1. INTRODUCTION

Men who have sex with men (MSM) are at high risk for HIV and other sexually transmitted diseases (STD), such as gonorrhea, chlamydia, and syphilis [1,2]. The Centers for Disease Control and Prevention (CDC) recommends routine HIV and STD screening of all sexually active MSM [2]. Specifically, sexually active MSM should be tested at least annually: for HIV; for syphilis; for urethral gonorrhea and chlamydia if they report insertive intercourse; for rectal gonorrhea and chlamydia if they report receptive anal intercourse; and for pharyngeal gonorrhea if they report receptive oral intercourse. More frequent STD screening, such as at 3–6 month intervals, is recommended for higher risk MSM, such as those who have multiple or anonymous partners. CDC also recommends that patients should be tested for other STDs if they have gonorrhea, chlamydia, or syphilis.

Previous studies have shown that chlamydia, gonorrhea, syphilis, and HIV testing is suboptimal among MSM and rectal gonorrhea, rectal chlamydia, and syphilis were associated with increased risk for HIV seroconversion among MSM [3–11]. However, none of those studies has focused on the association between rectal gonorrhea or chlamydia and syphilis among MSM. The objective of this study is to assess the frequency of testing for syphilis among MSM and how syphilis test results compared with results of rectal gonorrhea and chlamydia tests.

2. METHODS

Gonorrhea, chlamydia, and syphilis testing data were obtained from a US commercial laboratory that provides laboratory testing in all 50 states and the District of Columbia. These data included all gonorrhea detection tests, chlamydia detection tests, syphilis non-treponemal tests (qualitative and quantitative), and syphilis treponemal tests performed in men and women from 09/01/2013 through 09/30/2015. The gonorrhea and chlamydia detection tests include nucleic acid amplification test or culture during this study period. Of specimens collected for gonorrhea and chlamydia testing during this study period, more than 50% had no anatomic site information. The database included information on the patient’s year of birth, gender, US geographic region of residence, test type, anatomic site for a proportion of gonorrhea or chlamydial specimens, test result, and provider specialty. We used a combination of patient characteristics to create a de-identified analytic data set that permitted us to monitor testing over time for an individual patient.

The study protocol was reviewed and approved by the Institutional Review Board at the CDC (CDC protocol ID: 5935).

We limited our analysis to men aged 15–60 years who had rectal gonorrhea or chlamydia tests during the study period of 09/01/2013–09/30/2015. Men who had rectal gonorrhea or chlamydia tests were presumed to be MSM for this analysis. Among these MSM, we identified those who had any positive rectal gonorrhea or chlamydia tests and calculated the prevalence of rectal...
We assessed annual repeat testing for MSM who only had syphilis testing during 09/01/2013–09/30/2014 to allow at least 12 months of follow-up time. The earliest date of any syphilis testing during 09/01/2013–09/30/2014 was defined as the index date. Annual repeat syphilis testing was defined as any syphilis testing performed during 3–14 months after the index date. The average number of days between the index date and the earliest date of repeat testing was also assessed. Annual repeat syphilis testing rates were compared for MSM with and without positive rectal gonorrhea or chlamydia tests.

All analyses were performed using SAS version 9.3 (SAS Institute, NC, USA). We used χ²-tests to assess syphilis testing rates, reactivity of non-treponemal and treponemal tests, and the association of positive rectal gonorrhea or chlamydia tests with current or past syphilis. A two-sided p-value < 0.05 was considered statistically significant.

### 3. RESULTS

Between 09/01/2013 and 09/30/2015, 1,341,778 men aged 15–60 years had any gonorrhea or chlamydia tests in the laboratory data set; of those men, 52,771 (3.9%) had rectal gonorrhea or chlamydia tests. Of those 52,771 presumed MSM, 59.0% were aged 25–44 years, 42.9% were from the South, and 20.9% had positive rectal gonorrhea or chlamydia results Table 1.

Of those 52,771 MSM, 14.3% had no syphilis test during the study period. MSM who resided in the Midwest were significantly more likely to have no syphilis testing than those who resided in other regions (40.5% vs. 20.5% in the Northeast, 8.2% in the South, and 14.0% in the West, all p < 0.05). Among MSM who had no syphilis testing, 19.0% had a positive rectal gonorrhea or chlamydia test.

Overall, at least 15.3% of the 52,771 MSM had current or past syphilis. Current or past syphilis was more common among MSM with positive rectal gonorrhea or chlamydia tests (24.1%) than among MSM with negative rectal gonorrhea and chlamydia tests (13.0%, p < 0.05).

### Table 1  Syphilis testing received and the number of current or past syphilis among 52,771 MSM aged 15–60 years during the study period, 09/01/2013–09/30/2015

| Characteristics | Number of MSM | Syphilis testing received during the study period | Number of current or past syphilis |
|-----------------|--------------|-----------------------------------------------|-----------------------------------|
|                 | N (%)        | Both tests (%) | Non-treponemal test only (%) | Treponemal test only (%) | No test (%) | N (%) |
| Total           | 52,771 (100) | (17.7)          | (63.2) | (4.8) | (14.3) | 8090 (15.3) |
| Age (years)     |              |                 |                     |                    |             |    |
| 15–24           | 8369 (15.9)  | 12.6            | 62.2                | 5.0 | 20.2 | 841 (10.1)* |
| 25–34           | 19,303 (36.6)| 17.4            | 63.2                | 6.0 | 13.4 | 2871 (14.9) |
| 35–44           | 11,828 (22.4)| 19.8            | 62.5                | 4.7 | 12.9 | 2076 (17.6) |
| 45–54           | 10,557 (20.0)| 20.4            | 63.8                | 3.0 | 12.8 | 1922 (18.2) |
| 55+             | 2714 (5.1)   | 15.8            | 66.9                | 2.8 | 14.5 | 380 (14.0)  |
| Region          |              |                 |                     |                    |             |    |
| Midwest         | 4130 (7.8)   | 5.7             | 13.5                | 40.3 | 40.5 | 200 (4.8)*  |
| Northeast       | 7381 (14.0)  | 14.3            | 64.8                | 0.4 | 20.5 | 846 (11.5)  |
| South           | 24,353 (46.2)| 20.4            | 69.1                | 2.3 | 8.2 | 4215 (17.3) |
| West            | 16,907 (32.0)| 18.2            | 66.1                | 1.7 | 14.0 | 2829 (16.7) |
| Positive status |              |                 |                     |                    |             |    |
| of rectal       |              |                 |                     |                    |             |    |
| gonorrhea or    |              |                 |                     |                    |             |    |
| chlamydia tests |              |                 |                     |                    |             |    |
| Yes             | 11,036 (20.9)| 27.2            | 53.7                | 6.1 | 13.0 | 2660 (24.1)* |
| No              | 41,735 (79.1)| 15.1            | 65.7                | 4.5 | 14.7 | 5430 (13.0)  |

*p < 0.005 between syphilis testing and characteristic variable.
Among 52,771 MSM, 9340 (17.7%) had both non-treponemal and treponemal tests, 33,344 (63.2%) had non-treponemal tests only, 2530 (4.8%) had treponemal tests only, and 7557 (14.3%) had no syphilis test.

Figure 1  |  Syphilis testing status and rectal gonorrhea or chlamydial infection among 52,771 MSM aged 15–60 years during the study period, 09/01/2013–09/30/2015.

4. DISCUSSION

Our data show (1) a high prevalence of current or past syphilis infection (15.3%) and high rectal gonorrhea or chlamydia infections (20.9%) among MSM in this database, and (2) MSM with positive rectal gonorrhea or chlamydia tests were more likely to have current or past syphilis than those with negative rectal gonorrhea and chlamydia tests. Although it is important for clinicians to screen all sexually active MSM for syphilis, MSM with a positive rectal chlamydia or gonorrhea test result are at elevated risk. Our data show current syphilis cases were highly associated with positive rectal gonorrhea or chlamydia tests: 1.1% of MSM with positive rectal gonorrhea or chlamydia tests and 0.5% of MSM with negative rectal gonorrhea and chlamydia tests were identified as having current syphilis.

Compared with previous studies on syphilis testing (ranged from 49% to 71%) [7,8], our study showed that about 85.7% of men who had rectal gonorrhea or chlamydia tests in this data set during 2013–2015 had syphilis testing. But, our study also showed that syphilis testing rates were very low for MSM who resided in the Midwest region where about 40.5% of them had no syphilis testing or for young MSM aged 15–24 years that about 20% of them had no syphilis testing. Although young MSM aged 15–24 years had lower current or past syphilis than MSM aged 25–60 years, some of them may experience with the current syphilis. Further evaluation is needed to identify the reasons for the low syphilis testing rate in general and especially in the Midwest region. The rectal testing data show that MSM in the Midwest had similar positivity to MSM in the other regions; therefore increasing syphilis testing in this region is an important preventive strategy that could improve syphilis detection and treatment substantially.
Most of the MSM tested had negative non-treponemal tests only, indicating most syphilis testing was performed using the traditional algorithm. Most of the MSM who had both non-treponemal and treponemal tests appeared to have old syphilis because they were reactive on both, and few of them had high non-treponemal test titers that would suggest new infections. MSM with a history of syphilis are at risk for other infections and should be routinely tested for gonorrhea, chlamydia, and syphilis.

The annual repeat syphilis testing rate of 64.8% in MSM, plus suboptimal follow-up of rectal gonorrhea or chlamydia detailed in a previous study [13], suggests healthcare providers should prioritize adherence with CDC recommendations and test MSM routinely for gonorrhea, chlamydia, and syphilis. Of MSM who had syphilis testing during 09/01/2013–09/30/2014, MSM were more likely to have annual repeat syphilis testing if they were served by infectious disease (66%) or public health providers (69%) than multiple group practice providers (50%) at the index date. To continually monitor quality of healthcare service for MSM, annual repeat syphilis testing is needed especially for MSM who were served by infectious disease providers because they often provided healthcare for MSM or by multiple group practice providers because they were unlikely to provide annual repeat syphilis testing.

There were several limitations in this study. First, because this laboratory system does not include self-reported sexual identity and sexual behavior and not all specimens collected for gonorrhea and chlamydia had anatomic site information, the MSM that we identified might be underestimated and might not represent all MSM in the database. The MSM defined in this study as those with rectal chlamydia or gonorrhea testing may be biased to at-risk MSM. There may have been MSM in the data who did not receive rectal testing or who did not involve in rectal sex. Second, the data collection did not include the syphilis testing algorithm used; therefore we could not determine the number of tests performed under each syphilis testing algorithm and the number of initial syphilis tests. Also, the data lack details on the reasons for testing, such as referred syphilis tests or confirmatory syphilis tests. Third, our estimated numbers of current or past syphilis may have been underestimated because (1) 14.3% of MSM had no syphilis testing, (2) ≥90% of MSM with reactive qualitative non-treponemal tests did not receive quantitative non-treponemal testing, and (3) 6.5% of MSM with reactive qualitative non-treponemal tests did not receive treponemal tests. It is not clear what proportion of MSM with reactive qualitative non-treponemal syphilis had a history of reactive treponemal tests before the study period. Also, it is not clear what proportion of MSM were without quantitative non-treponemal tests because no quantitative non-treponemal test was performed in the reverse syphilis testing algorithm or because quantitative non-treponemal tests were performed but the valid results were not recorded in the data system. Finally, the data system does not include patients’ race and ethnicity or HIV infection status, although it is known that these factors are also highly associated with syphilis infection [1].

Our findings suggest that syphilis testing was suboptimal among MSM who had rectal chlamydia or gonorrhea testing. The lack of quantitative non-treponemal testing and limited repeat testing also suggest that syphilis screening of MSM could be improved. Positive tests for rectal gonorrhea or chlamydia were highly associated with current or past syphilis. Our study suggests that it is important to continually monitor syphilis for MSM, especially for those MSM who had rectal chlamydia or gonorrhea infection.

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### Table 2: Annual repeat syphilis testing rate among 27,434 MSM aged 15–60 years who had initial syphilis during 09/01/2013–09/30/2014

| Characteristics                                      | Number of MSM | Annual repeat syphilis testing rate (%) | Average days between initial syphilis test date and the earliest repeat syphilis test date (standard deviation) |
|------------------------------------------------------|---------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Total                                                | 27,434        | 64.8*                                  | 179 (95)                                                                                                       |
| Age in years                                         |               |                                        |                                                                                                               |
| 15–24                                                | 3107 (11.3)   | 52.9*                                  | 177 (92)                                                                                                       |
| 25–34                                                | 9691 (35.3)   | 61.6                                   | 179 (93)                                                                                                       |
| 35–44                                                | 6679 (24.4)   | 67.5                                   | 180 (96)                                                                                                       |
| 45–54                                                | 6351 (23.2)   | 71.6                                   | 181 (95)                                                                                                       |
| 55+                                                  | 1606 (5.8)    | 70.1                                   | 178 (94)                                                                                                       |
| Region                                               |               |                                        |                                                                                                               |
| Midwest                                              | 1801 (6.6)    | 63.5*                                  | 175 (88)                                                                                                       |
| Northeast                                            | 3596 (13.1)   | 67.5                                   | 182 (96)                                                                                                       |
| South                                                | 12,615 (46.0) | 55.1                                   | 193 (101)                                                                                                      |
| West                                                 | 9422 (34.3)   | 77.2                                   | 166 (87)                                                                                                       |
| Provider type at the index date                      |               |                                        |                                                                                                               |
| Infectious disease                                   | 20,347 (74.2) | 66.0*                                  | 171 (90)                                                                                                       |
| Internal medicine                                    | 2848 (10.4)   | 65.6                                   | 217 (109)                                                                                                      |
| Family practice                                      | 2083 (7.6)    | 59.9                                   | 199 (100)                                                                                                      |
| Public health                                        | 521 (1.9)     | 69.1                                   | 187 (91)                                                                                                       |
| Multiple group practice                              | 1113 (4.0)    | 49.7                                   | 202 (105)                                                                                                      |
| Other                                                | 522 (1.9)     | 63.4                                   | 191 (93)                                                                                                       |
| Positive status of rectal gonorrhea or chlamydia tests|               |                                        |                                                                                                               |
| Yes                                                  | 6192 (22.6)   | 75.4*                                  | 164 (85)                                                                                                       |
| No                                                   | 21,242 (77.4) | 61.8                                   | 185 (97)                                                                                                       |

*p < 0.005 between annual repeat syphilis testing and characteristic variable.
CONFLICTS OF INTEREST

The authors declare they have no conflicts of interest.

AUTHOR CONTRIBUTIONS

G.T., T.P., T.G. and M.N. study conceptualization and writing (review & editing) the manuscript; G.T. and M.N. data curation; G.T. formal analysis and writing (original draft); G.T. and T.P. investigation and methodology; M.N. and T.G. project administration.

DISCLAIMER

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the CDC.

REFERENCES

[1] CDC. Sexually Transmitted Disease Surveillance 2017. Atlanta: U.S. Department of Health and Human Services; 2018.

[2] Workowski KA, Bolan GA. Centers for Disease Control and Prevention. Sexually transmitted diseases treatment guidelines, 2015. MMWR Recomm Rep 2015;64;1–137.

[3] Pathela P, Braunstein SL, Blank S, Schillinger JA. HIV incidence among men with and those without sexually transmitted rectal infections: estimates from matching against an HIV case registry. Clin Infect Dis 2013;57;1203–9.

[4] Bernstein KT, Marcus JL, Nieri G, Philip SS, Klausner JD. Rectal gonorrhea and chlamydia reinfection is associated with increased risk of HIV seroconversion. J Acquir Immune Defic Syndr 2010;53;537–43.

[5] Mimiaga MJ, Helms DJ, Reisner SL, Grasso C, Bertrand T, Mosure DJ, et al. Gonococcal, chlamydia, and syphilis infection positivity among MSM attending a large primary care clinic, Boston, 2003 to 2004. Sex Transm Dis 2009;36;507–11.

[6] Katz DA, Dombrowski JC, Bell TR, Kerani RP, Golden MR. HIV incidence among men who have sex with men after diagnosis with sexually transmitted infections. Sex Transm Dis 2016;43;249–54.

[7] An Q, Wejnert C, Bernstein K, Paz-Bailey G. Syphilis screening and diagnosis among men who have sex with men, 2008–2014, 20 U.S. cities. J Acquir Immune Defic Syndr 2017;75 Suppl 3; S363–89.

[8] de Voux A, Bernstein KT, Bradley H, Kirkcaldy RD, Tie Y, Luke Shouse RL. Syphilis testing among sexually active men who have sex with men and who are receiving medical care for Human Immunodeficiency Virus in the United States: Medical Monitoring Project, 2013–2014. Clin Infect Dis 2019;68;934–9.

[9] Hoots BE, Torrone EA, Bernstein KT, Paz-Bailey G. Self-reported chlamydia and gonorrhea testing and diagnosis among men who have sex with men—20 US cities, 2011 and 2014. Sex Transm Dis 2018;45;469–75.

[10] Kahle EM, Meites E, Sineath RC, Nasrullah M, Bowles KE, DiNenno E, et al. Sexually transmitted disease testing and uptake of human papillomavirus vaccine in a large online survey of US men who have sex with men at risk for HIV infection, 2012. Sex Transm Dis 2017;44;63–7.

[11] Patton ME, Kidd S, Llata E, Stenger M, Braxton J, Asbel L, et al. Extragenital gonorrhea and chlamydia testing and infection among men who have sex with men—STD Surveillance Network, United States, 2010–2012. Clin Infect Dis 2014;58;1564–70.

[12] Association of Public Health Laboratories. Suggested Reporting Language for Syphilis Serology Testing. Silver Spring, MD: Association of Public Health Laboratories; 2015.

[13] Tao G, Hoover KW, Nye MB, Peters P, Gift TL, Peruvemba R, et al. Rectal infection with Neisseria gonorrhoeae and Chlamydia trachomatis in men in the United States. Clin Infect Dis 2016;63;1325–31.