

# A National Surveillance System for Newly Acquired HIV Infection in Australia

## ABSTRACT

**Objectives.** The purpose of this study was to describe the establishment of a national surveillance system for newly acquired human immunodeficiency virus (HIV) infection and present the first 3 years' results.

**Methods.** All new cases of diagnosed HIV infection were reported to the national HIV surveillance center through state and territory health authorities. Information sought on each case included evidence of whether the infection had been newly acquired, defined by the diagnosis of HIV seroconversion illness or by the report of a negative or indeterminate HIV antibody test result occurring within the 12 months prior to diagnosis of infection.

**Results.** Of 3602 reported cases of HIV infection in adults and adolescents newly diagnosed in Australia between 1991 and 1993, 11.4% were identified as newly acquired. The majority (85%) of cases of newly diagnosed HIV infection occurred among men who reported homosexual contact, and 15% of these cases were identified as newly acquired. Average age at diagnosis was 31 years for cases of newly acquired infection and 34 years for other cases.

**Conclusions.** Surveillance for newly acquired HIV infection has been established at a national level in Australia and provides valuable information for planning primary HIV prevention programs. (*Am J Public Health*. 1994;84:1923-1928)

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### Introduction

Incidence of human immunodeficiency virus (HIV) infection in a population is a key piece of information in the planning and evaluation of primary HIV prevention programs, but it is also extremely difficult to measure. Application of the back-projection method to the number of reported cases of acquired immunodeficiency syndrome (AIDS)<sup>1</sup> indicates that, in Australia, incidence of HIV infection reached a peak during the years 1983 to 1984 and declined rapidly thereafter. However, the back-projection method has only limited ability to provide information on the current rate of HIV infection because few cases of recently acquired infection will have progressed to AIDS.<sup>2</sup>

Other information on HIV incidence has come from longitudinal studies. Among homosexual and bisexual men participating in the Sydney AIDS Prospective Study, the incidence of HIV infection decreased from approximately 5% during the first 6 months of 1985 to 1% during the first 6 months of 1987.<sup>3</sup> The annual incidence of HIV infection in homosexual and bisexual men attending an HIV testing site in Sydney also declined between 1985 and 1990.<sup>4</sup> These findings corroborate the results of the back-projection method but may not be readily generalizable outside the study populations.

Wide availability of HIV antibody testing has been one of the cornerstones of the national response to the HIV epidemic in Australia, and each year, public health laboratories carry out a large number of HIV antibody tests.<sup>5</sup> In 1989, national surveillance for newly diagnosed HIV infection was established in Australia<sup>6</sup> to complement national surveil-

lance for AIDS<sup>7</sup> and serological surveys. Cases of newly diagnosed HIV infection have the potential to indicate more recent patterns of HIV transmission than are indicated by cases of AIDS, since diagnosis of HIV infection may occur earlier in the course of the disease than diagnosis of AIDS. However, a diagnosis of infection does not provide specific information on when the infection was acquired.

In 1991, national surveillance for newly diagnosed HIV infection was extended to include the collection of available information on the recency of acquisition of infection, determined by the date of either the last negative or indeterminate HIV antibody test result or the diagnosis of HIV seroconversion illness. We report on the development of this surveillance system and its results for the 3-year interval of 1991 to 1993.

### Methods

Under Australia's federal system of government, primary responsibility for disease surveillance rests with the eight state and territory health authorities. In response to the AIDS epidemic, each

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**Editor's Note.** See related annotation by Ward et al. (p 1888) in this issue.

**TABLE 1—Number of Cases of Newly Diagnosed HIV Infection, Number of Cases with Available Evidence of the Interval of Infection, and Number of Cases of Newly Acquired HIV Infection, by Sex and Year of HIV Diagnosis, 1991 through 1993**

HIV Diagnosis	1991			1992			1993			Cumulative Total, 1991–1993			
	Male	Female	Sex Not Recorded	Male	Female	Sex Not Recorded	Male	Female	Sex Not Recorded	Male	Female	Sex Not Recorded	Total <sup>a</sup>
Newly diagnosed HIV infection <sup>b</sup>	1244	71	91	1093	91	15	908	72	11	3245	234	117	3602
Newly diagnosed HIV infection with evidence of the interval of infection <sup>c</sup>	126	4	1	265	11	1	313	11	1	704	26	3	735
Newly acquired HIV infection <sup>d</sup>	77	2	0	140	8	1	172	7	1	389	17	2	410

<sup>a</sup>Total includes six people whose sex was reported as transsexual.

<sup>b</sup>Total number of cases of HIV infection newly diagnosed in 1991, 1992, and 1993 includes one, two, and three people, respectively, whose sex was reported as transsexual.

<sup>c</sup>Cases with a report of a previous negative HIV antibody test or an HIV seroconversion illness. Number of cases diagnosed in 1991 and 1993 includes one and two people, respectively, whose sex was reported as transsexual.

<sup>d</sup>Cases with a previous negative HIV antibody test or diagnosis of HIV seroconversion illness occurring within the 12 months before HIV diagnosis. Number of cases diagnosed in 1993 includes two people whose sex was reported as transsexual.

health authority developed its own methods of surveillance for cases of AIDS and, later, for cases of newly diagnosed HIV infection.<sup>8,9</sup> However, all health authorities receive reports of laboratory diagnoses of HIV infection in people voluntarily tested for HIV antibody, and it is upon these that surveillance for newly diagnosed HIV infection is based. Diagnoses of HIV infection are made using standardized tests and procedures, agreed upon by all HIV testing laboratories and coordinated by the National HIV Reference Laboratory in Fairfield, Victoria.<sup>10</sup>

In general, HIV infection was diagnosed over the study period by testing serological specimens, first with a high-sensitivity enzyme-linked immunosorbent assay and, if that proved reactive, by a supplemental assay, usually a Western blot. Cases of laboratory-confirmed HIV infection were reported to the state or territory health authority by the diagnosing laboratory in four of the jurisdictions and by doctors in the other four jurisdictions.<sup>6</sup> In both systems, the health authority or the diagnosing laboratory contacted the doctor who requested the HIV antibody test if the information provided on the case was either incomplete or unclear. Cases of duplicate reports of diagnosed HIV infection within a specific jurisdiction were identified by either the diagnosing laboratory or the health authority through use of the person's full name or name code.

National surveillance for newly diagnosed HIV infection was based on cases

of infection reported by state and territory health authorities to the national HIV surveillance center on the first occasion of diagnosis in Australia.<sup>6</sup> Information sought on each case included the state or territory of diagnosis, the sex and date of birth of the person, the date of specimen collection for the diagnosis of HIV infection, and information on reported exposure to HIV as determined by medical history taking. The name code (first two letters of the surname and first two letters of the given name) was sought for cases of newly diagnosed HIV infection from January 1992, and the CD4+ T-lymphocyte count at HIV diagnosis was sought from May 1992.

From January 1991, information was also sought on whether the case of newly diagnosed HIV infection was newly acquired, as defined by either the diagnosis of HIV seroconversion illness<sup>11</sup> or the report of a negative or indeterminate HIV antibody test result within the 12 months prior to diagnosis of infection. Evidence of newly acquired infection was available from the treating doctor based on the patient's medical history, from the diagnosing laboratory based on the patient's HIV antibody testing history,<sup>8</sup> from the patient via the treating doctor, or from a combination of these sources.

Cases of AIDS, including cases of late diagnosis of HIV infection (defined by a diagnosis of AIDS in the same year as the first diagnosis of HIV infection), were identified among AIDS cases reported to the National AIDS Registry.<sup>7</sup> Statistical

analyses (Student's *t* test for comparison of mean age at HIV diagnosis and  $\chi^2$  test for comparison of proportions) were carried out using EPI INFO, Version 5.<sup>12</sup>

## Results

By March 31, 1994, 3602 newly diagnosed cases of HIV infection among Australian adults and adolescents (including 6 people whose sex was recorded as transsexual and 117 people whose sex was not recorded) during the 3-year interval of 1991 to 1993 had been reported to the national HIV surveillance center (Table 1). Of these cases, 389 in males (12.0%) and 17 in females (7.3%) were reported to have been newly acquired. The annual number of new diagnoses declined by almost 30%—from 1407 cases in 1991 to 994 cases in 1993—whereas both the number and proportion of new infections increased from 79 (5.6%) in 1991 to 182 (18.3%) in 1993. The number and proportion of HIV diagnoses with a prior negative HIV antibody test at least 1 year before the diagnosis of HIV infection also increased over the interval from 131 (9.3%) in 1991 to 327 (32.9%) in 1993.

The method by which cases of newly acquired HIV infection were identified is summarized in Table 2. Most cases (71.7%) of newly acquired HIV infection were identified on the basis of a negative or indeterminate HIV antibody test result occurring within the 12 months prior to diagnosis of infection. Information on HIV antibody testing history was provided

by the diagnosing laboratory for 65% of these cases, by the patient in 24% of cases, and by the treating doctor in 11% of cases. A further 9.5% of cases were identified by the diagnosis of HIV seroconversion illness, and 18.8% were identified by both a diagnosis of HIV seroconversion illness and a history of a previous negative HIV antibody test.

The reported sources of exposure to HIV, both for cases of newly diagnosed infection and for cases identified as having been newly acquired, are summarized in Tables 3 and 4. Exposure to HIV for the majority (82.1%) of newly diagnosed cases in males with a reported source of exposure to HIV was homosexual contact, and injection drug use was also reported by a further 3.3% of cases (Table 3). A similar proportion of cases of newly acquired HIV infection for which exposure to HIV was reported was attributed to homosexual contact (90.1%) and to homosexual contact with a history of injection drug use (2.9%). Less than 10% of new diagnoses and less than 5% of new infections in males with a reported source of exposure to HIV were attributed to heterosexual contact. Of those new infections for which more detailed information on the sexual partner's exposure to HIV was available, 50% were attributed to heterosexual contact with a person who originated from a country in sub-Saharan Africa or Southeast Asia, where HIV is transmitted primarily through heterosexual contact. Exposure to HIV for the majority (78%) of new diagnoses in females with a reported exposure to HIV was attributed to heterosexual contact, and 16% of cases occurred in injection drug users (Table 4). Of cases of new infection in females for which exposure to HIV had been reported, 60% were attributed to heterosexual contact and 40% were attributed to injection drug use.

Mean age at diagnosis of HIV infection by HIV disease status is summarized in Table 5. Diagnoses of newly acquired HIV infection occurred at a significantly younger age than other diagnoses of HIV infection for both males and females. The mean age of males who reported a history of homosexual contact was 31 years for cases of newly acquired HIV infection compared with 34 years for other cases of newly diagnosed HIV infection. Ten cases of new HIV infection in males (less than 3% of new infections) and no cases in females were in people who were less than 20 years of age at HIV diagnosis.

For approximately 12% of cases of newly diagnosed HIV infection, AIDS

**TABLE 2—Number of Cases of Newly Acquired HIV Infection, by Evidence of New Infection and Year of Diagnosis**

Evidence of Newly Acquired HIV Infection	Year of HIV Diagnosis			Cumulative Total 1991–1993	Percentage <sup>a</sup>
	1991	1992	1993		
Negative HIV antibody test result occurring within the 12 months before diagnosis of HIV infection	63	92	115	270	65.9
Last negative test within 3 months of diagnosis	16	15	20	51	(18.9)
Last negative test between 3 and 6 months of diagnosis	19	31	44	94	(34.8)
Last negative test between 6 and 9 months of diagnosis	16	23	28	67	(24.8)
Last negative test between 9 and 12 months of diagnosis	12	23	23	58	(21.5)
Diagnosis of HIV seroconversion illness occurring within the 12 months before diagnosis of HIV infection	7	48	61	116	28.3
HIV seroconversion illness only	5	25	9	39	(33.6)
HIV seroconversion illness and a previous negative HIV antibody test result	2	23	52	77	(66.4)
Last negative test within 3 months of diagnosis of HIV infection	0	7	29	36	(31.0)
Last negative test between 3 and 6 months of diagnosis of HIV infection	1	3	11	15	(12.9)
Last negative test between 6 and 9 months of diagnosis of HIV infection	0	4	2	6	(5.2)
Last negative test between 9 and 12 months of diagnosis of HIV infection	0	2	1	3	(2.6)
Last negative test more than 12 months before diagnosis of HIV infection	1	7	9	17	(14.7)
Indeterminate HIV antibody test result only, occurring within the 12 months before diagnosis of HIV infection	9	9	6	24	5.8
<b>Total</b>	<b>79</b>	<b>149</b>	<b>182</b>	<b>410</b>	<b>100.0</b>

<sup>a</sup>Percentages in parentheses were calculated based on the total number of cases with the specified type of evidence only.

was diagnosed in the same year. Cases of newly diagnosed HIV infection with a concurrent diagnosis of AIDS were found in significantly older persons than were cases of newly diagnosed HIV infection without evidence of new infection (39 vs 34 years, *P* < .01). Throughout the period of 1991 to 1993, newly diagnosed HIV infection with a concurrent diagnosis of AIDS occurred in people who were approximately 10 years older at HIV diagnosis than did newly acquired HIV infection.

To March 1994, CD4+ T-lymphocyte count had been reported for 14% and

32% of cases of HIV infection diagnosed in 1992 and 1993, respectively. Of the 1993 cases with a CD4+ T-lymphocyte count available, 39% of those counts were greater than 500/μL. A significantly higher proportion of cases of newly acquired HIV infection compared with other cases of HIV infection diagnosed in 1993 had a CD4+ T-lymphocyte count of greater than 500/μL (49/76 vs 77/245, respectively; *P* < .01). Of cases of AIDS diagnosed in 1993, none had a CD4+ T-lymphocyte count greater than 500/μL and more than 90% had a count below 200/μL.

**TABLE 3—Numbers of Cases of HIV Infection Both Newly Diagnosed and Identified as Newly Acquired in Australian Males Aged 13 and Older between 1991 and 1993, by Year of Diagnosis and HIV Exposure Category**

Exposure Category	1991		1992		1993		Cumulative Total, 1991–1993		
	Newly Diagnosed	Newly Acquired	Newly Diagnosed	Newly Acquired	Newly Diagnosed	Newly Acquired	Newly Diagnosed	Newly Acquired	% Newly Acquired
Male homosexual/bisexual contact	798	68	753	120	655	150	2206	338	15.3
Male homosexual/bisexual contact and injection drug use	26	1	35	7	29	3	90	11	12.2
Injection drug use	46	1	43	5	32	4	121	10	8.3
Heterosexual	12	0	9	1	13	4	34	5	
Not further specified	34	1	34	4	19	0	87	5	
Heterosexual contact	79	3	93	5	73	8	245	16	6.5
Sex with injection drug user	2	0	4	1	3	1	9	2	
Sex with bisexual male from specified country	2	0	4	0	5	0	11	0	
Sex with person from specified country	7	3	10	0	12	2	29	5	
Sex with person with medically acquired HIV	0	0	2	0	1	1	3	1	
Sex with HIV-infected person, exposure not specified	3	0	10	1	4	1	17	2	
Not further specified	65	0	63	3	48	3	176	6	
Hemophilia/coagulation disorder	3	0	2	0	0	0	5	0	0.0
Receipt of blood, blood products or tissue	7	0	8	0	4	0	19	0	0.0
Other/undetermined	285	4	159	3	115	7	559	14	2.5
Total	1244	77	1093	140	908	172	3245	389	12.0

## Discussion

Overall, 410 of the 3602 cases of HIV infection newly diagnosed in Australian adults and adolescents between 1991 and 1993 were identified as newly acquired. From available evidence, it was not possible to determine whether the observed increase in both the annual number and the proportion of cases of newly acquired infection during the 3-year study period was attributable to a more complete reporting of new infection as opposed to a real increase in the number of cases of new infection. This difficulty in interpretation also applies to the increasing number of new infections in men who reported a history of homosexual contact, which was observed in surveillance of laboratory diagnoses of HIV infection in England and Wales between 1988 and 1991.<sup>13</sup>

The number of reported cases of newly acquired HIV infection, even in 1993, was substantially fewer than the 600 cases estimated to have occurred during 1990, the most recent year for which an estimate of the number of new HIV infections has been published.<sup>1</sup> The number of cases of newly diagnosed HIV

infection with evidence of newly acquired infection may be fewer than the actual number of cases of new infection for several reasons. First, reporting of new infection is recognized as incomplete even if evidence of new infection was available. In some jurisdictions, reporting of new infection for surveillance purposes did not occur routinely during 1991; in others, routine reporting began in the latter half of the year. Second, it is likely that a number of cases of newly acquired infection were not diagnosed within 1 year of their occurrence. Third, some cases of new infection may not have been reported as such because HIV infection occurs without symptoms or evidence of recent infection. There may also have been a failure to diagnose cases of HIV seroconversion illness or to document HIV antibody testing history accurately. The substantial number of cases of HIV infection diagnosed in 1993 with a CD4+ T-lymphocyte count above 500/ $\mu$ L but without direct evidence of new infection also suggests an underreporting of new infection.

Despite these limitations, national surveillance for newly acquired HIV infec-

tion has been established in Australia and clearly indicates continuing acquisition of HIV infection by adults and adolescents. Evidence of newly acquired HIV infection was corroborated by the relatively high CD4+ T-lymphocyte count at HIV diagnosis, indicating that cases of newly acquired infection were truly at an earlier stage in the course of the disease than other cases of newly diagnosed infection. The observed differences in mean age at HIV diagnosis between cases of newly acquired infection, cases of newly diagnosed infection, and cases of AIDS suggest that, in Australia, HIV infection has been acquired most often by people approximately 30 years of age and that age at infection has changed little over the past decade.

Younger age at HIV diagnosis for cases of newly acquired HIV infection compared with other cases of newly diagnosed infection may indicate a higher risk for HIV. Surveillance of HIV antibody tests in England has shown that, between 1988 and 1991, incidence of infection among men who reported homosexual contact peaked among those aged 20 to 24 years.<sup>14</sup> During the 3 previous

**TABLE 4—Numbers of Cases of HIV Infection Both Newly Diagnosed and Identified as Newly Acquired in Australian Females Aged 13 and Older between 1991 and 1993, by Year of Diagnosis and HIV Exposure Category**

Exposure Category	1991		1992		1993		Cumulative Total, 1991–1993		
	Newly Diagnosed	Newly Acquired	Newly Diagnosed	Newly Acquired	Newly Diagnosed	Newly Acquired	Newly Diagnosed	Newly Acquired	% Newly Acquired
Injection drug use	8	1	14	3	7	2	29	6	20.7
Heterosexual	2	0	5	1	5	2	12	3	
Not further specified	6	1	9	2	2	0	17	3	
Heterosexual contact	34	1	54	3	51	5	139	9	6.5
Sex with injection drug user	3	0	5	0	8	1	16	1	
Sex with bisexual male	3	0	6	0	6	1	15	1	
from specified country	1	0	4	0	2	0	7	0	
Sex with person from specified country	3	0	5	2	7	0	15	2	
Sex with person with medically acquired HIV	0	0	1	0	1	0	2	0	
Sex with HIV-infected person, exposure not specified	3	0	7	1	4	0	14	1	
Not further specified	21	1	26	0	23	3	70	4	
Hemophilia/coagulation disorder	0	0	0	0	0	0	0	0	0.0
Receipt of blood, blood products or tissue	4	0	6	0	1	0	11	0	0.0
Other/undetermined	25	0	17	2	13	0	55	2	3.6
Total	71	2	91	8	72	7	234	17	7.3

years (1986 to 1988), incidence of HIV infection among US active-duty navy personnel was highest among those aged 25 to 29 years.<sup>15</sup> In contrast to the apparently stable mean age at acquisition of HIV infection in Australia, recent back-projection estimates of HIV diagnoses in the United States suggest a declining mean age at acquisition over time.<sup>16</sup> From 1987 through 1991, approximately one quarter of new infections occurred in people less than 22 years of age.

The small number of cases of HIV infection, both newly acquired and newly diagnosed, for which exposure to HIV was attributed to heterosexual contact or to injection drug use without a reported history of male homosexual contact was consistent with the relatively low prevalence of infection documented in these groups in Australia.<sup>17,18</sup> However, heterosexual contact with a person who originated from sub-Saharan Africa or Southeast Asia may be a significant source of new infection among Australian heterosexuals.<sup>19</sup>

Although interpretation of the pattern of newly acquired HIV infection is limited by a lack of information on the pattern of testing for HIV antibody and clinical presentation among the various groups at risk, the surveillance system has documented ongoing transmission of HIV infection, predominantly by young men

**TABLE 5—Mean Age at Diagnosis of HIV Infection, by Sex, Year of Diagnosis, and HIV Disease Status**

HIV Disease Status	1991		1992		1993		Total Population, 1991–1993
	Male	Female	Male	Female	Male	Female	
Newly diagnosed HIV infection with evidence of newly acquired infection	29	30	32	31	30	25	30
Newly diagnosed HIV infection without evidence of newly acquired infection	33	33	35	34	35	32	34
Newly diagnosed HIV infection with an AIDS diagnosis in the same year <sup>a</sup>	39	40	40	41	38	40	39

<sup>a</sup>Based on cases of AIDS reported to the National AIDS Registry.

who report homosexual contact. Information on newly acquired HIV infection is published quarterly in the *Australian HIV Surveillance Report*<sup>19</sup> and has provided the basis for development of educational campaigns targeted to young homosexual men. Surveillance for newly acquired infection has also led to a case-control study of social and behavioral factors associated with acquisition of HIV infection in men who report homosexual

contact.<sup>20</sup> Such studies may generate valuable information for use in the development and modification of primary prevention programs for HIV infection. □

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