

Chlamydia trachomatis and *Neisseria gonorrhoeae* Transmission from the Oropharynx to the Urethra among Men who have Sex with Men

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(See the editorial commentary by Weinstock and Workowski on pages XXX–XX)

Background. Limited data exist on the risk of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* transmission from oropharynx to urethra. We examined urethral *C. trachomatis* and *N. gonorrhoeae* positivity among men who have sex with men (MSM) seen at San Francisco City Clinic (San Francisco, CA) during 2007.

Methods. All patients who sought care at the San Francisco City Clinic (the only municipal sexually transmitted disease clinic in San Francisco) received a standardized interview conducted by clinicians. We estimated urethral *C. trachomatis* and *N. gonorrhoeae* positivity for 2 groups of visits by MSM who visited during 2007: (1) men who reported their only urethral exposure was receiving fellatio in the previous 3 months and (2) men who reported unprotected insertive anal sex in the previous 3 months. Additionally, urethral *C. trachomatis* and *N. gonorrhoeae* positivity was estimated, stratified by human immunodeficiency virus infection status, urogenital symptom history, and whether the patient had been a contact to a sex partner with either chlamydia or gonorrhea.

Results. Among MSM who reported only receiving fellatio, urethral *C. trachomatis* and *N. gonorrhoeae* positivity were 4.8% and 4.1%, respectively. These positivity estimates were similar to positivity found among MSM who reported unprotected insertive anal sex.

Conclusions. A more complete understanding of the risks of transmission of *C. trachomatis* and *N. gonorrhoeae* from oropharynx to urethra will help inform prevention and screening programs.

Chlamydia trachomatis and *Neisseria gonorrhoeae* infections are the 2 most commonly reported notifiable conditions in the United States [1]. In 2007, over 1 million cases of chlamydia and nearly 360,000 cases of gonorrhea were reported to the Centers for Disease Control and Prevention [1]. Untreated *C. trachomatis* and *N. gonorrhoeae* infections are associated with infertility, pelvic inflammatory disease, and ectopic pregnancy in women and epididymitis, prostatitis, and infertility in men [2, 3]. Furthermore, chlamydia and

gonorrhea have been associated with increased risk of transmission and acquisition of human immunodeficiency virus (HIV) infection [4].

It is well established that *C. trachomatis* and *N. gonorrhoeae* can be transmitted through unprotected vaginal and anal sex and from the male urethra to the oropharynx through oral sex [2, 3, 5]. However, sparse data exist on the risk of transmission from the oropharynx to male urethra during fellatio. Case series have suggested the oropharynx might be an important reservoir for transmission [6, 7]. In a French clinic-based sample, 58% of men who have sex with men (MSM) with urethral gonorrhea reported that their only exposure was receiving fellatio [8]. A study by Lafferty et al [5] reported that a quarter of men with urethral gonorrhea reported receptive fellatio as the sole sexual exposure. These earlier reports were limited by unavailability of nucleic acid amplification testing for gonorrhea, which is a diagnostic technology with signifi-

Received 20 May 2009; accepted 5 August 2009; electronically published 13 November 2009.

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Clinical Infectious Diseases 2009;49:000–000

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1058-4838/2009/4912-00XX\$15.00

DOI: 10.1096/648427

cantly improved sensitivity, compared with culture [9, 10]. Furthermore, no studies have studied potential oropharynx-to-urethral transmission of *C. trachomatis*.

Here, we examined urethral chlamydial and gonococcal infections among MSM to estimate the probabilities of urethral infection that likely resulted from transmission from the oropharynx to the urethra. *C. trachomatis* and *N. gonorrhoeae* positivity was estimated among visits by MSM in which the only reported urethral exposure was receiving oral sex. In order to place these data in proper context, we also estimated urethral *C. trachomatis* and *N. gonorrhoeae* positivity among MSM visits in which patients reported unprotected insertive anal sex, which is behavior considered involve a high risk for urethral infection [2, 3].

PATIENTS AND METHODS

We examined urethral *C. trachomatis* and *N. gonorrhoeae* positivity among 2 groups of visits by MSM at San Francisco City Clinic (San Francisco, CA; the only municipal sexually transmitted disease [STD] clinic in San Francisco) during 2007. The first group (receiving fellatio only) was restricted to visits by MSM in which the patient reported receiving fellatio and denied vaginal sex and anal sex in the previous 3 months. The second group (unprotected insertive anal sex) was restricted to visits by MSM in which the patient reported unprotected insertive anal sex and denied vaginal sex in the previous 3 months. This second group did not exclude visits by MSM in which receptive fellatio was reported. Visits by MSM that did not include a test for either urethral gonorrhea or urethral chlamydia were excluded from the analysis.

As part of the San Francisco STD clinic visit, clinicians conducted a standardized interview with the patient, which included the reason(s) for the visit and any symptoms, as well as sexual and drug use risk behaviors in the preceding 3 months. All data were recorded on paper forms and entered into an electronic database. MSM provided urine specimens, which were tested for *C. trachomatis* and/or *N. gonorrhoeae* using transcription-mediated amplification (Gen-Probe APTIMA Combo 2; Gen Probe).

We estimated urethral positivity for *C. trachomatis* and *N. gonorrhoeae*, as well as corresponding 95% confidence limits assuming a binomial distribution [11], separately for MSM visits in the 2 groups. Additionally, we estimated *C. trachomatis* and *N. gonorrhoeae* positivity stratified by the presence or absence of urethral symptoms (ie, dysuria or discharge), HIV infection status, and whether the patient was exposed to a partner with chlamydia or gonorrhea (based on patient self-report). Pearson's χ^2 statistics were used in group comparisons. Because these data were de-identified and undergoing retrospective analysis, this study was considered exempt from human

subjects considerations in accordance with the Code of Federal Regulations, Title 45.

RESULTS

In 2007, there were 5715 visits by MSM to the San Francisco City Clinic that included a urine test for either *C. trachomatis* or *N. gonorrhoeae*. Of these visits, 397 (7.0%) were among MSM who reported that their only penile sexual contact in the past 3 months was receiving fellatio, and 1129 (19.8%) were among MSM who reported unprotected insertive anal sex in the previous 3 months. Among the 397 visits by MSM in which the patient reported receiving fellatio only, 393 (99.0%) reported not using a condom.

Urethral chlamydia positivity is shown in Table 1 and Figure 1. Among the 397 visits by MSM in which receiving fellatio was the only reported urethral exposure, 19 (4.8%; 95% confidence interval [CI], 2.9%–7.4%) had a urethral chlamydial infection. Urethral chlamydia positivity for visits in which only receiving fellatio was reported was not statistically significantly lower than visits in which any unprotected insertive anal sex was reported (Figure 1). Urethral chlamydia positivity for visits by MSM in which the patient reported only receiving fellatio did not differ with respect to urethritis symptoms or having a male partner with chlamydia. However, visits by HIV-infected MSM in which patients reported only receiving fellatio had higher urethral chlamydia positivity, compared with that for visits by HIV-negative MSM in which only receptive fellatio was reported (16.0% vs 3.0%; $P < .001$, by χ^2 test) (Table 1).

Urethral gonorrhea positivity results are also shown in Table 1 and Figure 1. Among the 395 visits by MSM who reported only receiving fellatio during the previous 3 months and who were tested for gonorrhea, urethral *N. gonorrhoeae* infection was identified in 16 (4.1%; 95% CI, 2.3%–6.5%). Urethral gonorrhea among visits by MSM in which only receiving fellatio was reported was significantly lower than urethral *N. gonorrhoeae* among MSM reporting unprotected insertive anal sex ($P = .018$, by χ^2 test) (Figure 1). Urethral gonorrhea positivity was significantly higher for visits by MSM with urethral symptoms who reported only receiving fellatio, compared with that for visits by asymptomatic MSM in which only receiving fellatio was reported (13.1% vs 0.7%; $P < .001$, by χ^2 test). For visits by MSM in which only receiving fellatio was reported, no differences in gonorrhea positivity were found with respect to having contact with a partner with gonorrhea. However, urethral positivity among visits by MSM in which the only sexual exposure was receiving fellatio differed by HIV infection status.

Additionally, we examined the self-reported behaviors of the 314 MSM with urethral *C. trachomatis* and 292 MSM with urethral *N. gonorrhoeae* infections diagnosed at San Francisco City Clinic in 2007. Sixteen (5.1%) and 19 (6.5%) of the urethral *C. trachomatis* and *N. gonorrhoeae* infections diagnosed

Table 1. Urethral *Chlamydia trachomatis* and *Neisseria gonorrhoeae* Positivity among Men Who Have Sex with Men (MSM) Who Visited the San Francisco City Clinic, 2007

Variable	No. of MSM tested	No. of MSM with positive results	Percentage of MSM positive (95% confidence interval)	P
<i>Chlamydia trachomatis</i>				
Only received fellatio in prior 3 Months	397	19	4.8 (2.9–7.4)	
Urethral symptoms				
Yes	107	9	8.4 (3.9–15.4)	.060
No	290	10	3.5 (1.7–6.3)	
Contact to a partner with chlamydia				
Yes	43	4	9.3 (2.6–22.1)	.138
No	354	15	4.2 (2.4–6.9)	
HIV status				
HIV infected	50	8	16.0 (7.2–29.1)	<.001
HIV uninfected	335	10	3.0 (1.4–5.4)	
HIV infection status unknown	12	1	8.3 (0.2–38.5)	
Unprotected insertive anal sex in prior 3 months	1129	79	7.0 (5.6–8.6)	
Urethral symptoms				
Yes	289	53	18.3 (14.1–23.3)	<.001
No	840	26	3.1 (2.0–4.5)	
Contact to a partner with chlamydia				
Yes	191	8	4.2 (1.8–8.1)	.039
No	938	82	7.6 (6.0–9.5)	
HIV status				
HIV infected	372	27	7.3 (4.8–10.4)	.698
HIV uninfected	748	52	7.0 (5.2–9.0)	
HIV infection status unknown	9	0	0.0 (0.0–33.6)	
<i>Neisseria gonorrhoeae</i>				
Only received fellatio in prior 3 months	395	16	4.1 (2.3–6.5)	
Urethral symptoms				
Yes	107	14	13.1 (7.3–21.0)	<.001
No	288	2	0.7 (0.1–2.5)	
Contact to a partner with gonorrhea				
Yes	42	0	0.0 (0.0–8.4)	.395
No	353	16	4.5 (2.6–7.2)	
HIV status				
HIV infected	50	5	10.0 (3.3–21.8)	.044
HIV uninfected	334	10	3.0 (1.4–5.4)	
HIV infection status unknown	11	1	9.1 (0.2–41.3)	
Unprotected insertive anal sex in prior 3 months	1121	84	7.5 (6.0–9.2)	
Urethral symptoms				
Yes	282	74	26.2 (21.2–31.8)	<.001
No	839	10	1.1 (0.6–2.2)	
Contact to a partner with gonorrhea				
Yes	189	9	4.8 (2.2–8.9)	.131
No	932	75	8.1 (6.4–10.0)	
HIV status				
HIV infected	370	41	11.1 (8.1–14.7)	.005
HIV uninfected	742	42	5.7 (4.1–7.6)	
HIV infection status unknown	9	1	11.1 (0.3–48.3)	

NOTE. HIV, human immunodeficiency virus.

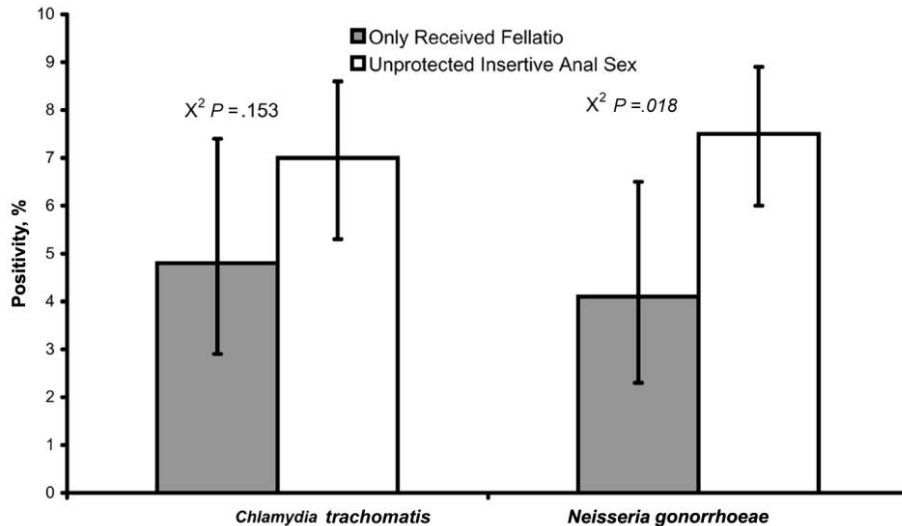


Figure 1. *Chlamydia trachomatis* and *Neisseria gonorrhoeae* positivity among men who have sex with men who visited the San Francisco City Clinic, 2007.

at the STD clinic were among MSM who reported receptive oral sex as their only urethral exposure.

DISCUSSION

Transmission of both *C. trachomatis* and *N. gonorrhoeae* from the male urethra to the oropharynx has been well described, [2, 3]; however, little data exist regarding transmission from the oropharynx to the urethra. Several case series exist [6, 8, 12], yet we know of only 1 epidemiologic study that has examined transmission from the oropharynx to the male urethra. That study was limited to *N. gonorrhoeae*, and diagnosis was based on culture, which is a technique that has limited sensitivity for gonococcal infection, compared with nucleic acid amplification testing [5]. Among visits by MSM in which the only reported urethral exposure was receiving oral sex, the positivity of urethral *C. trachomatis* and *N. gonorrhoeae* was 4.8% and 4.1%, respectively. The finding that urethral chlamydia positivity was not statistically different for visits by MSM in which patients reported only receiving fellatio, compared with those who reported unprotected insertive anal sex, further suggests that this mode of transmission might be more important than previously considered.

Limited data regarding urethral chlamydial and gonococcal infections contracted through oral sex might have led to the assumption that oral-genital transmission of these bacteria are relatively unimportant. Among the 314 and 292 urethral *C. trachomatis* and *N. gonorrhoeae* infections diagnosed among MSM at San Francisco City Clinic in 2007, 16 (5.1%) and 19 (6.5%), respectively, were among men who reported receiving fellatio in the prior 3 months as their only urethral exposure. These data are restricted to visits by MSM in which the only

source of urethral exposure was through receiving fellatio, likely making this an underestimate of the proportion of chlamydial and gonococcal infections potentially acquired through oral sex. Additional urethral *C. trachomatis* and *N. gonorrhoeae* infections among MSM who reported other urethral exposures, such as vaginal or insertive anal sex, in addition to oral sex, might have occurred as a result of fellatio.

Oral sex is a common practice among MSM [13, 14]. Recently collected data from a venue-based sample of MSM in San Francisco found that >80% reported receiving fellatio (H. Fisher Raymond, personal communication). As a result, urethral *C. trachomatis* and *N. gonorrhoeae* infections that result from fellatio might be an important and underappreciated mode of transmission. Additional studies that take advantage of sampling multiple anatomic sites with highly sensitive nucleic acid amplification tests might help to elucidate the potential public health impact of urethral gonorrhea and chlamydia acquired through oral sex.

Among visits by MSM in which patients reported only receiving fellatio, we found a higher urethral positivity for both *C. trachomatis* and *N. gonorrhoeae* among HIV-infected MSM, compared with MSM who were either HIV-uninfected or whose HIV infection status was unknown. This finding likely is more a result of sexual practices than of biological factors associated with HIV infection. Among visits by MSM in our analysis who reported only receiving fellatio, HIV-infected MSM reported more male sex partners in the previous 3 months than did HIV-uninfected MSM (HIV-infected: mean no. of partners, 7.54; median no. of partners, 4; HIV uninfected: mean no. of partners, 5.90; median no. of partners, 3). Therefore, the higher prevalence of urethral positivity among visits by HIV-infected

MSM might have resulted from increased sexual activity and, in turn, increased exposure to infected partners.

Our analysis has several limitations. Data were collected from MSM seeking care at the San Francisco STD clinic. As a result, these patients might not be representative of all MSM in San Francisco or other localities. Additionally, this analysis was cross-sectional and relied on self-reported sexual behavior in the 3 months prior to the clinic visit. It is possible that social desirability might have led some MSM to underreport unprotected anal sex, which might have been different between men with and men without urethral disease, especially among those men with urethral symptoms. However, when we limited analyses to visits by MSM in which the patient was asymptomatic when tested, the positivity of urethral *C. trachomatis* and *N. gonorrhoeae* was still statistically greater than zero, and no differences in positivity were seen between those reporting unprotected insertive anal sex and those reporting receiving fellatio only. We did not restrict this analysis to visits by MSM in which fellatio without condom use was reported. However, nearly all of the MSM in our analysis who reported receiving fellatio only did not use a condom. Additionally, the misclassification of some MSM as having only unprotected fellatio, when in fact that exposure was protected, would render our estimates as conservative, because it is unlikely that these men would get a urethral infection, yet would contribute to the calculation of positivity. Finally, it is possible that the urethral infections identified represent infections that were the result of exposures that occurred before the 3-month recall period. However, when we limited the analysis to patients who presented with urethritis, which likely represents recent infection, positivity increased among all groups. However, the results of the comparisons of positivity for *C. trachomatis* and *N. gonorrhoeae* between MSM visits in which only receptive fellatio and unprotected insertive anal sex were reported were similar to the crude analysis.

Among an STD clinic-based sample, we demonstrated that the transmission of *C. trachomatis* and *N. gonorrhoeae* from the oropharynx to the urethra is prevalent and might represent a mode of transmission important to the continual population-level spread of disease. Patients should be encouraged to be screened regularly for STDs at exposed anatomic sites if they are sexually active and should be reminded that urethral infections can be acquired through oral sex.

Acknowledgments

Potential conflicts of interest. J.D.K. has received research or educational support from Gen-Probe, Focus Technologies, and King Pharmaceuticals. P.M.B. has received research support from Forest Laboratories. J.D.K. has received research support from Forest Laboratories. All other authors: no conflicts.

Financial support. US Public Health Service T32 (grant AI007641-06A2), the Peninsula AIDS Research Center funded by California HIV Research Program (grant CH05-SMCHC-612), Comprehensive STD Prevention Projects (1H25PS001354-01) of the Centers for Disease Control and Prevention, and a Council of State and Territorial Epidemiologists/Centers for Disease Control and Prevention Applied Epidemiology Fellowship (to S.S.).

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