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Rates of Primary and Secondary Syphilis Among White and Black non-Hispanic Men Who Have Sex with Men, US States, 2014

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Abstract

Background—Men who have sex with men (MSM) in the United States experience an approximately 100-fold greater rate of primary and secondary (P&S) syphilis diagnoses compared to men who have sex with women only. As in the general population, racial/ethnic disparities in P&S syphilis diagnosis rates may exist among MSM, but MSM-specific P&S syphilis rates by race/ethnicity are unavailable. We enhanced a published modeling approach to estimate area-level MSM populations by race/ethnicity and provide the first estimates of P&S syphilis among black and white non-Hispanic MSM.

Methods—We used data from the American Community Survey (ACS), published findings from the National Health and Nutrition Examination Survey (NHANES), and national syphilis surveillance data to estimate state-level rates of P&S syphilis diagnoses among MSM, overall and for black and white non-Hispanic MSM. We also used variability around ACS and NHANES estimates to calculate 95% confidence intervals for each rate.

Results—Among 11,359 cases of P&S syphilis among MSM with known race/ethnicity in 2014, 72.5% were among white (40.3%) or black (32.2%) MSM. The national rate of P&S syphilis diagnosis was 168.4/100,000 for white MSM and 583.9/100,000 for black MSM. Regional rates for black MSM ranged from 602.0/100,000 (South) to 521.5/100,000 (Midwest) and were consistently higher than those for white MSM.

Conclusions—Although white MSM accounted for the majority of P&S syphilis diagnoses in 2014, when evaluating diagnoses based on rate per 100,000, black MSM had consistently and markedly higher rates than white MSM, with the highest-impacted states located in the US South.

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Note

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Keywords

syphilis; primary and secondary syphilis; men who have sex with men; population estimation; health disparities

Introduction

Syphilis is a sexually transmitted bacterial infection with broad implications for individual health, public health, and preventive medicine. Clinically, syphilis is classified into several stages; the primary and secondary (P&S) stages of syphilis suggest more recent infection and are often used in surveillance to represent acute infections.[1] Left untreated during these earlier stages, clinical manifestations of syphilis include cardiovascular and neurological morbidity as well as pregnancy complications such as stillbirth, low birth weight, prematurity, and congenital anomalies.[1] Syphilis has also been shown to increase the risk of transmission and acquisition of HIV.[3]

Rates of reported P&S syphilis declined to historic lows in the 1990s, leading to optimism about the potential for syphilis elimination in the US, a goal highlighted in the 1999 National Plan for the Elimination of Syphilis.[4] However, since 2001, the national rate of syphilis began rising, and rates of P&S syphilis have increased almost every year, nearly quadrupling between 2001 and 2015 (from 2.1 to 7.5 cases per 100,000 in 2015).[1] The increases in syphilis rates have occurred predominantly among men across all categories of age and race/ethnicity, with the largest increases noted among men who have sex with men (MSM).[1,4] Thus, further understanding of the racial, sexual, and geographic disparities in syphilis transmission should guide programs and policies aimed at reducing transmission of syphilis and addressing disparities in diagnosis rates.[1,5]

The epidemiology of P&S syphilis throughout the US highlights the heterogeneity of the epidemic. While P&S syphilis increases have been seen across many states and regions, state-level variation in case numbers is an important dimension of the syphilis epidemic. For example, there was nearly a 150% increase in diagnoses of P&S syphilis in California from 2006 (5.1/100,000) to 2015 (12.6/100,000), which exceeded the national rate increase during the same time period (3.3 to 7.5/100,000, a 127% increase).[1,6] Surveillance reports have shown that syphilis rates across the US population also show marked disparities by race/ethnicity, with diagnosis rates five times higher among black non-Hispanic men (39.0/100,000) compared to white non-Hispanic men (7.6/100,000) in 2015.[1]

Nationally, MSM experience an approximately 100-fold greater rate of P&S syphilis diagnoses compared to men who have sex with women only,[7] although MSM rates of P&S syphilis among racial/ethnic groups have not been possible. We recently developed a modeling approach for estimating numbers of MSM in US counties and states, as described in Grey et al.[8] This approach was used to update national estimates[7] and provide the first state-specific estimates of P&S syphilis burden among MSM in 2015.[9] Here, we extend this methodology to estimate area-level MSM populations by racial/ethnic groups. We synthesize this information to provide the first estimates of P&S syphilis by race/ethnicity – specifically black and white non-Hispanic – among MSM in the United States. This delineation of P&S

syphilis rates by racial/ethnic groups of MSM by state is a critical step in understanding the social determinants of syphilis and other STD risk disparities in the US.[7]

Methods

MSM population denominators

We estimated race/ethnicity-specific numbers of adult MSM in each state using an updated version of our previously published method.[8] In brief, the previous method adjusted published estimates of the percentage of adult men who are MSM, both nationally[7] and by its urban-rural classification[10] (also called "urbanicity")[11] according to each US county's concentration of households headed by a male with a male partner. The number of total households and male-male households in counties were obtained from the American Community Survey (ACS).[12] A county's weighted percentage of MSM among adult men (age 18 and older) was based on the ratio of the county's percentage of male-male households among all households to the percentage of male-male households among all counties at the same level of urbanicity. Thus, counties with greater than expected density of male-male households were estimated to have more MSM, while counties with less density of male-male households were estimated to have fewer MSM. The percentages from NHANES that were reported by Oster and colleagues[11] were multiplied by this ratio to get an adjusted percentage of MSM among adult men. Thus, the final estimates of MSM population size were determined by multiplying the adjusted percentage by the number of adult men in the county according to the current population estimates from the US Census Bureau. The number of MSM in states and metropolitan statistical areas were then calculated by summing county-level MSM population estimates.

For the analysis presented here, we modified the previously-published model by incorporating Oster and colleagues' estimates of the percentage of MSM among adult men within the four US regions.[11] Consequently, the new estimates take into account the county's density of male-male households relative to all counties at the same level of urbanicity and within the same region. This modification was made in order to reduce errors due to regional differences in same-sex cohabitation or reporting of male-male households to the US Census Bureau. In addition, we updated the prior estimates to represent 2014 by incorporating data from the ACS 2010–2014 summary files.[12]

After determining each county's estimated number of MSM according to the new method, we estimated the number of MSM within each racial/ethnic category according to the racial/ethnic distribution of adult men residing in that county. Here, we assume that the racial/ethnic distribution of the adult MSM population in a given county reflects the communities in which they reside.[7]

In addition to revising the method for estimating overall MSM populations at the county level, we estimated confidence intervals (CIs) around our state-level point estimates of MSM population size, which we did not include in our previous work.[8] These CIs took into account variability in the data sources by sampling from distributions around each estimate. For the data from the ACS summary files, we used margin of error files provided by the US Census Bureau for the 90% CIs for each variable. We also used published 95% confidence

intervals for the estimates published by Purcell et al.[7] and Oster et al.[11] Thus, using randomly drawn parameters from the distributions around these key model parameters, we performed our estimation method 100,000 times.

The values we report are the medians across the 100,000 results. The 95% CIs represent the values at the 2.5th and 97.5th percentiles around the race/ethnicity-specific national and area-specific estimates of MSM populations' sizes. These CIs for the number of MSM were carried forward as denominators to yield CIs for MSM P&S syphilis rates by area and race/ethnicity.

P&S syphilis cases

To calculate rates, we used state-level diagnoses of P&S syphilis ("cases") reported to the CDC by jurisdictions as part of the National Notifiable Diseases Surveillance System. Case reports include information on sex, race/ethnicity, and sex of partners – "male," "female," or "both male and female." The completeness of surveillance reporting for these data varies by state, however. In 2014, the percentage of unknown race/ethnicity ranged from 0% in 14 states (Alaska, Delaware, Indiana, Iowa, Kentucky, Michigan, North Carolina, Oklahoma, South Carolina, South Dakota, Utah, Vermont, Virginia, and West Virginia) to 31.3% (Maine).[13] The percentage of unknown sex of partners in the 49 states that reported those data ranged from 1.2% (South Carolina) to 80.9% (Delaware).[13]

Because diagnosis data among MSM are limited to cases for which all relevant data are reported, previous CDC reports have suppressed MSM-specific data for states in which data about sex of partners was reported on fewer than 70% of P&S syphilis cases.[13] For our one-year cross-sectional analysis, we expand this criterion to retain states with data on sex of partners from at least 50% but fewer than 70% of cases, but we report them separately. We fully suppressed data from states with less than 50% reporting of sex of partners for cases. Furthermore, states and state-by-race/ethnicity strata with fewer than 5 cases were suppressed to protect privacy. Those with 5 or more cases but less than 12 were reported, but rates were excluded because of instability.[14] Suppressed states, those with low reporting of sex of sex partners, and cases with missing race/ethnicity information contributed to regional and overall estimates. Due to low case counts in the majority of states for other races and ethnicities, we limited presented P&S syphilis rates to three groups: (1) MSM of all race/ethnicities, (2) black non-Hispanic MSM, and (3) white non-Hispanic MSM.

For rates, we divided the P&S syphilis case counts by the overall estimated number of MSM as well as the estimated number of MSM among each racial/ethnic category. Rates were calculated this way for each of the 100,000 iterations of the estimation method in order to determine the 95% CIs around each value. Thus, variation in the rates represents variability in the denominator estimates; the case counts do not vary.

Results

The estimated number of non-Hispanic black and white MSM, as well as the total number of MSM in 2014, are summarized by US region, division, and state in Table 1. (Estimates for all races/ethnicities according to the enhanced methodology are provided in Supplement

Table 1.) We estimated 4.64 million MSM in 2014 (95% CI: 4,165,934–5,174,979). Upon examining non-Hispanic black and white MSM, regional differences were apparent. The South had the largest absolute populations of both black (351,185; 95% CI: 266,440–448,993) and white (984,093; 95% CI: 746,228–1,260,888) MSM, and the South had a larger percentage of all black MSM in the US (56.2%; 95% CI: 45.9%–65.9%) compared to white MSM (36.2%; 95% CI: 27.8%–45.5%). California had the largest population of white MSM (311,012; 95% CI: 214,325–432,827) in the country but only the fourth-largest population of black MSM (44,226; 95% CI: 30,266–62,032). Three states had larger populations of black MSM than California, all of them in the South: Texas (63,590; 95% CI: 47,043–83,610), Florida (62,477; 95% CI: 47,143–80,519), and Georgia (46,540; 95% CI: 34,691–60,840).

We present the number and rates of reported P&S syphilis cases among adult MSM in 2014, by state and race/ethnicity, in Table 2 (states with sex partner information reported for at least 70% of cases) and Table 3 (states with at least 50% but less than 70% of sex partner information reported; rates are underestimated rates and should be examined with caution). In 2014, 11,711 cases of P&S syphilis were reported among adult MSM in the US, yielding a rate of 252.3 cases per 100,000 MSM. California had the highest reported number of cases among MSM at 2,244 (19% of cases), while Idaho, Maine, Montana, North Dakota, South Dakota, and Vermont each reported fewer than 12 cases among MSM. The top 5 highest rates were in South Carolina (545.7/100,000), Mississippi (539.3/100,000), Louisiana (527.2/100,00), Nevada (493.6/100,000) and Georgia (443.8/100,000, with 50–70% known partner sex). At the Census region level, rates ranged from 200.8/100,000 in the Midwest to 271.1/100,000 in the West, with the largest number of cases (4,625) in the South.

Of the 11,359 cases of P&S syphilis among MSM reported in 2014 for whom race/ethnicity were known (11,359/11,711, or 97.0% of all MSM cases), 8,240 (72.5%) were among non-Hispanic white or black MSM. White MSM represented 40.3% of all reported MSM cases with known race/ethnicity (4,580/11,359) and black MSM represented 32.2% (3,660/11,359). Among all states with sufficient data, rates for black MSM exceeded those for white MSM, with overall national rates of 583.9/100,000 among black MSM and 168.4/100,000 among white MSM. The rates among black MSM were consistently high across regions, from a high of 602.0/100,000 in the South to a low of 521.5/100,000 in the Midwest, with substantial variation between states. The highest rate was in South Carolina (1,398.1/100,000), with additional rates above 1,000.0/100,000 in Georgia, Mississippi, Nevada, and Pennsylvania. Among white MSM, the variation in rates was lower, from a low of 140.5/100,000 in the Midwest to a high of 168.3/100,000 in the Northeast. The highest rate was 359.0/100,000 in Nevada, and Arizona, California, Louisiana, Rhode Island, and South Carolina also had rates above 250.0/100,000.

Figures 1 and 2 display maps of the distribution of P&S syphilis rates among all MSM and among only white MSM and only black MSM, respectively, using decile cut-points. The maps underscore our finding that isolating state rates of P&S syphilis among MSM by race category significantly reduces the variation in rates by geographic location. When mapping P&S syphilis cases among all MSM, regardless of race/ethnicity, the highest rates are concentrated in a distinct band across the US South. In contrast, when rates among black and

white MSM are disaggregated and viewed on separate maps, the most notable feature is the lower rates of syphilis among white MSM (35 of 41 states with sufficient data for white MSM are in the lower 5 deciles), and the uniformly higher rates of syphilis among black MSM (29 of 30 states with sufficient data for black MSM are in the top 5 deciles), across most of the US.

Discussion

We present an enhancement to our previous methodology, enabling estimation of the sizes of race-specific populations of MSM by state across the US, and providing a clearer picture of the variation in distribution of the MSM population across the US by race and ethnicity. Using these revised estimates of the MSM population distribution in the US, we were then able to use syphilis case surveillance data to present the first-ever state-by-state estimates of P&S syphilis rates among non-Hispanic black and white MSM. Compared to heterosexual males, MSM in the US are disproportionately burdened by syphilis.[9] Our analysis further shows that among the MSM population, there are additional racial/ethnic disparities. Across all of the states examined, irrespective of the relative size of the MSM population, black MSM had significantly higher risks of P&S syphilis compared to white MSM.

The most recent report of MSM-specific syphilis rates used data from 2008.[7] Between 2008 and 2014, our data show a 63.8% increase in P&S syphilis among MSM overall (154 to 252.3/100,000), a 65.4% increase among non-Hispanic black MSM (353 to 583.9/100,000), and a 115.9% increase among white MSM (78 to 168.4/100,000).[7] Although percentage increases in P&S syphilis rates were higher among white MSM, absolute rate increases were higher among black MSM. Thus, these data reinforce the need to have population-specific interventions among MSM.

Although a critical finding from our data is the systematically higher rates of syphilis among black MSM, our state-by-state findings highlight areas where rates among black MSM are particularly elevated; for example, the P&S syphilis rate in Georgia, Mississippi, and South Carolina each represent a two-fold or greater rate than the national P&S syphilis rate among black MSM, and are nearly 10-fold the syphilis rate for MSM overall. When comparing these rates with the overall national syphilis surveillance rate of 7.5 cases per 100,000 US adults, these disparities and the vulnerability of the black MSM population in the South is further underscored.[1] In the West, South, and Northeast, the P&S syphilis epidemics for white MSM are more uniform and less concentrated in the South. These racially specific and different geographic patterns can inform national, state, and regional approaches to STD control.

The P&S syphilis racial/ethnic disparities can help inform local program planning and development of syphilis education and prevention interventions. The data presented here underscore the need to develop a more lucid local epidemiology of P&S syphilis, including greater attention to collecting and reporting comprehensive data regarding sexual history and sex of sex partners. Local and state health departments may need to explore whether prevention approaches for MSM may differ by racial/ethnic group. Importantly, the methodology presented will allow for continual updates as new surveillance and census data

become available, allowing the public health understanding of US syphilis rates and subpopulation disparities to evolve as new data become available.

The findings presented here illustrate the importance of surveillance methodologies for accurately estimating population denominators, such as developing accurate estimates of state- and county-level MSM populations by race across the US. In deepening our understanding of disease risk and transmission in the US, these denominator estimates can be as important as accurate case surveillance. For example, in Nevada, only 40 cases of P&S syphilis were reported among black MSM in 2014, compared to 359 cases among white MSM. Yet, the race-specific rates of P&S syphilis were estimated to be 1,058.5/100,000 and 252.0/100,000 for black and white MSM, respectively. In this example, the burden of disease is considerably higher for black MSM, compared to white MSM. Also, the rate ratio for black MSM compared to white MSM was 4.2, while the case ratio was 9, suggesting the magnitude of racial/ethnic disparities may also differ when rates are compared rather than absolute case counts.

The results of our model rely on the accuracy of the ACS data,[12] the published NHANES estimates,[7,11] and the surveillance data that were available. Consequently, there are several ways in which our findings and estimates are limited by those data. First, due to small cell sizes and resultant instability of rate estimates, we were unable to establish P&S syphilis rate estimates for racial and ethnic group other than non-Hispanic white and black MSM. In some areas, this limitation may result from very small population sizes of some MSM groups, whereas in other populations the model was limited by suppression of data in states where a significant proportion of P&S syphilis surveillance is lacking information about sexual behavior. As a result, important subpopulation disparities in P&S syphilis may be missed in this analysis, such as Hispanic or Asian MSM. However, the methodology presented can be applied to state- and county-level data by state and local health departments where sufficiently stable rate estimates can be calculated. Furthermore, in states where sex of sexual partner or race/ethnicity was not collected for all cases of P&S syphilis, rates are likely underestimated. While it is unlikely that the missing data would be skewed sufficiently to alter our finding of significant racial disparities in P&S syphilis infection rates, the implications of this missing data highlight the importance of accurate and complete disease surveillance reporting from state and local health departments.

Beyond the data and parameters used in our estimation method, we assumed that the racial distribution of MSM follows racial distribution of adult men in the county, as reported by census data. While there is no reason to expect that this assumption is erroneous in a manner that would alter the P&S syphilis rate disparities in a systematic fashion, absent a large-scale population-based study, it is impossible to know if there may be some areas of the country where this assumption leads to a racial distribution that is not fully representative of the population in question. However, given the very marked and consistent racial disparity in P&S syphilis rates observed in this study, it is unlikely that this assumption could be fully or largely explained by an error in this assumption.

We estimated race/ethnicity-specific rates of reported P&S syphilis among MSM in the US, by state of residence. Although white MSM account for the majority of cases, when

evaluating diagnoses based on rate per 100,000, black MSM had consistently and markedly higher rates (e.g., 583.9/100,000 nationally) than white MSM (e.g., 168.4/100,000 nationally), with the highest-impacted states located in the US South. This first-ever publication of state-level rates of P&S syphilis among MSM help state and local public health departments to better understand the populations' disparities and public health needs within the communities they serve, as well as underscoring the importance of ensuring complete and accurate surveillance collection data to drive data-based public health planning.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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References

1. Centers for Disease Control and Prevention. Sexually Transmitted Disease Surveillance, 2015. Atlanta, GA: 2016.
2. Clement ME, Okeke NL, Hicks CB. Treatment of syphilis: a systematic review. JAMA. 2014; 312(18):1905–17. DOI: 10.1001/jama.2014.13259 [PubMed: 25387188]
3. Fleming DT, Wasserheit JN. From epidemiological synergy to public health policy and practice: the contribution of other sexually transmitted diseases to sexual transmission of HIV infection. Sex Transmit Infect. 1999; 75(1):3–7.
4. Patton ME, Su JR, Nelson R, et al. Primary and secondary syphilis--United States, 2005–2013. MMWR Morb Mortal Wkly Rep. 2014; 63(18):402–6. [PubMed: 24807239]
5. Heffelfinger JD, Swint EB, Berman SM, et al. Trends in primary and secondary syphilis among men who have sex with men in the United States. Am J Public Health. 2007; 97(6):1076–83. DOI: 10.2105/AJPH.2005.070417 [PubMed: 17463387]
6. Centers for Disease Control and Prevention. Sexually Transmitted Disease Surveillance, 2006. Atlanta, GA: 2007.
7. Purcell DW, Hall HI, Bernstein KL, et al. The Importance of Population Denominators for High-Impact Public Health for Marginalized Populations. JMIR Public Health Surveill. 2016; 2(1):e26.doi: 10.2196/publichealth.5883 [PubMed: 27244773]
8. Grey JA, Bernstein KT, Sullivan PS, et al. Estimating the Population Sizes of Men Who Have Sex With Men in US States and Counties Using Data From the American Community Survey. JMIR Public Health Surveill. 2016; 2(1):e14. doi:0.2196/publichealth.5365. [PubMed: 27227149]
9. de Voux A, Kidd S, Grey JA, et al. State-specific rates of primary and secondary syphilis among men who have sex with men – United States, 2015. MMWR Morb Mortal Weekly Rep. 2017; 66:349–354. doi: http://dx.doi.org/10.15585/mmwr.mm6613a1.
10. Ingram DD, Franco SJ. 2013 NCHS urban–rural classification scheme for counties. Vital Health Stat. 2014; 2(166):1–73.

11. Oster AM, Sternberg M, Lansky A, et al. Population Size Estimates for Men who Have Sex with Men and Persons who Inject Drugs. J Urban Health. 2015; 92(4):733–43. DOI: 10.1007/s11524-015-9970-3 [PubMed: 26115985]
12. US Census Bureau. American Community Survey 5-Year Summary File. 2010–2014.
13. Centers for Disease Control and Prevention. Sexually Transmitted Disease Surveillance 2014. Atlanta, GA: 2015.
14. AIDSVu. [1/22/2017] Data Methods – State/County. 2016. Available from: https://aidsvu.org/data-methods-statecounty/

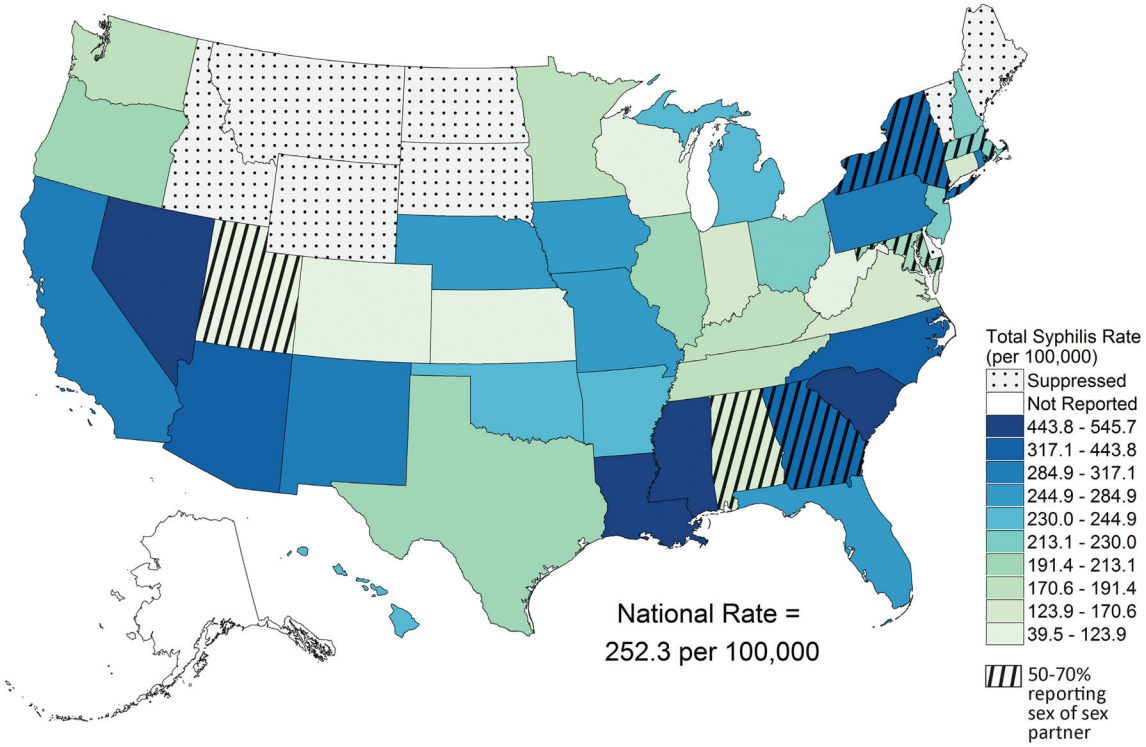

Figure 1.

Rates of primary and secondary (P&S) syphilis diagnoses among men who have sex with men (MSM), by decile – United States, 2014

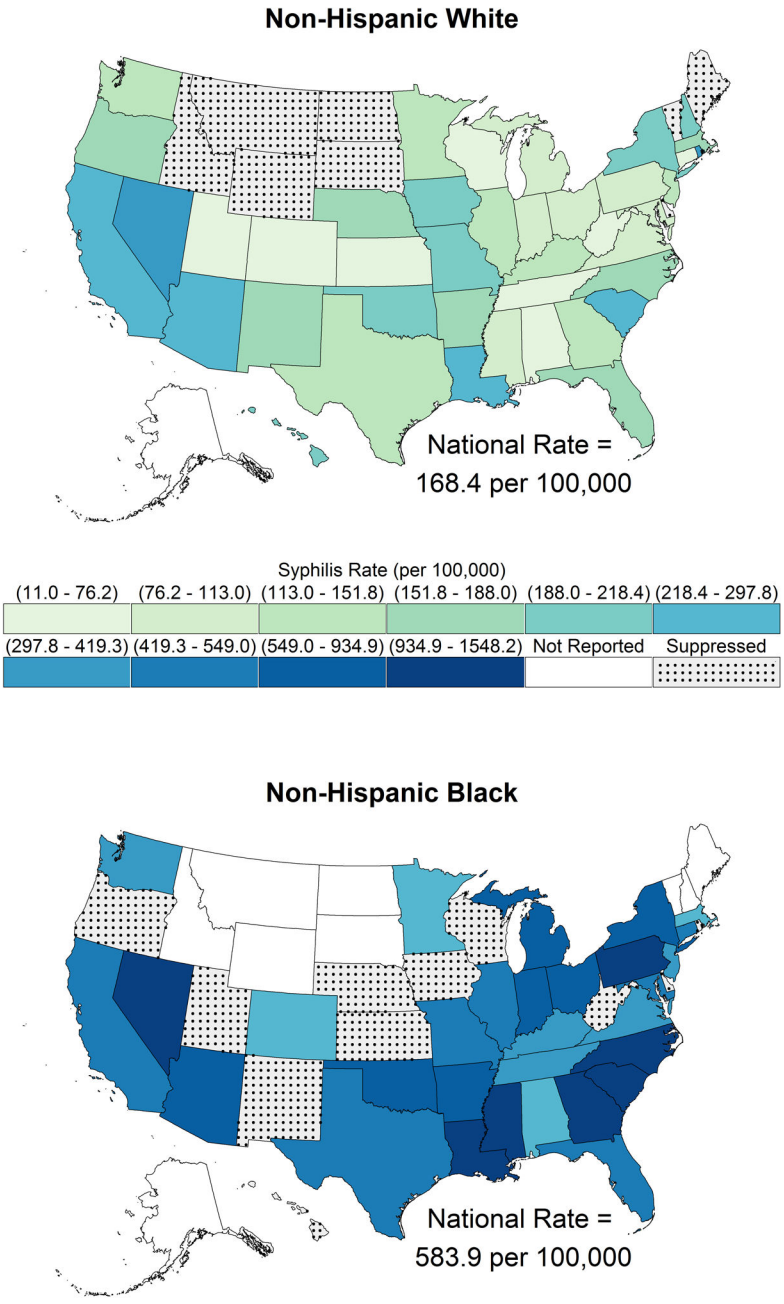

Figure 2.

Rates of primary and secondary (P&S) syphilis diagnoses among non-Hispanic white and black men who have sex with men, by decile – United States, 2014

Table 1

Estimated total number of men who have sex with men (MSM) and non-Hispanic black and white MSM, by US geographic area, 2014

	Total MSM		Black MSM		White MSM	
Area	***N***	**95% CI**	***N***	**95% CI**	***N***	**95% CI**
United States	4,642,002	(4,165,934, 5,174,979)	626,802	(538,880, 723,768)	2,719,737	(2,421,729, 3,057,643)
Northeast	625,768	(339,583, 1,103,228)	79,918	(43,060, 141,906)	393,919	(213,049, 697,150)
New England	150,768	(81,156, 268,041)	10,799	(5,843, 19,114)	114,847	(61,458, 205,142)
Connecticut	33,465	(17,761, 60,490)	3,217	(1,704, 5,827)	23,879	(12,673, 43,117)
Maine	12,702	(6,152, 25,381)	167	(82, 327)	12,034	(5,827, 24,093)
Massachusetts	69,948	(37,432, 125,125)	6,062	(3,265, 10,762)	50,109	(26,638, 90,261)
New Hampshire	10,433	(5,256, 20,221)	133	(68, 252)	9,639	(4,850, 18,736)
Rhode Island	16,853	(8,977, 30,336)	1,116	(587, 2,035)	12,294	(6,557, 22,086)
Vermont	6,475	(2,903, 14,337)	75	(35, 155)	6,105	(2,731, 13,569)
Mid-Atlantic	474,688	(257,404, 837,826)	69,125	(37,188, 122,882)	278,941	(151,176, 492,323)
New Jersey	84,548	(45,230, 151,323)	11,853	(6,393, 20,982)	45,200	(23,962, 81,737)
New York	271,985	(146,883, 481,436)	41,126	(22,014, 73,454)	144,949	(78,581, 256,078)
Pennsylvania	117,968	(63,652, 209,142)	16,108	(8,680, 28,598)	88,541	(47,563, 157,604)
Midwest	833,960	(523,997, 1,277,908)	119,852	(74,706, 185,947)	590,066	(370,012, 905,423)
East North Central	611,789	(384,179, 937,065)	96,319	(59,930, 149,803)	417,451	(261,986, 640,141)
Indiana	219,092	(136,821, 338,475)	37,519	(23,143, 58,778)	121,107	(75,827, 186,225)
Illinois	70,916	(44,137, 109,936)	8,970	(5,587, 13,904)	54,623	(33,846, 85,094)
Michigan	114,826	(71,909, 176,797)	19,649	(12,266, 30,400)	84,061	(52,454, 130,023)
Ohio	150,668	(94,497, 231,473)	24,354	(15,079, 37,977)	114,358	(71,679, 175,668)
Wisconsin	55,744	(34,660, 86,566)	5,797	(3,561, 9,082)	42,991	(26,593, 67,190)
West North Central	221,850	(138,977, 341,661)	23,545	(14,691, 36,355)	172,405	(107,775, 266,367)
Iowa	17,052	(9,476, 29,582)	615	(338, 1,084)	14,963	(8,319, 25,979)

	Total MSM		Black MSM		White MSM	
Area	***N***	**95% CI**	***N***	**95% CI**	***N***	**95% CI**
Kansas	19,647	(11,712, 31,840)	1,395	(819, 2,297)	15,236	(9,074, 24,706)
Minnesota	90,633	(56,435, 140,040)	7,259	(4,464, 11,406)	70,768	(44,098, 109,182)
Missouri	73,572	(45,873, 113,539)	13,350	(8,268, 20,775)	53,932	(33,494, 83,676)
Nebraska	11,582	(6,415, 20,221)	646	(348, 1,170)	9,448	(5,237, 16,473)
North Dakota	4,248	(2,298, 7,643)	104	(55, 190)	3,764	(2,035, 6,766)
South Dakota	4,356	(2,364, 7,808)	93	(50, 165)	3,741	(2,034, 6,688)
South	1,797,629	(1,364,897, 2,295,554)	351,185	(266,440, 448,993)	984,093	(746,228, 1,260,888)
South Atlantic	1,001,970	(759,011, 1,283,965)	218,957	(165,740, 280,644)	555,735	(419,676, 715,389)
Delaware	13,288	(9,078, 18,892)	2,462	(1,674, 3,532)	9,065	(6,191, 12,902)
District of Columbia	48,468	(34,183, 66,637)	20,738	(14,626, 28,511)	19,960	(14,077, 27,442)
Florida	408,746	(309,228, 524,949)	62,477	(47,143, 80,519)	211,349	(159,583, 271,789)
Georgia	146,022	(108,278, 192,007)	46,540	(34,691, 60,840)	76,677	(56,743, 101,168)
Maryland	86,222	(61,272, 118,971)	28,032	(20,460, 37,502)	44,328	(31,021, 62,304)
North Carolina	120,445	(90,148, 156,911)	24,871	(18,578, 32,462)	78,047	(58,328, 101,835)
South Carolina	34,637	(22,978, 51,423)	8,511	(5,616, 12,638)	23,308	(15,460, 34,555)
Virginia	128,323	(95,766, 167,777)	24,230	(18,088, 31,619)	79,737	(59,658, 103,990)
West Virginia	12,898	(8,311, 19,637)	538	(350, 812)	11,881	(7,637, 18,145)
East South Central	202,573	(151,086, 266,583)	44,759	(33,420, 58,322)	142,088	(105,211, 189,156)
Alabama	44,376	(32,526, 59,429)	11,855	(8,712, 15,744)	29,611	(21,605, 39,927)
Kentucky	52,558	(38,798, 70,344)	5,780	(4,305, 7,543)	43,184	(31,645, 58,572)
Mississippi	20,211	(13,061, 31,574)	6,820	(4,318, 10,929)	12,256	(7,956, 19,018)
Tennessee	85,102	(64,059, 109,885)	20,089	(14,770, 26,620)	56,877	(42,631, 74,016)
West South Central	591,872	(445,932, 763,063)	87,270	(65,314, 113,263)	285,397	(215,881, 366,071)
Arkansas	19,188	(12,259, 29,299)	3,003	(1,940, 4,549)	14,251	(9,079, 21,857)
Louisiana	47,233	(35,027, 62,329)	16,542	(12,352, 21,605)	25,994	(18,977, 34,942)
Oklahoma	42,005	(31,231, 55,283)	4,014	(2,979, 5,262)	28,583	(21,190, 37,773)
Texas	482,694	(361,353, 627,177)	63,590	(47,043, 83,610)	216,020	(162,563, 278,943)

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Area	Total MSM		Black MSM		White MSM	
	N	95% CI	*N*	95% CI	*N*	95% CI
West	1,326,943	(916,425, 1,839,495)	68,340	(47,000, 95,269)	716,204	(493,897, 993,593)
Mountain	349,506	(239,860, 490,614)	15,076	(10,382, 20,966)	230,994	(158,082, 325,336)
Arizona	102,595	(70,265, 144,136)	4,607	(3,145, 6,491)	62,542	(42,810, 87,999)
Colorado	110,607	(73,824, 159,436)	5,373	(3,615, 7,696)	77,951	(51,852, 112,816)
Idaho	15,326	(8,968, 25,889)	105	(62, 171)	12,922	(7,574, 21,763)
Montana	43,556	(29,312, 62,129)	3,779	(2,508, 5,473)	23,956	(16,170, 34,124)
Nevada	32,697	(22,072, 46,642)	422	(286, 599)	25,977	(17,522, 37,163)
New Mexico	11,553	(6,193, 22,140)	67	(38, 118)	10,237	(5,499, 19,540)
Utah	25,542	(15,216, 41,431)	577	(343, 937)	11,057	(6,599, 17,900)
Wyoming	5,627	(2,876, 11,446)	90	(50, 164)	4,837	(2,463, 9,881)
Pacific	976,424	(673,627, 1,355,935)	53,236	(36,548, 74,392)	484,626	(334,298, 672,662)
Alaska	8,311	(4,827, 14,006)	345	(198, 583)	5,209	(3,057, 8,637)
California	730,656	(502,434, 1,019,873)	44,226	(30,266, 62,032)	311,012	(214,325, 432,827)
Hawaii	20,847	(12,308, 34,346)	548	(321, 906)	6,061	(3,538, 10,214)
Oregon	78,841	(53,337, 112,220)	1,828	(1,249, 2,569)	61,645	(41,658, 87,791)
Washington	136,394	(93,075, 191,357)	6,253	(4,252, 8,811)	99,852	(68,005, 140,485)

Note. Because values for N of MSM are medians from 100,000 iterations of the estimation method, estimates from area components (e.g., states within divisions, divisions within regions, etc.) may not sum to the total estimate.

Table 2

Cases and rates of primary and secondary (P&S) syphilis among non-Hispanic black and white men who have sex with men – US regions, divisions, and states with at least 70% known partner sex, 2014

	Total MSM			Black MSM			White MSM		
Area	**Cases**	**Rate**	**95% CI**	**Cases**	**Rate**	**95% CI**	**Cases**	**Rate**	**95% CI**
United States	11,711	252.3	(226.3, 281.1)	3,660	583.9	(505.7, 679.2)	4,580	168.4	(149.8, 189.1)
Northeast	1,813	289.7	(164.3, 533.9)	553	692.0	(389.7, 1,284.2)	663	168.3	(95.1, 311.2)
New England	288	191.0	(107.4, 354.9)	40	370.4	(209.3, 684.6)	173	150.6	(84.3, 281.5)
Connecticut	53	158.4	(87.6, 298.4)	17	528.4	(291.8, 997.7)	20	83.8	(46.4, 157.8)
Maine	†			†			†		
Massachusetts	†			†			†		
New Hampshire	24	230.0	(118.7, 456.6)	*			21	217.9	(112.1, 433.0)
Rhode Island	50	296.7	(164.8, 557.0)	5	#		38	309.1	(172.1, 579.6)
Vermont	*			*			*		
Mid-Atlantic	1,525	321.3	(182.0, 592.5)	513	742.1	(417.5, 1,379.5)	490	175.7	(99.5, 324.1)
New Jersey	181	214.1	(119.6, 400.2)	47	396.5	(224.0, 735.2)	65	143.8	(79.5, 271.3)
New York	†			†			†		
Pennsylvania	1,007	370.2	(161.1, 529.4)	181	1,123.6	(632.9, 2,085.1)	118	133.3	(74.9, 248.1)
Midwest	1,675	200.8	(131.1, 319.7)	625	521.5	(336.1, 836.6)	829	140.5	(91.6, 224.0)
East North Central	1,202	196.5	(128.3, 312.9)	512	531.6	(341.8, 854.3)	536	128.4	(83.7, 204.6)
Indiana	121	170.6	(110.1, 274.1)	50	557.4	(359.6, 894.9)	63	115.3	(74.0, 186.1)
Illinois	466	212.7	(137.7, 340.6)	159	423.8	(270.5, 687.0)	196	161.8	(105.2, 258.5)
Michigan	268	233.4	(151.6, 372.7)	147	748.1	(483.6, 1,198.5)	109	129.7	(83.8, 207.8)
Ohio	325	215.7	(140.4, 343.9)	152	624.1	(400.2, 1,008.0)	154	134.7	(87.7, 214.8)
Wisconsin	‡			‡			‡		
West North Central	473	213.2	(138.4, 340.3)	113	479.9	(310.8, 769.2)	293	169.9	(110.0, 271.9)

Area	Total MSM			Black MSM			White MSM		
	Cases	Rate	95% CI	Cases	Rate	95% CI	Cases	Rate	95% CI
Iowa	48	281.5	(162.3, 506.6)	7	#		34	227.2	(130.9, 408.7)
Kansas	24	122.2	(75.4, 204.9)	6	#		13	85.3	(52.6, 143.3)
Minnesota	162	178.7	(115.7, 287.1)	17	234.2	(149.0, 380.8)	118	166.7	(108.1, 267.6)
Missouri	199	270.5	(175.3, 433.8)	73	546.8	(351.4, 882.9)	106	196.5	(126.7, 316.5)
Nebraska	33	284.9	(163.2, 514.4)	10	#		16	169.3	(97.1, 305.5)
North Dakota	*			*			*		
South Dakota	†			†			†		
South	4,625	257.3	(201.5, 338.9)	2,114	602.0	(470.8, 793.4)	1,521	154.6	(120.6, 203.8)
South Atlantic	2,819	281.3	(219.6, 371.4)	1,389	634.4	(494.9, 838.1)	868	156.2	(121.3, 206.8)
Delaware	‡			‡			‡		
District of Columbia	^			^			^		
Florida	1,152	281.8	(219.4, 372.5)	334	534.6	(414.8, 708.5)	404	191.2	(148.6, 253.2)
Georgia	†			†			†		
Maryland	†			†			†		
North Carolina	435	361.2	(277.2, 482.5)	244	981.1	(751.7, 1,313.4)	151	193.5	(148.3, 258.9)
South Carolina	189	545.7	(367.5, 822.5)	119	1,398.1	(941.6, 2,119.0)	61	261.7	(176.5, 394.6)
Virginia	194	151.2	(115.6, 202.6)	95	392.1	(300.5, 525.2)	81	101.6	(77.9, 135.8)
West Virginia	13	100.8	(66.2, 156.4)	*			12	101.0	(66.1, 157.1)
East South Central	412	203.4	(154.5, 272.7)	222	496.0	(380.6, 664.3)	164	115.4	(86.7, 155.9)
Alabama	†			†			†		
Kentucky	91	173.1	(129.4, 234.5)	20	346.0	(265.1, 464.6)	65	150.5	(111.0, 205.4)
Mississippi	109	539.3	(345.2, 834.5)	86	1,260.9	(786.9, 1,991.6)	17	138.7	(89.4, 213.7)
Tennessee	147	172.7	(133.8, 229.5)	82	408.2	(308.0, 555.2)	56	98.5	(75.7, 131.4)
West South Central	1,394	235.5	(182.7, 312.6)	503	576.4	(444.1, 770.1)	489	171.3	(133.6, 226.5)
Arkansas	47	244.9	(160.4, 383.4)	18	599.3	(395.7, 927.7)	27	189.5	(123.5, 297.4)
Louisiana	249	527.2	(399.5, 710.9)	157	949.1	(726.7, 1,271.0)	74	284.7	(211.8, 389.9)
Oklahoma	102	242.8	(184.5, 326.6)	23	573.0	(437.1, 772.0)	58	202.9	(153.6, 273.7)

Area	Total MSM			Black MSM			White MSM		
	Cases	Rate	95% CI	Cases	Rate	95% CI	Cases	Rate	95% CI
Texas	996	206.3	(158.8, 275.6)	305	479.6	(364.8, 648.3)	330	152.8	(118.3, 203.0)
West	3,598	271.1	(195.6, 392.6)	368	538.5	(386.3, 783.0)	1,567	218.8	(157.7, 317.3)
Mountain	877	250.9	(178.8, 365.6)	101	669.9	(481.7, 972.9)	396	171.4	(121.7, 250.5)
Arizona	405	394.8	(281.0, 576.4)	43	933.3	(662.4, 1,367.4)	187	299.0	(212.5, 436.8)
Colorado	137	123.9	(85.9, 185.6)	12	223.3	(155.9, 332.0)	74	94.9	(65.6, 142.7)
Idaho	9	#		*			7	#	
Montana	*			*			*		
Nevada	215	493.6	(346.1, 733.5)	40	1,058.5	(730.9, 1,594.9)	86	359.0	(252.0, 531.8)
New Mexico	81	317.1	(195.5, 532.3)	*			19	171.8	(106.1, 287.9)
Utah	†			†			†		
Wyoming	‡			‡			‡		
Pacific	2,721	278.7	(200.7, 403.9)	267	501.5	(358.9, 730.5)	1,171	241.6	(174.1, 350.3)
Alaska	^			^			^		
California	2,244	307.1	(220.0, 446.6)	239	540.4	(385.3, 789.7)	892	286.8	(206.1, 416.2)
Hawaii	48	230.2	(139.8, 390.0)	5	#		13	214.5	(127.3, 367.4)
Oregon	168	213.1	(149.7, 315.0)	*			114	184.9	(129.9, 273.7)
Washington	261	191.4	(136.4, 280.4)	19	303.8	(215.6, 446.8)	152	152.2	(108.2, 223.5)

† Cases and rates for this state are reported in Table 3 because the percentage of P&S syphilis cases with known sex partner was at least 50% but less than 70%. State still contributes to national and regional estimates.

‡ Cases and rates for this state are not reported in this manuscript because the percentage of P&S syphilis cases with known sex partner was less than 50%. State still contributes to national and regional estimates.

* Cases and rates not reported for this stratum because the number of cases is < 5. State still contributes to national and regional estimates.

Rates not reported for this stratum because the number of cases is ≥5 and < 12. State still contributes to national and regional estimates.

^ Sex of sex partners for cases not reported to CDC for this jurisdiction. Jurisdiction does not contribute to national or regional estimates.

Table 3

Cases and rates of primary and secondary (P&S) syphilis among non-Hispanic black and white men who have sex with men – US states with at least 50% but less than 70% known partner sex, 2014

	Total MSM			Black MSM			White MSM		
State	**Cases**	**Rate**	**95% CI**	**Cases**	**Rate**	**95% CI**	**Cases**	**Rate**	**95% CI**
Alabama	65	146.5	(109.4, 199.8)	34	286.8	(216.0, 390.3)	26	87.8	(65.1, 120.3)
Georgia	648	443.8	(337.5, 598.5)	474	1,018.5	(779.1, 1,366.4)	112	146.1	(110.7, 197.4)
Maine	6	#		*			5	#	
Maryland	180	208.8	(151.3, 293.8)	117	417.4	(312.0, 571.9)	46	103.8	(73.8, 148.3)
Massachusetts	151	215.9	(120.7, 403.4)	18	296.9	(167.3, 551.2)	85	169.6	(94.2, 319.1)
New York	1,007	370.2	(209.2, 685.6)	285	693.0	(388.0, 1,294.6)	307	211.8	(119.9, 390.7)
South Dakota	6	#		*			5	#	
Utah	27	82.6	(57.9, 122.3)	*			20	77.0	(53.8, 114.1)

Note. States in this table have >30% missing data on cases for sex of sex partner. Therefore, counts and rates represent an underestimate. Caution should be taken in comparing rates between states.

*Cases and rates not reported for this stratum because the number of cases is < 5. State still contributes to national and regional estimates.

#Rates not reported for this stratum because the number of cases is ≥5 and < 12. State still contributes to national and regional estimates.