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Problems in Estimating the Prevalence of HIV Infection

by Linda T. Bilheimer

(Ed. note: The following is excerpted, with the author's kind permission, from her draft paper, "Problems in Obtaining Statistics on AIDS." The other sections of the paper deal with estimating the size of risk groups, estimating the number of AIDS cases, projecting HIV-related morbidity, and estimating and projecting the costs of HIV-related morbidity and mortality. Copies of the complete paper can be obtained from Ms. Bilheimer at Mathematica, Inc., 600 Maryland Avenue, S.W., Suite 550, Washington, D.C. 20024-2512.)

National Estimates

Not only do estimates of the size of risk groups provide the denominators for disease incidence and prevalence rates, but they are also being used to estimate the total number of persons with HIV infection. Based upon independent estimates of infection prevalence rates by risk group, and the estimated risk group sizes, the frequently cited figures of 1-1.5 million infected people in 1986 were estimated [10]. However, the risk group prevalence estimates have not been based upon random samples from the risk group populations. Rather, such estimates are typically derived from public clinic client populations, etc., which introduces a potentially serious bias [8]. This, combined with the problems of the risk group estimates themselves, renders the national infection estimates highly tentative. Using the same basic approach, Harris [7] estimated that there would be 900,000 infected persons by mid-1987. This figure was based upon his own estimates of the sizes of the major risk groups, and an infection rate of 15% among gay and bisexual men, and 20% among IV drug users. In addition, he estimated that there would be 30,000 "second-hit" infected heterosexuals, 10,000 "second-hit" infected hemophiliacs, and 1,000 to 2,000 "second-hit" infected children. He defines "first-hit" groups as gay and bisexual men and IV drug users. "Second-hit" groups are those to whom the infection spreads from the first-hit groups. It is difficult to evaluate Harris's estimates, since no sources are given for most of the figures that he uses.

An alternative approach, that avoids having to estimate populations at risk, is based upon an estimate of the ratio of the number of infected persons to the number of AIDS cases. The total number of cases can then be used to estimate the infected population. Curran et al. [4] observed an infection/disease ratio of 28:1 in the San Francisco hepatitis B study cohort in 1984. Assuming that the rest of the country would be lagging behind the San Francisco experience, they postulated national infection/disease ratios of between 50:1 and 100:1. This gave estimates of between 500,000 and 1,000,000 infected Americans — a range that was at the lower end of the Coolfont estimates published the following year.

Curran's estimates were obviously based upon highly speculative assumptions. However, they served to demonstrate the potential magnitude of the problem at a time when there was very limited public understanding of the prevalence of infection. It was not implied that these were reliable prevalence estimates.

The results of other seroprevalence studies based upon the screening of particular populations, such as blood donors or military recruits, cannot be generalized because of the serious biases involved. High-risk persons are strongly discouraged from donating blood, and military recruits tend to be young and socioeconomically disadvantaged. However, military recruits may also have an underrepresentation of homosexual men and IV drug users. Thus, the biases may work both ways. See [2].

All of these approaches are crude at best, but national seroprevalence studies are fraught with problems. Random samples of hospital blood specimens can provide estimates that are a considerable improvement over what is currently available, even though they are still biased. Thus the Centers for Disease Control are currently sampling blood specimens from sentinel hospitals across the nation.

In June, 1987, the Department of Health and Human Services announced that a nationwide random seroprevalence study would be undertaken. See [5] and [1]. However, the methodological issues that need to be addressed are enormously complex. At issue is how to undertake a random seroprevalence survey with informed consent. The possibility of including such a survey as part of one of the national health surveys, such as the Health and Nutrition Examination Survey (HANES), raises serious questions about the possibilities of non-response bias.

This could have a damaging effect on the entire survey, and would have to be very carefully scrutinized before it was implemented. To this end, the National Health Interview Survey (NHIS) is being used to explore the public's willingness to take part in a national seroprevalence study. Preliminary data indicate that concerns about potential non-participation are well founded. See [12].

State and Local Estimates

State and local public health units are struggling to address the issue of ongoing infection prevalence estimation, which is critical for tracking the course of the epidemic at the local level. A small number of states — most notably Colorado — now mandate reporting of positive HIV antibody test results, but this does not provide an appropriate data source for estimating prevalence. Bias is introduced into any situation in which there is self-selection, but the magnitude of such bias is probably increased by perceived threats to confidentiality. A study in Oregon, for example, showed that the demand for HIV testing and counseling increased dramatically when the state permitted anonymous as well as confidential testing. Furthermore, the risk group responses differed. It was not known how far the effect was time limited. See [6].

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HIV Infection cont'd.

There is considerable interest at the state level in testing public health clients, with special emphasis on family planning and sexually-transmitted-disease (STD) clients. (Since it is anticipated that heterosexual spread will occur primarily in populations at risk for other STDs, this does provide an approach to studying heterosexual transmission.) CDC has recommended that routine counseling and testing should be provided to persons seeking treatment for STDs, to IV drug users, and to women of child-bearing age with identifiable risks. Routine counseling and testing has been defined as "a policy to provide these services to all clients after informing them that testing will be done. Except where testing is required by law, individuals have the right to decline to be tested without being denied health care or other services." See [3].

The right to reject routine testing, again, introduces bias into seroprevalence estimates among client populations. This is compounded in those states that require written consent for routine testing. See [8].

For the purposes of obtaining unbiased seroprevalence estimates among client populations, random sampling of unidentified blood specimens is the preferred approach, where this is allowed by law. Such a method, however, precludes informing the client of his/her seroprevalence status and prohibits contact tracing, i.e., there is potential conflict between the clinical and the statistical purposes for seroprevalence testing. Blind testing also limits the epidemiologic research possibilities, since the inability to follow back inhibits the study of risk factors. The latter is of considerable importance as we struggle to understand the epidemiology of heterosexual spread. However, obtaining valid seroprevalence estimates is probably even more critical.

Thus, for example, the District of Columbia is currently planning random anonymous sampling of blood specimens from homosexual men, women of child bearing age, IV drug users, and prison inmates. Blood specimens from public health clinics, hospitals, drug rehabilitation centers, and other locations would be sampled without the clients' knowledge. The District's attorneys are currently investigating the legality of this. See [9]. Similarly, the state of New York plans to sample 100,000 hospital blood specimens anonymously over the next year. However, some clinical information will be recorded to allow the determination of risk group status. See [5]. It is certainly questionable how reliable this risk group determination can be, in the absence of detailed individual investigations.

In addition, seven states are planning to test newborn PKU blood specimens as an approach to tracking heterosexual transmission [11].

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Valuation Guidelines for Participating Whole Life Policies

by the Committee on Valuation and Related Areas (COVARA), Robert W. Stein, *Chairperson*

Prior issues of *The Actuary* have reported on discussions concerning appropriate means of testing the adequacy of cash-flows for various lines of business. COVARA has reviewed some of the information presented, particularly the recent suggestion that cash-flow testing for some participating whole life business is not necessary to support conclusions regarding the adequacy of assets funding such business.

COVARA believes that valuation guidelines for participating whole life business should be consistent with guidelines for other types of policies. The valuation actuary must bear the burden of proof that his or her analysis is sufficient to confirm reserve adequacy.

COVARA also believes there is no reason to exempt some par whole life policies from the general valuation guidelines any more than there is to require cash-flow analyses for all other types of policies. The methodology employed by the valuation actuary should always (1) confirm the adequacy of assets to provide for the company's obligations, (2) recognize all material factors, and (3) sufficiently test potential variability. The actuary who does not project future asset liability cash flows will need to be satisfied that the methodology used meets these tests. Detailed cash-flow testing may not be required every year.

The character of the participating whole life line will vary widely among companies. For example, there will be significant differences in dividend philosophy, premium-dividend levels, net cost, competitive position, supporting assets and policyholder dividend expectations. The degree to which dividends could actually be reduced in a given adverse situation will vary among companies, depending on factors such as management's attitude toward dividend reductions and the effect of dividend reductions on persistency, particularly in

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