

## Original Article

# Sexual behavior survey and screening for chlamydia and gonorrhoea in university students in South Korea

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### Abstract

**Background:** The purpose of the present study was to define the prevalence of genital *Chlamydia trachomatis* and *Neisseria gonorrhoeae* infections and status of sexual risk behavior among university students (18–25 years old) in the capital region of South Korea.

**Methods:** Participants filled out a self-administered questionnaire related to sexuality. First-void urine was analyzed for chlamydial and gonococcal infection by strand displacement amplification (BDProtecET, BD Diagnostic Systems, MD).

**Results:** A total of 622 students from 15 colleges in three universities took part in the study. The median age was 21 and 39.1% of them reported having sexual intercourse at least once. The prevalence of *C. trachomatis* among sexually active men and women was 8.4% and 10.6%, respectively. Gonococcal infection was noted in one symptomatic male. Factors significantly associated with infection were the number of sexual partners during past year and lifetime and condom use.

**Conclusions:** This is the first sexually transmitted infection (STI) screening in university students in South Korea. Urine-based STI screening was both feasible and acceptable in university students in South Korea. It should be considered a routine part of programs to control STI nationally.

### Key words

*Chlamydia trachomatis*, *Neisseria gonorrhoeae*, students.

## Introduction

Infections with *Chlamydia trachomatis* and *Neisseria gonorrhoeae* are the most common bacterial sexually transmitted infections (STI) and the highest age-specific rates are found in adolescents and youth in their early twenties.<sup>1</sup> It is estimated that approximately half a million or 1 in 20 young people acquire a STI every day, adding up to more than 150 million new infections in a year.<sup>2</sup> The long-term consequences of chlamydial and gonococcal infections may be severe, particularly in

women, and cervical infection can lead to pelvic inflammatory disease, tubal scarring, infertility, ectopic pregnancy, chronic pelvic pain and, rarely, death from tubo-ovarian abscesses or ruptured ectopic pregnancies.<sup>3,4</sup> Women with a chlamydial infection are at an increased risk of developing cervical cancer, as high as 6.5 times greater than in women without infection.<sup>5</sup> Bacterial STI, such as chlamydia and gonorrhoea, are risk factors for human immunodeficiency virus transmission, with a risk ratio varying from 3.6 to 5.0.<sup>6,7</sup>

Since genital chlamydial and gonococcal infections cause no or few symptoms for as many as 80% of infected women and 50% of infected men, many infections remain undetected.<sup>8</sup> Delayed treatment increases the risk of sequelae and transmission to sex partners. Screening is therefore indicated to prevent the spread of STI and also to prevent complications. In South Korea, there is currently no generalized screening policy

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for STI and prevalence data from the general population are not available. A few surveys targeting only special groups, such as sex workers, have been performed by the governmental health institute.<sup>9</sup> Large proportions of young people do not seek or have special problems in accessing health care services. All university school students in South Korea have to have a routine medical check-up only one time at entrance. Young students in South Korea are a group considered to be medically underserved. A school-based screening of STI has the potential to identify disease at an early stage, prevent later morbidity and decrease transmission in the community.<sup>10</sup>

The new availability of amplification-based diagnostic methods provides the opportunity to screen large numbers of young people. Strand displacement of amplification (SDA) is a new DNA amplification-based diagnostic method and commercially available by the BDProbeTecET system (Becton Dickinson Microbiology System, Sparks, MD). The BDProbeTecET system is a semiautomated system for the simultaneous detection of *C. trachomatis* and *N. gonorrhoeae* from a non-invasive urine sample.<sup>11</sup>

We evaluated the magnitude of chlamydial and gonococcal infections using SDA technology among university students in Seoul and the capital region of South Korea. We also evaluated the status of sexual risk behavior among them to determine the risk factors and to design potential screening strategies based on these data.

## Materials and methods

### Study area, population and specimen collection

Seoul is the capital city of South Korea and the study samples were drawn from 15 colleges in three universities which were located in Seoul and the suburban area of Seoul. Almost half of all South Koreans and more than half of South Korean university students live in capital region of South Korea. Owing to this distribution of population, the capital region of South Korea was targeted as the subject of this screening for STI.

Information on the study was initially given through a letter and telephone to the school administration. Once final approval was obtained by the school administration, the study coordinator met with each student representative or department representative to coordinate and develop a campaign to maximize student participation. As part of the recruitment procedure and on the consent form, all students were provided information about the

purpose of the urine test, STI and the consequences of untreated STI.

### Data collection and ethical clearance

An anonymous, self-administered, structured questionnaire was used to collect data on sexuality, condom use and various psychosocial determinants of sexual behavior. A signed consent form was obtained from all subjects who volunteered to take part in the study. The questionnaire was prepared in Korean.

Participants were asked to provide 30 mL of first-void urine in a sterile 50-mL screw-cap plastic bottle for analysis of infection by *C. trachomatis* and *N. gonorrhoeae* after filling out the questionnaires. We assured all students of confidentiality. A code number linked the urine specimen and individual responses. The coded urine specimen was immediately put into a cold box and transported to the Catholic Research Institutes of Medical Science in Seoul within 2 h of collection.

All results were returned to students by internet web site or email on an individual bases. Students receiving a positive test result were referred on for treatment. Infected students were offered or asked to seek an additional STI examination with their physicians or at the city STI clinic. Infected students were also asked to refer their sex partners to the city STI clinic for treatment.

### Laboratory tests

Diagnoses were made by testing urine specimens using the BDProbeTecET system. Specimen processing and SDA assays were performed by two experienced technicians according to the manufacturer's instructions. Positive and negative controls for specimen processing are included in the kit, along with an amplification control to monitor assay inhibition.

### Statistical methods

Statistical analysis was performed using SPSS for Windows (version 11.0; SPSS, Chicago, IL). Associations between each risk factor and test result were assessed using Pearson's  $\chi^2$  test for univariate analyzes. Odds ratios (OR) with 95% confidence intervals (CI) were calculated. A *P*-value of less than 0.05 was considered significant. Variables that showed any evidence of association with infection on univariate analysis were included in a multivariate logistic regression model.

**Table 1** General and behavior characteristics of university students in the capital region of South Korea, according to sexual activity

	Number (%) of students			P-value*
	All (n = 622)	Sexually active (n = 243)	Not sexually active (n = 379)	
Gender				<0.001
Male	202 (32.5)	120 (49.4)	82 (21.6)	
Female	420 (67.5)	123 (50.6)	297 (78.5)	
Currently smoking	160 (25.7)	82 (33.7)	78 (20.6)	<0.001
Drinking alcohol regularly†	205 (33.0)	97 (39.9)	108 (28.5)	0.003
Current genital symptoms	89 (14.3)	49 (20.2)	40 (10.6)	0.001
Prevalence <i>Chlamydia trachomatis</i>	23 (3.7)	23 (9.5)	0 (0.0)	<0.001
Prevalence <i>Nisseria gonorrhoeae</i>	1 (0.2)	1 (0.4)	0 (0.0)	<0.001
Age at first sexual intercourse				
<17		27 (11.1)		
≥17		210 (86.4)		
Number of sexual partners during past year				
0–1		162 (66.7)		
≥2		76 (31.3)		
Number of lifetime sexual partners				
1		90 (37.0)		
2		56 (23.0)		
≥3		93 (38.3)		
Condom use				
Always		22 (9.1)		
Most of the time		38 (15.6)		
Sometimes		61 (25.1)		
Never		118 (48.6)		
Currently smoking				
Yes		82 (33.7)		
No		161 (66.3)		
Drinking regularly				
Yes		97 (39.9)		
No		146 (60.1)		
Previous STI				
Yes		23 (9.5)		
No		213 (87.7)		
Current genital symptoms				
Yes		49 (20.2)		
No		192 (79.0)		

The discordance between total number of subjects and the sum of each category was due to non-respondents of the questionnaire. STI, sexually transmitted infection. †Regularly was defined as drinking alcohol during the weekend or several days a week. \* $\chi^2$  test for differences in proportion between sexually active and non-sexually active students.

## Results

### Demographics

In the 15 colleges in three universities, there were 633 students registered in the present study. Eleven (1.7%) students refused to participate in the study and a total of 622 students (202 men and 420 women) aged between 18 and 25 years were voluntarily tested. Of the 202 men and 420 women, 120 (59.4%) and 123 (29.3%) were sexually active, respectively, with significant dif-

ference between sexes. General and behavior characteristics of sexually active and non-sexually active students are summarized in Table 1. There was a difference between sexually active students and students who were not sexually active regarding smoking status, regular drinking of alcohol and presence of current genital symptoms. Table 2 shows the demographic description of sexually active students according to sex. An early sexual debut (<17 years of age) was reported by 13.3% of males and 8.9% of females. Most students who had sexual intercourse had been sexually active during the

**Table 2** Demographic description of sexually active students, according to sex

	Number (%) of students		<i>P</i> -value*
	Male ( <i>n</i> = 120)	Female ( <i>n</i> = 123)	
Prevalence <i>Chlamydia trachomatis</i>	10 (8.4)	13 (10.6)	0.552
Prevalence <i>Nisseria gonorrhoeae</i>	1 (0.8)	0 (0.0)	0.494
Age at first sexual intercourse			0.275
<17	16 (13.3)	11 (8.9)	
≥17	101 (84.2)	109 (88.6)	
Number of sexual partners during past year			<0.001
0–1	58 (48.3)	104 (84.6)	
≥2	58 (48.3)	18 (14.6)	
Number of lifetime sexual partners			<0.001
1	26 (21.7)	64 (52.0)	
2	27 (22.5)	29 (23.6)	
≥3	66 (55.0)	27 (22.0)	
Condom use			0.658
Always	12 (10.0)	10 (8.1)	
Most of the time	21 (17.5)	17 (13.8)	
Sometimes	31 (25.8)	30 (24.4)	
Never	53 (44.2)	65 (52.8)	
Currently smoking			<0.001
Yes	66 (55.0)	16 (13.0)	
No	54 (45.0)	107 (87.0)	
Drinking regularly†			<0.001
Yes	72 (60.0)	25 (20.3)	
No	48 (40.0)	98 (79.7)	
Previous STI			0.760
Yes	12 (10.0)	11 (8.9)	
No	104 (86.7)	109 (88.6)	
Current genital symptoms			0.306
Yes	21 (17.5)	28 (22.8)	
No	98 (81.7)	94 (76.4)	

The discordance between total number of subjects and the sum of each category was due to non-respondents of the questionnaire. STI, sexually transmitted infection. †Regularly was defined as drinking alcohol during the weekend or several days a week. \* $\chi^2$  test for differences in proportion between sexually active and non-sexually active students.

past 12 months; 48.3% of males and 84.6% of females reported a single partner, whereas 48.3% and 14.6%, respectively, reported two or more than two sexual partners. Condoms were used during the first sexual contact by 50.6% of the students, although only 24.7% used a condom consistently. The majority of students were free of genital symptoms at the time of screening (81.7% of males and 76.4% of females) and a history of STI was reported by 10.0% of males and 8.9% of females.

### **Sexually transmitted infection prevalence and risk factors for infections**

Twenty-three of the 622 tested students (3.7%) were found to have *C. trachomatis* and/or *N. gonorrhoeae* infections. The rate of *C. trachomatis* positivity was 3.1% (13/420) among female students and 5.0% (10/202) among male students. One male student who

tested positive for *N. gonorrhoeae* had a dual infection with *C. trachomatis* (0.2%, 1/622). Prevalence among sexually active students was 9.5% (23/243) for *C. trachomatis* and 0.4% (1/243) for *N. gonorrhoeae*. A statistical difference of *Chlamydia* prevalence between male and female sexually active students was not observed (8.4% vs 10.6%).

Table 3 summarizes risk factors which were significantly associated with chlamydial infections. A statistically significant correlation ( $P < 0.001$ ) was found between a positive result on the test and the number of partners in the past year (two and more partners during past year). The number of lifetime partners was also found to be significant, evidenced by a greater prevalence of positive results among students who had three and more lifetime partners compared with those having less than three of partners. No use of a condom was also found to be significant. No statistically significant

**Table 3** Risk factors associated with *Chlamydia trachomatis* in sexually active students

	<i>n</i>	% positive	<i>P</i> -value	OR	95% CI
Number	243	9.5			
Age at first sexual intercourse			NS		0.38–4.30
<17	27	11.1		1.19	
≥17	210	9.5			
≥2 partners during past year			<0.001		2.12–14.00
Yes	76	19.7		5.45	
No	162	4.3			
≥3 lifetime partners			0.002		1.63–10.47
Yes	93	17.2		4.13	
No	146	4.8			
Recent partner change			NS		0.76–6.62
Yes	30	16.7		2.25	
No	208	8.2			
Condom use always or mostly			0.016		1.09–62.71
Yes	60	1.7		8.27	
No	179	12.3			
Condom use during last intercourse			NS		0.45–3.55
Yes	61	8.2		1.26	
No	178	10.1			
Previous STI			NS		0.21–4.47
Yes	23	8.7		0.97	
No	213	8.9			
Current genital symptoms			NS		0.26–2.50
Yes	49	8.2		0.81	
No	192	9.9			
Symptomatic partners			NS		0.16–3.29
Yes	29	6.9		0.73	
No	205	9.3			

NS, not significant; OR, odds ratio; 95% CI, 95% confidence interval.

difference was found among the age at first sexual intercourse, recent partner change, condom use during last intercourse and previous history of STI. There is no correlation with the subjective symptoms of the student and those of the partner.

In regard to OR, there is an importance among the number of sexual partners in the preceding year (OR = 5.45, 95% CI = 2.12–14.00), the number of lifetime sexual partners (OR = 4.13, 95% CI = 1.63–10.47) and whether condom is used regularly (OR = 8.27, 95% CI = 1.09–62.71) as factors that significantly increase the risk of infection. On multivariate analysis, the number of sexual partners during past year was the only significant independent variable (OR = 3.74, 95% CI = 1.12–12.55).

## Discussion

This is the first South Korean epidemiologic study on STI in university students. In South Korea, there are no national or local guidelines for the screening of STI.

Only a few surveillances have been performed among potential target groups for screening, such as female sex workers<sup>9</sup> and gynecologic patients.<sup>12</sup> Since 1954, when specific venereal disease legislation was passed, several venereal diseases, including *N. gonorrhoea* and non-specific urethritis, were subject to mandatory notification. However, statistical data of STI were unreliable because the proportion of unreported cases was very high. Furthermore, most notifications for gonorrhoea and non-specific urethritis were not based on laboratory tests, but only dependent upon clinical symptoms. The law governing the reporting of infectious diseases has recently been revised. Under the new Prevention against Infectious Diseases, which became effective in October 2000, clinical diagnoses of STI are no longer notifiable diseases. Since human immunodeficiency virus remain the only notifiable STI, all other STI have to be monitored through sentinel surveillance systems. These surveillance systems are currently being established. Under the new legislation, local health authorities have to provide adequate testing services for STI, which may provide laboratory-based surveillance.

In this school screening, the overall prevalence of chlamydial infection was 3.7% for all students and 3.1 for female students. This prevalence is consistent with the average prevalence (2.3%) of college women in United States.<sup>13</sup> The gender differences in chlamydial infection acquisition are not notable, with males being at a slightly elevated risk compared with females. To date, research and screening for Chlamydia has largely centered on women, justified on the basis that such a strategy is evidence based, cost effective and pragmatic.<sup>14</sup> Despite the current proposals for Chlamydia screening, there is evidence to suggest high rates of genital Chlamydia infection in male students in South Korea. The recent sexual health strategy for England suggested that appropriate methods of population-based screening, targeting both men and women, should be piloted.<sup>15</sup> By including men, we make them partners in the control and eradication of STI, which is part of the solution rather than the problem.

We screened all students regardless of sexual activity. Approximately 60% of male and 30% of female university students aged 18–25 years reported sexual activity at least once. Among them 31.3% had two or more sexual partners during the past year and 38.3% had three or more lifetime sexual partners. When the results were adjusted for sexual activity, the rates of infection became significantly higher. The prevalence of *C. trachomatis* among sexually active students was 9.5%. In South Korea, like other East Asian countries, the evolution of attitudes towards sex and sexual behavior was greatly influenced by Confucianism. Premarital sexual intercourse, as well as multiple sexual partners, has been forbidden by this cultural characteristic. Since the end of the 20th century, there has been a wide exchange between Western and Korean culture. Accompanied by the rapid development of a market economy, people's views and beliefs have also changed substantially. Concerning sex and sexual behavior, the most important change in recent years is the recognition of an increasing diversity of sexual behavior. Although there are no previous data for the sexuality of South Korean students, the results of this surveillance reflects the current changes.

The risk factors that were predictive of chlamydial infection in univariate analysis were the number of partners during the past year and lifetime and condom use. Surprisingly, only 27.5% of male and 21.9% female students reported having used condoms regularly. South Korea has one of the lowest human immunodeficiency virus infection rates in Asia.<sup>16</sup> Many health experts claim the low prevalence of human immunodeficiency virus infection is a major reason why South Koreans do not use condoms regularly. Additionally, there are few edu-

cational programs aimed towards students for prevention of STI, such as condom availability. We expect that this result will be helpful for motivating condom use in South Korea.

In the current study, the prevalence of gonorrhoea was 0.2% and quite low. In case of *C. trachomatis*, universal screening is no longer cost effective under 3% of prevalence rate.<sup>17</sup> Based on this strategy, gonorrhoea screening is not cost effective in university students in South Korea. The cost effectiveness of screening strategies should be analyzed based on the real costs in the South Korean situation. Also, the acceptability and feasibility of different selective screening strategies should be assessed in a pilot study before starting a widespread STI screening program in the student population of South Korea. Until additional data are available, a screening strategy to test only *C. trachomatis* in both male and female students appears to be sound and most cost effective.

## Conclusion

In conclusion, school-based screening is feasible and acceptable and can identify a large number of asymptomatic, infected youth. We found that urine testing, being non-invasive, was acceptable for the student population. Screening programs which target asymptomatic youth should be expanded in order to reduce the burden of STI in our communities, but should be assessed for cost-effectiveness.

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