ORIGINAL ARTICLE

Prevalence of *Neisseria gonorrhoeae* and *Chlamydia trachomatis* Infections among Thai Adolescents and Young Adult Men Who Have Anal Sex: Targeted Screening Strategy

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Objective: *Neisseria gonorrhoeae* (NG) and *Chlamydia trachomatis* (CT), are common among adolescents and young adults (AYA). The present study aimed to examine the prevalence of NG and CT among AYA using a targeted strategy for high-risk populations and to explore associated risk factors for these Sexually transmitted infections (STIs).

Materials and Methods: A cross-sectional study was conducted at an STI clinic in Bangkok. The inclusion criteria were 1) aged between 15 to 24 years, 2) engaging in anal sex, and 3) at high risk of STI acquisition, such as more than three sex partners in the preceding six months having symptoms of urethritis or proctitis. STI screening was performed using pooled specimens collected from urethral, anal, and throat swabs. Nucleic acid amplification tests (NAATs) for NG and CT were performed using GeneXpert assays.

Results: Between May 2023 and April 2024, 150 Thai AYA with a median age of 22 years (IQR 20 to 23) were enrolled. Forty-four participants (29.3%) presented with symptomatic STIs, 23 (15.3%) were living with HIV. The overall prevalence of NG or CT was 38.7% (95% CI 30.8 to 47.0). The prevalence of NG and CT were 21.3% (95% CI 15.1 to 28.8) and 23.3% (95% CI 16.8 to 30.9), respectively. Factors associated with NG infection were being both insertive and receptive sex partners (adjusted prevalence ratio [aPR] 3.1, 95% CI 1.2 to 7.5) and diagnosed with STIs in the preceding year (aPR 2.6, 95% CI 1.0 to 6.5) while factors associated with CT infection was living with HIV (PR 2.7, 95% CI 1.0 to 7.0).

Conclusion: About one-thirds of AYA who have anal sex had NG or CT infections. Reporting sexual roles as both insertive and receptive partners, a previous diagnosis of STI in the preceding year, and living with HIV increased the likelihood of having STIs. Targeted screening among AYA with these profiles should be considered.

Keywords: *Neisseria gonorrhoeae*; *Chlamydia trachomatis*; Sexually transmitted infections; Adolescents and young adults; Prevalence; Sexual roles; Living with HIV

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Sexually transmitted infections (STIs) are a significant public health concern globally, with *Neisseria gonorrhoeae* (NG) and *Chlamydia trachomatis* (CT) being among the most prevalent. According to surveillance reports of the World Health Organization (WHO) in 2020, there were an estimated 82.4 million new cases of NG infections and 128.5 million CT infections worldwide. These infections can lead to serious health complications if left untreated, including infertility and increased susceptibility to HIV[1,2]. For example, studies reported three times higher HIV acquisition risk in men who have sex with men (MSM) diagnosed with rectal chlamydia and gonorrhea compared to the general populations[3]. Adolescents and young adults (AYA), particularly those engaging in high-risk sexual activities, are disproportionately affected by these

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infections, especially MSM and transgender women (TGW). In the previous studies of Thai adolescents MSM and TGW[4], the incidence of NG and CT infections were 4.5% and 15%, respectively. These were greater than the prevalence from meta-analyses in the general population, which were 0.3% and 3.7%, respectively[5,6].

The U.S. Centers of Disease Control and Prevention (CDC) recommend routine annual screening of NG and CT infections for all sexually active MSM using a test for urethral infection if there was a history of insertive intercourse and a test for rectal infection if there is a history of receptive intercourse during the preceding year[7,8]. Standard screening techniques for NG and CT recommended are nucleic acid amplification testing (NAAT). Compared to traditional bacterial cultures, NAAT demonstrates superior sensitivity and specificity[9,10]. Due to the high cost of NAATs, routine screenings for target populations are not widely available in Thailand. Syndromic management is consequently often the primary approach used.

Another approach to reducing laboratory costs is to pool samples. Previous studies comparing the efficacy of pooling specimens from urethral, anal, and pharyngeal samples to single-site testing using multiplex polymerase chain reaction, showed non-inferiority for NG and CT detection[11-13].

The present study focused on the prevalence and associated factors of NG and CT infections among AYA attending an STI clinic in Bangkok, Thailand. By implementing a targeted screening strategy, aiming the test for higher-risk populations, the authors' point was to provide a clearer understanding of the epidemiology of these infections in this demographic and to inform future screening and intervention strategies.

Materials and Methods

Study design and participants

The present study was a cross-sectional study conducted at Buddy CU Clinic, an STIs clinic at King Chulalongkorn Memorial Hospital (KCMH) in Bangkok, Thailand. Inclusion criteria were 1) men aged 15 to 24 years, 2) engaged in anal sex, and 3) having factors increasing STI acquisition risk, including symptoms of urethritis or proctitis, or having more than three sexual partners in the preceding six months. Demographic data including sexual behaviors, previous STIs screening such as HIV, syphilis, gonorrhea, chlamydia, herpes simplex, and anogenital warts, risk perception of STIs acquisition as low, medium, and high, and clinical symptoms were collected through self-reported questionnaires. Targeted physical examinations were performed by a physician on the date of enrollment. The study was approved by the Institutional Board Review of the Faculty of Medicine, Chulalongkorn University (IRB No. 0861/65). Certificate of Full Board Approval (COA No. 029/2023). All participants were enrolled after obtaining written inform consent from participants aged over 18 years and assent from participants aged 15 to under 18 years.

Study procedures

Specimens for STI screening were obtained from urethral, anal, and throat swabs, which were then pooled for NAATs using GeneXpert CT/NG assays (Cepheid, Inc. California, USA), a WHO validated test for diagnosis of NG and CT infections[14]. Sensitivity and specificity for NG were 96.9% and 99.7%, and were 92.4% and 99.2% for CT, respectively[10,15].

NG infection was treated with a single dose of ceftriaxone of 500 milligrams intramuscularly. CT infection was treated with 100 mg oral tablets of doxycycline twice daily for seven days[1,2]. Ceftriaxone was prescribed to all symptomatic participants at the clinic as empirical treatment, while doxycycline was prescribed as home medication and participants would be notified by telephone call to start taking the medications if they were detected for CT. Asymptomatic participants would not be prescribed medications on the first visit, but would be called back to the clinic to receive the treatments if the infections were detected. Follow-up by telephone call was done seven days after receiving medication to check for the responses and the side effects of the treatment. Participants with persistent STIs symptoms were identified and appointed to the clinic for re-investigation and further treatment.

Sample size estimation

Estimating from results of previous sexually transmitted infections in MSM and TGW trials in Bangkok, Thailand[4], presuming that 4.5% of the population had NG and 15% had CT infections, assuming 5% for margin of error with a 95% confidence interval (CI), a sample size of 150 participants was calculated to be needed for the study.

Statistical analysis

Descriptive statistics were used to summarize the demographic and clinical characteristics of the

participants. Overall prevalence of NG and CT was reported with 95% CIs. Logistic regression models were used to identify factors associated with NG and CT infections. Univariate analysis described significant prevalence ratios (PRs) as p-value less than 0.1, while multivariate analysis described significant adjusted prevalence ratios (aPRs) as p-value less than 0.05. The associated factors were reported at 95% CIs.

All data analyses were performed using Stata/SE, version 18.0 (StataCorp LLC, College Station, TX, USA).

Results

Demographic data

Between May 2023 and April 2024, 150 Thai AYA were enrolled, including 142 MSM (94.7%) and eight TGW (5.3%) with a median (interquartile range, IQR) age of 22 years (20 to 23). The median age of sexual debut was 18 (16 to 19) years. Forty-four participants (29.3%) presented with STIs symptoms, including 19 urethritis (12.6%), 22 proctitis (14.7%), and three (2.0%) with both symptoms. Seventy-five participants (50.0%) reported as both insertive and receptive partners, 52 participants (34.7%) as receptive partners. One hundred twenty-three participants (82.0%) reported history of condomless oral sex. The number of participants living with HIV and HIV pre-exposure prophylaxis (PrEP) users were 23 (15.3%) and 50 (39.1%), respectively. According to the sexual history data, 48 participants (32.0%) had been previously diagnosed with and treated STIs in the preceding year, including 15 with syphilis (31.2%), 13 with gonorrhea (27.0%), 11 with chlamydia (22.9%), eight with anogenital warts (16.7%), three with herpes simplex (6.2%), and two with HIV (4.2%). None of the participants received Doxycycline post-exposure prophylaxis (Doxy-PEP) before enrollment. Among these, 127 participants (84.7%) perceived themselves to be at low risk of STIs and 55 (36.7%) had never been screened for STIs in the preceding year. The demographic data of the participants is shown in Table 1.

Table 1. Baseline characteristics of study participants

Characteristics	n=150; n (%)
Gender identity	
MSM	142 (94.7)
TGW	8 (5.3)
Age at enrollment (years)	
Median (IQR)	22 (20 to 23)
Self-reported age of sexual debut (years)	
Median (IQR)	18 (16 to 19)
Self-reported number of inconsistent condom-use sex partners in preceding 6-month	
1 to 3	28 (18.7)
≥3	122 (81.3)
Self-reported sexual role	
Insertive	23 (15.3)
Receptive	52 (34.7)
Both	75 (50.0)
Previous diagnosis of STIs in preceding years	
Screened, negative	55 (36.7)
Screened, positive	48 (32.0)
No screening	47 (31.3)
Living with HIV	
No	127 (84.7)
Yes	23 (15.3)
Using HIV PrEP (for participants with HIV negative)	
No	77 (60.6)
Yes	50 (39.4)
Self-perceived risk of STIs	
Low risk	127 (84.7)
High risk	23 (15.3)

MSM=men who have sex with men; TGW=transgender women; IQR=interquartile range; STIs=sexually transmitted infections; PrEP=pre-exposure prophylaxis

STIs prevalence

The overall prevalence of NG and CT was 38.7% (95% CI 30.8 to 47.0). Among these, only nine participants (6.0%) (95% CI 2.8 to 11.1) had NG and CT co-infections. The prevalence of NG infection was 21.3% (95% CI 15.1 to 28.8). Among participants who reported symptoms of STIs, seven out of 25 participants (28.0%) reported anal symptoms and seven out of 22 participants (31.8%) reported urethral symptoms from NG. The prevalence was higher than 19 out of 106 asymptomatic participants, which was 17.9% (95% CI 11.2 to 26.6). The prevalence of CT infection was 23.3% (95% CI 16.8 to 30.9). Among participants who reported symptoms of STIs five out of 25 participants (20.0%) reported anal symptoms and eight out of 22 participants (36.3%) reported urethral symptoms from CT. The prevalence was higher than 23 out of 106 asymptomatic participants, which was 21.6% (95% CI 14.3 to 30.8) (Table 2).

In the follow up call one week after receiving treatment, it was found that, among 29 symptomatic participants who were detected for either NG or CT at enrollment, none reported persistence or recurrence of STIs symptoms. None of the other 29 asymptomatic participants with STIs had STIs symptoms after receiving treatment. None of the participants needed

Table 2. Prevalence of *Neisseria gonorrhoeae* and *Chlamydia trachomatis* infections among MSM and TGW, classified by symptoms

STIs symptoms	*N. gonorrhoeae* infection (32 participants)[a]		*C. trachomatis* infection (35 participants)[b]	
	n (%)	95% CI	n (%)	95% CI
Symptomatic				
Anal symptoms (n=25)[c]	7/25 (28.0)	12.1 to 49.4	5/25 (20.0)	6.8 to 40.7
Urethral symptoms (n=22)[c]	7/22 (31.8)	13.9 to 54.9	8/22 (36.4)	17.2 to 59.3
Asymptomatic				
With high risk of STIs (n=106)	19/106 (17.9)	11.2 to 26.6	23/106 (21.7)	14.3 to 30.8

MSM=men who have sex with men; TGW=transgender women; CI=confidence interval

(a) 23 NG infection and 9 NG and CT co-infections, (b) 26 CT infection and 9 NG and CT co-infections, (c) 3 participants had both anal and urethral symptoms

Table 3. Factors associated with prevalence of *Neisseria gonorrhoeae* and *Chlamydia trachomatis* infections

	N. gonorrhoeae infection (32 participants)					*C. trachomatis* infection (35 participants)		
	n (%)	Univariate		Multivariate		n (%)	Univariate	
		PR (95% CI)	p-value	aPR (95% CI)	p-value		PR (95% CI)	p-value
Self-reported sexual role (both), n=75	23 (30.7)	3.24 (1.38 to 7.60)	0.01	3.07 (1.25 to 7.53)	0.01	18 (24.0)	1.08 (0.51 to 2.30)	0.85
Previously diagnosed and received treatment of STIs in preceding years, n=48	18 (37.5)	3.77 (1.67 to 8.50)	<0.01	2.58 (1.02 to 6.49)	0.04	15 (31.3)	1.86 (0.85 to 4.07)	0.12
Living with HIV, n=23	10 (43.4)	5.10 (1.96 to 13.28)	<0.01	2.91 (0.99 to 8.55)	0.05	9 (39.1)	2.72 (1.05 to 7.04)	0.04
Using HIV PrEP (for participants with HIV negative), n=50	8 (16.0)	0.95 (0.36 to 2.49)	0.92			11 (22.0)	1.18 (0.49 to 2.84)	0.70

STIs=sexually transmitted infections; PrEP=pre-exposure prophylaxis; PR=prevalence ratio; aPR=adjusted prevalence ratio; CI=confidence interval

re-investigation or further treatment of NG or CT.

Factors associated with STI prevalence

Factors associated with NG infection, according to multivariate logistic regression analysis, included self-reported sexual role as both insertive and receptive partner (aPR 3.07, 95% CI 1.25 to 7.53) and previous diagnosis of STIs in the preceding year (aPR 2.58, 95% CI 1.02 to 6.49). Factor associated with CT infection, according to univariate logistic regression analysis, was living with HIV (PR 2.72, 95% CI 1.05 to 7.04) (Table 3).

Discussion

The present study conducted in Thailand among young people engaging in anal sex found one-third had NG or CT infections. Participants being both insertive and receptive partners or having a previous diagnosis of STIs in the preceding year were at 2.5 to 3 times higher risk of NG infections. Additionally, AYA living with HIV had a 2.5 times higher risk of CT infections. Among the participants with STI symptoms, including urethritis and/or proctitis, two-thirds had NG or CT infections. The association between previous STI diagnoses and current NG infections emphasizes the need for continuous monitoring and interventions in this group such as routine STIs screening and encouragement for regular condom use. Those living with HIV were more likely to have CT infections, suggesting that integrated care for HIV and STIs is crucial for this population. The dual burden of HIV and STIs necessitates comprehensive prevention and treatment programs to address these overlapping health issues effectively.

A previous prospective cohort study of STIs in Thai MSM and TGW adolescents done in 2018 to 2019[3], where the median age of participants was 18 years, the overall STI prevalence was 22.5%. The prevalence of NG was 4.5% and CT was 15% of those screened. Factors associated with STIs were reported to have more than two partners in the past month. Compared to the present study that enrolled AYA with a median age of 22 years, the overall prevalence of STIs was 38.7% and the prevalence of NG and CT was 21.3 and 23.3%, respectively. It suggests that the older youth populations tend to be at a higher risk of acquiring STIs, due to the higher number of sexual partners and engagement in condomless anal sex activities.

A cross-sectional study in China done in 2015 to 2017[16], in MSM age 18 to 25 years involved in oral and anal sex found that the prevalence of NG and CT was 14.6% and 20.8%, respectively, which is lower than the results from the present study. This could be because of the low perception to the risk of infections among Thai youths lead to the lower screening rate

and receiving the treatment. The other reason was our study targeted a population with STIs symptoms or reported having high STI acquisition risk. About half of the participants in the present study had symptoms of urethritis or proctitis, which is a 30% possibility to have STIs. In the present study, most NG and CT infections were asymptomatic, consistent with findings from the previous studies and emphasizing the need to screen for STIs in high-acquisition risk populations[16].

Studies[11-13] reported that the use of pooled samples is as sensitive for detection as individual-site testing. It showed significant cost savings, particularly in health services with a large amount of MSM population requiring frequent testing.

A strength of the present study was the enrollment targeting the MSM youths, the key populations affected by HIV. The findings from the study could be applied in clinical practices and utilizations of limited resources of NAATs and laboratory investigations in the middle-income settings, for the higher yield of positive results, increasing cost effectiveness and underscore the importance of targeted screening strategies in this population, as routine screenings could significantly reduce the burden of these infections.

The limitation of the study was the extent of generalizability. Participants in the present study were enrolled from the HIV-PrEP clinic, so that the prevalence of the STIs could be lower and might not be definitely represented by the general populations who were not regularly screened and taking medications for prevention of STIs. The other limitation was the data record form did not identify the oral sexual roles. Therefore, the authors could not clearly prove oral sex as a significant factor related to the infections. Moreover, from the screening methods, pooled sampling technique could not particularly identify the sites of the infections. However, the treatment regimen and duration are not different between pharyngeal or urogenital gonorrhea. Alongside the treatment outcome, the authors did not follow up about drug adherence and side effects of the treatment among the participants. In addition, data such as sexual history were measured outcomes on self-reported questionnaires. These could be influenced by recall bias and social desirability.

Conclusion

Approximately one-third of AYA MSM and TGW had NG or CT infections, diagnosed by pooled NAATs. Reporting sexual roles as both insertive and receptive partners, diagnosed of STIs in the preceding year, and living with HIV had two to three times the likelihood to have STIs compared to peers. These findings support the need for targeted screening and prevention strategies among high-risk AYA to mitigate the public health impact of STIs.

What is already known about this topic?

NG and CT are two of the most common STI among Thai AYA especially men who were involving in anal sex. However, the reported risk factors associated with the infections have not been clearly reported.

What does this study add?

This study reported the prevalence of NG and CT among AYA at risk, which is 21.3% and 23.3%, respectively.

Factors associated with NG infection were self-reported sexual role as both insertive and receptive partner and previous diagnosis of STIs in the preceding year. The factor associated with CT infection was living with HIV.

These findings support the targeted screening and prevention strategies among high-risk populations to mitigate public health in a middle-income country.

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Conflicts of interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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