.	Can.	R	T	Q
1989...	0.399	0.391	0.431	0.463	0.55	0.11	0.07	0.07	0.08
1990...	0.469	0.467	0.539	0.593	0.67	0.14	0.10	0.10	0.14
1991...	0.511	0.523	0.637	0.748	0.77	0.16	0.15	0.16	0.23
1992...	0.522	0.557	0.716	0.856	0.85	0.18	0.22	0.22	0.35
1993...	0.509	0.572	0.776	0.984	0.92	0.19	0.33	0.30	0.51
1994...	0.478	0.572	0.821	0.089	0.96	0.20	0.45	0.39	0.68
1995...	0.436	0.563	0.854	1.173	0.97	0.21	0.56	0.48	0.84
1996...	0.383	0.539	0.864	1.232	0.96	0.21	0.65	0.58	0.97
1997...	0.331	0.513	0.867	1.162	0.92	0.20	0.71	0.67	1.06
1998...	0.284	0.489	0.872	1.094	0.87	0.19	0.75	0.75	1.12
1999...	0.241	0.467	0.875	0.988	0.80	0.18	0.76	0.82	1.15
2000...	0.201	0.442	0.868	0.869	0.73	0.16	0.76	0.88	1.15
2001...	0.159	0.402	0.825	0.760	0.65	0.14	0.67	0.85	1.01
2002...	0.121	0.355	0.759	0.640	0.56	0.12	0.60	0.85	0.93
2003...	0.090	0.309	0.685	0.525	0.48	0.11	0.56	0.87	0.88
2004...	0.066	0.267	0.610	0.420	0.41	0.09	0.55	0.87	0.85
2005...	0.048	0.230	0.539	0.329	0.35	0.08	0.54	0.87	0.84
2006...	0.034	0.194	0.464		0.29	0.06	0.46	0.74	0.69
2007...	0.024	0.163	0.395		0.24	0.05	0.38	0.65	0.58
2008...	0.016	0.137	0.333		0.19	0.04	0.33	0.60	0.50
2009...	0.011	0.115	0.281				0.29	0.57	0.45
2010...	0.008	0.097	0.234				0.27	0.56	0.43
2011...	0.006	0.086	0.205						
2012...	0.004	0.075	0.175						
2013...	0.003	0.064	0.147						
2014...	0.002	0.055	0.123						
2015...	0.002	0.048	0.103						
2016...	0.001	0.041	0.087						
2017...	0.001	0.038	0.077						
2018...	0.001	0.035	0.069						
2019...	0.001	0.032	0.061						

GRAPH F3
 COMPARISON OF AIDS MORTALITY RATES
 MALE AGE 45 IN 1989

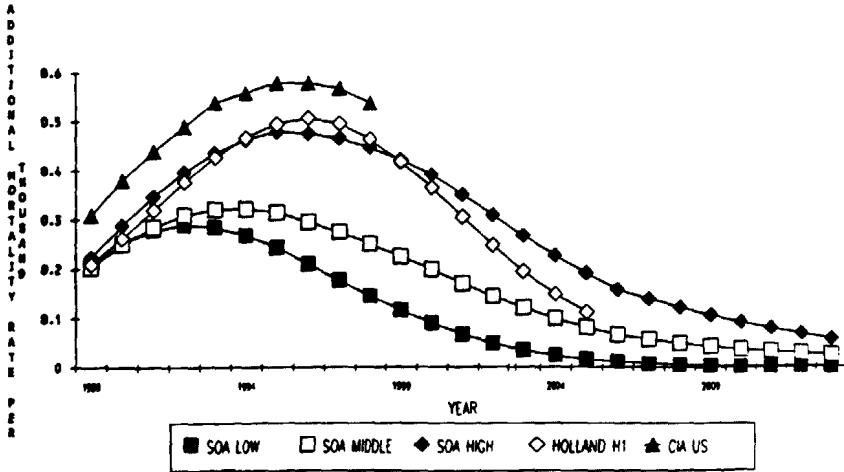
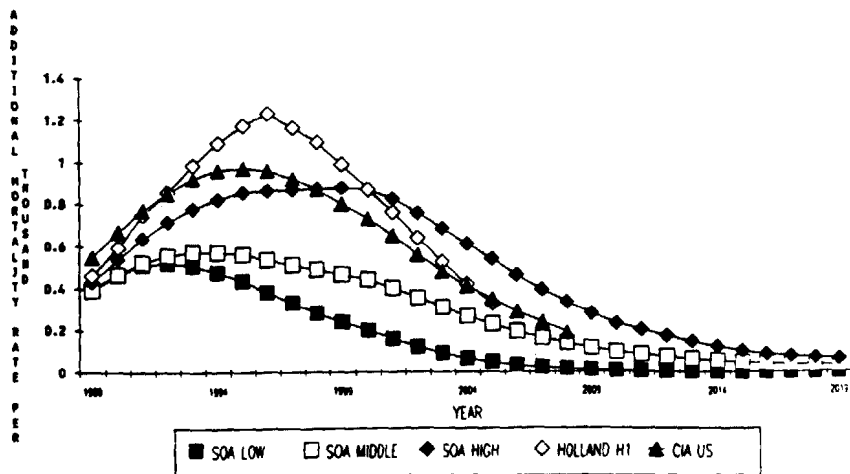


TABLE F4
COMPARISON OF GENERAL POPULATION AIDS MORTALITY (PER THOUSAND)
MALES ATTAINED AGE 55 IN 1989

Year	SOA			Holland HI	CIA		IOA		
	Low	Mid	High		U.S.	Can.	R	T	Q
1989...	0.207	0.203	0.224	0.210	0.31	0.08	0.03	0.02	0.04
1990...	0.251	0.250	0.289	0.262	0.38	0.10	0.04	0.03	0.05
1991...	0.279	0.286	0.348	0.320	0.44	0.11	0.05	0.04	0.07
1992...	0.290	0.310	0.398	0.377	0.49	0.13	0.06	0.05	0.09
1993...	0.286	0.322	0.437	0.428	0.54	0.14	0.08	0.06	0.11
1994...	0.270	0.323	0.463	0.468	0.56	0.15	0.10	0.07	0.13
1995...	0.245	0.316	0.479	0.496	0.58	0.15	0.12	0.09	0.15
1996...	0.211	0.297	0.477	0.508	0.58	0.15	0.12	0.09	0.15
1997...	0.178	0.276	0.467	0.497	0.57	0.15	0.14	0.11	0.16
1998...	0.146	0.252	0.449	0.466	0.54	0.15	0.13	0.11	0.15
1999...	0.117	0.226	0.423	0.420			0.14	0.12	0.15
2000...	0.091	0.200	0.393	0.366			0.13	0.11	0.14
2001...	0.068	0.171	0.352	0.307			0.13	0.13	0.15
2002...	0.050	0.145	0.310	0.249			0.12	0.12	0.13
2003...	0.035	0.121	0.268	0.196			0.12	0.12	0.12
2004...	0.025	0.100	0.228	0.150			0.11	0.10	0.10
2005...	0.017	0.082	0.193	0.113			0.10	0.09	0.09
2006...	0.012	0.067	0.159				0.08	0.08	0.08
2007...	0.008	0.058	0.140				0.07	0.08	0.07
2008...	0.006	0.050	0.123				0.06	0.07	0.05
2009...	0.004	0.044	0.107				0.05	0.06	0.04
2010...	0.003	0.039	0.093				0.03	0.03	0.02
2011...	0.002	0.034	0.081						
2012...	0.002	0.030	0.069						
2013...	0.001	0.026	0.058						
2014...							0.06		

GRAPH F4
 COMPARISON OF AIDS MORTALITY RATES
 MALE AGE 55 IN 1989



APPENDIX G

ASSUMED PROGRESSION RATES TO AIDS

The rates of progression from HIV infection to AIDS are the most critical of the modeling parameters that need to be estimated. Depending on the nature of the progression rates, the portion of the AIDS epidemic that has been reported to date could be either a relatively small problem consisting of a smaller population of infected individuals progressing to AIDS relatively quickly, or it could be a relatively large problem involving a larger infected population progressing to AIDS relatively slowly.

Experience Data Available

It is very difficult to attempt to measure the progression rates that apply to the general infected population. Reasons include:

1. It is impractical to determine the date of infection for the vast majority of infected persons.
2. The measurement of progression rates requires continued follow-up of defined cohorts of infected individuals.
3. The epidemic is still so new that there are relatively few individuals who have been infected with HIV for long periods of time. In fact, there is very little data for the periods after what we are assuming is the median progression period.

The experience studies that are available are mostly from groups not representative of the general at-risk population. Several studies have been made for persons infected through blood transfusions or for hemophiliacs. These studies provide good data for study because the date of infection can often be determined precisely.

Cowell and Hoskins and Harry Panjer studied the results of data from the Center of Internal Medicine of the University of Frankfurt, West Germany. These progression rates now appear to be too fast. The observation period for this study was relatively short, and the analysis depended on piecing together the rates of progression between stages in the progression from HIV infection to AIDS diagnosis.

The SFCC Study

The experience study from which we derive our assumed progression is the San Francisco City Clinic study. This is a study of periodically collected frozen blood samples from 6,700 homosexuals and bisexual men in San Francisco. These men were recruited between 1978 and 1980 from the San Francisco sexually transmitted disease clinic for a study of hepatitis B.

Serum samples were collected from this cohort at various periods of time. The unused serum samples were frozen and stored. Beginning in 1983, these frozen serum samples and the identified cohort of individuals at high risk of HIV infection were recognized as a valuable source of data for study.

This study was updated by Hessel et al. in a paper published in June 1988. This study produced estimated progression rates for the first ten years after infection, as well as 95 percent confidence boundary estimates.

Another study of these data was published by Bacchetti and Moss in March 1989. This study estimated a median progression time of 9.8 years, which is consistent with the 10 years median that we used to construct our middle set of progression rates assumptions. Further, this study also supports increasing progression rates, which is consistent with our choice of the Weibull function for our progression rates assumption.

An earlier study of these data by the CDC was used in developing estimates of the number of individuals infected with HIV at the end of 1987. The CDC assumptions stated that "the rates for years (7-10 after infection) were not taken directly from the San Francisco data but were extrapolated from prior years."

The Cowell/Hoskins paper used estimated progression rates based on the SFCC data in the generation of their model projections.

Table G1 shows a comparison (on a cumulative basis) of various estimated progression rates.

Graph G1A compares the 1988 SFCC best estimate and 95 percent confidence interval upper boundary progression rates with the two sets of rates, referred to earlier, that have been derived from the Frankfurt study. As a result of this comparison, we decided not to include the Frankfurt study data in our derivation of assumed progression rates.

Choice of Weibull Function

Biostatistical researchers have been estimating the shape of the distribution of the period from HIV infection to AIDS using both nonparametric ("actuarial") and parametric methods.

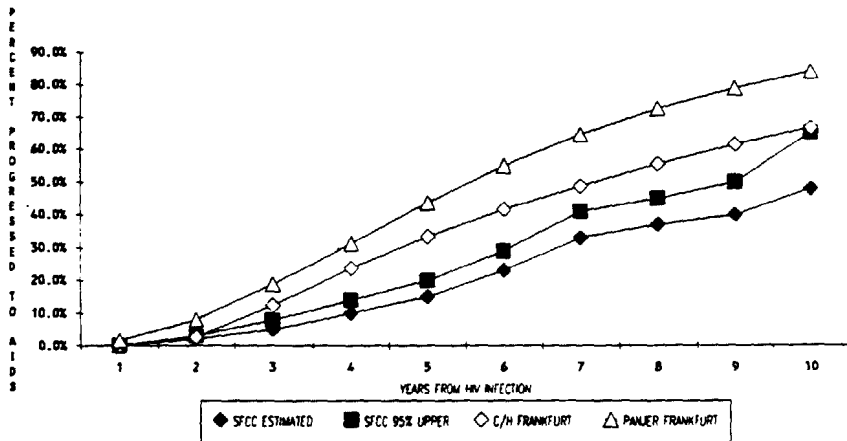
The data available for HIV-infected persons do not include any observations beyond about 10 years of incubation. Nonparametric methods will only give the shape of the distribution up to a maximum of this 10-year point. Parametric models implicitly provide a right-hand tail on the incubation distribution. The shape of the tail is not verifiable since no data exist beyond the approximate median of 10 years.

TABLE G1
CUMULATIVE PERCENTAGE PROGRESSED TO AIDS

San Francisco City Clinic Study							
Years from HIV Infection	Hessol et al., June 1988			1987 Cowell/Hoskins Estimate	1987 CDC Estimates		
	Lower Bound	Best Estimate	Upper Bound		Lower Bound	Best Estimate	Upper Bound
1.	0.0%	0.0	0.0	0.3%	0.0%	0.0%	0.0%
2.	1.0	2.0	3.0	1.5	0.0	2.0	4.0
3.	2.0	5.0	8.0	4.1	2.0	5.0	8.0
4.	6.0	10.0	14.0	8.4	5.0	10.0	15.0
5.	10.0	15.0	20.0	14.6	9.0	15.0	21.0
6.	17.0	23.0	29.0	23.2	17.0	24.0	31.0
7.	25.0	33.0	41.0	33.6	21.0	30.0	39.0
8.	29.0	37.0	45.0	43.6	26.0	36.0	46.0
9.	30.0	40.0	50.0	52.0	31.0	42.0	52.0
10.	31.0	48.0	65.0	59.2	36.0	47.0	58.0
11.	(These are the rates we						
12.	used as "SFCC estimates")						
Frankfurt Study				SOA Weibull Function Fits to SFCC Estimates			
Years from HIV Infection	Cowell/Hoskins	Panjer	Years from HIV Infection	SOA Scenarios			
				Low	Middle	High	
				(Progression Sets)			
				(Fast)	(Middle)	(Slow)	
1.	0.2%	1.6%	1.	0.7%	0.5%	0.1%	
2.	2.7	8.1	2.	3.2	2.3	0.8	
3.	12.4	18.8	3.	7.7	5.4	2.1	
4.	23.7	31.3	4.	14.0	9.6	4.3	
5.	33.4	43.7	5.	21.8	14.9	7.5	
6.	41.6	55.0	6.	30.8	21.1	11.5	
7.	48.8	64.6	7.	40.4	27.9	16.5	
8.	55.5	72.6	8.	50.0	35.2	22.2	
9.	61.4	78.9	9.	59.3	42.6	28.7	
10.	66.6	83.9	10.	67.8	50.0	35.6	

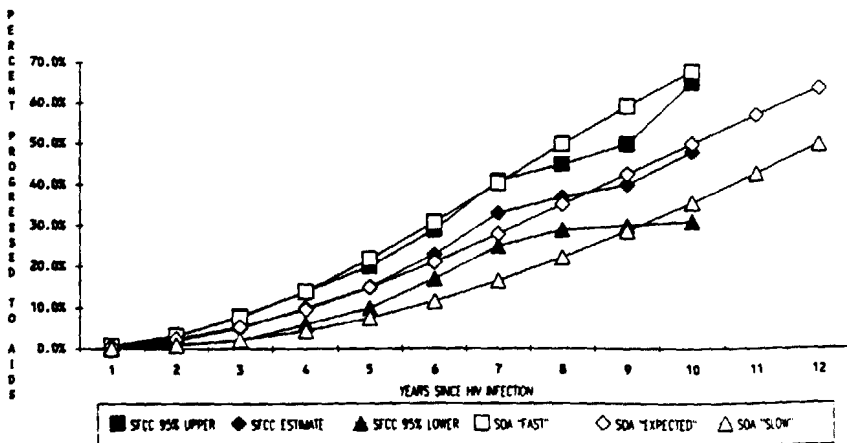
GRAPH G1A

COMPARISON OF SFCC VERSUS FRANKFURT STUDY OF AIDS PROGRESSION RATES



GRAPH G1B

WEIBULL FIT TO SFCC DATA FOR AIDS PROGRESSION RATES



Various distributions can be shown to fit the observed data over the left-hand portion of the distribution. The distributions may have significantly different right-hand tails.

Biostatistical researchers have favored the two-parameter Weibull distribution in studies of the incubation period, although other models have been used. It is a simple distribution to work with mathematically and adequately describes observed data in various studies.

In order to be consistent with this work, the committee selected the Weibull distribution over other possibilities to describe the incubation distribution.

Derivation of Assumed Rates

The progression rates assumed in our projections are based on the estimates derived from the SFCC study by Hessol et al.

The observed data in that study are consistent with a median period of 10 years from infection to diagnosis (that is, 50 percent will be diagnosed with AIDS within 10 years after becoming infected). We fit a Weibull curve with a median of 10 years to the SFCC observed data, adjusting the "shape" parameter to minimize the sum of squares criterion. The resultant progression rates became the basis for our middle scenario.

For the high and low scenarios, we chose Weibull curves representing slower and faster progression from HIV infection to AIDS diagnosis. The faster progression curve is based on the upper 95 percent confidence limit from the SFCC study. At all durations it indicates a cumulative rate of progression to AIDS that is equal to or slightly higher than the 95 percent confidence limit. Similarly, the slower progression rates are generally equal to or less than those of the lower 95 percent confidence limit.

The cumulative progression rates for our three sets of progression rates for the first 10 years after HIV infection are shown in Table G1. The full set of progression rates is documented in Table 7 Appendixes A, B, and C. Graph G1B compares the three Weibull curves to the estimates from the SFCC study.

Although the progression rates for the three projections are based on a 95 percent confidence interval for the San Francisco data, it does not follow that the three projections represent a 95 percent confidence interval for the epidemic. The confidence interval for progression rates applies only to the particular cohort that was studied during the time period of the study. In addition, there are a number of other assumptions that affect the projections of the epidemic (such as the assumed pattern of future behavioral changes), so that it is currently impossible to estimate a confidence level for the projected data.

APPENDIX H

ASSUMED MORTALITY RATES AFTER AIDS DIAGNOSIS

The AIDS mortality rates contained in Appendixes A, B, C, and D apply to the total population, which includes both HIV-infected and non-HIV-infected individuals. In Appendix H, we consider the mortality rates for individuals after they have been diagnosed as having progressed to clinical AIDS.

Derivation of Assumed Rates

In the "HIV Mortality" part of the Cowell/Hoskins paper, Table 4 and Chart 1 show how their derived mortality rates after AIDS diagnosis compare with CDC data reported as of March 30, 1987. The Cowell/Hoskins mortality rates from the time of AIDS diagnosis are:

Years from Diagnosis	Annual Mortality Rate
1	45%
2	45
3	35
4 +	25

Table H1 shows how these estimated mortality rates compare to the CDC data as of the end of the first quarter of 1987. This set of estimated mortality rates after AIDS diagnosis resulted in an overall actual-to-expected ratio of AIDS deaths of 103.7 percent.

Table H2 updates this comparison using CDC data reported through the end of 1988. This analysis shows that mortality rates after AIDS diagnosis have decreased since the former study was made. Now, the Cowell/Hoskins estimated mortality rates after AIDS diagnosis result in a rather low actual-to-expected ratio of only 91.5 percent.

There appear to be two significant reasons for this reduction in mortality rates after AIDS diagnosis. First, the expanding knowledge and awareness of AIDS since the early 1980s has resulted in better medical treatment that has some success in prolonging the lives of AIDS patients. Second, the broader definition of AIDS introduced by the CDC beginning in September 1987 has resulted in many AIDS cases being diagnosed earlier than would have been the case under the former definition.

The reported AIDS cases and deaths through the end of 1988 indicate a 40 percent mortality rate in each of the first two years after AIDS diagnosis.

TABLE H1

COMPARISON OF COWELL/HOSKINS MODELED MORTALITY RATES AFTER AIDS DIAGNOSIS WITH DATA FROM MARCH 30, 1987 CDC WEEKLY SURVEILLANCE REPORT

Average Diagnosis Date	Total Reported Cases	Reported Cumulative Mortality	Modeled Cumulative Mortality	Expected Deaths	Actual Deaths	Actual-to-Expected Ratio
1986.75	6,420	28.3%	25.8%	1,659	1,817	109.5%
1986.25	6,260	48.1	45.0	2,817	3,013	107.0
1985.75	5,335	62.7	59.2	3,159	3,343	105.8
1985.25	4,314	71.4	69.8	3,009	3,081	102.4
1984.75	3,166	77.8	75.6	2,394	2,464	102.9
1984.25	2,410	79.5	80.3	1,936	1,916	99.0
1983.75	1,578	83.4	83.0	1,309	1,316	100.5
1983.25	1,203	86.9	85.3	1,026	1,045	101.9
1982.75	637	86.8	87.2	556	553	99.5
1982.25	363	87.6	88.9	323	318	98.5
1981.75	178	89.9	90.4	161	160	99.4
1981.25	84	91.7	91.7	77	77	100.0
Total				18,425	19,103	103.7%
Years after AIDS Diagnosis	1	2	3	4	5	6+
Assumed AIDS Mortality Rate	45%	45%	35%	25%	25%	25%

GRAPH H1

CUMULATIVE AIDS MORTALITY
Model Is 45%, 45%, 35%, 25% Thereafter

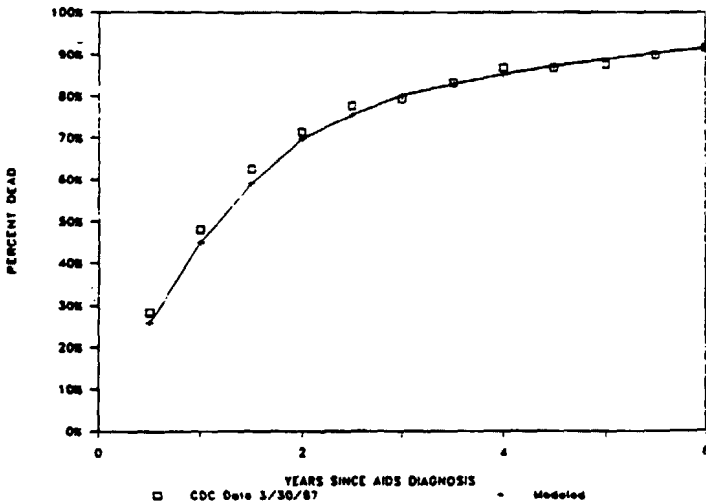


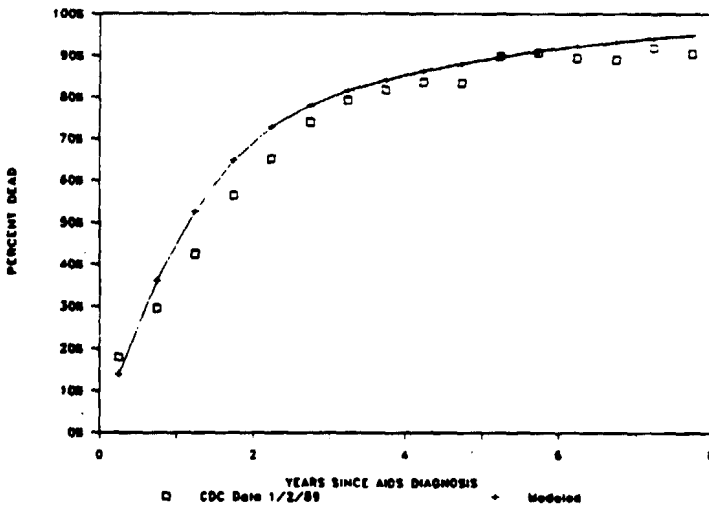
TABLE H2

COMPARISON OF COWELL/HOSKINS MODELED MORTALITY RATES AFTER AIDS DIAGNOSIS WITH DATA FROM JANUARY 2, 1989 CDC WEEKLY SURVEILLANCE REPORT

Average Diagnosis Date	Total Reported Cases	Reported Cumulative Mortality	Modeled Cumulative Mortality	Expected Deaths	Actual Deaths	Actual-to-Expected Ratio
1988.75	7,830	18.0%	13.9%	1,087	1,408	129.5%
1988.25	12,710	29.5	36.1	4,593	3,747	81.6
1987.75	12,562	42.5	52.6	6,612	5,333	80.7
1987.25	11,547	56.4	64.9	7,491	6,518	87.0
1986.75	9,365	65.3	72.8	6,821	6,111	89.6
1986.25	7,810	74.0	78.1	6,100	5,780	94.8
1985.75	6,061	79.4	81.7	4,952	4,810	97.1
1985.25	4,704	81.9	84.2	3,959	3,854	97.4
1984.75	3,313	83.6	86.3	2,858	2,771	96.9
1984.25	2,532	83.5	88.1	2,231	2,115	94.8
1983.75	1,625	89.9	89.7	1,458	1,461	100.2
1983.25	1,274	90.7	91.1	1,160	1,156	99.6
1982.75	667	89.5	92.3	616	597	97.0
1982.25	386	89.1	93.3	360	344	95.5
1981.75	188	91.9	94.2	187	182	97.6
1981.25	95	90.5	95.0	90	86	95.3
Total				50,574	46,273	91.5%
Years after AIDS Diagnosis	1	2	3	4	5	6+
Assumed AIDS Mortality Rate	45%	45%	35%	25%	25%	25%

GRAPH H2

CUMULATIVE AIDS MORTALITY
Model is 45%, 45%, 35%, 25% Thereafter



Beyond this point, the data are insufficient to make any refined calculations. We chose to continue using the mortality rates developed by Cowell and Hoskins for the third and following years, since these rates seemed to fit the data reasonably well.

Table H3 shows that this revised set of estimated mortality rates after AIDS diagnosis produces a reasonably good fit to current reported data. The overall actual-to-expected ratio is 98.1 percent.

Application of Assumed Rates

We applied the older, "45%-45%-35%-25%," set of mortality rates after AIDS diagnosis to those cases diagnosed prior to 1986, when medical treatments for AIDS were not as advanced as those available today. For cases diagnosed in 1986 and later, we applied our new, "40%-40%-35%-25%," set of rates.

This breakpoint in assumed mortality rates after AIDS diagnosis beginning in 1986 was determined by investigating the data for early-year deaths for cases diagnosed in various calendar years. Based on this analysis, this breakpoint appears to be appropriate.

We chose to use two sets of mortality rates after AIDS diagnosis because the former set more accurately reflects the mortality rates that applied to the earlier diagnosed cases. After four years from AIDS diagnosis, the difference in the probability of survival is less than 3 percent. Given that the cases diagnosed before 1986 have been exposed for over three years, the choice of mortality assumption makes relatively little difference to those cases.

Our model assumes that AIDS cases are diagnosed, on average, in the middle of the calendar year. Thus the probability of death in the year that AIDS is diagnosed is the probability of dying in the first half-year after diagnosis.

To calculate this half-year mortality rate after AIDS diagnosis, we use the standard exponential-type formula. That is, the probability of surviving for a half-year is the square root of the probability of surviving for a full year. Table 13 of Appendixes A, B, and C shows the transformation of the annual mortality rates after AIDS diagnosis into mortality rates after the calendar year of AIDS diagnosis.

Possible Variation by Subgroup

The above mortality studies involving diagnosed AIDS patients have been conducted for all AIDS cases together.

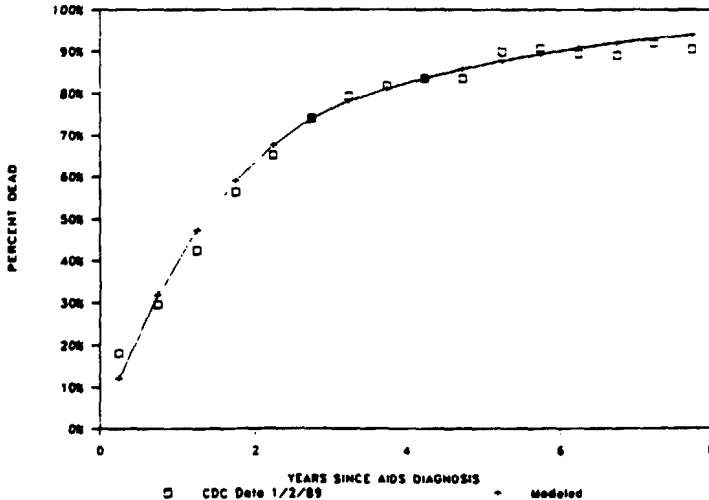
TABLE H3

COMPARISON OF SOA COMMITTEE ON HIV RESEARCH MORTALITY RATES AFTER AIDS DIAGNOSIS WITH DATA FROM JANUARY 2, 1989 CDC WEEKLY SURVEILLANCE REPORT

Average Diagnosis Date	Total Reported Cases	Reported Cumulative Mortality	Modeled Cumulative Mortality	Expected Deaths	Actual Deaths	Actual-to-Expected Ratio
1988.75	7,830	18.0%	12.0%	939	1,408	150.0%
1988.25	12,710	29.5	31.8	4,045	3,747	92.6
1987.75	12,562	42.5	47.2	5,928	5,333	90.0
1987.25	11,547	56.4	59.1	6,824	6,518	95.5
1986.75	9,365	65.3	67.7	6,338	6,111	96.4
1986.25	7,810	74.0	73.9	5,775	5,780	100.1
1985.75	6,061	79.4	78.2	4,741	4,810	101.5
1985.25	4,704	81.9	81.1	3,817	3,854	101.0
1984.75	3,313	83.6	83.7	2,772	2,771	100.0
1984.25	2,532	83.5	85.9	2,174	2,115	97.3
1983.75	1,625	89.9	87.8	1,426	1,461	102.5
1983.25	1,274	90.7	89.4	1,139	1,156	101.5
1982.75	667	89.5	90.8	606	597	98.6
1982.25	386	89.1	92.0	355	344	96.8
1981.75	198	91.9	93.1	184	182	98.7
1981.25	95	90.5	94.0	89	86	96.3
Total				47,152	46,273	98.1%
Years after AIDS Diagnosis	1	2	3	4	5	6+
Assumed AIDS Mortality Rate	40%	40%	35%	25%	25%	25%

GRAPH H3

CUMULATIVE AIDS MORTALITY
Model Is 45%, 45%, 35%, 25% Thereafter



Other studies have shown that mortality rates after AIDS diagnosis vary significantly for different AIDS case subgroups. One study (Reese) showed higher mortality rates for females than for males and for older versus younger ages.

We did not make any such refined studies because of our decision not to divide our model into separate subgroups. Instead, we noted that the combination of different processes, one of which is the mortality rates after AIDS diagnosis, is so far producing a stable distribution of AIDS deaths by age. Thus our combined macro model, with deaths distributed by age as a last step, directly produces the results we would have had to fit separate subgroup models to achieve.

Possible Future Studies

Until recently, we have had no data that reported dates of death. Thus the only diagnosed AIDS patient mortality studies possible were the kind discussed above. That is, past mortality rates must be estimated by observing the percentage of each half-year of AIDS diagnosis cohort surviving to a certain reporting date.

Recently, the CDC has added the quarter-year of death to its AIDS Public Information Data Set (PIDS) diskette that is available after the end of each calendar quarter. This information, along with the month of diagnosis, is available for each reported AIDS case. With this information, more refined AIDS mortality studies could be undertaken.

There are problems with these data, however. Members of the CDC's staff have told us that the data they report includes only the cases *known* to have died. Many cases have been lost to follow-up, with the result that they may never be reported as AIDS case deaths. Further, there are significant problems in accurately establishing the date of diagnosis. Thus we believe that such a study probably would not yield much better information than what we have now.

The assumed mortality rates after AIDS diagnosis are one of the least significant assumptions involved in the calculation of total population AIDS mortality rates. All sets of possible assumptions for mortality rates after AIDS diagnosis are so high that most modeled AIDS cases become modeled deaths within a few years after diagnosis. Thus a change in the assumed mortality rates after AIDS diagnosis would only shift some modeled deaths by one or possibly two calendar years. This would have an insignificant effect on the calculated total population AIDS mortality rates compared to the magnitude of the AIDS case projections.

APPENDIX I

DISCUSSION OF INFECTION SPREAD MODEL

We have developed three scenarios for the U.S. AIDS epidemic. Each of these scenarios is designed to be consistent with the number of diagnosed AIDS cases already reported to the CDC. However, future cases and deaths vary significantly among the three scenarios, reflecting uncertainty as to the rate at which the infection has spread and will spread in the future, and uncertainty as to the exact length of the period of progression from HIV infection to AIDS diagnosis.

Developing a projection of the AIDS epidemic involves the projection of the number of HIV infections and AIDS cases that will occur in each year. In order to project the epidemic, we first developed a set of parameters for the logistic formula (documented in Table 12 of each of Appendixes A, B, and C) that produces changes in the proportion of the at-risk population that is HIV-infected each year. The resulting change in the infected proportion was then applied to the estimated size of the at-risk population, producing modeled annual new HIV infections.

Progression rates (discussed in Appendix G) were then applied to these infections to produce the number of diagnosed AIDS cases for each year. These resulting modeled AIDS cases were then compared with the scenario's goals. The infection parameters were changed, and the process was repeated until satisfactory results were achieved.

An assumption was required as to the number of initial infections on a "starting date" early in the epidemic. Our model begins in 1975 and assumes several hundred infections at that point (the exact number varies among the three scenarios). Variations in this assumption do not have a significant effect on the projections.

Parameters for the logistic formula were developed separately for each of the three scenarios. These parameters were chosen so that the resulting number of AIDS cases would be consistent with cases reported to the CDC, after adjustment for reporting lags (see Appendix K). The target numbers for our modeling thus represent estimated cases diagnosed in each past period that will ultimately be reported, not just cases that have already been reported.

In setting these assumed infectivity factors, we required that the infectivity factors be relatively smooth and follow a monotonic decreasing pattern.

The decrease in infectivity factors reflects that those who engaged in the most high-risk behavior were more likely to become infected in the early stages of the epidemic, resulting in an initially high rate of spread, that is,

a high infectivity factor. As these more highly active individuals became infected and as lower-risk individuals became the primary source for new infections, the rate of spread decreased. The rate of spread in this context refers to the number of annual new infections per individual already infected, not the absolute number of new infections.

Besides this natural decrease in the rate of infection spread that occurs due to the saturation of the subpopulation at highest risk, infection spread rates have also likely decreased due to the effects of education and resulting behavioral change.

For each set of assumed rates of progression from HIV infection to AIDS diagnosis, we determined a set of infectivity factors that would reproduce the actual number of AIDS cases as closely as possible while still following a smooth, decreasing pattern. Closeness of fit was measured by a sum-of-squares criterion. This procedure provided infectivity factors through about 1985.

Infectivity factors between 1985 and the present cannot be determined by reference to past cases because infections that occurred during this period have not yet resulted in a significant number of AIDS cases. The only data available for setting these infectivity factors are relatively subjective seroprevalence estimates, or even more subjective estimates as to the extent of behavioral changes during recent years. Thus infectivity factors for future periods must be chosen without reference to supporting experience data.

For each scenario, infectivity factors for recent years and future years were chosen so as to be consistent with the pattern of factors for prior years, while also resulting in modeled AIDS cases consistent with each scenario's objectives. In addition, the middle scenario was adjusted slightly in order to be as consistent as possible with the CDC's Charlottesville (1988) projections (see Appendix L).

APPENDIX J

DERIVATION OF AT-RISK POPULATION

There are a variety of at-risk groups which can be considered to constitute the population at risk of AIDS. Each of these groups may have very different risks of infection, which have tended to change over time. In order of decreasing estimated seroprevalence, these groups include persons with hemophilia, intravenous (IV) drug users, male homosexuals, male bisexuals, and heterosexuals. These groups have been further subdivided in some studies.

Because of the wide range of risk of infection, HIV infections have spread rapidly through some groups and very slowly through others. In general, the rate of new infections is expected to start slowly, accelerate rapidly, and finally level out at some saturation level. In fact, it is believed that the incidence of infection has peaked in some geographical subgroups. Each group and the population as a whole can be expected to follow the trend described here.

The effect of the size of the assumed at-risk population must be considered in conjunction with the infection spread model being applied to that population. See Appendix I for a discussion of our infection spread model.

There is also a practical need to limit the at-risk population in a manner that can be effectively modeled. From a practical perspective, however, there is substantial uncertainty in the estimates that have been made about the size of the at-risk population groups. The sizes of the two largest HIV-infected groups, that is, homosexuals and intravenous drug users, are not readily available. Fortunately, the modeling of HIV infection and AIDS deaths is not highly sensitive to the assumptions made about the size of the at-risk group.

Our models used a fixed at-risk group of 4 million individuals. This figure is simply the 3.75 million at-risk group used in the Cowell/Hoskins model, rounded to the nearest million. The derivation of sizes used by Cowell/Hoskins and by the Public Health Service is discussed below.

Cowell/Hoskins Estimate

Cowell and Hoskins based their estimate of the "at-risk" population on estimates from the National Academy of Sciences (NAS). NAS estimated the "hard-core" IV-drug-using population in the U.S. to be about 750,000. They further estimate that 3 percent of the adult population are male homosexuals and that a similar number are bisexual at some time in their lives. This amounts to 2.5 million in each category. Of this 5.0 million, Cowell/Hoskins estimates the highest at-risk group to be at least 3 million.

It was estimated that about 30 percent of each group would be HIV-infected in 1987, based on the assumption that the disease had progressed uniformly through the two subgroups. This seemed to be consistent with available data. In conjunction with other elements of their modeling process, the assumption of 3.75 million at risk provided a reasonably close approximation of actual AIDS cases and deaths and was consistent with estimates by the CDC and the Surgeon General.

Public Health Services (PHS) Estimate

The original PHS estimate of at-risk individuals was made at the Coolfont conference in 1986. The feelings of that group about their estimates of the at-risk population probably reflect the feelings that should pertain to estimates today: "The group particularly expressed concern about the uncertainty of the size of groups at risk." However, it was noted that estimates made were consistent with what was known at that time about the progression of the disease.

The original, as well as the updated, estimate of the male homosexual at-risk population was based on a 1948 study by Kinsey et al. modified by 1980 census data. This estimate is 2.5 million. Certainly the reliance on a study more than 40 years old for estimating the largest part of the at-risk population does not add to the confidence that can be placed in this number.

PHS estimated that there are 1.1 million IV drug users in the U.S., of whom about 165,000, 15 percent, are in drug treatment. In addition, they refer to an estimated 200,000 intermittent users. PHS assumed that there were 750,000 regular IV drug users and a similar number of irregular users. In the case of HIV infection among drug users, two further groups are exposed, namely, their sexual partners and children.

Persons with hemophilia were estimated to number 14,000. In 1987, this estimate was refined to reflect hemophilia A, 12,500, and hemophilia B, 3,100. The latter is less serious and consequently has experienced a lower seroprevalence rate.

APPENDIX K

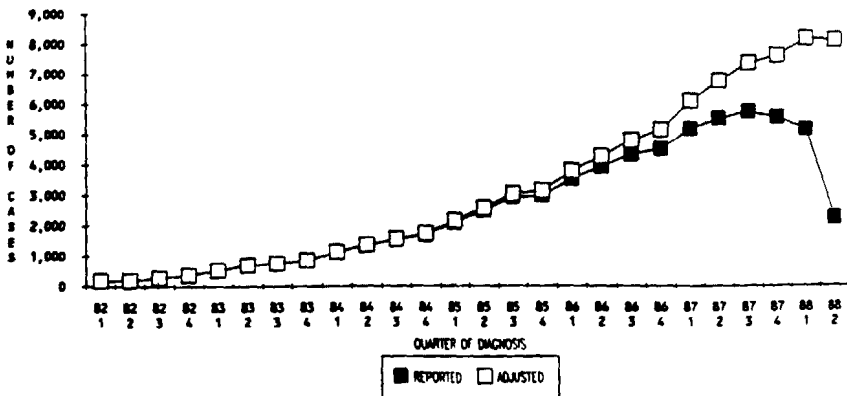
REPORTED PAST AIDS CASES

The back calculation method of projecting the AIDS epidemic involves the development of a pattern of HIV infections that is consistent with the number of AIDS cases diagnosed in prior periods. The target number of cases for each prior period is based on data available from the CDC. However, CDC data are affected by reporting delays and must therefore be adjusted to reflect cases that have been diagnosed but not reported. This appendix describes how reporting lag factors were developed for this adjustment.

Graph K1 shows AIDS cases reported to the CDC by quarter of diagnosis. There is a striking decline in reported cases that were diagnosed in recent quarters. This is clearly a result of reporting delays, rather than a reduction in the rate at which cases are being diagnosed. In developing a reporting lag adjustment, we attempted to adjust the data to an "incurred" (or diagnosed) basis. Our adjusted case data have also been plotted on the graph; applying the reporting lag adjustment has eliminated the apparent decline in new cases.

GRAPH K1

AIDS CASES REPORTED AS OF SECOND QUARTER 1988 ADJUSTED FOR REPORTING DELAY



Graph K1 also indicates that there has been a seasonal pattern of growth in new cases. This pattern is characterized by a lower growth rate in new

cases during the fourth quarter of each year. This pattern is presumably caused by reduced diagnosis activity during the holiday season.

The CDC's AIDS Public Information Data Set (PIDS) provides data on each reported AIDS case, including the month of diagnosis and the month the case was reported. Thus it is possible to examine the cases diagnosed during a given calendar quarter and develop a distribution of reporting delays, that is, the percentage of cases that were reported during the quarter of diagnosis, the percentage reported during the first quarter following diagnosis, etc.

Unfortunately, this pattern does not represent the cases reported each quarter as a percentage of total cases diagnosed during the period, but rather as a percentage of cases that have been reported so far. For a recent diagnosis period this might include less than half the cases diagnosed during the period. Thus distribution percentages for different diagnosis quarters are not comparable because their denominators are not consistent.

In order to put all diagnosis quarters on a comparable basis, we normalized the data for each quarter, by using as a denominator the cumulative cases reported during the first six reporting quarters (that is, the diagnosis quarter plus five subsequent quarters). Thus the "reporting pattern" for each diagnosis quarter reaches 100 percent after six quarters; it increases beyond 100 percent as cases continue to be reported after the first six quarters.

As the cases from a given diagnosis period approach an "ultimate" reported status, the percentage gradually approaches a limit, or "asymptote." By plotting the reporting patterns for all diagnosis quarters on a single graph, we were able to choose an appropriate asymptote for all quarters combined. Then the data were re-normalized so that the asymptote represented 100 percent of diagnosed cases.

In applying this process, we identified a change in reporting patterns in about the middle of 1985. Consequently, the data were split between pre- and post-July 1985 diagnosis dates. The two sets of data were analyzed separately. For each set, we chose an asymptote, re-normalized the reporting patterns, and averaged the reporting percentages for different diagnosis quarters together. The resulting reporting patterns were then smoothed and adjusted, so that they grade into a single curve after twelve quarters and reach 100 percent after twenty quarters (five years).

Because our projections were based on actual data reported through the second quarter of 1988, only one set of lag factors was needed. The different reporting pattern for cases diagnosed before July 1985 affected only the first twelve quarters after diagnosis. Since the pre-July 1985 cases were already

more than twelve quarters from diagnosis when we made our projections, separate factors for the earlier period were not needed.

The final lag factors are shown in Table K1. They are used as divisors to adjust reported cases upward. For example, the factors indicate that 73.1 percent of the cases diagnosed in the fourth quarter of 1987 were reported by the end of the third reporting quarter. Because 5,586 cases diagnosed in the fourth quarter of 1987 were reported through the end of the second quarter of 1988, we estimated that 7,642 ($= 5,586/0.731$) total cases were diagnosed during that quarter.

TABLE K1
ADJUSTMENT OF AIDS CASES REPORTED TO THE CDC
AS OF THE END OF THE SECOND QUARTER 1988

Year	Quarter	Quarterly Reported Cases	Reporting Delay Lag Factor	Quarterly Adjusted Cases	Annual Adjusted Cases	Cumulative Adjusted Cases
Pre-1982		348	1.000	348		348
1982 ...	1	175	1.000	175		523
	2	194	1.000	194		717
	3	286	1.000	286		1,003
	4	368	1.000	368	1,023	1,371
1983 ...	1	539	1.000	539		1,910
	2	703	1.000	703		2,613
	3	756	1.000	756		3,369
	4	856	0.998	858	2,856	4,227
1984 ...	1	1,135	0.995	1,141		5,367
	2	1,360	0.991	1,372		6,740
	3	1,545	0.986	1,567		8,307
	4	1,717	0.980	1,752	5,832	10,059
1985 ...	1	2,105	0.972	2,166		12,224
	2	2,485	0.965	2,575		14,800
	3	2,924	0.957	3,055		17,855
	4	2,994	0.947	3,162	10,958	21,016
1986 ...	1	3,564	0.935	3,812		24,828
	2	3,960	0.921	4,300		29,128
	3	4,357	0.903	4,825		33,953
	4	4,541	0.877	5,178	18,114	39,131
1987 ...	1	5,200	0.848	6,132		45,263
	2	5,553	0.816	6,805		52,068
	3	5,770	0.780	7,397		59,465
	4	5,586	0.731	7,642	27,976	67,107
1988 ...	1	5,182	0.631	8,212		75,319
	2	2,261	0.277	8,162		83,482

Table K1 also shows the number of cases reported through July 4, 1988 for each diagnosis quarter through the end of 1987, and how those numbers

were adjusted for reporting lags. This adjusted number of cases have been used as a target in validating the parameters for our model.

Change in Case Definition

The CDC changed the definition of AIDS effective September 1987. This change made it easier for a case to be classified as AIDS. Therefore, an adjustment was needed in the CDC projection of cases to reflect greater numbers of AIDS cases. The increase is due to two factors. First, cases would now be recognized *sooner* in some instances. Second, some cases will now be reported that would *never* have qualified under the old definition.

To account for the change in definition, the CDC adjusted their projection of cases upward by 9 percent starting in the fourth quarter of 1987. In addition, they adjusted the third quarter of 1987 by 3 percent to reflect the fact that the definition was in effect for one month of that quarter.

Because our projections are based on cases diagnosed through the end of 1987, the change in definition affects only one-third of the final year of our base period. No specific adjustment was made in our projections to correct for this change. However, as noted in Appendix I, our middle scenario has been adjusted slightly to agree with the CDC projections, which were adjusted for the change in definition.

Underreporting

The reported cases for the base period have not been adjusted for underreporting. The CDC estimates that about 10 percent of AIDS cases are not reported. However, since there is no good measure of this number, we have chosen to project only the number of diagnosed cases that will be reported.

APPENDIX L
CDC PROJECTED CASES

The Charlottesville Projections

The best known, and most widely accepted, projections of future AIDS cases are those published by the CDC. The CDC develops these assumptions by extrapolating trends from past reporting results. This method is generally satisfactory over the short time period (five years) that these projections cover.

Before the extrapolation is performed, past reported case data are adjusted. The CDC estimates the effects of reporting delays, the changed AIDS case definition in late 1987, and underreporting. Details about the CDC's methodology have been published.*

The most recent CDC projection of AIDS cases (that is publicly available) was presented in June 1988 at the Second Public Health Services AIDS Prevention and Control Conference in Charlottesville, Va. These were the projections presented:

CDC'S CHARLOTTESVILLE PROJECTIONS

Year	Annual AIDS Cases	Annual AIDS Cases 68% Prediction Interval
1988	39,000	32,000-41,000
1989	49,000	32,000-56,000
1990	60,000	28,000-73,000
1991	71,000	21,000-94,000
1992	80,000	13,000-119,000
Total through 1992	365,000	205,000-440,000

Derivation of Our CDC Targets

The CDC projections include an increase of 10 percent to account for underreporting of cases. As explained in Appendix K, our adjustments of past reported cases did not include an increase for the effect of underreporting.

To make the CDC projections consistent with these adjusted past cases, we removed the 10 percent underreporting factor from the CDC projected

*Karon, J.M., Devine, O.J., and Morgan, W.M. "Predicting AIDS Incidence by Extrapolating from Recent Trends." In *Mathematical and Statistical Approaches to AIDS Epidemiology*, C. Castillo-Chavez, ed. *Lecture Notes in Biomathematics* (Berlin: Springer-Verlag) 83 (1989): 58-88.

AIDS cases. The CDC's projected AIDS case formula included a final 19 percent increase—9 percent to reflect the effect of the 1987 change in the definition of AIDS diagnosis and 10 percent to account for underreporting. We removed the effect of underreporting by multiplying the CDC's exact formula projections by 109 percent divided by 119 percent. The adjusted CDC projections are shown in the table below.

PROJECTED ANNUAL AIDS CASES

Year	CDC Projection	CDC Formula Result	Underreporting Effect Removed
1989	49,000	49,277	45,137
1990	60,000	60,186	55,129
1991	71,000	70,677	64,737
1992	80,000	80,178	73,440

The Coolfont Projections

The previous CDC AIDS case projections were presented in June 1986 at the Coolfont Conference Center in Berkeley Springs, W.Va. These were the CDC projections available to Cowell and Hoskins when they developed their model. The table below compares the Coolfont and the Charlottesville CDC projections.

PROJECTED ANNUAL AIDS CASES

Year	Coolfont (1986)	Charlottesville (1988)
1988	33,000	39,000
1989	45,000	49,000
1990	58,000	60,000
1991	74,000	71,000
Total through 1991	265,000	285,000

The differences between the Coolfont and the Charlottesville projected AIDS cases explain a good portion of the differences between our projections and the 1987 Cowell/Hoskins projections. The more recent CDC projections are higher in 1988 through 1990, but lower in 1991. This results in a less steep slope in the CDC projections that we used to calibrate our model to versus the set of projections that Cowell and Hoskins had available to them.

APPENDIX M
AGE AND GENDER SPLITS OF AIDS DEATHS

Method

The method we used to distribute AIDS deaths by age and gender began with the modeling of total AIDS deaths by year, without respect to age and gender. A percentage split by gender was applied, and then a frequency distribution by age was used, to subdivide these deaths for the calculation of AIDS mortality rates.

Separate age frequency distributions were used for males and females. The gender/age-specific modeled AIDS deaths were then used in the calculation of AIDS mortality rates.

Basis for Method

There are many aspects of the AIDS epidemic that vary by age and gender. For both sexual and intravenous needle-sharing types of HIV infection spread, the risk of infection rises rapidly from the mid-teen ages to a peak at ages in the 20s, decreasing with increasing age thereafter. The infection has spread among males far more rapidly than it has among females.

Besides the risk of infection, there are other processes that vary by age and gender. The rates of progression from HIV infection to AIDS diagnosis may vary by age and gender also. It has also been demonstrated that mortality rates after AIDS diagnosis vary significantly by age and gender.

Finally, there are demographic factors to consider, that is, the relative size populations of the different age/gender cells that the age/gender-specific modeling parameters might apply to.

As discussed in our report, we chose to use a macro model that projects all HIV infections, AIDS cases, and deaths for the total U.S. population in the aggregate. To break the model into age/gender subgroups would significantly complicate the model. Further it would require the use of assumptions that cannot be validated using the data currently available.

Instead, we noted Holland's work, which demonstrated that the distribution of AIDS deaths by age at death has remained roughly stable over the period 1981 to 1988. This finding allows us to project AIDS deaths for the population as a whole, then allocate those deaths by gender and age at death. The effect is to achieve the same results with our macro model that we would have achieved through a collection of subgroup models.

Derivation of Age Distribution

Table M1 shows AIDS deaths by age group and calendar year of death for the years 1981 through 1988, based on deaths reported through the second quarter of 1988. Deaths are shown separately for males and females and for both genders combined. Although the number of deaths increases by year, the shape of the distribution is very similar from year to year.

When expressed as a frequency distribution, AIDS deaths by year and age form a relatively stable distribution. There has been a slight increase over the years in average age at death, which is expected. Since the HIV infection has a very long incubation period, those surviving longer die at slightly older ages and will move the distribution slightly.

The standard deviation of the distribution is relatively stable. Although there is reason to believe that there is a small shift in age, Klugman has demonstrated, based upon a negative log-likelihood test, that there is no statistical basis for the assumption that the average age has varied by calendar year of death. This suggests that it is reasonable to assume the same distribution will pertain to future deaths.

Graph M1 shows the age distribution of deaths for males and females using the data in Table M1. It can be seen that males and females do have significantly different age distributions.

GRAPH M1
AIDS DEATH DISTRIBUTION BY AGE BASED ON SECOND QUARTER 1988 REPORTING

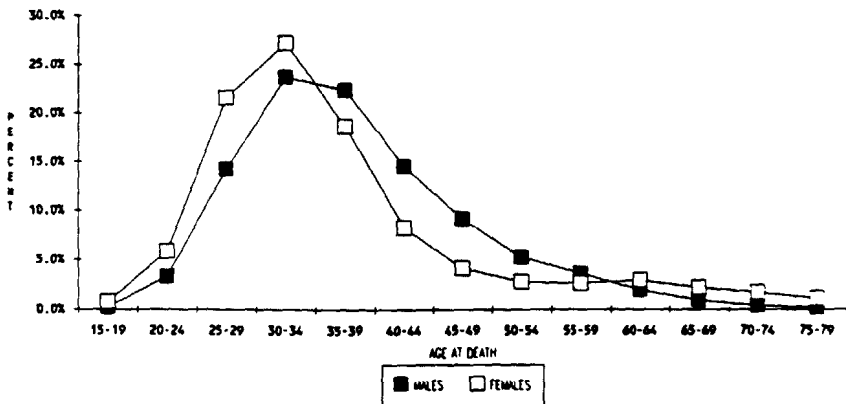


TABLE MI
 U.S. AIDS DEATHS BY AGE GROUP AND CALENDAR YEAR OF DEATH BASED ON A TABULATION AS OF THE END OF THE SECOND QUARTER OF 1988

Calendar Year	Age Group													Total																															
	0	1-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59		60-64	65-69	70-74	75-79	80-84	85-89	90-94																								
	Males																																												
1981	4	1	1	0	0	4	20	19	23	12	6	4	5	0	0	0	0	0	0	0	98																								
1982	4	1	1	0	0	11	55	87	76	44	28	16	12	6	0	0	0	0	0	0	341																								
1983	11	7	0	1	2	36	203	303	253	183	114	65	48	4	0	0	0	0	0	0	1,237																								
1984	13	8	3	3	10	92	416	674	644	415	263	165	100	24	5	7	1	0	0	0	2,883																								
1985	21	26	5	4	19	178	787	1,302	1,228	797	486	313	215	90	53	13	8	2	0	0	5,347																								
1986	38	52	13	6	24	306	1,234	2,069	2,063	1,273	814	471	301	191	81	33	18	2	3	0	8,953																								
1987	38	52	28	5	24	380	1,537	2,630	2,427	1,604	1,027	529	415	254	124	48	29	11	0	0	11,162																								
1988	7	16	1	7	10	119	530	886	809	566	351	211	125	70	39	27	15	5	0	0	3,794																								
Total..	119	141	51	26	89	1,126	4,782	7,970	7,523	4,894	3,089	1,774	1,221	660	326	130	71	20	3	0	34,015																								
Percent Distribution (Ages 15-79 only)																																													
		0.3%																				3.3%		14.2%		23.7%		22.4%		14.5%		9.2%		5.3%		3.6%		2.0%		1.0%		0.4%		0.2%	
	Females																																												
1981	2	1	0	0	0	1	1	3	2	0	0	0	0	0	0	0	0	0	0	0	10																								
1982	4	2	0	0	0	1	9	9	2	2	1	1	1	0	0	0	0	0	0	0	33																								
1983	7	3	0	0	2	9	31	20	12	6	6	4	3	3	1	0	0	0	0	0	107																								
1984	12	7	0	0	2	20	61	73	33	12	10	3	3	5	5	2	1	1	0	0	250																								
1985	16	24	6	2	4	16	98	80	30	28	14	8	10	11	14	6	2	3	0	0	458																								
1986	28	29	8	2	4	45	153	227	133	66	20	20	19	15	26	20	13	12	2	1	0	824																							
1987	36	48	15	2	7	63	206	249	216	100	55	38	33	28	20	22	15	5	3	0	1,161																								
1988	4	12	3	0	2	18	75	103	70	30	17	10	13	14	5	7	3	0	0	0	1,386																								
Total..	109	126	32	5	23	173	634	800	548	244	123	83	78	87	65	51	33	11	4	0	3,229																								
Percent Distribution: (Ages 15-79 only)																																													
		0.8%																				5.9%		21.5%		27.2%		18.6%		8.3%		4.2%		2.8%		2.7%		3.0%		2.2%		1.7%		1.1%	

We have calculated the frequency distribution by age group by examining only those deaths at ages 15 through 79. This assumption inherently allocates the deaths at younger and older ages to ages 15-79. Any resulting distortion is small; we felt it was not desirable to try to separately analyze this small fraction of cases from our projection of AIDS deaths.

The age distribution percentages used in our models are documented in Table 9 of each of Appendixes A, B, and C.

Derivation of Gender Distribution

As of the end of the first quarter of 1989 (April 1989 CDC HIV/AIDS Surveillance Report), 8.7 percent of the AIDS cases age 13 or older were females. However, this percentage has increased over past years. The table below shows the trend by year of reporting.

Reporting Year	Percentage of Cases Age 13 or Older That Are Female	Reported Female Cases Age 13 or Older
1989	10.1%	817
1988	10.4	3,331
1987	8.0	1,692
1986	7.1	934
1985	6.5	530
1984	6.5	293
1983	7.0	155
1982 and Earlier	5.7	48

We might have assumed a male/female distribution of the modeled AIDS deaths using a percentage factor that changes over time. We felt this would be an unnecessary refinement of the model, however, given the uncertainties that exist in the projections themselves.

Instead, we have assumed that 90 percent of our modeled AIDS deaths are males and 10 percent are females.

This variable should be monitored in the future. It remains to be seen whether the female percentage of cases will continue to rise past 10 percent, perhaps due to an increased spread of infections by heterosexual contact.

Population Mismatch

There is a slight mismatch between our age distribution and the population projections used to calculate mortality rates. The age split method assumes

a constant distribution over time of modeled deaths by age, while the population projections assume chronological shifts in the age distribution of the population.

However, this is not a material problem in view of our overall projections. Also, the impact of this mismatch is greatest in the more distant future where the present financial impact of the assumption is minimal and the assumptions are even more speculative.

APPENDIX N
AIDS CASE REPORTING TRENDS

DANIEL F. CASE

The report of the SOA Committee on HIV Research has presented projected AIDS cases, deaths and mortality rates on the basis of three scenarios: low, middle, and high. As stated in the introduction of the report, these three scenarios are intended to provide a practical basis for use by actuaries in investigating the financial impact of AIDS for life and health insurance.

As also stated in the introduction, it cannot be known whether any of these three projections is a reasonable description of the future course of the AIDS epidemic. Accordingly, actuaries will wish to compare emerging reported AIDS data with the projected numbers in order to judge, from time to time, which of the projections is likely to prove the most useful.

As explained in the report, the projections are presented in terms of the numbers of AIDS cases which will ultimately be reported to the CDC as having been diagnosed in particular years. Because of reporting lags, the number of reported cases diagnosed in year Y , say, is substantially smaller as of the end of year Y than it will be as of the end of year $Y+2$, and smaller at the end of year $Y+2$ than it will be at the end of year $Y+4$. Accordingly, working with reported cases by year (or quarter-year) of diagnosis involves adjusting the numbers of reported AIDS cases by means of lag factors, as is described in Appendix K with regard to the development of the projections presented in this report.

The lag adjustment that was done for this report utilized data from the CDC's AIDS Public Information Data Set and involved plotting the reporting patterns for all diagnosis quarters on a graph. In the event that actuaries may wish to track the course of the epidemic by an easier (though rougher) method, the following are some observations on one such method.

It is possible to observe trends by simply following the numbers of AIDS cases that are reported in specified calendar periods, without regard to dates of diagnosis. Since many cases reported in year Y , say, were diagnosed in year $Y-1$ or earlier, the cases reported in year Y relate to several diagnosis periods which are centered, by weight, on some point earlier than the middle of year Y . Determining exactly what the trend in cases reported each year means in terms of the trend in ultimately reported cases diagnosed in each year might be quite difficult. It seems reasonable, nevertheless, to assume that the trend in ultimately reported diagnosed cases will follow the trend in reported cases fairly closely.

Following the trend of reported cases has the advantage of fully utilizing the latest published data. It should be quite reliable if there are no great fluctuations from period to period in the length of the average reporting lag. One may note, however, that fluctuations in reporting lag also tend to distort the trends in reported cases by year (or quarter) of diagnosis, as used for the projections in this report, both before and after adjustment for reporting lag.

As an example of how closely the two trends may correlate, we may observe the following table:

REPORTED CASES VERSUS DIAGNOSED CASES (U.S.)

Calendar Year†	Number Reported		Number Diagnosed*	
	During Year	Ratio to Prior Year	During Year	Ratio to Prior Year
1982			1,023	
1983	2,221		2,856	2.79
1984	4,635†	2.05†	5,832	2.04
1985	8,249	1.81†	10,958	1.88
1986	13,055	1.58	18,114	1.65

*Estimated number ultimately reported as diagnosed in year, as described in Appendix K of this report.

†For reported cases the "calendar year" includes 52 weeks, except for 1984, which includes 53 weeks. The year-to-year ratios have been adjusted accordingly. The source of these data is the CDC's *AIDS Weekly Surveillance Report*, predecessor of the current *HIV/AIDS Surveillance Report*.

There are two readily available sources of information on recently reported AIDS cases in the U.S. One, the *HIV/AIDS Surveillance Report*, is published each month by the CDC. Copies are available free from the National AIDS Information Clearinghouse, P.O. Box 6003, Rockville, MD 20850. Individuals or organizations can be added to the mailing list by writing to Centers for Disease Control, Division of HIV/AIDS, Technical Information Activity, Mailstop G-29, Atlanta, GA 30333.

The other source is *Morbidity and Mortality Weekly Report* (MMWR), published weekly for the CDC by The Massachusetts Medical Society. Subscriptions are available through that organization at C.S.P.O. Box 9120, Waltham, MA 02254-9120. Subscription rates are \$33.00 per year by third class mail and \$48.00 per year by first class mail. Single copies and back issues of the weekly reports and various supplements, quarterly reports, and annual reports are available.

In Canada the Federal Centre for AIDS (Ottawa, Ontario K1A 0L2) publishes periodic reports covering not only Canada but also the U.S. and the world.

MMWR gives, each week, the number of cases reported in the first n weeks of the current year and the number reported in the first n weeks of the preceding year. The *HIV/AIDS Surveillance Report* gives the number reported during the latest complete 12-month period and the number reported during the 12-month period immediately preceding the latest. Accordingly, from each publication it is possible to identify trends in reported cases.

Two cautions must be given at the outset. First, there are wide fluctuations from week to week in the numbers of cases reported to the CDC (and hence by the CDC to the public). These fluctuations arise in part from procedures in the various state reporting offices. They can be expected to cause artificial distortions in weekly, quarterly, and even annual reported totals.

Second, the change in the surveillance definition of AIDS which became effective in September 1987 influenced the reported numbers dramatically. For example, here are rolling 12-month case-report totals from the CDC Surveillance Reports:

12 Months Ending	Number of Cases Reported	Ratio to Preceding Number
3/02/86	9,185	
8/31/86	11,449	1.25
3/02/87	14,038	1.23
8/31/87	17,080	1.22
2/29/88	22,766	1.33
8/29/88	30,132	1.32
2/28/89	33,215	1.10

A slightly more detailed examination suggests that a surge in reporting of AIDS cases began in about October 1987 and carried through much of 1988. The reason for the surge was, as explained elsewhere in this report, the fact that the revised (new) definition of AIDS is broader than the previous definition. Many cases that had not met the old definition had already met the new definition by September 1, 1987 and were reported some time after that date. (The persons reporting these cases assigned imputed dates of diagnosis on the basis of their records; hence many cases that were reported under the new definition are recorded as diagnoses in periods earlier than September 1987.) In addition, cases first meeting the new definition after September 1, 1987 and not yet meeting the old definition were reported earlier than they otherwise would have been.

The surge in reporting receded somewhat when the backlog consisting of the first type of case mentioned was reduced. The second type of case has, however, resulted in an ongoing higher level of reporting because of the earlier reporting of cases that meet the new definition before they meet the old definition.

Some of the "new definition only" cases will later meet the old definition as well, but will not be reported a second time. Others will die before ever meeting the old definition. These latter cases will occasion a permanent increase in the level of reported cases, as distinguished from an acceleration of the reporting of cases that would have eventually been reported under the old definition. A paper by CDC researchers John M. Karon and Owen J. Devine, not yet published, contains an assumption that this permanent increase in the level of reported cases is about 7 percent.

Keeping in mind the fluctuations in period-to-period reporting patterns and the influence of the September 1987 definition change, we can examine the following table.

TREND OF NUMBERS OF REPORTED U.S. AIDS CASES

Approximate Calendar Period	Number of Cases Reported in Year	Ratio between Periods
1983 (52 weeks)	2,221	
1984 (53 weeks)	4,635	2.05*
1985 (52 weeks)	8,249	1.81*
1986 (52 weeks)	13,055	1.58
1986, 1st 35 weeks	8,357	
1987, 1st 35 weeks†	12,671	1.52
1987, 1st 15 weeks	5,465	
1989, 1st 15 weeks	9,368	1.71‡

*Adjusted to reflect 53 weeks included here in 1984.

†Represents most of the portion of the year before the revised surveillance definition of AIDS took effect. Shortly after a transitional period in September 1987, there began a surge in the number of cases being reported.

‡Covers a two-year period (early 1987 to early 1989). If the 1987 backlog of cases meeting only the "new" definition was fully reported by the end of 1988, this ratio can be regarded as the product of three ratios: the underlying 1987-to-1988 ratio, the underlying 1988-to-1989 ratio, and a ratio reflecting a new, ongoing higher level of reporting attributable to the change in definition. Note that a 15-week reporting period is quite short, and these numbers could be strongly influenced by fluctuations in reporting delays.

It may be some time yet before the reporting surge of 1987-88 is far enough behind us to enable us to discern current trends in reported cases directly from published numbers. Meanwhile, a hypothetical calculation such as is suggested by the third footnote under the preceding table may be helpful. For example, the two-year ratio of 1.71 could be factored as follows: $1.71 = 1.34 \times 1.19 \times 1.07$, where 1.34 is the assumed underlying 1987-to-1988 ratio (based on 15 weeks), 1.19 is the corresponding 1988-to-1989 ratio, and 1.07 is the permanent increase attributable to the definition change. Note that this factoring ignores the additional effect of accelerated reporting of some AIDS cases. This effect should, however, become very small as the trend of new cases levels off.

Year-to-year reported-case ratios derived in some manner such as the above can be compared with the projected year-to-year diagnosed-case ratios shown in this report to get some idea of which projection is most closely tracking the course of the AIDS epidemic in the U.S.

For the convenience of persons wishing to use a method like the above, following are some 1987 cumulative reported numbers of AIDS cases, from 1987 issues of MMWR:

Reporting Week in 1987	Date on Which Week Ended	Cases Reported through Week
15th	April 18	5,465
20th	May 23	6,928
25th	June 27	8,783
30th	Aug. 1	10,518
35th	Sept. 5	12,671

After the 35th reporting week of 1989 (which ends on September 2), it becomes less desirable to compare 1989 reported cases with 1987 reported cases, because of the effect of the 1987 definition change. If we assume, however, that the reporting backlog under the new definition was nearly completely taken care of by the end of the third quarter of 1988, we can compare cases reported in the fourth quarter of 1989 directly with cases reported in the fourth quarter of 1988. This assumption seems plausible in the light of the following numbers from 1988 MMWRs.

COMMITTEE ON HIV RESEARCH

Reporting Week in 1988	Cases Reported through Week	Cases Reported in Latest 13 Weeks
13th	7,422	7,422
26th	15,278	7,856
39th	23,357	8,079
52nd	30,847	7,490

AIDS cases reported in the fourth quarter of 1989 will be included in 1989 MMWRs. It is preferable to work with the cumulative, rather than the single-week, numbers; the two sets of data often do not reconcile.

Starting in 1990 MMWR will, presumably, each week show cumulative 1990 and 1989 reported cases, which can be directly compared. Late in 1990 it should become possible also to compare rolling twelve-month totals from the HIV/AIDS Surveillance Report (for example, 12 months through October 1990 versus 12 months through October 1989) without fear of undue influence from the 1987 reporting backlog.

APPENDIX O

REFERENCES

Throughout our report and its appendixes, we have opted not to include footnoted references. Instead, we list here the main references from which we have drawn information.

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