

1-1-1988

The Acquired Immunodeficiency Syndrome in New England: An Epidemiological Review of the First Six Years

Laureen M. Kunches
Massachusetts Department of Public Health

Jeanne M. Day
Massachusetts Department of Public Health

Follow this and additional works at: <https://scholarworks.umb.edu/nejpp>



Part of the [Epidemiology Commons](#), [Health Policy Commons](#), [Immunology and Infectious Disease Commons](#), and the [Lesbian, Gay, Bisexual, and Transgender Studies Commons](#)

Recommended Citation

Kunches, Laureen M. and Day, Jeanne M. (1988) "The Acquired Immunodeficiency Syndrome in New England: An Epidemiological Review of the First Six Years," *New England Journal of Public Policy*. Vol. 4: Iss. 1, Article 8.

Available at: <https://scholarworks.umb.edu/nejpp/vol4/iss1/8>

This Article is brought to you for free and open access by ScholarWorks at UMass Boston. It has been accepted for inclusion in New England Journal of Public Policy by an authorized editor of ScholarWorks at UMass Boston. For more information, please contact scholarworks@umb.edu.

The Acquired Immunodeficiency Syndrome in New England:

An Epidemiological Review of the First Six Years

Laureen M. Kunches, R.N., M.P.H.

Jeanne M. Day, M.P.H.

Between 1981 and 1987 — the six-year period following initial recognition of the acquired immunodeficiency syndrome (AIDS) — 1,475 cases were reported among residents of the six New England states. Of nearly 40,000 cases nationwide, 3.8 percent occurred among New England residents, though the region's population represents 5.5 percent of the total United States population. The groups most affected include homosexual or bisexual men (65 percent) and intravenous drug users (20 percent). However, in the two southernmost states — Rhode Island and Connecticut — 32 to 40 percent of all cases have used intravenous drugs. In these states, the male:female ratio of adult cases is 6:1, compared to 12:1 in the remainder of the region. In Massachusetts, the disease incidence rate is equivalent to that of Connecticut (144 cases per 1 million population); however, a greater proportion of cases (69 percent versus 45 percent) are homosexual and bisexual men, and the incidence rate for adult females is lower (49 versus 100 cases/million). Maine, New Hampshire, and Vermont have low cumulative incidence rates (<50 cases/million), and no cases among adult females or associated with blood transfusion. In northern New England, 2 percent of adults with AIDS became infected through heterosexual contact, compared to 10 percent in the southern half of the region. Sources of other data, resulting from serologic testing for human immunodeficiency virus (HIV), confirm the predominance of infection in southern New England. Rates of HIV seropositivity in military recruits, blood donors, and specific high-risk populations are uniformly lower in New England than in high-incidence regions.

This review is based on statistics provided by AIDS surveillance programs operated by the Departments of Public Health in the six New England states.

Surveillance for the acquired immunodeficiency syndrome (AIDS) has been under way in the six New England states since the original cases were described in the summer of 1981.¹ The Department of Public Health in each state requires that AIDS cases be reported according to a standard format developed by the Centers for Disease Control

Laureen M. Kunches is director of the AIDS Program at the Massachusetts Department of Public Health. She was formerly an epidemiologist with the Massachusetts AIDS Surveillance Program. Jeanne M. Day is an epidemiologist with the AIDS Program at the Massachusetts Department of Public Health.

(CDC) of the U.S. Public Health Service. From the beginning, special effort has been focused on this unusual illness to assure accurate and complete epidemiological information. Many states have supplemented their existing disease surveillance programs with additional staff members assigned specifically to AIDS case reporting. Validation studies, which have been performed to estimate the accuracy of current surveillance data, have confirmed that case reporting is 90 percent complete.²

AIDS, as defined for surveillance purposes, is characterized by a spectrum of rare opportunistic infections and malignancies that are typically life-threatening.³ In the first four years of the epidemic, no specific laboratory test was available to identify the underlying cause of immunodeficiency which was common to all AIDS patients. Although the etiologic agent of AIDS was isolated in 1983 and 1984 by investigators in France and the United States,⁴ the case definition for AIDS reporting did not begin to incorporate serologic evidence of human immunodeficiency virus (HIV) infection until 1985, following the licensure of antibody assays. Because of the high specificity of the indicator diseases included in the surveillance definition, positive HIV serology is not a requirement for most cases. At the present time, specific reporting of cases of AIDS-related complex (ARC) or positive HIV antibody test results is not required in any of the New England states; reporting of descriptive data without identifying information is encouraged in Maine, New Hampshire, and Rhode Island, but is optional.

There are five primary sources of information concerning the epidemiology of AIDS in New England. The direct measure of disease morbidity is derived from AIDS surveillance data. Results of testing for antibody to HIV can be interpreted in light of various types of sampling bias. Groups for which information is available include military recruit applicants; blood donors; persons concerned about possible HIV exposure who seek confidential or anonymous testing at state-operated sites; and study populations surveyed by researchers to ascertain HIV seroprevalence. Through analyzing the messages from each of these indicators, we will present a comprehensive view of the current regional trends in AIDS and HIV infection.

AIDS Surveillance Data

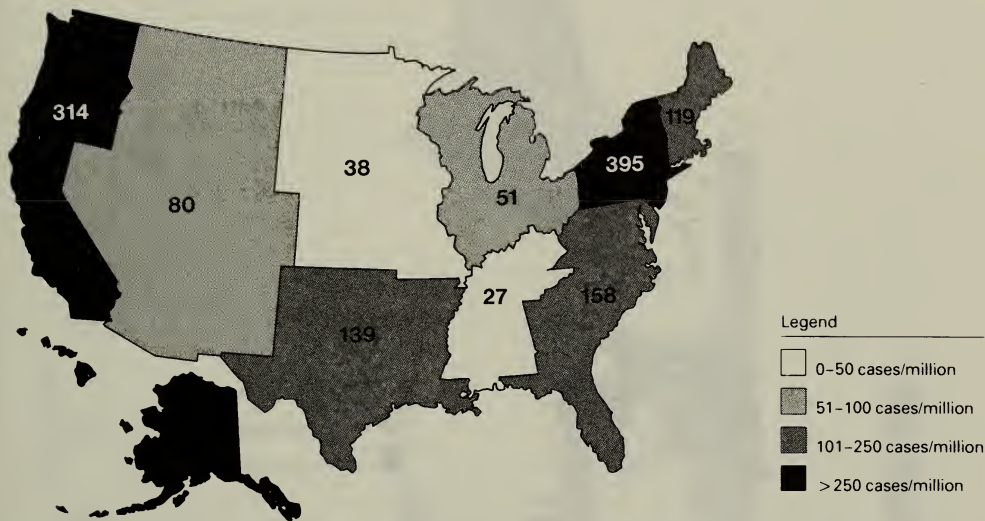
AIDS surveillance data have been the most consistently reliable measure of the scope and nature of this frightening new disease. They are the framework from which the modes of HIV transmission have been characterized, and the barometer of changing needs for health care resources. AIDS case reports, however, are limited in that they lag several years behind the original point of infection with HIV. An unusually long latency period, averaging between five and seven years, precedes the development of AIDS.⁵ Trends in AIDS cases, therefore, reflect the events of high-risk behavior from years past. The high degree of specificity and accuracy found in reported AIDS cases provides a solid base of demographic and behavioral information from which to define the epidemic in New England.

Incidence Rates

The cumulative incidence of AIDS cases in New England (119/million residents) falls directly in the middle of the other eight U.S. regions (fig. 1: cumulative AIDS case rates per million population in nine regions of the United States). The burden of cases has been greatest in the Middle Atlantic and Pacific states, where (in the metropolitan areas of New York City, San Francisco, and Los Angeles) the original cases of AIDS were recognized.

Figure 1

Cumulative AIDS Case Rates per Million in Nine Regions of U.S.*



*Cumulative AIDS rates per million (1980 U.S. Census data) in New England and the Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, and Pacific regions. Includes 39,201 cases reported as of July 1987 from the fifty states and District of Columbia.

The six-year cumulative incidence rates in these two regions (395/million and 314/million, respectively) are approximately twice the national average (175/million), and three to four times the rate in New England.

High-incidence states like Florida and Texas (each accounting for 7 percent of the national case total) cause the cumulative rates in the South Atlantic and West South Central regions (158/million and 139/million, respectively) to exceed slightly the New England rate. Rates in the Mountain and Midwestern states range between 38 and 80 cases/million residents. The four states of the East South Central region (Kentucky, Tennessee, Alabama, and Mississippi) have reported only 400 cases, a six-year cumulative incidence rate of 27 per million.

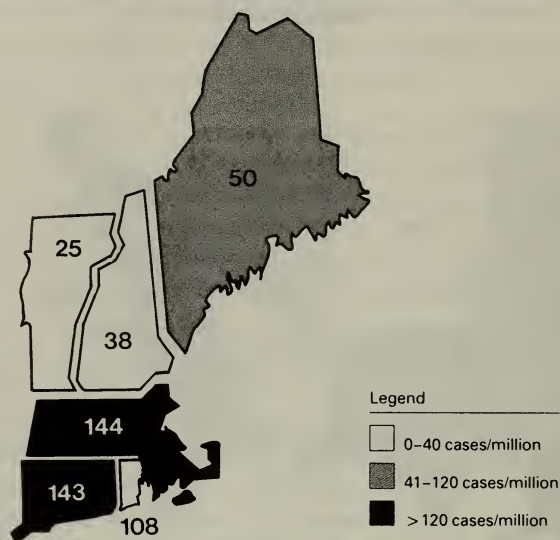
Within the New England region, variations exist in state-specific cumulative incidence rates (fig. 2: cumulative AIDS case rates per million population in the six New England states). New Hampshire and Vermont have rates among the lowest in the nation; only four other states have reported fewer actual cases than Vermont. Rates in Rhode Island and Maine are below the national total, and these states hold ranks of thirty and forty, respectively, among the fifty states for total cases reported. Connecticut and Massachusetts are among the fifteen states reporting the most cases, and have equivalent cumulative incidence rates. Only five other states, however, have reported more pediatric cases than Massachusetts and Connecticut; fourteen children under age thirteen have developed AIDS in each of these states.

Temporal Trends

The epidemic curve in New England (fig. 3: epidemic curve of AIDS cases in New England, according to year of diagnosis) illustrates the steady slope of increasing cases over

Figure 2

Cumulative AIDS Case Rates in New England*



*Cumulative AIDS rates per million (1980 U.S. Census data). Includes 1,475 cases reported as of July 1987.

the period. When surveillance began in earnest in 1983, reports of 122 cases were documented for the region. Over the three subsequent years, new case reports increased by nearly 70 percent each year.

In Massachusetts, the rate of increase for new case reports has decelerated over time. The annual total for 1985 (191 cases) was 82 percent higher than the 1984 total (105 cases). During 1986, 287 additional cases were diagnosed, representing a 50 percent increase above the level of the prior year. A projection based on reports received during the first half of 1987 suggests continued slowing to a 33 percent increase over the 1986 level.

Between 1984 and 1985, Connecticut's total increased by half the margin observed in Massachusetts (41 percent). However, a 67 percent increase the following year heralded an acceleration of cases. The trend appears to have reversed in 1987, if the first six months' data are projected with allowance for delayed reports. No more than 200 total cases would be expected in 1987, representing a 10 to 20 percent increase over 1986.

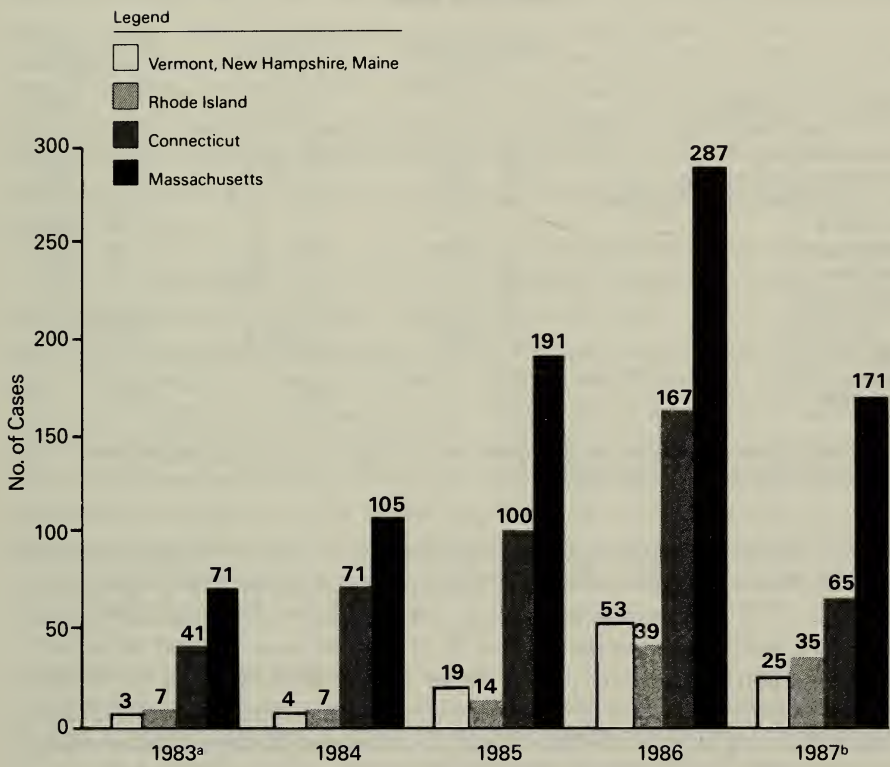
Each year between 1983 and 1986, the annual case totals in Rhode Island and the three northern states combined (Vermont, New Hampshire, Maine) increased by factors of two to four. However, such small actual numbers produce unstable measures of proportional increase which are inexact and not appropriate to compare with the trends seen in Massachusetts and Connecticut. Analysis of national figures confirms the steady deceleration in the rate of new cases, although reports of new cases are not expected to reach a true plateau in the near future.⁶

Transmission Categories

After being originally described among a small number of homosexual men with unexplained immune deficiency, AIDS has continued to occur primarily among men exposed

Figure 3

Epidemic Curve of New England AIDS Cases *
(N = 1,475)



*CDC-reported AIDS cases in New England, according to year of diagnosis

^aIncludes cases diagnosed prior to 1983.

^bIncludes cases reported as of July 1, 1987.

sexually to HIV through contact with other men. More than two-thirds of the nearly 40,000 U.S. cases reported during the first six years of the epidemic have been homosexual or bisexual men. New England AIDS cases are consistent with this trend, since 961 of the patients with AIDS (65 percent) reported homosexual contact with men, 68 of whom had the additional risk factor of prior intravenous drug use.

The relative significance of male homosexual transmission among cases reported from individual New England states is variable. For the three southern states (Massachusetts, Rhode Island, Connecticut), the male homosexual/bisexual category predominates, but accounts for fewer than half of adult cases in Connecticut, compared to nearly seven of ten cases in Massachusetts (table 1: comparison of transmission categories for southern New England AIDS cases reported as of July 1987). Rhode Island and Connecticut, perhaps because of their proximity to New York City, are more heavily affected by AIDS among intravenous drug users; this is thought to result from sharing of equipment used for injection. One-third of adults with AIDS in these states are heterosexuals who have used intravenous drugs. This heavier concentration has been persistent over the first six years but

Table 1

**Comparison of Transmission Categories for
Southern New England AIDS Cases Reported
as of July 1987**

Transmission Category	Massachusetts n = 825		Connecticut n = 444		Rhode Island n = 102	
	No.	(%)	No.	(%)	No.	(%)
Homosexual/bisexual	556	(69)	194	(45)	59	(58)
Intravenous (IV) drug user	107	(13)	143	(33)	33	(32)
Homosexual/bisexual IV drug user	34	(4)	31	(7)	0	(0)
Hemophilia	7	(1)	5	(1)	3	(3)
Heterosexual	64	(8)	25	(6)	2	(2)
Transfusion	23	(3)	12	(3)	3	(3)
Undetermined	20	(2)	20	(5)	2	(2)
Adult Total	811	(100)	430	(100)	102	(100)
Pediatric Cases	14		14		0	
Total Cases	825		444		102	

Source: Data provided by AIDS surveillance programs operated by the Department of Public Health in Massachusetts, Connecticut, and Rhode Island.

is expected to resolve in the future, as the accelerated rate of cases among drug users in Massachusetts moves in the direction of the Connecticut and Rhode Island experience.

Transmission of HIV through infected blood-clotting-factor concentrates (hemophilia products) and blood transfusions accounts for 53 of the adult cases of AIDS in southern New England (4 percent). Five (18 percent) of the 28 pediatric AIDS cases have been hemophiliacs or patients infected through blood transfusion. Although additional cases are anticipated among persons who have already been infected through blood products, future spread of HIV has been virtually eliminated by donor deferral and serologic screening and by inactivation steps routinely applied in product manufacturing.

In Massachusetts, the proportion of cases attributed to heterosexual transmission (8 percent) exceeds rates in neighboring states (2 to 6 percent) as well as the national average (4 percent). Such cases have occurred primarily (43 of 64 heterosexual cases) among patients who have recently entered the United States from Caribbean and central African countries, where HIV is transmitted most often heterosexually. In Zaire, Rwanda, Burundi, and Haiti, for example, AIDS cases occur with equal frequency in men and women, and rates of HIV infection are 10 to 100 times higher than in comparable age groups in the United States.⁷

Grouped together with these foreign-born heterosexual cases are patients who have had partners with high-risk behavior. The majority have had heterosexual contact with intravenous drug users, accounting for 18 cases (2 percent of adult cases) in Massachusetts and 17 (4 percent) in Connecticut. A small number of women partners of bisexual men and hemophiliacs have also developed AIDS in southern New England.

The pediatric cases are concentrated in the states of Connecticut and Massachusetts, and are primarily associated with perinatal infection due to parental drug use. Of the 28 children with AIDS in southern New England, 82 percent have parents with AIDS or with histories of high-risk drug-using or sexual behaviors; 7 percent have hemophilia; and 11 percent became infected by blood transfusion. Twenty children died of AIDS during the six-year period.

The transmission category is unknown in 2 to 5 percent of cases from these three states, a rate comparable to the national experience. Most patients listed as undetermined risk were deceased before a history of high-risk behavior could be ascertained. In a few cases, patients who have been interviewed deny homosexual contact or drug use; these patients typically report multiple heterosexual partners (including prostitute contact) and prior history of sexually transmitted diseases. Failure to clearly identify an infected partner will become more common in the future if HIV infiltrates the heterosexual population to a greater degree. Cases whose transmission category is listed as undetermined are not thought to represent new or unappreciated modes of HIV transmission; a low level of missing information is to be expected, in view of the sensitive nature of sexual and illegal drug use behavior.

In northern New England, cases have been heavily concentrated among homosexual and bisexual men (table 2: comparison of transmission categories for northern New England AIDS cases reported as of July 1987). In the tri-state area, 86 percent of the adult cases occurred among homosexual men, three of whom also used intravenous drugs. Heterosexual intravenous drug users represent 7 percent of the cases, while 2 percent of the cases are attributed to heterosexual transmission. Five persons with hemophilia have developed AIDS (5 percent); however, no transfusion-associated cases were reported in this part of the region during the period. The risk of HIV infection among hemophiliacs is consistent from region to region, because of widespread distribution of products.⁸ Transfusion-associated risk, on the other hand, is related to local blood donor characteristics, and appears to vary according to the prevalence of HIV in high-risk populations and the corresponding incidence of AIDS.

Demographic Characteristics

The distribution of AIDS cases according to age illustrates the general similarities among the New England states and is comparable to the national trend (table 3: New England AIDS cases according to age, sex, and racial/ethnic characteristics). Cases occur most frequently during the third decade of life; typically, two out of three patients are between twenty and forty years old. This unusual concentration of a fatal illness in young adults at the height of their productivity further complicates the economic and social impact of AIDS.

Very few cases thus far (four in New England) have occurred among adolescents. These are most often among children with hemophilia. Given the delay between the point of HIV infection and the diagnosis of AIDS, some of the cases in the twenty- to twenty-nine-year-old age group may have been acquired through contact during adolescence.

The male:female ratio of AIDS cases nationwide is 12:1 for adults and 1:1 for children less than thirteen years old. In states where intravenous drug use accounts for one-third or more of cases, the adult male:female ratio becomes more balanced. In the two southern New England states where this is true (Connecticut and Rhode Island), male cases predominate but outnumber female cases only by a ratio of 6:1. In the three northern New England states, no AIDS cases were reported among adult women; the single female case was a child residing in New Hampshire.

The overrepresentation of racial minorities among AIDS cases in the United States is now well documented.⁹ In southern New England, this appears to be true as well and may be linked to a higher incidence of intravenous drug use among urban minority populations. In Connecticut, for example, blacks account for 7 percent of the state's 3.1 million residents and 33 percent of the AIDS cases. Similarly, 16 percent of AIDS cases are His-

panic in a state where 4 percent of the residents have this ethnic background. The northern New England states have low numbers of racial and ethnic minority residents, making estimates of disease distribution difficult.

In Massachusetts, age-adjusted incidence data indicate that the risk of AIDS for black men (age fifteen to forty-nine) is five times greater than for white men; Hispanic men in this age group have a fourfold excess risk compared to their white counterparts. For women, the trend is even more striking, with blacks having AIDS cases of 320/million and Hispanics of 101/million, fifteen and five times higher, respectively, than white women of the same age category.

The most common primary diagnosis among New England AIDS cases is *Pneumocystis carinii* pneumonia, reported in two-thirds of the patients. This is consistent with the national experience. Kaposi's sarcoma was reported in 20 percent of the New England cases for which data are available. Over the years, there has been a decrease in the proportion of cases with Kaposi's sarcoma which cannot be explained by a decrease in the proportion of new cases in the homosexual category. (Nearly all cases of Kaposi's sarcoma have occurred in homosexual or bisexual men with AIDS.) Epidemiologists have hypothesized that reduction of certain implicated cofactor effects, such as inhalant nitrites or other unspecified transmissible agents, may be contributing to the decline in Kaposi's sarcoma diagnoses in AIDS cases.¹⁰ Alternatively, changes in reporting habits or other types of ascertainment bias may explain this trend; attempts to evaluate such artifactual effects have been unsuccessful.

Opportunistic infections other than *P. carinii* pneumonia have been reported in 44 percent of the cases. The most common of these infections, on the basis of Massachusetts AIDS Surveillance Program data, are esophageal candidiasis (6 percent), cytomegalovirus or cryptococcal infections (4 percent), and atypical mycobacterial infection (3 percent).

Table 2

**Comparison of Transmission Categories for
Northern New England AIDS Cases Reported
as of July 1987**

Transmission Category	Maine n = 56		New Hampshire n = 35		Vermont n = 13	
	No.	(%)	No.	(%)	No.	(%)
Homosexual/bisexual	50	(91)	26	(79)	8	(62)
Intravenous (IV) drug user	2	(4)	2	(6)	3	(23)
Homosexual/bisexual IV drug user	0	(0)	2	(6)	1	(8)
Hemophilia	3	(5)	1	(3)	1	(8)
Heterosexual	0	(0)	2	(6)	0	(0)
Transfusion	0	(0)	0	(0)	0	(0)
Undetermined	0	(0)	0	(0)	0	(0)
Adult Total	55	(100)	33	(100)	13	(100)
Pediatric Cases	1		2		0	
Total Cases	56		35		13	

Source: Data provided by AIDS surveillance programs operated by the Department of Public Health in Maine, New Hampshire, and Vermont.

Mortality Data

During the six-year period, nearly 800 AIDS deaths were documented by the New England surveillance programs. At any point in time, approximately half of all reported AIDS cases are known to have died. Nationwide in 1986, one in 27,000 deaths was due to AIDS. The high case-fatality rate and the relative youth of those affected by AIDS dramatically reduces life expectancy in certain population groups, especially in high-incidence cities. Review of national statistics on premature mortality, commonly measured in “years of potential life lost” (YPLL) before age sixty-five, indicates that 2.1 percent of YPLL in 1986 was attributable to AIDS. Although causes of YPLL usually decrease or increase slightly from year to year, AIDS moved up from the thirteenth (in 1984) to eighth (in 1986) overall, and ranks sixth for men between the ages of twenty-five and forty-four.¹¹ For men in this age group residing in San Francisco or Manhattan, AIDS has become the leading cause of premature mortality, accounting for more YPLL than accidents, homicides, suicides, and cancer combined.¹²

As further progress is made toward effective antiviral therapy, there is optimism that survival can be substantially prolonged. A recent New York study¹³ demonstrated evidence of improvement already, particularly for patients with *P. carinii* pneumonia; in 1981, only 18 percent survived for one year after diagnosis, compared to 49 percent of cases diagnosed in 1985. The median survival period for all cases reported from New York during these five years was eleven months, with significant variability according to primary disease and demographic characteristics. For example, white men with Kaposi’s sarcoma alone had twenty-seven months median survival, while black women with *P. carinii* pneumonia survived only seven months. Eleven percent of patients died at the time of diagnosis of AIDS.

Table 3

New England AIDS Cases According to Age, Sex, and Racial/Ethnic Characteristics

Age (years)	Massachusetts		Rhode Island		Connecticut		New Hampshire		Vermont		Maine	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
< 13	14	(2)	1	(1)	14	(3)	2	(6)	0	(0)	1	(2)
13–19	3	(0)	0	(0)	0	(0)	0	(0)	0	(0)	1	(2)
20–29	175	(21)	20	(20)	106	(24)	8	(23)	3	(23)	18	(32)
30–39	405	(49)	50	(49)	186	(42)	20	(57)	4	(31)	26	(46)
40–49	158	(19)	25	(24)	81	(18)	3	(9)	3	(23)	8	(14)
> 49	70	(8)	6	(6)	57	(13)	2	(6)	3	(23)	2	(4)
Sex												
Male	758	(92)	88	(86)	372	(84)	34	(97)	13	(100)	56	(100)
Female	67	(8)	14	(14)	72	(16)	1	(3)	0	(0)	0	(0)
Racial/Ethnic Group												
White	602	(73)	84	(82)	224	(50)	NA*		13	(100)	48	(86)
Black	155	(19)	14	(14)	149	(33)			0	(0)	2	(4)
Hispanic	63	(8)	4	(4)	69	(16)			0	(0)	1	(2)
Unknown	5	(0)	0	(0)	2	(1)			0	(0)	5	(9)

*Data not available

Source: Data provided by AIDS surveillance programs operated by the Department of Public Health in the six New England states.

Death certificate review is a commonly used method of case ascertainment, and can provide a validation tool to assess the completeness of case reporting. In Boston, a death record review of more than 2,100 certificates issued during a three-month period identified twenty deaths (1 percent of the period total) in reported AIDS cases. Three additional cases that had not been reported were identified through follow-up of deaths in young men and women which were caused by unspecified pneumonia or lymphoma. AIDS-related causes of death listed by the certifying physician, such as *P. carinii* pneumonia and Kaposi's sarcoma, were highly (80 to 100 percent) predictive of AIDS.

Projections from AIDS Cases

Using mathematical modeling, epidemiologists from the Centers for Disease Control have estimated that by 1991, 270,000 cases of AIDS will have occurred in the United States. If New England trends follow the first six years' experience, approximately 10,000 of the cases will be residents of the region. It is likely that more than 4,000 New Englanders will have died of AIDS in the ten years since the disease was recognized, and that 6,000 others will be living with AIDS and requiring specialized medical and support services.

Up to 60,000 others may have minor clinical symptoms associated with HIV infection and varying degrees of immunodeficiency, commonly referred to as ARC (AIDS-related complex). Without systematic information on the proportional relationship between AIDS cases and numbers of patients with ARC, generally accepted estimates range from 1:5 to 1:10. It is even more difficult to estimate the number of persons who are currently infected with HIV and asymptomatic. Projections for the nation, based to denominator approximations for high-prevalence population groups, suggest that between 1 million and 1.5 million Americans are already infected. If AIDS case distribution mirrors the geographic pattern of HIV in general, 35,000 to 56,000 New Englanders have been infected with HIV thus far, representing a ratio of 25 to 35 infected persons for each reported AIDS case.

Further refinement of this estimate can be achieved by focusing on the age groups likely to be infected. For adults age 20 to 39, representing 70 percent of AIDS cases, infected individuals without symptoms probably outnumber AIDS cases by a factor of fifty to one. This proportion is consistent with other population-based sources of data such as newborn screening, as well as the projected AIDS incidence data for the next five years. Using the 50:1 estimate, approximations of the number of 20- to 39-year-old adults in New England currently infected are 1 in 500 for Vermont; 1 in 156 for Maine; 1 in 215 for New Hampshire; 1 in 83 for Rhode Island; and 1 in 65 for Connecticut and Massachusetts. The likelihood of infection for males in this age group is generally twice as high as the above figures, which combine males and females. Using precise age and sex data for AIDS cases in Massachusetts and Connecticut, approximately 1 in 35 men in this age group may be infected currently. For women, rates of 1 in 200 and 1 in 400 are estimated for Connecticut and Massachusetts, respectively.

Military Recruit Applicant HIV Testing Data

The U.S. Department of Defense adopted a policy in October 1985 which required all applicants for military service to have serologic testing for HIV infection. The rationale for this policy included concern about (1) possible adverse reactions when routine immunizations (including live virus vaccines) are administered to recruits; (2) emergency blood

donation requirements during battle; and (3) physical handicap or impairment of military forces. Any seropositive applicant is referred to civilian medical consultants and counselors, and is rejected from military service.

Tests of 1.1 million men and women applying to the military during the first twenty-one months of the screening program have provided valuable statistical data for HIV surveillance purposes. Since recruiting officials inform applicants that drug use and homosexual activity are grounds for exclusion from entry into military service, volunteers tested for HIV underrepresent the major HIV-infected populations (including hemophiliacs, deferred for medical considerations). The crude overall prevalence rate of 0.15 percent has remained stable during this period, with no statistically significant upward or downward trend.¹⁴ The rate among military recruit applicants in the New England region (0.08 percent) is among the lowest in the country. In the Middle Atlantic and Pacific regions, where AIDS incidence rates are highest, the prevalence of HIV infection among military recruit applicants is two to four times higher than in New England.¹⁵

The prevalence of infection varies considerably from state to state and according to age, sex, and racial characteristics (table 4: comparison of military recruit applicant HIV test results in New England residents by state, according to sex and racial/ethnic characteristics). The data are consistent with AIDS incidence rates — lowest in northern New England, where only one recruit in the tri-state area was found to be seropositive. The nearly identical rates of seropositivity observed in residents of Connecticut (0.14 percent) and Massachusetts (0.12 percent) further substantiates the validity of the cumulative AIDS cases rates (144/million population for each).

The excess burden of AIDS cases among ethnic and racial minorities is reflected in military recruit data as well. Overall rates of HIV seropositivity for blacks are seven to ten times higher than for whites in the volunteers tested from Connecticut and Massachusetts. Data for other racial groups (including Hispanics, native Americans, and Asian/Pacific Islanders) come from small samples that prevent meaningful estimates of infection prevalence.

Table 4

Comparison of Military Recruit Applicant HIV Test Results in New England Residents by State, According to Sex and Racial/Ethnic Characteristics, October 1985–June 1987

	Number Tested (% Seropositive) by Subgroup						Total Number Seropositive No. (%)
	Males No. (%)	Females No. (%)	Black No. (%)	White No. (%)	Other No. (%)		
Connecticut	8,941 (.15)	1,389 (.07)	1,553 (.52)	8,200 (.05)	577 (.34)	14 (.14)	
Massachusetts	16,426 (.12)	2,350 (.13)	1,536 (.52)	16,753 (.07)	487 (.41)	22 (.12)	
Maine	5,515 (.00)	931 (.00)	24 (.00)	6,371 (.00)	51 (.00)	0	
New Hampshire	3,669 (.03)	587 (.00)	31 (.00)	4,190 (.02)	35 (.00)	1 (.02)	
Rhode Island	3,008 (.07)	443 (.00)	214 (.47)	3,134 (.03)	103 (.00)	2 (.06)	
Vermont	2,279 (.00)	370 (.00)	17 (.00)	2,620 (.00)	12 (.00)	0	
New England	39,838 (.09)	6,070 (.07)	3,375 (.50)	41,268 (.04)	1,265 (.32)	39 (.08)	
United States	953,166 (.16)	151,927 (.07)	205,130 (.41)	814,316 (.08)	85,647 (.22)	1,641 (.15)	

Source: Data provided by AIDS surveillance programs operated by the Department of Public Health in the six New England states.

Combined seropositivity rates for military recruit applicants in the New England region are higher for men (0.09 percent) than for women (0.07 percent). In Massachusetts, however, the prevalence of infection is uniform for male and female recruit applicants. Nationwide, the disparity between rates for men and women is more pronounced (0.16 percent vs. 0.07 percent) than in the New England region. Higher rates of seropositivity have consistently been seen among military recruit applicants age twenty-five and over, compared to those of younger ages.

Blood Donor HIV Screening

In April 1985, the first laboratory test kits for HIV antibody testing were licensed by the federal Food and Drug Administration. Since that time, more than 25 million donations of blood and plasma have been screened for HIV, in a critical step toward assuring safety of the blood supply. The nationwide trend indicates a decline in the rate of HIV seropositivity in blood donors, from 0.035 percent in 1985 to less than 0.015 percent in 1987.¹⁶

Data from blood donor screening have been viewed as a crude measure of the degree to which HIV is present in the so-called "general population." Since homosexual men, intravenous drug users, hemophiliacs, and their sexual partners are actively deferred from donating blood, the prevalence of HIV infection in the highly selected blood-donor population should be exceedingly low. The overall decline in the national rates of seropositivity over time is primarily the result of eliminating previously identified seropositive persons from the donor pool.

The most unbiased estimate of HIV prevalence in the segment of the population that donates blood is obtained from data on first-time donors; the cumulative statistics indicate a 0.043 percent seropositivity rate in this group. In 80 to 90 percent of donors who test positive for HIV antibody, recognized risk factors can be determined when follow-up interviews are performed.¹⁷

The general geographic correlation between AIDS case rates and HIV prevalence is illustrated in blood donor screening data as well. Combined data from New York (0.04 percent seropositive) and California (0.026 percent seropositive) document rates that exceed the Central and Mountain states by factors of 10 to 20. In New England, data combined for the four northern states (Massachusetts, Maine, New Hampshire, and Vermont) indicate 0.011 percent seropositivity, compared to a lower rate in Rhode Island and Connecticut (0.004 percent).¹⁸

Voluntary HIV Testing of Individuals with Perceived Risk

Alternative testing sites for HIV antibody testing were created to provide free and anonymous HIV antibody testing and counseling and to discourage high-risk individuals from donating blood as a way of learning their antibody status. All of the New England states have established counseling and testing sites that provide confidential or anonymous HIV antibody testing. As of June 1987, cumulative seroprevalence rates for more than three thousand persons seeking testing in the New England area have ranged from 1.8 to 6.7 percent. Overall, 2 to 3 percent of the clients tested in northern New England (Maine, New Hampshire, Vermont) were seropositive, compared with 6 to 7 percent of seropositive clients who were tested in southern New England (Massachusetts, Connecticut, Rhode Island).

In states where clients are asked to self-report their risk-group status, the seroprevalence of HIV remains highest in those risk groups — specifically, homosexual or bisexual men and intravenous drug users — which also account for the majority of AIDS cases. Eleven percent of homosexual or bisexual men are seropositive in New Hampshire, Massachusetts, and Rhode Island, while 13 percent of those tested in Connecticut are seropositive. The seroprevalence among intravenous drug users varies somewhat geographically — 21 percent of intravenous drug users in Connecticut are seropositive; 13 percent in Massachusetts; 11 percent in Rhode Island; and 3 percent in New Hampshire. Heterosexual HIV-antibody test clients who perceive themselves at risk for HIV infection have considerably lower seropositivity rates; in both Massachusetts and New Hampshire, 1.4 percent of self-identified heterosexual clients were seropositive.

Other Seroprevalence Surveys

The most meaningful measures of HIV prevalence have been drawn from studies that select a population sample according to a predetermined method that does not rely on an individual subject to volunteer for testing. Bias that is introduced when testing is voluntary can be difficult to evaluate and control. On the other hand, population-based sampling for HIV seroprevalence studies must include rigorous protocols for protection of personal identifying information, in order to assure that test results cannot be linked to individuals. To this end, samples are often batched together according to schemes that prohibit precise analysis of demographic and risk factor data. Although a “family of seroprevalence surveys” will be initiated nationwide sometime in 1988, preliminary information is available from New England, thanks to an innovative strategy initiated here in 1986.

Investigators at the Massachusetts Department of Public Health have developed a novel method of measuring HIV seroprevalence among childbearing women.¹⁹ Using a filter-paper-absorbed sample of blood collected routinely on all newborn infants for metabolic screening, a mini-blot method of HIV serologic testing provides a measure of the mother’s infection status. To assure absolute anonymity, specimens are batched according to characteristics of the hospital where the delivery occurred, and all identifiers are removed from the sample. By extension, the results of this survey have provided data on the true prevalence of HIV in the U.S. general population.

The overall rate of seropositivity for childbearing women in Massachusetts was estimated at 2.3 per thousand, or approximately 180 of the nearly 80,000 women who give birth each year. Half of the newborns whose mothers are infected will become infected themselves, with high probability of developing AIDS-related diseases. Within the state, seropositivity appears concentrated in inner-city hospitals serving the highest-risk women. In these areas, infection rates from the preliminary data were 7.5/1,000, although subsequent studies indicate that the rate is now 18/1,000.²⁰ Rates among women delivering in suburban and rural hospitals were only 1.4/1,000.

Preliminary estimates from the Centers for Disease Control indicating that nationwide seroprevalence of HIV approximates 1.9/1,000 are consistent with this population-based study, especially because other trends within Massachusetts closely reflect the combined U.S. experience. In the spring of 1988, thirty sites nationwide will embark on HIV seroprevalence studies, including long-term observation of newborn screening data as a barometer of future heterosexual spread of AIDS.

Summary

Nearly fifteen hundred AIDS cases occurring in New England during the first six years of a worldwide epidemic provide a basis for determining local resource needs and prevention strategies. The northern states of the region, having been relatively spared the severe disease burden thus far, appear to have a window of opportunity to initiate targeted intervention strategies. With low rates of seropositivity, approaches such as notification of partners of HIV-infected individuals are more feasible and potentially more effective than in other areas. Major emphasis can be placed on educating the public about sexual risk reduction and targeting patients seen in sexually transmitted disease clinics, since intravenous drug use is associated with very few of the northern New England cases.

The southern part of the region faces greater challenges to develop programs that deal with the complex interaction of HIV infection and drug use, particularly among urban minority populations. Each week that passes, four more infants are born in southern New England who are likely to develop AIDS before their second birthday. The mothers and fathers of these children face odds of developing AIDS that increase by 5 to 10 percent each year. Nearly one in four sexually active homosexual men in the urban centers has been infected already, and perhaps six thousand of them will advance to life-threatening illness by 1991. The human and economic toll of the crisis will surpass any problem of modern times.

Although New England has been only moderately affected by the AIDS epidemic compared to other areas of the United States, the task ahead is clear and ominous. With continued attention to disease trends and systematic research to monitor future spread of HIV, a reliable forecast of the region's needs and challenges can be made. 🍷

The authors gratefully acknowledge the assistance and cooperation of AIDS surveillance epidemiologists throughout New England: Julia Miller (Connecticut); David Akers (Maine); Beverly Heinze-Lacey and George Seage (Massachusetts); Joyce Cournoyer and Susan Keady (New Hampshire); Louis Dondero (Rhode Island); and Deborah Kutsko (Vermont). For the technical assistance they provided, we also thank Tim Broadbent, Mary Ann Bucci, and Heidi Hunt of the Massachusetts Department of Public Health AIDS Program.

Notes

1. Centers for Disease Control. Pneumocystis pneumonia — Los Angeles. *Morbidity and Mortality Weekly Report* 1981; 30:250–252.
2. A. M. Hardy, E. T. Starcher, W. M. Morgan, et al. Review of death certificates to assess completeness of AIDS case reporting. *Public Health Reports* 1987; 102:386–391.
3. Centers for Disease Control. Appendix A: Revision of the CDC surveillance case definition for Acquired Immunodeficiency Syndrome. *Morbidity and Mortality Weekly Report Supplement*, 14 August 1987; 36 (1S).
4. F. Barre-Sinoussi, J. C. Chermann, F. Rey, et al. Isolation of a T-lymphotropic retrovirus from a patient at risk for AIDS. *Science* 1983; 220:868–871; and R. C. Gallo, S. Z. Salahuddin, M. Popovic, et al. Frequent detection and isolation of cytopathic retroviruses (HTLV-III) from patients with AIDS and at risk for AIDS. *Science* 1984; 224:500–503.
5. G. F. Medly, R. M. Anderson, D. R. Cox, et al. Incubation period of AIDS in patients infected via blood transfusion. *Nature* 1987; 328:719.

6. Centers for Disease Control. Update: Acquired Immunodeficiency Syndrome — United States. *Morbidity and Mortality Weekly Report* 1987; 36:522–526.
7. T. C. Quinn, J. M. Mann, J. W. Curran, et al. AIDS in Africa: An epidemiologic paradigm. *Science* 1986; 234:955–963.
8. J. W. Curran, H. W. Jaffe, A. M. Hardy, et al. Epidemiology of HIV Infection and AIDS in the United States. *Science* 1988; 239:610–616.
9. Centers for Disease Control. Acquired Immunodeficiency Syndrome (AIDS) among blacks and Hispanics — United States. *Morbidity and Mortality Weekly Report* 1986; 35:655–666.
10. Centers for Disease Control. Update: Acquired Immunodeficiency Syndrome — United States. *Morbidity and Mortality Weekly Report* 1986; 35:17–21.
11. Curran, Jaffe, Hardy, et al. (note 8).
12. J. W. Curran, W. M. Morgan, A. M. Hardy, et al. The epidemiology of AIDS: Current status and future prospects. *Science* 1985; 229:1352–1357.
13. R. Rothenberg, M. Woelfel, R. Stoneburner, et al. Survival with the acquired immunodeficiency syndrome: Experience with 5833 cases in New York City. *New England Journal of Medicine* 1987; 317:1297–1302.
14. Centers for Disease Control. Trends in human immunodeficiency virus infection among civilian applicants for military service — United States, October 1986–December 1986. *Morbidity and Mortality Weekly Report* 1987; 36:273–276.
15. Centers for Disease Control. Human T-lymphotropic virus type III/lymphadenopathy-associated virus antibody prevalence in U.S. military recruit applicants. *Morbidity and Mortality Weekly Report* 1986; 35:421–424.
16. Curran, Jaffe, Hardy, et al. (note 8).
17. Centers for Disease Control. Human immunodeficiency virus infection in the United States: A review of current knowledge.
18. Centers for Disease Control (note 17).
19. R. Hoff, V. P. Berardi, B. J. Weiblen, et al. Seroprevalence of human immunodeficiency virus among childbearing women: Estimation by testing samples of blood from newborns. *New England Journal of Medicine* 1988; 318:525–529.
20. Personal communication to the authors from Donald E. Craven, M.D., City of Boston Department of Health and Hospitals.

Glossary

CSF.	Cerebrospinal fluid is the fluid covering the brain and spinal cord. Obtained by a lumbar puncture, this fluid may contain inflammatory cells or antibodies, or both, when there is infection in the brain.
Dysphoria.	This is a negative mood such as anxiety or depression.
Endothelial and glial cells.	These are nonneuronal cells found in the brain. Endothelial cells are found throughout the body; glial cells are restricted to the central nervous system.
Factor VIII.	This factor is a protein that is required for the clotting of blood. People with hemophilia lack this factor and must continually take it to prevent bleeding.
Intracellular/extracellular.	Viruses replicate only within cells. If the virus, or a portion thereof, remains within the cell, it is said to be intracellular. If it is liberated from the cell, generally with the death of the cell, it becomes extracellular and can be detected in various body fluids.
Monocyte.	This is a cell that circulates in the blood. It may lodge in tissues and at sites of inflammation; in these loci, these cells are called macrophages.
Multinucleated, syncytial giant cells.	These are large cells that have two or more nuclei. They form when cells fuse. Certain viruses, such as HIV, cause cells to fuse.
Neuromodulators.	These are small proteins that are synthesized in cells of the nervous system and peripheral nerves. They are also known as neuromediator and neurotransmitter substances. They are important in transferring "information" from one nerve to another, and for movements of muscle. They also may have general, metabolic effects, and, recently, several have been found to affect the immune system.

Glossary continued on page 108