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# Narrative Review: Assessment of *Neisseria gonorrhoeae* Infections Among Men Who Have Sex With Men in National and Sentinel Surveillance Systems in the United States

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## Abstract

To assess trends in *Neisseria gonorrhoeae* among gay, bisexual, and other men who have sex with men (MSM), we reviewed existing and published gonorrhea surveillance data in the United States. Data identified in this review include the following: national gonorrhea case report data and data from 3 other surveillance programs, the Gonococcal Isolate Surveillance Project (GISP), the STD Surveillance Network (SSuN), and National HIV Behavioral Surveillance.

Rates of reported cases of gonorrhea among men increased 54.8% in 2006 to 2015 compared with a 2.6% increase among women. Since 2012, the rate of reported gonorrhea cases among men surpassed the rate among women; the male-to-female case rate ratio increased from 0.97 in 2012 to 1.31 in 2015. The proportion of gonococcal urethral isolates collected in the Gonococcal Isolate Surveillance Project that were collected from MSM increased from 21.5% to 38.1% in 2006 to 2015. In 2009 to 2015, the percent of MSM who tested positive for rectal and oropharyngeal gonorrhea in sexually transmitted disease (STD) clinics increased by 73.4% and 12.6%, respectively. Estimated rates of gonorrhea among MSM increased by 151% in 2010 to 2015 in jurisdictions participating in the STD Surveillance Network. Data from the National HIV Behavioral Surveillance demonstrate that testing for gonorrhea among MSM increased by 23.1% between 2011 and 2014.

Together, surveillance data suggest a disproportionate burden of gonorrhea among MSM in the United States and suggest increases in both screening and disease in recent years. Because each data source has inherent limitations and biases, examining these data from different systems together strengthens this conclusion.

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## BACKGROUND

Infection with *Neisseria gonorrhoeae* in men can occur in the oropharynx, genitals, and rectum. Although often asymptomatic, infections can result in dysuria, discharge, epididymitis, anal itching, soreness, bleeding, or painful bowel movements.[1] In addition, gonococcal infections can elicit mucosal inflammation facilitating HIV transmission and acquisition.[2–4] To prevent gonorrhea-associated morbidity and associated sequelae, effective prevention and control efforts are needed and should be targeted to populations at increased risk. From 2002 to 2012, rates of reported gonorrhea cases in the United States have been higher among women, most likely because of screening practices and recommendations.[5,6] Since 2013, however, the rate of reported gonorrhea cases among men have been higher than the rates among women, suggesting a change in the epidemiology of gonorrhea in the United States, such as increasing incidence among gay, bisexual, and other men who have sex with men (MSM).[7] To better describe the current epidemiology of gonorrhea among men in the United States, we reviewed available national and sentinel surveillance data and describe trends in gonorrhea among MSM.

## METHODS

We reviewed existing and published data from national and sentinel sources on gonococcal infection among men in the United States. Data identified for use in this summary include national gonorrhea case report data from the National Notifiable Disease Surveillance System and data from the Gonococcal Isolate Surveillance Project (GISP), the STD Surveillance Network (SSuN), and the National HIV Behavioral Surveillance (NHBS).

### Case Report Data

State and local health departments report cases of gonorrhea weekly to the Centers for Disease Control and Prevention (CDC) National Notifiable Disease Surveillance System.[8] Case reports include a limited set of required demographic data elements usually provided on laboratory reports (e.g., age and gender) and may include optional data elements collected during case investigations (e.g., gender of sex partners and HIV status).[9]

We reviewed trends in reported gonorrhea cases in 2006 to 2015 among men by age, race/ethnicity (using US census population bridged race files), and census region (Midwest, Northeast, South, and West). To investigate trends by sex, we calculated the male-to-female rate ratio using the rate of reported male cases and the rate of reported female cases (rate ratio = rate for males/rate for females). We assumed that an increasing rate ratio suggests increasing gonorrhea rates among MSM.[10,11]

Although gender of sex partner is not a required data element for reported cases of gonorrhea and not routinely reported in national surveillance summaries, we investigated the proportion of male cases that were reported among MSM in jurisdictions reporting gender of sex partner data for at least 70% of their male cases. We used a 70% cut point because it has been previously used when assessing variable completeness for other reportable STDs.[7]

### Gonococcal Isolate Surveillance Project

Gonococcal Isolate Surveillance Project is an ongoing CDC-supported surveillance system that monitors gonococcal antimicrobial susceptibility in selected STD clinics in 25 to 30 cities each year.[12] Each month, up to 25 *N. gonorrhoeae* urethral isolates are collected from consecutive men with gonococcal urethritis attending participating STD clinics and submitted to regional laboratories for antimicrobial susceptibility testing. Demographic and clinical data (such as gender of sex partner) are abstracted from medical records by clinic staff and submitted each month to the CDC. Gender of sex partner data are collected in accordance with local clinic practice and can include chart notation from previous visits based on patient self-report of sexual orientation or reported gender of sex partners (from the previous 3, 6, or 12 months).[12] Men reporting gay or bisexual sexual orientation or who reported recent male sex partners were categorized as MSM. Men who reported sex only with women were categorized as MSW. We report the proportion of submitted isolates collected from MSM for each year from 2006 to 2015; data from other subgroups in GISP are presented elsewhere.[12]

### STD Surveillance Network

STD Surveillance Network is a CDC-supported surveillance system comprising selected state and city health departments. It addresses gaps in national case data through 2 activities: (*a*) enhanced case-based gonorrhea surveillance, referred to as the “population component,” and (*b*) sentinel surveillance in key facilities, including STD clinics, referred to as the “facility component.” STD Surveillance Network jurisdictions participating in the population component identify a random sample of gonorrhea cases reported from all providers for administration of a standardized behavioral interview. In the facility component, demographic, behavioral, and clinical information is collected from all patients presenting for care in participating STD clinics (the number of clinics under surveillance ranged from 28 clinics in 2009 to 25 clinics in 2015). For the population component, men who identified as gay or bisexual or who reported male sex partners in the previous 12 months were categorized as MSM. For the facility component, men who identified as gay or bisexual, or who reported ever having male sex partners were categorized as MSM. For both activities, men who reported only female sex partners, or those who did not report any recent sex partners but who identified as heterosexual were categorized as MSW. Six jurisdictions (Baltimore, Maryland; California excluding San Francisco; New York City, New York; Philadelphia, Pennsylvania; San Francisco, California; and Washington) provided data from continuously participating STD clinics for the facility component in 2009 to 2015. The same 6 jurisdictions provided data for the population component in 2010 to 2015; in addition, 4 other jurisdictions (Multnomah County, Oregon; Minnesota; Massachusetts; and Florida) provided data in 2015.

We used enhanced case investigation data from the population component to calculate the weighted proportion of gonorrhea cases attributable to MSM, MSW, and women in the 10 jurisdictions participating in 2015. To examine temporal trends, we report published estimates of calculated incidence of gonorrhea diagnoses among MSM from the population component (calculated using MSM population estimates at the county level) in the 6 jurisdictions participating in 2010 to 2015.[13] Using SSuN facility data from 6 jurisdictions

participating in 2009 to 2015, we assessed the annual number of unique facility visits by MSM, the percentage of MSM tested for gonorrhea by anatomical site, and the percent positive (positivity) by anatomical site.

### National HIV Behavioral Surveillance

National HIV Behavioral Surveillance is a CDC-supported surveillance system that monitors HIV-associated behaviors and HIV prevalence in 20 cities with high AIDS burden. Cross-sectional behavioral data were collected from MSM recruited for interviews through venue-based, time-space sampling in 2011 and 2014.[14] Men attending venues frequented by MSM (i.e., bars, dance clubs, gyms, restaurants, parks, street locations, and social organizations) were systematically screened for eligibility. Eligibility criteria were age at least 18 years, residence in a participating city, ever having had sex with another male, and ability to complete the interview in English or Spanish. Consenting MSM were interviewed by trained interviewers using a standardized questionnaire covering demographics, HIV-associated behaviors, use of HIV prevention and testing services, and STD testing history.

Men who have sex with men with complete and valid interview data who were currently sexually active, defined as having at least 1 male partner in the past 12 months, were included in analyses. We report estimates for the proportion of MSM who self-reported gonorrhea testing in the past 12 months for years 2011 and 2014, including a prevalence ratio comparing the 2 periods adjusting for key epidemiologic characteristics. Testing was ascertained from the question, “In the past 12 months, were you tested by a doctor or other healthcare provider for a sexually transmitted disease like gonorrhea, chlamydia, or syphilis? Do not include tests for HIV or hepatitis.” If the participant answered yes, they were then asked separately if they were tested for gonorrhea.

## RESULTS

### Case Report Data

In 2015, 221,070 cases of gonorrhea were reported among men corresponding to a rate of 140.9 cases per 100,000 men. The rate increased by 54.8% from a historic low rate in 2009 (91.0 cases per 100,000 men; Fig. 1). In contrast, the rate of reported gonorrhea among women in 2015 (107.2 cases per 100,000 women) increased by 2.6% from the historic low rate in 2009 (104.5 cases per 100,000 women).

The rate of reported gonorrhea increased among all male age groups in 2006 to 2015 except among those younger than 20 years. In 2006 to 2015, gonorrhea case rates among men increased among all race/ethnicities except among black men, despite black men continuing to have the highest rates. By census region, rates among men increased substantially in 2006 to 2015 in the West (75.7%) and in the Northeast (62.5%), whereas rates in the South increased slightly (2.7%) and decreased in the Midwest (0.8%). It is likely that rates by region and by race/ethnicity are intertwined as the largest increase in rates (228.6%) among white men was observed in the West and the rates among black males decreased by 28.9% in the Midwest and 20.4% in the South in 2006 to 2015.

Starting in 2012 (Fig. 1), there was an increase in the overall male-to-female case rate ratio from 0.97 in 2012 to 1.31 in 2015. By region, only the West had a male-to-female rate ratio greater than 1.0 in 2006 to 2015, although the Northeast had a similar trend to the United States overall in 2012 to 2015 (Fig. 1A). Every age group greater than 24 years had a male-to-female rate ratio greater than 1.0 in 2006 to 2015 (Fig. 1B), and older age groups generally exhibited higher rate ratios. The male-to-female rate ratio increased among nearly all racial/ethnic groups. The increases were most pronounced among Asian/Pacific Islanders, Hispanics or Latinos, and whites. Although an increase in the rate ratio was not clearly observed among blacks, the ratio was greater than 1.0 during the entire analytic period (Fig. 1C).

In 2006, only 8.9% of reported gonorrhea cases had corresponding gender of sex partner data, and by 2015, that increased to 9.7%. When restricted to the 4 jurisdictions with greater than 70% completion of this variable, 41.0% of cases were classified as MSM, 41.4% of cases were classified as MSW, and 17.6% of cases were had unknown gender of sex partner. No jurisdictions reported at least 70% of cases with gender of sex partner each year in 2006 to 2015, so temporal trends among MSM were not able to be determined.

### Gonococcal Isolate Surveillance Project

In 2006 to 2015, a total of 55,336 gonococcal urethral isolates (range, 5032 [2014]–5962 [2006]) were collected in GISP. Of these, 16,504 (29.0%) were collected from MSM. The proportion of urethral isolates from MSM increased from 21.5% in 2006 to 38.1% in 2015 (Fig. 2). When stratified, the proportion of isolates that were from MSM increased in almost all categories. For example, among black men, the proportion of isolates that were collected from MSM increased from 6.4% to 20.3%, and among men aged 20 to 29 years, the proportion of isolates that were from MSM increased from 39.3% to 77.0% in 2006 to 2015; among Asian men, the proportion of isolates collected from MSM decreased by 10.7%. The proportion of isolates from all 4 census regions collected from MSM also increased in 2006 to 2015; however, it was increases in the Midwest (180.0%), Northeast (178.2%), and South (187.4%) that were largest.

Among MSM specifically, the largest percentages of isolates collected in 2006 to 2015 were from white men (42.4%), were between the ages of 20 and 29 years (48.6%), were from the West (63.5%), had a history of gonorrhea (54.8%), had no gonococcal infections in the previous 12 months (68.7%), and were not HIV infected (65.0%).

### STD Surveillance Network

In the SSuN population data in 2010 to 2015, the number of MSM diagnosed as having gonorrhea in the 6 sites continuously participating in SSuN increased from 14,993 in 2010 to 38,848 in 2015, a 160% absolute number increase. The rate of reported gonorrhea cases among MSM in these jurisdictions was 1369 cases per 100,000 in 2010 and increased by 150.9% to 3435 cases per 100,000 in 2015 (Fig. 3). In 2015, the rate among MSM was 30.9 times the rate among men who have sex with women only (3435 vs. 111 per 100,000 population).

In the SSuN facility data in 2009 to 2015, 941,223 patients had at least 1 visit to SSuN STD clinics, of which 141,396 (15.0%) patients were MSM. During this time, the number of MSM with at least 1 visit increased from 16,799 in 2009 to 27,182 in 2015, and MSM made up an increasing proportion of total clinics patients (10.6% in 2009 to 25.8% in 2015). In 2009 to 2015, the proportion of MSM tested for oropharyngeal and urogenital gonorrhea was stable (67.4%–66.1% and 85.2%–86.3%, respectively) and the proportion of MSM tested for rectal gonorrhea decreased (49.9%–45.4%); however, because the MSM clinic population increased during the same period, the absolute number of MSM tested for gonorrhea at any anatomical site increased by 66.8% from 2009 to 2015 (15,029 to 25,072).

In 2009 to 2015, 16.6% of MSM tested positive for gonorrhea at any anatomical site; positivity for rectal gonorrhea was 11.7%, oropharyngeal gonorrhea was 7.3%, and urogenital gonorrhea was 9.9%. Over time, positivity decreased by 12.9% for urogenital gonorrhea; however, the MSM clinic population increased during this time and the overall number of MSM diagnosed as having urogenital gonorrhea increased by 42.8% (1443 to 2061). During this same period, positivity increased by 12.6% for oropharyngeal gonorrhea and 72.4% for rectal gonorrhea (Fig. 4). As both positivity at extragenital sites and the MSM clinic population increased during this period, the overall number of MSM diagnosed as having oropharyngeal gonorrhea increased by 78.7% (757 to 1353) and the overall number of MSM diagnosed as having rectal gonorrhea increased by 155.0% (725 to 1849).

### National HIV Behavioral Surveillance

National HIV Behavioral Surveillance data came from 20 cities in 2011 (n = 9256) and 2014 (n = 9640). Approximately 40% of MSM were white, non-Hispanic or Latino, and aged 18 to 29 years; 70% of MSM had some college education or higher and had health insurance; and 80% of MSM were HIV negative. However, the percent of HIV-positive MSM increased overall between 2011 and 2014. The prevalence of self-reported gonorrhea testing among MSM increased from 38.8% in 2011 to 47.8% in 2014. After adjusting for race, age, health insurance, self-reported HIV status, number of sex partners, and city, the adjusted prevalence ratio comparing the 2 periods was 1.18 (confidence interval, 1.14–1.22). Testing for gonorrhea was more prevalent among MSM who were younger, had more education, had health insurance, and were HIV positive. Testing for gonorrhea increased among all demographic subgroups.

## DISCUSSION

A review of available national and sentinel surveillance data suggests that MSM bear a disproportionate burden of gonorrhea in the United States and that in recent years, an increasing number of MSM are being diagnosed as having gonorrhea. National case report data show increases in the rates of reported diagnoses among men in 2012 to 2015. Although few case reports contained information on gender of sex partner, the increasing male-to-female case rate ratio suggests increases in the number of diagnosed infections among MSM. Using county-level estimates of the MSM population to estimate rates, the rate among MSM was 30.9 times the rate among men who have sex with women only in SSuN jurisdictions in 2015, and in 2010 to 2015, the rate among MSM increased by 151%.

Increases in diagnoses among MSM may reflect increases in screening, increases in incidence, or a combination of both. Trends in the total number of MSM screened for gonorrhea are not available; however, between 2011 and 2014, more MSM participating in NHBS reported having been tested for gonorrhea, and in 2009 to 2015, the number of MSM tested for gonorrhea in SSuN STD clinics increased by almost 70%. Combined, this suggests that screening among MSM has likely increased. Increased screening may be due to the increased availability of extragenital testing, as well as more frequent STD screening as a result of increased preexposure prophylaxis use among MSM. Surveillance data also suggest that concurrent with increases in screening, incidence among MSM may have increased. In 2006 to 2015, the percentage of urethral isolates from MSM in GISP increased by 77% suggesting increases in symptomatic MSM seeking care over time, which may be a marker of increased incidence. In addition, in 2009 to 2015, positivity estimates among MSM in SsuN's facility component show that the proportion of MSM testing positive is increasing, especially among those with rectal and oropharyngeal gonococcal infections, also suggesting increased incidence. Increases in incidence may reflect changes in sexual behavior, including increased condomless sex due to preexposure prophylaxis and expanded sexual networks due to use of geolocating apps for sexual partners.[15]

In combination, these national and sentinel surveillance data provide insight into the gonorrhea epidemic. However, each of the data sources reviewed has limitations. Although national case data allow for the analysis of trends in reported diagnoses over time and by key demographics such as age and race/ethnicity, most reported gonorrhea cases (>90% in 2015) were missing information on gender of sex partner. Lack of information on gender of sex partner on reported gonorrhea cases is not surprising; case report forms may not allow for the collection of the sexual behavior data, or the only information available to the local health department is from the laboratory report, which rarely contains sexual behavior data.[16] As a result, the male-to-female case rate ratio can be used as a proxy for gonorrhea rates among MSM when gender of sex partner is unknown.[11] However, gonococcal infection can be asymptomatic in men, so observed case rates are heavily influenced by screening practices. Observed increases among men may be a reflection of increased screening or could represent other epidemics among higher-risk populations, such as commercial sex workers or those in correctional facilities.

Gonococcal Isolate Surveillance Project was established to provide information on gonococcal antimicrobial susceptibility patterns. Epidemiologic data, including gender of sex partner, are collected with the susceptibility test results, so these data can also provide a snapshot of symptomatic men seeking care for urethral gonorrhea in STD clinics. Because GISP uses a standardized protocol (e.g., only collecting the first 25 urethral isolates from symptomatic men visiting STD clinics each month), the data are not heavily influenced by changes in screening practices. In 2006 to 2015, an increasing proportion of men included in GISP were MSM, suggesting increases in gonorrhea among MSM. In addition, it is also possible that the population seeking care in STD clinics has changed over time and increases in the proportion of isolates that are among MSM reflect changes in the clinic population (e.g., more MSM are attending STD clinics either due to increased incidence among MSM or changes in where MSM access STD-related services).

STD Surveillance Network conducts surveillance for gonorrhea through enhanced case investigations in the population component. Enhanced patient interviews among those diagnosed as having gonorrhea allows for collection of data usually missing from case reports, including gender of sex partner. Because interviews are conducted on a random sample, estimates are weighted to be representative of all cases in the jurisdiction and can be used to document the disproportionate burden of gonorrhea among MSM in some jurisdictions. In addition, use of MSM population estimates as denominators for rates has allowed for estimation of MSM and MSW rates and data from 2010 to 2015 document increasing rates among MSM. However, these rates are based on diagnosis of gonorrhea. Because gonorrhea can be asymptomatic, observed diagnosis rates in SSuN are influenced by changes in screening and increases among MSM could be attributable to increased screening, particularly of extragenital anatomical sites.

STD Surveillance Network also conducts sentinel surveillance in STD clinics, providing information on the health care–seeking behavior of MSM as well as estimates of gonorrhea positivity which can account for changes in screening coverage. In 2009 to 2015, positivity at extragenital sites (i.e., rectal and oropharyngeal) increased suggesting possible increases in incidence among MSM. Urethral positivity, on the other hand, was stable suggesting no change in incidence. However, screening practices may vary between SSuN clinics, which may impact observed positivity. In addition, these estimates are limited to persons seeking care in STD clinics, which may not be representative of all persons at risk for gonorrhea. Finally, jurisdictions participating in both the population and facility components of SSuN were not randomly selected; therefore, trends may not be representative of all jurisdictions.

Results from NHBS show a higher rate of gonorrhea testing in 2014 than in 2011 among MSM in participating surveillance sites. This surveillance system describes populations that are at highest risk for HIVand allow for a glimpse into special populations, such as MSM, and surveillance is not just limited to participants in STD clinics. The data, however, are limited to 2 time points and cannot be interpreted as a trend. In addition, the reported data have not been weighted to account for complex sampling methodologies. As described, the data on STD testing are self-reported and subject to social desirability bias and recall error. Lastly, NHBS is not nationally representative; therefore, the results may not be generalizable to all MSM in participating cities or to all MSM. However, the results match trend data that are available from SSuN regarding increased testing among MSM.

Finally, for all data sources, there is the potential for mis-classification of men as MSM or MSW. Some men may be reluctant to disclose their behaviors, especially those with other male sex partners, and therefore may have been misclassified as MSW. Thus, the data presented in this review may be an underestimate of disease among MSM and trends may be biased if disclosure patterns changed over time. In addition, nonresponse during patient interviews and missing data on gender of sex partner in medical records also affect the validity of data.

This review of existing surveillance data sources provides insight into the current epidemiology of gonorrhea among MSM and suggests that more MSM are being diagnosed

as having gonorrhea, which is likely due to a combination of both increased disease incidence and increased screening.

Enhancing current surveillance efforts could help to better monitor gonorrhea among MSM. For example, jurisdictions that routinely collect gender of sex partner data for reported gonorrhea cases should examine trends among MSM. Jurisdictions that are not able to capture gender of sex partner information for all cases could calculate the male-to-female case rate ratio, and if resources allow, jurisdictions could implement an SSuN-like methodology by taking a random sample and collecting more complete data for those cases. In both situations, jurisdictions could take advantage of the recently released MSM county-level population denominators to calculate rates among MSM.[17] In addition, mathematical modeling may help disentangle the impact of increased incidence and increased screening on observed diagnoses. Beyond understanding these trends, additional efforts and approaches are needed to develop and identify effective and appropriate prevention and control measures to address gonococcal infections among MSM.

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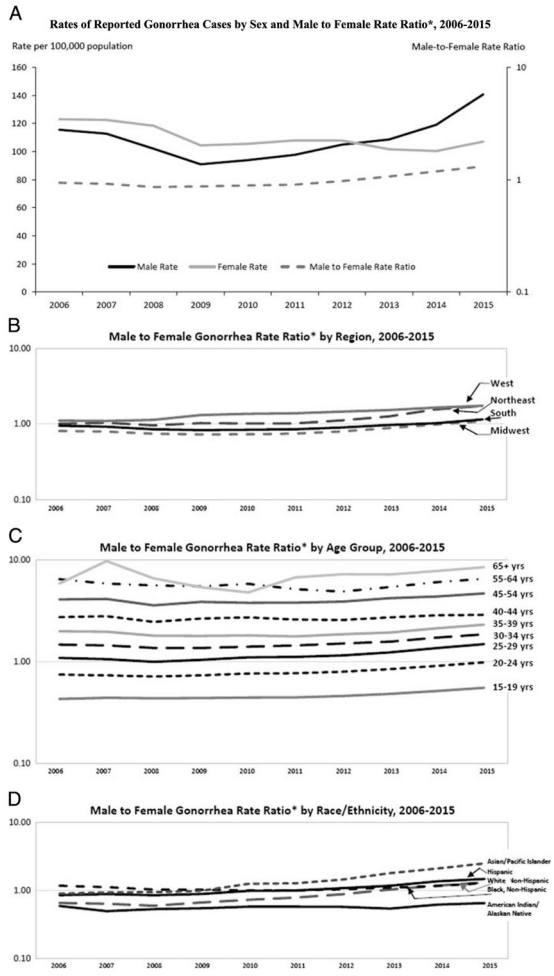


**Figure 1.**

A, Rates of reported gonorrhea cases by sex and male-to-female rate ratio*, 2006–2015. B–D, Male-to-female gonorrhea rate ratio by region, age group, and race/ethnicity*, 2006–2015. *All figures calculated as follows: male rate/female rate.

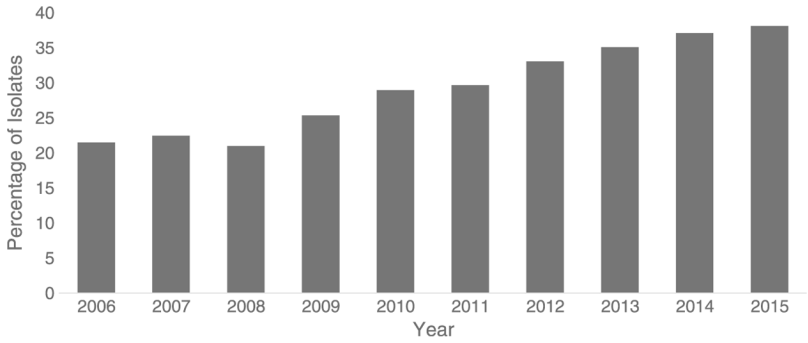


**Figure 2.**

Percentage of urethral *N. gonorrhoeae* isolates collected from MSM, GISP, 2006 to 2015.

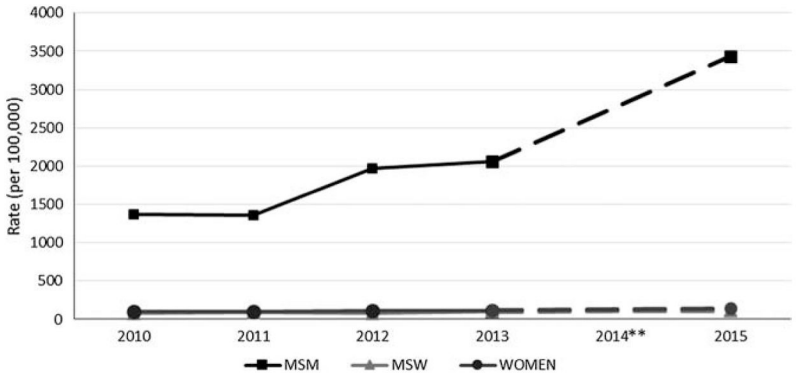


**Figure 3.**

Estimated case rate among MSM, MSW, and rate of reported cases among women*, SSuN, 2010 to 2015. * Estimated case rate for MSM, MSW; reported case rate for women. **Data not available for 2014; 2014 data imputed from 2013 to 2015 data by linear interpolation; trend lines for MSW and women overlap. Figure taken from Stenger et al.[13]

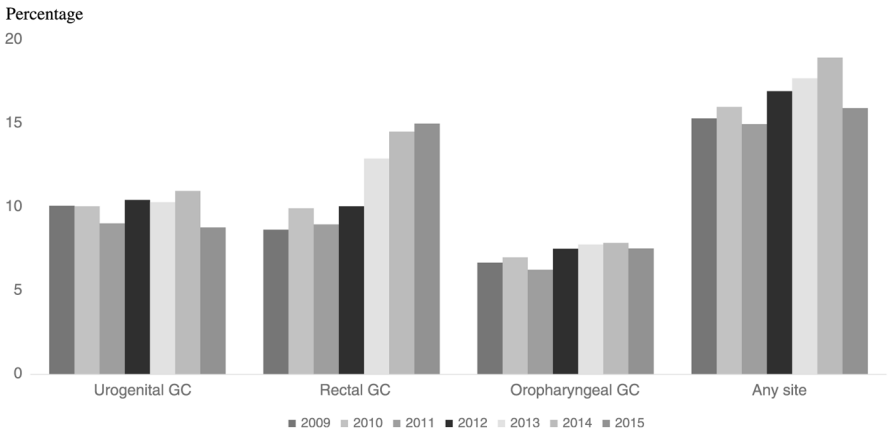


**Figure 4.**

Proportion of MSM* attending STD clinics testing positive[†] for gonorrhea by anatomical site, SSuN, 2009 to 2015. * MSM = gay, bisexual and other MSM (collectively referred to as MSM). [†]Results based on data obtained from number of positive unique MSM patients tested by anatomical site for gonorrhea attending STD clinics in Baltimore, California, New York City, Philadelphia, San Francisco, and Washington.