

HIV Infection in Homosexual and Bisexual Men 18 to 29 Years of Age: The San Francisco Young Men's Health Study

ABSTRACT

Objectives. Recent studies suggest very high human immunodeficiency virus (HIV) infection rates in some populations of younger homosexual men, but these studies may represent only particularly high-risk populations. The current study obtained population-based data on the HIV epidemic in young homosexual/bisexual men.

Methods. A household survey of unmarried men 18 through 29 years of age involved a multistage probability sample of addresses in San Francisco. A follow-up interview and HIV test for men who were HIV negative at baseline were completed; the median follow-up was 8.9 months.

Results. Sixty-eight of 380 homosexual/bisexual men (17.9%) tested HIV seropositive. Sixty-three percent of men reported one or more receptive anal intercourse partners in the previous 12 months, and 41% of those men did not use condoms consistently. The HIV seroincidence rate among those seronegative at first study was 2.6% per year.

Conclusions. HIV infection rates in young homosexual men in San Francisco are lower than those in the early 1980s; however, the rate of infection in these men, most of whom became sexually active after awareness of AIDS had become widespread, threatens to continue the epidemic in the younger generation at a level not far below that of a decade ago. (*Am J Public Health*. 1994;84:1933-1937)

Dennis H. Osmond, PhD, Kimberly Page, MPH, James Wiley, PhD, Karen Garrett, MA, Haynes W. Sheppard, PhD, Andrew R. Moss, PhD, Lewis Schragger, MD, and Warren Winkelstein, MD

Introduction

Human immunodeficiency virus (HIV) infection in San Francisco has been studied in three prospective cohort studies of homosexual/bisexual men. The rate of new HIV infections in these cohorts declined substantially in the mid-1980s and has been estimated at 0.8% to 0.9% per year in recent years.¹⁻⁴ Similar reductions in risk behavior and HIV seroconversion rates have been reported from cohorts of homosexual men in other cities.^{5,6} The median age of the men in these cohorts, however, is now close to 45 years, and the youngest men are more than 30 years old. They therefore are unable to provide information on HIV infection rates in young gay men.

A recent study conducted by the Department of Public Health in San Francisco found that HIV seroprevalence was 12% among men 17 to 22 years old recruited from bars, dance halls, and public parks.⁷ The men tested were probably at higher risk than the broad community of young homosexual/bisexual men in San Francisco. In addition, there have been reports of an increase in unsafe sexual behavior among homosexual men in San Francisco and elsewhere.⁸⁻¹⁰ For these reasons, we undertook the San Francisco Young Men's Health Study, a population-based investigation of HIV infection and risk behaviors among homosexual/bisexual men 18 to 29 years of age.

Methods

San Francisco Young Men's Health Study

The San Francisco Young Men's Health Study is a survey of HIV infection

and behavior based on a multistage probability sample of single men 18 to 29 years of age residing in households from the 21 census tracts in San Francisco with the highest number of cumulative acquired immunodeficiency syndrome (AIDS) cases in 1992. It is modeled on the San Francisco Men's Health Study, a multistage probability sample drawn in 1984 of single men 25 to 54 years of age.¹¹ All households in the 21 census tracts were listed, and a multistage sample was drawn of 6671 addresses, of which 6186 proved to be eligible households. Unmarried, English-speaking men between 18 and 29 years of age at the time of contact were eligible. Sample weights were assigned to each participant on the basis of (1) the probability that the housing unit would fall into the sample and (2) the response rate.

Follow-up HIV testing of subjects initially seronegative is ongoing, and a preliminary estimate of the seroconversion rate was available from the first wave

Dennis H. Osmond and Andrew R. Moss are with the Division of Epidemiology and Medicine, San Francisco General Hospital, University of California, San Francisco Medical Center. Kimberly Page and Warren Winkelstein are with the School of Public Health, Division of Epidemiology and Population Biology, and Karen Garrett and James Wiley are with the Survey Research Center, the University of California, Berkeley. Haynes W. Sheppard is with the California Department of Health Services, Berkeley. Lewis Schragger is with the National Institute of Allergy and Infectious Diseases, Bethesda, Md.

Requests for reprints should be sent to Dennis H. Osmond, PhD, Box 1347, Division of Epidemiology and Medicine, San Francisco General Hospital, University of California, San Francisco Medical Center, San Francisco, CA 94143-1347.

This paper was accepted August 16, 1994.

TABLE 1—HIV Seroprevalence by Demographic Characteristics, San Francisco Young Men's Health Study

	n	HIV Positive, No. (%)	95% CI
Age			
18–23	84	4 (4.8)	0.2, 9.3
24–26	149	16 (10.7)	5.7, 15.6
27–29	187	54 (28.9)	22.4, 35.3
Total	420	74 (17.6)	14.0, 21.2
Race/ethnicity			
Black	20	7 (35.0)	14.1, 55.9
Asian ^a	26	7 (26.9)	9.9, 43.9
Hispanic	36	9 (25.0)	10.9, 39.1
White	322	50 (15.5)	11.5, 19.5
Other	14	1 (7.1)	0.0, 20.6
Education			
High school or less	63	22 (34.9)	23.1, 46.7
1–4 y college	170	28 (16.5)	10.9, 22.1
> 4 y college	186	24 (12.9)	8.1, 17.7

^aIncludes Filipino/Pacific Islanders; 6/12 (50%) were HIV positive.

of follow-up examinations. In addition, we estimated HIV seroincidence rates among all of the subjects tested at baseline using the number seropositive as the numerator and the estimated number of years sexually active and HIV negative as the denominator. The denominator was estimated from subjects' self-reported date of first regular sexual activity with men and the date of their first HIV-positive test (if they were seropositive) or the date of the interview (if they were seronegative). A minimum age of 16 years was set for age first at risk because some subjects reported that they had first engaged in regular sex with a male when they were as few as 4 years old (such ages probably do not reflect years at risk for HIV). This method only approximated seroincidence rates, as the date of seroconversion for positives was generally not known.

A sample of peripheral blood was obtained on filter paper by finger stick.¹² Samples were tested for HIV antibodies at the California Department of Health Services Viral and Rickettsial Disease Laboratory (Berkeley, Calif) with enzyme-linked immunosorbent assay (ELISA) (Organon Teknika, Durham, NC), and specimens positive on ELISA were confirmed with Western blot (Organon Teknika).

Ninety-five percent confidence intervals (CIs) were calculated for proportions assuming a normal distribution. Differences between proportions were analyzed with Fisher's exact tests for 2 × 2 tables

and chi-square tests for 2 × k tables. Associations of predictor variables with HIV seropositivity were examined in univariate tables and in multivariate models by means of logistic regression.

The protocol was approved by the Committee for the Protection of Human Subjects of the University of California, Berkeley.

Results

The baseline survey began in March 1992 and was completed in April 1993. Enumeration of 5801 (93.8%) households yielded 1387 eligible young single men, of whom 1076 (77.6%) completed the interview. Two hundred twenty-seven (16.4%) refused participation, 39 (2.8%) moved after enumeration, 31 (2.2%) had a language barrier, and 14 (1.0%) were never found at home. Among those interviewed, 428 (39.8%) either identified their sexual identification as homosexual/bisexual or reported sexual intercourse with a male in the previous 5 years. Three hundred eighty (88.8%) of the 428 homosexual/bisexual men consented to HIV testing. Forty of the 48 who declined testing self-reported their HIV status from a previous test, resulting in 420 men with a known HIV status.

Overall, 68 of 380 men (17.9%) tested in the study were HIV positive. The weighted seroprevalence estimate, calculated with individual weights for selection probability and participation rates within

TABLE 2—HIV Seroprevalence by Number of Receptive Anal Intercourse Partners in Previous 12 Months, San Francisco Young Men's Health Study

No. of Partners	n	HIV Positive, No. (%)	95% CI
0	149	13 (8.7)	4.2, 13.2
1	107	18 (16.8)	9.7, 23.9
2–4	100	15 (15.0)	8.0, 22.0
5–9	28	10 (35.7)	17.9, 53.5
≥ 10	33	18 (54.5)	37.5, 71.5
Unknown	3	0 (0)	...
Total	420	74 (17.6)	14.0, 21.2

the sampling units, was 17.88%. Because this estimate did not differ from the raw proportion seropositive, we used unweighted numbers throughout the remaining analyses. When self-reported HIV results were included, 74 of 420 (17.6%) were HIV positive, a nearly identical seroprevalence. Because the tabular results presented here were not different when self-reported HIV results were included, we have based the tables on all 420 men with a known HIV result.

HIV seropositivity increased sharply with increasing age (Table 1). Only 8 men less than 20 years of age fell into the sample. One was HIV positive. Seroprevalence also varied by race and ethnicity. Overall, the non-White/Hispanic prevalence was 24.5%, and the non-Hispanic White prevalence was 15.5%. Higher seroprevalence was inversely associated with years of education. If the 52 bisexual men who reported no date of first regular sex with men are removed from the analysis (these men were included because they reported at least one male partner in the previous 5 years), seroprevalence increases to 20.1%. All 52 were HIV seronegative.

Behavior Associated with HIV Infection

HIV seropositivity was associated with the number of sexual intercourse partners in the previous 12 months (data not shown) and, more strongly, with the number of persons with whom the respondent had been the receptive partner in anal intercourse (Table 2).

Risk from oral intercourse was difficult to examine separately from risk from receptive anal intercourse because the

number of oral receptive partners was highly correlated with the number of receptive anal intercourse partners (Pearson's $r = .75$). Among the 92 men who reported oral intercourse partners but no receptive anal intercourse partners, there was no association between HIV seropositivity and number of oral intercourse partners.

Sixty-three percent of the subjects (268) reported at least one partner with whom they had engaged in receptive anal intercourse in the previous 12 months, and 38% reported two or more. Fifty-eight percent (155/268) of those with at least one such partner reported using condoms all of the time; 20.8%, most of the time; 6.0%, some of the time; and 12.7%, none of the time. The HIV seropositivity rate was 16.1% in those always using condoms during receptive anal intercourse vs 32.5% among all other subjects reporting receptive anal intercourse.

A primary partner or "special relationship" was reported by 232 men (54.2%), of whom 60 (25.9%) also reported only one sexual partner during the prior 12 months. Among this latter group, HIV seroprevalence was 18.3%, not significantly different from the overall seroprevalence in the study. When this group was further divided into those who believed they were their partner's only sexual partner (referred to as "monogamous couples"; $n = 54$) vs those who were aware that their partner had other sexual partners ($n = 6$), seroprevalence was 18.5% in the former and 16.7% in the latter group, also not different from the overall seroprevalence.

Participants reporting a primary partner were asked whether they knew their partner's HIV antibody status. Such knowledge did not appear to be a factor in reducing high-risk sexual behavior. In fact, subjects were at least as likely to practice receptive anal intercourse if their primary partner was known to be HIV positive (25/30; 83.3%) as they were if he was HIV negative (90/135; 66.7%) ($P = .07$). Looking further at only those 30 partnerships in which the partner was known to be HIV positive, the subject's HIV status did not alter the frequency of receptive anal intercourse: 19 of these subjects were HIV negative and 16 (84.2%) practiced receptive anal intercourse with their seropositive primary partner, whereas 9 of the 11 subjects (81.8%) who were themselves HIV positive also practiced receptive anal intercourse with their primary partner.

Forty-four men (10.2%) reported a history of injection drug use, and 16 of these men were HIV positive (36.4%). The proportion who reported injection drug use did not vary significantly across age groups, and subjects reporting such drug use did not report more high-risk sexual behavior. Fifty-nine percent reported one or more partners with whom they engaged in receptive anal intercourse, and 29.5% reported two or more, slightly below the proportions for all study subjects. When the men reporting injection drug use were removed from the analysis, HIV seroprevalence was 15.4% (58/376).

Multivariate Analysis of Risk Factors

Number of sexual intercourse partners, number of receptive anal intercourse partners, injection drug use, age, race, education, and year of first regular sexual intercourse with men were significantly associated with HIV positivity in univariate analyses. Beginning regular sexual intercourse with men after 1985 was protective (odds ratio [OR] = 0.22, 95% CI = 0.12, 0.40, $P < .001$) and was used in place of age in multivariate analyses. A multivariate logistic regression model indicated that recent number of receptive anal intercourse partners, history of injection drug use, beginning regular sex with men before 1985, and non-White race were independently associated with being HIV seropositive (Table 3). Among the men who practiced receptive anal intercourse, using condoms all of the time had a significant protective effect after number of receptive anal intercourse partners had been controlled (OR = 0.50, 95% CI = 0.25, 1.0, $P = .05$). Reporting oral receptive intercourse in the previous 12 months had an odds ratio of 2.0 when added to this model but was not statistically significant ($P = .27$).

Comparison with the San Francisco Men's Health Study

The San Francisco Men's Health Study sampled homosexual/bisexual men 25 to 54 years of age in 1984; therefore, the age overlap with the current study was limited to the 25- to 29-year-old group. Within this age range, we compared HIV seroprevalence from the same San Francisco neighborhoods in 1993 with the seroprevalence in 1984.

Figure 1 compares the relative proportions who were HIV seropositive by reported number of sexual partners among 25- to 29-year-olds in the 1984 baseline

TABLE 3—Factors Independently Contributing to Risk of HIV Infection: Logistic Regression Model, San Francisco Young Men's Health Study

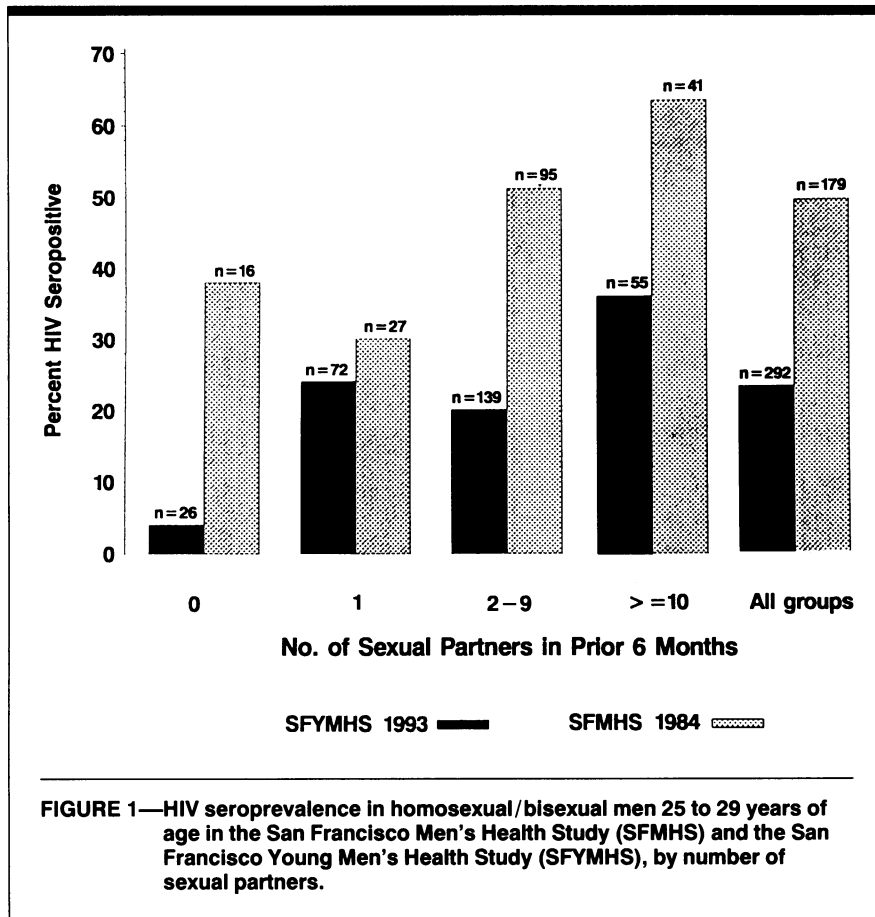
	Odds Ratio	95% CI	P
Receptive anal intercourse risk group			
0 partners	1.0
1 partner	2.8	1.2, 6.3	.01
2-9 partners	3.5	1.6, 7.8	.002
10+ partners	15.0	5.6, 39.8	.001
Regular sexual activity (began 1984 or earlier)	4.3	2.4, 8.3	<.001
Injection drug use (ever/never)	2.5	1.1, 5.7	.024
Race (non-White/White)	3.0	1.6, 5.7	<.001

examination of the San Francisco Men's Health Study (hatched bars) and the recently completed Young Men's Health Study (dark bars). Overall, 49% of men 25 to 29 years old were seropositive in 1984 compared with 22% in the Young Men's Health Study in 1993. The proportion positive in 1984 was about twice as high in each of the sexual partner groups except the group reporting only one partner (rates of 29.6% in 1984 and 23.0% in 1993).

Estimated HIV Seroincidence Rates

Five seroconversions have been observed between baseline and the first follow-up HIV test on 256 subjects initially HIV seronegative, an estimated annual rate of 2.6% per year (the mean follow-up was 8.9 months).

Using all baseline HIV results and estimating an annual incidence rate over the years each person had been sexually active (as described earlier), we estimated the annual HIV incidence to be 2.7%. By age groups, the rates were 1.2% for those 18 to 23 years old, 1.8% for those 24 to 26 years old, and 3.7% for those 27 to 29 years old. In order to examine the extent to which the higher rate in those 27 to 29 years old was a cohort effect reflecting a higher risk of HIV infection in San Francisco in the early 1980s (when rates were estimated at more than 10% per year^{1,4}), we stratified subjects by their year



of first regular homosexual activity. Those who began regular homosexual activity in 1984 or earlier had an estimated 3.2% per year seroincidence, in comparison with 2.0% per year among those who began in 1985 or later ($P < .001$). Thus, the higher rate in the oldest age group is, in part, a cohort effect reflecting high incidence rates from the early 1980s in San Francisco. Part of the difference is also associated with a somewhat greater frequency of current high-risk sex in this age group. The proportion in the oldest age group who reported 10 or more partners with whom they had engaged in receptive anal intercourse was 10.5%; the corresponding figures were 5.9% in the 18- to 23-year-olds and 6.0% in the 24- to 26-year-olds. Only 27.4% of those in the oldest age group reported no receptive anal intercourse partners (the proportions were 47.1% and 39.3% in the two younger age groups, respectively).

Discussion

With nearly one in five seropositive, our results show a disturbingly high prevalence of HIV infection among young homosexual men from a population-based

household sample in San Francisco. Although the 4.8% we found infected in the 18- to 23-year-old age group is, as expected, lower than the 12% reported by Lemp et al.⁷ from a street and bar sample of 17- to 22-year-olds, the data reported in the current study are likely to be representative of most young homosexual/bisexual men in San Francisco and perhaps other cities. The higher rate of infection in African-American homosexual men has also been reported from sexually transmitted disease clinics in other cities from the San Francisco Bay Area.¹³

The first wave of follow-up HIV tests in baseline seronegatives resulted in an incidence rate of 2.6% per year. This observed rate compares with an estimated rate of 2.7% per year using baseline data and an estimate of the number of years at risk since first regular sex with men. Both the observed and estimated incidence rates are two to three times as high as those reported from San Francisco cohort studies of homosexual men more than 30 years of age²⁻⁴ and higher than the rate of 1.9% among injection drug users in San Francisco treatment programs from 1985 to 1990.¹⁴

The area of the survey captured only a portion of homosexual men living in San Francisco, but about half of AIDS cases in homosexual men in San Francisco have come from the sample area. The inverse association we found with education (Table 1) suggests that those residing in this area, which is, on average, more affluent than some areas where AIDS cases are reported in appreciable numbers, might be at somewhat lower risk for HIV. For example, the areas of San Francisco that contain short-term hotels and the most male street prostitution were not included in the sample. Therefore, the current study is most likely to be conservative with respect to HIV risk.

Monogamous couples had almost the same seroprevalence (18.3%) as the whole sample, suggesting that subjects who reported only one primary partner did not represent a group of individuals who had been consistently at lower risk for HIV infection. Among HIV-negative subjects, having a primary partner and knowing his HIV test result did not affect the frequency with which receptive anal intercourse was reported, and this was true whether or not the couple could be classified as monogamous. Serodiscordant couples were as likely to practice receptive anal intercourse as seroconcordant couples. This finding suggests that some of the strongest barriers to practicing safe sex may exist in close relationships in which issues of intimacy, trust, and sharing risk may work against safe sex behaviors. This observation has also been made in heterosexual couples.¹⁵ Many may find it easier to insist on condom use in more casual relationships.¹⁶

In 1984/85, phone surveys in San Francisco using probability sampling showed that homosexual men were rapidly adopting safe sex practices.¹⁷ The proportion who reported only "safe sex" practices increased from 69% to 81% in the 8 months between August 1984 and April 1985. HIV seroprevalence among men in our study 25 to 29 years of age was only about half the seroprevalence in the same age group in the same neighborhoods in 1984, suggesting that HIV risk has been reduced from the high levels of the early 1980s, even among these younger men. However, it must be emphasized that the 1984 seroprevalence reflected exposure before there was widespread public awareness of AIDS. During that era, new infection levels were extraordinarily high (greater than 10% per year at peak). Thus, the data suggest only a modest reduction in the new infection

rate during the 1984 to 1993 period. In addition, despite the significant reduction in high-risk behavior and the lower HIV infection level in comparison with 1984, a high proportion of the young men in our sample were not consistently following safe sex guidelines. Sixty-three percent reported one or more partners with whom they had engaged in receptive anal intercourse, 38% reported two or more such partners, 10% reported a history of injection drug use, and one in four reported receptive anal intercourse without a condom during the previous 12 months. The potential benefit of condom use was lessened by the tendency of condom users to be those men with the highest numbers of partners and the greatest frequency of receptive anal intercourse. In accord with most previous studies of risk factors for HIV,^{11,18-20} number of receptive anal intercourse partners, even without accounting for condom use, was the strongest risk factor for infection.

HIV infection rates among young homosexual men in San Francisco have declined significantly from a decade ago. However, this decline has not been enough to prevent a significant proportion of the next generation of homosexual men from being infected. At the observed infection rate, seroprevalence in this cohort, which has a median age of 25 years, will be 35% in 9 years when it reaches the median age of the San Francisco Men's Health Study cohort in 1984. That level of infection would be about three fourths of the seroprevalence in 1984 (48.5%). Thus, the AIDS epidemic threatens to continue in the younger generation of homosexual men in San Francisco at a level not far below the epidemic in the older generation. The education and public health outreach efforts successful with older gay men probably need to be reorganized for younger men. Assuming that an effective HIV vaccine, even if it is attainable, is

many years in the future, these findings point to the need for aggressive new interventions targeting the current generation of young homosexual men. □

Acknowledgments

This study was funded by contract N01-A1-82515 from the National Institute of Allergy and Infectious Diseases and by center grant MH42459 from the National Institute of Mental Health.

References

1. Winkelstein W, Samuel M, Padian NS, et al. The San Francisco Men's Health Study: III. Reduction in human immunodeficiency virus transmission among homosexual/bisexual men, 1982-86. *Am J Public Health*. 1987;76:685-689.
2. Winkelstein W, Wiley JA, Padian N, et al. The San Francisco Men's Health Study: continued decline in HIV seroconversion rates among homosexual/bisexual men. *Am J Public Health*. 1988;78:1472-1474.
3. Samuel M, Hessol N, Shiboski S, Engel RR, Speed TP, Winkelstein W. Factors associated with human immunodeficiency virus seroconversion in three San Francisco cohort studies, 1984-1989. *J AIDS*. 1993;6:303-312.
4. Hessol NA, Lifson AR, O'Malley PM, Doll LS, Jaffe HW, Rutherford GW. Prevalence, incidence, and progression of human immunodeficiency virus in homosexual and bisexual men in hepatitis B vaccine trials, 1978-1988. *Am J Epidemiol*. 1989;130:1167-1175.
5. Kingsley LA, Zhou SYJ, Bacellar H, et al. Temporal trends in human immunodeficiency virus type 1 seroconversion 1984-1989. *Am J Epidemiol*. 1991;134:331-339.
6. Centers for Disease Control. Patterns of sexual behavior change among homosexual/bisexual men—selected U.S. sites, 1987-1990. *MMWR*. 1991;40:792-794.
7. Lemp G, Hirozawa AM, Givertz D, et al. Seroprevalence of HIV and risk behaviors among young homosexual and bisexual men: the San Francisco/Berkeley Young Men's Survey. *JAMA*. 1994;272:449-454.
8. Stall R, Ekstrand M, Pollack L, McKusick L, Coates TJ. Relapse from safer sex: the next challenge for AIDS prevention efforts. *J AIDS*. 1990;3:1181-1187.
9. Hays RB, Kegeles SM, Coates TJ. High HIV risk-taking among young gay men. *AIDS*. 1990;4:901-907.
10. Melbye M, Smith E. Preventing HIV spread in homo/bisexual men: how effective is it? Experience from the National Mandatory HIV registry in Denmark. *J AIDS*. 1993;6:536-537.
11. Winkelstein W, Lyman DM, Padian N, et al. Sexual practices and risk of infection by the human immunodeficiency virus: the San Francisco Men's Health Study. *JAMA*. 1987;257:321-325.
12. Fazedegan H, Quinn T, Polk BF. Detection of antibodies to human immunodeficiency virus in dried blood on filter paper. *J Infect Dis*. 1987;155:1073-1074.
13. Kellogg TA, Reardon J, Ruiz J, Tempelis C, Lemp GF, O'Malley PA. Trends in HIV-1 seroprevalence among gay and bisexual men in the San Francisco Bay Area. In: IX International Conference on AIDS; June 6-11, 1993; Berlin, Germany. Abstract PO-C11-2882.
14. Moss AR, Vranizan K, Gorter R, Bacchetti P, Watters J, Osmond D. Seroconversion for HIV in San Francisco intravenous drug users 1985-1990. *AIDS*. 1994;8:223-231.
15. Wolfe H, Marmor M, Guttmacher S, Harrison C, Titus S, Waldman M. Trust as a barrier to condom use with steady vs. casual partners among New York City IDUs and sex partners. In IX International Conference on AIDS; June 6-11, 1993; Berlin, Germany. Abstract PO-DO8-3641.
16. Catania JA, Coates TJ, Stall R, et al. Prevalence of AIDS-related risk factors and condom use in the United States. *Science*. 1992;258:1101-1106.
17. Centers for Disease Control. Self-reported behavior change among gay and bisexual men—San Francisco. *MMWR*. 1985;34:613-615.
18. Moss AR, Osmond D, Bacchetti P, Chermann J-C, Barre-Sinoussi F, Carlson JR. Risk factors for AIDS and HIV seropositivity in homosexual men. *Am J Epidemiol*. 1987;12:1035-1047.
19. Goedert JL, Sarnagadharan MG, Biggar RJ, et al. Determinants of retrovirus (HTLV-III) antibody and immunodeficiency conditions in homosexual men. *Lancet*. 1984;1:711-716.
20. Kingsley LA, Detels R, Kaslow R, et al. Risk factors for seroconversion to human immunodeficiency virus among male homosexuals. *Lancet*. 1987;1:345-348.