

# The Changing Distribution of HIV Infection: HIV Surveillance in Lazio, Italy, 1985 through 1994

## ABSTRACT

**Objectives.** This study sought to describe the human immunodeficiency virus (HIV) surveillance system in Lazio, Italy, and to analyze exposure patterns and time trends of HIV serodiagnoses from January 1985 to December 1994.

**Methods.** A linkage procedure made it possible to identify newly diagnosed HIV cases. Anonymous information was collected on demographic and exposure factors for each individual.

**Results.** Of 35 425 reports, 13 660 were newly diagnosed HIV cases, 70.9% of them in men. The proportion of women increased at the beginning of the study period (the male:female ratio declined from 3.5 in 1985 to 2.6 in 1986) and then remained stable. The proportion of subjects reporting heterosexual exposure, in men and women, respectively, increased from 1.5% and 2.0% in 1985 to 21.2% and 60.8% in 1994. Starting in 1992, heterosexual contact has become the main transmission route for women.

**Conclusions.** A changing pattern in the HIV epidemic is emerging, with a shift in the incidence of HIV diagnosis from "core" high-risk groups (drug injectors) to the large low-risk population (the general population) exposed through heterosexual transmission. This is probably occurring in other areas (e.g., large urban centers in the United States) with a similar epidemiological situation. (*Am J Public Health.* 1997;87:1654-1658)

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## Introduction

Given the long and varying incubation time between human immunodeficiency virus (HIV) infection and the onset of acquired immunodeficiency syndrome (AIDS), surveillance systems based on AIDS cases provide a delayed and possibly distorted picture of the spread of HIV.<sup>1</sup> The apparently changing pattern of AIDS distribution, from small high-risk groups to the whole general population,<sup>2-4</sup> has already demonstrated the need for supplementing AIDS surveillance with HIV monitoring systems.<sup>3,5,6</sup> HIV surveillance systems that describe the distribution of the currently infected population and reflect the patterns of HIV transmission can provide timely indications for public health interventions.<sup>7-11</sup>

In Italy, reporting of AIDS cases is mandatory at the national level; however, surveillance for HIV infection has not been mandated nationally. Because HIV testing became widely available in early 1985 in Lazio (a region of 5 million inhabitants and including Rome), a laboratory-based HIV surveillance system was instituted by regional law in that year. Thus, Lazio is one of the few Italian regions where reporting a diagnosis of HIV infection to the health authority is mandated.<sup>12-14</sup>

The HIV epidemic in Rome and in Italy has been similar, respectively, to what has been reported in other metropolitan areas (e.g., New York City, Edinburgh) and in other countries (e.g., Spain) since its beginnings among the drug-injecting population.<sup>15</sup> Apparently, AIDS surveillance in Lazio has reported an increasing incidence of cases and a stable proportion of 60% of cases attributable to injection drug users.

We report here on the changing pattern of the HIV epidemic in Lazio, as monitored during the 10 years of activity of the HIV surveillance system.

## Materials and Methods

The mandatory surveillance system for HIV infection in Lazio is based on the anonymous and systematic notification to the regional Department of Epidemiology of individual HIV-positive tests from public and private laboratories and blood banks. Seropositivity is defined as a positive result on two consecutive assays for HIV antibodies performed with commercially available, second-generation immunoenzymatic tests and confirmed by a positive Western blot analysis<sup>16</sup> on the same serum sample.

At the beginning of the surveillance system, the test was available on request from infectious disease specialists, and the person tested was charged a set fee. Starting in December 1988, because of both new knowledge about the natural history of the epidemic and public health recommendations,<sup>17,18</sup> the HIV testing activities of the National Health System underwent a major reorganization: access

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This paper was accepted December 18, 1996.

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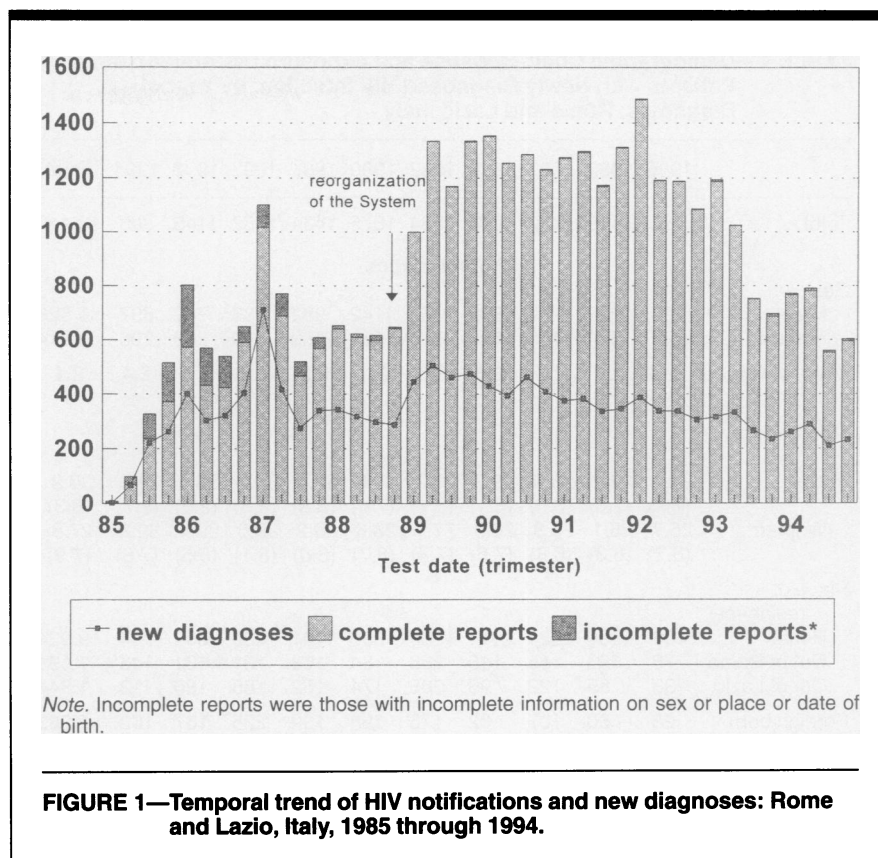
to confidential testing was encouraged, the test became free of charge and easily accessible, and the use of blood banks as testing sites was discouraged. Testing on personal request has been made possible with pre- and posttest counseling. The surveillance system has consequently had to be updated and reorganized.

Now, laboratories fill out standardized individual forms with demographic information and test results. The individual information collected includes sex, date and place of birth, place of residence, exposure group, date of test, and date of the last negative test (when available). The forms are sent to AIDS units, where the test results are given to patients, who are also provided with counseling. The AIDS units also fill in the additional information on risk factors, which is obtained through direct interview. An anonymous copy of the notification is then sent to the Department of Epidemiology. Computer procedures support the information system at the regional level and in some local AIDS units.

Up to four exposure categories can be reported in each notification. For routine data monitoring, an exposure category is attributed to each subject by means of a standard procedure that results in the following hierarchical, mutually exclusive groups: transfusion of blood or blood products, injection drug use, homosexual/bisexual exposure, heterosexual exposure, and mother-to-child transmission. For subjects with more than one reported test, the earliest valid exposure category is considered. The reliability of such information between two consecutive tests of the same person has been found to be satisfactory ( $K$  statistic  $> .76$ ).<sup>19</sup>

A linkage procedure, based on sex and on date and place of birth, is routinely performed on the test reports to identify multiple notifications attributable to the same subject. This generates a file of "incident" diagnoses of HIV infection, which contains anonymous information on individual persons and is periodically updated. Overlinkage error may occur, however, as a consequence of this procedure; it has been estimated that from 1985 to 1986, such error resulted in an underestimation of about 1.5% of the actual number of new diagnoses, and that by 1992, this figure had increased to 6%.<sup>19</sup> To guarantee confidentiality, this file is protected with safety procedures and can be accessed only for the purpose of surveillance; no information is available for linkage with personal data.

For the purposes of the present study and to allow for reporting delay, the data



from tests performed from January 1, 1985, to December 31, 1994, and reported up to June 30, 1995, were analyzed.

## Results

Between January 1, 1985, and December 31, 1994, the HIV surveillance system received 35 425 notifications. Temporal trends of new diagnoses and notifications are presented in Figure 1. Frequency of notifications rose sharply, reaching a first peak of 1100 at the beginning of 1987; then from 1989 through 1991, the mean number of notifications rose and stabilized at approximately 1250 per trimester, after which it decreased continuously to the end of 1994. The observed peak in 1987 corresponds to the period that mathematical modeling, back calculation, and multiple imputation techniques have indicated as that of maximum HIV incidence in Lazio and in Italy.<sup>20-22</sup> Nevertheless, the peak can also be partially attributable to the testing of prevalent cases infected before 1985. The increase in 1989 was likely due to reorganization of the system.

The linkage procedure performed during this entire period on notifications with no missing data on the linkage variables produced an estimate of 13 440

newly diagnosed HIV patients. Table 1 shows the demographic characteristics and exposure distribution over time of these patients. Overall, 9526 (70.9%) of the new diagnoses were in men and 3914 (29.1%) were in women. The estimated yearly incidence of positive tests (rates  $\times 10\ 000$ ) for the resident population aged 15 to 44 was 7.0 and 3.4 in 1986, 7.6 and 4.3 in 1990, and 4.6 and 2.2 in 1994 in men and women, respectively (data not shown). The number of new HIV diagnoses, in men and women, respectively, decreased from 1142 and 533 in 1990 to 697 and 296 in 1994. Over the study period, the male/female ratio declined from 3.5 in 1985 to 2.6 in 1986 and then remained stable. Overall, mean age at diagnosis was 30.9 for men and 27.8 for women. In both men and women, mean age at diagnosis increased from 1985 to 1994; however, men were consistently older than women (27.9 vs 25.7 in 1985, 34.8 vs 30.2 in 1994). The proportion of reported Italian-born patients residing outside Lazio increased over time, from 6.4% in 1985 to 11.7% in 1994. The proportion of patients born outside Italy also increased considerably during the period, from 4.2% in 1985 to 16.4% in 1994.

Among men with complete information on exposure ( $n = 7805$ ), 5530

**TABLE 1—Demographic Characteristics and Exposure Distribution of Patients with Newly Diagnosed HIV Infection, by Year of Diagnosis: Rome and Lazio, Italy**

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	Total
Total	552	1419	1742	1244	1884	1675	1434	1352	1145	993	13 440
<b>Characteristics</b>											
Sex											
Male	429	1028	1277	899	1357	1142	982	933	782	697	9 526
Female	123	391	465	345	527	533	452	419	363	296	3 914
Male:female ratio	3.5	2.6	2.7	2.6	2.6	2.1	2.2	2.2	2.2	2.4	2.4
Mean age, y (SD)											
Men	27.9 (7.4)	28.2 (7.0)	28.9 (6.6)	29.3 (8.1)	30.7 (8.1)	31.0 (7.6)	32.3 (8.8)	32.7 (8.5)	33.5 (9.5)	34.8 (9.7)	30.9 (8.3)
Women	25.7 (6.7)	25.1 (6.3)	26.8 (6.8)	26.3 (7.8)	27.1 (7.8)	28.6 (8.7)	28.2 (8.0)	29.6 (8.1)	29.4 (8.5)	30.2 (7.8)	27.8 (7.9)
Place of residence <sup>a</sup>											
Rome	409	1090	1325	814	1358	1296	1101	1028	809	704	9 934
Out of Rome	76	193	155	145	268	184	163	131	131	145	1 591
Out of Lazio	33	85	122	95	205	174	152	185	180	113	1 344
Foreign born	23	50	107	82	176	198	192	225	167	163	1 383
<b>Exposure category<sup>a</sup></b>											
Men											
Injection drug user	292	661	884	619	744	654	536	461	387	292	5 530
Homosexual/bisexual	38	85	111	71	196	161	143	168	119	119	1 211
Heterosexual	5	15	33	28	84	81	107	123	105	120	701
Other	8	46	43	38	57	42	31	34	29	35	363
Women											
Injection drug user	94	263	287	187	226	224	172	144	127	76	1 800
Homosexual/bisexual	0	0	0	0	0	1	0	0	0	0	1
Heterosexual	2	29	75	61	130	127	143	164	132	135	998
Other	5	33	26	38	57	31	28	16	25	11	270

<sup>a</sup>Totals vary because of missing values.

(70.9%) reported injection drug use as their main exposure. However, this proportion decreased from 85.1% in 1985, to 68.8% in 1989, to 51.6% in 1994. On the other hand, the proportion of men who reported having sex with other men increased from about 9% in 1988 to 21% in 1994 (Table 1). The proportion of men reporting heterosexual contacts also increased during the period (from 1.5% in 1985, to 7.8% in 1989, to 21.2% in 1994). On the whole, injection drug use as mode of infection reached a peak in 1987 and has been declining since then, whereas the sexual route of transmission increased until 1989 and then remained constant at more than 40% of the diagnoses throughout 1989 to 1994 (Figure 2).

Among women whose exposure category was known (n = 3069), 58.7%

reported injection drug use. However, this proportion decreased dramatically over time (from 93.1% in 1985, to 54.7% in 1989, to 34.2% in 1994) contemporaneously with a comparable increase in heterosexual transmission (60.8% of all female cases in 1994). Among women, sexual exposure overtook injection drug use in 1992 and subsequently remained the primary mode of exposure (Figure 2).

## Discussion

Results from 10 years' operation of the surveillance system for HIV infection in Lazio show a peak in the incidence of notifications and new diagnoses in 1987, a plateau following system reorganization in 1988, and a decline in both notifications and new diagnoses from 1992 on. There is

also evidence that new diagnoses among injection drug users decreased and that those attributable to sexual transmission, especially among women, increased.

To assess the prevalence of HIV infection, capture-recapture methods were applied to the surveillance data set. The estimates of prevalent cases of HIV infection changed from 10 151 (95% confidence interval [CI] = 8122, 12 180) in men and 3406 (95% CI = 2479, 4333) in women in 1990 (male:female ratio = 3.0)<sup>23</sup> to 10 955 (95% CI = 8597, 13 313) in men and 5988 (95% CI = 3696, 7980) in women in 1992 (male:female ratio = 1.8).

The decline in HIV diagnoses observed since 1992 is a new finding that deserves consideration. It is mainly due to the early "saturation" of the injection drug-using population with HIV infection. The high prevalence of HIV infection in this group, together with the group's peculiar sex and age structure (male:female ratio = 4, proportion younger than age 35 = 85%), leads to a high potential for sexual transmission, especially from male injectors to non-drug-using women.

Validity problems should be considered, however, when one evaluates trends by exposure category. Because it can be influenced by individual or health service characteristics or both, the lead time between HIV infection or seroconversion and the first diagnosis of HIV varies over time and between population groups. From the early stages of the epidemic, drug users attending treatment centers have been offered and actively encouraged to have HIV testing, according to the provisions of the National Health System in Italy. Although injection drug users who are currently in treatment represent only 47% of the estimated overall population of injection drug users, more than 84% of "street" drug users who were not in treatment and were interviewed reported having been in treatment at least once in the past.<sup>24</sup> Therefore, it can be assumed that the surveillance system's sensitivity in detecting new cases of HIV infection among injection drug users has been high and that the interval between infection and diagnosis has been relatively short and stable over time.

This may not have been true for other population groups. At the beginning of the observed epidemic during the 1980s, AIDS in Italy was mislabeled by the media as "the gay disease," and there was a strong emphasis on testing men with homosexual behavior. In more recent

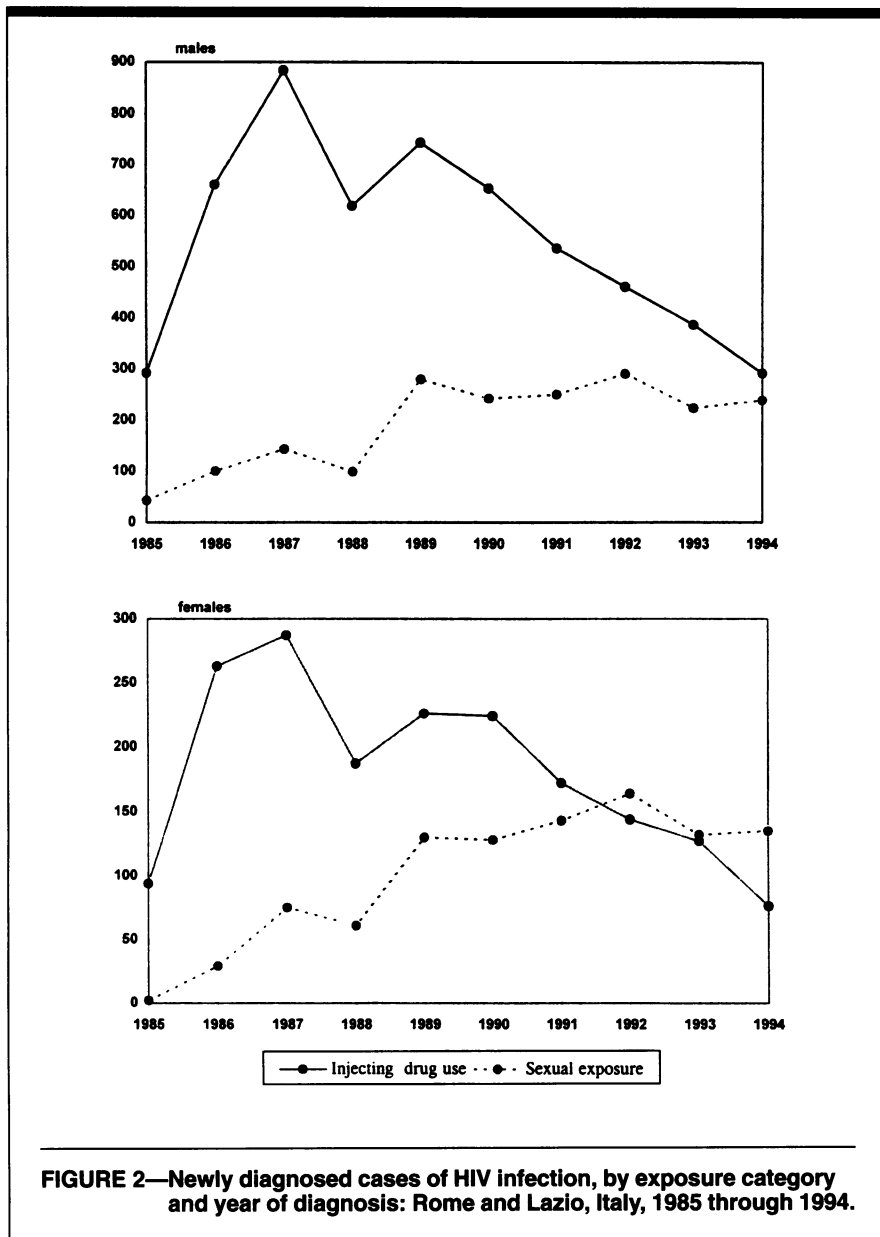


FIGURE 2—Newly diagnosed cases of HIV infection, by exposure category and year of diagnosis: Rome and Lazio, Italy, 1985 through 1994.

years, the emphasis has switched to drug users and heterosexuals, with a relative relaxation of testing pressure on homosexual men. In other words, for men who have sex with other men, the surveillance system may have had a higher sensitivity and a shorter lead time between infection and diagnosis at the beginning of the epidemic and a lower sensitivity and higher specificity in more recent years. For women, on the other hand, testing activity was extremely low during the first years of the epidemic (low sensitivity, long lead time) and then sharply increased during the 1990s (higher sensitivity, shorter lead time).

It must also be considered that, owing to the hierarchical procedure, all HIV-infected individuals reporting drug

injection have been automatically classified as injection drug users unless a blood transfusion from an HIV-positive donor has been documented. Moreover, in Italy it was estimated that 10% and 30% of HIV infections among male and female injection drug users, respectively, could be attributable to heterosexual transmission.<sup>20,25</sup> This would make the actual decrease in the proportion of cases due to injection drug use even greater than the observed one.

In addition, HIV-infected men are nowadays less likely to report sex with other men, even if a homosexual contact was the actual modality of transmission. In fact, from repeatability analysis of risk factors, it emerged that of the men who reported homosexual contact at the first

test, 22.1% had reported an HIV exposure other than homosexual contact.

In conclusion, given the limited and variable validity of exposure information, HIV surveillance data by risk group should always be interpreted with caution. However, as expected from epidemic modeling,<sup>20</sup> our results support the hypothesis that the HIV epidemic in Lazio is moving away from injection drug users, who are mainly men, to non-drug-using women. Prevention campaigns should continue to focus on injection drug users in order to avoid a slower but possibly much larger epidemic. However, the costs and benefits of HIV surveillance systems must be carefully evaluated in relation to local needs and resources before we can make specific recommendations on their effectiveness in monitoring the HIV epidemic. □

### Acknowledgments

This study was partially funded by grants from the Progetto AIDS, Ministero della Sanità—Istituto Superiore di Sanità, Rome, Italy, from 1990 to 1995.

The authors thank Dr Francesco Forastiere for his comments.

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