



## ***Chlamydia trachomatis* prevalence and sexual behaviour in Christchurch high school students**

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### **Abstract**

**Aims** To estimate the prevalence of *Chlamydia trachomatis* among young people in Year 12 and Year 13 in Christchurch secondary schools.

**Methods** A cross-sectional survey on sexual behaviour was carried out in conjunction with the collection of urine samples, which were tested for *C. trachomatis*.

**Results** 1582 young people were invited to take part in the study. 72% of these students answered the questionnaire of whom 49% had experienced sexual intercourse. The mean age of the sample was 16.7 years. The prevalence of *C. trachomatis* among the sexually active participants who provided a urine sample was 2.0% (1.8% of males and 2.3% of females). 39% of sexually active participants had had one partner in their lifetime and 13% had had more than five partners. 51% of males and 39% of females indicated that they always used condoms and 69% of males and 57% of females reported using a condom on the last occasion of sexual intercourse.

**Conclusions** Our study shows that 2.0% of sexually active senior high school students have asymptomatic *C. trachomatis* infections. Opportunistic screening for *C. trachomatis* should be offered to all sexually active males and females at risk.

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*Chlamydia trachomatis* is the most common sexually transmitted bacterial pathogen in New Zealand.<sup>1</sup> It can cause symptomatic urethritis and epididymitis in males and cervicitis, salpingitis and endometritis in females. Unfortunately over 90% of infections in males and females are asymptomatic and therefore often go untreated.<sup>2</sup> Untreated women can go on to develop pelvic inflammatory disease and subsequent chronic pelvic pain, infertility or ectopic pregnancy. Untreated infection in men can lead to epididymitis. Because of the long-term complications, it is estimated in the United States that *C. trachomatis* infections cost approximately \$2.4 billion each year.<sup>3</sup>

The prevalence of *C. trachomatis* in New Zealand is unknown. The only information currently collected systematically is from sexual health clinics and gives the prevalence of *C. trachomatis* among clinic attendees. In 2000 the overall prevalence of *C. trachomatis* in clinic attendees aged 15-19 years was 6.3%.<sup>4</sup> Some indication of the cumulative incidence of *C. trachomatis* in the community is available from past cohort studies. The self-reported cumulative incidence of *C. trachomatis* infection in 21 year old members of the Dunedin Multidisciplinary Health and Development Study (DMHDS) was 2.4% for males and 9.0% for females.<sup>5</sup> The Christchurch Health and Development Study found that the self-reported cumulative incidence of sexually transmitted diseases (STDs) in females at age 18 was 5.8%.<sup>6</sup> The vast majority of these STDs were *C. trachomatis* (David Fergusson, Department of Psychological Medicine, Christchurch School of Medicine and Health Sciences, personal

communication). A 1999 estimate of *C. trachomatis* incidence from community laboratory positivity data in the Waikato and Bay of Plenty showed a 1.9% *C. trachomatis* incidence in males and females aged 15-19.<sup>7</sup> Such studies may underestimate prevalence, however. Community based studies indicate a higher prevalence. One study in 1999 in New Orleans urban high schools found a baseline prevalence of 11.5% in females and 6.2% in males.<sup>2</sup> A recent United Kingdom study found a 3.0% prevalence of *C. trachomatis* in sexually active women aged under 25 years and a 2.7% prevalence in men.<sup>8</sup>

The need for community based studies in New Zealand prompted this study of prevalence, risk factors and help-seeking behaviour.

## Methods

All 26 public and private high schools in the Christchurch urban area were approached by letter and telephone and visited by one of the researchers to request participation. Information about the study and a questionnaire was provided to principals and school boards. Approval for the study was received from the Canterbury Ethics Committee. To obviate the need for parental consent only students aged sixteen or older in Years 12 and 13 were invited to participate. It was thought that about 50% of these students would be sexually active based on data from the DMHDS.<sup>9</sup> Although it was planned to sample by classroom within participating schools, some schools asked us to approach the students in senior assemblies. Each of the participating schools was stratified into Year 12 and Year 13 classes. 50% of classes from within each stratum were randomly selected for participation. The cluster design of the study was factored into sample size calculations by assuming a design effect of 1.5. It was expected that a sample of 1500 Year 12 and 13 students would yield about 750 sexually active students. We expected the *C. trachomatis* rate to be between 2% and 10% in sexually active students. Taking into account the design of the study, the confidence intervals were predicted. It was calculated that if the observed prevalence was 2.0% amongst sexually active participants, a sample of 750 students would result in a 95% confidence interval of between 1.0% and 3.6%.

Students at participating schools were either seen in a classroom setting or in larger groups in the school hall and students completed their questionnaires there under the supervision of the researchers. Data collection took place between June and September 2001. The students were supplied with an information sheet about the study and about *C. trachomatis*. The study was also verbally explained to them by a member of the research team. Participation was voluntary and written consent was obtained. Students were asked both to complete a questionnaire and to provide a urine sample. They were informed that urine would be tested only from those who reported that they were sexually active. If they had passed urine in the past hour they were asked to provide a urine sample later in the day. The questionnaire asked about demographic details including age, sex, gender and ethnicity. They were also asked to indicate whether they had ever had sexual intercourse and to answer questions regarding sexual behaviour. The questionnaire was piloted with two groups of young people and revised in accordance with their feedback. All questionnaires and urine samples were given an encrypted label. The research co-ordinator had a master list matching names, questionnaires and urine samples which was used for notification of results.

Samples were transferred directly to the laboratory in insulated containers and handled according to the manufacturer's recommendations. The Cobas Amplicor (Roche Molecular Diagnostics Branchburg, NJ, USA) test based on a polymerase chain reaction system was used to detect *C. trachomatis* according to the manufacturer's instructions. About one week after the sample and data collection, each participating student was seen in private by a member of the research team and given a sealed envelope containing their results. Students with a positive test were given the opportunity to debrief and were directed to a range of free treatment providers for themselves and their sexual contacts. Students with negative tests and those whose urine samples were not tested were given an envelope containing basic information on the prevention of sexually transmitted diseases.

Data were entered into EpiInfo 2000 version 1.1.2. After completion of data entry, a check on 10% of data from respondents was carried out which revealed an error rate of 0.2%. To take account of the cluster design of the study, analyses were carried out using the Complex Sample program in EpiInfo and SUDAAN 8.0. In addition, a weighting was taken into account in the analysis as one of the schools required that all, instead of half of their Year 13 students, participate.

## Results

Twelve of the fifteen public high schools and five of the eleven private schools agreed to take part in the study. Of the twelve public schools eight were co-educational, two were girls' schools and two boys' schools. The five private schools consisted of two co-educational, one girls' and two boys' schools. Over half the participating students came from socio-economically advantaged schools with decile ratings of between eight and ten. Although there appeared to be 2300 students on the school rolls for the classes selected only 1582 students were present when the study was explained due to a number of factors including absenteeism, outdated school rolls, students away on field trips and failure to arrive at the school hall to be informed of the study. Of these 1582 students 1136 consented to take part in the study giving a participation rate of 72%. Three questionnaires were excluded from further analysis as there were inconsistencies in answering, leaving a total of 1133 participants.

**Table 1. Description of the sample.**

	N	%
<b>Age</b>		
16 years	502	46
17 years	497	43
18 years	119	10
>18 years	11	1
<b>Gender</b>		
Male	585	51
Female	547	49
<b>Ethnicity</b>		
Maori	79	7
Pacific Island	37	3
Asian	114	10
NZ European	817	72
Other European	83	8
<b>Year Group</b>		
Year 12	705	64
Year 13	427	36
<b>School Decile Rating</b>		
3-4	121	11
5-7	354	32
8-10	657	57
<b>Sexually Active</b>		
Yes	563	49
No	568	51

Of the sexually active students, 84% provided urine samples. Non-suppliers were more likely to have been diagnosed with a previous sexually transmitted infection (8.2%) than the suppliers (1.1%). The mean age of participants was 16.7 years and there were slightly more male than female participants. The ethnic distribution closely resembled the overall distribution in the Christchurch area. 49% of students indicated past sexual intercourse (Table 1).

Participants were asked about previous diagnosis of a sexually transmitted disease and 2.3% of sexually active participants reported having been diagnosed with a sexually transmitted disease at some stage. No male participants and 2.4% of sexually active female participants indicated a previous diagnosis of *C. trachomatis*. The point prevalence of *C. trachomatis* in the study population was 2.0% for all sexually active

participants who provided urine specimens. The rate of infection was similar for males and females with 1.8% of males and 2.3% of females testing positive (Table 2).

**Table 2. Sexually transmitted infection amongst sexually active participants.**

	Total	Male	Female
Previously diagnosed STI			
%	2.3	0.4	4.1
95% C.I.*	1.0-3.6	0-1.2	1.7-6.5
N	563	273	290
Previously diagnosed <i>C. trachomatis</i>			
%	1.2	0	2.3
95% C.I.*	0.3-2.1	0-1.3†	0.6-4.0
N	563	273	290
Prevalent <i>C. trachomatis</i> ‡			
%	2.0	1.8	2.3
95% C.I.*	0.5-3.5	0.2-3.3	0.4-4.2
N	466	240	226

\* Calculated allowing for clustering in classes. † Calculated using exact formula.<sup>32</sup> ‡ Prevalence amongst all sexually active participants who provided urine. STI = sexually transmitted infections

39% of sexually active participants indicated that they had had only one partner in their lifetime and 53% indicated only one partner in the last twelve months. 44% of sexually active participants reported that they always used condoms (51% of males and 39% of females) and 63% reported using condoms the last time that they had had sexual intercourse (69% of males and 57% of females) (Table 3).

## Discussion

Although there have been a few reports from school clinics and one report from females in a single-sex school on *C. trachomatis* rates we are only aware of two other school based prevalence studies.<sup>10</sup> The point prevalence of *C. trachomatis* infection in our study was considerably below that reported from a New Orleans school-based study<sup>2</sup> which looked at rates in urban, public high schools in very deprived areas. Our rates were slightly higher than the 1.4% reported from a recent study in Belgian female high school students.<sup>11</sup> A higher prevalence of *C. trachomatis* was expected in this Christchurch study as incidence rates of 1.9% in the Waikato and 2.4% locally have been reported from laboratory data in males and females aged 15-19 years (personal communication from Medlab South and Southern Community Laboratories for Christchurch data).<sup>7</sup> As it was assumed that as the population denominator of 15-19 year olds would have included individuals who were not sexually active, the prevalence in sexually active students within this sample would have been higher than the laboratory positivity data. Countering this would have been the fact that some of those getting laboratory tests would have been symptomatic and our sample had a lower mean age than the 15-19 year old laboratory groups reported.

Several factors in this study would have had the effect of lowering prevalence. The 96 sexually active participants who did not provide a urine sample were more likely to have had a previously diagnosed sexually transmitted infection which may have had a lowering effect on the overall *C. trachomatis* prevalence rate. Some of these students reported verbally to the researchers that they had recently been treated for *C. trachomatis* and did not want to provide a urine sample. That half of participating students reported past sexual intercourse was to be expected as similar figures have been reported in other studies of people of this age group.<sup>9,11</sup>

**Table 3. Sexual behaviour of sexually active participants.**

	Total % N=563	Male % N=273	Female % N=290	M vs F*
<b>No. of Partners in lifetime</b>				
1	39	42	37	$\chi^2=4.1$ df=4 p=0.39
2	24	23	24	
3-5	24	21	26	
6-10	10	10	11	
>10	3	4	2	
<b>No. of Partners in Last 12 months</b>				
0	6	8	5	$\chi^2=3.4$ f=4 p=0.49
1	53	55	52	
2	22	19	24	
3-5	15	14	15	
>5	4	4	4	
<b>Condom Use</b>				
Always	44	51	39	$\chi^2=9.0$ df=3 p=0.03
Most times	26	24	28	
Sometimes	22	19	24	
Never	8	6	9	
<b>Condom use at last sex</b>	63	69	57	$\chi^2=9.3$ df=1 p=0.002

\* Calculated allowing for clustering in classes.

When looking at risk factors for acquiring a sexually transmitted infection, the results obtained in this study are comparable to those in other studies. The DMHDS reported a mean number of partners in the previous twelve months for males of 1.7 and for females 1.5 at age 18 years.<sup>12</sup> Although the mean age of the participants in this study was lower than the Dunedin study, partner numbers were slightly higher with a mean number of partners in the previous twelve months of 1.9 for males and 1.8 for females.

Condom use in this study was similar to the DMHDS, which reported 37.6% of sexually active females and 48% of sexually active males using condoms “usually or always”.<sup>12</sup> Condom use on the last occasion of sex was also similar to an Australian study of school students, which reported 71.5% of males and 53.4% of females using condoms at last sex.<sup>13</sup> Condom use among females is consistently reported as being lower than males.<sup>5,14,15</sup> This is most likely due to girls often having older partners and relying on oral contraceptives to prevent pregnancy, which may pose more of a threat than sexually transmitted infections.<sup>13,16-18</sup>

Nevertheless, despite such behavioural differences the infection rate in this study was similar in males and females. This is in contrast to the results from the New Orleans study and underlines the importance of focussing control efforts on both males and females.

Disease prevalence has a major bearing on potential benefits from population screening. Does the 2% prevalence of *C. trachomatis* in sexually active Christchurch students warrant formal screening? All but two of the ten Wilson and Junger criteria for successful screening programmes apply to screening for *C. trachomatis*.<sup>19</sup> Two criteria that are impossible to meet given our current level of knowledge about *C. trachomatis* are the need to understand the natural history of the condition and the need to balance the costs of screening in relation to possible expenditure on medical care as a whole. The natural history of *C. trachomatis* is not well understood. It is not known what proportion of cases of untreated *C. trachomatis* infections lead on to the

known sequelae of pelvic inflammatory disease, ectopic pregnancy and infertility. Moreover it is not clear how long untreated *C. trachomatis* infection remains in the genital tract.<sup>20</sup> Estimates of what proportion of untreated infections go on to cause pelvic inflammatory disease range from 10% to 80%; estimates of what percentage of this untreated cohort goes on to infertility range from 8% to 20%.<sup>21-24</sup> The Wilson and Junger criterion for economic 'balance' in relation to possible expenditure on medical care as a whole is an even harder goal to meet in regards to screening for *C. trachomatis*. Although the costs of ectopic pregnancy or infertility treatment can be quantified, what price can be put on infertility or chronic pelvic pain? It is unsurprising that cost-benefit models and analyses for *C. trachomatis* screening reach very different conclusions.<sup>22-26</sup>

Given the wide variation of estimates for *C. trachomatis* complications the prevalence of *C. trachomatis* becomes less of a determinant of screening costs. Moreover, the cost of screening for *C. trachomatis* in lower prevalence (2%) populations is reduced by 59% by using pooled urine and DNA amplification techniques.<sup>27</sup> It should be noted that DNA amplification tests have much greater sensitivity than previously available tests for *C. trachomatis*. The Cobas Amplicor test we used has been shown to have sensitivities ranging from 89%-93% for both urine and endocervical or urethral swabs and specificities of 99%.<sup>28,29</sup>

Although one randomised controlled trial of screening has given support to screening, it has been criticised on methodological grounds.<sup>30,31</sup> It would be extremely difficult on ethical and practical grounds to repeat a randomised controlled trial of screening for *C. trachomatis* and screening decisions must be made on inferences from existing evidence.

The similar rates of *C. trachomatis* infection in males and females in our study suggest that opportunistic screening should be offered to both males and females at risk. It is also interesting that in our study although 2.4% of females had previously been diagnosed with *C. trachomatis* no males had, suggesting that males are not being tested either opportunistically or as contacts of females with *C. trachomatis*. We hope our results will help inform the current debate on how best to tackle sexually transmitted diseases in New Zealand.

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