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The Continuing HIV Epidemic Among Men Who Have Sex with Men

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The Continuing HIV Epidemic Among Men Who Have Sex With Men

ABSTRACT

Objectives. This study characterized the AIDS epidemic among urban men who have sex with men (MSM).

Methods. A probability sample of MSM was obtained in 1997 (n = 2881; 18 years and older) from New York, Los Angeles, Chicago, and San Francisco, and HIV status was determined through self-report and biological measures.

Results. HIV prevalence was 17% (95% confidence interval = 15%, 19%) overall, with extremely high levels in African Americans (29%), MSM who used injection drugs (40%), "ultraheavy" noninjection drug users (32%), and less educated men (<high school, 37%). City-level HIV differences were nonsignificant once these other factors were controlled for. In comparing the present findings with historical data based on public records and modeling, HIV prevalence appears to have declined as a result of high mortality (69%) and stable, but high, incidence rates (1%–2%).

Conclusions. Although the findings suggest that HIV prevalence has declined significantly from the mid-1980s, current levels among urban MSM in the United States approximate those of sub-Saharan countries (e.g., 14%–25%) and are extremely high in many population subsegments. Despite years of progress, the AIDS epidemic continues unabated among subsegments of the MSM community. (*Am J Public Health.* 2001;91: 907–914)

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In the United States, AIDS is most prevalent among men who have sex with men (MSM).[1–3] However, not since the 1980s have investigators obtained unbiased estimates of HIV prevalence among MSM.[1,3,4] (A study by Osmond et al.[3] focused on young adult MSM only; Kanouse et al.[5] conducted a small sample probability survey [N = 286] in Los Angeles County, Calif, in 1989.) Earlier studies are of unknown generalizability beyond the high-density "gay neighborhoods" of San Francisco, Calif. Studies based on opportunistic samples of MSM have been conducted but are biased in terms of overrepresenting men with high levels of risk or related HIV cofactors (e.g., MSM obtained from bar samples, HIV test sites, sexually transmitted disease clinics, bathhouses). Furthermore, samples based on high-density gay neighborhoods may underrepresent men of color, older gay men, and less sexually open men, because these social segments are less integrated into mainstream gay communities.[6–9]

Less is known about HIV levels among so-called marginal populations.[6–8] Clearly, unbiased HIV estimates that extend beyond single-city ("gay ghetto") observations are needed. By developing methodological procedures to achieve this goal,[10–13] the Urban Men's Health Study was able to obtain a probability sample of MSM in multiple cities that includes representative samples of MSM outside high-density gay neighborhoods.

The need for accurate population-level estimates is underscored by findings suggesting that past prevention successes may be faltering. There are indications of a resurgence of high-risk sexual behavior and related infections during the early to mid-1990s. For instance, rectal gonorrhea rates among MSM declined substantially in the 1980s but increased from 12% in 1993 to 23.5% in 1996 ($P < .001$).[14] In addition, a probability sample–based longitudinal survey found that in 1992, 38% of the young adult MSM (18–29 years) reported recent occurrences of unprotected anal intercourse,[3] and by 1998 this rate had increased significantly, to 51%.[15] These findings and recent data showing increased HIV incidence rates among MSM[16] suggest that prevention efforts are slipping. In this context, the present study provides a "baseline" HIV measure for the next decade among urban MSM.

Methods

Sampling MSM

We conducted a telephone survey of MSM from 4 urban centers (San Francisco; Los Angeles; New York, NY; Chicago, Ill), where the proportion of households with tele-

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TABLE 1—Characteristics of the Urban Men's Health Study Respondents

	Unweighted, %	Weighted, %
Sexual orientation[a]		
Behavior, past 5 y (n=2751)		
Homosexual	80	81
Heterosexual	3	3
Bisexual	13	14
Undetermined[b]	3	3
Self-perceived (n=2744)		
Gay	84	84
Heterosexual	3	3
Bisexual	9	9
Undetermined[b]	4	5
City of residence (n=2881)		
San Francisco[c]	32	23
New York	28	44
Los Angeles	26	25
Chicago	14	8
Age, y (n=2879)		
18–29	18	20
30–39	38	39
40–49	26	25
50–59	11	10
≥60	6	6
Education (n=2879)		
<High school	2	2
High school	28	28
College	45	45
Master's degree	19	18
Doctorate	7	7
Estimated household income, $[d] (n=2673)		
<20 000	15	16
20 001–40 000	27	26
40 001–60 000	21	20
60 001–80 000	13	13
80 001–100 000	7	8
>100 000	16	17
Race/ethnicity (n=2867)		
White	79	79
African American	5	4
Hispanic	9	10
Asian or Pacific Islander	4	4
Native American	3	3
Other	<1	<1
Relationship status[e] (n=2841)		
Cohabiting primary	24	30
Noncohabiting primary	22	20
No primary	54	51
Legal marital status[f] (n=2711)		
Married	3	3
Prior marriage	7	6
Gay marriage	29	35
Never married	61	56
Openness about sexual orientation (n=2691)		
Low	41	41
Moderate	37	39
High	21	21

[a]All respondents indicated same-sex sexual behavior since age 14.
[b]Undetermined behavioral definition=no sex in past 5 years.
[c]An oversample was conducted in San Francisco, thus contributing to large differential for weighted vs unweighted proportions.
[d]Household income was provided by respondents as an aggregate value and was intended to estimate their personal income plus that of anyone else in their household who contributed financially to their situation; therefore, these are not individual earnings per se.
[e]Primary=person respondent is in love with and committed to; no primary=those with secondary partners and who reported "no sex" partners in the past 12 months.
[f]Gay marriage=as defined by respondent as domestic partnership or "gay marriage."
[g]Openness about sexual orientation ("closetedness") was assessed with 2 items that asked the extent to which respondents were "out" to friends and family members (5-point scale from "out to all" to "out to none"). Men who were out to fewer than half of their friends or family were categorized as highly closeted, moderately closeted men were out to half but not all, and low closeted men were out to all or more than half (e.g., "Men vary in the degree to which they are 'out of the closet' or open about being gay or bisexual to others. I would like you to tell me how 'out' you are about your sexual orientation to the following groups of people . . . about how many of your friends are you 'out' to about your sexual orientation at present?").

phones was approximately 95%.[17,18] Qualitative and quantitative aspects of the current sample design were described in previous papers.[10–13] Preliminary work estimated MSM density by geographic zip codes within each city. We selected zip codes and telephone exchanges within those zip codes where the estimated screening and interview costs were less than $1000 per case (details available from first author).

The sampled areas accounted for an estimated majority of all MSM households in these cities. We used disproportionate and adaptive sampling techniques[10,19–21] to construct a random-digit-dialed sample. The obtained MSM proportions across zip codes ranged from 1.6% to 4.0% in the lower-density zip codes and from 4.1% to 33.6% in the higher-density zip codes (denominator=all screened households, plus an estimate of the number of unscreened MSM households, in a particular zip code). Prior analyses indicated that men residing in lower-density neighborhoods provided greater representation of men of lower socioeconomic status, racial/ethnic minorities, and "closeted" men.[12]

The Urban Men's Health Study obtained a diverse sample of MSM in these large urban centers (Table 1). Residency data stratified by age and racial/ethnic group indicated that racial/ethnic distributions of urban MSM were related to in-migration of White MSM, particularly during the young adult years, that effectively diluted the "indigenous" racial/ethnic minority representation in the MSM communities (Table 2). Cases were weighted in the final sample to reflect probability of selection, nonresponse, and noncoverage. The sample was adjusted to maintain proportionality among cities based on the estimated MSM population size in each city (New York, 44% [n=1274]; Los Angeles, 25% [n=716]; San Francisco, 23% [n=657]; Chicago, 8% [n=234]).

Survey Procedures

We conducted presurvey community awareness programs in each city. Households were screened by telephone to determine initial eligibility (zip code, adult male occupant) and subsequent eligibility based on the sexual orientation of the adult men. We screened more than 95 000 households on geographic location and sex makeup and found approximately 55 000 that were eligible. For households in the sample area with a resident adult (≥18 years) male, we screened the first available adult man for a history of same-sex sexual behavior and then screened for other MSM in the household, randomly selecting 1 man for interview when multiple eligible MSM were identified. Approximately 13.3% of the households with an adult man in our combined sampling areas con-

TABLE 2—Percentage Reporting Long-Term Residency[a] and Percentage In-Migrating to Urban Areas Since Age 18, by Age and Race/Ethnicity: All Cities

	Age Groups, y			
	18–29	30–39	40–49	≥50
Long-term residency, %				
Race/ethnicity				
White	9	35	77	92
African American	39	55	91	95
Hispanic	33	45	77	100
Asian or Pacific Islander	22	34	44	94
Native American	12	47	100	60
In-migrating (since 18 years of age), %				
Race/ethnicity				
White	86	88	85	78
African American	61	65	78	90
Hispanic	64	69	75	67
Asian or Pacific Islander	64	88	80	100
Native American	67	65	60	82

Note. Overall, 82% migrated since age 18.
[a]Long-term residency = residency ≥ 10 years in current city of residence. The residency question asked, "I'd like to start [the interview] by asking you some questions about your life in [city]. How many years, total, have you lived in [city]? [total years do not need to be consecutive years]."

tained MSM. We obtained 2881 completed interviews from November 1996 through February 1998 (78% of all identified eligible MSM households, n = 3700).

We used procedures that past studies indicated increase disclosure of same-sex sexual behavior, including high numbers of callbacks to resolve unscreened households and use of male interviewers.[22,23] Furthermore, multiple screener definitions of MSM were used to include eligible subjects based on recent or past sexual behavior or self-perceptions of sexual orientation. We selected all men reporting same-sex sexual behavior since 14 years of age or who self-labeled as homosexual, gay, or bisexual. These criteria broaden eligibility to avoid excluding potentially important groups (e.g., more closeted men and gay men who are less sexually active).

We used privacy and study credibility procedures designed to increase respondents' comfort with questions of a sexual nature. Interviews were conducted in Spanish and English at a time the respondents chose and lasted an average of 75 minutes. Interviews covered a range of social, psychologic, and health-related topics with an emphasis on HIV-related issues (questionnaire available from first author). Self-reported HIV status was determined by asking respondents if they had ever been tested (10% had never been tested, 1.5% did not know or declined to answer) and when they were most recently tested and the result of that test. An embedded mode experiment found that self-administered computer-based telephone interviewing yielded the same results for serostatus reporting by MSM as those obtained by a live interviewer via telephone. (All other measures are described as table notes or are standard assessments available from the first author.)

To corroborate self-reported HIV status, we obtained oral HIV test specimens from a subsample of respondents 3 to 4 months post-interview (n = 414 of 615 sampled) (for details, see Osmond et al.[24]). This subsample overrepresented men who were HIV negative and never tested. A specimen was read as testing positive only if the screening enzyme immunoassay was repeatedly reactive and a confirmatory Western blot was positive. Oral-based testing was 98.3% sensitive and 100% specific.

All men who self-reported HIV-positive status had positive test results (100% agreement), and 99% of the men who self-reported HIV-negative status had negative test results (overall cooperation = 67%; 54% of those never tested vs 83% of those who were HIV positive were compliant). This high level of agreement between self-reports and biological tests is unlikely to be biased, because respondents were blind to the subsequent HIV oral testing study. Men who failed to return test kits did not differ from compliant participants on demographics or HIV risk behaviors.[24] The overall cooperation rate compares favorably with rates for blood-drawn serum collections in the National Health and Nutrition Examination Survey (NHANES) (72%) and the AIDS in Multiethnic Neighborhoods Study (71%).[25,26]

Results

HIV prevalence data were computed on the basis of combined data from self-reports and biological testing. HIV prevalence rates for the total sample, by city and by sample characteristics, are presented in Table 3. From the oral HIV test results of respondents who self-reported HIV-negative status and whose serostatus was previously untested (1.7% and 1.3%, respectively, were HIV positive; the remainder were assumed to be HIV negative), we imputed the proportion of men who were HIV positive among men who self-reported HIV-negative status and who had not received biological testing. These revised figures were similar to the unadjusted values (total sample [adjusted percentages] = 18%; Los Angeles, 20%; San Francisco, 22%; New York, 15%; Chicago, 14%). (For computational ease, unadjusted rates are reported throughout.)

Examination of population subsegments suggests that HIV prevalence varies extensively, with the highest prevalence figures observed for low socioeconomic status men, African Americans, injection drug users, and heavy noninjection substance users (Table 3). In addition, HIV prevalence was higher among MSM in their 40s, those who were fully out, and more strictly homosexual men or men who self-identified as gay.

Serostatus was regressed (logistic model) on the significant variables in Table 3. All independent variables were significant except city (not shown, $P > .10$). HIV prevalence was significantly higher among recent and past injection drug users; other substance users, including moderate, heavy, and ultraheavy users; less closeted men; less educated men; African American men; middle- and late-middle-aged men; and homosexually identified men (Table 4). (Men of indeterminate sexual orientation were not significantly more likely to be HIV positive than were heterosexually, bisexually, or homosexually identified men; $P > .10$ for all comparisons.)

We contrasted the current prevalence figures in each city with estimates for the mid-1980s. For San Francisco, we obtained data from 2 probability sample–based surveys: the San Francisco Men's Health Study[29] and the AIDS in Multiethnic Neighborhoods Study.[25,30,31] Comparisons were made by restricting the Urban Men's Health Study sample to approximately the same geographic areas, age groups (25–54 years, San Francisco Men's Health Study; 20–44 years, AIDS in Multiethnic Neighborhoods Study), and definitions of sexual orientation as prior studies. We conducted *z* tests, which showed that the 1986 San Francisco Men's Health Study prevalence rate (49%) was not significantly different from the 1988 AIDS in Multiethnic

TABLE 3—HIV Prevalence, by Demographic, Social, and Substance-Using Groups[a]

	Prevalence	% (95% CI)
Overall	17	(15, 19)
City		
San Francisco	20	(17, 23)
New York	14	(11, 17)
Los Angeles	20	(16, 24)
Chicago	14	(10, 18)
Race/ethnicity*		
African American	29	(20, 40)
Native American	25	(15, 39)
Hispanic	19	(13, 27)
White	16	(14, 18)
Asian or Pacific Islander	9	(4, 18)
Education**		
<High school	37	(19, 59)
High school	20	(17, 24)
College	17	(14, 20)
Master's degree	12	(9, 16)
Doctoral degree	10	(6, 15)
Age, y***		
18–29	11	(7, 16)
30–39	16	(13, 19)
40–49	26	(22, 30)
50–59	19	(14, 25)
≥60	3	(1, 10)
Sexual orientation[b]		
Behavior, past 5 y**		
Homosexual	19	(17, 21)
Heterosexual	0	
Bisexual	10	(6, 16)
Undetermined	13	(6, 25)
Self-perceived***		
Gay	18	(16, 20)
Heterosexual	4	(1, 12)
Bisexual	6	(4, 10)
Undetermined	15	(9, 26)
Injection drug user (IDU)[c]***		
Non-IDU	15	(13, 16)
IDU ≤ 5 y	40	(26, 55)
IDU > 5 y	43	(33, 53)
Noninjection drug user[d]***		
Ultraheavy	32	(24, 40)
Heavy	24	(18, 32)
Moderate	22	(17, 27)
Light	16	(13, 20)
Nonuse	12	(10, 14)
Closetedness[e]***		
High	6	(4, 9)
Medium	15	(12, 18)
Low	25	(22, 28)

Note. CI = confidence interval.

[a]All HIV-positive estimates include men who have sex with men identified as seropositive by oral HIV testing, but no other adjustments have been made.

[b]For sexual orientation categories, see Table 1 notes.

[c]IDUs who had injected drugs at least once in the past 5 years, or more than 5 years ago, formed the 2 IDU categories of the variable.

[d]Ultraheavy use was use of any type of recreational drug, other than alcohol, 5 or more days per week; heavy use was use of drugs 3–4 days per week; weekend use was use of drugs 1–2 days per week; monthly use was <3 times per month; and nonuse was never using drugs of any kind. Respondents were read an extensive list of substances, including marijuana, poppers, other inhalants, crack or other forms of cocaine, methamphetamines or other "uppers," barbiturates or other tranquilizers, heroin, painkillers, and ecstasy or other party drugs such as "special K" or "rophies." Respondents indicated how often they used these drugs in the past 6 months. These responses were derived into categories to approximate the time intervals of use described previously. The categories are a slight expansion of those used in the National Drug Survey.[28]

Continued

Neighborhoods Study level (42%; $z = 1.35$, $P > .10$), but both the San Francisco Men's Health Study and the AIDS in Multiethnic Neighborhoods Study prevalence levels were significantly higher than the geographic- and age-adjusted 1996 to 1997 Urban Men's Health Study estimate (28% for ages 25–54 years; 20% for ages 20–44 years; $z = 5.52$ and 2.76, respectively, $P < .005$ for both).

We used back-calculation procedures to generate HIV prevalence estimates for the year 1985 for all cities (detailed report available from first author). Back calculations were based on AIDS cases (MSM, MSM injection drug users aged 18 years and older) through 1992 with methods developed by Bacchetti et al.,[32] incubation period estimates derived by Cooley et al.,[33] and adjustments for case definition changes and treatment with zidovudine.[27,34] Estimates of AIDS deaths were obtained from city public health departments. The back calculations used MSM population size estimates for each city derived from the present study. The range of back-calculation estimates was moderately larger than the current 1996 to 1997 HIV prevalence estimates for all cities except Los Angeles (back-calculation HIV prevalence [range]: Los Angeles, 19%–29%; San Francisco, 43%–55%; New York, 17%–26%; Chicago, 20%–27%; based on MSM population size estimates of, respectively, 93 000, 46 000, 148 000, and 36 000).

To better understand current prevalence estimates, we considered them in the context of mortality and incidence rates for MSM. (We used San Francisco as a case example because San Francisco has the largest number of independent, probability-based MSM sample estimates.) An AIDS mortality rate of 69% was reported for San Francisco for the period 1984 through 1998 (San Francisco Department of Public Health, unpublished data, July 1999).

To obtain incidence estimates specific to the Urban Men's Health Study sample and cities, we conducted epidemiologic modeling of behavioral and serostatus data from the current study based on Service and Blower's HIV incidence model.[35] (A description of the model, including details on calculation of incidence rates and average incidence estimates, is available from the first author.) This model was validated ("blind" prediction of incident cases) in a longitudinal study of young adult MSM.[35]

For San Francisco, the average 1996 to 1997 incidence was approximately 1.2%. This estimate corresponds to data reported by McFarland et al.[36] for MSM in San Francisco and based on "detuned" assays aggregated across 1996 to 1998 (1.5%). For the total Urban Men's Health Study sample, the average 1996 to 1997 incidence was approximately 1.12% (average city incidence = 1.2% San Francisco, 1.2% Los Angeles, 1.1% New York, and 0.8% Chicago).

TABLE 3—*Continued*

[e]Openness about sexual orientation ("closetedness") was assessed with 2 items that asked the extent to which respondents were "out" to friends and family members (5-point scale from "out to all" to "out to none"). Men who were out to fewer than half of their friends or family were categorized as highly closeted, moderately closeted men were out to half but not all, and low closeted men were out to all or more than half (e.g., "Men vary in the degree to which they are 'out of the closet' or open about being gay or bisexual to others. I would like you to tell me how 'out' you are about your sexual orientation to the following groups of people . . . about how many of your friends are you 'out' to about your sexual orientation at present?").

*$P < .01$; **$P < .001$; ***$P < .0001$.

TABLE 4—Multivariate Correlates of HIV Prevalence

Variable (Reference)	OR	95% CI
Injection drug use (no use)		
Recent use	3.4	1.8, 6.6
Distant use	2.8	1.7, 4.7
Noninjection drug use (no use)		
Light	1.3	0.9, 1.9
Moderate	1.9	1.3, 2.9
Heavy	2.2	1.4, 3.5
Ultraheavy	3.0	1.9, 4.9
Closetedness (high)		
Low	3.9	2.3, 6.7
Moderate	2.5	1.4, 4.3
Education (doctorate)		
< High school	5.0	1.6, 15.2
High school	2.0	1.1, 3.5
College	1.8	1.1, 3.2
Master's degree	1.2	0.6, 2.1
Race/ethnicity (White)		
African American	3.3	1.8, 6.0
Hispanic	1.5	0.9, 2.5
Asian or Pacific Islander	1.1	0.5, 2.4
Native American	2.0	0.8, 5.2
Age (≤ 60 y)		
18–29	3.1	0.7, 14.1
30–39	4.4	1.0, 19.7
40–49	8.9	2.0, 39.4
50–59	7.6	1.7, 34.3
Sexual orientation (heterosexual)		
Homosexual	3.3	0.8, 13.4
Bisexual	1.5	0.3, 6.9
Undetermined	2.3	0.5, 10.7

Note. OR = odds ratio; CI = confidence interval. See Table 3 for variable definitions. All variables were regressed with forward and backward elimination. The following pairwise comparisons yield ORs with 95% CIs that do not contain 1: African American (Asian or Pacific Islander) OR = 3.0, CI = 1.1, 8.0; African American (Hispanic) OR = 2.2, CI = 1.0, 4.8; homosexual (bisexual) OR = 2.2, CI = 1.2, 4.2; low closetedness (moderate closetedness) OR = 1.6, CI = 1.2, 2.1; heavy drug use (light) OR = 1.7, CI = 1.0, 2.8; ultraheavy drug use (light) OR = 2.3, CI = 1.4, 3.9; < high school (master's degree) OR = 4.3, CI = 1.5, 12.3; high school (master's degree) OR = 1.7, CI = 1.1, 2.6; aged 50–59 (18–29) OR = 2.5, CI = 1.4, 4.4; aged 50–59 (30–39) OR = 1.7, CI = 1.1, 2.6; aged 40–49 (18–29) OR = 2.9, CI = 1.8, 4.8; aged 40–49 (30–39) OR = 2.0, CI = 1.4, 2.8. All other pairwise comparisons were not significant.

Historically, HIV incidence values for MSM in San Francisco were approximately 5% in 1985 and 1% in 1987.[29] Thus, incidence rates in San Francisco appear to have been stable from 1987 to 1997 at approximately 1% to 2%. For our case example, we derived 1998 prevalence estimates of 20% and 25% for MSM in San Francisco based on the number of MSM AIDS cases between 1984 and 1998, an incidence of 1% or 2%, and a mortality rate of 69% (final prevalence = initial prevalence − cumulative mortality + cumulative incidence; assumes net migration = 0). This range of prevalence estimates includes the adjusted (22%) and unadjusted (20%) HIV point prevalence estimates obtained in the Urban Men's Health Study for San Francisco.

Discussion

The present study characterized the AIDS epidemic among MSM residing in large urban centers in the late 1990s. Through comparisons of current findings with data from earlier studies, back calculation, and incidence modeling, we conclude that HIV prevalence has declined across cities, likely as a result of high mortality and stable HIV incidence rates during the late 1980s and early 1990s. Such prevalence declines have been observed in other high-risk populations as well (e.g., injection drug users in New York City[37]).

Nevertheless, the HIV epidemic among MSM is continuing and at a very high level. We found extremely high HIV levels for African Americans (29%), MSM injection drug users (40%), ultraheavy noninjection drug users (32%), and less educated men (<high school, 37%). In general, HIV prevalence levels of US urban MSM were similar to those for sub-Saharan Africa, where 7 countries have estimated adult HIV prevalence levels of 14% to 25% (e.g., Malawi, Zimbabwe).[38] Furthermore, as mortality decreases among MSM in US cities as a result of better treatment, prevalence may begin to increase even with no corresponding increase in risk behavior. However, evidence from at least 1 US city indicates that risk behavior among some MSM population segments appears to be increasing,[15] as has HIV incidence.[16] Under current conditions, such changes may produce a rapid increase in the size of the infected population. The health, social, and economic costs of such an overall increase in HIV disease among MSM may be considerable.

The current study drew samples from 4 cities that represent large urban centers of the United States. Urban centers such as these contain the majority of MSM in the United States,[39] have the preponderance of AIDS cases, and represent the historical origins of HIV disease in the United States. Moreover, New York City and Los Angeles contain the 2 largest MSM communities in the United States, Chicago contains a focal community for MSM in the northern Midwest, and San Francisco has the highest-density MSM neighborhoods of any US city. These 4 cities alone hold more than one third of all MSM AIDS cases in the United States. Furthermore, these cities also are common vacation destinations for many MSM and thus may provide geographic foci from which HIV infection may spread to other areas of the country.

One limitation of the current study was that although we used weighting adjustments for nonresponse and noncoverage, the absence of an MSM census prohibited our making standard poststratification adjustments. However, in general, our confidence in the representativeness of probability samples of MSM is strengthened by the fact that prior MSM studies based on probability samples have been extremely accurate in predicting HIV mortality and prevalence rates for MSM.[4,29,40] (The San Francisco Men's Health Study provided estimates of HIV infection that were substantially more accurate than those obtained in a nearly 7-fold-larger San Francisco clinic survey.[4,40,41])

The back calculation and incidence modeling, along with the case example analysis for San Francisco, have placed the present findings in a broader historical context. They suggest that prevalence levels have declined across cities within the context of stable, but high, incidence rates and extremely high mortality rates. Unfortunately, probability-based sample data that exist for San Francisco are not available for the other 3 cities. Even though estimates based on modeling[32] have limitations, the confluence and coherency of the findings taken as a whole suggest that the findings provide a relatively valid construction of the historical context for the present findings. In addition, the incidence modeling is remarkably consistent with city-level biological data reported for MSM by McFarland et al.[36] and Osmond et al.[3] and with national estimates generated by Holmberg[42] for MSM in the early 1990s. Our case example analysis for San Francisco also provides a measure of validity for the incidence modeling estimates for that city.

Several other findings argue for the validity and generalizability of the reported aggregate prevalence levels. First, the present findings may be generalizable to the large US sexually transmitted disease clinic population of MSM because our overall findings were similar to HIV prevalence data obtained through serum collections by the Centers for Disease Control and Prevention from opportunistic samples of MSM attending sexually transmitted disease clinics in 16 US cities (prevalence = 19.3%).[43]

Our analysis of San Francisco's historical record, taking into account AIDS cases, mortality, and incidence rates since the 1980s, also supports the validity of our current prevalence estimates. Furthermore, the self-reported HIV data were validated by the oral HIV test results. Approximately 99% of the men who were HIV negative and 100% of the men who were HIV positive in the oral testing subsample provided self-report HIV status data consistent with the findings from the oral HIV tests.[24] In addition, the results of our embedded mode experiment (interview vs self-administration) suggest that the self-report HIV data were not significantly distorted by response bias. In effect, HIV serostatus may be a relatively mundane aspect of everyday discourse among MSM in large urban centers and, within the context of a legitimate scientific study, is likely to be reported with candor to the best of the respondent's ability.

All surveys underrepresent, to some extent, subsegments of the MSM population. Telephone surveys have been viewed with caution in this regard. However, numerous telephone surveys of sexual behavior have been successfully conducted in general and in MSM populations.[44,45] Furthermore, telephone surveys of adults produce estimates similar to those obtained through in-person face-to-face and self-administered questionnaires for many highly sensitive behaviors, including same-sex sexual intercourse, extramarital sexual intercourse, and high-risk sexual behaviors.[13,46,47] In addition, we compared estimates for the proportion of MSM from the present study with those from 2 prior in-person face-to-face probability-based sample surveys of MSM in San Francisco, controlling for zip code, and found extremely similar results (30% Urban Men's Health Study; 28%–30% San Francisco Men's Health Study and San Francisco Young Men's Health Study[3,4]).

Despite these findings, we acknowledge that unwillingness to reveal sexual orientation may be a concern of unknown dimensions across all types of interview contexts. Although we may never know what percentage of the population denies same-sex sexual behavior, it is important to note that our analyses of public record AIDS data for San Francisco, which presumably include the closeted MSM population, resulted in prevalence estimates similar to those obtained from the present survey. This suggests that closeted men may not significantly affect HIV prevalence estimates in MSM population-based surveys.

Another frequently expressed concern is that urban MSM surveys underrepresent racial/ethnic minority men. However, the present study (Table 2) and prior opportunistic sample surveys documented significant migration streams of MSM to large urban centers[48,49] (e.g., Bell and Weinberg[48] reported that 90% of their MSM sample were not native to the Bay Area). These MSM migration streams may substantially alter the demographics of the indigenous MSM population of a given urban area. Large urban cities are a likely migration end point for MSM because the large urban gay communities have political and economic strength, and such communities are supportive of being "out."[48,49] That the bulk of these in-migrants are White and young adults is not surprising, considering that outside the major urban areas, approximately 80% of the adult male population is White, and young adults typically are among those most likely to migrate in the United States.

Our migration findings also are consistent with earlier research. For instance, the hypothesized high rate of in-migration of MSM to large urban centers is consistent with the observed relation between increasing city size and concentration of MSM.[39] In-migration provides an additional explanation of the income and education profiles observed among urban MSM. High levels of such resources may be necessary to succeed in making the transition from a small city to more-costly large urban centers. The migration findings may be important, however, for more than merely understanding the demographic profiles of urban MSM. City population changes due to migration may disproportionately affect HIV levels for some population segments in ways that can be detected only by more complex survey designs than the cross-sectional design of the present study. Future studies need to examine migration issues more closely in relation to risk behaviors and new infection rates.

Generalizability of the present findings to other regions of the United States is unknown. However, based on adaptations of the methods developed for the current investigation, future studies would be able to obtain representative MSM samples from other urban areas and potentially from more rural environs. But the United States has yet to finance long-term HIV surveillance systems of high-risk populations that are based on current advances in scientific sampling. Unfortunately, greater emphasis is placed on HIV case-based reporting than on sentinel surveillance. The former is a window on the past, whereas the latter is the much-needed window on the future. The number of AIDS cases is important to many local planning agencies engaged in making funding allocations, but this does not seem to be the best way to reduce new infections.

We recognize that the financial costs of collecting probability samples and biological data present barriers to many local communities. However, oral HIV testing and detuned assays are methodological developments that reduce data collection costs,[24,36] and the high costs of obtaining probability samples can be decreased by use of disproportionate and adaptive sampling techniques.[10,19] Opportunistic sampling may be the only viable alternative in smaller communities, but given sufficient sample size, these samples may come close to capturing the "local" universe of at-risk persons (e.g., MSM in a city with a population of fewer than 250 000).

The present study addressed the HIV epidemic among MSM near the end of the 1990s.

It is unclear what the next decade will bring. There is optimism, but treatments that have brought about declining mortality rates among MSM are harsh and difficult to adhere to and may themselves contribute to development of new variants of the disease. In this context, we must increase efforts to conduct high-quality biological and behavioral HIV-related surveillance research. □

Contributors

J. A. Catania was the principal investigator of the Urban Men's Health Study (UMHS). He oversaw the study design and the data collection, conceptualized the paper and relevant analyses, and wrote the paper. D. Osmond, a coinvestigator of the UMHS, conducted the oral testing phase of the study, contributed to the conceptualization of the paper, and contributed to the revisions of the paper. R. D. Stall, co–principal investigator of the UMHS, participated in all phases of the study and reviewed the paper. L. Pollack, project director of the UMHS, conducted and conceptualized statistical analyses of the UMHS data and reviewed the paper. J. P. Paul participated in all phases of the study and reviewed the paper and analytic strategies. S. Blower directed the incidence-modeling work for the study and wrote and reviewed the portions of the paper concerning incidence modeling. D. Binson, a coinvestigator of the UMHS, participated in all phases of the study and reviewed the paper. J. A. Canchola contributed to the conceptualization of the statistical analyses and conducted statistical analyses for Dr Blower. T. C. Mills contributed to all phases of the study and provided commentary on the paper. L. Fisher, a coinvestigator of the UMHS, provided clinical expertise and reviewed and commented on the paper. K.-H. Choi, a coinvestigator of the UMHS, reviewed and commented on the paper. T. Porco conducted the back-calculation analyses, wrote the portions of the paper relevant to these analyses, and reviewed and commented on the paper. C. Turner collaborated on the mode experiment, directed the computer-assisted portion of this mode experiment, and reviewed and commented on the paper. J. Blair contributed to the conceptualization of the sample design, directed the sampling work, and reviewed the paper. J. Henne directed the field staff, contributed to all phases of the study, and commented on the paper. L. L. Bye contributed to the conceptualization of the study, consulted on the data collection phase of the study, contributed to the conceptualization of the paper, and reviewed the paper. T. J. Coates contributed to the conceptualization and design of the study, contributed to the conceptualization of the paper, and reviewed the paper.

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