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Katherine Hill Chavigny
*American Medical Association*

Sarah L. Turner
*Lander University*

Anne K. Kibrick
*University of Massachusetts Boston*

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# Epidemiology and Health Policy Imperatives for AIDS

*Katherine Hill Chavigny, Ph.D., FACE*
*Sarah L. Turner, R.N., M.P.H., Ph.D.*
*Anne K. Kibrick, Ph.D.*

*The purpose of this article is to describe the statistics and epidemiological facts about the most virulent epidemic of our age, acquired immunodeficiency syndrome (AIDS). The discussion argues for broadened public policy to promote the surveillance of communities in order to enhance the effectiveness of data gathering for epidemiological reasoning, analysis, and control measures. To accomplish these goals, the essential characteristics of epidemiology are defined. The use of deductive and inductive reasoning is applied to describe and analyze known facts concerning the AIDS epidemic. Hypotheses are suggested from current amorphous and continually changing information to assist in further explanations of the epidemic and in the evaluation of methods of prevention and control. Current policies for sexually transmitted diseases are reviewed briefly to identify epidemiological concerns, with the aim of assisting policymakers. Implications for public policy are discussed in the context of seeking epidemiological information for the ultimate protection of the public good.*

Epidemiology is logical thinking applied to health problems that threaten the public. A more generally accepted definition of epidemiology is the study of patterns of diseases and their precursors in communities; however, the essential elements of the epidemiological perspective are inductive and deductive processes of logical thought applied to problems of sickness and health in groups. Many health professionals use the concepts, processes, and results of epidemiological investigations to accomplish their goals. Epidemiology crosses the conceptual delineations of disciplines concerned with health; it seeks to identify health hazards to communities and evaluate the results of interventions, including the effects of public policy on health matters. Its main purposes are to provide information to achieve the goals of public health; to prevent and control sickness as well as disease precursors in communities, and to promote community health.

*Katherine Hill Chavigny is director of the Office of Related Health Professions and Nursing Affairs at the American Medical Association in Chicago. Sarah L. Turner, an epidemiologist by training, teaches public-health nursing at Lander College in Greenwood, South Carolina. Anne K. Kibrick is dean of the School of Nursing at the University of Massachusetts at Boston.*

## Epidemiology and Public Policy

In the new federalism that is now in vogue, the states have assumed increased fiscal responsibilities. Reduction in federal support affects administrative and government decisions at the state level.[1] Policies are codified and funds are allocated for state initiatives that are influenced by many factors besides scientific logic. In regard to human immunodeficiency virus (HIV) infections, Massachusetts has enacted laws requiring written, informed consent prior to testing for HIV antibody by physicians and health care facilities. These statutes address confidentiality, insurance, and informed consent.[2] The laws define AIDS as a handicap and invoke legal sanctions against discrimination toward persons with AIDS; also, the disclosure of test results to any person except the patient is prohibited by law. Informed consent of a person is required in written form before a test may be obtained. These state statutes protect the rights of the individual in respect to the group or community. State regulations must relate to and coordinate with national imperatives to effectively control epidemics.

At the federal and international levels, goals have been formulated, as follows, to coordinate state activities to control sexually transmitted diseases (STDs):[3]

1. To minimize disease exposure by reducing sexual intercourse with persons who have a high probability of infection.

2. To prevent infection by increasing the use of condoms or other prophylactic barriers.

3. To detect and cure disease by implementing screening programs, providing effective diagnostic and treatment facilities, and promoting health-seeking behaviors.

4. To limit complications of infections by providing early treatment to symptomatic and asymptomatic infected individuals.

5. To limit disease transmission within the community through the above efforts.

These objectives affect current policy for all sexually transmitted diseases in the United States, including the reporting and control of AIDS.

The syndrome known as AIDS is characterized by two inescapable but, it is hoped, not immutable facts that demand special policy approaches: (1) it is an infection with extended periods of infectivity (the harboring of an infective agent), and (2) eventually, the disease is fatal. It is crucial to recognize that the virus is carried and harbored by infected persons long before symptoms of acute illness occur. Owing to the longevity and fatality of HIV infection, the public requires policies for protection against a protracted, virulent, and, often, sequestered hazard. But AIDS is also a social disease; its major risk groups are associated with lifestyle behaviors such as homosexuality and illegal intravenous (IV) drug use, about which the larger society has moral and ethical preconceptions. Public policy, therefore, has to weigh civil liberties against the healthy survival of society.

Policymakers require facts to understand the risk of HIV infections, to ascertain the

spread of the epidemic, and to assign resources. Basic scientific information is required to make convincing arguments for change which can be justified as objective, unprejudiced, and realistic. Epidemiology provides a comprehensive resource of scientific information about group problems for the use of administrators and legislators. All medical, social, and basic sciences are marshaled and integrated in order to apply epidemiology to the purpose of solving problems regarding the health of the community.

Policy for AIDS which meets the needs of each state requires reliable, valid, quantified information for assisting policymakers in protecting the public and the individual. National policy is based on the coordination and analysis of quantified data from state surveillance systems. Access to accurate information is a basic prerequisite for solving problems associated with community hazard. It is epidemiological practice to constantly monitor communities and collect information. Each state has a surveillance system, integrated on a national basis, to provide facts for scientific analysis. The civil concern to protect homosexual and racial rights are real and are an irrevocable constitutional mandate; however, protection of the group is an effective method of protecting individuals within the community. Statutes and policies guard the individual by expressing group decisions for mutual advantage of all people.

Methods used to determine the public good are all too frequently debatable issues. Epidemiology attempts to provide a logical basis for assessing public hazards and the effectiveness of communal solutions to protect the greatest good for all the people. Its special contribution is that it provides a rational, objective groundwork on which to base policy decisions. Facts are important to political arguments for opinion leaders, policymakers, and administrators. Valid information affords a means of allaying fear, provoking concern, and setting priorities. Assessment of risk and assessment of effectiveness of methods for the optimal protection of the people are prerequisite to setting cogent injunctions.

The public health system was slow to respond to the AIDS epidemic; too little was known about a slowly evolving but complex crisis that at first was not recognized as an infectious disease. As a result, policies that govern infectious disease surveillance were activated sluggishly. Partly because of this delay, there is a notable lack of reliable and valid information to guide epidemiologists in their quest for group parameters to assist policymakers. Measurement of community events are necessary to provide a scientific basis for policies that are well-reasoned and just.

## Issues in the Analysis of Epidemiological Information

Epidemiology quantifies the incidence of disease in communities. Epidemiological surveillance provides objective data that allow comparisons between communities for decision making. But the mere collection of facts is never enough; to be meaningful, these facts require analysis and interpretation. Epidemiology as a discipline provides the scientific methods to analyze and optimize information through hypothesizing the cause of monitored problems in communities and identifying the most effective methods of prevention and control. These methods yield data to guide administrators and policymakers at all levels of government.

Hypothesizing the cause of public health problems is the central theme in epidemiology. Postulating the cause of health problems guides various strategies in analyzing observations and planning intervention in epidemic circumstances. In the interest of economy and

effectiveness, it is important to choose a hypothesis that has the greatest power to produce the true associations. This is no small task, and it depends on analysis of facts that can be gleaned from the problem at issue, using hypothetical reasoning. The strength of the postulated association between potential causes and effects can be tested through inductive and deductive methods.

Scientific method is traditionally inductive, collecting observed facts to test a postulated cause. Epidemiology utilizes this approach and claims the distinction of being a science for public health. According to Karl Popper, all hypothetical reasoning is deductive, rather than inductive.[4] In other words, a causal relationship is made first and then facts are collected in support of the postulation. Popper also claims that refuting a hypothesis is more powerful than verifying the postulated relationship; the process of refutation leads to creative thinking and the selection of the most useful hypotheses. When refutation through the application of present information to test the hypothesis fails, then the hypothesis is worth testing through vigorous scientific research. Both approaches are available to yield answers to the difficult, unsolved problems concerning HIV infections; however, both methods of scientific inquiry require a body of known facts collected from the population in order to be innovative as well as effective.

The formulation of causal hypotheses as applied to populations demands special methods not always used in the strictly experimental sciences. Epidemiology uses the terminology of exposure for cause and effect for illness. There are several methods of assessing the merits of any hypothesis. Critical challenges to hypothetical association between exposure and effect include questions concerning (1) time order, (2) specificity, (3) consistency, and (4) coherence. Time order requires the exposure to precede the effect (illness) for the hypothetical association to be logical. Although it is known that some exposures can cause more than one disease, specificity is the precision of the exposure to predict illness and only that illness. Consistency is the ability of the hypothesized association to persist regardless of time, place, and person; and lastly, coherence demands the biological and clinical plausibility of the association.[5] In order to apply these (and other) logical challenges and hypothesize productively and economically, the availability of facts about the cases and their frequency is mandatory. Without facts — without the knowledge of where and when the cases of AIDS and the incidence of seroconversion (infection) are occurring — hypothesized solutions for public policy are constrained and impaired.

## Issues in Measurement of the Epidemic

The need to have valid and representative information to identify an emerging epidemic and to hypothesize cause is demonstrated through the history of the emergence of the epidemic. The first necessity that arose regarding the syndrome called AIDS was to establish that a problem existed and to describe its characteristics and distribution. Although the first case of the disease syndrome was reported in 1978, it was not until 1981 that a cluster of several cases emerged indicating a possible problem.[6] Several outbreaks of *Pneumocystis carinii* pneumonia and Kaposi's sarcoma, a rare form of cancer, were reported to the Centers for Disease Control (CDC), the division of the U.S. Public Health Service which is responsible for monitoring infectious diseases in the United States. Examination of this cluster of diseases disclosed that the problem appeared to be confined to previously healthy, young, homosexual males. These differing diseases all showed the common phenomena of the evidence of immunosuppression, depleting the ability of patients to regulate and overcome infection.

Uniform case identification is crucial to any form of epidemiological investigation, whether it is descriptive or etiologic. The designation of an AIDS case was particularly difficult: not only does the disease syndrome present in several ways, but patients can have recurrent episodes and different causes of death. For instance, according to the report of the Committee for a National Strategy for AIDS, the major causes of death for HIV infection through 1986 were *Pneumocystis carinii* (64 percent), Kaposi's sarcoma (23 percent), and candida esophagitis (7 percent).[7] More recent information from the CDC indicates that the proportion of deaths due to Kaposi's sarcoma is decreasing to 11 percent relative to opportunistic infections such as candida esophagitis.[8] As with most mortality data, preexisting diagnoses are not shown. Reports usually indicate the frequency of cases and the proportions of diagnoses relative to all cases. The number of cases do not express the risk of AIDS and therefore do not relate to the community or group risk. More important, many diagnoses associated with HIV infection, such as AIDS dementia, are not systematically reported, although they are used within the new definitions for diagnosing HIV infection.[9] The methodic, consistent categorizing of persons with AIDS and the reporting of pre-mortality diagnoses are important for identifying hypotheses that will yield salient knowledge for scientists, administrators, and government leaders.

Because of the several diagnoses that accompany HIV infection as a result of reduced immunity, it became clear that a collection of signs and symptoms, a syndrome, furnished a preferred method of diagnosing the "cases" in the epidemic. In about 1982, the CDC differentiated AIDS from AIDS-related complex (ARC) and persistent generalized lymphadenopathy (PGL) in order to designate different stages of the disease. At that time, it was hypothesized that there was a linear progression from PGL to ARC to AIDS and so at least fifty thousand ARC cases were not reported to the Centers for Disease Control for inclusion in the epidemic.[10] The coherence of this postulate was soon shattered by the observation that ARC patients died without progressing to AIDS; also, PGL was not necessarily the first stage of what has subsequently been recognized as HIV infection. The CDC surveillance system, based on state reports, has not included ARC or PGL as cases of HIV infection in routine collection and reporting of epidemic data. The revised definitions of 1987 do not include the denotations ARC or PGL; however, the same syndromes are used for diagnosing the all-inclusive term of HIV infection or AIDS. Until the new diagnostic criteria are applied consistently and until enough time has passed to compile new rates rather than count cases, the extent of the epidemic remains equivocal.

The need for consistent, complete, valid information that is based on a comprehensive, consistent case definition is aptly illustrated by the fact that the true extent of the epidemic of all cases of HIV infection has not yet been detailed and made available to policymakers. Importantly, the most recent definitions may improve case finding in the future, but it will compromise any comparisons that may be made with information collected before September 1987, when the revised case definitions went into effect. The loss of comparable baseline statistics will create difficulties for policymakers who wish to have evidence of the effectiveness of regulations in slowing or deterring the spread of the epidemic.

Other epidemiological approaches are used to identify cases of infectious diseases. Any test that can measure antibodies to a specific infectious agent or a generalized response to infection is called a biological, epidemiological marker. The rationale for the use of the marker is not only to assist in diagnosis of cases but also to screen populations in order to identify the number of people who are infected in a community or in a subgroup of the general population. Epidemiological markers provide serologic evidence of present or

past infection from analysis of the blood. Blood contains red blood corpuscles and white cells suspended in a yellow fluid called serum. Antibodies to HIV and other infectious agents are found in sera that provide the serologic evidence to substantiate the presence of infection. When the tests are administered to a large group, the level of infection within the community or the proportion of those remaining susceptible to an infection can be estimated.

In many cases of infection with diseases other than AIDS, the evidence of invasion of the microbe is followed within a period of time, called the incubation period, by obvious signs and symptoms of illness. In most infections, the incubation period is short and the serum of the blood shows antibodies, a response to infection, almost at the same time that illness occurs. In some diagnoses, such as syphilis or herpes hominis II, the symptoms occur but may be too subtle to force an immediate consultation with a physician. After invasion of the body with HIV, signs and symptoms of illness may be delayed indefinitely; the only indication that the person is infected with the virus may be a positive blood test, also called a positive serology. This means that an apparently healthy person is infected with the virus and that it may be passed to others. The person is infected but has no diagnosed disease and may be unaware that he or she may be a danger to others.

The enzyme-linked immunosorbent assay, the ELISA test, made available in 1985, is an epidemiological marker for measuring the presence of antibodies to the human immunodeficiency virus in the serum of the blood. A second test to corroborate a positive serology is always required to verify the first measure, and the Western blot test is used when the ELISA suggests the presence of HIV antibody. In HIV infection, the use of the tests makes it possible to define infected populations who are without signs and symptoms of acute illness. Tests are also used to verify the diagnosis of AIDS when illness has already occurred.

In 1987, the International Nomenclature Committee and others advised that the formerly used diagnostic term (AIDS) be discarded in favor of the global term HIV infection.[11] Almost simultaneously, diagnostic criteria for HIV infection were revised, and signs and symptoms were regrouped.[12] These measures will assist in increasing the effectiveness of quantifying cases for entry into the numerator of the rate, the basic statistic of public health. Rates are important in epidemiology. The numerator is the frequency of diagnosed cases; but it can also be restricted to the number of infected, asymptomatic persons, such as those with positive blood (serology) tests. The denominator is the population at risk of exposure to the hazard at the local, state, or national level. Accuracy of rates depends on precise case identification and the size of the community where cases occur. It is also heavily dependent on the identification and reporting of cases and infected persons. Rational policy depends on access to valid rates to enhance the assessment of public problems associated with diseases that threaten the well-being of the community. Frequency of cases, the counting of the numerator of the rate, is often regarded as a questionable measure of the progress of an epidemic when the incubation period is lengthy, as in HIV infection. Lack of methods of case identification that included all HIV infections in the past has compromised the estimates of the extent of the epidemic and the hazard to the public. In the same way, lack of reporting of persons with positive serology is a serious barrier to accurate assessments of group risk; it also makes any claims that the epidemic is slowing down open to question.[13]

## Describing and Analyzing the Epidemic

The use of available facts to formulate hypotheses in epidemiology is illustrated by a selective review of the evolution of the problem of AIDS. One of the first hypotheses concerning the cause of the epidemic was based on the observation that the syndrome occurred in male homosexual populations.[14] Several exposures common to this group were examined. A reasonable association from early studies was thought to be the exposure to sniffing amyl and butyl nitrite, drugs used to enhance orgasm. The amyl nitrites are commonly used to relieve anginal pain. The causal association between the use of these drugs and AIDS seemed to be refuted in later studies, mainly because the design had not included a heterosexual control group; the sample was too restrictive.[15] Subsequently, it became clear that the hypothesis did not meet the demand of criteria for establishing a causal relationship, such as time order, specificity, and consistency, although the use of these drugs may be a cofactor. The occurrence of AIDS was not always preceded by use of the nitrites; the taking of the drugs by homosexuals did not always predict AIDS, nor did this association persist in groups such as hemophiliacs.

Other hypotheses were advanced. The autoimmune reaction is depleted when exposed to spermatozoa that are forced into the bloodstream. It was thought that this antigenic response was the cause of AIDS. This postulated association was thought to be biologically plausible (coherent), because immunosuppression and the increased occurrence of tumors had been noted in primates who had had vasectomies. Although this hypothesis has not yet been clearly refuted, it lost precedence when other information emerged from increased surveillance and reporting.

Further analysis of available information showed similar patterns to hepatitis B virus infection.[16] Rates of hepatitis B are highest in those who practice illegal intravenous drug use and in persons with a history of venereal disease. Hepatitis B is spread through blood, blood products, and sexual contact. The agent is a virus. Comparison between the group pattern of hepatitis B and emerging facts about AIDS led to the hypothesis that AIDS, too, is an infectious disease, a postulate that has now been verified and that meets all logical, critical challenges.

The identification of what is now known as the human immunodeficiency virus, a retrovirus with lentivirus characteristics, was a result of the work of a group of scientists including Barne-Sinoussi,[17] Gallo,[18] and Levy[19] in 1983. As discussed earlier, the ELISA test became available in 1985 — a direct result of identifying the causal agent. This epidemiological marker traces the extent of the infection in the population; it is a screening method for detecting the presence of asymptomatic infection as well as a diagnostic tool for confirming cases. Lack of systematic screening policies has made the estimates of the extent of the asymptomatic infection in the population unreliable. It was thought that there might be between 1.5 million and 2 million seropositive people in the United States, but this was a crude guess made in the absence of evidence. The reporting of seropositivity is crucial to making the estimates valid, but policies to ensure the accurate collection of these facts are still in debate. It is not surprising that the reported estimate was recently revised and is thought to be much less, about 470,000,[20] although evidence is still sparse to support this figure. The scope of the infected but submerged reservoir of infected people is particularly troubling because the exact relationship of seroconversion to extant illness is still not clear. The occurrence of AIDS after conversion to a positive ELISA test used to be quoted as 1:5, or 20 percent. It is now thought that 50 percent of people with positive serology may develop the disease.[21]

The description of the epidemic which was derived from analysis of collected observations showed that by the end of 1986, over 24,500 cases of AIDS had been reported to the CDC.[22] It is thought that over 50,000 ARC cases had occurred during the same time period.[23] By May 1987, the total had increased to 35,318 cases of AIDS. Of the total 35,318 cases, 92.6 percent occurred in males and 7.4 percent in females; 498 cases, or 1.4 percent, were under the age of thirteen.[24]

The profile or pattern of the disease has now taken shape. Male homosexuality and male bisexuality account for 71 percent of the 35,318 cases, illegal intravenous drug use 14 percent, and male homosexuality with illegal intravenous drug use another 8 percent.[25] Illegal drug use is the major means of HIV transmission in females, followed by heterosexual activity. When the mode of transmission of HIV infection is compared to white/non-Hispanic, black/non-Hispanic, and Hispanic ethnic classifications, male homosexual/bisexual activity was a major factor in white/non-Hispanic cases. Among blacks and Hispanics, intravenous drug use was the main channel of transmission of the virus, and heterosexual transmission of HIV was highest in blacks.[26]

Few mandatory testing/screening programs for asymptomatic but infected people are in place; however, the armed forces require ELISA screening for new applicants. Information from this form of surveillance shows interesting epidemiological patterns.[27] From a total of over three-quarters of a million applicants for military service, there were fewer than two cases per thousand, or about a total of fifteen hundred persons with asymptomatic infections. Anecdotal accounts of these data suggest that many of the seropositive applicants assert they had no knowledge of their exposure to infected sources.[28] Also shown in this report are the higher rates of seroconversion in blacks and Hispanics, confirming other observations that rates of diagnosed AIDS in these minority groups are almost double the rates of overt disease in the Caucasian/non-Hispanic group.[29]

Facts describing the present status of the epidemic which may indicate intervention methods for prevention and control include the following: Among female cases, 50 percent are attributable to transmission by illegal intravenous drug use, 29 percent by heterosexual spread, and 10 percent by blood or blood components.[30] Although females form a small percentage of all reported cases, AIDS is associated with intravenous drug use twice as much in women as in men; also in females, AIDS is associated with heterosexual activity fourteen times more than in males.[31] In the larger male groups, homosexual activity and drug use, in that order, are the major forms of transmission.

The extent of the epidemic of HIV infection in women from 1981 through 1986 describes 1,819 cases, using the case definition that excluded cases of ARC[32] occurring during this time period. For this reason, these figures should be regarded as very conservative estimates. Little is known about female homosexual transmission of the virus between infected women. Usually, epidemiologists consider that compared to the male homosexual/bisexual group, there is no equivalent risk group for females.[33] The predominant method of transmission of HIV infection to women is illegal use of intravenous drugs, followed by heterosexual contact with a person at risk for AIDS. Because women have the possibility of sexual contact with groups at high risk of HIV infection, such as bisexual males, they are viewed as the interface between male homosexual/bisexual groups and the heterosexual population, where seepage of the infection to non-high-risk groups may take place. Following the progress of the epidemic through analysis of the frequency of cases in women may be a method of categorizing the spread of the infection into the heterosexual population. For instance, the proportion of cases in women which is

ascribed to heterosexual transmission increased from 12 to 26 percent between 1982 and the end of 1986. It is also obvious that infected women are the source of the transplacental transmission that takes place from mother to infant, increasing the threat of AIDS to the unborn.[34] Statistics in August 1987 indicated that, under the "old" CDC case definition, 40,051 cases had been reported to the CDC from fifty states in the Union. Fifty-eight percent of these patients had died.[35] By mid-December, the total number of cases was 48,574.[36]

## Methods of Transmission of HIV Infection

The transmission of an infective agent requires a reservoir that harbors the infective source; a route of transmission or vehicle for spreading the organism; a susceptible host; a portal of exit from the infected reservoir; and a portal of entry into the susceptible host. The greater the knowledge about transmission of infectious disease, the more likely that methods of prevention and control will be effective. Administrative and legislative initiatives utilize epidemiological information to break the chain of transmission, to plan services, and to allocate resources.

The mode of transmission of HIV is similar to that of the virus of hepatitis B that spreads through blood, blood products, and sexual intercourse. The transmission of the hepatitis B virus differs from HIV because chronic carriers of the hepatitis B virus are few, about 10 percent, and the incubation period is not longer than six months. It is also a recognized occupational hazard to health care workers.[37] Hepatitis B is a reportable communicable disease that is under constant surveillance by public health authorities. It is epidemic in proportions and has epidemiological tests or markers to screen high-risk populations, a practice recommended by the Immunization Practice Advisory Committee. A vaccine is available for primary prevention.[38]

The reservoirs for HIV are infected asymptomatic and symptomatic persons. Once the infection has taken place, the person remains infected and becomes a source of the virus. High levels of infectivity are found in groups whose lifestyle, such as illegal IV drug use or male homosexuality, places them at high risk. The chief vehicles through which the disease is spread are blood, blood products, and semen. Portals of entry for infected semen to enter the body of a susceptible person are provided, probably, through trauma to mucous membranes and through skin abrasions or open lesions. Another portal of entry is provided through the direct injection of the virus into the bloodstream.[39] Methods of spread are through sexual activities that may injure tissues and afford entry into the bloodstream and (perhaps) through multiple sexual contacts in a short period of time.[40] Other routes of transmission are through illegal intravenous drug use, particularly the use of shared needles, and through infected blood transfusions and blood products.

Portals of exit for infected secretions are provided through blood outlets such as bleeding gums, accidental hemorrhage, and the emission of semen from infected persons. All secretions for seropositive people have the potential to be infectious, including saliva and vaginal secretions, possibly because the virus has been retrieved from the secretions;[41] however, transmission through these means is highly unlikely, because epidemiological evidence indicates that casual social contact does not spread the disease. Direct contact with an infected person or susceptible host with appropriate portals of entry seems the necessary prerequisite for developing infection and subsequent AIDS.

Transmission of HIV infection between high- and low-risk populations is of great con-

cern and requires further epidemiological studies to define accurately. The populations with high and low rates interface through illegal drug use, bisexual behaviors, prostitution, blood transfusions, artificial insemination, and organ transplantation.

The risk of HIV infection for health care workers who deliver direct services is low, but examination of information about the spread of disease to health workers illustrates the need to protect portals of entry, such as skin abrasions, from accidental transmission. A 1986 study by the CDC showed that out of 750 physicians and nurses exposed to body fluids of infected patients, only 3 workers, after complaining of needle sticks, were found to have converted to positive antibody tests.[42] These professionals admitted to other risk factors such as male homosexuality. In a larger study of 20,000 health care workers, 4 percent were seropositive; but it is thought that all workers with seroconversions had other risk factors besides contact with HIV-infected patients.[43]

It may be true that transmission occurs in health care workers without the presence of any high-risk factors, but such transmission seems rare. Nine cases reported to the CDC during 1987 did not admit to any high-risk lifestyles.[44] Anecdotal evidence implied that seroconversion occurred from contact with infected fluid in the presence of injured skin.[45] Four of the cases had suffered needle-stick exposures; two others had had extensive contact with infected body fluids but had failed to observe the recommended barrier precautions to wear gloves. The remaining three cases illustrate the need to provide a portal of entry for the virus to invade the body. A female worker with chapped hands applied pressure to a bleeding arterial site to prevent hemorrhage during an emergency episode; subsequently the worker had a positive ELISA test. In another case, the top of a 10 ml vacuum blood collection tube flew off, and infected blood was splattered over the faces and in the mouths of two workers, one of whom suffered from acne. The latter developed a positive serology for HIV but the other worker remains seronegative. In another incident, a major blood spill covered the gloved hands and forearms of a health care worker. She had dermatitis in one ear and may have touched the ear during the incident; subsequently she became seropositive.[46] Needle-stick injuries and exposure of mucous membranes to secretion and blood infected with the virus do not appear inevitably to result in seroconversion; however, the precise risk of transmission has not yet been defined. In spite of the general low occupational risk, it seems that the possibility of transmission will increase as the number of infected patients increases.[47]

Studies of hemophiliacs with AIDS/ARC substantiate that social contact with family and friends does not spread the disease. In a study of the family contacts of fifty children and adults with diagnosed hemophilia, sexual contact between spouses was the only mode of transmission of the disease.[48] Social interaction between friends and nonspouses with antibody-positive, asymptomatic hemophiliacs did not spread the disease. The findings in this study also showed that in comparison to the immune response in the social contacts of the antibody-negative (uninfected) group of hemophiliacs, the immune response in the social but nonsexual contacts of infected hemophiliacs was diminished. This suggests hypotheses that perhaps nonsexual social exposure results in physiological responses of the immune system, which may give some indications for research on an effective vaccine. See figure 1.

The study by Jason and McDougal which was used as the source for figure 1 was small. More recent studies substantiate that changes in the blood lymphocytes do not predict clinical change.[49] Studies of the hemophiliac group establish that transmission of the virus requires sexual contact or exposure to infected blood through a portal of entry that gives access to the bloodstream.[50]

*Figure 1*

**Diagnosis and HIV Antibody Status of Household Contacts of Persons with Hemophilia**

| Health Status of Hemophiliacs | Hemophiliacs | Incidence Rate of AIDS in Family Contacts |
|---|---|---|
| AIDS (with signs and symptoms) | 12 | 1 Spouse Out of 15 Contacts |
| ARC (with signs and symptoms) | 5 | 1 Spouse Out of 18 Contacts |
| Antibody-Positive (infected but no signs or symptoms) | 17 | 0 Cases Out of 29 Contacts (Including 7 Spouses) |
| Antibody-Negative (noninfected) | 9 | 0 Cases Out of 21 Contacts |
| | 43 | 83 |

Rate of disease in sexual partners of AIDS/ARC hemophiliacs = 14% (2/14)

Rate of disease in sexual partners of antibody-positive hemophiliacs = 0% (0/7)

Significantly lower lymphocytes in social contacts with hemophiliacs with AIDS, ARC, and antibody-positive serology than in contacts with antibody-negative hemophiliacs.

*Source:* Janine M. Jason, J. Steven McDougal, Gloria Dixon, et al. "HTLV-III/LAV Antibody and Immune Status of Household Contacts and Sexual Partners of Persons with Haemophilia." *Journal of the American Medical Association* 255 (1986): 212–215.

Choice of sexual behavior in heterosexuals may influence transmission of HIV infection, given that one of the partners is a reservoir for the virus. A hypothesis that anal intercourse may transmit the virus has been postulated from observations of the higher frequency of AIDS in the receptive homosexual partner. This suggests that anal intercourse may be a high-risk activity for females with an infected partner. The results of an ongoing study of females exposed to seropositive partners indicate that there is increased risk of AIDS to support this hypothesis.[51] Specialists in obstetrics and gynecology advocate tactful and sensitive inquiry into their patients' histories to obtain information on frequency of anal intercourse in order to guide counseling. It is estimated from some preliminary studies that 25 percent of American women engage in occasional anal intercourse and that 10 percent of women practice anal intercourse regularly.[52, 53] These rates are based on limited observations. Bolling and Voeller confirmed that information on frequency of anal sex in women is sparse.[54] They estimate that the frequency of anal intercourse is greater in cultural groups that use it as a method of contraception and preservation of virginity; nonetheless, it is thought that there is still a lower frequency of anal intercourse in women than in homosexual men.

Heterosexual transmission is documented,[55] but the direction of transmission from female to male was questioned. There is evidence that infected females practicing prosti-

tution infect male heterosexuals.[56] This may be associated with the increased drug use in this group. Though the risk appears small, it is expected that by 1991 heterosexual transmission will account for perhaps 10 percent of all HIV infections.[57]

Another mode of transmission between low- and high-risk groups is transplacental spread to children born to infected mothers. A study in 1985 showed that of twenty-two babies diagnosed with HIV infection who were born to sixteen mothers, fifteen were asymptomatic at the time of birth of their first child with AIDS. Four of the mothers admitted to high-risk activities such as IV drug use and prostitution.[58] Other, more recent studies indicate that the risk of transmission of the infection to the child seems to be 1:5, or 20 percent.[59, 60, 61]

## Methods of Prevention and Control

Decisions regarding the most effective methods of prevention and control require reliable evidence of modes of transmission; valid estimates of the risk of exposure to the virus; and knowledge of the virulence of the disease. Disease virulence (the serious consequences of an infection) affects policy decisions regarding prioritization of goals, assignments of funds, and allocation of resources. The virulence of a disease is measured by the case fatality rate, which is the number of deaths occurring in diagnosed cases. At present, the seven-year case fatality rate for AIDS is about 58 percent; in other words, more than half the AIDS cases reported to the CDC between 1981 and 1987 have died.[62] Perhaps of greater concern is that no diagnosed case of AIDS (or ARC) has recovered.[63] It is clear that infection is extremely virulent, and this lends great urgency to the need to seek methods to control the spread of the epidemic.

Prevention and control methods block the invasion and transmission of the virus. One of the most effective methods of preventing any infectious disease is through the immunization of populations. This primary prevention technique protects against common infectious diseases before infection takes place. For the immediate future, the availability of a generalized effective vaccine for HIV infection seems remote.[64] Effective vaccines against retrovirus infections have yet to be discovered. HIV has been described as a lentivirus that has the characteristic of antigenic variation generated during replication of the virus. The development of a vaccine that gives broadly effective immunity is quite difficult, on account of genomic diversity, or changes in the basic proteins in the chromosomes. The existence of different strains of HIV creates a major obstacle for the generation of a single, effective vaccine. This means that antibodies manufactured in response to the antigens are not effective against successive generations of the virus. Should a vaccine become available, such social concerns as how to evaluate its efficacy in populations will have to be addressed. It is important to recognize that the effectiveness of vaccination would have to be measured against baseline information that has already been collected concerning rates of infection or seropositivity, and these rates are often questionable or unavailable.

Public information and education, at present, are the most important means of primary intervention to prevent the occurrence of the disease. Education for safer sexual practices includes the use of the condom as a barrier to transmission of the virus during intercourse. Determining the efficacy of these measures to change behavior and maintain behavioral change will require reliable information. This information will be used to show decline in the rate of increase of infection. It will also require information on the distribution and characteristics associated with sexual practices and mores in several subgroups, such as

the minorities. Several disciplines devoted to the study of behavioral phenomena need to research these questions. A multidisciplinary approach crossing all professional boundaries is required to develop the most effective methods of control of HIV infection.[65]

Primary prevention — intervention in the transmission of disease before the disease occurs — is the sine qua non of methods of preserving the health of the public. It is economical; it is effective; it is the most humane approach to protecting the group and the individuals within the group. Special kinds of scientific and epidemiological facts are essential to the implementation of primary prevention. For instance, a hypothesis concerning an effective vaccine must be scientifically plausible, and risk of acquiring the disease after exposure must be verified so that vaccination can be timely. This information is also important for conserving a safe blood supply.

It seems that the period between an exposure to an infected person and seroconversion varies. The Institute of Medicine in late 1986 stated that seroconversion could occur as early as six to eight weeks after exposure; however, the period is highly variable and may extend as long as eight months.[66] More recently, it has been suggested that seroconversion may occur up to twelve months after exposure.[67] The incubation period — the time between invasion and the occurrence of signs and symptoms of disease — is an important epidemiological variable and is even more uncertain. Estimations made from infected blood transfusions indicate an incubation period of about five years.[68] For adult cases not associated with transfusions, the mean incubation period may be fifteen years.[69] These analyses are compromised by limited data.

Reasons for the difficulty in identifying the incubation period are several. Establishing the date of exposure is problematic, especially without established surveillance systems denoting infected but asymptomatic persons. The incubation period may vary according to mode of transmission, the age of the patient, and the initial concentration of the virus in the infected substrate. Other strains of human immunodeficiency virus are appearing which may lack the virulence of the microbe most frequently infecting the population. Male-to-female, female-to-male transmission may be less effective than male-to-male transmission.[70] Repeated exposure to the infected person may be necessary before the susceptible partner contracts the virus, obfuscating the time of exposure. These factors and others reflect the uncertainties of the discussion on the incubation period. They also underscore the need for reliable documentation of infected persons to keep pace with the ever changing state of the art concerning AIDS.

Secondary intervention is the early detection of infected people in the population. ELISA and Western blot tests provide screening tools to identify the infected, asymptomatic pool in the population, besides verifying the diagnosis in those with illness. Once identified, those who are infected remain in the community as reservoirs for the virus for a considerable length of time. Antiviral medication does not eliminate the virus; cure for the infection is not yet within reach. For these reasons, HIV infection is called a chronic disease. Moreover, because of the variability between seroconversion and overt illness, the infected population does not always seek medical intervention; some may be unaware that they have been exposed to those with high-risk lifestyles.

Infected populations fall into two groups: the asymptomatic, who feel well; and those in whom symptoms are emerging or full-blown. Screening of populations would assist in identifying infected patients, particularly those in whom infection is not suspected. The greatest hazard to the community is the undetected infection. It has been long known in infection control in hospitals that the greatest risk to hospitalized patients and staff is from the "hidden," or undiagnosed, infected person.

The asymptomatic, infected person is the greatest threat to the health of the community. Screening is part of surveillance activities that include testing of high-risk groups attending venereal disease clinics, hospital emergency rooms, and jails. Testing for more than one infection is possible and, often, routine. From the information obtained from these tests, epidemiologists provide information for the community. Administrators learn the degree of need in their locale and are able to plan resources to meet these needs. Local communities are provided with evidence of the threat that exists in their cities and neighborhoods and can organize programs to enhance education of the public. Politicians obtain facts with which they can justify acquiring funds to focus on the greatest area of concern and to encourage the promulgation of regulations to protect the public and the individual. Surveillance also documents the spread or the lack of spread of epidemics into low-risk groups; with a virulent disease such as AIDS, confirming a low prevalence of infection can allay fears and offer reassurance to concerned citizens.

Many feel that the case yield (identified cases of infection) from screening of populations is necessary only where the group may have high levels of infected persons. The danger of false positives is quoted as a reason to reduce screening activities. These arguments have merit from a statistical point of view; however, the tests have over 98 percent sensitivity and specificity — an excellent epidemiological marker to denote true cases and true noncases. In populations of low prevalence, these figures deteriorate and the problem of false positives increases. But the fact is that no test of positive serology is ever performed without a repeat test. Even in situations where prevalence of HIV infection is low, repeat testing increases the likelihood of accurate results. However, routine testing and mandated testing must be differentiated in considering policy. Routine testing consists of usual procedures of public health surveillance. Mandatory testing is supported by law. Statutes requiring written permission for testing for AIDS — the Massachusetts law is an example — create barriers to routine and confidential testing in clinics for sexually transmitted diseases. This is important, because patients in these clinics constitute a high-risk population for HIV infection.[71]

The information gained from programs identifying infected populations is a powerful tool for controlling spread of the infection among the public. Infected women can use the information to make decisions about pregnancies. Infected partners can be taught to prevent the further spread of the infection. In HIV infections, screening for seropositivity before the signs and symptoms occur identifies a group that may be willing to assist researchers in obtaining knowledge to obviate the development of the disease; this screening also identifies those in need of the latest discoveries for treating the infection.

Surveillance information can also be used to plan tertiary prevention and the optimizing of life for the chronically ill and the dying. Resources for meeting the needs of the afflicted and for tending to the dying are needed not only for reasons of humanitarianism, but also to assure the best methods of controlling accidental transmission of the disease during critically ill periods at home and in the hospital, when direct access to infected blood of the patients may occur.

Other facts are required to formulate hypotheses that justify further research, which in turn provides answers that eventually lead to intervention. Several hypotheses for epidemiological research require immediate development,[72] not the least of which is the spread of the disease into groups defined as low risk. Screening reveals populations where rates of infection are low; the armed forces, a population with mandated testing, has low rates

of seroconversion; however, the spread of the infection at the interface of high- and low-risk groups may be increasing.[73] The risk of developing symptoms when a person has a positive serology may be 50 percent, but this figure remains tentative,[74] with some even projecting that, except for dying from competing causes before the symptoms of AIDS manifest, eventual occurrence of the disease is inevitable.[75]

Hypotheses are legion. It is possible that a segment of the population is immune to the virus; if this is so, it promotes areas of research with vast potential for prevention and control. Minority groups, including mothers and babies, seem to die faster from HIV infection than nonminority groups, but why this occurs is a challenging question.[76] Central nervous system AIDS may be an autoimmune reaction that afflicts only hyperallergenic subjects; if this is not the case, then other reasons for its apparently selective occurrence must be sought. AIDS in Europe and Africa is primarily a heterosexual disease, for reasons that remain obscure.[77] HIV infection is a chronic illness that suppresses the immune reaction to other infectious diseases; it is reasonable to predict a rise in other infectious diseases such as tuberculosis and mononucleosis.[78] Hepatitis B, owing to similar modes of transmission, may rise concomitantly with the HIV epidemic.[79] Increased surveillance of all infectious diseases is necessitated by the AIDS epidemic, and support for the public health system that is already in place for public protection becomes an imperative.

The questions are compelling and the problem is critical. Surveillance information that is salient, focused, and informative is urgently needed to enhance the contribution of epidemiological research so that prevention and control methods can be determined. Problems must be solved creatively so that a variety of methods of prevention can be identified through deductive and inductive reasoning; however, facts must be available from which the most plausible and coherent hypotheses can be formulated. Assignment of public and private funds may then be applied to the most productive research to assist in solving the problem of HIV infection.

## Discussion

Epidemiology, a public health science, is also called social medicine. The role of epidemiology is to describe the health problems afflicting a society, seek the cause of hazards, provide logical solutions, and evaluate interventions. Because epidemiology deals with communities and provides information to protect social systems, it inevitably impacts public policy. The origins of epidemiology lie deep in the history of infectious diseases that have long plagued the human race. Its methods — which are designed to evaluate and weigh evidence, test hypotheses, and provide answers that are derived from the group experience — have established its success over time. Answers are shared with politicians, administrators, and leaders, and, because of its application to public problems, epidemiological research is often funded from public coffers. Where necessary, laws are made, on the basis of scientific inquiry, with the goal of promoting realistic and defensible regulations that are barriers to the spread of disease and that protect the rights of both the sick and the well. But the degree to which any individual requires the protection of the statutory system must be weighed and balanced against the degree of threat to the total community, if only because individual safety often depends upon protective legislation that applies to all. Objective, scientific observations of the spread of AIDS must be available to policymakers so that individual rights can be considered within the context of the public good.

Compared to many infectious disease hazards that have occurred in the past, the HIV epidemic has evolved slowly. Evidence has accumulated less quickly about a disease that causes death and is unusual in its complexity. It has not been possible to marshal the facts that were necessary to assuage fear and misconceptions that have spread within the community. The public health system was hampered by the lack of epidemiological markers such as the ELISA test until the epidemic had been acknowledged for some time. This has contributed to the delay in the customary public health methods of reporting, surveillance, and routine testing. The complexity of adequate case definition has added to the problems of activating public health reporting and surveillance systems for epidemiological purposes. Accurate information gathered from the population is still needed to allay fears, to document the lack of infection as well as its presence, and to establish the limits of spread of HIV across the boundaries of high- and low-risk groups. Policy and regulation need facts from adequate surveillance, accurate reporting, and scientific documentation of AIDS in order to support public health methods rather than obstruct the system.

Many precedents for public policy to control socially linked infections have already been set. Syphilis has long been a disease that afflicted adults, that infected mothers, and that spread to unborn infants. There was a time when it was incurable, inexorable, and misunderstood. In the past, screening for antibodies to syphilis was mandated by law for entry into the United States. Even today, testing for syphilis remains a statutory requirement in two states for obtaining marriage licenses. Costs of testing for syphilis are borne by the applicants. As with any sexually transmitted disease, persons with positive serology for syphilis require contact tracing. Social discrimination, confidentiality, and invasion of privacy remain issues that cannot be avoided. The rights to confidentiality and privacy are recognized and respected by the public health community.

Arguments against routine testing for HIV infection include prohibitive expense and the lack of vaccine or treatment for contacts. Clearly, costs are a matter of administrative and political priorities. Prevention methods for AIDS are only palliative, it is true; however, it is hoped that this will change. Not only can contact tracing yield information for the common good; it can also identify people in jeopardy of contracting AIDS and other communicable diseases such as tuberculosis and hepatitis B. Those who are infected or in need may be willing to become engaged in decisions to assist themselves and others as part of prevention activities. Contact tracing will also provide a cadre of people who require immediate treatment when the discovery of effective therapy is disclosed. Hepatitis B, a disease associated with illegal IV drug use, was subject to all the usual public health approaches of surveillance, screening, and reporting, despite the problems of contact tracing and confidentiality, even before a vaccine became available.

The American Medical Association promotes ethical standards for the practice of medicine. In 1986, partly in response to the AIDS epidemic,[80] these standards were updated and emphasized. When a physician provides treatment to a patient, confidentiality is the hallmark of professional practice. Also, the physician may not refuse to properly inform the patient of the diagnosis and treatment. The patient's consent is a prerequisite for the sharing of information with any other person, and where statistical information is shared, any personal identification must be deleted. These principles of medical ethics represent ideal standards that can be overridden only in a court of law. Physicians are the gatekeepers for patients' rights, especially for communicable diseases. With respect to HIV testing, therefore, it is difficult to justify statutes that may enable a person to bypass physician intervention and care.

Physicians safeguard the confidentiality of the patient and counsel patients about treatment in order to ensure informed consent. Nowhere is this more important than with social disease. Public health and preventive medicine have developed methods of contact tracing which are committed to the ethos of respecting individual privacy while protecting group concerns. Contacts are informed only with patient consent. Similarly, all epidemiologists are obligated to respect confidentiality. Group information for analysis is filed under conditions of strictest privacy, without any identifying information. The AMA has recently reemphasized these high precepts for the guidance and direction of ethical conduct of medical practitioners.

Anonymity is preserved through universal mandates. In other words, when testing is required routinely or by statute for groups such as prisoners, members of the armed forces, persons seeking marriage, or patients attending clinics for sexually transmitted diseases, no one is at risk of discrimination, because all must experience the same test in obedience to the law. The results of the tests are group results — they are population-based, and they supply a constant source of data for epidemiologists, who use them to further the goals of prevention and control community health hazards. These ideals should be sought and upheld by those who make public policy.

The public health community seeks to minimize disease through early detection and treatment. These are accomplished through implementing screening programs, providing effective diagnostic and treatment facilities, and promoting health-seeking behaviors. Prevention and control include limiting the complications of infection by providing early treatment to symptomatic and asymptomatic infected individuals and by limiting disease transmission within the community. These efforts are communal and require dependable surveillance systems that are accurate, reliable, and comprehensive. Enlightened public policy is required to marshal the human and technical resources of the community to protect individuals by protecting the public good.

## Conclusions

Ongoing surveillance of virulent epidemics is an activity that is a national imperative. To date, information on the size and extent of the epidemic is obscure, owing to a lack of consistent, stable definitions of cases of illness for HIV infection and statutes that obstruct routine tests of high-risk populations. We now have a method of identifying the asymptomatic but infected populations — the hidden and sinister reservoir of a virulent virus. The seropositive populations can be identified through screening activities that are part of ongoing monitoring activities. Surveillance needs the support of political leadership. The interface of high-risk and so-called low-risk groups is real. All estimates of risk of spread of disease to groups with low-risk lifestyles are guesswork, based on inadequate and incomplete data. In order to secure valid information for effective decision making, influential leaders must create policy that ensures the accuracy of statistics. Only then can epidemiologists apply scientific principles for identifying the extent of the disease, the risk to the unborn, and the effectiveness of methods of prevention and control. HIV infection is a national hazard and is the concern of all the people. The challenge for policymakers is to assure protection for every human being while protecting the total community.

## Notes

1. John Shannon, "De Facto New Federalism: Phase II?" *New England Journal of Public Policy* (Winter–Spring 1986): 26–36.
2. American Medical Association, Division of Legislative Activities, "AIDS State Legislative Activities" (June 1987), Chicago. Specifically, "An Act for the Confidentiality of HTLV-III Tests." Massachusetts Regular Session. Chapter 241, Laws 1986, House Bill No. 5491, approved July 15, 1986. Effective October 13, 1986.
3. American Medical Association, Board of Trustees Report YY, "Prevention and Control of AIDS: An Intermediate Report" (June 1987), p. 182, Chicago. Reports to the Board of Trustees of the American Medical Association are prepared and reviewed by medical scientists who are on the Council of Scientific Affairs. The reports are subjected to intense internal and external peer review before being submitted to the Board of Trustees. After careful scrutiny, revision, and, if necessary, further review, the reports are submitted to the House of Delegates. When they are accepted by the House, the reports enter the public domain.
4. Karl Popper, *The Philosophy of Scientific Reasoning,* 6th Impression. Revised, London, Hutchinson (1972), chapter 2.
5. Mervyn Susser, "The Logic of Sir Karl Popper and the Practice of Epidemiology." *American Journal of Epidemiology* 124, no. 5 (1986): 711–719.
6. U.S. Public Health Service (USPHS), Centers for Disease Control, "Kaposi's Sarcoma and Pneumocystis Carinii Among Homosexual Men, New York City and California." *Morbidity and Mortality Weekly Report* 30, no. 26 (1981b): 305–308.
7. National Academy of Sciences, Institute of Medicine, *Confronting AIDS: Directions for Public Health, Health Care, and Research.* National Academy Press, Washington, D.C. (1986). Cited information from the Centers for Disease Control, *1986c Acquired Immunodeficiency Syndrome (AIDS) AIDS Weekly Surveillance Report* United States Cases Reported to CDC* (September 9, 1986): 72, 73. (Hereafter in these notes, this CDC report will be referred to simply as the *AIDS Weekly Surveillance Report — United States.)*
8. Centers for Disease Control, *AIDS Weekly Surveillance Report — United States* (December 19, 1987). This report includes a comprehensive review of cases (not rates) by high risk, racial categories, and age, as well as some diagnostic classifications.
9. Centers for Disease Control, "Revision of the Centers for Disease Control Surveillance Case Definition for Acquired Immunodeficiency Syndrome." *Morbidity and Mortality Weekly Report* (September 1987) 36, supplement no. 15: 5s, A7.
10. Note 7, p. 70.
11. Kenneth H. Mayer, Steven M. Opal, "Therapeutic Approaches to AIDS." *Rhode Island Medical Journal* 70, no. 1 (January 1987): 27–33.
12. Note 8.
13. *USA Today,* December 7, 1987, 13A: interview with James Mason, director of the Centers for Disease Control, quotes the report of the USPHS interim report to President Reagan on AIDS which says that AIDS has stabilized for white homosexual males. Also *Chicago Tribune,* December 3, 1987, reporter John Crewdon quotes the same interim report to President Reagan as claiming that the general rate of new AIDS infection may have declined somewhat from the rates that prevailed in the early 1980s. The same Chicago paper (December 10, vol. 30, page 1), in an article entitled "A little good news about AIDS," says that the estimate of 1 million to 1.5 million infected Americans may be too high, and other projections suggest lower totals. But AIDS is "not spreading like wildfire," according to Dr. James Mason.
14. Note 6, pp. 305–308.

15. Discussion on causal association in case control studies. University of North Carolina Alumnae Meeting (March 1986), Chapel Hill, North Carolina.

16. Centers for Disease Control, *Morbidity and Mortality Weekly Report* 34, no. 48 (1985). Published in the *Journal of the American Medical Association* 254 (1985) and in *AIDS from the Beginning,* edited by Helene M. Cole and George D. Lundberg. Special edition, American Medical Association (1986), p. 34.

17. F. Barne-Sinoussi, J. C. Chermann, et al., "Isolation of a T-Lymphotropic Retrovirus from a Patient at Risk for Acquired Immune Deficiency Syndrome (AIDS)." *Science* 220 (1983): 868–871.

18. Robert C. Gallo, Syed Z. Salahuddin, Mikulas Popovic, et al., "Frequent Detection and Isolation of Cytopathic Retroviruses (HTLV-III) from Patients with AIDS." *Science* 224 (1984): 500–505.

19. Jay A. Levy, Anthony D. Hoffman, Susan Kramer, et al., "Isolation of Lymphocytopathic Retrovirus from San Francisco Patients with AIDS." *Science* 225 (1984): 840–842.

20. Note 12, section 1.

21. Interview with Dr. Robert C. Gallo, co-discoverer of the HIV virus. *Chicago Tribune,* December 10, 1987, section 1, p. 31.

22. American Medical Association, Board of Trustee Report SS, "AIDS Status Report: Update on Epidemiology" (1987), p. 163.

23. Note 7, p. 70.

24. Note 22, p. 164.

25. Note 22, p. 164.

26. Note 22, p. 165.

27. Centers for Disease Control, "Trends in HIV infection Among Civilian Applicants for Military Service. U.S. Oct. 1985–Dec. 1986," *Morbidity and Mortality Weekly Report* 36, no. 18 (May 15, 1987): 275.

28. Personal communication, Centers for Disease Control, Task Force on AIDS (September 1987).

29. Note 27, p. 276.

30. Note 22, p. 163.

31. Note 22, p. 164.

32. Mary E. Guinan, Ann Hardy, "Epidemiology of AIDS in Women in the United States, 1981 through 1986." *Journal of the American Medical Association* 257, no. 5 (April 17, 1987): 2039–2043.

33. Note 32, p. 2039.

34. Note 32, pp. 2040, 2041.

35. Centers for Disease Control, "Update: Acquired Immunodeficiency Syndrome," *Morbidity and Mortality Weekly Report* 36, no. 31: 522; and CDC *AIDS Weekly Surveillance Report — United States,* note 7.

36. Centers for Disease Control, *AIDS Weekly Surveillance Report — United States* (December 17, 1987).

37. "Agents for Active and Passive Immunity," chapter 67, 1125. Table 6, "Expected Hepatitis B Virus (HBV) Prevalence in Various Population Groups." *Drug Evaluations* (6th ed., September 1986, pp. 1124,1125). Prepared by the American Medical Association Department of Drugs and Technology in cooperation with the American Society for Clinical Pharmacology and Therapeutics, Chicago.

38. Note 37, p. 1124.

39. Note 7, p. 55.

40. Nathan Clumeck, Philippe Van De Perre, et al., "Heterosexual Promiscuity Amongst African Patients with AIDS." *New England Journal of Medicine* 313 (1985): 182.

41. Gerald H. Friedland, Robert S. Klein, "Transmission of the Human Immunodeficiency Virus." *New England Journal of Medicine* 317, no. 18 (October 29, 1987): 1124, 1125.

42. Centers for Disease Control, "Human Immunodeficiency Virus Infections in Health Care Workers Exposed to Blood of Infected Patients." *Morbidity and Mortality Weekly Report* 36, no. 16 (1987): 19.

43. Note 7, p. 63.

44. Note 42, p. 20.

45. Note 42, p. 20.

46. Note 42, p. 21.

47. Note 22, p. 164.

48. Janine M. Jason, J. Steven McDougal, Gloria Dixon, et al., "HTLV-III/LAV Antibody and Immune Status of Household Contacts and Sexual Partners of Persons with Haemophilia." *Journal of the American Medical Association* 255 (1986): 212–215.

49. M. Elaine Eyster, Mitchell H. Gail, James O. Ballard III, et al., "Natural History of Human Immunodeficiency Virus Infection in Haemophiliacs: Effects of T-cell Subsets, Platelet Counts, and Age." *Annals of Internal Medicine* 107 (1987): 1–6.

50. Margaret W. Hilgartner, "Aids and Hemophilia." *New England Journal of Medicine* 317, no. 18 (October 29, 1987): 1153, 1154. Also see note 35, p. 1125.

51. Nancy Padian, Linda Marquis, Donald P. Francis, et al., "Male to Female Transmission of Human Immunodeficiency Virus." *Journal of the American Medical Association* 258, no. 6 (August 17, 1987): 788.

52. David R. Bolling, "Prevalence, Goals and Complications of Heterosexual Intercourse in a Gynecologic Population." *Journal of Reproductive Medicine* 29 (1977): 120–124.

53. Bruce V. Voeller, "Heterosexual Anal Sex." *Mariposa Occasional Papers* 1B (1983): 1–8.

54. David R. Bolling, Bruce V. Voeller (letter to the editor), "AIDS and Heterosexual Anal Intercourse." *Journal of the American Medical Association* 258, no. 4 (July 24–31, 1987): 474.

55. Note 45, pp. 788–789; note 48, p. 474.

56. Robert R. Redfield, Paul D. Markham, Syed Z. Salahuddin, et al., "Heterosexually Acquired ARC and AIDS Epidemiologic Evidence for Female to Male Transmission." *Journal of the American Medical Association* 254 (1985): 2094–2096.

57. Note 21, p. 164.

58. Gwendolyn B. Scott, Margaret A. Fischl, Nancy G. Klimas, et al., "Mothers of Infants with AIDS: Evidence for Both Symptomatic and Asymptomatic Carriers." *Journal of the American Medical Association* 253 (1985): 363–366.

59. Robert W. Marion, Andrew A. Wiznia, Gordon Hutchinson, "Human T-cell Lymphotropic Virus Embryopathy: A New Dysmorphic Syndrome Associated with Intrauterine Infection." *American Journal of Diseases of Children* 140 (1986): 638.

60. Centers for Disease Control, "Recommendations for Assisting in the Prevention of Perinatal Transmission of Acquired Immune Deficiency Syndrome." *Morbidity and Mortality Weekly Report* 34 (1986b): 721–726, 731–732.

61. Note 34, p. 52.

62. Centers for Disease Control, *AIDS Weekly Surveillance Report — United States* (September 21, 1987).

63. Note 7, p. 46.

64. Note 7, pp. 221, 223, 225.

65. William W. Darrow (editorial), "A Framework for Preventing AIDS." *American Journal of Public Health* 77, no. 7 (1987): 778.

66. Note 7, p. 45.

67. Jay A. Levy, M.D., professor of medicine, University of California. "HIVs: Their Role in AIDS." Presentation at scientific seminar at the American Medical Association, December 14, 1987, Chicago.

68. Cited by Malcolm Rees, "Incubation Period for AIDS." *Nature* 330 (December 3, 1987): 428.

69. G. F. Medley, R. M. Anderson, et al., "Incubation Period of AIDS in Patients Infected Via Blood Transfusion." *Nature* 328, no. 20 (August 1987): 721.

70. Note 67; also note 7, p. 70.

71. Note 7, p. 162; also *Focus: A Guide to AIDS Research* 2, no. 5 (April 1987): 1–3.

72. Editor, "AIDS Epidemic: Neglected Issues." *Infectious Disease Alert* 6, no.19 (July 1987): 73–74.

73. Ibid., p. 73.

74. Note 68, p. 428.

75. Note 69, p. 721.

76. Richard Rothenburg, Mary Wodfel, Randi Stoneburner, et al., "Survival with the Acquired Immunodeficiency Syndrome." *New England Journal of Medicine* 317, no. 21 (November 19, 1987): 1297.

77. Note 7, p. 51.

78. Centers for Disease Control, "Tuberculosis and AIDS — Connecticut." *Morbidity and Mortality Weekly Report* 36, no. 9 (1987): 133–135.

79. Note 37, p. 1123.

80. American Medical Association, "Confidentiality." Section 5.05–5.09 in *Current Opinions of the Council on Ethical and Judicial Affairs of the American Medical Association* (1986), Chicago.

*"I'm really surprised I'm here. When I was originally diagnosed over two and a half years ago, my doctor told me I wouldn't be alive today, and he certainly didn't give me any indication that I would be able to live a more productive life, and my life has made a 180-degree turn since diagnosis. Before diagnosis I was an active alcoholic and drug addict and I've been clean for almost two years. And I'm real grateful for that chance."*