Estimated HIV Incidence, Prevalence, and Mortality Rates Among Racial/Ethnic Populations of Men Who Have Sex with Men, Florida

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Background: Population-based HIV incidence, prevalence, and mortality rates among men who have sex with men (MSM) have been unavailable, limiting assessment of racial/ethnic disparities and epidemic dynamics.

Methods: Using estimated numbers of MSM aged ≥18 years by race/ethnicity as denominators, from models in our prior work, we estimated MSM HIV prevalence and mortality rates for 2006–2007 and HIV incidence rates for 2006 in Florida.

Results: Overall, the estimated MSM HIV prevalence rates per 100,000 MSM were 7354.8 (2006), and 7758.3 (2007). With white MSM as the referent, MSM HIV prevalence rate ratios (RRs) equaled 3.7 for blacks in 2006 and 3.6 in 2007 and 1.7 for Hispanics in both years (all $P < 0.001$). Among all MSM with HIV, the mortality rates were 199.8 (2006) and 188.4 (2007), with RRs of 5.4 for blacks in 2006 and 4.9 in 2007, and 1.6 for Hispanics in 2006 and 1.4 in 2007 (all $P < 0.001$). In 2006, the estimated HIV incidence rate among all MSM was 656.1 per 100,000 MSM, with RRs of 5.5 (blacks) and 2.0 (Hispanics) (both $P < 0.001$). A sensitivity analysis indicated that error due to misclassification of minority MSM as males who are not MSM lowered rates and RRs for all the 3 indicators but racial/ethnic disparities persisted (all $P < 0.001$).

Conclusions: The impact of HIV by each measure was greater on black and Hispanic MSM than on white MSM. Quantifying estimates of HIV incidence, HIV prevalence, and mortality rates among MSM with HIV informs HIV surveillance, prevention, treatment, resource allocation, and community mobilization.

Key Words: HIV/AIDS, HIV incidence, HIV prevalence, men who have sex with men, mortality, racial/ethnic disparities

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INTRODUCTION

Men who have sex with men (MSM) continue to be a priority population for primary and secondary HIV prevention in the United States and Florida. Estimates indicate that MSM accounted for the majority of incident and the greatest proportion of prevalent HIV infections among adults and adolescents aged ≥13 years in the United States in 2006.[1–3] In Florida, which ranks third in the nation in cumulative AIDS cases through 2007 (n = 109,524 cases, or 10.6% of the national total),[4] MSM have accounted for more reported AIDS cases and HIV cases than any other behaviorally defined risk group every year since case reporting began in 1982 and 1997, respectively.[5] Assessing the impact of HIV-related indicators on risk populations informs effective allocation of resources for outreach, prevention, care, and treatment. However, estimates of MSM population size are needed to compute population-based estimates of rates of HIV incidence, prevalence, and mortality for MSM. HIV surveillance, community mobilization, advocacy, and structural analysis of community vulnerability are likely to be enhanced by analyzing HIV indicator rates in racial/ethnic MSM populations. As always, the dilemma is to raise awareness although finding ways to reduce stigma.[6]

HIV seroprevalence rates among MSM have previously been reported in selected US cities. In 1996, Holmberg[7] reported a set of risk population estimates for the largest 96 United States metropolitan areas, including numbers and HIV seroprevalence rates of MSM. In 2001, Catania et al[8] presented such estimates for MSM in 4 cities (Chicago, Los Angeles, New York, and San Francisco). The Young Men's Survey, conducted in several cycles between 1994 and 2000, tested MSM for HIV antibody in 6 cities (Baltimore, Dallas, Los Angeles, Miami, New York, and Seattle).[9,10] The National HIV Behavioral Surveillance system tested MSM for HIV antibody during 2004–2005 in 5 cities (Baltimore, Los Angeles, Miami, New York, and San Francisco)[11] and during 2008 in 21 cities (results for 2008 currently pending). Estimated HIV prevalence rates among MSM in each completed study were extremely high, compared with those in the overall US population.[3,12] Black MSM typically had higher rates than white MSM in the serosurveys. Using a somewhat broad range of MSM population estimates, where 4%–10% of each racial/ethnic group of males were assumed to be MSM, HIV prevalence rates were estimated for Florida and selected counties by race/ethnicity in 2006.[13] Again, rates were highest among black MSM.

Estimated population-based death rates among MSM with HIV, by race/ethnicity, have been reported in a study conducted in Miami-Dade County, Florida, in 2005.[14] However, such death rates have not been developed at the state level

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in the United States HIV incidence estimates among MSM by race/ethnicity have been established for the United States and selected states and cities in 2006.[1,2] Yet, in the absence of reliable estimates of the MSM population size, these numbers have not been converted to HIV incidence rates. To enable population-based estimation of all HIV indicator rates, our recent work established MSM population estimates (ie, rate denominators) for Florida and each of the 16 other states in the southern region of the United States, by race/ethnicity.[15]

In this report, we take advantage of our racial/ethnic MSM population estimates for the state of Florida, in particular, by dividing them, respectively, into the number of living MSM HIV cases, deaths among MSM HIV cases, and HIV incidence estimates among MSM to quantify population-based indicator rates by race/ethnicity. Epidemic dynamics are thereby clarified to enhance HIV surveillance and other public health purposes served by surveillance data. To our knowledge, these 3 HIV indicators among MSM have not previously been converted to rates for any state or large geographic area. For HIV cases and deaths, we analyze data for 2006 and 2007. For estimated incident HIV infections, data are analyzed for 2006 only, as data for earlier or later years were not yet available.

METHODS

Definition of MSM

For MSM population estimates, we defined MSM as males aged ≥18 years with a lifetime history of any male–male sex contact. For the estimates of HIV incidence, prevalence, and deaths among HIV cases, MSM were defined as males aged ≥18 years with a history of any male–male sex contact at some time after 1977, but before their diagnosis of HIV or AIDS, consistent with the definition used by the Centers for Disease Control and Prevention (CDC) for national HIV/AIDS surveillance.[16] MSM who were also injection drug users (IDUs) were counted as MSM.

HIV Cases and Deaths

HIV prevalence consisted of the number of MSM living with HIV through 2006 or 2007 (reported cases). HIV cases were reported through the statewide HIV/AIDS Reporting System. HIV prevalence and mortality among those with HIV applies to those with HIV infection at any stage of infection, consistent with the CDC case definition.[4] There is only 1 database for HIV cases and AIDS cases in Florida, with no duplicate counting of cases. An AIDS diagnosis supersedes an HIV diagnosis, as people who converted from HIV to AIDS are counted as AIDS cases only.

Behavioral risk information was generally obtained from medical records and publicly funded HIV test site records. However, reported HIV cases with no identified risk for HIV infection were redistributed into recognized transmission categories, based on expected results of follow-up investigations.[17] Deaths among reported MSM HIV cases in 2006 and 2007 were those that were due to any cause. Deaths were reported by county and multicounty HIV/AIDS surveillance coordinators and the state Office of Vital Statistics. Deaths were also ascertained through matching of the state HIV/AIDS database with the Social Security Death Index, a national database of all decedents for whom Social Security death benefits have been claimed.

Completeness of reporting of Florida HIV cases and AIDS cases is estimated at approximately 95%, that is, approximately 95% of these cases are ultimately reported. Greater than 95% of HIV cases and AIDS cases reported in Florida in 2006 and 2007 were reported within 12 months of their diagnosis. Further, less than 5% of the AIDS cases were reported after death. Florida law requires both laboratory and provider reporting. HIV/AIDS surveillance staff are strategically located throughout the state to provide timely and complete reporting for their local areas. State-level HIV/AIDS surveillance staff in Tallahassee routinely generate validation reports to ensure complete reporting of all required demographic variables and elimination of duplicate cases. Although behavioral risk information is not always available at the initial report, efforts are made by staff in the field and at the state level to identify sources of transmission when available.

HIV Incidence Estimates

HIV incidence refers to those with recently acquired HIV infection, that is, on average, within 156 days of seroconversion.[1] The estimated numbers of recent HIV infections in 2006 were determined by methods previously described (incidence estimates for earlier or later years were not available).[1] Briefly, the number of recent HIV infections in the US population was estimated from a sample composed of all persons who were diagnosed with HIV in 2006 and classified as recently infected using the BED HIV-1 capture enzyme immunoassay. Information on HIV cases diagnosed in 2006 were included in the estimation calculations, adjusted for reporting delays and redistribution of risk.[17] A sampling weight was assigned to each person in the sample. The weight was the inverse of the estimated probability that a case with similar characteristics had a positive HIV test and was determined to have a recent infection by the serologic testing algorithm for recent HIV seroconversion.[18] Newly diagnosed cases in Florida were stratified by sex, race/ethnicity, age group, and transmission category depending on the number of cases per stratum and the CDC minimum requirements for estimating HIV incidence. State-wide estimates were rounded to the nearest 10 infections.

Although HIV incidence estimates were produced for adults and adolescents aged ≥13 years, we limited the age group to those aged ≥18 years to conform to our MSM definition. Examination of the Florida data indicated that the estimated number of incident HIV infections among all those aged 13–17 years was negligible (<1.0% of total infections); thus, no adjustments to the total estimates for MSM by race/ethnicity were made for excluding this age group from the analysis.

Estimation of the Numbers of MSM

The denominators of each of the 3 HIV indicator rates were the estimated numbers of MSM in Florida in 2006 or 2007, by race/ethnicity. These estimates were derived using methods from our previous work,[15] where 2 statistical models were used to estimate the total state-wide percentage of adult males who were MSM in the 17 states of the southern region of

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the United States in 2007, and the findings were averaged, resulting in a Florida percentage MSM estimate of 7.5%. This percentage MSM estimate was multiplied by the mid-year 2007 adult male population estimate[19] to obtain the estimated total number of MSM in the state in 2007. This number of MSM was then partitioned by race/ethnicity using a third model.

Briefly, the first estimation model relied on national estimates of the percentage of US males who were MSM in rural, suburban, and urban areas, according to Laumann et al,[20] and state-specific census data by corresponding geographic area.[21] The second model relied on a national estimate of the overall percentage of males who are MSM (ie, 6.0%) from the National Survey of Family Growth,[22] which was multiplied by an "MSM Index." The MSM Index we constructed equaled the ratio of the proportion of US same-sex unmarried male partner households in a given state to the proportion of all US households in the state.[23] By definition, the MSM Index for the United States was 1.0. The third model was based on algebraic conversions of national estimated percentages of males who were MSM that were found in the National Survey of Family Growth for whites (6.5%), blacks (5.0%), and Hispanics (6.2%). The estimated percentages MSM for Florida were determined to be 7.9% for whites, 6.1% for blacks, and 7.6% for Hispanics. These percentages were multiplied by the mid-year 2007 adult male population estimates, by race/ethnicity,[19] to produce the racial/ethnic-specific MSM population estimates. In the present study, we applied the same principals and procedures to obtain the state-wide MSM estimates for 2006. Assumptions and limitations of the methods for the 3 models were thoroughly discussed in our previous report.[15]

Computation of Rates

The numbers of MSM living with HIV, deaths among MSM with HIV, and estimated incident HIV infections among MSM were divided by the estimated numbers of MSM to produce the estimated indicator rates, by race/ethnicity. Statistical significance of the rate ratios (RRs) was determined by a 2-tailed test of difference from 1.0. For comparison with MSM, we estimated the number of males who are not MSM in Florida in 2006 (ie, those with an injection drug use, heterosexual contact, or blood-related risk) and computed estimated HIV incidence rates among them. We subtracted the estimated numbers of MSM from the total adult male population, by race/ethnicity, to obtain the denominators of the non-MSM male HIV incidence rates. Numerators were similarly obtained through subtraction of the MSM incidence numbers from the total adult male incidence estimates.

Survival Analysis

We evaluated the median time from an AIDS diagnosis to death for MSM and for males who are not MSM, by race/ethnicity, for the 2 years combined (2006 and 2007). Evaluation of median time from an HIV diagnosis to death was not possible due to insufficient data on time of HIV diagnosis for all cases.

Sensitivity Analysis

We conducted a sensitivity analysis to test the robustness of the indicator rate estimates. In the original analysis, we utilized as denominators MSM population estimates in Florida by race/ethnicity from our previous work.[15] The white percentage MSM estimate was approximately 30% and 4% higher than that among black and Hispanic MSM, respectively. We examined the possibility that minority MSM were misidentified as heterosexuals to a greater extent than white MSM, consistent with a number of other reports.[24–28]

In the sensitivity analysis, we considered the degree to which the observed racial/ethnic disparities in the original analysis of the indicator rates were a function of underestimating the percentage and number of MSM among minorities. Thus, we assumed that a history of male–male sexual behavior was as common among black and Hispanic males as among white males. Accordingly, we set the estimated percentage MSM among blacks and Hispanics within Florida as equal to the higher white percentage MSM (7.9%). We then recomputed the estimated indicator rates for MSM by race/ethnicity under this assumption, although holding constant the numbers of MSM who were living with HIV, deaths among MSM with HIV, and HIV incidence estimates (ie, the numerators of the respective rates). We evaluated the extent to which racial/ethnic disparities persisted in the sensitivity analysis as measured by the estimated RRs and associated *P* values.

Racial/Ethnic Categories

Computation of rates for the 3 HIV indicators by race/ethnicity was limited to MSM in the 3 major demographic categories, that is, whites, blacks, and Hispanics. American Indians/Alaska Natives, Asians/other Pacific Islanders, and those of unknown or multiple race/ethnicity accounted for too few MSM HIV cases, deaths, and incident HIV infections for reliable statistical analysis.

Data Analysis

The *P* values and 95% confidence intervals of the RRs were determined using R software [R Core Development Team (computer software) Version 2.5.1. Vienna: R Foundation for Statistical Computing; 2004]. Tests of significance comparing the differences in 2 RRs were conducted using a method from Kanji.[29] The Wilcoxon test was used to determine the statistical significance of differences in median times from AIDS diagnosis to death.[30]

RESULTS

The estimated total number of white, black, and Hispanic MSM in Florida increased by 1.4% from 2006 (501,412) to 2007 (508,448) (Table 1), largely reflecting a year's growth in the overall adult male population in the state because the percentage of adult males who were estimated to be MSM was assumed to remain essentially unchanged across the 2 years. Meanwhile, the total number of prevalent MSM HIV cases increased by 7.0%, from 36,878 to 39,447. Nearly half the prevalent cases were among white MSM in both years. Estimated HIV prevalence rates increased from 2006 to 2007 by 5.5% overall, with 5.7%, 4.0%, and 4.8% increases, respectively, among white, black, and Hispanic MSM. The estimated prevalence rates among black and Hispanic MSM, respectively, were 3.7 and 1.7 times that of white MSM in

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TABLE 1. Estimated Number of MSM and Population-Based HIV Prevalence Rates Among MSM (≥18 Yrs.), by Race/Ethnicity, Florida, 2006–2007

	Estimated MSM			MSM HIV Prevalence*				
Year	Race/Ethnicity	Number†	% of Total	Cases	% of Total	Rate	RR‡	95% CI
2006	White	346,383	69	17,948	49	5181.5	1.00	—
	Black	53,385	11	10,160	28	19,031.6	3.67	3.59 to 3.76
	Hispanic	101,644	20	8770	24	8628.2	1.67	1.62 to 1.71
	Total§	501,412	100	36,878	100	7354.8	—	—
2007	White	348,043	68	19,059	48	5476.0	1.00	—
	Black	54,717	11	10,829	27	19,790.9	3.61	3.54 to 3.69
	Hispanic	105,688	21	9559	24	9044.5	1.65	1.61 to 1.69
	Total§	508,448	100	39,447	100	7758.3		

Rates are per 100,000 MSM.

*HIV prevalence numbers represent reported HIV or AIDS cases that were alive through the end of 2006 or 2007.

†Estimated numbers of MSM are based on Lieb et al[15] and are equal, respectively, to the Florida 2006 and 2007 mid-year racial/ethnic-specific male populations aged ≥18 yrs. multiplied by the following percentages of males who are MSM: 7.9% for whites, 6.1% for blacks, 7.6% for Hispanics, and 7.5% overall (see Text).

‡All RRs are significant at $P < 0.001$.

§Totals include white, black, and Hispanic MSM only.

MSM, men who have sex with men (includes MSM who have used injection drugs); RR, rate ratio; CI, confidence interval.

2006, and 3.6 and 1.7 times that of white MSM in 2007 (all $P < 0.001$). The black-to-Hispanic HIV prevalence RR in both years was 2.2 ($P < 0.001$).

Black/white racial/ethnic disparities in estimated death rates among MSM HIV cases were more pronounced than the disparities in the corresponding prevalent HIV case rates in both 2006 and 2007. The black-to-white MSM HIV death RR in 2006 (5.4) (Table 2) was significantly greater than the black-to-white MSM HIV prevalence RR (3.7) ($P < 0.001$). The corresponding RRs also differed in 2007 (4.9 and 3.6, respectively) ($P < 0.001$). Death rates among MSM HIV cases decreased in 2007 among black MSM by 8.7% and among Hispanic MSM by 13.7%, but remained level among white MSM.

The survival analysis indicated racial/ethnic disparities in the median time from a diagnosis of AIDS to death in both years. For deaths that occurred in 2006 and 2007 (combined data), this length of time was 79 months for white MSM, 56 months for black MSM, and 62 months for Hispanic MSM (white MSM vs. black MSM, $P < 0.001$; white MSM vs. Hispanic MSM, $P < 0.05$; Hispanic MSM vs. black MSM, P not significant). By contrast, for males who were not MSM, the median time from AIDS to death was 51 months for whites, 43 months for blacks, and 33.5 months for Hispanics (all comparisons, P not significant). All 3 racial/ethnic-specific comparisons of MSM vs. males who were not MSM were significant at $P < 0.01$.

In 2006, the total HIV incidence estimate for the United States was 56,300, of which 30,800 (54.7%) infections were among MSM.[1] Florida's incidence estimate was 5550, of which 3350 (60.4%) infections occurred among MSM in all racial/ethnic groups. HIV incidence rates per 100,000 MSM among black MSM (2154.2) and Hispanic MSM (767.4) were higher than the rate among white MSM (392.6), whereas the black MSM rate was also higher than the Hispanic MSM rate ($P < 0.001$ for all comparisons) (Table 3). The black-to-white MSM incidence RR (5.5) was similar to the corresponding MSM HIV death RR in 2006 (5.4) but significantly greater than the corresponding MSM HIV prevalence RR (3.7) ($P < 0.01$). Estimated HIV incidence numbers and rates among males who are not MSM were relatively very low. Dividing the MSM HIV incidence rates by the non-MSM male incidence rates thus resulted in extremely high RRs (130.9 for whites, 45.4 for blacks, 94.7 for Hispanics, and 65.3 overall) (all $P < 0.001$).

The sensitivity analysis suggested the HIV rates according to each of the indicators were fairly robust to error associated with misclassification of minority MSM as non-MSM males (Table 4). For all 3 measures, rates remained significantly elevated among black and Hispanic MSM compared with those among white MSM (all $P < 0.001$), although the rates and RRs were lower than in the original analysis. As with the original analysis, each indicator rate in

TABLE 2. Estimated Population-Based Death Rates Per 100,000 MSM Among MSM With HIV (>18 Yrs.), by Race/Ethnicity, Florida, 2006–2007

	Deaths Among MSM With HIV*					
Year	Race/Ethnicity	Number	% of Total	Rate	RR†	95% CI
2006	White	437	44	126.2	1.0	—
	Black	361	36	676.2	5.4	4.7 to 6.2
	Hispanic	204	20	200.7	1.6	1.3 to 1.9
	Total‡	1002	100	199.8	—	—
2007	White	437	46	125.6	1.0	—
	Black	338	35	617.7	4.9	4.3 to 5.7
	Hispanic	183	19	173.2	1.4	1.2 to 1.6
	Total‡	958	100	188.4	—	—

Rates are per 100,000 MSM.

Denominators of the death rates (not shown) are the same as the denominators (estimated numbers of MSM) shown in Table 1.

*Deaths may be due to any cause.

†All RRs are significant at $P < 0.001$.

‡Totals include white, black, and Hispanic MSM only.

MSM, men who have sex with men (includes MSM who have used injection drugs); RR, rate ratio; CI, confidence interval.

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TABLE 3. Estimated Population-Based HIV Incidence Rates Among MSM and Males Who are not MSM (≥18 Yrs.), by Race/Ethnicity, Florida, 2006

	Estimated MSM		Estimated MSM HIV Incidence				
Race/Ethnicity	Number*	% of Total	Number	% of Total	Rate	RR†	95% CI
White	346,383	69	1360	41	392.6	1.0	—
Black	53,385	11	1150	35	2154.2	5.5	5.1 to 5.9
Hispanic	101,644	20	780	24	767.4	2.0	1.8 to 2.1
Total‡	501,412	100	3290	100	656.1	—	—
	Estimated non-MSM males		**Estimated non-MSM male HIV incidence**				
Race/ethnicity	**Number§**	**% of total**	**Number**	**% of total**	**Rate**	**RR†**	**(95% CI)**
White	4,021,897	66	120	20	3.0	1.0	—
Black	821,838	14	390	64	47.5	15.9	13.0 to 20.0
Hispanic	1,242,218	20	100	16	8.1	2.7	2.1 to 3.6
Total‡	6,085,953	100	610	100	10.0	—	—

Rates are per 100,000 MSM or per 100,000 non-MSM males.
*Estimated numbers of MSM are based on Lieb et al., 2009,[15] and are equal to the Florida 2006 midyear racial/ethnic-specific male populations aged ≥18 yrs. multiplied by the following percentages of males who are MSM: 7.9% for whites, 6.1% for blacks, 7.6% for Hispanics, and 7.5% overall (see text).
†All RRs are significant at $P < 0.001$.
‡Totals include white, black, and Hispanic MSM only.
§Numbers of non-MSM males were obtained by subtracting the estimated numbers of MSM from the population of all males (≥18 yrs.) in each racial/ethnic group.
MSM, men who have sex with men (includes MSM who have used injection drugs); RR, rate ratio; CI, confidence interval.

the sensitivity analysis was also higher among black MSM than among Hispanic MSM ($P < 0.001$).

DISCUSSION

The absolute numbers of incident HIV infections and deaths among MSM with HIV in Florida relate one part of the epidemic narrative, as they drive MSM HIV prevalence. Further perspective is gained by the conversion of these numbers to population-based rates, enabling direct comparisons of the impact of HIV on individual groups of MSM. White MSM in our study account for the greatest number of new HIV infections, prevalent HIV cases, and deaths among HIV cases, mainly due to their larger population size, but black and Hispanic MSM experience significantly greater impact, according to each measure. Despite evidence that suggests black MSM have no riskier behavior than white MSM,[26,28] HIV has gained a greater foothold in the black MSM population, with an HIV prevalence rate equivalent to roughly 19% (or 1 in 5) in both 2006 and 2007, which was nearly 4 times that of white MSM in those years.

Increases in HIV prevalence rates among all racial/ethnic groups of MSM can be expected to continue as long as the annual number of deaths is lower than the annual number of incident HIV infections. This assumes the percentage growth in numbers of prevalent HIV cases continues to outpace the percentage growth in MSM populations. Enhanced reporting in Florida was implemented in November 2006 (ie, viral loads and CD4 counts became reportable), resulting in some increased HIV case ascertainment. A shift from paper to

TABLE 4. Sensitivity Analysis*: Adjusted Estimated HIV Prevalence, Death, and Incidence Rates Among MSM (≥18 Yrs.), by Race/Ethnicity, Florida, 2006

	Estimated MSM HIV Prevalence			Deaths Among MSM with HIV			Estimated MSM HIV Incidence		
Race/Ethnicity	Rate	RR†	95% CI	Rate	RR†	95% CI	Rate	RR†	95% CI
White	5181.5	1.00	—	126.2	1.00	—	392.6	1.00	—
Black	14,639.6	2.78	2.76 to 2.89	520.2	4.12	3.59 to 4.74	1657.0	4.22	3.90 to 4.56
Hispanic	8230.0	1.58	1.55 to 1.63	191.4	1.52	1.29 to 1.79	732.0	1.86	1.71 to 2.04
Total‡	7060.1	—	—	191.8	—	—	629.9	—	—

Rates are per 100,000 MSM.
*In the sensitivity analysis, the estimated number of MSM in Florida in 2006 (not shown) assumes the percentage of adult males who are MSM among blacks and Hispanics is the same as that among whites (7.9%) (see text).
†All RRs are significant at $P < 0.001$.
‡Totals include white, black, and Hispanic MSM only.
MSM, men who have sex with men (includes MSM who have used injection drugs); RR, rate ratio; CI, confidence interval.

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electronic laboratory reporting improved completeness and timeliness in the reporting both of HIV and AIDS cases in 2007. These factors also contributed to an increase in the observed HIV prevalence from 2006 to 2007. Meanwhile, no reporting changes influenced the number of deaths among MSM with HIV during the 2 years, as there was ongoing matching of HIV cases with Florida vital statistics and the Social Security Death Index to ascertain deaths. The level of death rates among white MSM with HIV from 2006 to 2007, compared with the decreases in death rates among black and Hispanic MSM with HIV, warrant close monitoring for trend.

Black MSM with HIV had approximately a 5-fold greater death rate than their white counterparts in 2006 and 2007, perhaps reflecting greater rates of undiagnosed or late-diagnosed HIV infection among black MSM, as has been previously reported.[28,31,32] Overall, blacks seem to be relatively less likely to have access to quality HIV care and treatment than whites.[33–35] The 5-fold greater estimated HIV incidence rate for black MSM and 2-fold greater rate for Hispanic MSM, compared with white MSM, could reflect greater pre-existing HIV prevalence in the overall minority communities. Racial/ethnic minority MSM might perceive or experience increased stigma, contributing to delayed screening and treatment,[36,37] and affecting racial/ethnic disparities both in incidence and death rates.

Late diagnosis of HIV and AIDS, which has been documented among minority MSM,[28,31,32] could account for the greater median survival time from AIDS diagnosis to death among white MSM, compared with black and Hispanic MSM. However, compared with males who were not MSM, MSM seemed to have a survival advantage for each racial/ethnic group, for reasons requiring further research.

MSM had extremely high estimated HIV incidence rates, compared with males who are not MSM, with the rate among black MSM exceeding 2% in 2006 (2154.2 per 100,000 MSM). However, the black-to-white HIV incidence RR among males who are not MSM (15.9) was much greater than the corresponding black-to-white RR among MSM (5.5) (Table 3). Low HIV incidence among white males who are not MSM could be associated with the relatively small proportion of white men diagnosed with HIV who are classified as high-risk heterosexuals or IDUs. An understanding of the impact of HIV on non-MSM males would be advanced by estimates of population-based rates of each of the 3 measures among these 2 important behavioral risk groups. Estimates of IDU populations and HIV seroprevalence rates among IDUs have been reported for 96 large metropolitan areas of the United States.[38–40] However, reliable population estimates of high-risk heterosexuals and IDUs by race/ethnicity remain to be developed at the state level for computation of HIV indicator rates.

Consideration of several underlying factors could help clarify the observed disparities. Stigma and denial, including fear of learning one's HIV status or disclosing one's HIV-positive status, are an impediment to prevention.[36,37,41,42] Discrimination and homophobia can lead to fear of disclosure of being a gay man/MSM.[43] HIV complacency and treatment optimism can result in reduction or loss of fear of infection.[44,45] Disparities in the HIV indicator rates might be further explained by racial/ethnic tendencies in social mixing and sexual partnering, which were examined in 1 recent San Francisco study of racial mixing and HIV risk among MSM.[46] A survey determined the observed and expected number and percentage of partnerships of the same race/ethnicity, finding that black MSM were 3 times more likely to have partners who were also black, compared with what was expected. Black MSM seemed to be largely limited by peers to sexual contacts within their own race/ethnicity, which may or may not align with the personal preferences of black MSM. As long as this social tendency exists, HIV will pass more readily and repeatedly within the black MSM community. To the extent that Florida MSM have social/sexual mixing tendencies similar to those in San Francisco, a high degree of inter-connectedness could have led to a more rapid HIV transmission and a higher sustained HIV prevalence among black MSM than among white or Hispanic MSM.

Each of the 3 measures we considered has public health implications. HIV incidence estimates among MSM can help lead to more effective primary HIV prevention efforts, whereas prevalent MSM HIV cases represent an opportunity for implementing targeted secondary HIV prevention efforts, that is, reduction of transmission from those known to be infected. Deaths among HIV cases indicate a need for earlier diagnosis through increased and routine testing, and improved linkage and access to quality care and treatment. Evaluation of progress in meeting HIV prevention goals and objectives is possible by monitoring these measures among MSM and computing the estimated population-based rates to which they give rise.

Our findings have a number of limitations. Numerator issues include the accuracy of imputing HIV risk for cases, deaths, and infections among men with no identified risk behavior. The methodology for developing HIV incidence estimates has thus far been applied to a single year only, although national estimates for 2006 were corroborated with modeled back calculation.[1] Further limitations of the HIV incidence estimates include the influence of variability due to missing data, the percentage of recent BED cases, and the percentage of all infections with a concurrent diagnosis of AIDS.[1] The HIV incidence estimates include those who are aware of their HIV infection and those who are unaware, whereas the HIV prevalence estimates include only those who have been diagnosed. True HIV prevalence would include both diagnosed and undiagnosed MSM living with HIV and would thus be higher than presented. An estimated 22% of HIV-infected MSM in the United States do not know their serostatus,[3] although this estimate has not been stratified by race/ethnicity. Increasingly, in the era of improved antiretroviral therapies, deaths among HIV cases are associated with underlying causes other than HIV/AIDS,[47–49] but cause of death data were not examined in our study.

Denominator issues, which were extensively addressed in our previous study,[15] begin with the problem of eliciting a history of male–male sex contact in behavioral surveys, and 2 of these surveys provided input data for our 3 denominator estimation models.[20,22] This is perhaps the greatest source of bias in estimating MSM populations by race/ethnicity. A number of studies have suggested that minority men are less

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likely to disclose male–male sex contact than white men.[24–28] Our sensitivity analysis took this possibility into account by setting the percentage of black and Hispanic men who were MSM equal to that of white MSM. Significant racial/ethnic disparities in the 3 indicators of interest persisted in the estimates, although the absolute rates and RRs decreased.

The intensity of the epidemic among MSM is not uniform across the state. Routine HIV surveillance data suggest considerable variability by locality.[5] The estimated indicator rates could differ by urban/suburban/rural geographic areas, undetectable by our methods. There could be issues with the broad inclusive definition of MSM that we used for the denominators of the rates. It captures experimenters and those without ongoing male–male sexual behavior. It does not specify the type of sexual activity, for example, oral or anal. The result could be overestimates of those with recent male–male sex contact of a specific type. However, our MSM definition is aligned with the one used by CDC for national HIV/AIDS surveillance.[16] Overestimates of numerator and denominator data are not cancelled out when converted to HIV indicator rates but could be somewhat offsetting. Further research is needed to validate the assumptions we have made and to determine the extent to which our findings might apply to other states.

Despite limitations, the findings we present indicate that resources are urgently needed to scale up a comprehensive culturally specific set of primary and secondary HIV prevention interventions for Florida MSM. Structural interventions should be designed and implemented,[50] which attempt to influence social, political, or economic environments that affect a community's overall behaviors and beliefs simultaneously. Effective social marketing campaigns are needed. Grassroots advocacy and community mobilization should be promoted to complement local health department HIV prevention initiatives.

Our estimates of HIV incidence, HIV prevalence, and death rates among racial/ethnic MSM populations could provide important insight into the epidemic, guiding researchers, planners, and policymakers in addressing the above imperatives. Estimates based on empirical research or further independent modeling of the denominators of the rates could help refine the current rates of the measures, improve program/policy guidance, and better inform resource allocation. Many other states could readily apply our methods to compute the estimated HIV rates among MSM, deriving the denominators by applying our previously reported methodology.[15] To the extent that the rates we present reflect the actual situation in Florida, there will be considerable public health utility to the estimates.

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