BC Centre for Disease Control
Provincial Health Services Authority

STI

Annual Report
2017

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Summary of Trends

Genital Chlamydia

In 2017, the rate of genital chlamydia increased to 322.0 per 100,000 population, continuing the overall provincial trend of a steady increase since 1998.

- The highest rates were in Vancouver, Northwest and Northern Interior Health Service Delivery Areas.
- Females continue to have higher rates of genital chlamydia infection compared to males.
- The highest rates were in the 20-24 year age group.
- The number of Lymphogranuloma venereum (LGV) cases remains higher than historic levels. In 2017, there were 47 LGV cases, compared to 40 in 2016.

Genital Gonorrhea

In 2017, the rate of genital gonorrhea decreased to 58.2 per 100,000 population, from 68.5 per 100,000 in 2016. This represents a change in the overall provincial trend of a steady increase between 1998 and 2016.

- The highest rates were in Vancouver, Northern Interior and Northwest Health Service Delivery Areas.
- Males continue to have higher rates of genital gonorrhea infection compared to females.
- The highest rates were in the 25-29 year age group.

Infectious Syphilis

In 2017, the provincial rate of infectious syphilis was 14.2 per 100,000 population.

- The highest rates were in Vancouver and South Vancouver Island Health Service Delivery Areas.
- Over 95% of cases were male in 2017.
- The majority of cases were among people identified as Caucasian.
- Gay, bisexual and other men who have sex with men make up the greatest number of new infections.

Chlamydia

Genital Chlamydia by Region, Gender, and Age

Genital chlamydia is the most commonly reported sexually transmitted infection in BC. As the majority of chlamydia infections are asymptomatic, the reported number of chlamydia infections is only a portion of the total population burden. If untreated, genital chlamydia may lead to complications such as pelvic inflammatory disease (a major cause of infertility, ectopic pregnancy, and chronic pain) in women and epididymo-orchitis in men.

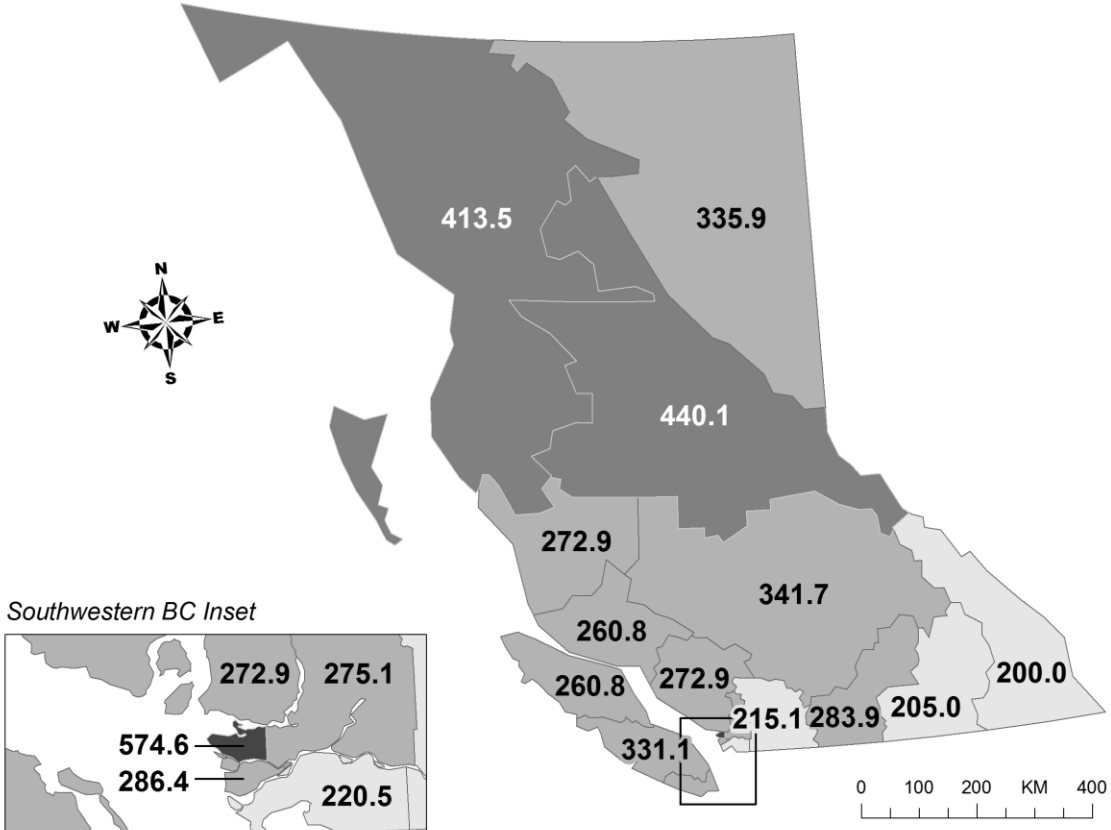
Mirroring the national trend, chlamydia (both genital and extra-genital) rates have steadily increased from 1998 to 2017 (Figure 2). In 2017, the rate of genital chlamydia for BC increased to 322.0 from 316.5 (15,057 cases) per 100,000 population in 2016. The highest rates of genital chlamydia were in Vancouver Coastal and Northern Health Authorities (Figure 3). Rates among Health Service Delivery Areas varied with the highest rates in Vancouver, Northwest and Northern Interior, and the lowest rates in Kootenay Boundary, East Kootenay, and Fraser East (Figure 1).

Similar increases in chlamydia infections have been observed in high income countries around the world. (1) There are multiple reasons for this increase, including increases in the sensitivity of laboratory tests and uptake of testing (e.g., the greater acceptability of urine-based tests among men) as well as provider screening practices. There may also be a paradoxical effect in which improvements in early screening and treatment for chlamydia over the past decades have resulted in individuals being less likely to develop full immunity thus consequently more susceptible to re-infection (known as the “arrested immunity” hypothesis (2)(3)). While data on population trends in sexual behaviour is not available for BC, it is possible that changes in behaviour, such as decreased condom use, may also be contributing to increasing chlamydia incidence.

Females continue to have approximately 1.3 times the diagnosis rate compared to males. The rate for females in 2017 decreased to 368.0 (8,934 cases) from 377.2 (9,039 cases) per 100,000 population in 2016, while the rates in males increased to 274.2 (6,552 cases) per 100,000 in 2017 from 253.9 (5,995) per 100,000 (Figure 4). The greater number of infections among females is partially due to routine screening performed at the time of visits that were for other reasons (e.g. pap testing or contraception counselling). However, the difference in rates appears to be narrowing due to the increasing number of male cases. The increase among male cases may be partly due to the increased uptake of sensitive testing since males are considered a hidden reservoir of chlamydia (4)(5). This may include the increased use of NAAT to detect extra-genital infections (especially rectal infections among men who have sex with men) and increased availability of urine-based NAAT tests may also explain the observed rise in chlamydia rates among men (6).

In 2017, the highest rates of chlamydia were among young adults aged 20-24 years followed by both adults aged 25-29 years and adolescents aged 15-19 years (Figure 6), driven primarily by the high rates of infection among young females (Figure 7). Males aged 20-29 years had the highest chlamydia rates in 2017 compared with other age groups (Figure 8).

1. Genital chlamydia case reports in BC by health service delivery area, 2017



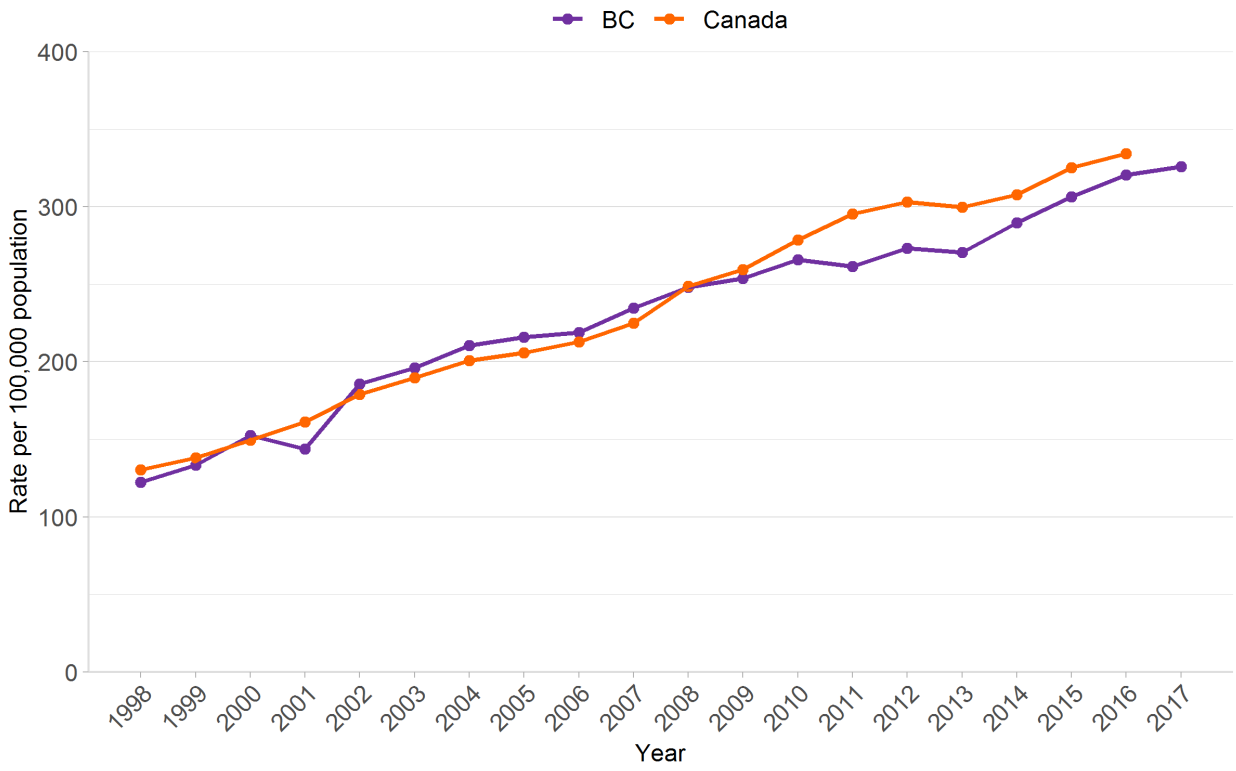
ID	Health Service Delivery Area	Cases	Rate
11	East Kootenay	154	200.0
12	Kootenay Boundary	160	205.0
13	Okanagan	1058	283.9
14	Thompson Cariboo Shuswap	783	341.7
21	Fraser East	652	215.1
22	Fraser North	1831	275.1
23	Fraser South	1843	220.5
31	Richmond	628	286.4
32	Vancouver	3888	574.6
33	North Shore/Coast Garibaldi	784	272.9
41	South Vancouver Island	1262	321.9
42	Central Vancouver Island	918	331.1
43	North Vancouver Island	323	260.8
51	Northwest	294	413.5
52	Northern Interior	618	440.1
53	Northeast	228	335.9

Rate per 100,000 population by HSDA

- 200.0 - 220.5
- 260.8 - 341.7
- 413.5 - 440.1
- 574.6

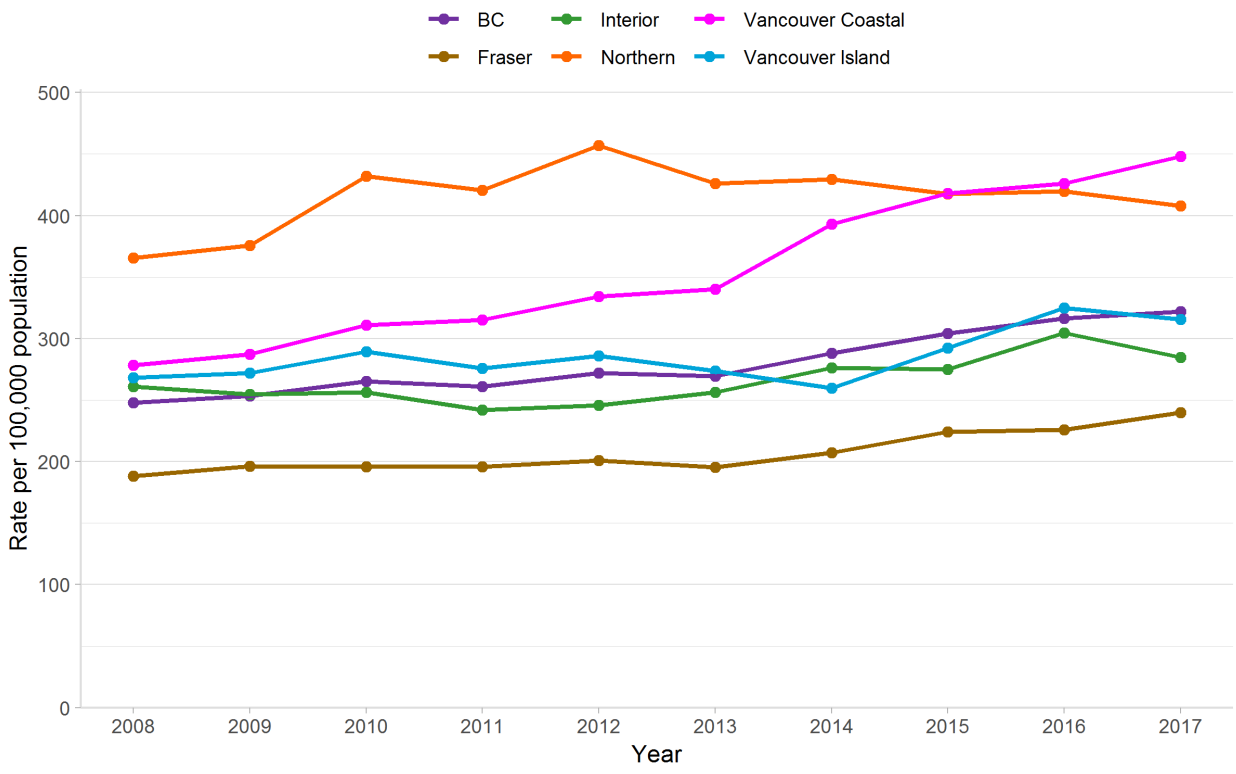
Rates calculated with population estimates released by BC Stats.

2. Genital and extra-genital chlamydia case reports in BC and Canada, 1992 to 2017*

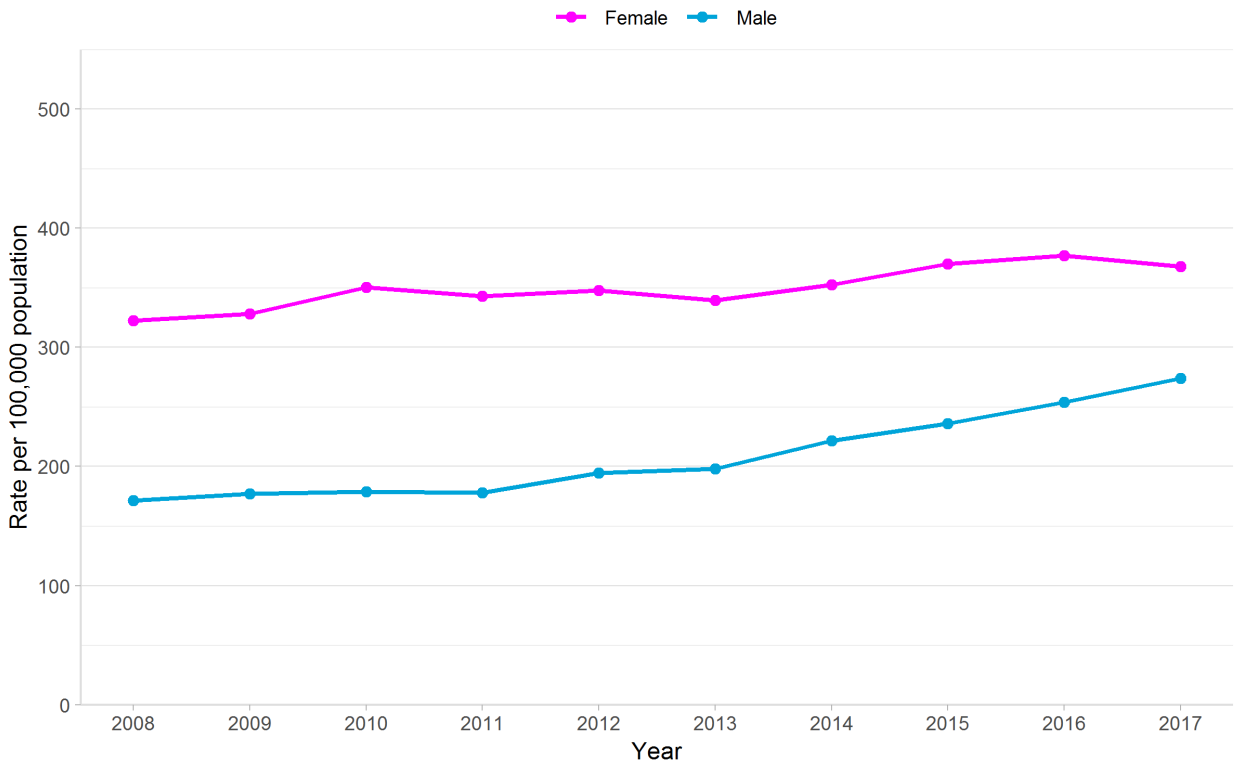


*2017 Canadian rate was not available at time of publication

3. Genital case reports in BC by health authority, 2008 to 2017



4. Genital chlamydia case reports in BC by gender, 2008 to 2017



Rates of genital chlamydia case reports by gender, 2008 to 2017

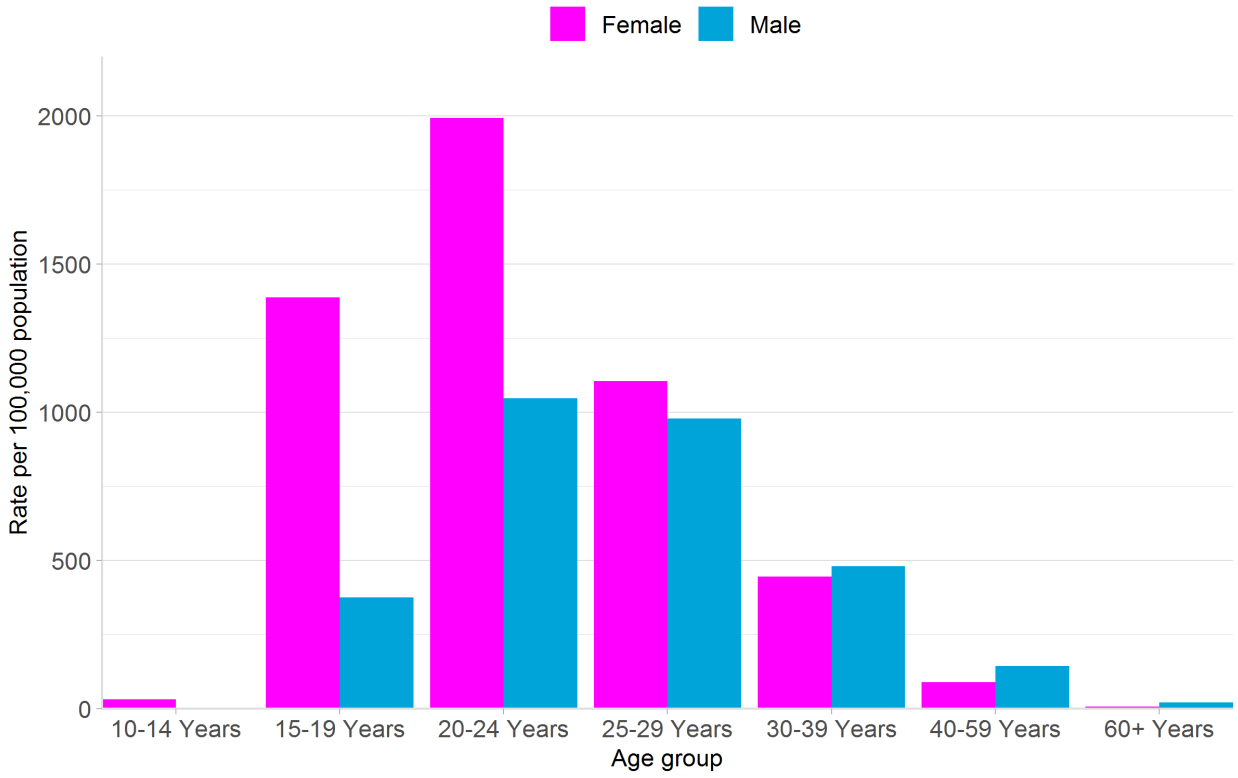
Gender	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Female	322.6	328.3	350.4	343.0	347.9	339.4	352.6	370.0	377.2	368.0
Male	171.5	177.1	178.9	177.9	194.7	197.9	221.7	236.0	253.9	274.2
BC Total	247.8	253.4	265.3	261.1	272.0	269.3	287.9	304.0	316.5	322.0

Counts of genital chlamydia case reports by gender, 2008 to 2017

Gender	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Female	7068	7287	7870	7761	7956	7839	8247	8750	9039	8934
Male	3703	3881	3971	3980	4400	4512	5115	5498	5995	6552
Other*	6	9	5	7	12	11	13	23	23	24
BC Total	10777	11177	11846	11748	12368	12362	13375	14271	15057	15510

*Other- transgender and gender unknown

5. Genital chlamydia case reports in BC by age group and gender, 2017



Rates of genital chlamydia case reports by gender and age group, 2017

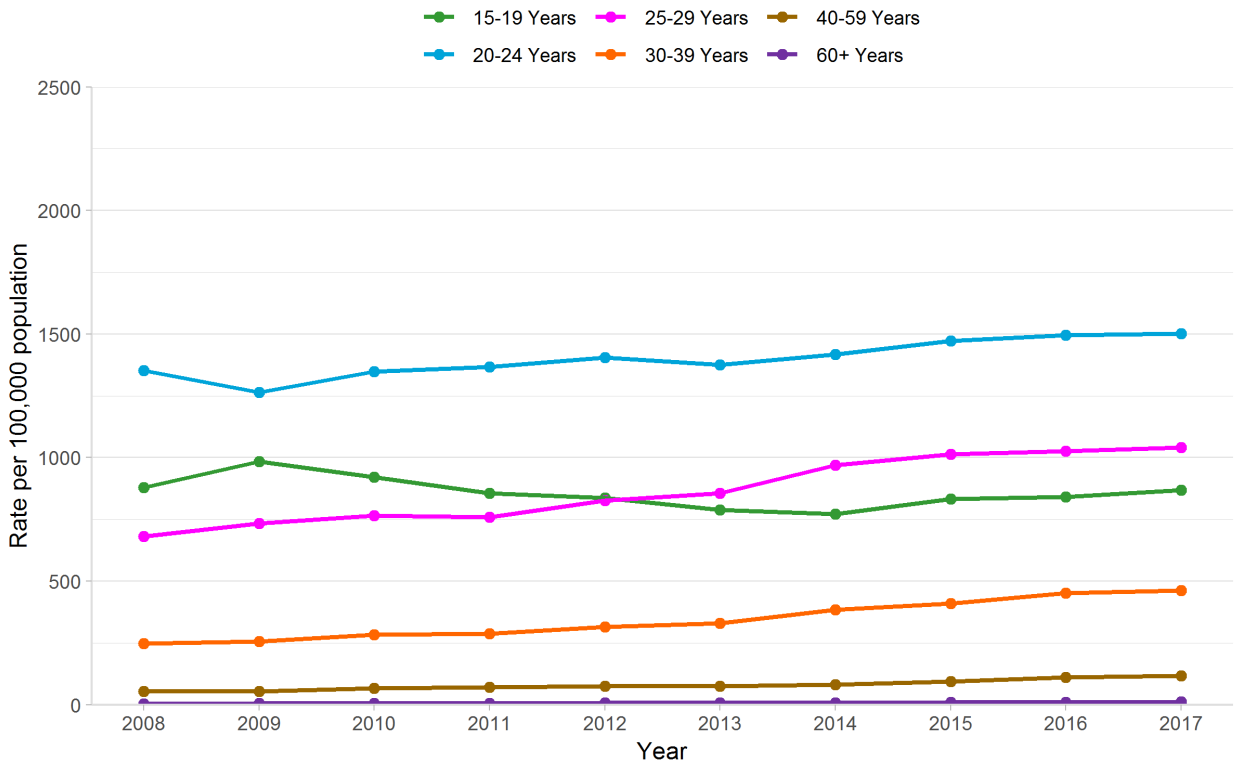
Gender	10-14 Years	15-19 Years	20-24 Years	25-29 Years	30-39 Years	40-59 Years	60+ Years
Female	31.6	1386.4	1992.9	1104.5	445.5	89.5	5.9
Male	1.6	374.4	1046.5	977.5	479.3	143.3	20.4

Counts of genital chlamydia case reports by gender and age group, 2017

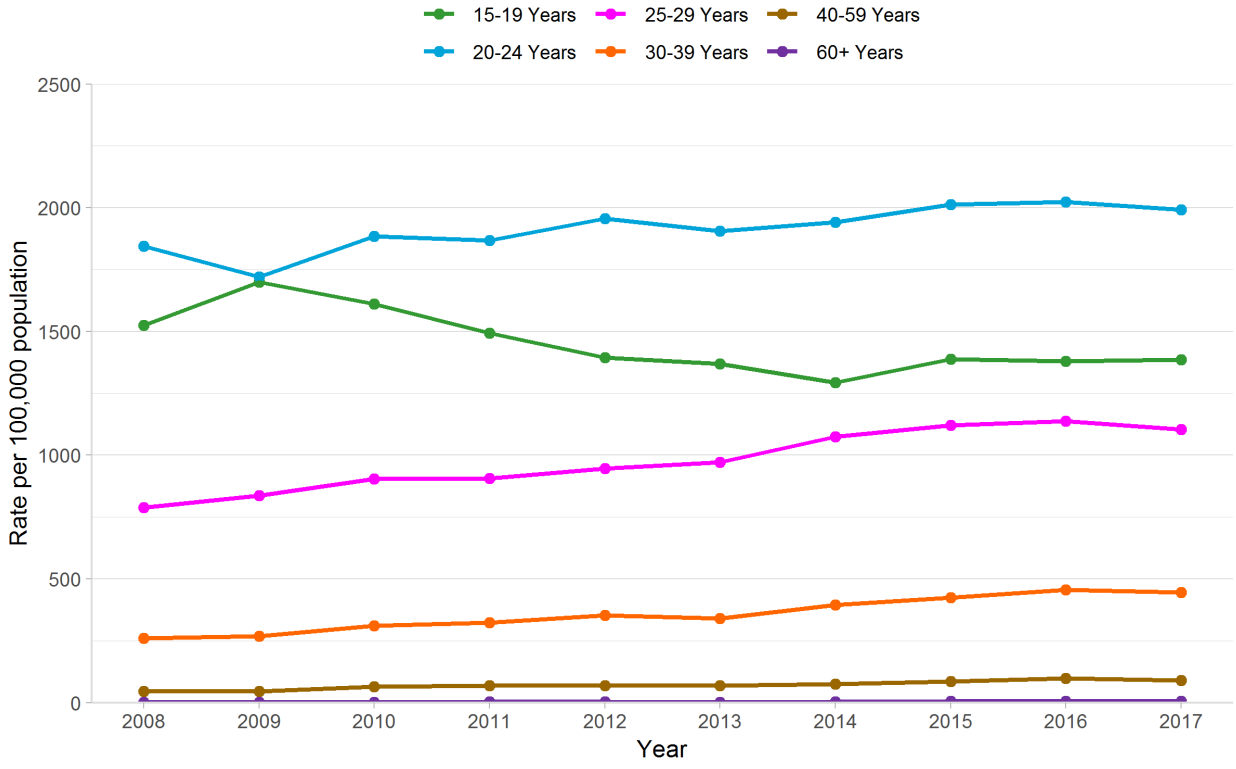
Gender	10-14 Years	15-19 Years	20-24 Years	25-29 Years	30-39 Years	40-59 Years	60+ Years	Unknown
Female	36	1835	3157	1783	1473	605	37	6
Male	2	522	1812	1603	1551	938	117	6
Other*	0	4	7	2	5	5	0	1

*Other- transgender and gender unknown

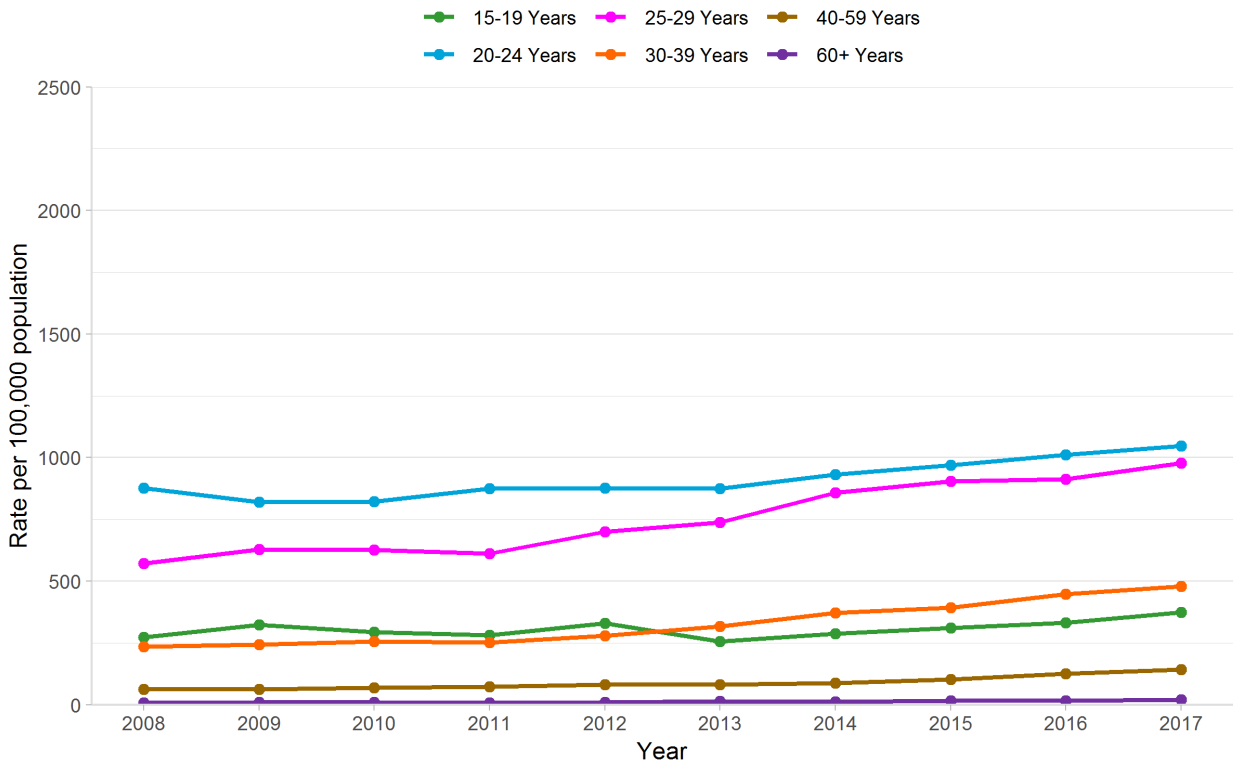
6. Genital chlamydia case reports in BC by age group, 2008 to 2017



7. Genital chlamydia case reports in BC by age group - female, 2008 to 2017



8. Genital chlamydia case reports in BC by age group - male, 2008 to 2017



Extra-genital Chlamydia

In 2017, 189 extra-genital cases were identified (72 were among females, 114 were among males, 3 were among transgender). As screening for chlamydia infections at extra-genital sites is not routine practice, these findings are strongly influenced by provider testing practices. Much of the increase observed since 2012 is likely due to increase awareness and testing for chlamydia in extra-genital sites. From 2008 to 2017, 730 infections were identified in specimens collected from the following sites: throat (450 cases, 61.6%), eye (69 cases, 9.5%), and other sites (211 cases, 28.9%) (Table 9).

9. Extra-genital chlamydia case reports in BC by site, 2008 to 2017

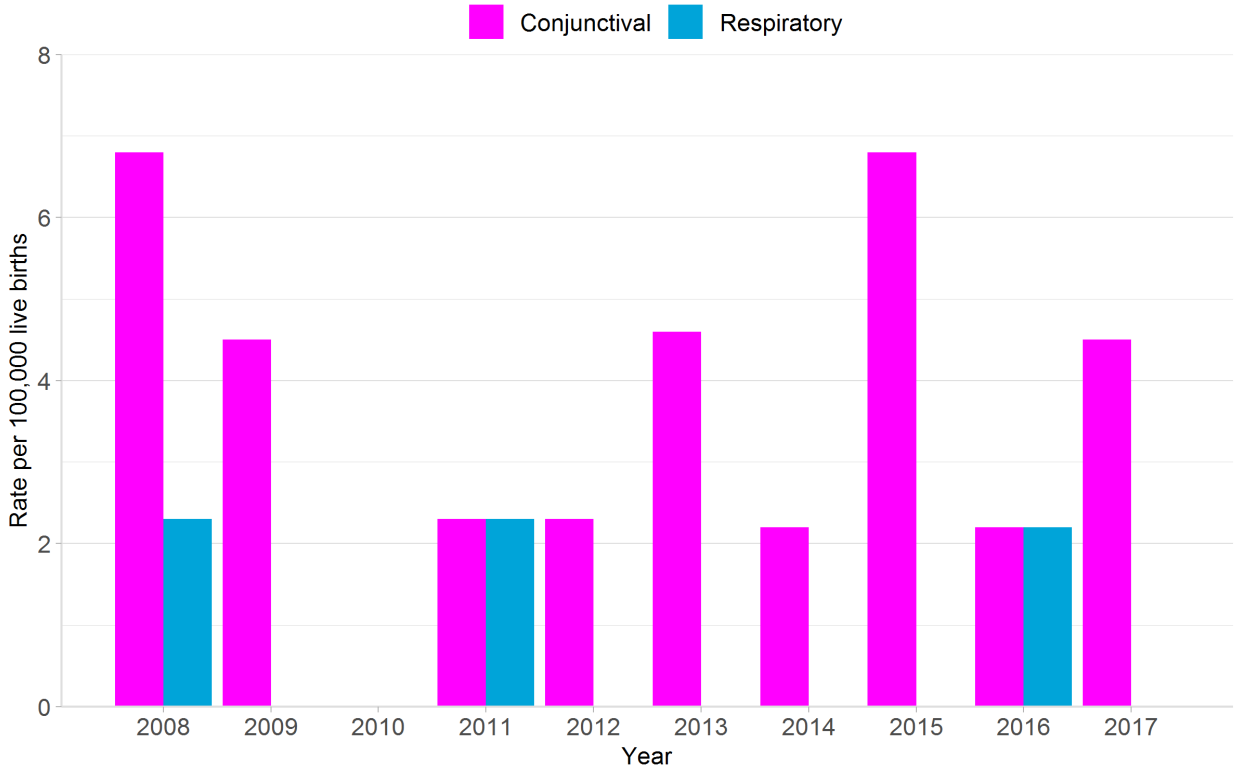
Gender	Site	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Female	Eye	2	5	3	0	2	2	2	4	2	4
	Throat	0	0	0	0	3	3	6	11	33	37
	Other*	2	7	6	5	4	6	14	10	55	31
	Total	4	12	9	5	9	11	22	25	90	72
Male	Eye	4	2	4	5	3	2	6	10	3	4
	Throat	3	2	5	1	32	32	49	61	69	96
	Other*	3	0	6	5	3	3	6	8	23	14
	Total	10	4	15	11	38	37	61	79	95	114
BC	Eye	6	7	7	5	5	4	8	14	5	8
	Throat	3	2	5	1	35	35	55	73	105	136
	Other*	5	7	12	10	7	9	20	18	78	45
	Total	14	16	24	16	47	48	83	105	188	189

*Other - nasopharyngeal washing, lesion, fluid from groin mass lesion, pelvic fluid, and other.
Total reports for BC is the sum of the following genders: female, male, transgender, and gender unknown.

Perinatally-acquired Chlamydia

Genital chlamydia can be passed by pregnant women to their infants during delivery which can lead to pneumonia, and neonatal conjunctivitis (inflammation or swelling of the mucous membrane that covers the front of the eyes and the inside of the eyelids, also known as ophthalmia neonatorum). Two cases of perinatally-acquired chlamydia infection were found in a conjunctival specimen in 2017. From 2008 to 2017, the majority of perinatal cases are from conjunctival specimens (16/19 cases, 84.2%) while three cases (15.8%) was identified in a respiratory specimen (Figure 10).

10. Perinatally-acquired chlamydia case reports in BC by site, 2008 to 2017.



Counts and rates of perinatally-acquired chlamydia case report in BC by site, 2008 to 2017

Measure	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Reports - Respiratory	1	0	0	1	0	0	0	0	1	0
Reports - Conjunctival	3	2	0	1	1	2	1	3	1	2
Rate - Respiratory	2.3	0.0	0.0	2.3	0.0	0.0	0.0	0.0	2.2	0.0
Rate - Conjunctival	6.8	4.5	0.0	2.3	2.3	4.6	2.2	6.8	2.2	4.5

*Rate per 100,000 live births

Lymphogranuloma Venereum

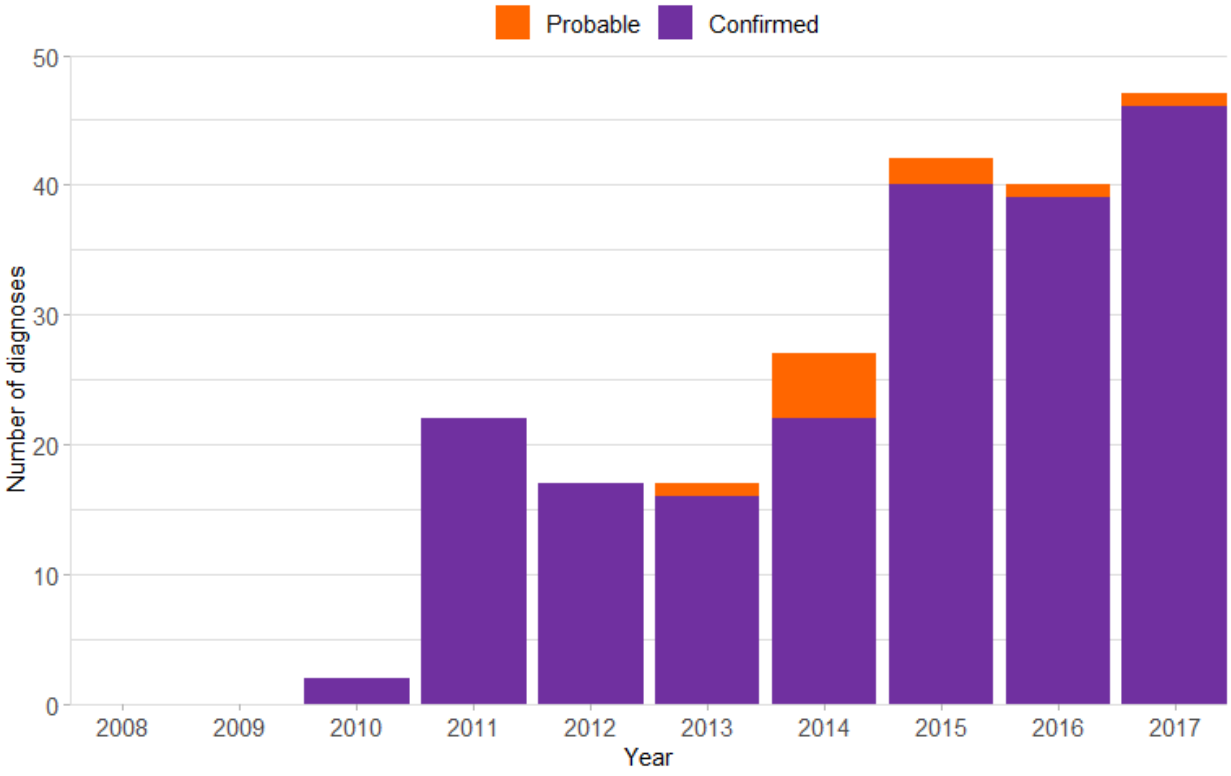
Lymphogranuloma venereum (LGV) is a sexually transmitted infection caused by *Chlamydia trachomatis* serovars L1, L2, and L3. The clinical presentation of LGV includes genital papules, ulcers, inguinal lymphadenopathy, and hemorrhagic proctitis. If left untreated, LGV can cause serious sequelae such as lymphatic obstruction or anogenital ulcerations.

LGV was first reported in Canada in 2003 and in BC in 2004. With increasing cases of LGV among gay, bisexual, and other men who have sex with men (MSM) in Europe and the US, provincial LGV surveillance commenced in 2004. Occurring in tandem with reports of increased transmission in the US (7) and Europe (8), an increase of LGV cases was observed in 2011 in BC, in part due to routine testing of rectal chlamydia specimens for LGV and augmented case-finding. In 2017, the number of LGV cases in BC increased to 47 cases (46 confirmed, 1 probable) from 40 cases (39 confirmed, 1 probable) in 2016 (Figure 11).

From 2008 to 2017, 214 cases of LGV (204 confirmed, 10 probable) were reported in BC. Most cases (197 cases, 92%) were among MSM and diagnosed in Vancouver Coastal Health Region (188 cases, 88%). Of those with known HIV status, 61% (128/209 cases) were co-infected with HIV. Most cases (133/214 cases, 62.1%) presented with symptoms of proctitis, inflammation of the rectum and anus.

All 47 LGV cases reported in 2017, were among males. (2.0 per 100,000 population among males). Of the 47 cases, 2 cases reported both male and female partners, while 45 cases reported only male partners. Of these 45 cases, the mean age was 38.6 years (range 23-70 years), and 57.8% (26 cases) identified as Caucasian, 15.6% (7 cases) Hispanic, and 4.4% (2 cases) Asian.

11. Lymphogranuloma venereum case reports in BC, 2008 to 2017



Gonorrhea

Genital Gonorrhea by Region, Gender, and Age

Gonorrhea infections may be asymptomatic or the symptoms may be mild, and as a result, the reports of diagnosed infections are only a portion of the total population burden. As with chlamydia, genital gonorrhea if untreated can lead to pelvic inflammatory disease (and associated complications) in females. An individual infected with gonorrhea is also at increased risk of acquiring HIV. (9) (10)

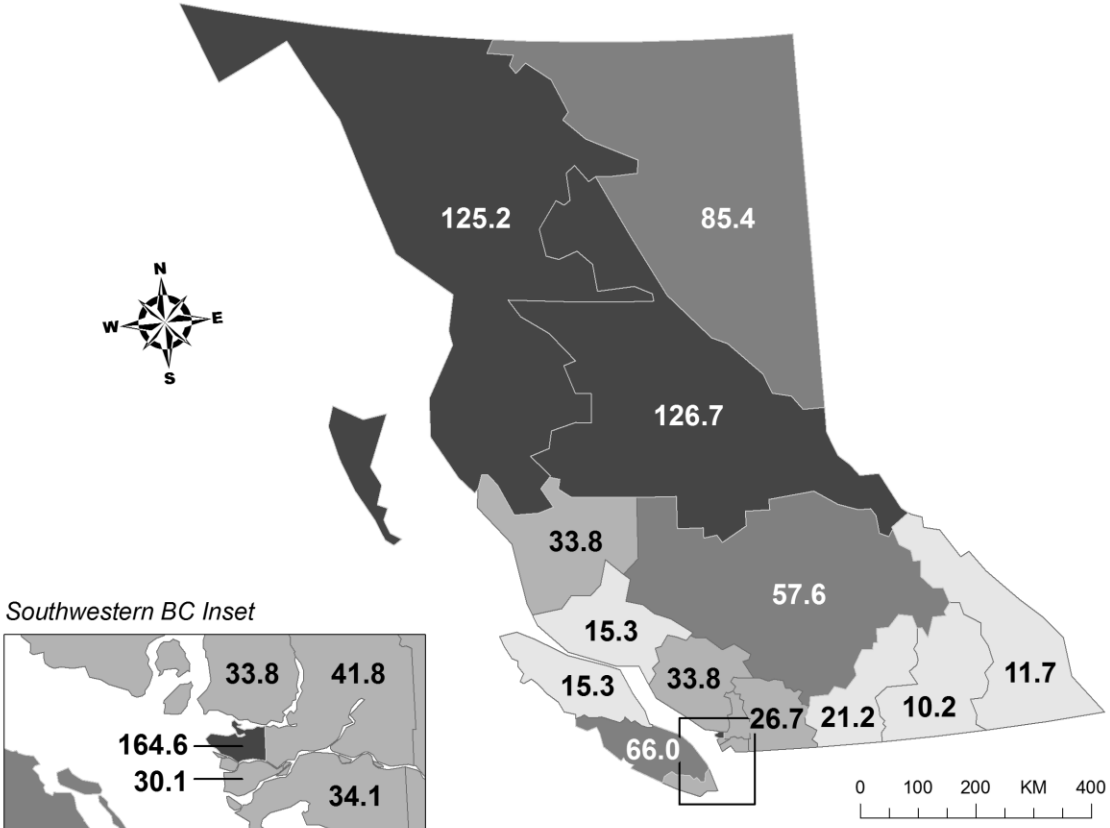
Overall since 1998, the gonorrhea (both genital and extra-genital) rate in BC has increased steadily, consistent with national rates (Figure 13). However, the genital gonorrhea rate in BC decreased to 58.2 (2,805 cases) in 2017 from 68.5 (3,259 cases) per 100,000 population in 2016. The highest rates of genital gonorrhea were in Vancouver Coastal and Northern Health Authorities (Figure 14). Rates among Health Service Delivery Areas vary with the highest rates in Vancouver, Northern Interior and Northwest, and the lowest rates in East Kootenay, North Vancouver Island and Kootenay Boundary (Figure 12). Reasons for the increase in gonorrhea rates in 2015-2016 are still under investigation. A shift in strain-type may account for some of this increase, as well as increased testing. (11)

Males continue to have a rate about two times greater than females (Figure 15). Since 2007, male and female gonorrhea rates have been steadily increasing. In 2017, the rates among both males and females decreased from a 25-year high seen in 2016, to 80.8 (1,930 cases) among males and 35.6 (864 cases) among females per 100,000 population.

In 2017, the highest rates among males were in those aged 25-29 years (460 cases, 280.5 per 100,000 population) and among females in those aged 20-24 years (210 cases, 132.6 per 100,000 population) (Figure 16).

Gonorrhea is more likely to be concentrated in sexually active networks and it is likely that the higher rates of gonorrhea in males is, in part, due to higher rates of gonorrhea among gay, bisexual, and other men who have sex with men (MSM). While provincial surveillance data does not permit identification of MSM cases, this has been observed in other jurisdictions. (12) (13)

12. Genital gonorrhea case reports in BC by health service delivery area, 2017



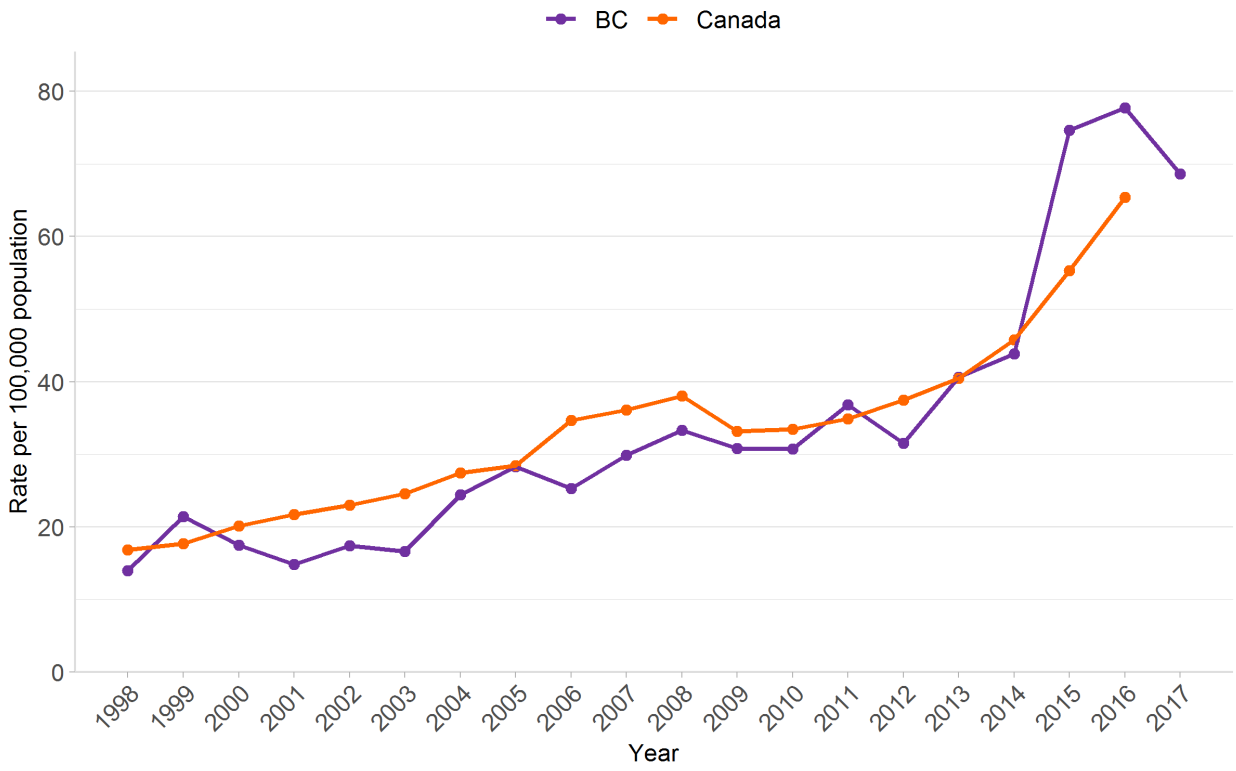
Rate per 100,000 population by HSDA

- 10.2 - 21.2
- 26.7 - 41.8
- 57.6 - 85.4
- 125.2 - 164.6

ID	Health Service Delivery Area	Cases	Rate
11	East Kootenay	9	11.7
12	Kootenay Boundary	8	10.2
13	Okanagan	79	21.2
14	Thompson Cariboo Shuswap	132	57.6
21	Fraser East	81	26.7
22	Fraser North	278	41.8
23	Fraser South	285	34.1
31	Richmond	66	30.1
32	Vancouver	1114	164.6
33	North Shore/Coast Garibaldi	97	33.8
41	South Vancouver Island	106	27.0
42	Central Vancouver Island	183	66.0
43	North Vancouver Island	19	15.3
51	Northwest	89	125.2
52	Northern Interior	178	126.7
53	Northeast	58	85.4

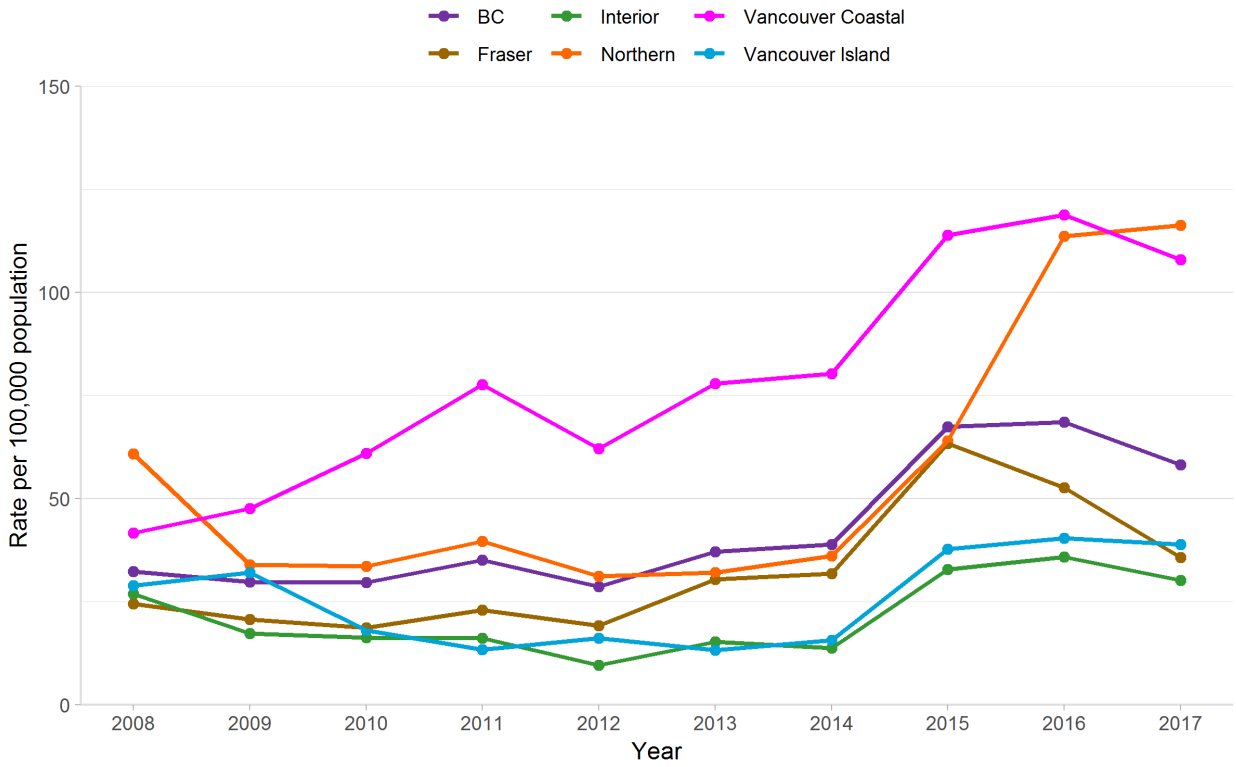
Rates calculated with population estimates released by BC Stats.

13. Genital and extra-genital gonorrhea case reports in BC and Canada, 2008 to 2017*

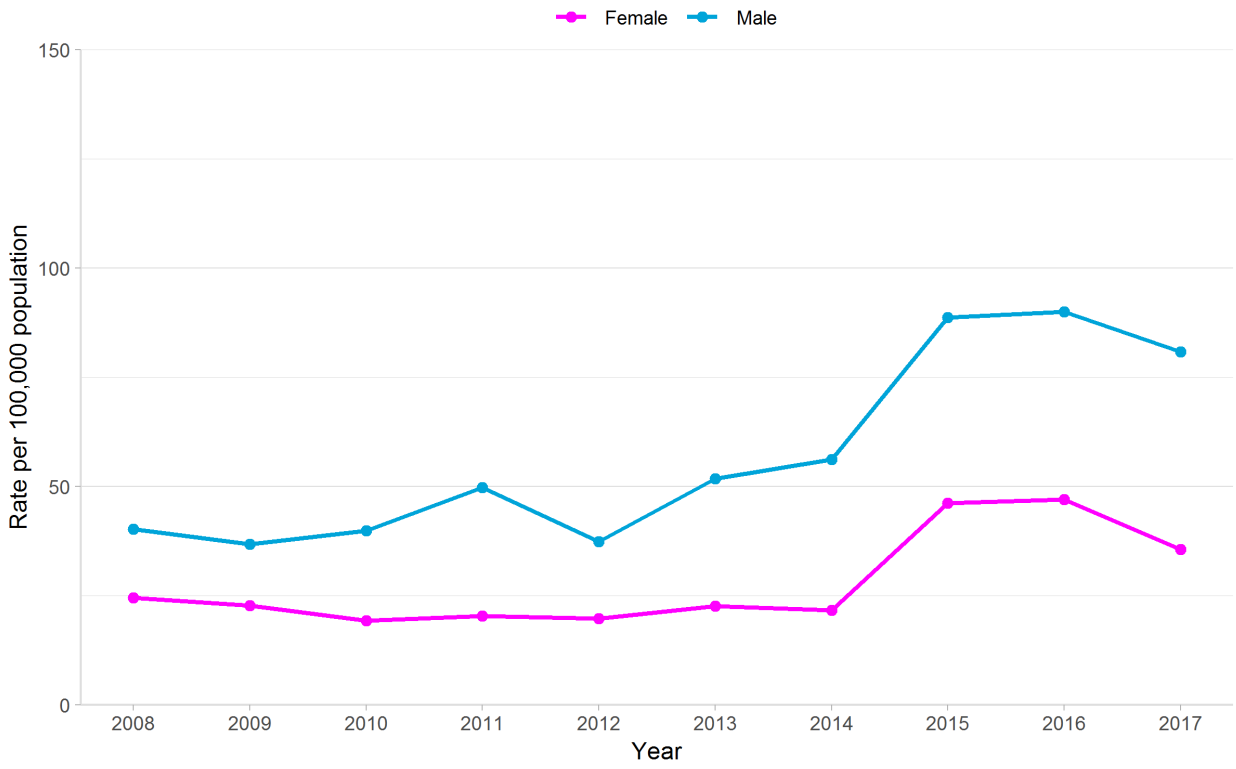


*2017 Canadian rate was not available at time of publication

14. Genital gonorrhea case reports in BC by health authority, 2008 to 2017



15. Genital gonorrhea case reports in BC by gender, 2008 to 2017



Rates of genital gonorrhea case reports in BC by gender, 2008 to 2017

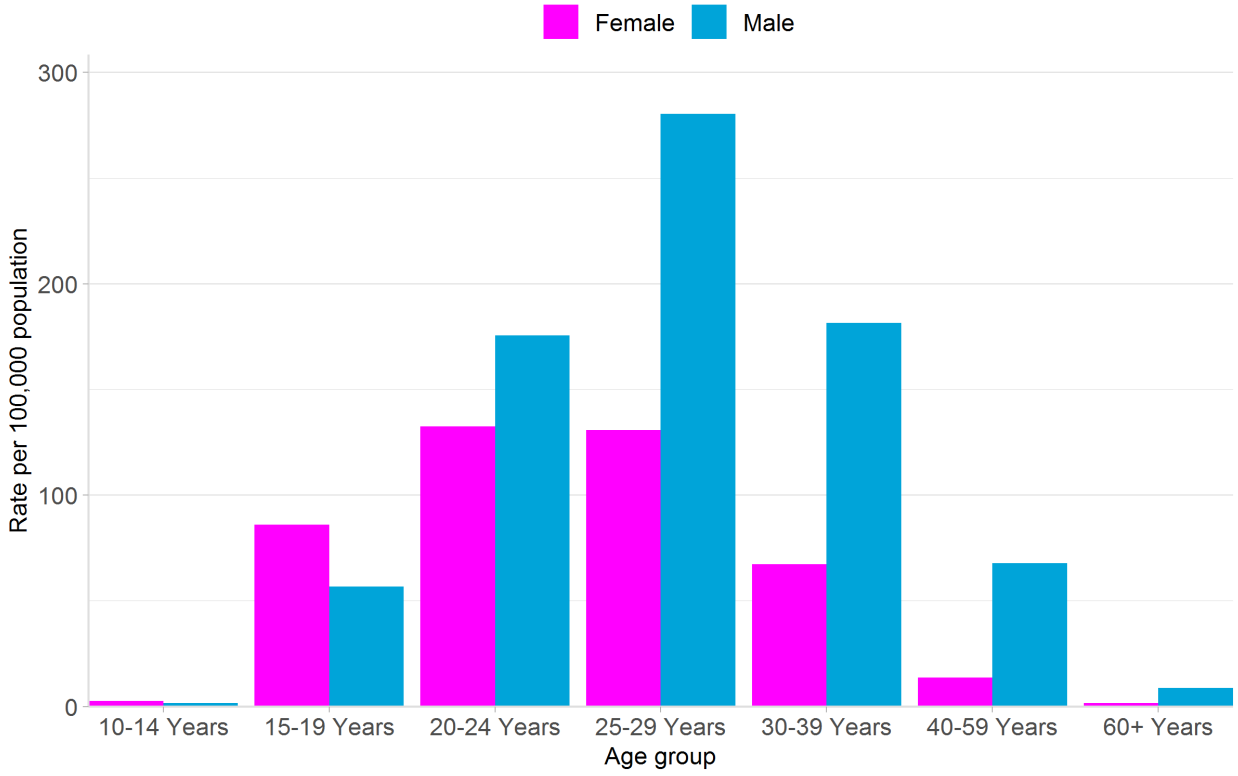
Gender	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Female	24.5	22.7	19.3	20.3	19.7	22.6	21.6	46.1	47.0	35.6
Male	40.2	36.8	39.8	49.7	37.4	51.7	56.2	88.7	90.0	80.8
BC Total	32.3	29.7	29.6	35.0	28.6	37.1	38.9	67.4	68.5	58.2

Counts of genital gonorrhea case reports in BC by gender, 2008 to 2017

Gender	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Female	537	503	434	459	450	523	506	1091	1127	864
Male	867	806	883	1111	845	1178	1298	2066	2126	1930
Other*	2	1	3	4	3	4	4	6	6	11
BC Total	1406	1310	1320	1574	1298	1705	1808	3163	3259	2805

*Other- transgender and gender unknown

16. Genital gonorrhea case reports in BC by age group and gender, 2017



Rates of genital gonorrhea case reports in BC by age group and gender, 2017

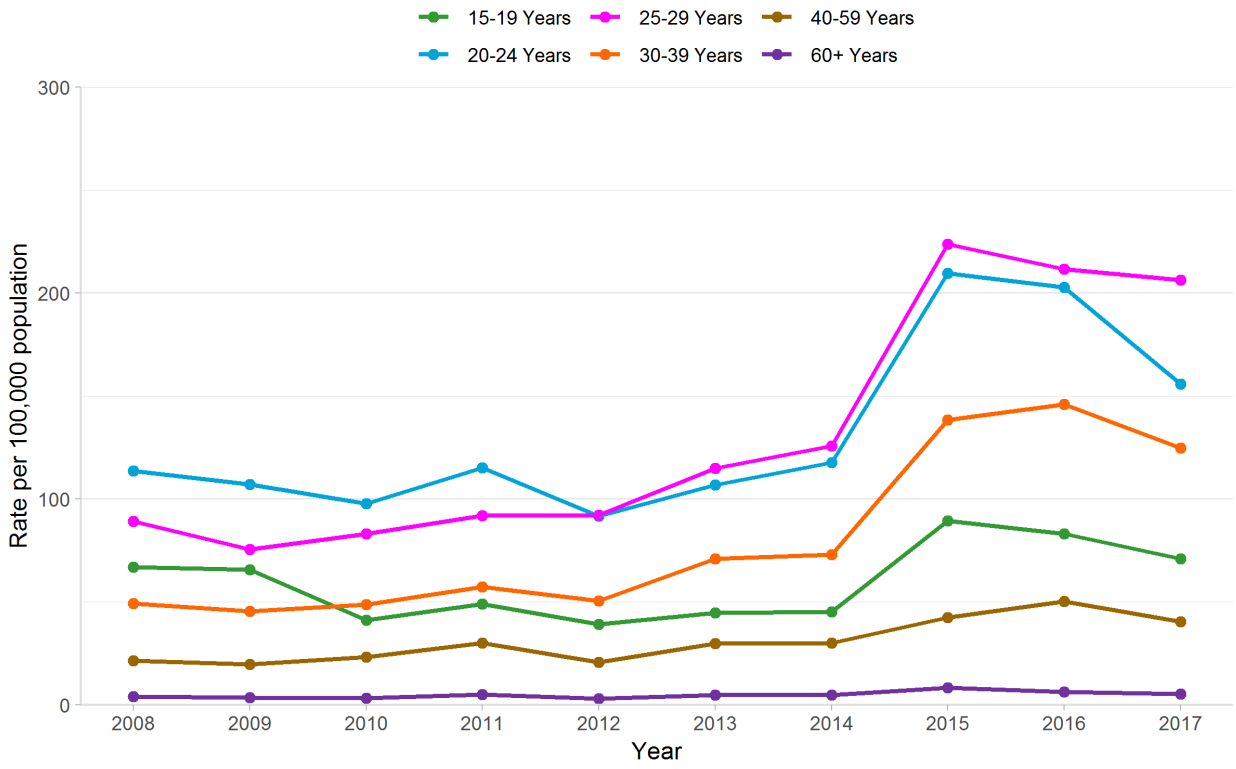
Gender	10-14 Years	15-19 Years	20-24 Years	25-29 Years	30-39 Years	40-59 Years	60+ Years
Female	2.6	86.1	132.6	130.7	67.4	13.6	1.7
Male	1.6	56.7	175.6	280.5	181.4	67.8	8.9

Counts of genital gonorrhea case reports in BC by age group and gender, 2017

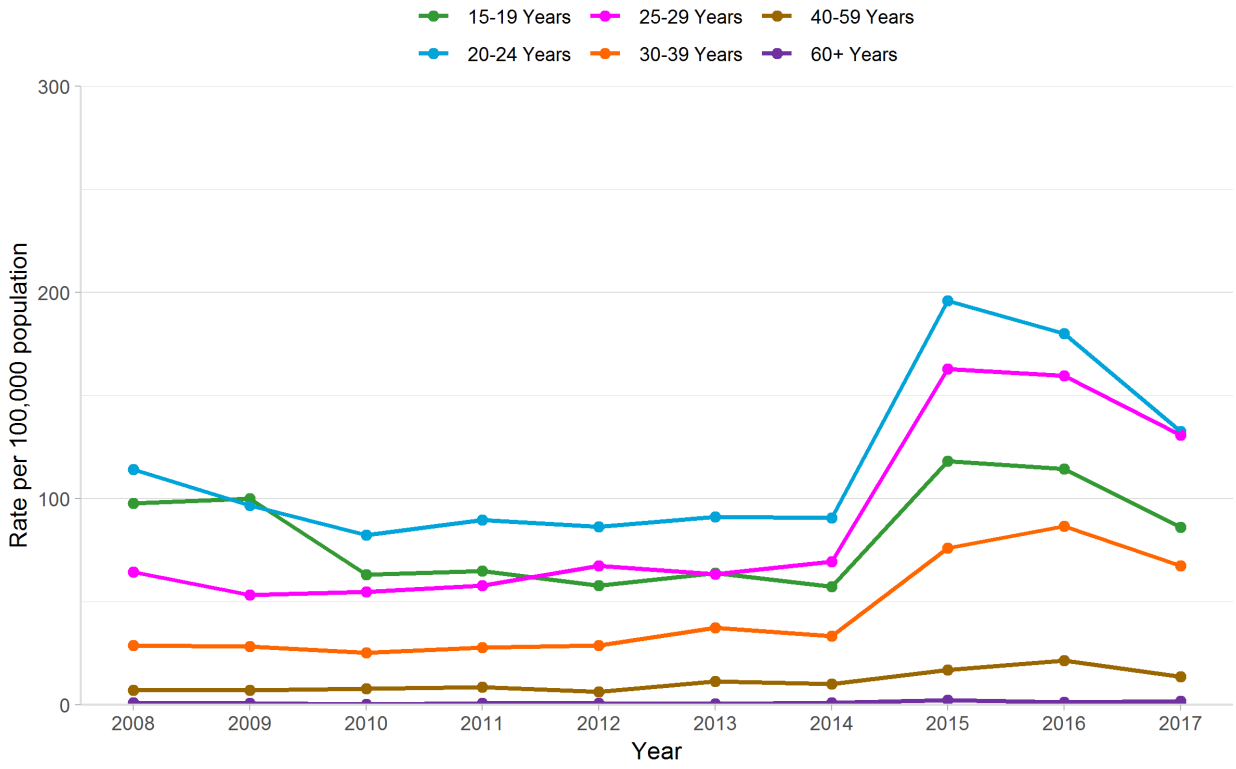
Gender	10-14 Years	15-19 Years	20-24 Years	25-29 Years	30-39 Years	40-59 Years	60+ Years	Unknown
Female	3	114	210	211	223	92	11	0
Male	2	79	304	460	587	444	51	3
Other*	0	0	2	0	6	2	1	0

*Other- transgender and gender unknown

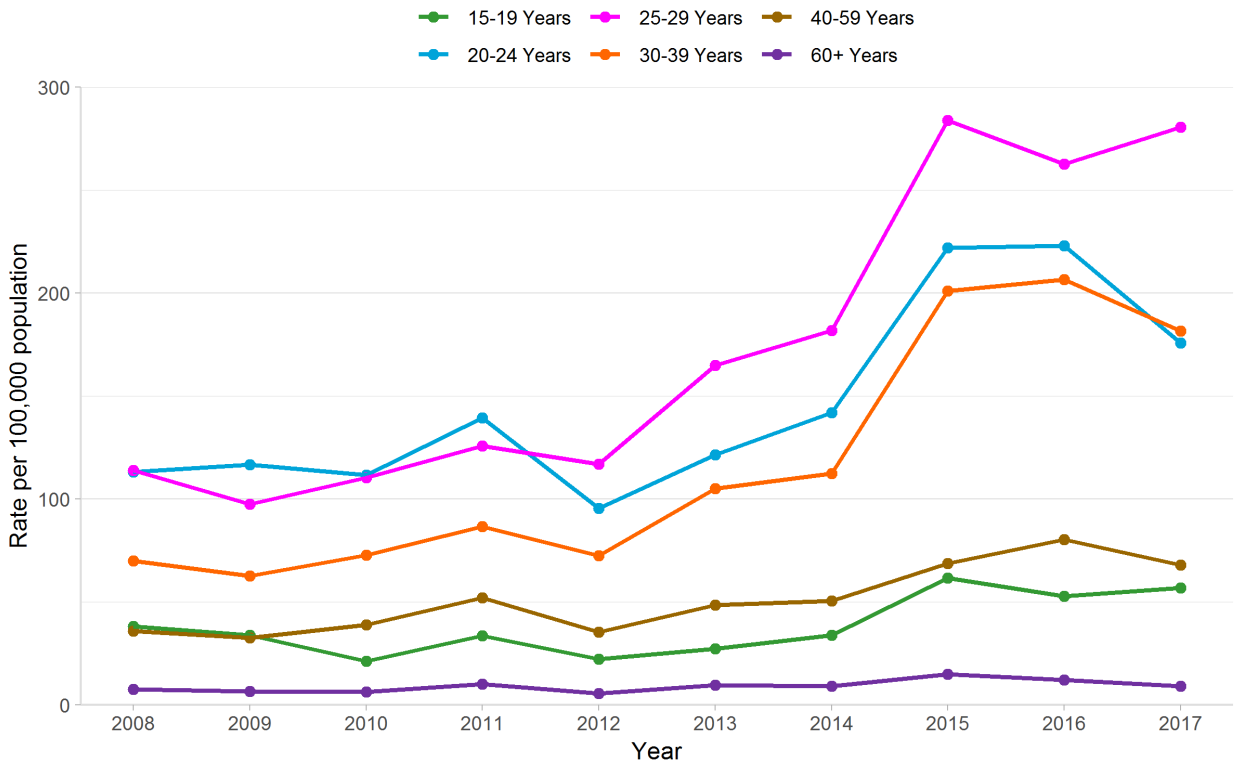
17. Genital gonorrhea case reports in BC by age group - total, 2008 to 2017



18. Genital gonorrhea case reports in BC by age group - female, 2008 to 2017



19. Genital gonorrhea case reports in BC by age group - male, 2008 to 2017



Extra-genital Gonorrhea

In 2017, 495 cases were identified (54 were among females, 438 were among males) which was an increase from 438 cases (48 were among females, 375 were among males) in 2016. As screening for gonorrhea infections at extra-genital sites is not routine practice, these findings are strongly influenced by provider testing practices, including increases in screening in the past few years. Of the 2,002 cases diagnosed from 2008 to 2017, cases were identified in the throat (1,864 cases, 93.1%), eye (25 cases, 1.3%), and other sites (113 cases, 5.6%) (Table 20).

20. Extra-genital gonorrhea case reports in BC by site, 2008 to 2017

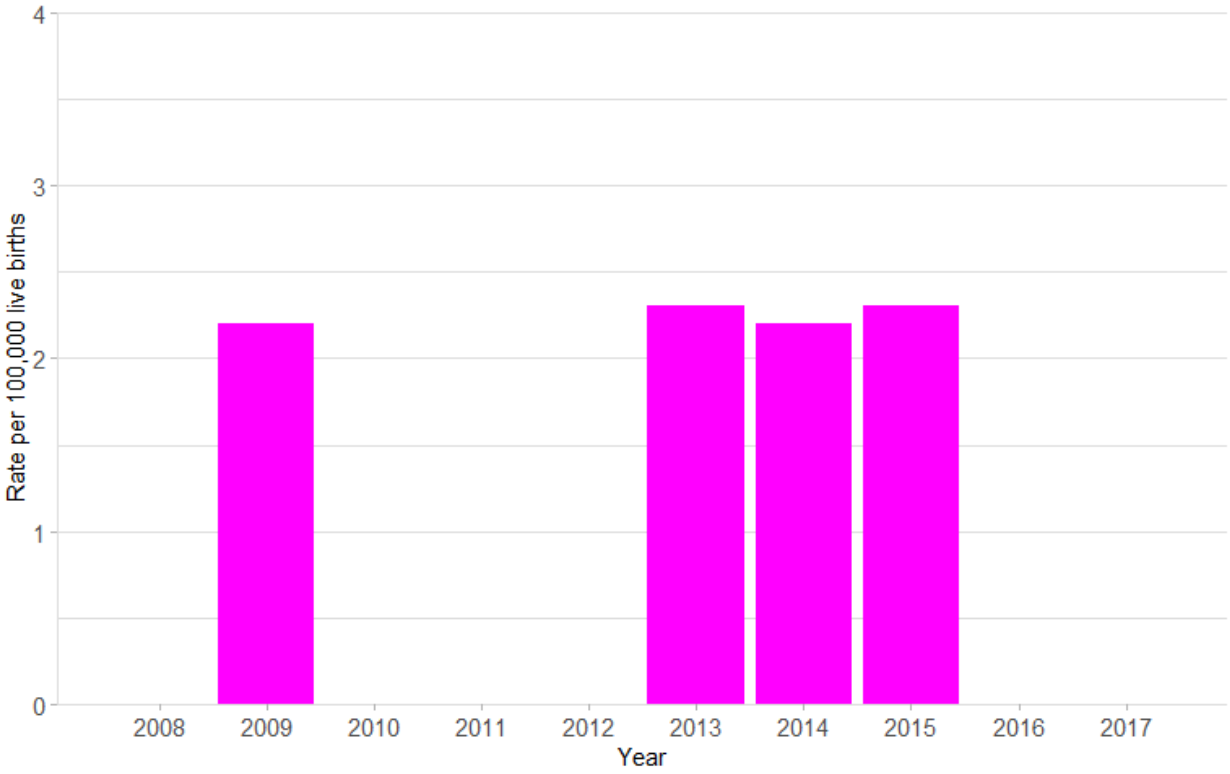
Gender	Site	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Female	Eye	1	0	1	0	0	1	1	2	1	1
	Throat	2	5	6	8	4	19	13	22	38	34
	Other*	1	0	1	1	3	0	1	3	9	19
	Total	4	5	8	9	7	20	15	27	48	54
Male	Eye	0	3	1	0	0	1	3	5	3	1
	Throat	30	34	34	62	111	129	209	300	375	420
	Other*	1	7	11	8	4	4	5	8	10	17
	Total	31	44	46	70	115	134	217	313	388	438
BC	Eye	1	3	2	0	0	2	4	7	4	2
	Throat	32	40	40	70	117	149	222	322	415	457
	Other*	2	7	12	9	7	4	6	11	19	36
	Total	35	50	54	79	124	155	232	340	438	495

*Other - nasopharyngeal washing, lesion, fluid from groin mass lesion, pelvic fluid, and other.
Total reports for BC is the sum of the following genders: female, male, transgender, and gender unknown.

Perinatally-acquired Gonorrhea

Gonorrhea can be passed by pregnant women to their infants during delivery which can lead to neonatal conjunctivitis (inflammation or swelling of the mucous membrane that covers the front of the eyes and the inside of the eyelids, also known as ophthalmia neonatorum). Rarely, it can spread throughout the body in a condition called disseminated gonococcal infection. No case of perinatally-acquired gonorrhea infection was reported in 2017. From 2008 to 2017, there were four cases of perinatally-acquired gonorrhea. All were found in conjunctival specimen (Figure 21).

21. Perinatally-acquired gonorrhea case reports in BC, 2008 to 2017



Counts and rates of perinatally-acquired gonorrhea case report in BC by site, 2008 to 2017

Measure	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Reports - Eye	0	1	0	0	0	1	1	1	0	0
Rate- Eye	0.0	2.2	0.0	0.0	0.0	2.3	2.2	2.3	0.0	0.0

*Rate per 100,000 live births

Gonorrhea Antimicrobial Resistance

Treatment of gonorrhea has long been challenged by the bacterium's ability to acquire resistance to multiple classes of antibiotics. Antibiotics previously effective against gonorrhea - penicillin, doxycycline, and ciprofloxacin - can no longer be used, leaving few remaining options. BC treatment guidelines currently recommend third-generation cephalosporins for the treatment of gonorrhea: injectable ceftriaxone (250 mg) or oral cefixime (800 mg), co-treated with 1 g of azithromycin.(14) Recent international surveillance data and case reports however, suggest that susceptibility of gonorrhea to these current first-line treatments is also now threatened.(15)(16) In this context, local surveillance is critical.

The BCCDC Public Health Laboratory (PHL) routinely tests *Neisseria gonorrhoeae* isolates for susceptibility to a panel of antimicrobial drug s, including cefixime, ceftriaxone, and azithromycin. Data presented here summarize the minimum inhibitory concentration (MIC) of these drugs among isolates from BC. The MIC is the lowest amount of antibiotic required to inhibit growth of the bacterium; a higher MIC means the bacterium is less susceptible to the antibiotic. Minimum inhibitory concentration (MIC) breakpoints to define "resistance" to cefixime, ceftriaxone, and azithromycin have not yet been established. However, the World Health Organization have defined decreased susceptibility to cefixime as MIC ≥0.25µg/mL and decreased susceptibility to ceftriaxone as MIC ≥0.125µg/mL.(17) The US Centers for Disease Control and Prevention (CDC) has proposed MIC 2µg/mL as elevated MIC for azithromycin.(18) The Public Health Agency of Canada's enhanced surveillance of antimicrobial resistant gonorrhea uses the same breakpoints.(19)

A total of 4,311 isolates were tested between 2008 and 2017, representing 19.9% (4,311/21,665) of all gonorrhea cases reported in the province. Forty-six percent (1,966/4,311) of isolates tested for drug susceptibility were sampled from the urethra, 23.4% (1,007/4,311) from the rectum, 11.5% (496/4,311) from the cervix, and 12.5% (537/4,311) from the throat.

Since 2008, 0.5% (21/4,311) of isolates showed decreased susceptibility to cefixime (i.e. MIC ≥0.25µg/mL) and 0.8% (33/4,311) of isolates showed decreased susceptibility to ceftriaxone (i.e. MIC ≥0.125µg/mL) (Figure 22). Fortunately, no treatment failures were reported in BC during this period. The increasing trend in percentage of isolates with elevated MIC (i.e., reduced susceptibility) to cefixime or ceftriaxone observed in 2008-2010 reversed in 2011-2016 for ceftriaxone, and in 2011-2015 for cefixime. However, the proportion of isolates with elevated MICs for cefixime and ceftriaxone have increased in recent years. Similarly, the increasing trend in percentage of isolates with elevated MIC to azithromycin in 2008-2011 was reversed in 2012-2016 before a slight increase in 2017.

The marked decline observed from 2011 onward for reduced susceptibility to cefixime or ceftriaxone among tested isolates is encouraging and, may in part be due to changes in the Canadian and provincial gonorrhea treatment guidelines to more effective regimens (i.e. increased cefixime dosage or improved medication adherence due to single dosage). These trends will be closely monitored in order to inform the future evolution of gonorrhea treatment recommendations. The continued threat of emerging resistance reinforces the need for STI prevention and control measures such as increased testing for gonorrhea, partner testing and treatment of gonorrhea, tests of cure, as well as the need for antibiotic stewardship to ensure effective treatments for bacterial infections.

22. Percentage of tested *N. gonorrhoeae* isolates with elevated minimum inhibitory concentrations (MIC) to Cefixime, Ceftriaxone, and Azithromycin in BC, 2008 to 2017

Elevated MIC defined here as ≥0.064µg/mL for cefixime/ceftriaxone and ≥0.5µg/mL for azithromycin.

Pelvic Inflammatory Disease and Ectopic Pregnancy

Pelvic inflammatory disease (PID) and ectopic pregnancy (EP) are medical conditions in women that can be caused by chlamydia or gonorrhea infection. Examination of the rates of these conditions can provide an indication of the complications of chlamydia and gonorrhea infections. Included in this report are data of physician billings to the BC Medical Services Plan (MSP) (representing outpatient diagnosis (e.g. doctor's office)) and hospital discharges from the discharge abstracts database (DAD) (representing inpatient diagnosis). Both MSP and DAD data were provided by the BC Ministry of Health.

In BC, there has been an overall decrease in hospital discharges relating to both PID and EP, with the largest decline in hospital discharges related to EP observed between 2015 and 2017. During the same time period, the rate of physician billing related to EP has been increasing.

This inverse relationship may be due to a shift in treating EP as outpatient rather than in hospital. This paradoxical trend of decreasing EP and PID while increasing rates of chlamydia and gonorrhea may be a result of targeted screening programs that have led to earlier diagnosis and treatment of chlamydia and gonorrhea that may reduce the probability of complications like PID and EP. Notably, there are causes for PID and EP other than chlamydia and gonorrhea and thus, further analysis are needed to understand the changes in PID and EP epidemiology.

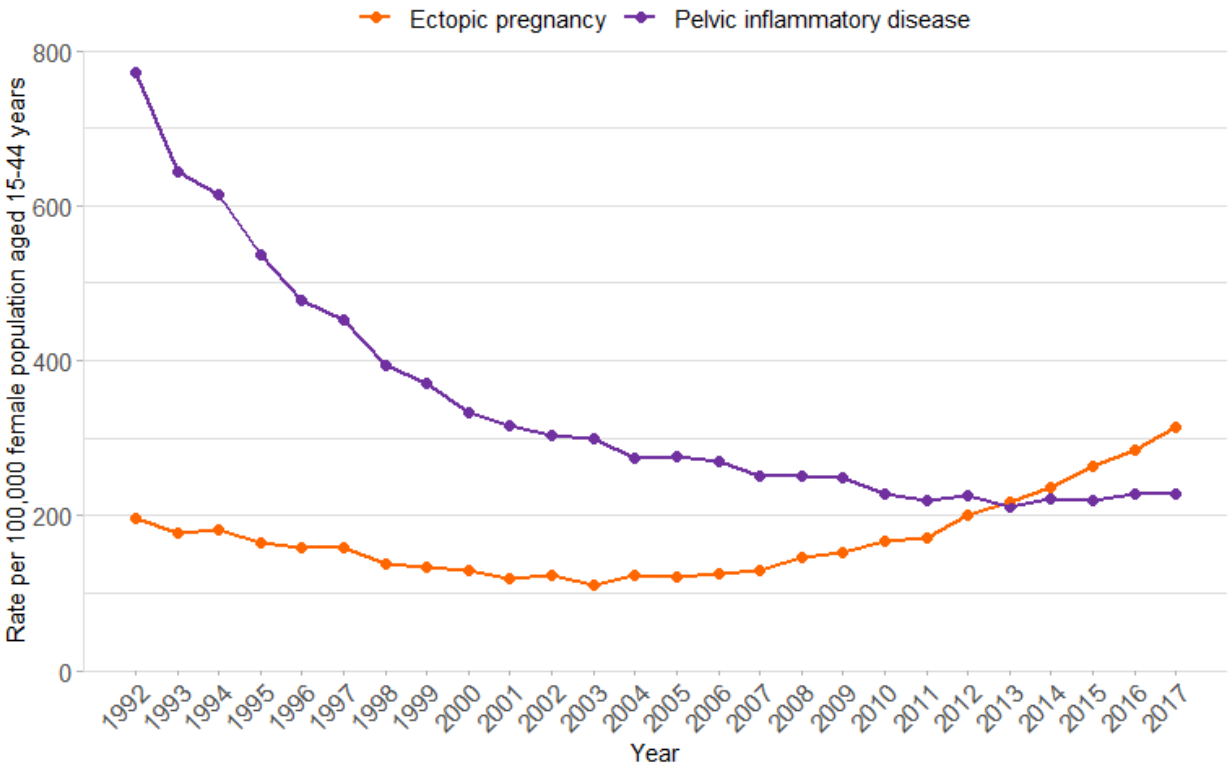
Pelvic Inflammatory Disease

In 2017, the rate of physician billings related to PID increased slightly to 228.5 (2,141 physician billings) from 227.5 (2,108 physician billings) per 100,000 women aged 15-44 years in 2016 (Figure 23). During the same time period, rate of hospital discharges related to PID decreased to 25.4 (238 hospital discharges) in 2017 from 30.3 (281 hospital discharges) per 100,000 women aged 15-44 years in 2016 (Figure 24).

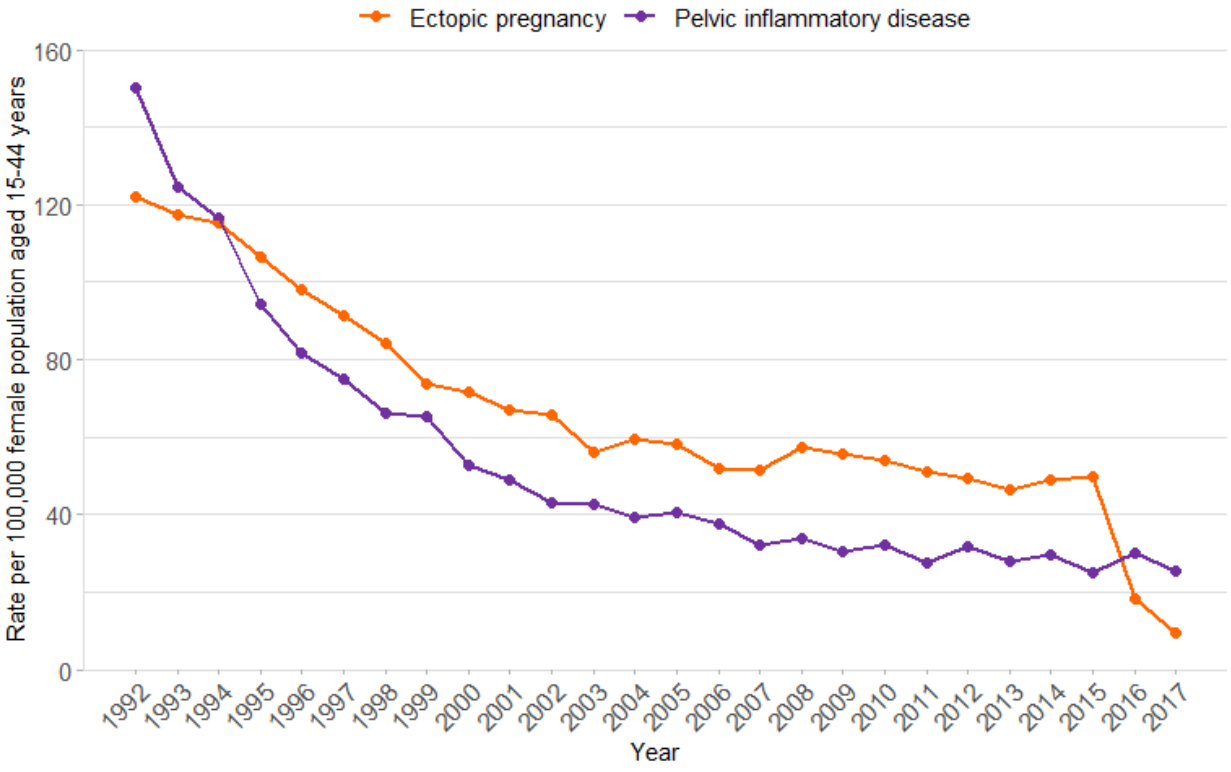
Ectopic Pregnancy

The rate of physician billings related to EP increased to 314.4 (2,946 physician billings) in 2017 from 284.9 (2,639 physician billings) per 100,000 women aged 15-44 years in 2016 (Figure 23). The rate of hospital discharges related to EP has dropped considerably over the past few years, from 50.0 (460 hospital discharges) in 2015, to 9.5 (89 hospital discharges) per 100,000 women aged 15-44 years in 2017 (Figure 24). As described above, this inverse relationship may be due to a shift in treating EP as outpatient rather than in hospital.

23. Case reports of women aged 15-44 years with a physician billing related to pelvic inflammatory disease (PID) or ectopic pregnancy (EP) in BC, 1992 to 2017



24. Case reports of women aged 15-44 years with a hospital discharge related to pelvic inflammatory disease (PID) or ectopic pregnancy (EP) in BC, 1992 to 2017



Infectious Syphilis

Infectious Syphilis by Region, Gender, and Age

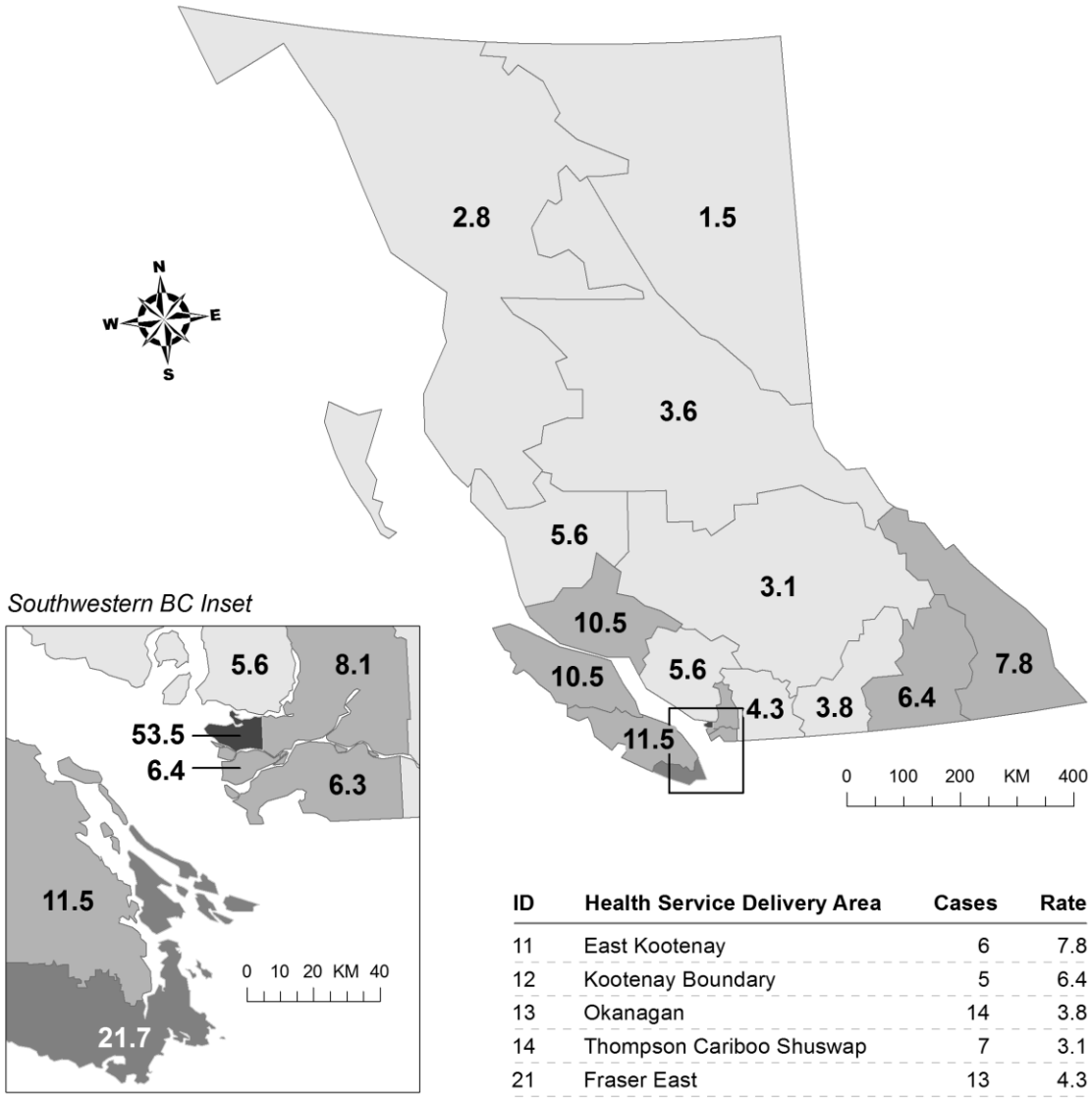
Syphilis infections are divided into several stages: primary, secondary, early latent, and late latent. In the primary stage of syphilis there is a painless lesion (called a chancre). Because it is painless, it may not be recognized as syphilis. The lesion then resolves but the person is still infected with syphilis. In the secondary stage, syphilis is disseminated throughout the body and can cause a variety of symptoms, like rashes, nausea and fever. These symptoms will also resolve and the person enters in asymptomatic phase (the latent phase). The latent stage is divided into early (<1 year) and late latent (>1 year). Without treatment, syphilis infection can lead to serious complications, including cardiovascular and neurologic disease, and may be fatal.

Following a decline in rates in BC in the early 1990's, infectious syphilis (i.e., primary, secondary, and early latent stages) began to re-emerge in BC starting in 1997, corresponding to a series of outbreaks in different populations. While provincial trends had been decreasing in 2009-2010, infectious syphilis rates began to increase in 2010. In 2017, the rate was 14.2 per 100,000 (over four times the rate in 2010 (3.4 per 100,000). The highest rate of infectious syphilis was in the Vancouver Coastal Health Authority (Figure 25). Across Health Service Delivery Areas, the highest rates were in Vancouver and South Vancouver Island (Figure 25).

The majority of infectious syphilis cases in BC are male (Figure 28). Although male infectious syphilis rates decreased in 2009-2010, male infectious syphilis rates rose to 30.7 (725 cases) per 100,000 population in 2016. In 2017, the rate among males declined slightly, to 26.9 per 100,000 population (643 cases). Males aged 25-39 continue to have higher rates of infectious syphilis than other age groups (Figure 28 and 31). In 2017, the rate of infectious syphilis among females was 1.4 (35 cases) per 100,000, similar to 2016 (Figure 28).

In 2017, 588 cases (86.0%) discussed sexual partners with public health nurses, reporting a total of 3,563 partners (1,815 (50.9%) anonymous, and 1,748 (49.1%) notifiable). Out of the 588 cases, 461 (78.4 %) individuals reported at least one notifiable partner, with 96 of those cases (20.8 %) delegating partner follow up to public health nurses (for at least one partner). Public health nurses were subsequently asked to contact 287 notifiable partners (of the total 1,748 notifiable partners).

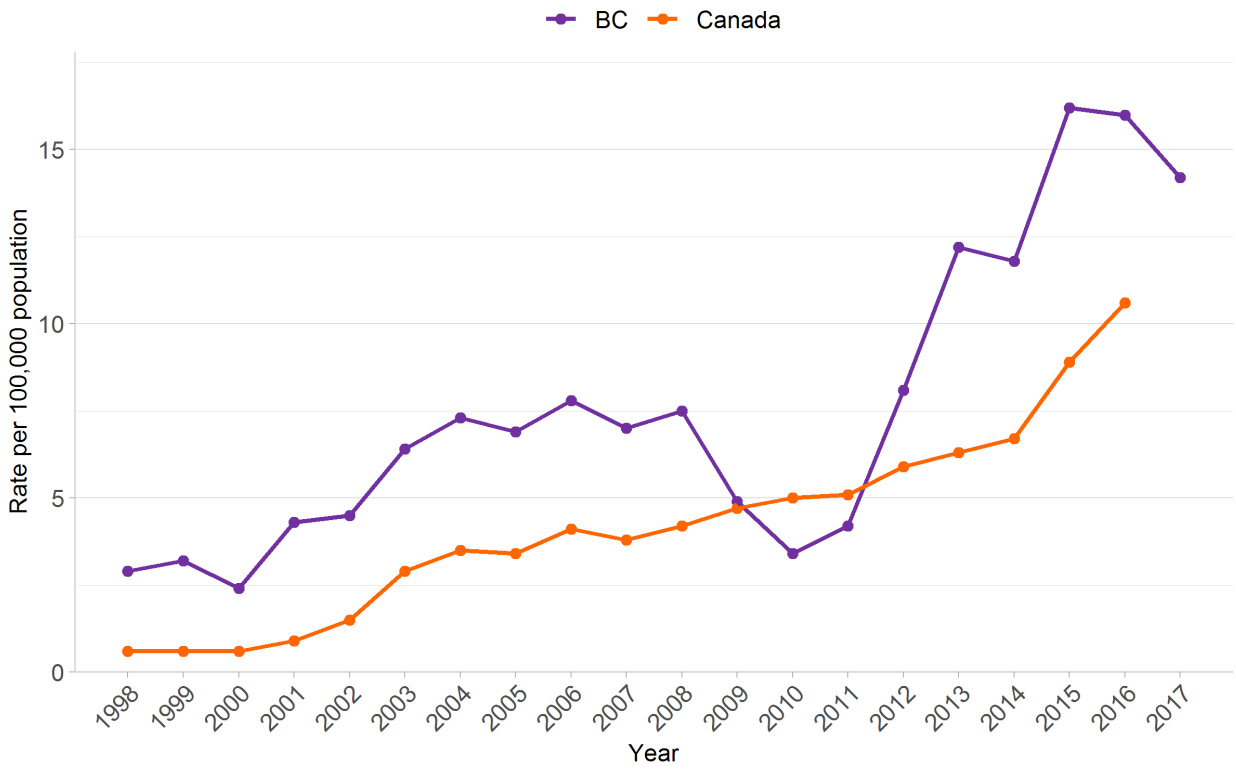
25. Infectious syphilis case reports in BC by health service delivery area, 2017



ID	Health Service Delivery Area	Cases	Rate
11	East Kootenay	6	7.8
12	Kootenay Boundary	5	6.4
13	Okanagan	14	3.8
14	Thompson Cariboo Shuswap	7	3.1
21	Fraser East	13	4.3
22	Fraser North	54	8.1
23	Fraser South	53	6.3
31	Richmond	14	6.4
32	Vancouver	362	53.5
33	North Shore/Coast Garibaldi	16	5.6
41	South Vancouver Island	85	21.7
42	Central Vancouver Island	32	11.5
43	North Vancouver Island	13	10.5
51	Northwest	2	2.8
52	Northern Interior	5	3.6
53	Northeast	1	1.5

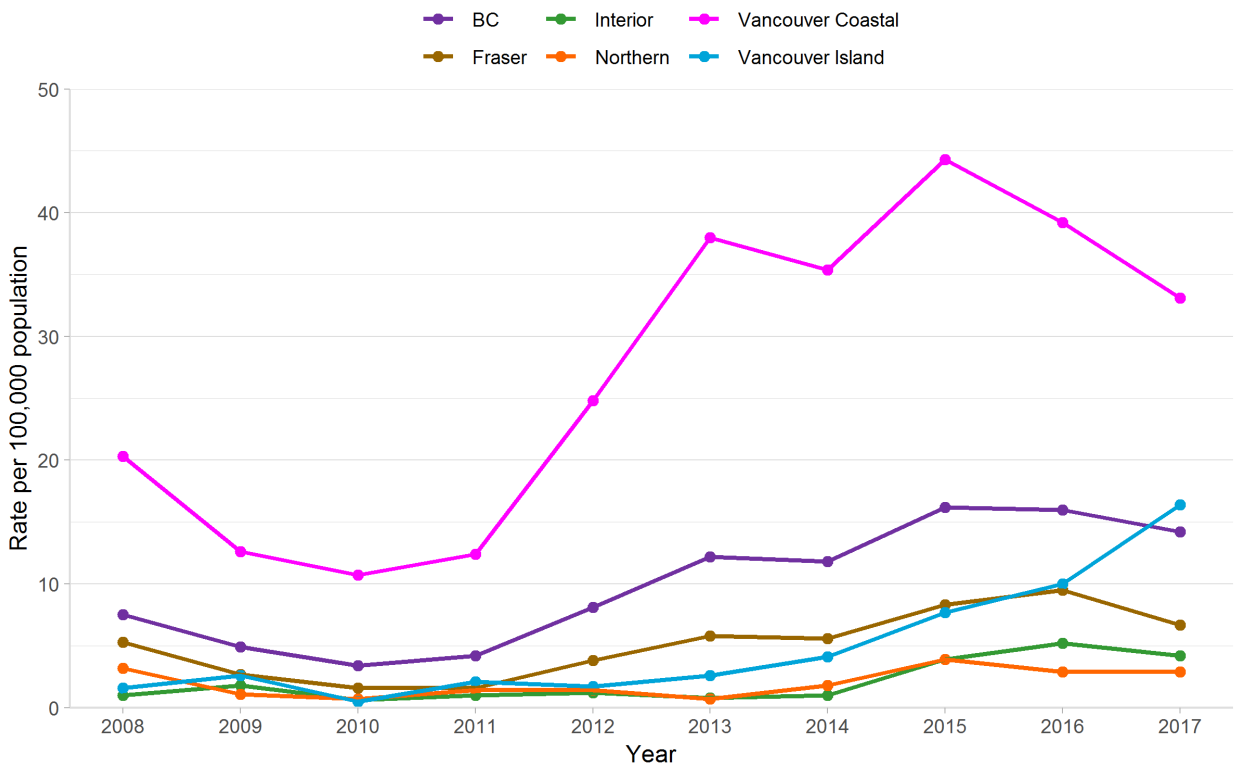
Rates calculated with population estimates released by BC Stats.

26. Infectious syphilis case reports in BC and Canada, 2008 to 2017*

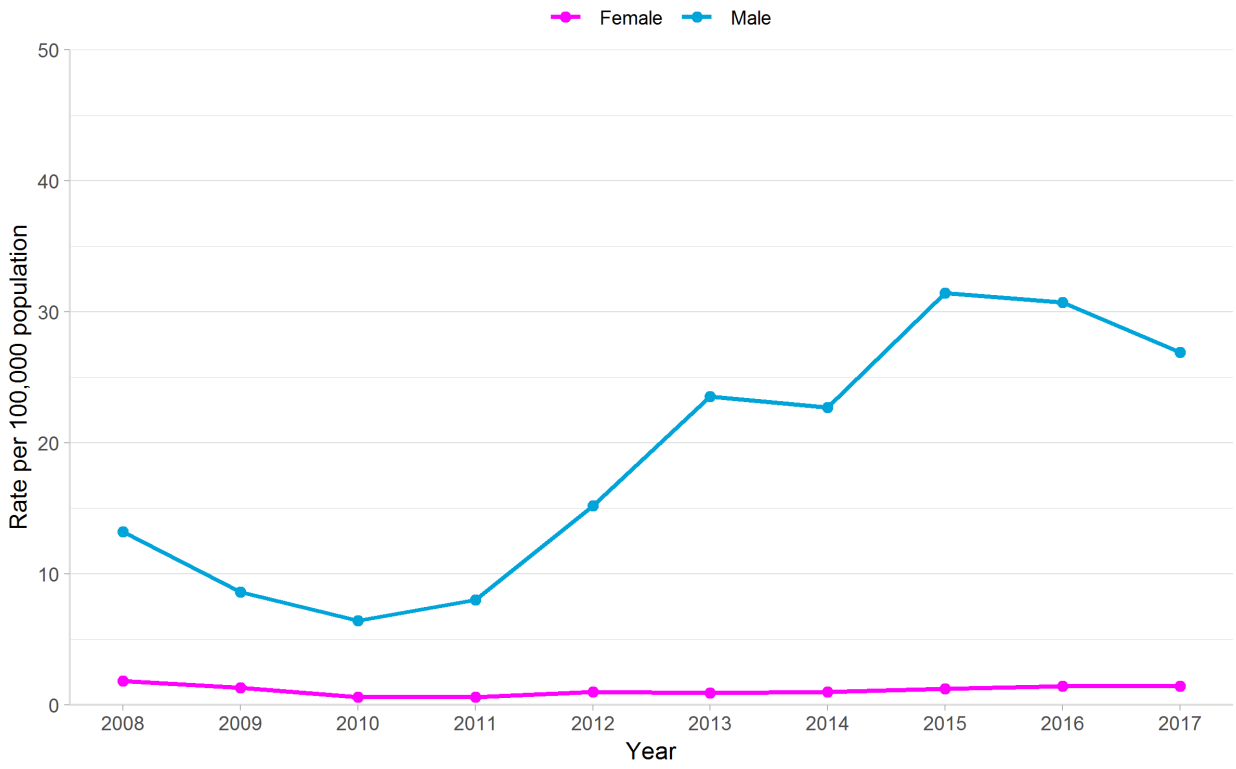


*2017 Canadian rate was not available at time of publication

27. Infectious syphilis case reports in BC by health authority, 2008 to 2017



28. Infectious syphilis case reports in BC by gender, 2008 to 2017



Rates of infectious syphilis case reports in BC by gender, 2008 to 2017

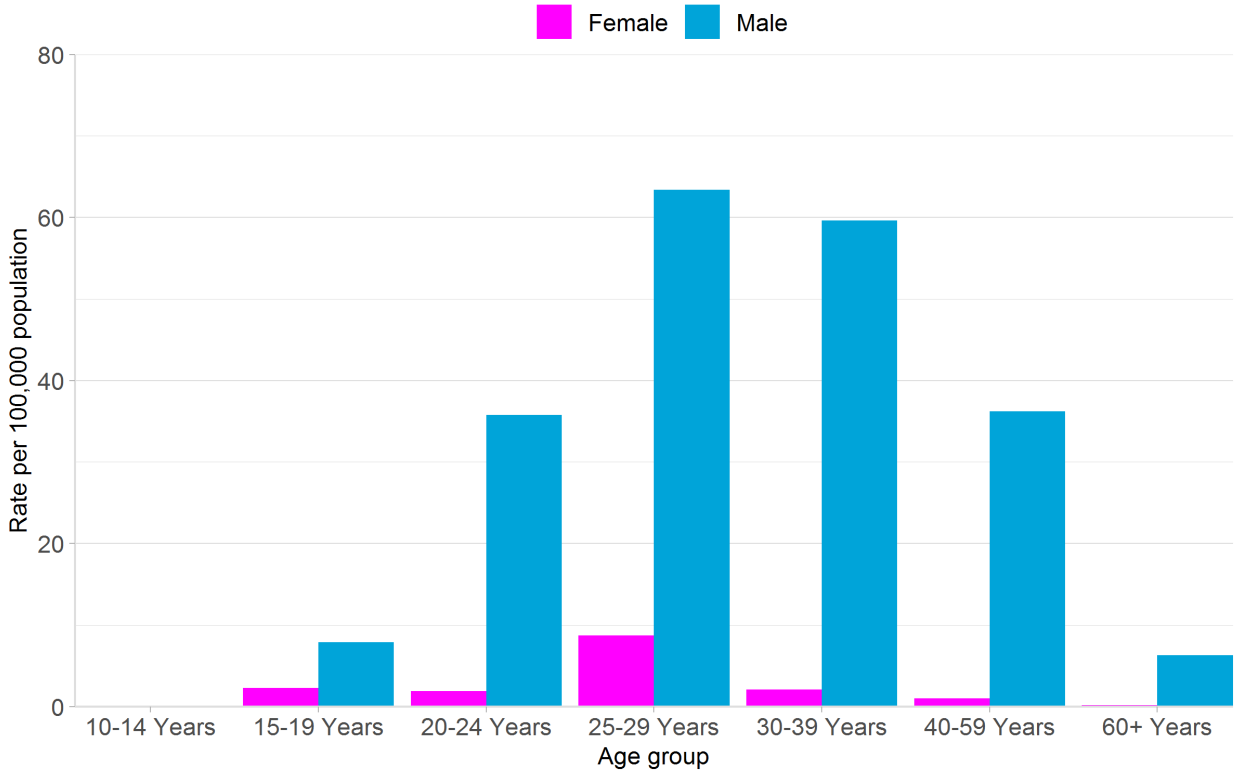
Gender	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Female	1.8	1.3	0.6	0.6	1.0	0.9	1.0	1.2	1.4	1.4
Male	13.2	8.6	6.4	8.0	15.2	23.5	22.7	31.4	30.7	26.9
BC Total	7.5	4.9	3.4	4.2	8.1	12.2	11.8	16.2	16.0	14.2

Counts of infectious syphilis case reports in BC by gender, 2008 to 2017

Gender	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Female	40	28	13	13	24	20	24	28	33	35
Male	286	188	141	178	344	537	524	732	725	643
Other*	2	1	0	0	1	2	1	0	1	5
BC Total	328	217	154	191	369	559	549	760	759	683

*Other- transgender and gender unknown

29. Infectious syphilis case reports in BC by age group and gender, 2017



Rates of infectious syphilis case reports in BC by age group and gender, 2017

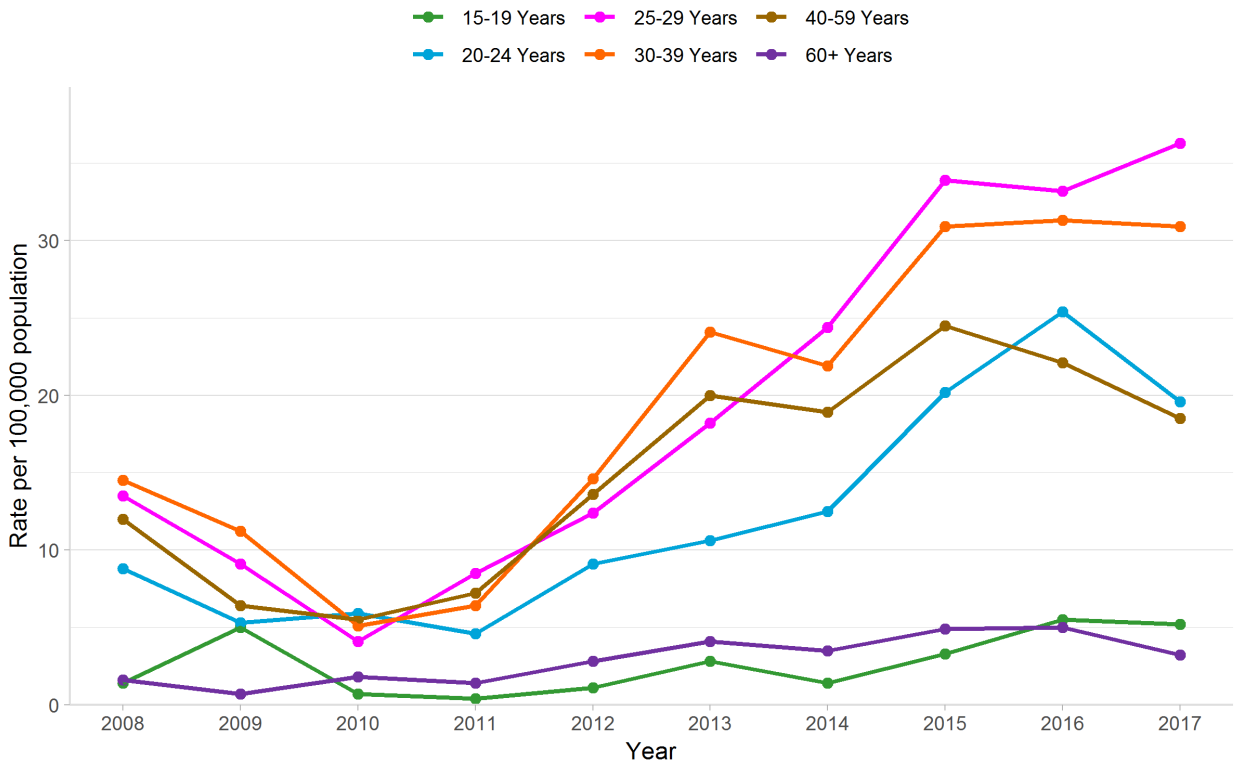
Gender	10-14 Years	15-19 Years	20-24 Years	25-29 Years	30-39 Years	40-59 Years	60+ Years
Female	0.0	2.3	1.9	8.7	2.1	1.0	0.2
Male	0.0	7.9	35.8	63.4	59.6	36.2	6.3

Counts of infectious syphilis case reports in BC by age group and gender, 2017

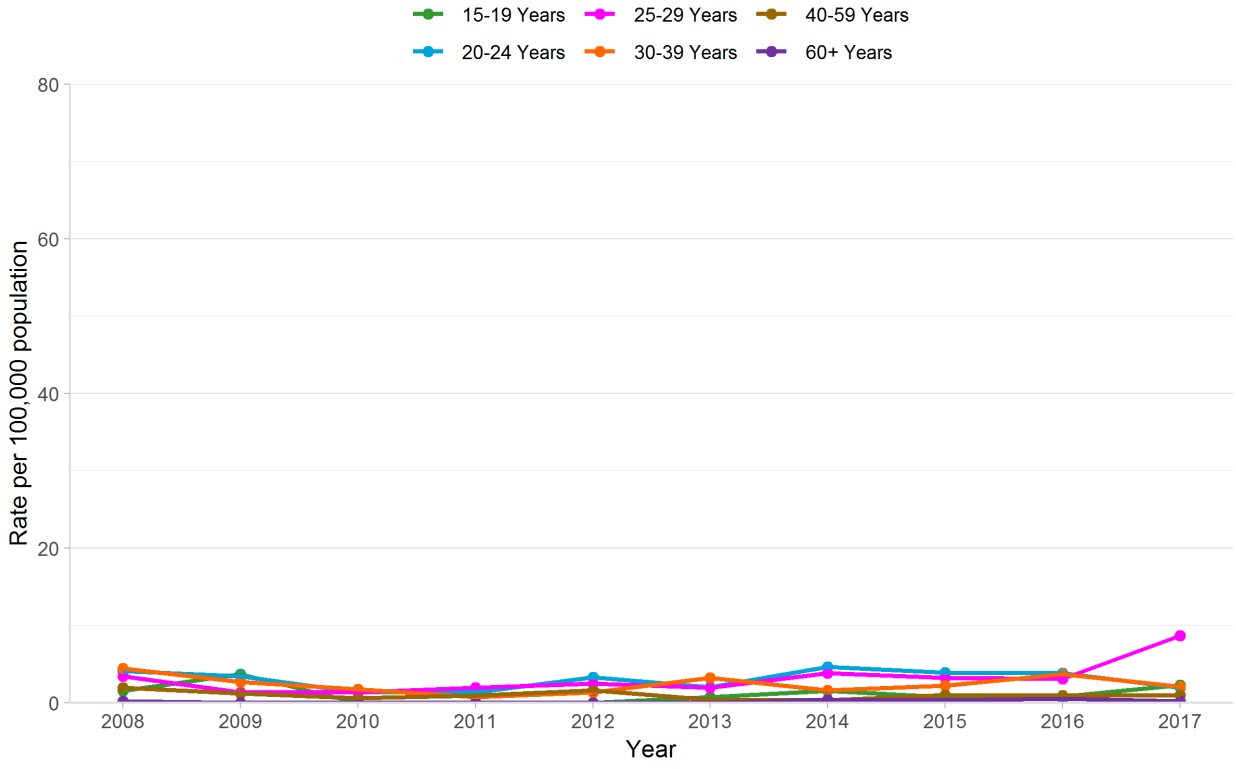
Gender	10-14 Years	15-19 Years	20-24 Years	25-29 Years	30-39 Years	40-59 Years	60+ Years
Female	0	3	3	14	7	7	1
Male	0	11	62	104	193	237	36
Other*	0	0	0	0	2	2	1

*Other- transgender and gender unknown

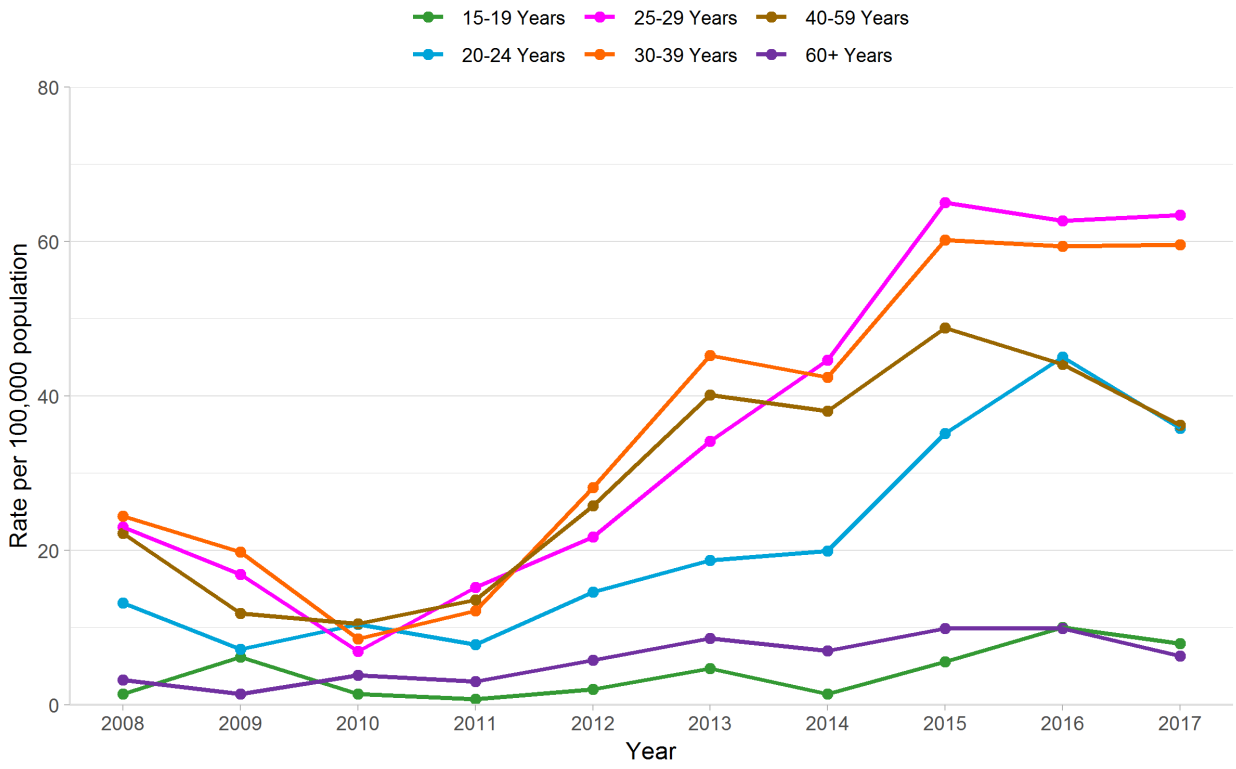
30. Infectious syphilis case reports in BC by age group - total, 2008 to 2017



31. Infectious syphilis case reports in BC by age group - female, 2008 to 2017



32. Infectious syphilis case reports in BC by age group - male, 2008 to 2017



Infectious Syphilis by Ethnicity

In males, 37.8% of cases in 2017 were among people who identified as Caucasian (Table 34). In comparison, most females in 2017 identified as either Caucasian (3 cases, 8.6%) or Asian (3 cases, 8.6%) however, the trends are highly variable due to the small number of female cases each year (35 cases in 2017) (Table 33). At the time of this report, the ethnicity of 309 cases (45.2%) was unknown and so caution is recommended when interpreting these data.

33. Percentage of infectious syphilis case reports in BC by ethnicity - total, 2008 to 2017

Ethnicity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
No. Diagnoses	328	217	154	191	369	559	549	760	759	683
Caucasian	62.5	59.9	68.2	66.0	55.3	50.8	48.3	47.9	44.3	36.2
Indigenous	8.8	8.3	3.9	3.7	4.6	3.6	2.7	2.9	2.5	2.3
Asian	10.1	5.5	11.0	9.9	8.9	9.8	11.8	7.6	6.6	8.5
South Asian	4.3	1.4	2.6	5.8	2.7	2.9	1.8	1.6	1.8	1.9
Hispanic	4.3	9.7	1.9	6.8	5.7	5.0	5.1	4.9	4.2	3.5
Black	2.7	2.8	1.9	0.5	1.1	1.6	1.8	0.5	1.2	0.7
Other*	2.7	3.7	1.9	4.7	1.9	1.8	1.5	1.8	1.3	1.6
Unknown	4.6	8.8	8.4	2.6	19.8	24.5	27.0	32.8	38.1	45.2

*Other- Arab/West Asian and other/mixed ethnicity

34. Percentage of infectious syphilis case reports in BC by ethnicity - female, 2008 to 2017

Ethnicity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
No. Diagnoses	40	28	13	13	24	20	24	28	33	35
Caucasian	27.5	39.3	61.5	38.5	25.0	15.0	4.2	14.3	15.2	8.6
Indigenous	30.0	28.6	15.4	15.4	16.7	15.0	8.3	17.9	6.1	5.7
Asian	12.5	0.0	0.0	23.1	16.7	15.0	25.0	7.1	9.1	8.6
South Asian	10.0	3.6	0.0	7.7	8.3	10.0	0.0	0.0	3.0	0.0
Hispanic	0.0	0.0	0.0	7.7	0.0	5.0	0.0	3.6	0.0	2.9
Black	2.5	3.6	7.7	0.0	4.2	0.0	0.0	0.0	0.0	0.0
Other*	0.0	10.7	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0
Unknown	17.5	14.3	15.4	7.7	29.2	40.0	62.5	53.6	66.7	74.3

*Other- Arab/West Asian and other/mixed ethnicity

35. Percentage of infectious syphilis case reports in BC by ethnicity - male, 2008 to 2017

Ethnicity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
No. Diagnoses	**286**	**188**	**141**	**178**	**344**	**537**	**524**	**732**	**725**	**643**
Caucasian	67.5	63.3	68.8	68.0	57.3	52.1	50.4	49.2	45.5	37.8
Indigenous	5.6	5.3	2.8	2.8	3.8	3.2	2.5	2.3	2.3	2.0
Asian	9.8	6.4	12.1	9.0	8.4	9.7	11.3	7.7	6.5	8.6
South Asian	3.5	1.1	2.8	5.6	2.3	2.6	1.9	1.6	1.8	2.0
Hispanic	4.9	11.2	2.1	6.7	6.1	5.0	5.3	4.9	4.4	3.4
Black	2.8	2.7	1.4	0.6	0.9	1.7	1.9	0.5	1.2	0.8
Other*	3.1	2.1	2.1	5.1	2.0	1.7	1.5	1.8	1.4	1.7
Unknown	2.8	8.0	7.8	2.2	19.2	24.0	25.2	32.0	36.8	43.7

*Other- Arab/West Asian and other/mixed ethnicity

Infectious Syphilis among Indigenous Peoples

This section describes cases of infectious syphilis among people who self-identify as Indigenous (i.e., First Nations, Inuit, and/or Métis). Among the nearly 270,000 Indigenous persons living in BC, representing about 6% of the general BC population, approximately 65% are First Nations, 33% are Métis, and fewer than 1% are Inuit or of other Indigenous identity (20). This section is included in response to the Truth and Reconciliation Commission of Canada's Call to Action 19 to assess progress and long term trends towards closing health gaps between Indigenous and non-Indigenous peoples (21).

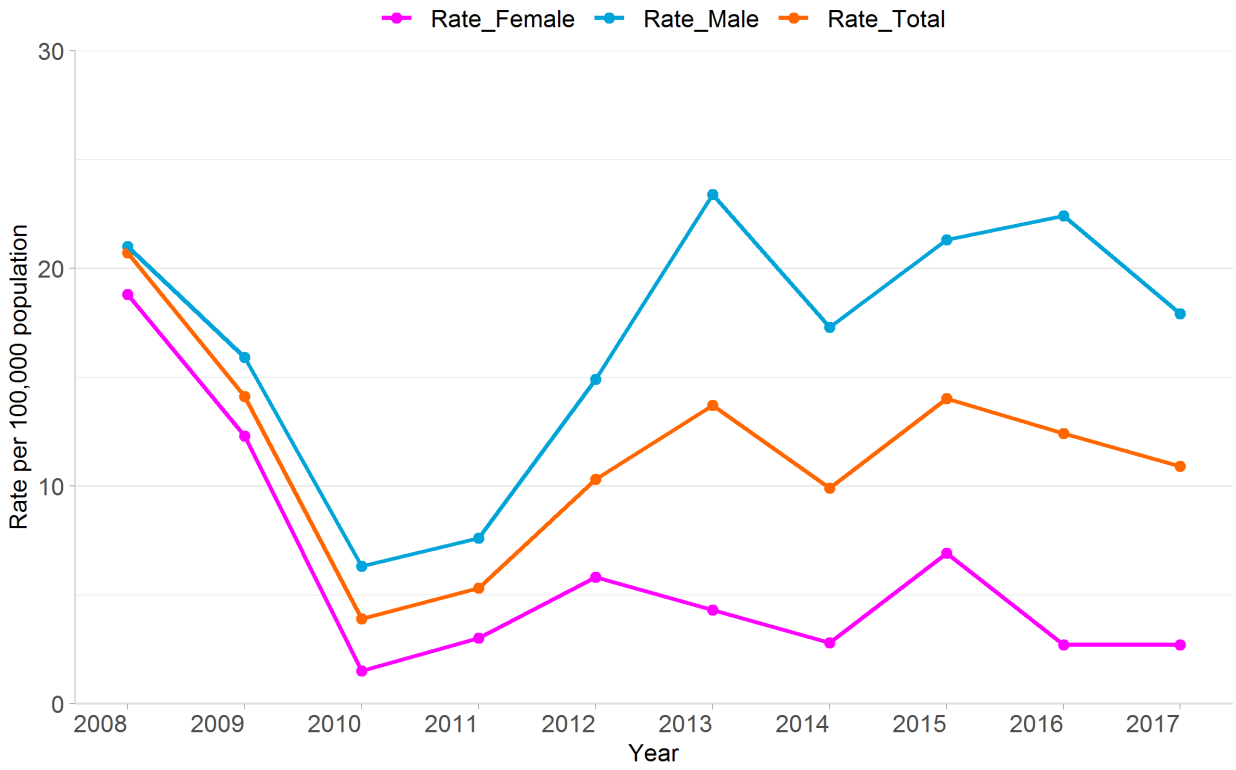
Statistics can help us understand the impact of syphilis among Indigenous peoples in BC but they tell only part of the story. Behind each individual with syphilis counted in this report is a family, a community, and a broader social and economic context. Indigenous peoples face inequities in health from colonial legacies, and can experience additional barriers to syphilis testing and care, such as concerns about confidentiality, access to testing, and racism. Although this surveillance report will focus on simple statistics, we acknowledge the complex factors that determine health and recognize that Indigenous peoples and communities hold many strengths to draw on to address syphilis prevention, care, treatment, and support.

From 2008 to 2017, the proportion of infectious syphilis cases who identified as Indigenous ranged from 2.3% to 8.8% (16 to 29 cases) annually (Table 33). These trends should be interpreted with caution given the large proportion of cases with unknown ethnicity, ranging from 19.8% in 2012 to 45.2% in 2017 (Table 33).

Due to the small number of cases and the limited availability of population estimates of Métis and Inuit people, the remainder of this section focuses on infectious syphilis cases among people who identify as First Nations. The population estimates for status First Nations people are used for rate calculations. For further details, see the Technical Appendix.

Consistent with overall provincial trends, there appears to be an increase in the rate of infectious syphilis among First Nations people since 2010 (Figure 36). First Nations men have consistently higher rates compared to First Nations women over this time period. Note that these rates may be underestimated given the large proportion of unknown ethnicity data among infectious syphilis cases. For further details about how data was collected, see the Technical Appendix.

36. Infectious syphilis case reports among First Nations people in BC by gender, 2008 to 2017



Gender	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Male	21.0	15.9	6.3	7.6	14.9	23.4	17.3	21.3	22.4	17.9
Female	18.8	12.3	1.5	3.0	5.8	4.3	2.8	6.9	2.7	2.7
Total	20.7	14.1	3.9	5.3	10.3	13.7	9.9	14.0	12.4	10.9

*Rates based on First Nations population estimates from the former Aboriginal and Northern Development Canada now known as Indigenous Services Canada

Infectious Syphilis by Exposure Category

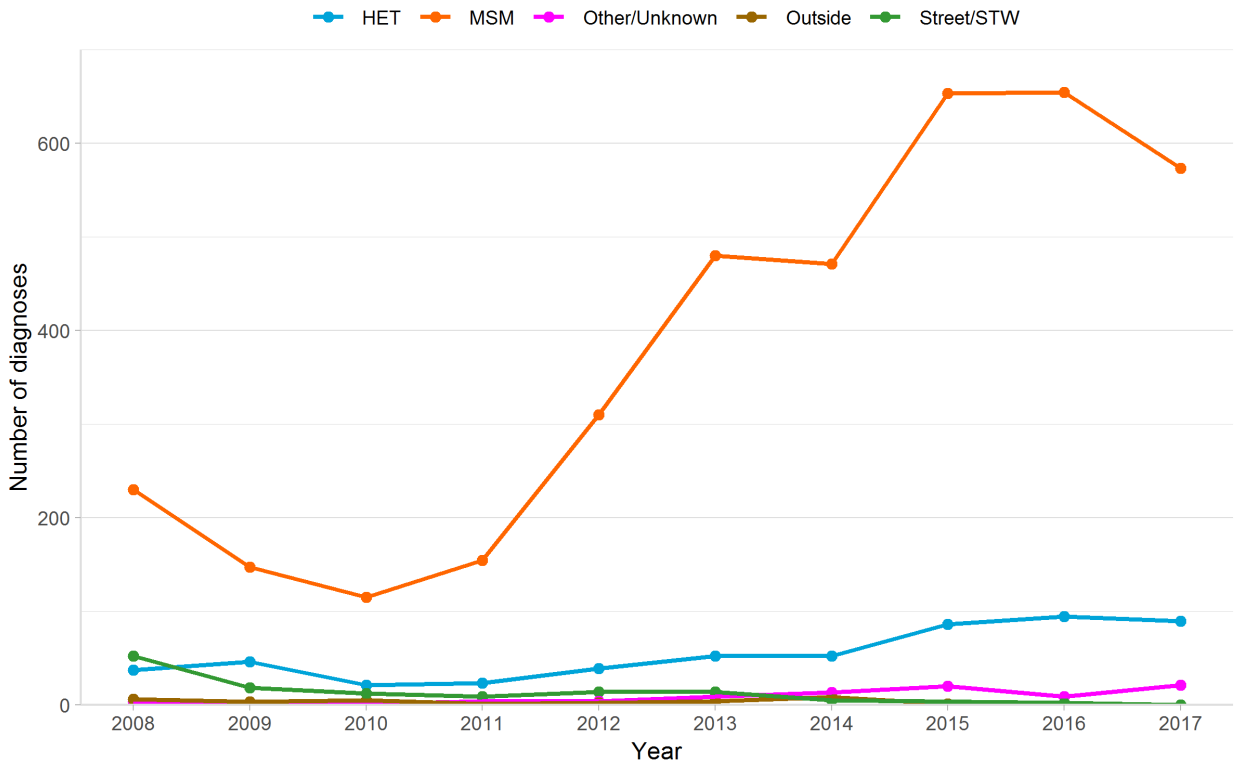
Gay, bisexual, and other men who have sex with men (MSM) continue to comprise the greatest number of infectious syphilis cases in BC (Figure 37). The number of syphilis cases among MSM declined in 2017 to 573 cases (83.4% of all cases) compared to 654 cases (86.2%) in 2016. The proportion of infectious syphilis cases among heterosexual persons without other risk factors increased slightly in 2017 (13.0%, 89 cases; 12.4%, 94 cases, in 2016). Trends among MSM in BC are explored in more detail in the next section.

37. Infectious syphilis case reports in BC by exposure category and health authority, 2008 to 2017

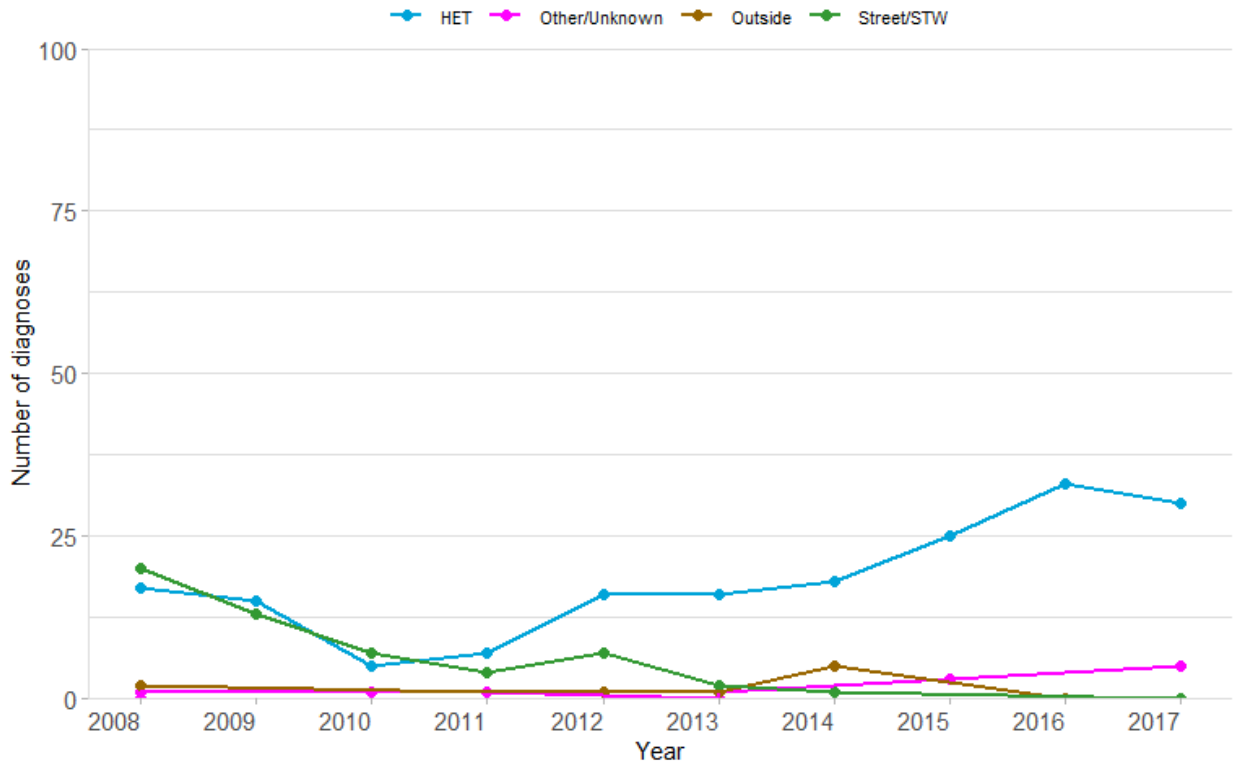
Health Authority	Exposure Category	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Interior	HET	2	7	2	4	2	2	2	6	11	10
	MSM	2	4	1	3	6	4	3	23	27	21
	Street/STW	3	1	1	0	0	0	0	0	0	0
	Outside	0	0	0	0	1	0	1	0	0	0
	Other/UNK	0	1	0	0	0	0	1	0	1	1
Fraser	HET	15	13	5	8	12	19	11	33	36	18
	MSM	41	25	17	15	46	73	79	107	132	97
	Street/STW	20	4	2	2	4	4	1	0	1	0
	Outside	5	1	2	0	1	1	2	0	0	0
	Other/UNK	1	0	0	2	1	1	3	6	1	5
Vancouver Coastal	HET	14	18	11	7	19	25	30	32	37	30
	MSM	179	110	94	121	248	388	360	469	416	352
	Street/STW	23	6	9	6	9	10	4	0	0	0
	Outside	1	2	3	1	0	3	4	1	0	0
	Other/UNK	1	1	1	2	3	6	9	10	6	10
Vancouver Island	HET	2	7	1	3	3	6	8	13	9	29
	MSM	7	7	3	13	10	13	22	42	67	96
	Other/UNK	1	1	0	0	0	1	0	4	1	5
	Outside	0	0	0	0	0	0	1	0	0	0
	Other/UNK	1	1	0	0	0	1	0	4	1	5
Northern	HET	4	1	2	1	3	0	1	1	1	1
	MSM	1	0	0	2	0	1	4	10	7	7
	Street/STW	4	2	0	1	1	0	0	0	0	0
	Other/UNK	0	0	0	0	0	1	0	0	0	0
Outside BC	HET	0	0	0	0	0	0	0	1	0	1
	MSM	0	1	0	0	0	1	3	2	5	0
	Street/STW	0	1	0	0	0	0	0	0	0	0
BC	HET	37	46	21	23	39	52	52	86	94	89
	MSM	230	147	115	154	310	480	471	653	654	573
	Street/STW	52	18	12	9	14	14	5	0	2	0
	Outside	6	3	5	1	2	4	8	1	0	0
	Other/UNK	3	3	1	4	4	9	13	20	9	21

MSM – gay, bisexual, other men who have sex with men
Street/STW - street involved / sex trade worker or patron
HET - heterosexual contact
Outside - acquired outside of Canada
UNK - exposure unknown

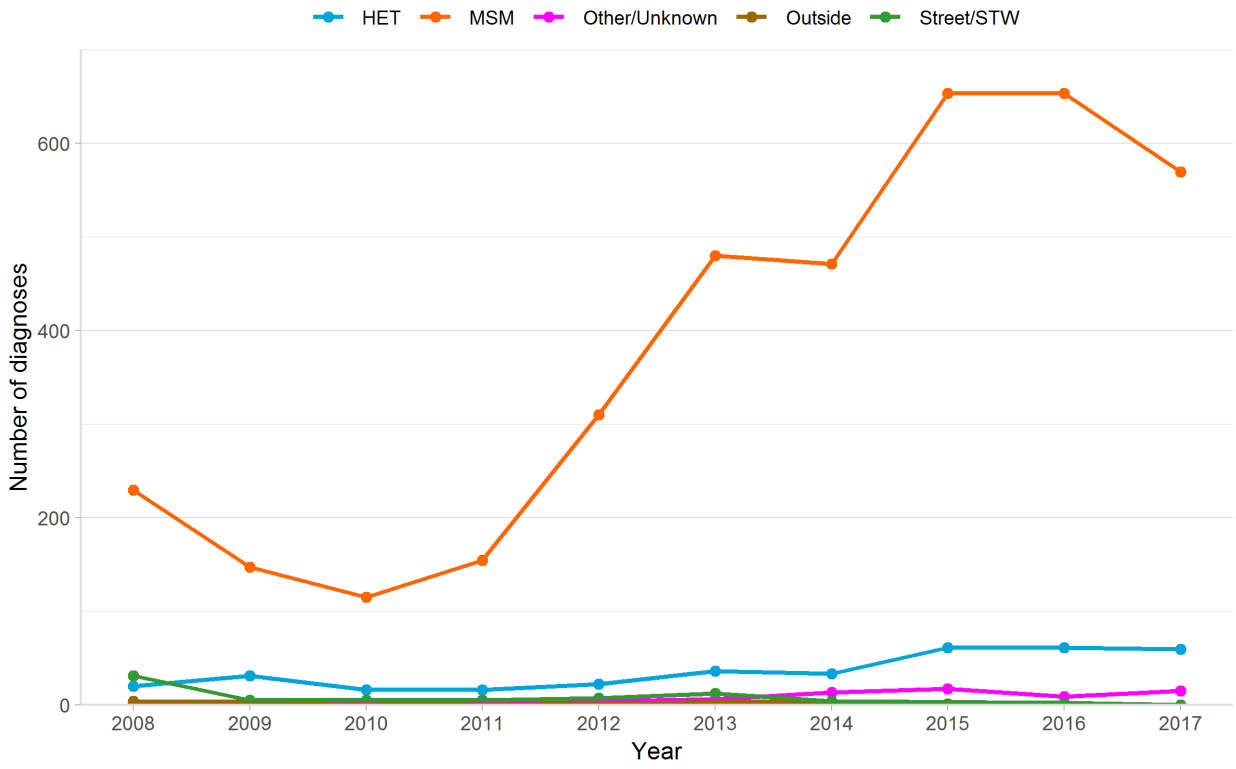
38. Infectious syphilis case reports in BC by exposure category - total, 2008 to 2017



39. Infectious syphilis case reports in BC by exposure category - female, 2008 to 2017



40. Infectious syphilis case reports in BC by exposure category - male, 2008 to 2017



Infectious Syphilis among Men who have Sex with Men

Gay, bisexual, and other men who have sex with men (MSM) continue to be disproportionally affected by the current infectious syphilis epidemic in BC, constituting 83.4% (573/683 cases) of all cases in 2017 (Figure 37). The number of infectious syphilis cases among MSM has been steadily increasing since 2011. This is similar to the profile of syphilis epidemics in other Canadian provinces (22), the US (23), and several European countries (24) where syphilis cases were also predominantly among MSM and trends are increasing.

There were 573 cases among MSM in 2017. Despite recent increases in the number of annual cases, the characteristics of MSM with syphilis have remained similar over time. In 2017, the mean age of MSM diagnosed with syphilis was 39 years (range 17-79 years). In 2017, the majority of cases resided in the Lower Mainland with 57.8% (331 cases) residing in Vancouver and 16.9% (97 cases) in Fraser. As in previous years, the majority of cases in 2017 were among Caucasian (233 cases, 43.1%), Asian (51 cases, 9.2%), and Hispanic (23 cases, 4.1%) men (Table 41).

Living with HIV continues to be an important risk factor associated with infectious syphilis. In 2017, 554 MSM cases (96.7%) had a known HIV status, of these, 42.6% (236 cases) were living with HIV at the time of their syphilis diagnosis which is around the same as 2016 (273/634 cases, 43.1%) (Figure 43). The possible roles of core sexual networks and the biological synergy between HIV and syphilis are important areas of study which may help explain this trend. Coordinated public health follow-up, promotion of condom use, partner notification, and partner testing for all syphilis cases remain the cornerstone to controlling the syphilis epidemic for MSM in BC as do efforts to raise awareness among MSM. Given the continued increase of syphilis cases, the enhancement of ongoing programs and development of new syphilis control interventions for MSM remain a priority in BC.

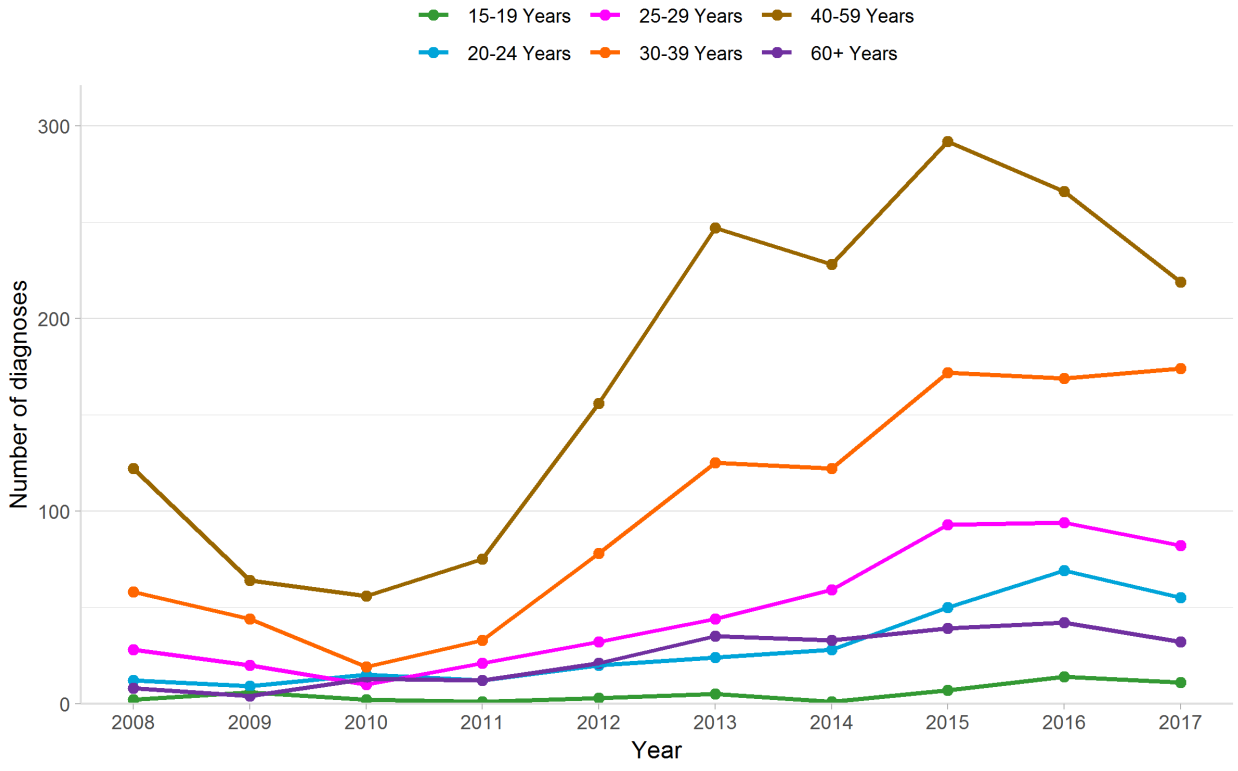
There have been slow changes in the proportion of infectious syphilis cases by stage of infection among MSM (i.e., primary, secondary, and early latent) over time. However, the proportion of infectious syphilis cases among MSM in the early latent stage of infection has steadily increased over time. This may reflect a greater uptake of syphilis screening, as people with syphilis infections in the early latent stage of infection are symptomatic. In 2017, 177 (25.9%) MSM infectious syphilis cases had a prior syphilis diagnosis within the past five years, highlighting the importance of repeat infections in the current epidemic. (25)(26) In 2017, 20.1% (115 cases) were diagnosed with primary syphilis, 16.8% (96 cases) with secondary syphilis, and 66.5% (381 cases) were diagnosed with early latent infection. In 2017, 177 (25.9%) (Figure 44).

41. Percentage of infectious syphilis case reports among MSM in BC by ethnicity, 2008 to 2017

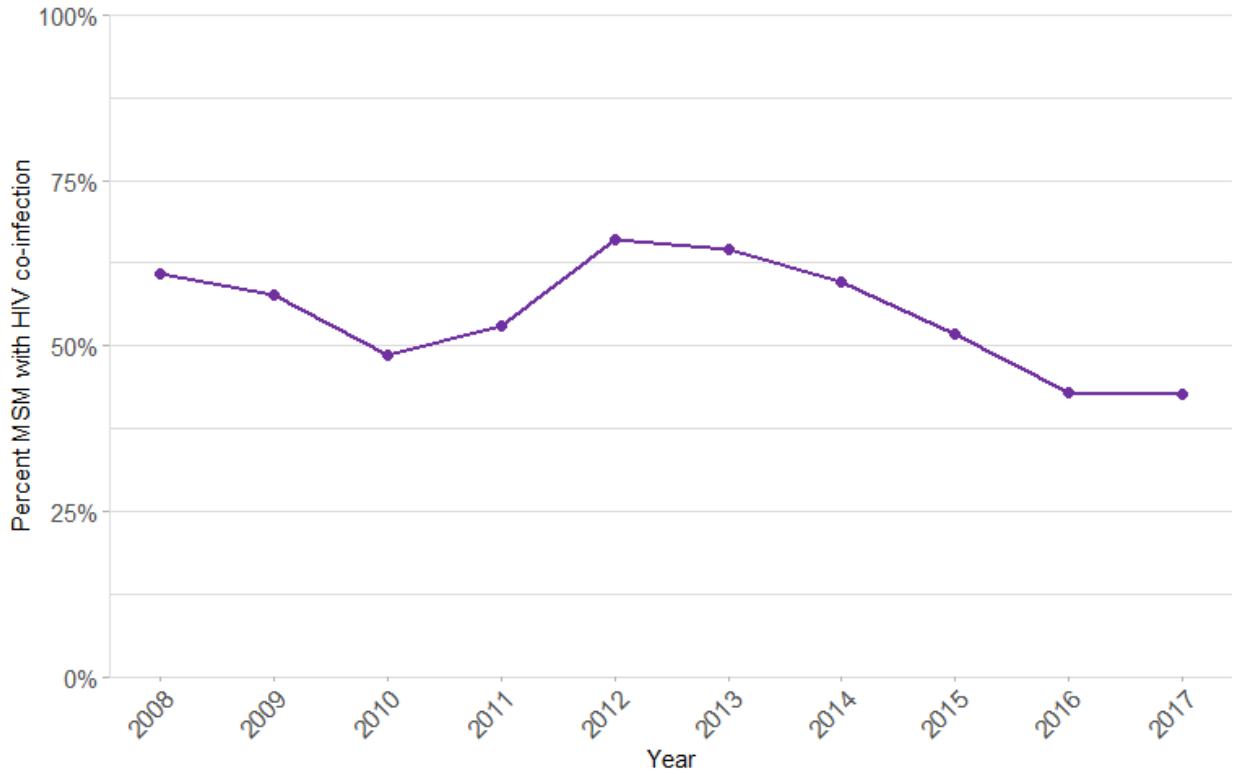
Ethnicity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
No. Diagnoses	230	147	115	154	310	480	471	653	654	573
Caucasian	74.2	65.5	73.9	71.2	60.3	54.8	53.5	55.1	51.3	43.1
Indigenous	2.6	3.4	3.5	2.0	3.9	3.1	2.6	2.4	2.5	2.4
Asian	9.2	5.5	7.8	7.2	7.7	9.4	12.1	7.9	7.4	9.2
South Asian	3.1	0.0	2.6	4.6	2.3	2.1	2.0	1.6	2.2	2.4
Hispanic	4.8	13.8	2.6	7.8	6.5	5.4	5.7	5.5	4.5	4.1
Black	1.3	2.8	0.9	0.0	1.0	1.7	2.0	0.6	1.5	0.8
Other*	2.6	2.8	1.7	5.2	2.3	2.1	1.3	1.6	1.5	1.7
Unknown	2.2	6.2	7.0	2.0	16.1	21.3	20.8	25.4	29.1	36.2

*Other- Arab/West Asian and other/mixed ethnicity

42. Infectious syphilis case reports among MSM in BC by age group, 2008 to 2017

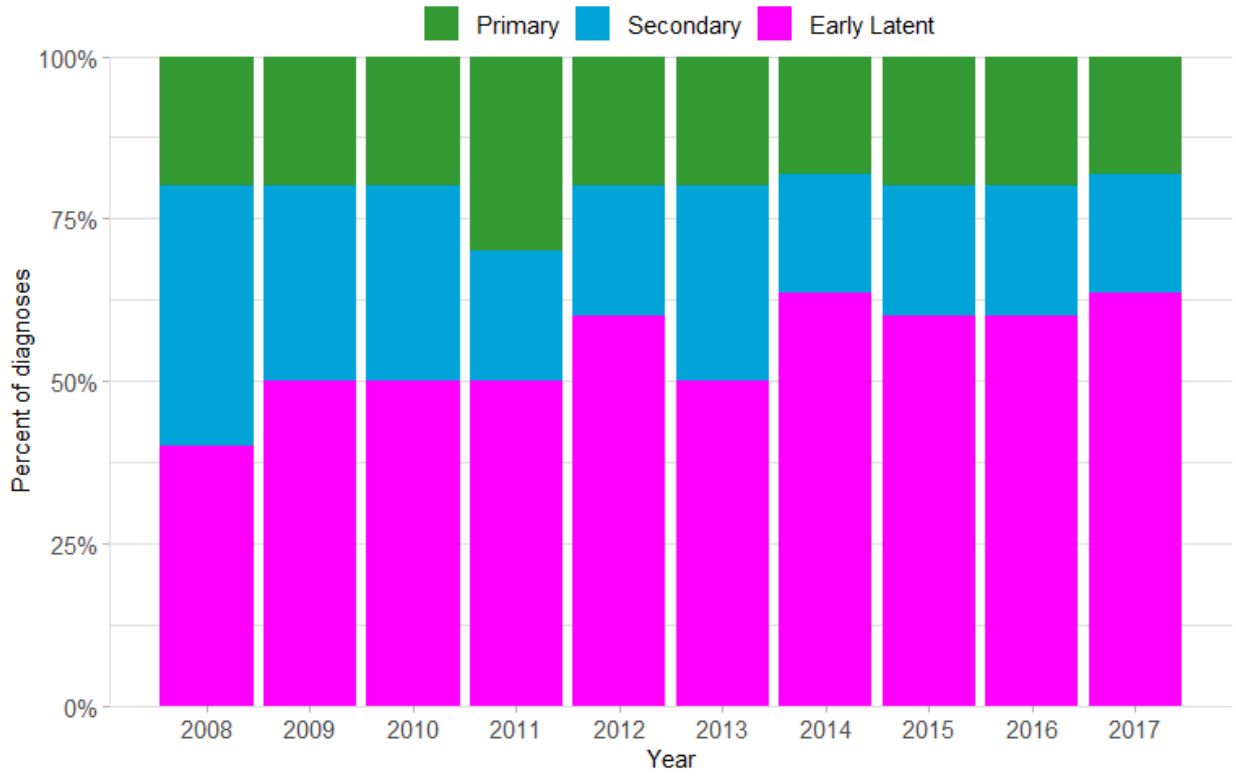


43. Infectious syphilis case reports* among MSM in BC by HIV co-infection, 2008 to 2017



*Of those with known HIV status

44. Stage* of infection at time of syphilis diagnosis among MSM in BC, 2008 to 2017



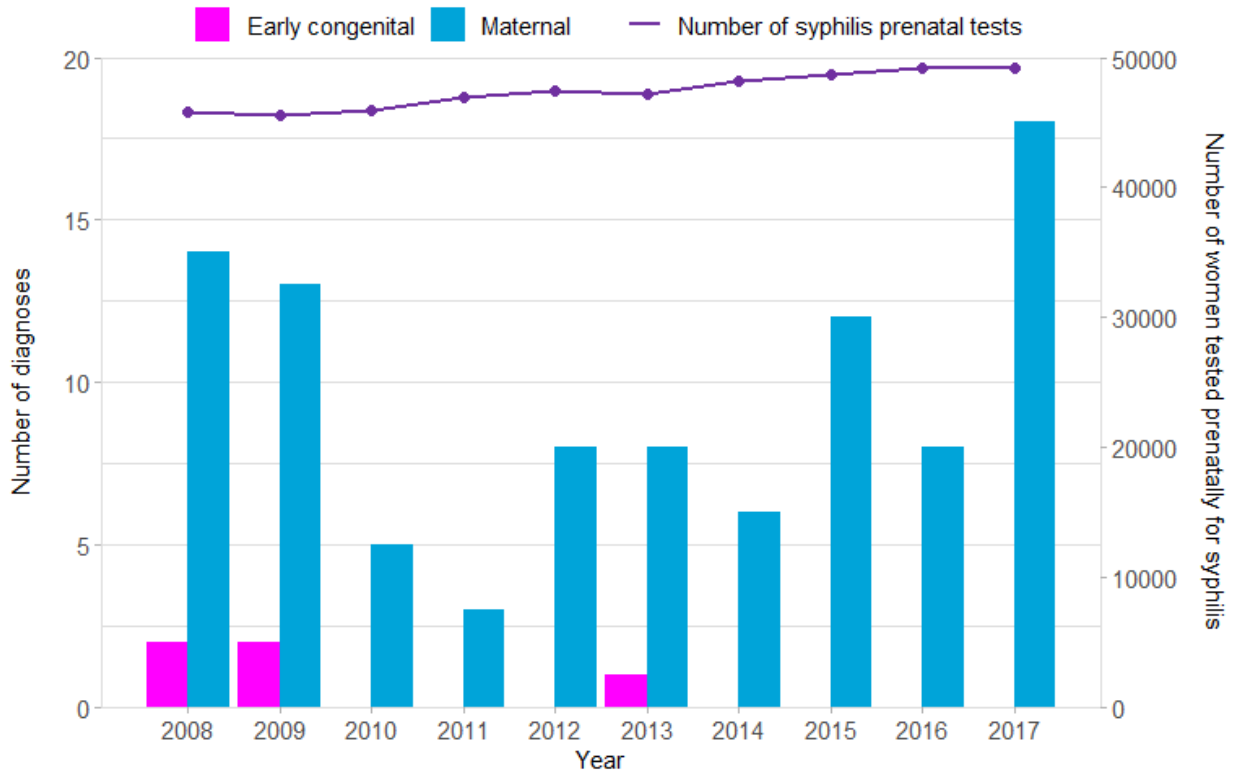
*Early Latent includes both Early Latent and Early Latent Probable stages

Maternal and Early Congenital Syphilis

Syphilis infection can be vertically transmitted in utero to the infant (called congenital syphilis) which can have serious consequences, including infant death. Accordingly, prenatal screening for syphilis is recommended for all pregnant women in BC, as treatment will reduce the risk of transmission to or complications in infants.

In 2017, 52,019 syphilis tests were conducted as part of prenatal screening, for 49,221 women, a slight decrease from 2016 (52,170 tests for 49,245 women). There were no cases of congenital syphilis identified in BC in 2017 (Figure 45). In 2017, 18 maternal syphilis cases were reported whereas eight cases were reported in 2016.

45. Maternal and early congenital syphilis case reports in BC, 2008 to 2017



Neurosyphilis by Stage of Infection Category

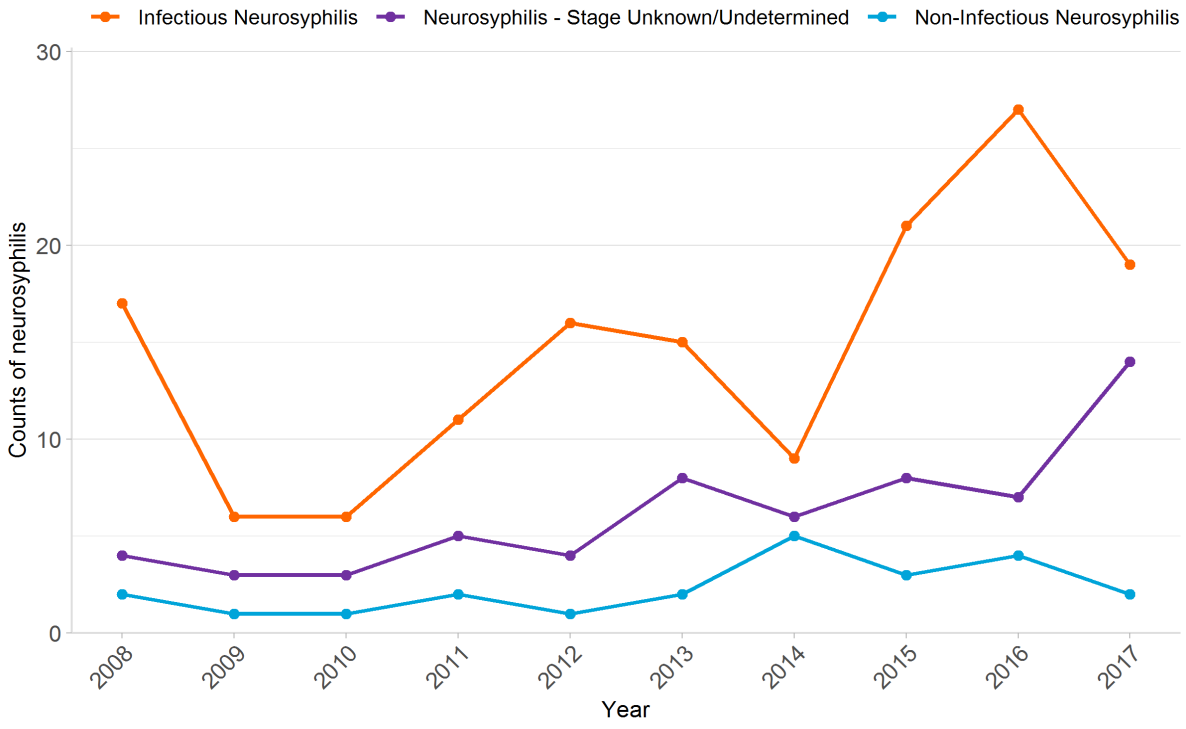
Neurosyphilis is syphilis infection of the brain and central nervous system. Neurosyphilis is commonly considered to be indicative of an advanced syphilis infection but can occur at any stage of infection.

Infectious neurosyphilis is the diagnosis of neurosyphilis within 12 months after infection, co-occurring with primary, secondary, early latent stages. Non-infectious neurosyphilis is the diagnosis of neurosyphilis > 12 months after infection, co-occurring with late latent stages of syphilis. Neurosyphilis with stage unknown/undetermined is the clinical diagnosis or neurosyphilis based on compatible clinical or laboratory findings and in the absence of being staged (e.g. no co-occurrence with infectious or non-infectious stage).

From 2008 to 2017, 3.5% (232/6,556 cases) of infectious and non-infectious syphilis cases were also diagnosed with neurosyphilis. Among cases with infectious stages of syphilis, 3.2% (147/4,569 cases) were diagnosed with neurosyphilis.

In 2017, of the 35 total reported neurosyphilis cases (confirmed and probable), 19 were infectious (54%), 2 were non-infectious (6%), while 40% (14 cases) had no stage co-occurring with the neurosyphilis diagnosis. In comparison, of the 38 neurosyphilis cases reported on 2016, 27 (71%), 4 (11%) and 7 (18%) were classified as infectious, non-infectious and stage unknown/undetermined, respectively (Figure 46).

46. Infectious and non-infectious neurosyphilis case reports in BC, 2008 to 2017



*"Infectious Neurosyphilis" includes syphilis diagnosed in the Primary, Secondary, Early Latent, or Early Latent Probable stage; "Non-infectious Neurosyphilis" includes syphilis diagnosed in the Late Latent stage; "Neurosyphilis - stage unknown/undetermined" includes missing and unknown/undetermined stage values.

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We would like to acknowledge the contributions of our many partners who without their support this report would not have been possible.

- Staff from the BCCDC Public Health Laboratory (PHL) for the collecting and compiling of gonorrhea antibiotic susceptibility data and syphilis screening data.
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Technical Appendix

Data Limitations

There are several key limitations to surveillance data which are important to understand in order to interpret surveillance data appropriately.

- Surveillance data are based on diagnosis only and does not include people who have been tested for STIs. Many people with sexually transmitted infections do not have symptoms and so do not seek health care advice or testing. This under-counting of cases may disproportionately affect some groups. For example, more women than men are tested for syphilis because of prenatal syphilis screening. Also, some sexually transmitted infections are more or less likely to show symptoms depending on sex and site of infection (e.g., urethral gonococcal infections in men are more likely to produce symptoms than those in women or those in the pharynx/throat).

- Surveillance trends are influenced by provider testing behaviours which may result in changes to the numbers of tests performed each year (e.g., increased vigilance for lyphogranuloma venereum in 2010-2011 may have resulted in more diagnoses of this disease, artificially driving up lymphogranuloma rates).

- Trends are influenced by temporal changes in testing technologies. Over the past ten years, nucleic acid amplification tests (NAAT) have replaced culture-based diagnostics for chlamydia and gonorrhea testing. The use of NAAT, which is a more sensitive test, has resulted in increased detection of these infections. NAAT technology has also allowed urine-based screening for chlamydia and gonorrhea thus reducing the use of urethral swabs for asymptomatic male clients. With the use of this less-invasive procedure, more men may be getting screened for chlamydia and gonorrhea.

- The majority of surveillance data presented in this surveillance report are extracted from case report forms completed by health care providers or public health nurses as part of the case follow-up process (which includes partner notification, patient education, and referral to appropriate services). There is an expected reporting delay to receipt of these forms which may range from days to months depending on the infection.

- Cases are classified by exposure category, ethnicity, and Indigenous self-identity according to information elicited during follow-up from the case or their health care provider. Under-reporting of this information may lead to misclassification. For example, gay, bisexual and other men who have sex with men, and transgender persons may be reluctant to disclose these factors to their health care providers due to social stigma. Furthermore, lack of health care services that are culturally safe may lead to under-reporting of Indigenous information. Ongoing work is being done to improve cultural competency in order to monitor progress towards closing the gaps in health outcomes between Indigenous and non-Indigenous peoples, as outlined in the Truth and Reconciliation Commission of Canada's Calls to Action (21).

Case Definitions

Sexually transmitted infections (STIs) included in this report are listed as reportable diseases in the Communicable Disease Regulation (Schedule A) of the Public Health Act.

Chlamydia

Genital*:

- Detection and confirmation of *Chlamydia trachomatis* in genital or urinary specimens by appropriate laboratory techniques, such as the demonstration of *C. trachomatis* by detection of nucleic acid or antigen.

Extra-genital:

- Detection and confirmation of *C. trachomatis* in specimens from the conjunctiva, pharynx and other non-genital sites by appropriate laboratory techniques, such as the demonstration of *C. trachomatis* by detection of nucleic acid or antigen.

Perinatally-acquired:

- Detection and confirmation of *C. trachomatis* in nasopharyngeal or other respiratory tract specimens from an infant who developed pneumonia in the first 12 weeks of life by appropriate laboratory techniques, such as the isolation of *C. trachomatis* by culture or the demonstration of *C. trachomatis* by detection of nucleic acid or antigen; **OR**
- Detection and confirmation of *C. trachomatis* in conjunctival specimens from an infant who developed conjunctivitis in the first month of life by appropriate laboratory techniques, such as the demonstration of *C. trachomatis* by detection of nucleic acid or antigen.

***Notes:** Genital sites include urethra, penis, vagina, cervix, and rectum.

Lymphogranuloma Venereum (LGV)

Confirmed Case:

- DNA sequencing for *Chlamydia trachomatis* confirming presence of serovars L1, L2, or L3.

Probable Case:

- Detection and confirmation of *C. trachomatis* (from any site) by detection of nucleic acid or antigen;

  AND

- Presence of one of the following:
  - proctitis; **OR**
  - inguinal/femoral lymphadenopathy; **OR**
  - suspicious lesion; **OR**
  - sexual exposure to a partner with confirmed or probable LGV;

  OR

- Clinical symptoms consistent with LGV (i.e., proctitis, inguinal/femoral lymphadenopathy, or suspicious lesion) without a confirmed case of chlamydia; **AND**
- Sexual exposure to a partner with confirmed or probable LGV.

Notes: A case that meets the case definition for probable LGV with a negative test result for LGV serovars is not considered a probable LGV case. A case that meets the case definition for probable

LGV with an inconclusive test result for LGV serovars on confirmatory (genotype) testing is considered a probable LGV case.

Gonorrhea

Genital*:

- Detection and confirmation of *Neisseria gonorrhoeae* in genital or urinary specimens by appropriate laboratory techniques, such as the isolation of *N.* gonorrhoeae by culture or the demonstration of *N. gonorrhoeae* by detection of nucleic acid or antigen.

Extra-genital:

- Detection and confirmation of *N. gonorrhoeae* in specimens from the conjunctiva, pharynx, joint, blood, and other non-genital sites by appropriate laboratory techniques, such as the isolation of *N. gonorrhoeae* by culture or the demonstration of *N. gonorrhoeae* by detection of nucleic acid or antigen.

Perinatally-acquired:

- Detection and confirmation of *N. gonorrhoeae* infection in the first 4 weeks of life leading to the diagnosis of gonococcal infection, including conjunctivitis, scalp abscess, bacteremia, arthritis, meningitis or endocarditis, by appropriate laboratory techniques, such as the isolation of *N. gonorrhoeae* by culture or the demonstration of *N. gonorrhoeae* by detection of nucleic acid or antigen.

***Notes:** Genital sites include urethra, penis, vagina, cervix, and rectum.

Infectious Syphilis

Syphilis is a complex sexually transmitted infection that has a highly variable clinical course. Three stages of syphilis, primary, secondary and early latent, comprise infectious syphilis. Classification by a clinician with expertise in syphilis may take precedence over the above case definitions developed for surveillance purposes.

Primary Syphilis (Confirmed Case):

- Clinical presentation of one or more ulcers or chancre;

  AND

- Presence of one of the following:
  - detection and confirmation of *Treponema pallidum* in clinical specimens (e.g., chancre, regional lymph node) by appropriate laboratory techniques, such as dark-field microscopy, direct fluorescent antibody, or nucleic acid amplification test (NAAT); **OR**
  - reactive treponemal serology (regardless of non-treponemal serology reactivity) in a case with no previous history of syphilis; **OR**
  - four-fold or greater increase (e.g., 1:8 to 1:32) in titre over the last known non-treponemal test.

Secondary Syphilis (Confirmed Case):

- Clinical presentation of rash, fever, malaise, lymphadenopathy, mucous lesions, condyloma latum, alopecia, meningitis, headaches, uveitis, retinitis, or recent hearing impairment;

  AND

- Presence of one of the following:

- detection and confirmation of *T. pallidum* in clinical specimens (e.g., chancre, regional lymph node) by appropriate laboratory techniques, such as dark-field microscopy, direct fluorescent antibody, or nucleic acid amplification test (NAAT); **OR**
- reactive treponemal serology (regardless of non-treponemal serology reactivity) in a case with no previous history of syphilis; **OR**
- four-fold or greater increase in titre over the last known non-treponemal test.

Note: The possibility of a prozone reaction should be considered in individuals who are suspected of having secondary syphilis but whose non-treponemal test is non-reactive. Neurological symptoms may be present.

Early Latent Syphilis (Confirmed Case):

- No signs or symptoms of primary or secondary syphilis and either reactive treponemal serology (regardless of non-treponemal serology reactivity) or four-fold or greater increase in titre over the last known non-treponemal test;

  AND

- Presence of one of the following within the previous 12 months:
  - non-reactive serology; **OR**
  - signs or symptoms suggestive of primary or secondary syphilis; **OR**
  - sexual exposure to a partner with primary, secondary, or early latent syphilis.

Early Latent Syphilis (Probable Case):

- No signs or symptoms of primary or secondary syphilis and either reactive treponemal serology (regardless of non-treponemal serology reactivity) or four-fold or greater increase in titre over the last known non-treponemal test;

  AND

- Presence of one of the following within the previous 12 months:
  - a titre at least or greater than 1:8 at time of diagnosis; **OR**
  - is a member of a group at known increased risk of acquiring syphilis in British Columbia; **OR**
  - sexual exposure to a partner, in the previous 12 months, who is a member of a group at known increased risk of acquiring syphilis in British Columbia.

Late Latent Syphilis (Confirmed Case):

- No signs or symptoms of primary or secondary syphilis;

  AND

- Persistently reactive treponemal serology (regardless of non-treponemal serology reactivity); **AND**
- Does not meet the case definition for early latent (confirmed or probable) syphilis; **AND**
- Has not been previously treated for syphilis.

Neurosyphilis (Confirmed Case):

- Meets the case definition for any stage of syphilis; **OR**
- Reactive treponemal serology (regardless of non-treponemal serology reactivity);

  AND

- Presence of one of the following:
  - reactive VDRL in non-bloody cerebrospinal fluid (CSF); **OR**

- clinical evidence of neurosyphilis and either elevated CSF leukocytes or elevated CSF protein in the absence of other known causes.

Neurosyphilis (Probable Case):

- Meets the case definition for any stage of syphilis; **OR**
- Reactive treponemal serology (regardless of non-treponemal serology reactivity);

AND

- Clinical diagnosis of neurosyphilis, based on compatible clinical or laboratory findings, in the absence of other known causes.

Early (infectious) neurosyphilis – diagnosis of neurosyphilis within 12 months after infection (i.e., neurosyphilis coincides with primary, secondary or early latent syphilis)
Late (non-infectious) neurosyphilis – diagnosis of neurosyphilis more than 12 months after infection

Congenital Syphilis (Confirmed Case):

- Clinical presentation* compatible with congenital syphilis in a stillbirth, neonate or older case;

AND

- Presence of one of the following:
  - titre greater than maternal titre and reactive treponemal confirmatory test; **OR**
  - detection and confirmation of *T. pallidum* in clinical specimens (e.g., lesions, placenta, umbilical cord, or autopsy) by appropriate laboratory techniques, such as dark-field microscopy, direct fluorescent antibody assay or polymerase chain reaction (PCR); **OR**
  - mother with untreated or inadequately treated syphilis (i.e., primary, secondary, early latent, or late latent syphilis) during pregnancy or at birth.

Early congenital syphilis – onset less than two years of age, including stillbirth
Late congenital syphilis – onset at two or more years of age

***Notes:** Clinical presentation includes any evidence of congenital syphilis on physical examination (e.g., skin lesions, lymphadenopathy, hepatosplenomegaly); on radiographs of long bones; a reactive CSF-VDRL; or an elevated CSF cell count or protein in the absence of other known causes. Note that neonates may not display clinical manifestations of congenital syphilis thus may only meet laboratory criteria.

Maternal Syphilis (Confirmed Case):

- Meets the case definition for infectious syphilis (i.e., primary, secondary or early latent) or late latent syphilis;

AND

- Presence of one of the following:
  - syphilis serology conducted as part of prenatal blood screening; **OR**
  - known to have given birth to an infant, live or stillborn, with congenital syphilis; **OR**
  - clinical presentation of infectious syphilis during pregnancy.

Syphilis Stage Unspecified:

- Reactive treponemal serology (regardless of non-treponemal serology reactivity) in an individual either with no previous history of syphilis or four-fold or greater increase in titre over the last known non-treponemal test; **AND**
- Follow-up to determine staging of syphilis is not complete.

Data Sources

STI Data (Chlamydia, Gonorrhea, and Infectious Syphilis): When an individual is diagnosed with a reportable STI, the care provider completes a case report form (Health 208 form) then forwards it to BCCDC where the information is entered into the provincial STI database. Public health clinics with access to the provincial STI database directly enter the information for their newly diagnosed individuals.

BCCDC Public Health Laboratory (PHL): Since July 2011, all rectal specimens that test positive for *C. trachomatis* in BC are routinely forwarded to the National Microbiology Laboratory in Winnipeg MB for LGV serovar testing via the BCCDC PHL. In addition, since 2012, clinics operated by the BCCDC have been routinely screening for *C. trachomatis* from sites among those reporting behaviours that may put them at risk for pharyngeal or rectal infections. The BCCDC PHL performs approximately 15-20% of all gonorrhea testing in the province, receiving specimens predominantly from Provincial Sexually Transmitted Infection Clinic sites operated by the BCCDC, from regional public health, youth, reproductive and sexual health clinics, and from hospitals throughout the province. At the BCCDC PHL, gonorrhea may be detected by nucleic acid amplification testing (NAAT) or conventional culture diagnostic methods. Culture testing is preferentially used for rectal and pharyngeal specimens and for all specimens from contacts to gonorrhea as well as patients who are symptomatic, not responding to treatment, or presenting for treatment after an initial NAAT-positive test. Antimicrobial susceptibility testing is routinely performed for all *N. gonorrhoeae* isolated by culture from clinical specimens. The BCCDC PHL additionally receives gonorrhea isolates forwarded for susceptibility testing from community or hospital-based laboratories in BC. Antimicrobial susceptibility testing is by E-test (bioMerieux) and data are analyzed by isolate.

Population Data: Unless noted otherwise, population data and associated rates are based on the P.E.O.P.L.E. 2017 Population Estimates and Projections released by BC Stats, BC Ministry of Technology, Innovation and Citizens' Services.

Live Births: Perinatal rates are calculated using live births data from the BC Vital Statistics Agency.

First Nations Population: Estimates are calculated using estimates from Indigenous Services Canada (formerly Aboriginal Affairs and Northern Development Canada).
These estimates are based on the Indian Registry System (IRS) which includes individuals who have registered for First Nations status under the Indian Act. The IRS is subject to several limitations, including:

- Under-counting due to delayed reporting of infants entitled to be registered, as well as other unregistered individuals who are entitled for status designation
- Over-counting due to individuals remaining on the IRS after they are deceased
- Geographic misclassification because individuals are included in the BC population according to membership of a BC band rather than current place of residence
- Systematic biases from imbalance in the migration into and out of the BC region (these are difficult to quantify)

For further details about the data source and its limitations, see the report Registered Indian Population by Sex and Residence 2014 - Statistics and Measurement Directorate (27).

BC Ministry of Health: Estimates of physician billings for pelvic inflammatory disease (PID) were calculated using Medical Services Plan (MSP) data that were associated with any of the following ICD-9 diagnosis codes: 614 to 616. Estimates of physician billings for ectopic pregnancy (EP) were calculated using MSP data that were associated with the ICD-9 diagnosis codes 633 plus 761.4 or any of the fee item codes 04034, 04035, 04208 or 04664. Estimates of hospital discharges for PID were calculated using the discharge abstract database (DAD) that that had any of the following diagnosis codes: 614 to 616 (in ICD-9) or N70 to N77 (in ICD-10-CA). Estimates of hospital discharges for EP were calculated using the DAD that had any of the following diagnosis codes: 633 *plus* 761.4 (ICD-9) or O00.0 to O00.9 *plus* P01.4 *plus* O36.7 (in ICD-10-CA).

Additional Notes

Classification of Health Region: This report includes cases that are diagnosed in BC. Cases are assigned geographically (e.g. Health Authority or Health Service Delivery Area) by residence. If residence is unknown, the case is then assigned to the geography where the individual was tested. Cases assigned to the 'Outside BC' geography in this report were diagnosed in BC, but reported to reside outside BC.

Classification of Ethnicity: Ethnicity is based on information elicited from the case or health care provider during follow-up. Since ethnicity data for chlamydia and gonorrhea cases are often not collected they are not included in this report.

Exposure Group Hierarchy: Cases may have more than one type of sexual exposure. The following are definitions of sexual exposures used in this surveillance report. For infectious syphilis cases, individuals are assigned to the exposure category listed first (or highest) in the following hierarchy.

1. MSM: Male who reports having male sex partner(s), with or without female sex partners.

2. Street-Involved, Sex Trade Worker and Patron: i) Street-Involved - Person who reports either: (a) living on the street or in a single room occupancy (SRO) hotel; or (b) attached to the street; or (c)having no fixed address; or (d)transient ii) Sex Trade Worker (STW)- Person who reports providing sex to another individual in exchange for money, shelter, food, drugs, etc. iii) Patron of STW - Person who reports payment (with money, shelter, food, drugs, etc.) for sex with a STW

3. Heterosexual Contact*: Male who reports having female sex partner(s) only or female who reports having male with/without female sex partner(s).

4. Acquired Outside of Canada: i) Foreign Acquired - Person currently residing in Canada but likely acquired syphilis outside of Canada (i.e., reports sexual partner(s) in other countries) and/or ii) Immigration - Person immigrating to Canada and identified with syphilis through testing done as part of the immigration process.

5. Other Risk Factor: Likely route of exposure is known but cannot be classified into any of the major exposure categories listed here. For example, females reporting female sex partner(s) only.

6. Unknown: Route of exposure is unknown or not identified at the time of completion of case follow-up (e.g., route of exposure not provided by case).

Note: A transgender individual may be assigned to either MSM or heterosexual contact exposure category based on the gender the individual identifies with.

References

1. European Centre for Disease Prevention and Control. (February 2014). Chlamydia control in Europe: literature review. Retrieved from https://www.ecdc.europa.eu/sites/default/files/media/en/publications/Publications/chlamydia-control-europe.pdf

2. Brunham RC, Rekart ML. The Arrested Immunity Hypothesis and the Epidemiology of Chlamydia Control. Sexually Transmitted Diseases. 2008 Jan;35(1):53–4.

3. Rekart ML, Gilbert M, Meza R, Kim PH, Chang M, Money DM, et al. Chlamydia Public Health Programs and the Epidemiology of Pelvic Inflammatory Disease and Ectopic Pregnancy. The Journal of Infectious Diseases. 2013 Jan;207(1):30–8.

4. Stoner BP, Cohen SE. Lymphogranuloma Venereum 2015: Clinical Presentation, Diagnosis, and Treatment. Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America. 2015 Dec;61 Suppl 8:S865–873.

5. Rodríguez-Domínguez M, Puerta T, Menéndez B, González-Alba JM, Rodríguez C, Hellín T, et al. Clinical and epidemiological characterization of a lymphogranuloma venereum outbreak in Madrid, Spain: Co-circulation of two variants. Clinical Microbiology and Infection: The Official Publication of the European Society of Clinical Microbiology and Infectious Diseases. 2014 Mar;20(3):219–25.

6. Spaargaren J, Fennema HSA, Morré SA, de Vries HJC, Coutinho RA. New lymphogranuloma venereum Chlamydia trachomatis variant, Amsterdam. Emerging Infectious Diseases. 2005 Jul;11(7):1090–2.

7. Schachter J, Moncada J. Lymphogranuloma Venereum: How to Turn an Endemic Disease into an Outbreak of a New Disease? Start Looking. Sexually Transmitted Diseases. 2005 Jun;32(6):331–2.

8. Childs T, Simms I, Alexander S, Eastick K, Hughes G, Field N. Rapid Increase in Lymphogranuloma Venereum in Men Who Have Sex with Men, United Kingdom, 2003 to September 2015. Eurosurveillance. 2015 Dec;20(48).

9. CATIE, Canada's source for HIV and hepatitis C information. (2012). STIs: What role do they play in HIV transmission? Retrieved from http://www.catie.ca/en/pif/spring-2012/stis-what-role-do-they-play-hiv-transmission

10. Bernstein KT, Marcus JL, Nieri G, Philip SS, Klausner JD. Rectal Gonorrhea and Chlamydia Reinfection Is Associated With Increased Risk of HIV Seroconversion. Journal of Acquired Immune Deficiency Syndromes. 2010 Apr;53(4):537.

11. BC Centre for Disease Control. (2018). STI in British Columbia: Annual Surveillance Report 2016. Retrieved from http://www.bccdc.ca/resource-gallery/Documents/Statistics%20and%20Research/Statistics%20and%20Reports/STI/STI_Annual_Report_2016.pdf

12. Public Health England. (June 2014). Sexually transmitted infections and chlamydia screening in England, 2013. Health Protection Report, 8(24). Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/326935/hpr2414.pdf

13. Wolitski RJ, Fenton KA. Sexual Health, HIV, and Sexually Transmitted Infections among Gay, Bisexual, and Other Men Who Have Sex with Men in the United States. AIDS and behavior. 2011 Apr;15 Suppl 1:S9–17.

14. Lester R, Montgomery C, Arnold B, Makaroff S, Spencer A, Ogilvie G. Sexually Transmitted Infections in Adolescents and Adults 2014. BC Centre for Disease Control; 2014.

15. Unemo M, Golparian D, Syversen G, Vestrheim DF, Moi H. Two Cases of Verified Clinical Failures Using Internationally Recommended First-Line Cefixime for Gonorrhoea Treatment, Norway, 2010. Eurosurveillance. 2010 Nov;15(47):19721.

16. Yokoi S, Deguchi T, Ozawa T, Yasuda M, Ito S-i, Kubota Y, et al. Threat to Cefixime Treatment for Gonorrhea. Emerging Infectious Diseases. 2007 Aug;13(8):1275–7.

17. World Health Organization. (2012). Global action plan to control the spread and impact of antimicrobial resistance in Neisseria gonorrhoeae. Retrieved from: http://apps.who.int/iris/bitstream/10665/44863/1/9789241503501_eng.pdf

18. Centers for Disease Control and Prevention, Division of STD Prevention. (January 2019). Gonococcal Isolate Surveillance Project (GISP) Supplement & Profiles. Retrieved from https://www.cdc.gov/std/stats17/gisp2017/docs/gisp_2017_supplement_final_2019.pdf

19. Public Health Agency of Canada. (April 2019). Report on the enhanced surveillance of antimicrobial-resistant gonorrhea (ESAG) - Results from 2014 and 2015. Retrieved from: https://www.canada.ca/en/public-health/services/publications/diseases-conditions/2014-2015-report-enhanced-surveillance-antimicrobial-resistant-gonorrhea.html

20. Statistics Canada. Aboriginal Peoples Highlight Tables, 2016 Census. Retrieved from https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/hlt-fst/abo-aut/Table.cfm?Lang=Eng&T=101&S=99&O=A

21. Truth and Reconciliation Commission of Canada: Calls to Action. (2015). Retrieved from http://nctr.ca/assets/reports/Calls_to_Action_English2.pdf

22. Public Health Agency of Canada. (2009). Executive Summary - Report on sexually transmitted infections in Canada: 2009. Retrieved from https://www.canada.ca/en/public-health/services/infectious-diseases/surveillance-epidemiology-sexually-transmitted-infections-hep-b-c/executive-summary-report-2009.html

23. Centers for Disease Control and Prevention, Division of STD Prevention. (October 2016). Sexually Transmitted Disease Surveillance 2015. Retrieved from http://www.cdc.gov/std/stats15/std-surveillance-2015-print.pdf

24. Savage EJ, Hughes G, Ison C, Lowndes CM, Network C the ES of STI(. Syphilis and Gonorrhoea in Men Who Have Sex with Men: A European Overview. Eurosurveillance. 2009 Nov;14(47):19417.

25. Hottes TS, Lindegger M, Consolacion T, Wong S, Lester R, Montgomery C, et al. Infectious Syphilis among Gay, Bisexual and Other Men Who Have Sex with Men in British Columbia. BC Centre for Disease Control; 2013.

26. Konrad S, Mak DB, Grennan T, Zakher B, Brownrigg B, Ogilvie G, et al. Characteristics of Gay, Bisexual and Other Men Who Have Sex With Men With Multiple Diagnoses of Infectious Syphilis in British Columbia, Canada, 2005-2014. Sexually Transmitted Diseases. 2019 Jul;46(7):423–8.

27. Aboriginal Affairs and Northern Development Canada. Registered Indian Population by Sex and Residence 2014 - Statistics and Measurement Directorate (2014). Retrieved from https://www.aadnc-aandc.gc.ca/eng/1429798605785/1429798785836