

AIDS: Statistics But Few Answers

The clear message of a recent meeting in Washington, D.C., is that AIDS continues to spread and presents a major global health problem, but many scientific and epidemiological questions remain about transmission of the virus

PARTICIPANTS at the Third International Conference on AIDS* (acquired immune deficiency syndrome) were inundated with data about the spread and transmission of the disease. Many of the epidemiological studies are of relatively small groups of people at high risk for AIDS, and all of the estimates about the number of infected people in large populations are based on incomplete data.

Still, patterns emerge about rates and risks of infection with HIV (human immunodeficiency virus) and progression to disease. In particular, new information indicates that the disease is spreading quickly in Africa, and that intravenous drug users and their sexual partners account for many of the heterosexual cases of AIDS in the United States. A recent written report from the Centers for Disease Control (CDC) indicates that three more health care workers—in addition to six others previously infected—now carry the AIDS virus, leading many to question again just how easy it is to contract HIV. To date there has been no definitive, statistically significant study of the number of HIV-infected persons in any country, an issue that appears on the surface to be clear-cut, but is instead extremely complex.

A sampling of reports about the epidemiology of AIDS, transmission of the virus within specified groups, and a discussion of three health care workers who recently became infected because of skin exposure to contaminated blood, reveals some of that complexity.

■ **AIDS in Africa.** "The information is sketchy and incomplete," says I. S. Okware of the Ministry of Health in Entebbe, Uganda. "But one thing is clear. The disease is spreading and spreading fast."

A total of 1138 cases of AIDS have been reported in Uganda, Okware says, about 85% of which occur among the sexually most active age group—men and women in equal numbers between 15 and 40 years of age. These include some of Uganda's most productive adults, in professional and eco-

nomic terms, and Okware predicts that the impact of AIDS-related deaths among this group could be devastating to the country's welfare.

■ **Intravenous drug users.** Within the United States, researchers are focusing on intravenous drug users as a group prominent in the spread of AIDS. Intravenous drug users now account for about 70% of the reported cases of AIDS among heterosexual men and women.

"Twenty-five percent of AIDS patients in the United States have a history of drug

"The most common question I get is, How many people in the United States are infected with HIV?... I don't know."

abuse," says Peter Selwyn of Albert Einstein College of Medicine in Bronx, New York, who heads a study of 470 people enrolled in a methadone program in the Bronx. A total of 184, or 39%, now carry the AIDS virus; more blacks and Hispanics are infected with HIV than whites. Selwyn finds that having a high number of injections with contaminated needles is a factor that predicts progression to disease.

■ **Heterosexuals.** Other researchers focus on AIDS among heterosexuals, who represent about 4% of the total number of reported AIDS cases in the United States. "Eighty-three percent of the heterosexual contact cases are female," says Mary Chamberlin of the CDC. "This is the only category where women with AIDS outnumber men." Her study, which defines a heterosexual contact case narrowly as someone who is not a hemophiliac or drug user, and has no sexual contact with a homosexual or an intravenous drug user, includes 475 people with AIDS. Although relatively small, this number is growing.

■ **Hemophiliacs and heterosexual**

transmission. "There are approximately 20,000 hemophiliacs in the United States who were at risk for exposure to the AIDS virus prior to the availability of heat-treated clotting factor [or the antibody test for HIV infection] in 1985," says Charla Andrews of the University of Massachusetts Medical Center in Worcester, Massachusetts. She reports that about 70% have antibodies to HIV and of those infected, 331 have now developed AIDS.

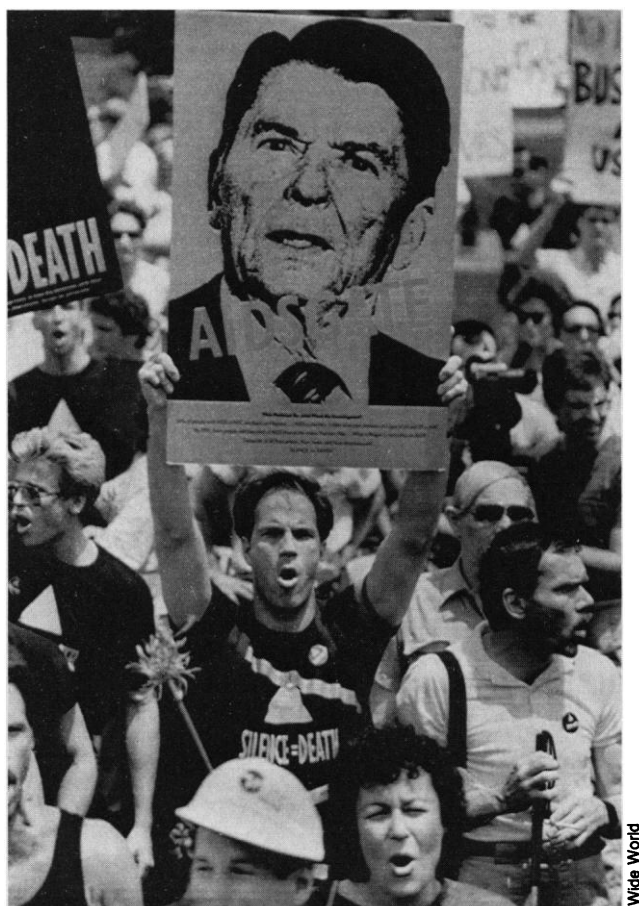
Andrews and her co-workers began evaluating hemophiliacs who had antibodies to HIV partly to determine why, with so many apparently infected, relatively few had developed disease. One reason, perhaps, was that some hemophiliacs who tested positive for antibodies against the AIDS virus might not have an active virus infection. By successfully isolating virus from 25% of their test group, the researchers demonstrated that many antibody-positive hemophiliacs have an active virus infection. Andrews also reported that people with active infections often have had low levels of T4 lymphocytes, a finding that others have correlated with progression to more serious disease.

James Goedert of the National Cancer Institute studied a different aspect of HIV infection in hemophiliacs—namely, what factors predict that infected men are likely to transmit the virus during sexual intercourse. The new data show that the prevalence of HIV infections among the female sex partners of male hemophiliacs seems to be increasing very rapidly and also indicate that falling numbers of T4 cells in the infected male signal an increased level of infectivity.

■ **Military screening.** New figures from the U.S. military show no apparent overall trend in the percentage of recruits infected with the AIDS virus, but indicate that the prevalence of infection among young black men is about five times greater than in white males of the same age group. Three times as many male applicants are infected as female for all races and older male applicants are more likely to be infected than those under 21 years of age.

In addition to determining the one-time prevalence of infection among different groups, researchers also calculated annual

*The Third International Conference on AIDS was held 1 to 5 June in Washington, D.C.



AIDS protest

A coalition of national and local groups protest the Reagan Administration's policy on AIDS testing on the opening day of the Washington meeting.

infection rates. Between October 1985 and October 1986, the army screened for HIV infection in more than 640,000 civilians applying for military service. John Brundage of Walter Reed Army Institute of Research in Washington, D.C., reports that black men between the ages of 21 and 25 have an estimated annual infection rate of 1 in 210 to 1 in 350 men per year. Estimates for white males in the same age groups range from 1 in 1000 to 1 in 5000 per year.

Whether the new military statistics indicate that the rate of HIV infection among young adults is leveling off is a matter of debate. Timothy Dondero of the CDC sees a leveling off and James Curran, also of CDC, thinks it is too early to tell. Both note that the new data may underestimate HIV infection in young adults because many people at high risk for AIDS do not apply to the military.

■ **Progression to disease.** Perhaps the longest term investigation measuring the progression from HIV infection to AIDS is of homosexual and bisexual men in San Francisco, 6700 of whom participated in a study of hepatitis B from 1978 to 1980. An estimated 70% of these men are now infected with HIV and about 10% have AIDS. George Rutherford of the Department of Public Health reported on 63 who became infected prior to 1983, and an additional

112 men who later participated in a hepatitis vaccine trial. He predicts that an average of 15% will develop AIDS over 5 years of infection, 24% after 6 years, and 36% after 6½ years. "The risk of developing AIDS from HIV infection increases with time," he says.

■ **Health care workers.** Perhaps the most frightening aspect of the AIDS epidemic for those individuals who are not infected with HIV is assessing their own risk of becoming infected.

According to CDC's 22 May *Morbidity and Mortality Weekly Report* (MMWR), an emergency room nurse and two other health care workers have recently become infected with the AIDS virus as a result of exposure to contaminated blood at their jobs—not because they had any other risk factors. With thousands of health care workers caring for AIDS patients, in and out of the hospital, many of whom have been accidentally stuck with needles containing virus-contaminated blood, why are these three women and six others reported over the last several years now infected?

No one knows and identifying the circumstances that surround the three new cases—beyond what the MMWR reports—is not easy. "This was not a clustering of cases," says Curran. "The three people were exposed in three different states at three

different times during 1986. The circumstances were quite different in all three cases." But all three lacked antibodies to HIV before the incident and were antibody-positive at varying times afterward.

The first involved an emergency room nurse who, according to the MMWR report, tried to help save the life of a cardiac arrest patient, later found to be infected with HIV. The report notes that, the nurse "may have had a small amount of blood on her index finger for about 20 minutes before washing her hands. Afterwards, she may also have assisted in cleaning the room but did not recall any other exposures to the patient's blood or body fluids. She had no open wounds, but her hands were chapped," and she was not wearing gloves.

Cases 2 and 3 clearly involved large quantities of blood. In the second, a 10-milliliter vacuum tube of blood splattered in the face and mouth of a health care worker when its top flew off. This woman was wearing gloves and eyeglasses, and had facial acne but no open wounds. In the third case, a medical technologist spilled blood on her forearms and hands as she operated a machine that separates blood. She was not wearing gloves, had no open wounds, but remembers having dermatitis on one ear. In cases 2 and 3, other workers were similarly exposed to the blood and are not now infected with the AIDS virus. Whether the three now-infected women have biological, perhaps genetic, factors that make them more susceptible to infection is still not known.

The news about the health care workers raises the general issue of risk of becoming infected with the AIDS virus. Does the recent report mean that the AIDS virus can cross intact skin? "I haven't seen any data on that," says Anthony Fauci of the National Institute of Allergy and Infectious Diseases, "but how would you test it?" He stresses that the chances of a health care worker becoming infected with the AIDS virus because of exposure to contaminated blood are very small. Existing data indicate that, among many thousands of people caring for AIDS patients, only nine have become infected with HIV so far.

Both the National Institutes of Health and CDC are presently conducting large-scale studies to assess the risk of workers who are in close daily contact with AIDS patients. To date, no one on the NIH health care staff has become infected despite numerous needle sticks and splashes with contaminated blood. The CDC reports that one health care worker has tested positive for antibodies against the AIDS virus. The other cases of health care worker infection were in other countries.

■ **Numbers.** Over 100 countries now report cases of AIDS to the World Health Organization (WHO) in Geneva, for a global total of more than 50,000 cases. Based on these admittedly incomplete data, Jonathan Mann of WHO projects that 500,000 to 3 million people will develop AIDS by 1992. In the United States, Curran reports that more than 36,000 people have AIDS and that over 21,000 have died from it. He estimates that about 1.5 million are now infected and that an average of 1 in 30 men between the ages of 20 and 50 carries the virus, a projection that varies widely with geographical location and risk factors.

■ **Assessing the extent of infection.** "The most common question I get is, How many people in the United States are infected with HIV?" said Curran in his address to participants at the AIDS conference. "I don't know. It's extremely difficult to learn the precise number of people infected with the virus . . . and the reason is that studies to do this require sampling of the general population. The general population, as we know consists of homosexual and bisexual men, intravenous drug abusers, people from other risk transmission categories, as well as heterosexual men and women. Surveys often either undersample or oversample these categories and often do not ascertain accurately which category people belong in."

■ **Protest.** No country has a method for determining the exact number of persons infected with the AIDS virus. Whether such a mechanism should exist is a matter of considerable debate. President Ronald Reagan's announcement on the eve of the AIDS meeting—that immigrants, prisoners, and marriage license applicants should undergo routine screening for antibodies to the AIDS virus—sparked numerous protests.

Dissenters fear discrimination, in jobs opportunities and the ability to obtain health and life insurance, for example. And in the absence of any legislation at a national level that protects the civil rights of people who test positive for the virus, these concerns are well founded. Additionally, a one-time negative test for antibodies against the AIDS virus is not a guarantee that the individual is free of infection, because a recently exposed person may take several months to develop antibodies. If national legislators have considered what should be done after the test results are in their thoughts are not reflected in any part of the public record.

Taken together, these data on the epidemiology of AIDS show how incomplete an understanding yet exists about the disease and therefore how difficult a comprehensive national policy will be to formulate. ■

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Geophysics Smorgasbord Was Spread in Baltimore

Geophysicists specializing in everything from atmospheric science to volcanology converged on Baltimore for the spring meeting of the American Geophysical Union held 18 to 21 May. The range of fare was huge, but here is a sampler: two high-energy phenomena—nuclear testing and the less frequent cratering by large impacts—and an imperceptibly slow process—the motion of the tectonic plates.

Direct Measurements Confirm Plate Tectonics

For any doubting Thomases out there, the final word is in—plate tectonics is real, the continents do drift the way the theory predicts. Fixist models of Earth and variations on plate tectonics, such as an expanding Earth, can be put to rest.

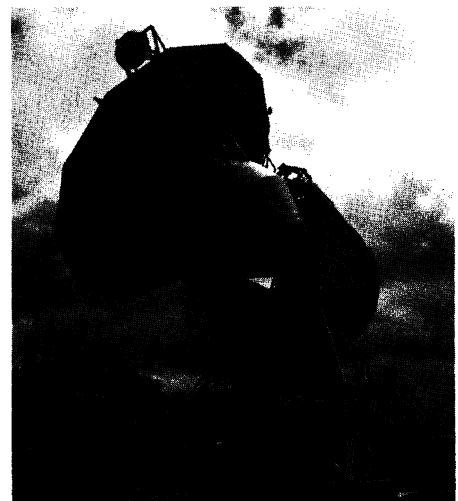
The deciding evidence comes from the precise measurement of distances across plate boundaries made by the technique of very long baseline interferometry (VLBI). At the meeting James Ryan of Goddard Space Flight Center in Greenbelt, Maryland, reported the latest VLBI results from the Crustal Dynamics Project operated by the National Aeronautics and Space Administration. In a subprogram of the project called the Great Alaska-Pacific Experiment (GAPE), large radio antennas in western North America, the central Pacific, and Japan were used to record radio noise from immensely distant quasars that act as stationary reference points. The millisecond differences in the arrival times of the same signals at different sites yielded the distance between receivers.

Thanks to the relatively high speed of the Pacific plate, there is no doubt that real plate motion has been detected. After only 3 years of observation, Ryan noted, the calculated shortening of the distance between Hawaii and a site near Fairbanks in central Alaska appears to be 52.3 ± 5.5 millimeters per year. Hawaii is moving toward Japan at a rate of 83 ± 8 millimeters per year.

Although researchers have been trying for years to determine how much larger than such formal errors the true error is, no one doubts that the observed rapid movement far exceeds any possible error. In addition, the GAPE sites are moving much the way plate tectonics predicted. Hawaii, for example, is moving 83 millimeters per year to the northwest (a course of 322°) if Fairbanks is considered stationary. Previous analyses of the magnetic stripping of the ocean floor

and other geologic evidence showed that in the geologic past Hawaii had moved at 90 millimeters per year to the northwest (320°). Around the Pacific, observed rates are tending to be a few millimeters per year less than the geologic rate, but so far GAPE researchers do not consider the differences significant. A few more years of observation will be required before any real differences might be discerned.

In the Atlantic things are much slower moving, but VLBI researchers, despite their conservative nature, are conceding that they have probably detected plate motion there as well. A consortium of Crustal Dynamics Project researchers from one European and six U.S. institutions recently stated in print that they have measured the opening rate between North America and Europe as 17 millimeters per year. The geologic rate is also 17 millimeters per year. After a considerable analysis effort, they placed an upper limit of 10 millimeters per year on the rate's true uncertainty. According to consortium member Thomas Herring of the Harvard-Smithsonian Center for Astrophysics, that is "very strong evidence of plate motion."



On the move. This VLBI antenna on the island of Kauai in Hawaii is moving 8 centimeter per year toward Japan.