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Association between where men who have sex with men (MSM) meet sexual partners and chlamydia/gonorrhoea infection before and during the COVID-19 pandemic in San Diego, CA

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Abstract

Background: Meeting sex partners online is associated with increased risk of acquiring sexually transmitted infections. We examined whether different venues where men who have sex with men (MSM) meet sex partners was associated with prevalent Chlamydia trachomatis (CT) and Neisseria gonorrhoeae (NG) infection, and whether prevalence increased during (vs. before) the COVID-19 pandemic.

Methods: We conducted a cross-sectional analysis of data from San Diego's "Good To Go" (GTG) sexual health clinic from two enrolment periods: (1) March-September 2019 (pre-COVID-19), and (2) March-September 2021 (during COVID-19). Participants completed self-administered intake assessments. This analysis included males ≥18 years old self-reporting sex with males within 3 months before enrolment. Participants were categorized as (1) meeting new sex partners in-person only (e.g., bars, clubs), (2) meeting new sex partners online (e.g., applications, websites), or (3) having sex only with existing partners. We used multivariable logistic regression, adjusting for year, age, race, ethnicity, number of sex partners, PrEP use, and drug use to examine whether venue or enrolment period were associated with CT/NG infection (either vs. none).

Results: Among 2,546 participants, mean age was 35.5 (range: 18–79) years, 27.9% were non-white, and 37.0% were Hispanic. Overall, CT/NG prevalence was 14.8% and was higher during COVID-19 versus pre-COVID-19 (17.8% vs. 13.3%). Participants met sex partners online (56.9%), in-person (16.9%), or only had existing partners (26.2%) in the past 3 months. Compared to having only existing sex partners, meeting partners online was associated with higher CT/NG

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Contributors:

C. M. B. King conducted the data analysis and wrote the manuscript. B. Skaathun, R. S. Garfein, A. R. Bazzi, S. J. Little made editorial contributions and provided direction for the manuscript and analysis. B. Skaathun and S. J. Little coordinated the data collection. All individuals made significant contributions to this work to qualify for authorship.

Competing Interests:

SJL has received funding from Gilead Sciences paid to her institution and donation of medications from Gilead Sciences.

prevalence (adjusted Odds Ratio [aOR]: 2.32; 95% confidence interval [CI]: 1.51–3.65), while meeting partners in-person was not associated with CT/NG prevalence (aOR: 1.59; CI: 0.87–2.89). Enrolment during COVID-19 was associated with higher CT/NG prevalence compared to pre-COVID-19 (aOR: 1.42; CI: 1.13–1.79).

Conclusions: CT/NG prevalence appeared to increase among MSM during COVID-19, and meeting sex partners online was associated with higher prevalence.

INTRODUCTION

MSM are disproportionately impacted by STIs, particularly at extragenital sites for Chlamydia trachomatis (CT) and Neisseria gonorrhoeae (NG). [1] For example, the prevalence of rectal NG and CT can be as high as 24% and 23%, respectively. [1] It is estimated that approximately 70% of NG and CT infections are asymptomatic, thereby posing a concern during the COVID-19 pandemic when asymptomatic screening may have declined due to clinics limiting appointments to only patients experiencing symptoms. [1–2]

Transmission of STIs can vary by where MSM meet sex partners, such as in-person venues (i.e., bars, clubs, gyms, or other physical locations frequented by MSM), through online venues, (i.e., websites or mobile applications), or by maintaining existing sex partners. [3] Research that pre-dates the pandemic has shown an increase in odds of NG and CT among MSM who meet sex partners online. [4–5] Specifically, one study identified increased odds of CT and NG among those who met sex partners online and in-person compared to neither venue. [4] Another study found increased odds of both CT and NG among individuals who met sex partners on geosocial networking applications compared to individuals who met in-person only. [5]

In March 2020, the State of California issued an executive shelter-in-place order (COVID-19 lockdown) to help prevent SARS-CoV-2 transmission; however, the COVID-19 pandemic may have had negative consequences for sexual health in the United States. [2, 6] For example, pandemic-response efforts caused many healthcare clinics to close or limit in-person visits, thereby reducing screening and testing for asymptomatic sexually transmitted infections (STIs). [2] At the same time, social distancing measures may have decreased in-person interactions, offsetting the need for STI screening during the pandemic. [2, 7]

Currently, the relationships between NG and CT infections and venues where men who have sex with men (MSM) met sex partners amidst COVID-19 pandemic shelter-in-place orders are understudied. Moreover, the relationship between NG and CT infection and where MSM meet sex partners (such as meeting in-person vs. online) is understudied, with no studies assessing the impact of COVID-19 on this relationship.

The COVID-19 pandemic further raised concerns about where MSM meet sex partners, since shelter-in-place orders limited the ability to meet sex partners at in-person venues due to closures of these spaces. [6, 8] At the beginning of the COVID-19 pandemic, many MSM increased their use of dating applications to connect with other men online; however, this did not directly translate to an increase in meeting sexual partners through online methods. [9–10] Within one month of the initial shelter-in-place order, MSM did not change the

frequency of using dating apps to meet people in person. [10] However, there is a gap in research as to whether this changed as shelter-in-place orders were extended while the pandemic progressed. As such, with community venues being closed or operating at reduced capacity for an extended period due to the COVID-19 pandemic, it is plausible that MSM shifted to meeting sexual partners online as the pandemic progressed.

This study had three objectives. The first objective was to describe changes in demographics and STI-associated behaviours, the prevalence of CT/NG, and the venues where MSM meet sex partners before and during the COVID-19 pandemic. The second objective was to investigate the association between venues where MSM meet sex partners and CT/NG prevalence before and during the COVID-19 pandemic, while controlling for demographics that significantly differed between time periods. Lastly, the third objective was to determine whether any factors significantly modified the relationship between venue and STI status, using a parsimonious fit model.

METHODS

Study Design and Sample

We utilized data from adult participants who received STI testing at the “Good To Go” (GTG) sexual health clinic in San Diego, CA during two time periods: (1) pre-COVID-19 (March-September 2019) and (2) during COVID-19 (March-September 2021). The GTG clinic provided free, community-based, confidential acute and early HIV infection and STI screenings. To receive testing at the GTG clinic, participants were required to be ≥ 18 years old, report one or more behaviour that could increase risk of acquiring HIV during the previous 6 months, and report HIV-negative or unknown HIV status. GTG primarily targeted MSM and transgender individuals with risk of HIV infection, however, any person meeting the criteria could receive testing. The GTG screening process included HIV testing for acute and established infection, [11–13] reverse sequence algorithm syphilis testing, [14] and self-collection of 3-site samples for CT and NG[15] (urine, posterior pharynx, and rectal). Participants were offered testing from all three anatomical sites but had the option to decline one or more tests. If a test produced an invalid result, the test was repeated on the original sample. A self-administered survey was administered to collect demographic and behavioural information. The University of California, San Diego Institutional Review Board reviewed and approved this study protocol (#180747).

Measures

STI Outcome Measure—CT and NG infections were detected using the Cepheid GeneXpert (Sunnyvale, CA) CT/NG Rapid PCR from urine, oropharynx, and rectal samples. [16] The Cepheid CT/NG Xpert Test is a validated, NAAT-based point-of-care, test to detect bacterial STIs in urogenital samples, as well as extragenital sites, such as the rectum and pharynx. [17] Test results from either STI (CT or NG) and any collection site (urethral, rectal, or pharyngeal) were combined into one variable to align with the study aims. Therefore, if participants tested positive for CT or NG at any collection site, they were categorized for our binary dependent variable as having a prevalent STI.

Venue Exposure Measure—Participants were asked to self-report all the places where they met any sex partners in the last 3 months. We then categorized the ways that participants reported meeting sex partners in the past 3 months into three groups: (1) only met partners in in-person venues (i.e., bars, clubs, gyms, outdoors, bathhouses, sex clubs, school, work, through friends/family); (2) met partners via online venues (i.e., mobile apps, websites, and both online and in-person); and (3) only had existing sex partners (i.e., did not have new partners in the past 3 months). Participants who self-reported meeting sex partners at both in-person and online venues were categorized into the online category since previous studies have shown that meeting any sex partners online is associated with higher odds for STIs. [5]

Covariates—As numbers of sexual partners and recent drug use (excluding marijuana) have been associated with venues where people meet sex partners and STI outcomes, [18–19] we considered these variables as possible covariates. Drug use in the past three months was coded to include barbiturates/tranquilizers, crack, cocaine, ecstasy, erectile disfunction medications, gamma hydroxybutyrate (GHB), heroin, ketamine, methamphetamine, nitrates/nitrites, prescription pain medications, and steroids. Other measured covariates previously shown to be associated with STIs included age at enrolment, sex, gender, sexual orientation, race, and ethnicity. [20–22] Finally, elevated STI prevalence has been observed among some individuals using pre-exposure prophylaxis (PrEP) for HIV prevention, [23] so we included PrEP use in the past 2 weeks (yes/no) as a covariate. We also controlled for year of enrolment to address potential unmeasured effects of the COVID-19 pandemic.

Statistical Analyses—Data from participants who self-identified as male and reported having sexual intercourse with other males in the 3 months prior to their visit were included in the analysis. We calculated descriptive statistics for the study sample overall and stratified by enrolment period. Chi-squared tests, Welch's t-tests, and Wilcoxon Ranked Sum tests assessed whether socio-demographics (age, race, ethnicity, sex at birth, gender identity, sexual orientation) and sexual behaviours (number of sex partners in the past 3 months, PrEP use in the past 2 weeks, drug use in the past 3 months) differed between participants recruited before versus during COVID-19.

Multivariable logistic regression identified associations between venues where MSM met sex partners and CT/NG prevalence. The reference group for venue was only having sex with existing partners in the past 3 months. We adjusted for enrolment period and covariates (age, race, ethnicity, number of sex partners, drug use, and PrEP use). Additional analyses examined whether year, number of sex partners, or age acted as effect modifiers of associations between venues and prevalent CT/NG, including determining a parsimonious fit model. The interaction between venue and number of sex partners was included in the final multivariable logistic regression due to a statistically significant parsimonious fit. All analyses were performed using R version 4.0.2. [24]

RESULTS

Sample Characteristics

Among 2,546 participants, 59.0% were under the age of 35 (range: 18–79) years, 27.9% were non-white, and 37.0% were Hispanic/Latino (Table 1). In the past 2 weeks, 18.2% had used PrEP. In the past 3 months, 15.3% reported drug use, and the median number of unique sex partners was 3 (IQR: 2,5). The two groups differed by age, race, ethnicity, sexual orientation, use of PrEP, and number of sex partners (all $p<0.05$).

Compared to those who enrolled pre-COVID-19 (n=1,554), in the past 3 months, more participants who enrolled during the COVID-19 pandemic (n=992) had only existing sex partners (22.0% vs. 32.9%) and fewer met sex partners online (58.9% vs. 53.7%) and in in-person venues (19.1% vs. 13.4%) (Table 1).

STI Prevalence

Of the participants who received CT/NG testing, 78.5%, 94.3%, and 94.0% provided rectal, pharyngeal, and urine samples, respectively. The prevalence of STIs was highest in extragenital samples (Table 2). The prevalence of STIs was higher among participants enrolled during COVID-19 compared to pre-COVID-19 for all collection sites, except for pharyngeal CT (Table 2). There was an increase in the prevalence of STIs among participants recruited during COVID-19 compared to those recruited pre-COVID-19 (13.3% vs. 17.0%, p=0.01).

STI Prevalence by Venues for Meeting Sex Partners

STI prevalence was higher among participants who enrolled during compared to pre-COVID-19 for each venue category (Figure 1). In 2019, the prevalence of STIs for in-person venues was similar to the prevalence for existing partners; however, in 2021, the prevalence for in-person venues increased significantly to nearly the same prevalence as online venues.

Multivariable Logistic Regression

Using multivariable logistic regression analysis, we found that compared to having only existing sex partners in the past 3 months, meeting new sex partners online was associated with higher odds of prevalent STIs (adjusted Odds Ratio [aOR]: 2.32; 95% confidence interval [CI]: 1.51–3.65) (Table 3) while meeting new sex partners in-person was not associated with prevalent STIs (aOR: 1.59; CI: 0.87–2.89). Further, the odds of having prevalent STIs were higher among those enrolled during versus pre-COVID-19 (aOR: 1.42; CI: 1.13–1.79). Age, number of sex partners, and PrEP use were also significantly associated with prevalent STIs, whereas race, ethnicity, and drug use were not (Table 3).

Effect Modification

We also investigated effect modification on the associations between venue and prevalent STIs by enrolment year, age, drug use, and number of sex partners. Each model with an interaction term was checked for parsimonious fit using ANOVA likelihood ratio tests. The models for venue and STI status which included year of enrolment, age, and drug use were not the best fitting models; however, the model which included the interaction by number

of sex partners accomplished the most parsimonious fit (p=0.001). Among participants who met sex partners in-person, the odds of STIs increased by 8.58% per 1-unit increase in the number of sex partners. Among participants who met sex partners online, the odds of STIs increased by 2.63% per 1-unit increase in the number of sex partners.

DISCUSSION

In this large sample of MSM presenting at a sexual health clinic before and during the COVID-19 pandemic, we identified independent associations between the venues where participants met new sex partners and enrolment period (pre-COVID-19 and during COVID-19) with CT/NG. Of note, we observed a significant increase in STI prevalence for MSM who met sex partners in-person between enrolment periods. The prevalence of STIs for this group was similar to those with only existing sex partners pre-COVID-19, but shifted during COVID-19 to be more similar to online venues. At the same time, we noted an increase in the proportion of MSM who only had existing sex partners during COVID-19 compared to pre-COVID-19, which could demonstrate an attempt to decrease the risk of COVID-19 transmission (e.g., by only having sex with known, trusted partners while avoiding strangers or anonymous partners) or fewer opportunities to meet partners in-person due to physical distancing guidelines or shelter-in-place orders. Regardless, over 50% of participants reported using online methods to meet sex partners in both enrolment periods, highlighting a continued need to educate mobile application users about STI transmission and local testing and treatment resources. [25]

Compared to only having existing sex partners, there was an increased odds of STIs among participants who met partners online, which is consistent with other literature showing this association. [4–5] The prevalence of STIs among participants during COVID-19 was also higher than the pre-COVID-19 period. However, our study did not find that the association between STI prevalence and venue changed across time intervals. This is consistent with research conducted early in the pandemic showing that MSM were increasingly connecting with others online but that these connections were not leading to increased sexual encounters. [9–10]

We also found that, while the prevalence of STIs increased between time periods, the number of sex partners declined. One potential reason for the increase in STI prevalence during COVID-19 could be barriers to clinical care, including a reduction of testing and treating STI infections during the pandemic. One recent prospective cohort study based in Baltimore, Maryland found that STI testing significantly decreased during the beginning of the pandemic, but was restored to pre-COVID-19 levels by the end of 2020. [26] Of note, this particular study found no change in prevalence of CT and NG, however, the researchers provided at-home test kits to their participants, thus being unable to account for the impact of clinical closures on this relationship. [26] Although the State of California recently passed legislation allowing state-regulated private insurance plans to reimburse at-home STI collection kits, [27] further research is needed that focuses on reducing barriers to STI testing such as clinical closures, privacy, stigma, and cost.

It is important to note that those who met sex partners at in-person venues had the largest increase in the prevalence of STIs between enrolment periods. Further, the odds of prevalent STIs associated with increasing numbers of sex partners was greater among participants who met new sex partners at in-person venues compared to online venues. This could indicate that MSM who met sex partners in-person during the pandemic were also more likely to exhibit behaviours that may increase the risk of STIs than those who were maintaining social distancing measures throughout the pandemic.

Limitations and Strengths

There were specific limitations to this study. Notably, due to the cross-sectional design, we cannot determine causality or temporality between the identified associations. Furthermore, we used two cross-sectional samples from different time periods; as such, the differences we observed could relate to differing samples rather than actual behavioural changes over time. Similar to other studies based on sexual health clinic populations, our findings might overestimate STI prevalence among MSM overall because participants seek testing and treatment due to possible exposure or symptoms. [28] One limitation with categorization was including public sex environments (PSE) and commercial sex venues (CSV) into the in-person category, even though sexual behaviours can vary between private locations, PSE, and CSV. For example, those who have sexual encounters in a CSV are more likely to have multiple sex partners and sex with anonymous partners. [29] However, few MSM reported meeting through PSE and CSV. We also categorized MSM who met sex partners both online and in-person into the online category, which did not separately account for those who use multiple modalities for meeting sex partners. This overlap in categorization could skew data, as it is possible that individuals who use multiple modalities to meet sex partners could have different risks for STIs. Therefore, future studies should further disaggregate the venues where MSM meet sex partners to determine whether these significant differences remain true when held in separate categories. Further, alcohol and marijuana were not evaluated for this study, however, could be possible covariates for this analysis. Our study also had several strengths. Given the study period overlapped with the start of the COVID-19 pandemic, we were able to examine STI prevalence during the COVID-19 pandemic among MSM. Further, STI results were based on NAAT at a clinic using samples from 3 anatomic sites, thus providing objective and comprehensive STI prevalence estimates.

Conclusion

We hypothesized that, due to the closure of in-person venues during the COVID-19 pandemic, MSM would be more likely to meet sex partners through online methods. Our study did not identify a significant interaction between venues and enrolment year, demonstrating that changes in STI prevalence did not result from the increased use of online venues during the pandemic. However, we found that meeting sex partners online was associated with increased CT/NG prevalence among participants of a sexual health clinic during this time period. Further, we found that the prevalence of STIs appeared to increase during the COVID-19 pandemic compared to pre-COVID-19.

Future studies should continue to assess the impact of the COVID-19 pandemic on the relationship between venues where MSM meet sex partners and STI transmission, as this

relationship could change as the pandemic evolves. Collecting data in future studies that specifically assesses the use of online apps while at in-person venues will be necessary to further assess the intersection of this relationship. Qualitative studies could also help elucidate barriers to STI testing and treatment, protective measures, and possible strategies that could support access to STI testing and treatment. While online venues provide an avenue for STI prevention education, these programs can be expensive. Additional support (including insurance coverage) for at-home STI testing could help reduce barriers to access. Since STI rates are expected to continue increasing post-COVID-19 pandemic, interventions are needed to address these barriers long-term. [30]

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Key Messages

What is already known on this topic:

Meeting sex partners online is associated with a higher prevalence of STIs; however, this is the first paper to our knowledge that examines how meeting sex partners and the prevalence of Chlamydia trachomatis/Neisseria gonorrhoeae changed during the COVID-19 pandemic, compared to before.

What this study adds:

The prevalence of Chlamydia trachomatis and Neisseria gonorrhoeae increased during the COVID-19 pandemic, while many sexual behaviours decreased. This further adds to current literature by showing that the odds of CT and NG infection were increased among MSM who met sex partners online.

How this study might affect research, practice or policy:

Policies and interventions are needed to address events, such as the COVID-19 pandemic, that produce barriers and possible disruptions in sexual health services for MSM.

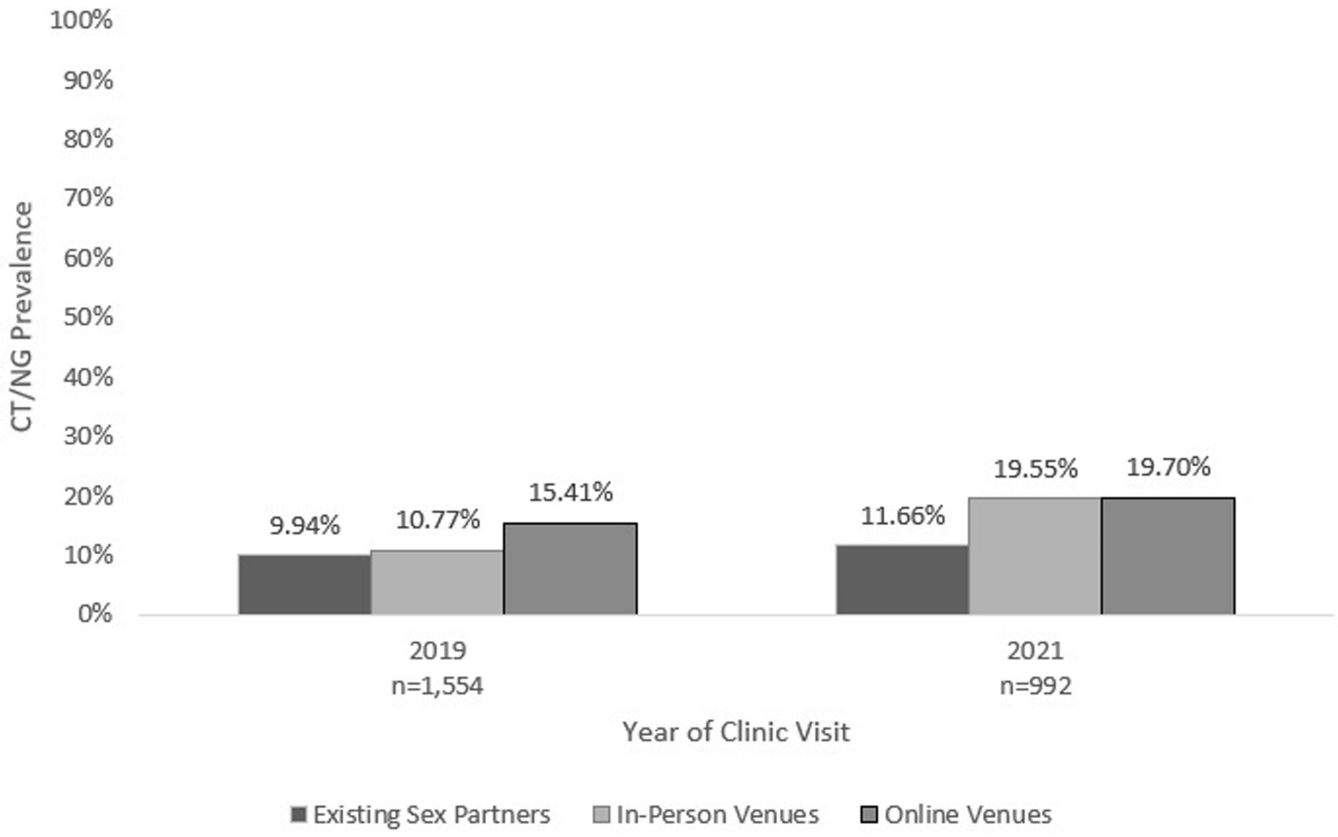

Figure 1.
Chlamydia trachomatis (CT)/Neisseria gonorrhoeae (NG) prevalence at each venue where men who have sex with men met sex partners, stratified by year.

Table 1:

Characteristics of participants, stratified by year.

Characteristic	Total n=2,546	March-Sept 2019 n=1,554	March-Sept 2021 n=992	p-value[1]
	n (%)	n (%)	n (%)	
Age				
<25	317 (12.5)	188 (12.1)	129 (13.0)	0.02*
25–34	1,186 (46.6)	711 (45.8)	475 (47.9)	
35–44	538 (21.1)	312 (20.1)	226 (22.8)	
44–54	273 (10.7)	184 (11.8)	89 (9.0)	
≥55	232 (9.1)	159 (10.2)	73 (7.4)	
Race				
White	1,835 (72.1)	1,092 (70.3)	743 (74.9)	<0.001*
American Indian/ Alaskan Native	33 (1.3)	22 (1.4)	11 (1.1)	
Asian	246 (9.7)	161 (10.4)	85 (8.6)	
Pacific Islander/Native Hawaiian	30 (1.2)	22 (1.4)	8 (0.8)	
Black/African American Other	183 (7.2) 84 (3.3)	101 (6.5) 51 (3.3)	82 (8.3) 33 (3.3)	
Multiracial	88 (3.5)	59 (3.8)	29 (2.9)	
Does not want to report	47 (1.9)	46 (3.0)	1 (0.1)	
Ethnicity				
Hispanic/Latino	943 (37.0)	545 (35.1)	398 (40.1)	0.02*
Not Hispanic/Latino	1,596 (62.7)	1,003 (64.5)	593 (59.8)	
Did not report	7 (0.3)	6 (0.4)	1 (0.1)	
Sex at birth				
Male	2,543 (99.9)	1,552 (99.9)	991 (99.9)	1.00
Did not report	3 (0.1)	2 (0.1)	1 (0.1)	
Gender Identity				
Male	2,515 (98.8)	1,534 (98.7)	981 (98.9)	0.54
Do not identify as female, male, or transgender	1 (0.0)	1 (0.1)	0 (0.0)	
Non-binary/Genderqueer/Gender Fluid/Agender	25 (1.0)	14 (0.9)	11 (1.1)	
Another identity not listed	2 (0.1)	2 (0.1)	0 (0.0)	
Did not report	3 (0.1)	3 (0.2)	0 (0.0)	
Sexual Orientation				
Gay	2,053 (80.6)	1,286 (82.8)	767 (77.3)	0.001*
Bisexual	390 (15.3)	201 (12.9)	189 (19.1)	
Straight (heterosexual)	32 (1.3)	22 (1.4)	10 (1.0)	
Queer	41 (1.6)	26 (1.7)	15 (1.5)	

Characteristic	Total n=2,546	March-Sept 2019 n=1,554	March-Sept 2021 n=992	p-value[1]
	n (%)	**n (%)**	**n (%)**	
Another orientation not listed	27 (1.1)	18 (1.2)	9 (0.9)	
Did not report	3 (0.1)	1 (0.1)	2 (0.2)	
Sexual Behaviours				
	n (%)	**n (%)**	**n (%)**	
Venue where MSM met sex partners				
No New Sex Partners in the past 3 months (only existing partners)	668 (26.2)	342 (22.0)	326 (32.9)	<0.001*
In-person venues	430 (16.9)	297 (19.1)	133 (13.4)	
Bar/Club	*128 (29.8)*	*70 (23.6)*	*58 (43.6)*	
Bathhouse/Sex Club	*16 (3.7)*	*13 (4.4)*	*3 (2.3)*	
Friends/Acquaintances	*238 (55.3)*	*184 (61.9)*	*54 (40.6)*	
Gym	*17 (4.0)*	*9 (3.0)*	*8 (6.0)*	
Outdoor	*12 (2.8)*	*8 (2.7)*	*4 (3.0)*	
Work/School	*19 (4.4)*	*13 (4.4)*	*6 (4.5)*	
Online Venues	1,448 (56.9)	915 (58.9)	533 (53.7)	
Online Only	*851 (58.8)*	*480 (52.5)*	*371 (69.6)*	
Online and In-Person	*597 (41.2)*	*435 (47.5)*	*162 (30.4)*	
PrEP Use in the past 2 weeks				
Yes	462 (18.2)	308 (19.8)	154 (15.5)	0.01*
No	2,082 (81.8)	1,244 (80.1)	838 (84.5)	
Did not report	2 (0.1)	2 (0.1)	0 (0.0)	
Drug Use in the past 3 months [2]				
Yes	389 (15.3)	239 (15.4)	150 (15.1)	0.90
No	2,157 (84.7)	1315 (84.6)	842 (84.9)	
	Median (IQR)	**Median (IQR)**	**Median (IQR)**	
Number of Sex Partners in past 3 months	3 (2,5)	3 (2,5)	3 (2,5)	<0.001*

[1] p-values were calculated using Chi-Squared test for age, Wilcoxon ranked sum test for sex partners, and Welch's t-tests for continuous variables

[2] Excludes alcohol and marijuana

Table 2:

Neisseria gonorrhoeae (NG) and Chlamydia trachomatis (CT) prevalence by anatomical site and year

	Total n=2,546			March-Sept 2019 n=1,554			March-Sept 2021 n=992			p-values[1]		
	NG only	CT only	NG and CT	NG only	CT only	NG and CT	NG only	CT only	NG and CT	NG only	CT only	NG and CT
Rectal	117 (4.60)	157 (6.17)	27 (1.06)	56 (3.60)	93 (5.98)	17 (1.09)	61 (6.15)	64 (6.45)	10 (1.01)	<0.01*	<0.01*	0.83
Pharyngeal	116 (4.56)	29 (1.14)	4 (0.16)	67 (4.31)	19 (1.22)	3 (0.19)	49 (4.94)	10 (1.01)	1 (0.10)	<0.01*	<0.01*	0.57
Urethral	27 (1.06)	63 (2.47)	5 (0.20)	9 (0.58)	31 (1.99)	1 (0.06)	18 (1.81)	32 (3.23)	4 (0.40)	<0.01*	<0.01*	0.06
Total Unique	194 (7.62)	221 (8.68)	39 (1.53)	102 (6.56)	128 (8.24)	23 (1.48)	92 (9.27)	93 (9.38)	16 (1.61)	0.02*	0.32	0.79
Total with CT or NG	376 (14.77)			207 (13.32)			169 (17.04)			0.01*		

[1] p-values were calculated using Chi-Squared tests

Table 3:

Multivariable analysis of factors associated with CT and/or NG infection among MSM

Covariate	CT/NG+ (n=376)	CT/NG− (n=2,170)	Unadjusted OR (95% CI)	Adjusted OR[1] (95% CI)	Adjusted p-value
Year, n (%)					
2019	207 (13.32)	1,347 (86.68)	1.00 (Reference)	1.00 (Reference)	
2021	169 (17.04)	823 (82.96)	1.34 (1.07, 1.67)	1.42 (1.13, 1.79)	0.003*
Venue, n (%)					
No new sex partners in the past 3 months	72 (10.78)	596 (89.22)	1.00 (Reference)	1.00 (Reference)	
In-person venues[2]	58 (13.49)	372 (86.51)	1.29 (0.89, 1.87)	1.59 (0.87, 2.89)	0.13
Online Venues[3]	246 (16.99)	1,202 (83.01)	1.69 (1.29, 2.26)	2.32 (1.51, 3.65)	<0.001*
Age, Mean (SD)	32.66 (10.19)	35.94 (11.74)	0.97 (0.96, 0.98)	0.97 (0.96, 0.98)	<0.001*
Race, n (%)					
White	256 (13.95)	1,579 (86.05)	1.00 (Reference)	1.00 (Reference)	
American Indian/Alaskan Native	6 (18.18)	27 (81.82)	1.37 (0.51, 3.14)	1.01 (0.36, 2.42)	0.99
Asian	37 (15.04)	209 (84.96)	1.09 (0.74, 1.57)	1.13 (0.75, 1.66)	0.56
Pacific Islander/Native Hawaiian	3 (10.00)	27 (90.00)	0.69 (0.16, 1.96)	0.79 (0.18, 2.31)	0.70
Black/African American	33 (18.03)	150 (81.97)	1.36 (0.90, 2.00)	1.32 (0.86, 1.99)	0.19
Other	14 (16.67)	70 (83.33)	1.08 (0.44, 2.29)	1.08 (0.56, 1.93)	0.81
Multiracial	20 (22.73)	68 (77.27)	1.81 (1.06, 2.98)	1.80 (1.03, 3.02)	0.03*
Did not report	7 (14.89)	40 (85.11)	1.23 (0.66, 2.16)	1.21 (0.48, 2.65)	0.66
Ethnicity, n (%)					
Not Latino/Hispanic	226 (14.16)	1,370 (85.84)	1.00 (Reference)	1.00 (Reference)	
Latino/Hispanic	150 (15.91)	793 (84.09)	1.15 (0.92, 1.43)	1.16 (0.90, 1.50)	0.25
Sex Partners, Mean (SD)	6.09 (6.67)	4.38 (5.53)	1.04 (1.02, 1.06)	1.33 (1.16, 1.55)	<0.001*
Drug Use, n (%)					
No	298 (13.82)	1,859 (86.18)	1.00 (Reference)	1.00 (Reference)	
Yes	78 (20.05)	311 (79.95)	1.56 (1.18, 2.05)	1.26 (0.94, 1.68)	0.12
PrEP Use, n (%)					
No	272 (13.82)	1,810 (86.18)	1.00 (Reference)	1.00 (Reference)	
Yes	104 (20.05)	358 (79.95)	1.93 (1.50, 2.48)	1.77 (1.35, 2.30)	<0.001*
Interaction between venue and number of sex partners, n (%)					
No new sex partners in the past 3 months	-	-	-	1.00 (Reference)	
In-person venues[2]	-	-	-	0.82 (0.69, 0.97)	0.02*
Online venues[3]	-	-	-	0.77 (0.66, 0.89)	<0.001*

[*] Statistically significant at the 0.05 level

[1] Adjusted for year of clinic visit, venue, age, race, ethnicity, number of sex partners, PrEP use, and drug use

[2] Includes only in-person venues (community venues and social network)

[3] Includes only online venues and online or in-person venues