

# Supplementary Appendix to ‘Estimating the test-adjusted incidence of *Chlamydia trachomatis* infections identified through Public Health Ontario laboratories in Peel region, Ontario, 2010–2018: A population-based study’

## Appendix 1: Methods and Equations

### *Standardized morbidity ratio, testing ratio, and test positivity*

Standardized morbidity ratio, testing ratio, and test positivity (SMR, STR, and STP) were estimated for monthly and cumulative data to explore infections, testing, and test positivity. Where a ratio above 1 indicate infections, testing, or test positivity are higher than expected, and below 1 indicates they are lower than expected. First, average annual incidence of infection, testing, and positivity per test, was calculated for the population as a whole and for each age-sex subgroup. The ratios were then estimated by dividing subgroup specific estimates by the overall population estimates. Confidence intervals were calculated using standard error estimates as follows (14):

$$\text{EQ1. SE} (\ln(\text{SMR, STR or STP})) = \sqrt{\left(\frac{1}{A}\right) - \left(\frac{1}{A+C}\right) + \left(\frac{1}{B}\right) - \left(\frac{1}{B+D}\right)}$$

Where  $A$  is the case or test count in a subgroup,  $B$  is the case or test count not in the subgroup,  $C$  is the subgroup population or test count subtract  $A$ , and  $D$  is the population or test count not in the subgroup subtract  $B$ . The effect of sex and age on standardized morbidity ratios, standardized testing ratios, and standardized test positivity was explored using meta-regression models using monthly standardized ratio estimates. The model follows the form of:

$$\text{EQ2. } \ln(\text{SMR}_{ij}, \text{STR}_{ij}, \text{ or } \text{STP}_{ij}) = \alpha + \beta_i x_i + \beta_j x_j$$

where  $\alpha$  is the model intercept and each  $\beta$  represents a coefficient for the  $i^{\text{th}}$  age group and  $j^{\text{th}}$  sex.

### *Adjusting for testing*

To account for the differential testing across age and sex subgroups, a test-adjusted incidence using standardization was applied. First, the “test-adjusted” SMR was estimated for each age-sex subgroup using meta-regression models where the  $\ln(\text{STR})$  is the independent variable. Standard errors were calculated as described above and within-subgroup standard errors were estimated by the square root of summed variance of SMR and STR. The model follows the form of:

$$\text{EQ3. } \ln(\text{SMR}_{ij}) = \alpha_{ij} + \beta_{ij} \ln(\text{STR}_{ij})$$

where  $\alpha$  is the model intercept and each  $\beta$  represents a coefficient for the subgroup of  $i^{\text{th}}$  age group and  $j^{\text{th}}$  sex (2). When STR is equal to 1, where testing in a given subgroup is equivalent to the overall population test rate,  $\ln(\text{STR})$  is zero and therefore, the SMR is equal to the intercept,  $\alpha$ , exponentiated ( $e^\alpha$ ). This can be interpreted as the test-frequency-adjusted SMR expected when all age-sex subgroups were tested at the same rate as the population overall. To investigate this further, the expected test-frequency-adjusted incidence of each subgroup (if tested at the same rate as the maximally tested subgroup) was calculated, as follows:

$$\text{EQ4. } I_{ijT_{\max}} = \text{SMR}_{ij} * I_0$$

Hence, the observed average annual incidence in the maximally tested  $i^{\text{th}}$  age group and  $j^{\text{th}}$  sex,  $I_{ijT_{\max}}$ , was divided by the test-adjusted  $\text{SMR}_{ij}$  to find  $I_0$ , the test-adjusted expected incidence in the population overall. For all other subgroups, the test-adjusted incidence when tested at the rate of the maximally tested subgroup, was the test-adjusted  $\text{SMR}_{ij}$  multiplied by  $I_0$ . This calculation was conducted for each age-sex subgroup, where females aged 20–29 were the maximally tested subgroup.

## Appendix 2: Tables

**Table A1:** Data sources and variables used in study.

Variable	Data source
Population	Statistics Canada Census (3–5)
Cases by age and sex subgroups	Integrated Public Health Information System (iPHIS)
Test counts by age and sex subgroups	Ontario Laboratory Information System (OLIS)

**Table A2:** Summary of monthly chlamydia incidence and testing rates and percentage positivity by age group and sex in Peel, Ontario, identified through Public Health Ontario laboratories, 2010–2018.

Demographic		Monthly Median Value (Range)		
Sex	Age Group	Cases	Tests	Positivity (%)
<b>Female</b>	<b>15-19</b>	14 (4–26)	134 (96–194)	11.1 (3.8–18.5)
	<b>20-29</b>	29 (15–47)	552 (407–668)	5.3 (2.5–8.9)
	<b>30-39</b>	5 (1–14)	269 (166–365)	1.7 (0.3–6.3)
	<b>40 and over</b>	2 (0–6)	174 (90–268)	1.0 (0–3.3)
<b>Male</b>	<b>15-19</b>	5 (0–14)	43 (23–71)	12.5 (0–27.0)
	<b>20-29</b>	27 (14–42)	270 (182–443)	9.1 (4.4–16.2)
	<b>30-39</b>	7 (1–17)	132 (82–219)	5.6 (0.8–12.6)
	<b>40 and over</b>	4 (0–9)	105 (67–182)	3.4 (0–11.8)

**Table A3:** Standardized morbidity ratio (SMR), testing ratio (STR), and test positivity (STP) of chlamydia infections, by age and sex groups, in Peel, Ontario, identified through Public Health Ontario laboratories, 2010–2018.

Demographic		Standardized Ratios		
Sex	Age Group	SMR (95% CI)	STR (95% CI)	STP (95% CI)
Female	15-19	3.62 (3.43–3.82)	1.87 (1.84–1.90)	1.93 (1.83–2.04)
	20-29	3.71 (3.56–3.87)	3.85 (3.81–3.89)	0.97 (0.92–1.01)
	30-39	0.61 (0.56–0.67)	1.79 (1.77–1.82)	0.34 (0.32–0.37)
	40 and over	0.06 (0.05–0.07)	0.34 (0.33–0.34)	0.17 (0.15–0.20)
Male	15-19	1.22 (1.12–1.32)	0.54 (0.53–0.56)	2.24 (2.05–2.45)
	20-29	3.31 (3.17–3.45)	1.97 (1.95–2.00)	1.68 (1.60–1.75)
	30-39	1.07 (1.01–1.15)	1.03 (1.01–1.05)	1.04 (0.97–1.12)
	40 and over	0.15 (0.14–0.17)	0.24 (0.23–0.24)	0.65 (0.59–0.71)

**Table A4:** Meta-regression models of sex and age on standardized morbidity ratios, standardized testing ratios, and standardized test positivity, in Peel, Ontario, identified through Public Health Ontario laboratories, 2010–2018. Females aged 20-29 were used as the referent group in meta-regression models.

<b>Covariate</b>	<b>SMR (95% CI)</b>	<b>STR (95% CI)</b>	<b>STP (95% CI)</b>
<b>Sex</b>			
<b>Male</b>	0.872 (0.826–0.920)	0.504 (0.490–0.518)	1.837 (1.753–1.901)
<b>Female</b>	1 (referent)	1 (referent)	1 (referent)
<b>Age</b>			
<b>15-19</b>	0.754 (0.706–0.805)	0.387 (0.372–0.403)	1.842 (1.759–1.953)
<b>20-29</b>	1 (referent)	1 (referent)	1 (referent)
<b>30-39</b>	0.264 (0.245–0.283)	0.490 (0.472–0.509)	0.521 (0.498–0.562)
<b>40 and over</b>	0.041 (0.037–0.045)	0.101 (0.098–0.105)	0.366 (0.343–0.406)

**Table A5:** Observed and test-adjusted incidence of chlamydia infections, by age and sex subgroups, in Peel, Ontario, identified through Public Health Ontario laboratories, 2010–2018.

<b>Age Group</b>	<b>Female</b>		<b>Male</b>		<b>Overall</b>	
	Obs.	Test-adj. (95% CI)	Obs.	Test-adj. (95% CI)	Obs.	Test-adj (95% CI)
<b>15–19</b>	379	299 (231–388)	128	205 (152–277)	248	249 (236–263)
<b>20–29</b>	388	388 (132–1143)	346	340 (257–449)	367	338 (306–372)
<b>30–39</b>	65	69 (45–108)	113	124 (115–134)	87	118 (109–127)
<b>40 and over</b>	7	23 (6–81)	16	40 (16–99)	11	5 (3–9)

## Appendix References

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