ISBN 1188–4169

Canada Communicable Disease Report

FAX FAX FAX FAX

Vol . 23–15

Date of publication: 1 August 1997

Contained in this FAX issue: *(No. of pages: 5)*

CHLAMYDIA TRACHOMATIS IN CANADA: AN UPDATE

Chlamydia trachomatis infections are one of the most common bacterial sexually transmitted diseases (STDs)[1]. An estimated 300 million cases have been reported worldwide[2]. Currently, 84% of reported STDs in Canada are attributable to genital chlamydial infections. Genital *Chlamydia* became nationally notifiable in Canada in 1990[3]; however, data from all provinces and territories are only available from 1992 onward. Prior to 1990, positive test results were collected from Canadian laboratories through a voluntary reporting system[4].

Chlamydiae are distinguised from other organisms because of their unique growth cycle. They are obligate intracellular parasites and cannot be cultured on artificial media; they depend on the host cell to synthesize high-energy compounds. The organism primarily infects columnar epithelium. The growth cycle starts with the infectious particle, called an elementary body, attaching and penetrating the susceptible host cell. Replication destroys the host cell. Accordingly, the organism is considered pathogenic.

Both horizontal and vertical transmission occurs. Vertical transmission occurs when the neonate acquires the infection passing through the mother's infected birth canal. The infant may develop pneumonia or conjunctivitis.

Approximatley 70% of infections in women are asymptomatic. Symptoms may occur within 6 to 14 days of exposure. When symptoms occur, the spectrum of clinical manifestations include mucopurulent cervicitis, endometritis, salpingitis, and perihepatitis.

In males, the main clinical manifestation of chlamydial infection is urethritis. An estimated 1% to 25% of sexually active men are asymptomatic carriers of infection and act as a reservoir for its spread. Complications of untreated urethritis include epididymitis, infertility, and Reiter's syndrome. Receptive anal intercourse in homosexual men may result in proctitis and proctocolitis; however, there is insufficient evidence on whether *C. trachomatis* causes prostatitis.

Genital chlamydia infections are important because of the complications that may result from untreated infections. These complications have the greatest impact on women of childbearing age. Up to 65% of all pelvic inflammatory disease (PID) cases, 70% of all tubal infertilities, and 30% of all ectopic pregnancies are associated with a prior chlamydial infection[2]. Burden of illness estimates for genital chlamydial infections range from $41 to $123 million annually[2].

Chlamydia is often a marker for infection with another STD, notably gonorrhea. An estimated 40% of men and 60% of women with chlamydial infections have concurrent infections with gonorrhea. Because of the high rate of coinfection, and the fact that gonococcal cervicitis and chlamydial cervicitis are difficult to distinguish clinically, current treatment regimens recommend dual therapy with regimens effective against both gonorrhea and chlamydial infections.

Prevalence of infection in a community varies by population screened. Prevalence of infection in the general population has been estimated at 5% to 6% in women who are not pregnant; however, estimates of infection in the general population provide little epidemiologic insight into developing prevention and intervention strategies. Screening of adolescents who are sexually active, or college students yield prevalence rates of 15% and 25%, respectively.

In 1995, 37,557 cases of genital *Chlamydia* were reported in Canada, a decrease of 19% from the 46,365 cases reported in 1992. The national rate of infection decreased 22% from 162.4 to 126.8 cases per 100,000 population in 1992 and 1995, respectively.

Persons between 15 and 29 years of age represented more than 85% of the reported cases in 1995, with 10% in those between 30 and 39 years of age, 3.4% ≥ 40 years of age, and 1.5% ≤ 14 years of age.

Screening

Screening programs for STDs (notably genital *Chlamydia*, gonorrhea, and syphilis) are focused primarily on sexually active individuals < 25 years of age. This is due to their high rate of infection and because females within this age cohort are at risk of

developing serious sequelae[5]. Table 1 provides a full list of criteria for screening. Screening involves obtaining the individual's sexual history, a physical examination, and laboratory tests. General screening of pregnant women is also recommended, which involves obtaining a sexual history, an external genital examination, and targeted extragenital examination[5].

Table 1
Criteria for laboratory screening of *Chlamydia trachomatis*[5]

Method of Screening	Whom to Screen
CASE FINDING **a patient-based strategy for individuals with an increased risk of one or more STD (e.g. sexual contacts)**	Sexual contacts of persons proven or suspected of having one or more of the following: • *Chlamydia* • gonorrhea • syphilis • hepatitis B virus • HIV • urethritis • cervicitis • PID • epididymitis
	Neonates at risk of congenitally acquired STD infection when: • mother is at high risk for STD (see focused screening) • mother's STD status is unknown (i.e. no prenatal screening) • one or both parents are known to have urethritis, cervicitis, PID, epididymitis, or an infection with *Chlamydia*, gonorrhea, syphilis, HIV, or hepatitis B virus
	Persons who have been sexually assaulted and children who have been sexually abused
FOCUSED SCREENING **a group-based strategy for subpopulations with high STD prevalence rates (e.g. street youth, adolescents, core groups)**	Siblings of sexually abused children Sexually active persons with one or more of the following risks: • < 25 years of age • injection drug user • other substance abuser • street youth • history of STD in the past year • new partner in the past 2 months • two or more new partners in the past year • use of non-condom contraception • unprotected sex (no condom used) with any partners having any of the preceding risks
GENERAL SCREENING **a population-based strategy for certain members of the general public who are not considered to be at increased risk for STD but in whom serious consequences may result if infected (e.g. syphilis and HIV testing of pregnant women)**	High-risk pregnant women in the third trimester (See above sections on case finding and focused screening)

Analysis

Table 2 lists age- and sex-specific cases and rates of genital *Chlamydia* for 1992 to 1995.

Males and Females > 14 Years of Age (does not include 'Age not specified' in Table 2)

In 1995, 36,715 cases of genital *Chlamydia* were reported in persons who were > 14 years of age compared with 43,595 in 1992. This represents a decrease of 16% over 4 years. The number of female cases dropped 16.5% from 33,242 reported in 1992 to 27,747 in 1995. The number of reported cases for males dropped 13% from 10,316 in 1992 to 8,962 in 1995.

The gender differential has remained relatively stable from 1992 to 1995. In 1992, the female-to-male ratio was 3.2:1.0; by 1995, this ratio had dropped slightly to 3.1:1.0.

The reported rate of infection for females > 14 years of age in 1995 was 230.9 cases per 100,000 compared with 288.5 in 1992. For their male counterparts, the rate dropped from 92.6 per 100,000 to 88.9 per 100,000 between 1992 and 1995, respectively. This represents a drop in rates of 20% for females and 4% for males.

In 1995, females aged 15 to 19 years had the highest rate of infection: 1,109.1 cases per 100,000. This is almost nine times higher than the national rate for males and females combined, and six times the national rate for females (all ages). Females aged 20 to 24 years had the second highest rate of infection with 1,041.7 cases per 100,000, over eight times greater than the national rate. The highest rates for males were 335.6 cases per 100,000 in those 20 to 24 years of age, and 169.6 cases per 100,000 in those 15 to 19 years of age. These rates were 2.6 and 1.3 times greater than the national rate.

In 1995, 75% of female cases reported were in those 15 to 24 years of age. The corresponding proportion for males was 57%. Males aged 25 to 39 represented 37% of male cases. The gender differential for those 15 to 24 years of age was 4.1 female cases for every one male case. For those ≥ 25 years of age, the female-to-male ratio was 1.7:1.0.

Females in all age groups had higher rates than did their male counterparts for the years 1992 and 1993. Similarly, for the years 1994 and 1995, in each age group, except for those > 60 years of age, females had higher rates than males. However, for those > 60 years of age, the rates are low, and the differences between male and females rates are most likely due to random fluctuation and/or instability associated with small numbers.

Males and Females ≤ 14 Years of Age

Cases of STDs reported in those ≤ 14 years of age are of concern because of the probability of sexual abuse and exploitation. In 1995, 2% of reported genital *Chlamydia* cases in females were < 15 years of age. The corresponding proportion of male cases was 0.5%. The gender differential for this age group is four female cases for every one male case. In those 10 to 14 years of age, the reported rates of *Chlamydia* were 47.6 and 2.0 cases per 100,000 for females and males, respectively. In 1992, the reported rates of infection for the same age group were 64.1 and 3.2 cases per 100,000 for females and males, respectively. These decreases in rates most likely reflect decreases in rates of the adult population. They should not be interpreted as a change in the cases or rates of sexual abuse and exploitation.

Cases reported in infants < 1 year of age (56 cases: 32 female, 24 male) may represent chlamydial conjunctivitis or pneumonia acquired at birth from infected mothers.

Geographic Distribution

Table 3 presents the provincial and territorial rates of genital *Chlamydia* for 1995. The highest rate was 1,388.5 cases per 100,000 in the Northwest Territories. Newfoundland had the lowest rate with 47.5 cases per 100,000. Generally speaking, a downward trend in the number of cases and incidence rates has been observed in all provinces and territories from 1992 to 1995 (Table 3) with some upward fluctuations in the intervening years in some provinces.

A variety of factors, such as screening practices, educational programs, health promotional campaigns, choice of treatment (single-dose versus multidose antibiotic therapy) and effectiveness of contract tracing, may contribute to the differences in rates between provinces. Therefore, caution should be exercised in making comparisons between provinces.

Table 2
Reported cases and rates* of genital *Chlamydia* in Canada, by age and sex, 1992-1995

Age (years)	1992						1993					
	M		F		Total†		M		F		Total†	
	C	R	C	R	C	R	C	R	C	R	C	R
<1	24	11.6	23	11.7	**47**	**11.7**	9	4.5	18	9.5	**27**	**6.9**
1-4	7	0.9	16	2.1	**24**	**1.5**	4	0.5	11	1.4	**15**	**0.9**
5-9	3	0.3	14	1.5	**17**	**0.9**	6	0.6	11	1.1	**17**	**0.9**
10-14	32	3.2	605	64.1	**637**	**32.9**	51	5.1	600	62.6	**651**	**33.2**
15-19	2,047	207.2	13,235	1,403.3	**15,291**	**791.8**	2,077	208.6	12,744	1,342.1	**14,825**	**762.2**
20-24	4,290	403.0	12,466	1,203.5	**16,774**	**798.7**	4,132	390.1	12,012	1,166.9	**16,145**	**773.0**
25-29	2,122	169.2	4,550	373.3	**6,678**	**270.0**	2,250	185.5	4,558	385.9	**6,810**	**284.4**
30-39	1,423	55.8	2,407	95.8	**3,833**	**75.7**	1,490	57.1	2,542	99.1	**4,035**	**78.0**
40-59	400	12.1	526	16.0	**926**	**14.0**	451	13.2	500	14.7	**951**	**14.0**
60+	34	1.7	58	2.3	**93**	**2.1**	27	1.3	40	1.5	**67**	**1.5**
Age not specified	429	—	1,463	—	**2,045**	**—**	124	—	343	—	**479**	**—**
Total	**10,811**	**76.4**	**35,363**	**245.7**	**46,365**	**162.4**	**10,621**	**74.0**	**33,379**	**228.7**	**44,022**	**152.1**

Age (years)	1994						1995					
	C	R	C	R	C	R	C	R	C	R	C	R
<1	20	10.1	27	14.3	**47**	**12.1**	24	12.2	32	12.7	**56**	**14.7**
1-4	2	0.2	13	1.6	**15**	**0.9**	6	0.7	5	0.6	**11**	**0.7**
5-9	4	0.4	13	1.3	**17**	**0.9**	3	0.3	10	1.0	**13**	**0.7**
10-14	33	3.2	577	59.5	**610**	**30.7**	21	2.0	466	47.6	**487**	**24.3**
15-19	1,914	190.4	11,567	1,208.4	**13,486**	**687.2**	1,721	169.6	10,704	1,109.1	**12,427**	**627.6**
20-24	3,859	369.8	11,282	1,111.5	**15,157**	**736.2**	3,478	335.6	10,496	1,041.7	**13,976**	**683.7**
25-29	2,022	173.7	4,165	366.0	**6,196**	**269.2**	1,848	163.1	3,745	336.8	**5,594**	**249.2**
30-39	1,544	58.5	2,669	103.1	**4,218**	**80.7**	1,484	55.7	2,312	88.5	**3,796**	**72.0**
40-59	460	13.0	589	16.7	**1,049**	**14.9**	398	10.9	459	12.6	**858**	**11.8**
60+	38	1.8	40	1.5	**78**	**1.7**	33	1.6	31	1.2	**64**	**1.3**
Age not specified	110	—	234	—	**362**	**—**	69	—	191	—	**269**	**—**
Total	**10,006**	**69.0**	**31,176**	**211.3**	**41,235**	**141.0**	**9,085**	**62.0**	**28,451**	**190.4**	**37,551**	**126.8**

* Per 100,000 population
† Totals include cases not specified for sex
M = Male
F = Female
C = Case
R = Rate

Population figures: Statistics Canada, estimates based on 1991 census

Table 3
Reported cases and rates* of genital *Chlamydia* in Canada, by province and territory, 1992-1995

Province/ Territory	1992		1993		1994		1995	
	C	R	C	R	C	R	C	R
Newfoundland	450	77.1	463	79.3	356	61.3	272	47.5
Prince Edward Island	204	155.0	139	104.4	109	81.0	112	82.3
Nova Scotia	1,646	178.0	1,459	156.8	1,446	154.8	1,167	124.4
New Brunswick	1,339	177.8	1,066	141.1	917	121.0	762	94.7
Quebec	10,361	144.7	9,647	133.3	7,837	107.5	7,048	96.1
Ontario	12,830	120.5	14,041	129.8	13,465	123.1	12,090	109.0
Manitoba	3,290	294.4	3,259	289.9	3,075	272.2	3,008	264.4
Saskatchewan	2,408	238.9	2,309	228.4	2,497	246.7	2,344	230.8
Alberta	6,312	238.5	5,199	193.6	5,010	184.5	5,018	182.7
British Columbia	6,434	185.1	5,302	148.2	5,368	146.3	4,660	123.7
Yukon	192	634.3	166	545.3	153	515.1	156	518.0
Northwest Territories	899	1,437.1	972	1,526.8	1,002	1,548.8	914	1,388.5
Canada	**46,365**	**162.4**	**44,022**	**152.1**	**41,235**	**141.0**	**37,551**	**126.8**

* Per 100,000 population
C = Cases
R = Rate

Discussion

Although chlamydial infections have been found in all population groups, they are mainly characterized by young age and high-risk behaviour[6]. Sexually active adolescents are particularly susceptible to genital chlamydial infections because of their high rate of participation in high-risk behaviour, such as having numerous sexual partners, unprotected sex, and using non-barrier contraception[6].

The gender differential is an artifact of screening and does not reflect true differences in the epidemiology of infection. Higher rates in females likely reflect the fact that females present to the health-care system and are tested more frequently than males. Males have been reluctant to be tested because samples were obtained with urethral swabs causing some pain and discomfort. The introduction of DNA amplification procedures, such as ligase and polymerase chain reactions, should eliminate this reluctance. These laboratory procedures allow detection of infection in both men and women by testing urine samples instead of using urethral or cervical swabs. The sensitivity of these tests exceed 95% in urine samples from men and 80% to 90% from women, compared to an expanded "gold" standard based on two positive tests from urethral urine or cervical specimens. Other advantages of the laboratory-amplification tests include a turnaround time of 2 to 4 hours and the ability to test large volumes of samples.

These new techniques are not without problems. There is the potential for false-positive results due to contamination and sample-related inhibitors, such as heparin and phosphate ions. In addition, there is the broader issue based on the need to understand the meaning of a positive result by polymerase chain reaction-based assay. When a small number of organisms are detected, the interpretation may indicate a carrier, a preclinical state, or a minimal disease state that is stable and presents little or no risk of illness.

In the short term, the number of men tested may increase and, subsequently, the gender differential will narrow, and the prevalence of chlamydial infection in the male population can be more accurately estimated. As a result of more people being tested (and more sensitive tests), it is likely that a short-term increase in the number of cases and rates of *Chlamydia* in Canada (most probably in adolescents and young adults) may be seen. In turn, with more people getting tested and treated, the pool of infected individuals should decrease, and the number of cases and rates should decrease in the long-term.

The *1995 Update: Canadian STD Guidelines* has recommended single-dose therapy of azithromycin[5]. Azithromycin, however, is not highly efficacious against gonorrhea. Therefore, the treatment regimen for *Chlamydia* is dual therapy with regimens effective against both gonorrhea and chlamydial infections. Azithromycin is as effective as the 7-day regimen of doxycycline.

Strategies to reduce the incidence of chlamydial infections include increasing and expanding STD education, increasing the screening of high-risk individuals, and expanding partner notification[6]. Recent advances in AIDS education have effected decreases in rates of high-risk behaviour associated with all STDs. Through these decreases in high-risk behaviour, a decrease in the incidence of *C. trachomatis* has resulted[7].

The Division of STD Prevention and Control, Laboratory Centre for Disease Control, in partnership with the provincial and territorial STD control programs, will continue to closely monitor and report on future trends in genital *Chlamydia*.

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Notice

TRENDS IN GONORRHEA IN CANADA, 1990-1995
Vol. 23-12, 15 June 1997

Please note that this article was based on **preliminary** data. The 1995 annual report on sexually transmitted disease surveillance in Canada, to be published as a supplement to the CCDR later this year, will present a detailed analysis of final data.

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