

- Risk factors for primary invasive *Haemophilus influenzae* disease: increased risk from day care attendance and school aged household members. *J Pediatr.* 1985;106:190-195.
12. Anderson LJ, Parker RA, Strikas RA, et al. Day-care center attendance and hospitalization for lower respiratory tract illness. *Pediatrics.* 1988;82:300-308.
 13. Berg AT, Shapiro ED, Capobianco LA. Group day care and the risk of serious infectious illnesses. *Am J Epidemiol.* 1991;133:154-163.
 14. Pass RF, Hutto C, Ricks R, et al. Increased

- risk of cytomegalovirus infection among parents of children attending day care centers. *N Engl J Med.* 1986;314:1414-1418.
15. McGullagh P, Nelder JA. *Generalized Linear Models.* London: Chapman and Hall; 1983.
 16. SAS Institute Inc. *SAS/STAT User's Guide.* Version 6, 4th ed, Vol 2. Cary, NC: SAS Institute Inc; 1989:1168-1173.
 17. Miettinen OS. Proportion of disease caused or prevented by a given exposure, trait or intervention. *Am J Epidemiol.* 1974;99:325-332.
 18. Wald ER, Guerra N, Byers C. Frequency

- and severity of infections in day care. *J Pediatr.* 1988;112:540-546.
19. Hardy AM, Fowler MG. Child care arrangements and repeated ear infections in young children. *Am J Public Health.* 1993;83:1321-1325.
 20. Haskins R, Kotch J. Day care and illness. Evidence, costs and public policy. *Pediatrics.* 1986;77(suppl.):951-982.
 21. Petridou E, Kassimos D, Kalmanti M, et al. Age of exposure to infections and risk of childhood leukaemia. *BMJ.* 1993;307:774.
 22. *Statistical Yearbook of Finland 1992.* Helsinki, Finland: Valtion painatuskeskus; 1992.

ABSTRACT

This study assessed the concordance between the transmission classification of 725 acquired immunodeficiency syndrome (AIDS) cases by the Italian AIDS Registry (the national surveillance system) and the classification of the same cases by the Italian Cooperative Group on AIDS-Related Tumors. A high degree of concordance emerged for intravenous drug users in both sexes ($\kappa = 0.88$; 95% confidence interval [CI] = 0.84, 0.92), for homosexual men ($\kappa = 0.83$; 95% CI = 0.79, 0.87), and for persons infected through contaminated blood or blood derivatives ($\kappa = 1.00$). The concordance was lower among heterosexual men ($\kappa = 0.51$; 95% CI = 0.37, 0.65) and especially among men whose risk group was not determined ($\kappa = 0.28$; 95% CI = 0.12, 0.44). The discrepancies observed among heterosexual men indicate a need for continuing and accurate monitoring of AIDS reporting by transmission category. (*Am J Public Health.* 1995;85:1112-1114)

The Classification of AIDS Cases: Concordance between Two AIDS Surveillance Systems in Italy

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Introduction

The prevention and control of human immunodeficiency virus (HIV) infection depends on the completeness and accuracy of case ascertainment and reporting. However, several sources of error—such as underreporting—affect acquired immunodeficiency syndrome (AIDS) surveillance data.¹ These limitations are more severe when the spread of HIV is studied separately in different risk groups. The potential for the heterosexual spread of the virus in the general population, for instance, plays a major role in forecasting the heterosexual diffusion of AIDS in Western countries. Such predictions, however, have provided conflicting results because of a great uncertainty in the interpretation of time trends among heterosexuals.²

Few studies have focused on the reproducibility of the classification of AIDS cases as classified by HIV transmission categories. To study this, we examined 725 Italian AIDS cases for whom two independent sources of information on risk group were available: the Italian AIDS Registry and the Italian Cooperative Group on AIDS-Related Tumors.

Methods

In Italy, AIDS cases are compulsorily reported to the Italian AIDS Registry, the national surveillance system located at the

Istituto Superiore di Sanità in Rome.³ At the time of AIDS diagnosis, information on the patient's sociodemographic characteristics, medical condition, and risk factors for HIV infection are collected by interview and are registered on a standard form by the medical staff who report the case. After the risk factors are evaluated, the registry staff classifies each case into one HIV transmission category according to a hierarchical order based on the frequency of cases (i.e., intravenous drug users, homosexual men, homosexual men who are intravenous drug users, recipients of blood or blood derivatives, and heterosexuals).³ In the absence of a history of intravenous drug abuse and/or homosexual intercourse (for men) and in accordance with the suggestion of the European Centre for the Epidemiological Monitoring of AIDS in Paris, HIV infection is attributed to heterosexual transmission if the patient reported (1) origin from a country where heterosexual transmission of HIV is predominant; (2) sexual

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TABLE 1—Classification according to HIV Transmission Category of 725 AIDS Cases in the Italian AIDS Registry and in the Italian Cooperative Group on AIDS-Related Tumors, by Sex, 1982 through 1993

HIV Transmission Category: Cooperative Group on AIDS-Related Tumors	HIV Transmission Category: AIDS Registry						Total No.
	No. (%) Intravenous Drug Users	No. (%) Homosexuals and Bisexuals	No. (%) Homosexuals and Intravenous Drug Users	No. (%) Blood Recipients	No. (%) Heterosexuals	No. (%) Not Determined	
Men							
Intravenous drug users	243 (94)	7 (3)	7 (23)	0 (0)	5 (13)	0 (0)	262
Homosexuals and bisexuals	3 (1)	233 (88)	4 (13)	0 (0)	7 (18)	10 (33)	257
Homosexuals and intravenous drug users	7 (3)	1 (0)	19 (63)	0 (0)	1 (3)	0 (0)	28
Blood recipients	0 (0)	0 (0)	0 (0)	10 (100)	0 (0)	0 (0)	10
Heterosexuals	1 (0)	13 (5)	0 (0)	0 (0)	24 (62)	11 (37)	49
Not determined	6 (2)	11 (4)	0 (0)	0 (0)	2 (5)	9 (30)	28
Total	260	265	30	10	39	30	634
Women							
Intravenous drug users	60 (95)	...	...	0 (0)	3 (16)	0 (0)	63
Blood recipients	0 (0)	...	...	3 (100)	0 (0)	0 (0)	3
Heterosexuals	2 (3)	...	...	0 (0)	16 (84)	2 (33)	20
Not determined	1 (2)	...	...	0 (0)	0 (0)	4 (67)	5
Total	63	...	...	3	19	6	91

intercourse with a person belonging to known risk groups; (3) sexual intercourse with an HIV-positive person, whether or not the partner is known to belong to a risk group; or (4) infection through sexual intercourse with partner(s) on whom information is not available (e.g., prostitutes, or men who have sex with prostitutes or with multiple partners).⁴ AIDS cases with insufficient information are classified as "not determined," and an active reclassification of such cases is periodically carried on by the registry.³

The Italian Cooperative Group on AIDS-Related Tumors is a voluntary group established in 1986 with the aim of studying, from several points of view, the neoplasms that develop in patients infected with HIV.⁵ When the neoplasm is diagnosed, the staff in charge of the patient conducts an interview to determine, among other clinical, pathological, and epidemiological information, the patient's history of intravenous drug use, homosexual and heterosexual intercourse, and transfusion of blood or of blood derivatives. The classification of each patient into HIV transmission categories is made at the Epidemiology Unit of the Aviano Cancer Centre in northeastern Italy according to the same method adopted by the AIDS Registry.

A linkage of the 846 patients reported to the Cooperative Group with the

16 860 AIDS cases reported to the AIDS Registry up through March 1993 allowed the identification of 725 cases (634 men, mean age = 35; 91 women, mean age = 31) listed in both files. The degree of agreement between the AIDS Registry's and the Cooperative Group's classification of HIV transmission category for these 725 cases was assessed using the kappa (κ) coefficient and its 95% confidence interval (CI).⁶

Results

Of the 260 males classified as intravenous drug users in the AIDS Registry, 243 (94%) were similarly classified in the Cooperative Group ($\kappa = 0.88$; 95% CI = 0.84, 0.92) (Tables 1 and 2). A similar level of agreement between the two sources emerged for homosexual men ($\kappa = 0.83$; 95% CI = 0.79, 0.87), whereas for homosexuals who were also intravenous drug users, the concordance of the two classifications was lower ($\kappa = 0.64$; 95% CI = 0.50, 0.78) (Table 2).

A total agreement was found for cases infected by blood or blood derivatives ($\kappa = 1.00$), but some discrepancies turned out in the classification of heterosexual men. The Cooperative Group agreed on 62% of the 39 men coded as heterosexuals in the AIDS Registry ($\kappa = 0.51$; 95% CI = 0.37, 0.65), while 34% of the men coded as heterosexuals in

the AIDS Registry were classified as intravenous drug users, homosexuals, or both in the Cooperative Group (Tables 1 and 2). The lowest degree of concordance was registered for men whose risk group was not determined. Of 30 such men in the AIDS Registry, only 9 (30%) were similarly coded by the Cooperative Group ($\kappa = 0.28$; 95% CI = 0.12, 0.44), while of the remaining 21, 11 (37%) were classified as heterosexuals and 10 (33%) were classified as homosexuals by the Cooperative Group (Table 1).

Among the 91 women with AIDS included in the present study, the Cooperative Group and AIDS Registry classifications agreed in 95% of intravenous drug user cases ($\kappa = 0.85$; 95% CI = 0.73, 0.97) and 84% of heterosexual cases ($\kappa = 0.77$; 95% CI = 0.61, 0.93) (Tables 1 and 2).

The kappa coefficients of the three combinations of "not determined" plus intravenous drug users, homosexual men, and heterosexuals were also computed. Only the addition of the heterosexual category to those not determined led to a substantial elevation of the kappa coefficient in males (from 0.28 to 0.58, Table 2).

Discussion

Transmission categories for HIV infection are derived from behaviors that are difficult to explore and are not

TABLE 2—Concordance of the Classification of HIV Transmission Category in 725 AIDS Cases between the Italian AIDS Registry and the Italian Cooperative Group on AIDS-Related Tumors, by Sex, 1982 through 1993

HIV Transmission Category	Men		Women		Total	
	κ	95% CI	κ	95% CI	κ	95% CI
Intravenous drug users	0.88	0.84, 0.92	0.85	0.73, 0.97	0.88	0.84, 0.92
Homosexuals and bisexuals	0.83	0.79, 0.87	...	...	...	...
Homosexuals and intravenous drug users	0.64	0.50, 0.78	...	...	...	...
Blood recipients	1.00		1.00		1.00	
Heterosexuals	0.51	0.37, 0.65	0.77	0.61, 0.93	0.59	0.47, 0.71
Not determined	0.28	0.12, 0.44	0.71	0.32, 0.95	0.34	0.18, 0.50
Intravenous drug users + not determined	0.80	0.76, 0.84	0.79	0.65, 0.93	0.80	0.76, 0.84
Homosexuals + not determined	0.83	0.79, 0.87	...	...	...	...
Heterosexuals + not determined	0.58	0.46, 0.70	0.83	0.74, 0.98	0.65	0.57, 0.73

mutually exclusive. Thus, in the absence of a gold standard for the classification of AIDS cases into transmission categories, the comparison of different sources of information on risk factors for HIV infection is of special interest.

In the present study, a satisfactory degree of concordance between two independent sources of classification was found for the major risk groups: intravenous drug users in both sexes and homosexual men. A lower level of concordance emerged, however, for the heterosexual and not-determined categories of men. These results are in agreement with those from a previous study on the reliability of exposure definition in Italy,⁷ and they suggest, as already reported in both Italy⁸ and the United States,⁹ that substantial and similar proportions of subjects with no identified risk factors may actually have been infected through heterosexual or homosexual intercourse.

The low level of concordance between the AIDS Registry and the Cooperative Group with respect to the heterosexual and not-determined categories of men cannot be attributed to the use of different definitions. Intravenous drug users and homosexual men tend to report heterosexual exposure as the mode of acquiring HIV infection to avoid the social stigmatization related to these habits, and risk factors may be identified only after the case has been reported to the surveillance system. Moreover, since the Italian surveil-

lance system only recently began using for classification purposes information about sexual intercourse with prostitutes and promiscuous heterosexual partners,^{3,4} the report of sexual exposures is likely to have suffered in the past from a lack of completeness and accuracy.

The present group of 725 AIDS cases with cancers is not representative of the totality of Italian cases, and inferences based on kappa values suffer from methodological drawbacks.¹⁰ Moreover, the small number of cases found in the not-determined transmission category, in particular among women, create wide variability in the estimation of the degree of reproducibility. With these limitations in mind, however, the results of the present study imply that, in Italy, the disagreement on risk group classifications has selectively affected the heterosexual and not-determined categories of men. As was similar to findings from southern Florida,¹¹ most of the Italian men coded as heterosexuals in the AIDS Registry file—but not in the Cooperative Group file—were coded in the latter as intravenous drug users or homosexuals. Some discrepancies between the two files in the classification of heterosexual and not-determined transmission also appeared among women, but the small number of cases under investigation severely limited a deeper analysis.

In conclusion, the degree of concordance between the AIDS Registry's and the Cooperative Group's classification of

AIDS cases according to risk group was high overall, with the noteworthy exception being the heterosexual and not-determined categories of men. As the AIDS epidemic continues to grow, increasing efforts should be directed toward actively monitoring the reporting of AIDS cases according to transmission categories. This is especially true for the heterosexual group, as surveillance data provide crucial information on the evolving epidemic among heterosexually acquired cases. □

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References

- Buehler JW, Berkelman RL, Stehr-Green JK. The completeness of AIDS surveillance. *J Acquir Immune Defic Syndr*. 1992;5:257-264.
- Anderson R. AIDS: trends, predictions, controversy. *Nature*. 1993;363:393-394.
- Commissione Nazionale per la Lotta contro l'AIDS. Il sistema di sorveglianza dell'AIDS. *Giornale Italiano dell'AIDS*. 1992;3:141-148.
- Aggiornamento dei casi di AIDS con clamato notificati in Italia al 31 dicembre 1993. Rome, Italy: Notiziario dell'Istituto Superiore di Sanità; 1994.
- Tirelli U, Carbone A, Monfardini S, et al. Malignant tumors in patients with human immunodeficiency virus infection: a report of 580 cases. *J Clin Oncol*. 1989;7:1582-1583.
- Rosner B; Payne M, ed. *Fundamentals of Biostatistics*. Boston, Mass: Duxbury Press; 1986:424-429.
- Rapiti E, Perucci CA, Sangalli D, Abeni D, Carboni A, Miceli M. Reliability of exposure definition in surveillance systems of HIV infection. Ninth International Conference on AIDS; June 6-11, 1993; Berlin, Germany. Abstract PO-C27-3247.
- Zaccarelli M, Salmaso S, Urcioli R, Greco D. Indagine sui casi italiani di AIDS con fattore di rischio indeterminato. *Giornale Italiano dell'AIDS*. 1991;2:38-42.
- Castro KG, Lifson AR, White CR, et al. Investigations of AIDS patients with no previous identified risk factors. *JAMA*. 1988;259:1338-1342.
- Kelsey LK, Thompson WD, Evans AS. *Methods in Observational Epidemiology*. New York, NY: Oxford University Press; 1986:292.
- Nwanyanwu OC, Conti LA, Ciesielski CA, et al. Increasing frequency of heterosexually transmitted AIDS in southern Florida: artifact or reality? *Am J Public Health*. 1993;83:571-573.