Men Who Have Sex With Men

Estimated Population Sizes and Mortality Rates by Race/Ethnicity, Miami-Dade County, Florida

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Background: Estimated numbers of men who have sex with men (MSM) by race/ethnicity and mortality rates among such MSM with HIV/AIDS are unavailable. This hampers efficient targeting of HIV/AIDS prevention and care resources.

Methods: An existing estimation methodology was adapted to develop MSM population estimates by race/ethnicity for Miami-Dade County, Florida. We ascertained and characterized deaths that occurred during 2003 to 2005 among MSM HIV/AIDS cases, matching HIV/AIDS surveillance and vital statistics registries. We calculated estimated average annual racial/ethnic-specific mortality rates and rate ratios (RRs) among MSM HIV/AIDS cases.

Results: An estimated 63,020 men aged ≥18 years in the county are MSM (7.5% of all men aged ≥18 years; point estimate). Among 754 MSM HIV/AIDS deaths, point-estimate mortality rates per 100,000 MSM were higher for blacks (733.5) than for whites (229.2) ($P < 0.01$) and Hispanics (360.5) ($P < 0.01$). The best estimate of the black/white MSM mortality RR among HIV/AIDS cases was 3.20:1 ($P < 0.01$); for Hispanic/white MSM, it was 1.57:1 ($P < 0.01$). Sensitivity analyses suggested the estimates were reasonably robust to biases that we examined.

Conclusions: Black and Hispanic MSM were more likely to die with HIV/AIDS than white MSM. Plausible racial/ethnic-specific MSM population and mortality rate estimates can inform effective HIV/AIDS prevention efforts and program planning.

Key Words: epidemic modeling, HIV/AIDS, HIV/AIDS mortality, HIV prevalence, men who have sex with men, racial/ethnic MSM estimates

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Public health planners, policy makers, and workers could gain insight into primary and secondary HIV prevention and issues concerning access to or acceptance of quality care and case management through an understanding of the racial/ethnic-specific burden and impact of HIV/AIDS mortality on men who have sex with men (MSM). The effective targeting of resources for HIV/AIDS prevention and treatment programs could benefit from knowledge of the population size, behavioral characteristics, and mortality experience of those at most increased risk for HIV by race/ethnicity. The population sizes of MSM have been previously estimated; however, the models on which these estimates have been based have tended to be complex and/or costly to apply, and apparently have been utilized by few planning agencies.[1–7] Surveys to measure the occurrence of male-male sexual contact have often resulted in underestimates, largely because of stigmatization and concealment of risk behaviors that might be considered immoral by society.[1,8–10]

In 2005, the Miami metropolitan statistical area (MSA) (Miami-Dade County, FL) had the highest reported AIDS case rate (52.8 per 100,000 population) among MSAs with ≥500,000 population in the United States.[11] According to the Florida Department of Health (FDOH) HIV/AIDS Reporting System, there were more than 20,000 persons living with HIV/AIDS (PLWHAs) aged ≥18 years through 2005 (reported cases), of whom approximately 45% were classified in the HIV exposure category of MSM. Of these PLWHAs classified as MSM, 23% were non-Hispanic white (referred to as white), 24% were non-Hispanic black (black), 52% were Hispanic (might be of any race), and 1% were of other race/ethnicity or multiracial. Among the Miami MSA's overall male population aged ≥18 years (N = 860,941), 18% are white, 20% are black, 60% are Hispanic, and 2% are of other race/ethnicity or multiracial (FDOH midyear population estimate, 2005). Little is known about the population sizes of the subgroups of white, black, and Hispanic MSM, however. Consequently, little is known about the MSM population-based impact of mortality on the respective cohorts of MSM.

Several studies have developed MSM population estimates for urban areas.[3,6,12] The estimation of plausible numbers of white, black, and Hispanic MSM in a specific MSA has not been previously attempted, so far as we know, nor have there been any racial/ethnic-specific estimates of mortality rates among MSM with HIV/AIDS using estimated

MSM populations as denominators. In this report, we apply an existing estimation model[13] to HIV/AIDS surveillance data and population data for the Miami MSA to arrive at estimates concerning racial/ethnic subpopulations of MSM and their mortality experience. The methodology has the advantages of being transparent and inexpensive to implement, relying on available data from a few sources, and being adaptable to other MSAs.

METHODS

The Centers for Disease Control and Prevention (CDC) HIV/AIDS surveillance classification scheme for HIV behavioral risk factors encompasses risk behaviors that have occurred since 1978.[14] Accordingly, we defined MSM as all men aged ≥18 years who had male-male sex contact since 1978, including MSM who had a history of injection drug use. We defined all other men with HIV/AIDS as injection drug users (IDUs) or high-risk heterosexuals (ie, men who had sexual contact with a woman known to be HIV-infected or at high risk for HIV infection [eg, history of injection drug use]).[15] Men in the general population who were not MSM and who do not have HIV/AIDS may or may not have a behavioral risk factor for HIV that meets these criteria.

Estimates of the Numbers of MSM and Other Men

The MSM population estimates were based on methods previously described.[13] Briefly, the average annual estimated number of HIV-infected MSM living and residing in the Miami MSA (2003 to 2005) was designated as k (ie, the HIV prevalence estimate among these MSM). The estimated numbers of MSM (a) and the HIV seropositivity rates among MSM in 2004 to 2005 (b) were variables related by the function $k = ab$; thus, $a = k/b$. Average annual values of a by race/ethnicity were calculated for 2003 to 2005. The 3 racial/ethnic groups for which all estimates were developed were whites, blacks, and Hispanics. Estimates for all other individuals (ie, Asian/Pacific Islanders, American Indians, multiracial persons) were not developed because their numbers of reported HIV/AIDS cases were too small for reliable estimates. Estimates of the numbers of other men in the population were obtained by subtracting the estimated numbers of MSM from the respective average annual racial/ethnic male populations of the Miami MSA from 2003 to 2005.

Values of *k*

To estimate the HIV prevalence among all MSM in the Miami MSA (k), we started with the reported number of persons living with AIDS (PLWAs) through 2005 in the United States and in Florida, respectively: 437,982 and 45,246 (or 10.3% of the national total).[11] Given that the midpoint of the most recent national HIV prevalence estimate is 1,112,000,[16] we extrapolated that Florida's HIV prevalence estimate is 10.3% of the national total, or 114,536. Next, we considered the average annual number of PLWHAs (2003 to 2005) who had been diagnosed and reported to the FDOH HIV/AIDS Reporting System: for Florida (N = 76,251) and the Miami MSA (N = 19,139 [or 25.1% of the statewide total PLWHAs]). PLWHA data were used for Florida's extrapolation purposes because they are more comprehensive and reflective of the current state of the epidemic than PLWA data alone; however, data on cases of HIV infection (and hence PLWHAs) were not yet available nationwide. The average Miami MSA HIV prevalence estimate was then extrapolated from the statewide estimate as being 28,749 (25.1%) of 114,536. The average total number of white, black, and Hispanic Miami-Dade PLWHAs who were reported as MSM (N = 8440 [or 44.1% of the countywide total PLWHAs]) was used to extrapolate the Miami MSA HIV prevalence estimate among these MSM as being 12,678 (44.1%) of 28,749. This estimate was further disaggregated by race/ethnicity by determining the percentage of the Miami MSA's MSM PLWHAs in each racial/ethnic category and applying these percentages to the countywide total MSM HIV prevalence estimate.

Imputation of Risk

Risk information was generally obtained by FDOH staff from medical records and publicly funded HIV testing sites. PLWHAs in the Miami MSA who had been reported with no identified risk for HIV (NIRs) were redistributed into recognized risk groups based on expected results of follow-up investigations. This imputation procedure was modified from a procedure developed by Green[17] and has been previously described.[13] Sensitivity analysis was conducted to assess the effect of varying these patterns.

Values of *b*

Estimates of population-based HIV seropositivity rates (b) among MSM, by race/ethnicity, were obtained from the National HIV Behavioral Surveillance (NHBS) project in the Miami MSA conducted during 2004 to 2005 (M. LaLota et al, unpublished data, 2005). The HIV seropositivity rate data for 2003 were presumed to be similar to those for 2004 and 2005.

Ascertainment of Deaths Among Men With HIV/AIDS

In the FDOH HIV/AIDS Reporting System, through November 15, 2006, there were 1120 men who were diagnosed with HIV/AIDS while residents of the Miami MSA and were known to have died during 2003 to 2005. The names of all Miami MSA men with HIV/AIDS who were presumed to be alive through November 15, 2006 (N = 15,757) were then matched with the names of all decedents in the FDOH Vital Statistics database and all names in the Social Security Death Index (SSDI; a comprehensive public-access national registry of all decedents for whom a Social Security death benefit was claimed by a survivor) for 2003 to 2005. This resulted in the identification of an additional 206 deaths, bringing the total number of male deaths to 1326, of which 15 were deaths among multiracial men and were excluded from further analysis. Deaths among all male Miami MSA HIV/AIDS cases that occurred from 2003 to 2005 were characterized by exposure category, race/ethnicity, and age at death. Underlying cause of death analyses are not presented because of missing data.

Estimates of Mortality Rates and Rate Ratios Among Men With HIV/AIDS

Estimated average annual racial/ethnic-specific mortality rates among MSM with HIV/AIDS for 2003 to 2005 were calculated by dividing the average annual number of deaths among MSM HIV/AIDS cases by the average annual estimated populations of MSM in each group. The rates were similarly calculated for other men with HIV/AIDS. Rate ratios (RRs) for blacks versus whites and Hispanics versus whites were computed for the MSM and other male HIV/AIDS cases.

Varying the MSM HIV Positivity Rates and the Effect on Subsequent Estimates

As part of a sensitivity analysis, a plausible range (tantamount to an 80% confidence interval [CI]) was calculated around the point-estimate HIV seropositivity rates for the Miami MSA to determine the effect of widely varying these seropositivity rates on the mortality rates and RRs. The decision to set the CIs of the HIV seropositivity rates at 80% was intended to convey a sense that there was a broad range of possible random variation and/or bias in the MSM seropositivity rate estimates and a high probability that the true value would fall within this broad range.

The institutional review boards of the various institutions with whom the authors of the report were affiliated considered the research exempt from formal review.

RESULTS

Estimates of Numbers of MSM

The estimated average total number of MSM aged ≥18 years in the Miami MSA for 2003 to 2005 was 63,020 (Table 1), or 7.5% of the annual average combined male population of whites, blacks, and Hispanics aged ≥18 years (N = 843,722). Table 1 also shows the interrelated numbers of MSM PLWHAs, HIV prevalence estimates, HIV seropositivity rates, and estimated numbers of MSM, by race/ethnicity, for 2003 to 2005.

Deaths Among Men With HIV/AIDS

Of the 1311 white, black, or Hispanic men with HIV/AIDS who had died during 2003 to 2005, 754 (57.5%) were classified as MSM and 557 (42.5%) as other men (Table 2). The age range of the men who died was 18 to 96 years; the age range of the subset of MSM who died was 23 to 81 years. The distributions by age at death among white, black, and Hispanic MSM did not differ significantly, nor did those among the other men (data not shown). The median age at death ranged from 44 to 48 years for all risk and racial/ethnic subgroups.

Estimated Mortality Rates

Average annual point-estimate mortality rates among men with HIV/AIDS corresponding to the point-estimate NHBS HIV seropositivity rates among MSM by race/ethnicity (Table 3) reflected higher mortality rates for black MSM and other black men (733.5 per 100,000 black MSM and 101.3 per 100,000 other black men) than for their white (229.2 and 5.9, respectively) and Hispanic (360.5 and 7.2, respectively) counterparts (all comparisons, $P < 0.01$). Estimated mortality rates among MSM with HIV/AIDS were consistently higher than those among their other male counterparts in the population, regardless of race/ethnicity (all comparisons, $P < 0.01$).

Sensitivity Analysis 1

The first sensitivity analysis considered the effect of widely varying the NHBS HIV seropositivity rates. Differences in mortality rates among the racial/ethnic groups of MSM and other men with HIV/AIDS at the midpoint and lower and upper ends of the plausible ranges (see Table 3) remained statistically significant (all comparisons, $P < 0.01$).

Sensitivity Analysis 2 and Estimated Mortality Rate Ratios

Point-estimate mortality RRs were calculated (Table 4). To assess the plausibility of the RR point estimates, minimum and maximum RRs were determined in a second sensitivity analysis. Although the point-estimate NHBS HIV seropositivity rates for MSM did not differ significantly from each other, many of the estimated mortality RRs did. Among MSM with HIV/AIDS, the mortality RR for blacks-to-whites ranged from 1.51 ($P < 0.05$) to 6.82 ($P < 0.01$) (point estimate = 3.20; $P < 0.01$), and for Hispanics-to-whites, the RR ranged from 0.90 (not significant; $P \geq 0.05$) to 3.01 ($P < 0.01$) (point

TABLE 1. Computation of Average Annual Estimated Numbers of MSM (≥18 Years), by Race/Ethnicity, Miami MSA, 2003 to 2005

Race/Ethnicity	Average No. MSM PLWHAs*	Percentage of Total	*k* Average MSM HIV Prevalence Estimate	*b* MSM HIV Seropositivity Rate†	*a = k/b* Average Estimated No. MSM	Percentage of Total‡
White	1950	23.1%	2929	17.5%	16,726	26.5%
Black	2059	24.4%	3093	25.0%	12,360	19.6%
Hispanic	4431	52.5%	6656	19.6%	33,934	53.8%
Total	8440	100.0%	12,678	20.0%	63,020	100.0%

MSM include those with a joint risk factor of MSM and injection drug use.

*Cases of PLWHAs aged ≥18 years at time of diagnosis, with those cases reported without an HIV risk factor redistributed into categories for specified risk factors based on expected results of follow-up investigations.

†HIV seropositivity rates from the NHBS project, Miami MSA, 2004 to 2005.

‡Distribution of the overall average annual Miami MSA male population aged ≥18 years, by race/ethnicity, is 18% white, 20% black, 60% Hispanic, and 2% other race/ethnicity or multiracial.

TABLE 2. Deaths Among MSM and Other Men With HIV/AIDS,* by Race/Ethnicity, Miami MSA, 2003 to 2005

Race/Ethnicity	No. MSM Deaths	Percentage of Total	No. Other Male Deaths	Percentage of Total	Total No. Deaths†	Percentage of Total
White	115	15.3%	25	4.5%	140	10.7%
Black	272	36.1%	424	76.1%	696	53.1%
Hispanic	367	48.7%	108	19.4%	475	36.2%
Total	754	100.0%	557	100.0%	1311	100.0%

MSM include those with a joint risk factor of MSM and injection drug use.
*Cases of men with HIV/AIDS aged ≥18 years at time of diagnosis, with those cases reported without an HIV risk factor redistributed into categories for specified risk factors based on expected results of follow-up investigations.
†Total excludes 15 deaths among multiracial men.

estimate = 1.57; $P < 0.01$). Among the other men with HIV/AIDS, black-to-white RRs were elevated for all mortality rates corresponding to the midpoint and lower and upper ends of the plausible ranges of the HIV seropositivity rates (all comparisons, $P < 0.01$); the Hispanic-to-white RRs were not significant ($P \geq 0.05$).

Sensitivity Analysis 3

We examined the possibility that black male PLWHAs were more likely than white and Hispanic male PLWHAs to be misclassified as not being MSM. We altered the redistribution fraction for blacks such that there were as many as 20% more black MSM PLWHAs than initially computed. Because this affected the percentage distribution of MSM PLWHAs by race/ethnicity, it affected all subsequent estimates of HIV prevalence (k) and the numbers of MSM (a). Specifically, the estimated number of white MSM decreased 4.0%, from 16,725 to 16,056, whereas the number of black MSM increased 14.8%, from 12,362 to 14,192, and the number of Hispanic MSM decreased 4.9%, from 33,932 to 32,269. These differences seemed to be tolerable. Consequently, the estimated HIV/AIDS mortality rates changed, and the point-estimate RR for black MSM/white MSM became 2.4:1 ($P < 0.01$ [formerly 3.2:1; $P < 0.01$]), whereas that for other black men/other white men became 15.7:1 ($P < 0.01$ [formerly 17.3:1; $P < 0.01$]). These reasonably tolerable differences also seemed to support the plausibility of the initial estimates.

DISCUSSION

Plausible estimates of the population size of MSM by racial/ethnic subgroups in the Miami MSA and the comparative burden/impact of mortality on MSM racial/ethnic subgroups that die with HIV/AIDS may help to optimize the use of scarce resources to prevent HIV transmission and minimize HIV/AIDS-related mortality, especially among black MSM. Our findings have implications for HIV/AIDS program planners, prevention interventionists, policy makers, grant writers, and the community as well as for sexually transmitted infection (STI) programs. Having estimates of the population size of at-risk MSM by race/ethnicity informs the process of targeting primary and secondary HIV prevention

TABLE 3. Estimated Average Annual Mortality Rates per 100,000 MSM and per 100,000 Other Men With HIV/AIDS,* by Race/Ethnicity, Miami MSA, 2003 to 2005

Race/Ethnicity	MSM HIV Seropositivity Rate (Plausible Range)†	Corresponding Estimated Average No. MSM (Plausible Range)	Average No. Deaths Among MSM With HIV/AIDS	Estimated Average HIV/AIDS Mortality Rate per 100,000 MSM (Plausible Range)
White	17.5% (11.1% to 24.0%)	16,726 (12,196 to 26,369)	38	229.2 (145.4 to 314.3)
Black	25.0% (16.2% to 33.8%)	12,360 (9,142 to 19,074)	91	733.5 (475.3 to 991.8)
Hispanic	19.6% (15.4% to 23.8%)	33,934 (27,945 to 43,188)	122	360.5 (283.3 to 437.8)
Total	20.0% (16.7% to 23.3%)	63,020 (49,283 to 88,631)	251	398.8 (283.6 to 510.0)

Race/Ethnicity	Corresponding Estimated Average No. Other Men (Plausible Range)	Average No. DeathsAmong Other Men With HIV/AIDS	Estimated Average HIV/AIDS Mortality Rate per 100,000 Other Men (Plausible Range)
White	141,907 (132,264 to 146,437)	8	5.9 (5.7 to 6.3)
Black	139,502 (132,788 to 142,720)	141	101.3 (99.0 to 106.4)
Hispanic	499,293 (490,039 to 505,282)	36	7.2 (7.1 to 7.3)
Total	780,702 (755,091 to 794,439)	186	23.8 (23.4 to 24.6)

MSM include those with a joint risk factor of MSM and injection drug use.
*Cases of men with HIV/AIDS aged ≥8 years at time of diagnosis, with those cases reported without an HIV risk factor redistributed into categories for specified risk factors based on expected results of follow-up investigations.
†Plausible range is equal to an 80% CI (see text).

TABLE 4. Estimated Mortality RRs Among MSM and Other Men With HIV/AIDS,* by Race/Ethnicity, Miami MSA, 2003 to 2005

Comparison Groups	Point-Estimate Mortality RR	95% CI	Estimated Minimum Mortality RR	95% CI	Estimated Maximum Mortality RR	95% CI
MSM						
Black/white	3.20†	2.19 to 4.66	1.51‡	1.04 to 2.20	6.82†	4.68 to 9.94
Hispanic/white	1.57†	1.09 to 2.26	0.90	0.63 to 1.29	3.01†	2.10 to 4.33
Other men						
Black/white	17.25†	8.58 to 34.70	15.72†	7.82 to 31.61	18.70†	9.30 to 37.61
Hispanic/white	1.23	0.58 to 2.61	1.13	0.53 to 2.40	1.29	0.61 to 2.74

MSM include those with a joint risk factor of MSM and injection drug use.

*Case of men with HIV/AIDS aged ≥18 years at time of diagnosis, with those cases reported without an HIV risk factor redistributed into categories for specified risk factors based on expected results of follow-up investigations.

†$P < 0.01$; ‡$P < 0.05$.

initiatives. In turn, combining these estimates with data on deaths among MSM with HIV/AIDS can result in more accurate estimates of mortality rates, which could reflect the need for enhancement of HIV diagnostic, linkage-to-care, treatment, and case management services, including the promotion of treatment adherence, to reduce mortality. Other studies that looked at MSM HIV/AIDS mortality rates have acknowledged that their rates might be underestimates because of the use of the general male population as denominators.[18,19]

HIV-infected black MSM in the Miami MSA seem to be at significantly greater risk of dying than their white counterparts, with more than a 3-fold greater point-estimate mortality rate. This is consistent with findings from an analysis of national surveillance data, which found highest death rates for black MSM with AIDS and lower survival among black MSM compared with white and Hispanic MSM with AIDS.[19] In our study, the point-estimate mortality rate among HIV-infected Hispanic MSM was also significantly elevated above that for white MSM (RR = 1.57). The NHBS findings indicated there were no statistically significant differences in racial/ethnic HIV seropositivity rates, however. Thus, we cannot assess the extent to which the observed mortality rate differentials might be explained by the HIV seropositivity rates.

Evidence suggests that black MSM tend to be diagnosed relatively late with HIV[20–22] and/or may be relatively less likely to seek or have access to quality care and treatment than white MSM,[23–25] thus putting them at increased risk for progressing to AIDS and death. In the NHBS for MSM conducted in 5 cities in 2004 to 2005, black MSM had the highest proportion of unrecognized HIV infection.[20] The combined stigma of being an MSM, belonging to a racial minority group, and being at risk for or having HIV/AIDS may contribute to delayed screening and treatment.[26,27] Preexisting stigma experienced by MSM can be layered on top of HIV/AIDS stigma.[28] In a study, young PLWHAs who were MSM with HIV symptoms or an AIDS diagnosis felt more stigma than their heterosexual counterparts.[29] Other contributing, underlying factors could include the amount of HIV already in the community, cultural taboos and homophobia, non-HIV STIs in the community, incarceration, and many complex factors related to socioeconomic status. Such factors could partly explain our observed differentials in the racial/ethnic mortality experience.

Estimated mortality rates were far higher among each racial/ethnic group for the MSM with HIV/AIDS than for the other men with HIV/AIDS. In part, this reflects their different population compositions and behavioral risk profiles (ie, there are far greater numbers of other men in the community [denominators], and many of them might have no behavioral risk factor for HIV). Clearly, there are individual MSM in the community who are also at no elevated risk for HIV; however, as a group, all those with a history of male-male sexual contact are considered at increased risk according to CDC convention.[30]

Our point estimate of the percentage of the adult male population who are MSM (7.5%) is aligned with several other such estimates. Estimates derived from random sampling indicate that as many as 9% of adult men in large urban areas might be MSM; the corresponding percentages were 4% in suburban areas and 1% in rural areas.[12] Another report, using the same estimation model that was adopted for this article, indicated that approximately 9.5% of all adult men in the Miami MSA might be MSM;[13] however, this finding is apparently an overestimate, based on an apparent underestimate of the overall MSM HIV seropositivity rate (17.0%) compared with the current NHBS overall HIV seropositivity rate (20.0%) (see Table 1). Approximately 7% of men in the United States aged ≥19 years might be MSM according to estimates based on national survey data.[5]

There are a number of limitations to our study, as with most modeled estimation studies. There is no "gold standard" for estimating the numbers of MSM by race/ethnicity. There are multiple uncertainties about the various parameters used to develop our estimates, including the extrapolation of HIV prevalence estimates, the imputation of risk,[31] and the representativeness of the NHBS sample of MSM and their HIV seropositivity rates. Our method of extrapolating local HIV prevalence estimates of at-risk populations from national HIV prevalence estimates has previously helped to produce plausible estimates of at-risk populations.[13,32] The procedure may be regarded as somewhat crude, however. In particular, we have no reliable data to help us set limits on and conduct sensitivity analyses for certain parameters that could affect the accuracy of these extrapolations (eg, differences in relative completeness of reporting among the various surveillance systems and differences in rates of incidence, diagnosis, or treatment for AIDS cases and HIV [not AIDS] cases in the United States, Florida, and the Miami MSA). Different diagnosis or reporting patterns could affect the estimates of HIV prevalence but would not affect the relative rankings of

the mortality rates among black, Hispanic, and white MSM with HIV/AIDS.

We used a broad definition of MSM that encompassed any male-male sex behavior since 1978, consistent with the CDC's classification scheme for HIV/AIDS cases.[14] This might have captured experimenters and those whose behavior was not ongoing, leading to overestimates of the numbers of MSM and underestimates of mortality rates. Because HIV seropositivity rates are inversely related to estimates of the numbers of MSM in our model, underestimates of rates result in overestimates of the numbers of MSM and vice versa. Nonetheless, the sensitivity analyses suggest that our estimates of racial/ethnic-specific numbers of MSM and mortality rates among MSM and other men with HIV/AIDS were fairly robust to the biases that we were able to examine.

According to our best estimates for the period 2003 to 2005, in the Miami MSA, black MSM with HIV/AIDS were at significantly greater risk of dying than Hispanic MSM, who, in turn, were at significantly greater risk than white MSM. An advantage of the estimation procedure we used is that it relies on available HIV/AIDS data from multiple sources: national, statewide, and county-specific HIV/AIDS surveillance data; HIV seropositivity rates among MSM; and vital statistics concerning male HIV/AIDS cases. These elements are combined in a transparent way to produce plausible estimates. Quantifying the MSM (and other male) mortality experience by race/ethnicity helps to determine and justify effective targeting of resources to improve services like HIV screening, primary and secondary HIV and STI prevention, and linkage and adherence to quality care. Other MSAs or states interested in developing such estimates could readily adapt our methods if reliable MSM HIV seropositivity rates by race/ethnicity are determined.

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REFERENCES

1. Binson D, Michaels S, Stall R, et al. Prevalence and social distribution of men who have sex with men: United States and its urban centers. *J Sex Res*. 1995;32:245–254.
2. Blair JA. A probability sample of gay urban males: the use of two-phase adaptive sampling. *J Sex Res*. 1999;36:39–44.
3. Catania JA, Osmond D, Stall RD, et al. The continuing HIV epidemic among men who have sex with men. *Am J Public Health*. 2001;91:907–914.
4. Davies AG, Cormack RM, Richardson AM. Estimation of injecting drug users in the City of Edinburgh, Scotland, and number infected with human immunodeficiency virus. *Int J Epidemiol*. 1999;28:117–121.
5. Fay RE, Turner CF, Klassen AS, et al. Prevalence and patterns of same-gender sexual contact among men. *Science*. 1989;243:338–348.
6. Holmberg SD. The estimated prevalence and incidence of HIV in 96 large US metropolitan areas. *Am J Public Health*. 1996;86:642–654.
7. Pisani E. Estimating the size of populations at risk for HIV: issues and methods. A joint UNAIDS/IMPACT/Family Health International workshop: report and conclusions. May 2002. Updated July 2003. Available at: http://www.fhi.org/en/HIVAIDS/pub/guide/popsizecontent.htm. Accessed March 26, 2007.
8. Centers for Disease Prevention and Control. HIV/STD risks in young men who have sex with men who do not disclose their sexual orientation—six U.S. cities, 1994–2000. *MMWR Morb Mortal Wkly Rep*. 2003;52:81–85.
9. Rogers SM, Turner CF. Male-male sexual contact in the USA: findings from five sample surveys, 1970–1990. *J Sex Res*. 1991;28:491–519.
10. Archibald CP, Jayaraman GC, Major C, et al. Estimating the size of hard-to-reach populations: a novel method using HIV testing data compared to other methods. *AIDS*. 2001;15(Suppl 3):S41–S48.
11. Centers for Disease Control and Prevention. Cases of HIV infection and AIDS in the United States and dependent areas. *HIV/AIDS Surveillance Report, 2005*. 2006;17:1–33.
12. Michael RT, Gagnon JH, Laumann EO, et al. *Sex in America: A Definitive Survey*. New York: Warner Books; 1994.
13. Lieb S, Friedman SR, Zeni MB, et al. An HIV prevalence-based model for estimating urban risk-populations of injection drug users and men who have sex with men. *J Urban Health*. 2004;81:401–415.
14. Centers for Disease Control and Prevention. Adult HIV/AIDS confidential case report. Form CDC 50.42A, revised January 2003.
15. Centers for Disease Prevention and Control. HIV/AIDS diagnosis among blacks—Florida, 1999–2004. *MMWR Morb Mortal Wkly Rep*. 2007;56:69–73.
16. Glynn M, Rhodes P. Estimated HIV prevalence in the US at the end of 2003 [abstract 595]. Presented at: National HIV Prevention Conference; 2005; Atlanta.
17. Green TA. Using surveillance data to monitor trends in the AIDS epidemic. *Stat Med*. 1998;17:143–154.
18. Centers for Disease Control and Prevention. HIV/AIDS among racial/ethnic minority men who have sex with men—United States, 1989–1998. *MMWR Morb Mortal Wkly Rep*. 2000;49:4–11.
19. Blair JM, Fleming PL, Karon JM. Trends in AIDS incidence and survival among racial/ethnic minority men who have sex with men, United States, 1990–1999. *J Acquir Immune Defic Syndr*. 2002;31:339–347.
20. MacKellar DA, Valleroy LA, Secura GM, et al. Unrecognized HIV infection, risk behaviors, and perceptions of risk among young men who have sex with men: opportunities for advancing HIV prevention in the third decade of HIV/AIDS. *J Acquir Immune Defic Syndr*. 2005;38:603–614.
21. Centers for Disease Control and Prevention. HIV prevalence, unrecognized infection, and HIV testing among men who have sex with men—five U.S. cities, June 2004–April 2005. *MMWR Morb Mortal Wkly Rep*. 2005;54:597–601.
22. McGinnis KA, Fine MJ, Sharma RK, et al. Understanding racial disparities in HIV using data from the Veterans Aging Cohort 3-Site Study and VA Administrative Data. *Am J Public Health*. 2003;93:1728–1733.
23. Jain S, Schwarcz S, Katz M, et al. Elevated risk of death for African Americans with AIDS, San Francisco, 1996–2002. *J Health Care Poor Underserved*. 2006;17:493–503.
24. Wong MD, Cunningham WE, Shapiro MF, et al. Disparities in HIV treatment and physician attitudes about delaying protease inhibitors for nonadherent patients. *J Gen Intern Med*. 2004;19:366–374.
25. King WD, Wong MD, Shapiro MF. Does racial concordance between HIV-positive patients and their physicians affect the time to receipt of protease inhibitors. *J Gen Intern Med*. 2004;19:1146–1153.
26. Lichtenstein B. Stigma as a barrier to treatment of sexually transmitted infection in the American Deep South: issues of race, gender, and poverty. *Soc Sci Med*. 2003;57:2435–2445.
27. Chesney MA, Smith AW. Critical delays in HIV testing and care. *Am Behav Sci*. 1999;42:1162–1174.
28. Nyblade LC. Measuring HIV stigma: existing knowledge and gaps. *Psychol Health Med*. 2006;11:335–345.
29. Swendeman D, Rotherman-Borus MJ, Comulada S, et al. Predictors of HIV-related stigma among young people living with HIV. *Health Psychol*. 2006;25:501–509.
30. Centers for Disease Control and Prevention. Twenty-five years of HIV/AIDS—United States, 1981–2006. *MMWR Morb Mortal Wkly Rep*. 2006;55:585–589.
31. Schmidt MA, Motokoff ED. HIV/AIDS surveillance and prevention: improving the characterization of HIV transmission. *Public Health Rep*. 2003;118:197–204.
32. Friedman SR, Lieb S, Tempalski B, et al. HIV among injection drug users in large US metropolitan areas, 1998. *J Urban Health*. 2005;82:434–445.

