



Antimicrobial susceptibilities of *Neisseria gonorrhoeae* in Canada, 2021

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Table S1: Summary of the *Neisseria gonorrhoeae* culture and laboratory data received by the National Microbiology Laboratory, 2017–2021

Province/territory ^a	2017	2018	2019	2020	2021	Total
Alberta	471	837	926	575	652	4,479
Submitted AMR data (Alberta)	451	200	134	102	131	
British Columbia	303	219	255	129	119	2,055
Submitted AMR data (British Columbia)	N/A	296	258	266	210	
Manitoba	143	195	167	137	44	686
Nova Scotia	33	35	30	2	10	110
Ontario	1,338	1,370	889	262	250	4,109
Québec	620	805	736	455	985	7,912
Submitted AMR data (Québec)	903	1,060	1,051	721	576	
Saskatchewan	125	135	127	51	41	479
Other ^b	21	19	28	17	36	121
Total cultures sent to NML with demographic data	4,408	5,171	4,601	2,717	3,054	19,951
Total cultures sent to the NML with available demographic data excluding duplicates, contaminated and non viable ^c	4,143	4,943	4,334	2,679	2,909	19,008
Total number of cultures tested in each province ^d	5,290	5,607	4,859	3,130	3,439	22,325
Total cultures resistant to at least one antibiotic	3,356	4,061	3,690	2,195	2,501	15,803
Percentage of cultures resistant to at least one antibiotic	63.4%	72.4%	75.9%	70.1%	72.7%	70.9%
Percentage of total cases tested ^d	18.2%	18.2%	13.7%	10.2%	N/A	N/A
Total cases reported in Canada	29,034	30,874	35,443	30,833	N/A	N/A

Abbreviations: AMR, antimicrobial resistance; N/A, not applicable; NML, National Microbiology Laboratory

^a Nunavut and the Yukon did not report or send any *Neisseria gonorrhoeae* cultures to the NML from 2017 to 2021

^b Other includes New Brunswick, Newfoundland and Labrador, Northwest Territories and Prince Edward Island

^c Isolates that were duplicates (i.e. from the same patient and same collection date or treatment failures), contaminated or did not grow were excluded

^d Total number of isolates tested by the provincial and territorial laboratories is used as the denominator in all percent resistance calculations

Table S2: *Neisseria gonorrhoeae* antimicrobial resistance criteria

Antibiotic ^a	Recommended testing concentration ranges (mg/L)	MIC interpretive standard (mg/L)			
		S	DS	I	R
Penicillin (1)	0.032–128.0	≤0.06	N/A	0.12–1.0	≥2.0
Tetracycline (1)	0.064–64.0	≤0.25	N/A	0.5–1.0	≥2.0
Erythromycin (2)	0.032–32.0	≤1.0	N/A	N/A	≥2.0
Spectinomycin (1)	4.0–256.0	≤32.0	N/A	64.0	≥128.0
Ciprofloxacin (1)	0.001–64.0	≤0.06	N/A	0.12–0.5	≥1.0
Ceftriaxone (3)	0.001–2.0	N/A	≥0.125	N/A	N/A
Cefixime (3)	0.002–2.0	N/A	≥0.25	N/A	N/A
Azithromycin (1)	0.016–32.0	≤1.0	N/A	N/A	≥2.0
Ertapenem (4)	0.002–2.0	N/A	≥0.063 (NS)	N/A	N/A
Gentamicin (5,6)	0.5–128	≤4.0	N/A	8–16	≥32.0

Abbreviations: DS, decreased susceptibility; I, intermediate; MIC, minimum inhibitory concentration; N/A, not applicable; NS, non-susceptible; R, resistant; S, susceptible
^aAntibiotics were purchased from Sigma-Aldrich, Oakville, Ontario

Table S3: Age of patient and isolation site of the *Neisseria gonorrhoeae* isolates tested at the National Microbiology Laboratory, 2021 (N=2,909)

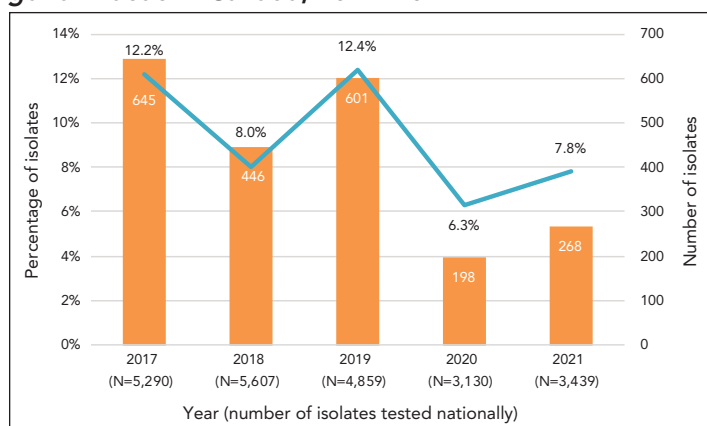
Patient characteristics	Male		Female		Gender-diverse		Not given		Total	
	n	%	n	%	n	%	n	%	n	%
Age (years)										
≤15	10	0.4	8	1.8	0	0	1	7.1	19	0.7
16–20	125	5.1	69	15.8	0	0	1	7.1	195	6.7
21–25	385	15.7	121	27.8	3	23.1	0	0	509	17.5
26–30	522	21.3	81	18.6	5	38.5	4	28.6	612	21
31–40	839	34.3	105	24.1	4	30.8	3	21.4	951	32.7
41–50	291	11.9	38	8.7	0	0	1	7.1	330	11.3
51–60	189	7.7	10	2.3	1	7.7	1	7.1	201	6.9
>60	85	3.5	4	0.9	0	0	0	0	89	3.1
Not specified	0	0	0	0	0	0	3	21.4	3	0.1
Total	2,446	100	436	100	13	100	14	100	2,909	100
Isolation site										
Penis/urethra	1,395	57	0	0	2	15.4	4	28.6	1,401	48.2
Rectum	534	21.8	45	10.3	1	7.7	0	0	580	19.9
Throat	446	18.2	148	33.9	0	0	4	28.6	598	20.6
Cervix	0	0	138	31.7	3	23.1	0	0	141	4.8
Vagina	0	0	71	16.3	7	53.8	1	7.1	79	2.7
Eye	28	1.1	9	2.1	0	0	0	0	37	1.3
Blood	13	0.5	5	1.1	0	0	0	0	18	0.6
Synovial fluid	11	0.4	9	2.1	0	0	0	0	20	0.7
Other	27	1.1	11	2.5	0	0	3	21.4	41	1.4
Not specified	2	0.1	0	0	0	0	2	14.3	4	0.1
Total	2,446	100	436	100	13	100	14	100	2,909	100



Table S4: *Neisseria gonorrhoeae* cultures tested in each province, 2017–2021

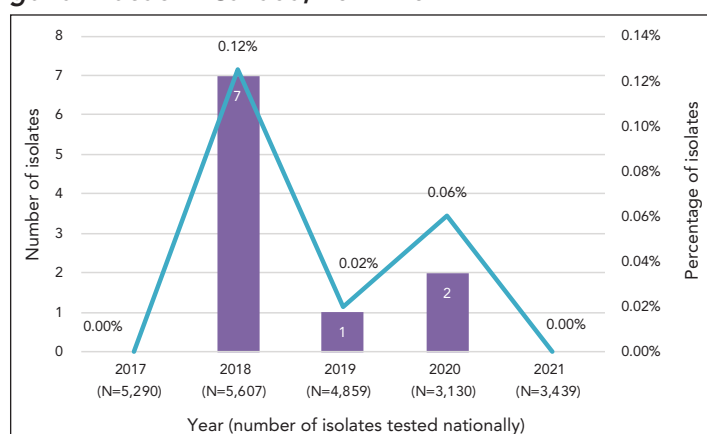
Province	<i>Neisseria gonorrhoeae</i> cultures tested				
	2017	2018	2019	2020	2021
Alberta	895	899	909	687	776
British Columbia	478	489	497	408	329
Manitoba	134	183	184	131	48
New Brunswick	10	11	9	9	32
Newfoundland and Labrador	3	1	1	0	2
Northwest Territories	14	5	17	8	1
Nova Scotia	29	31	24	1	10
Ontario	2,108	1,981	1,333	667	636
Prince Edward Island	0	1	0	0	0
Québec	1,486	1,874	1,765	1,169	1,562
Saskatchewan	133	132	120	50	43
Total	5,290	5,607	4,859	3,130	3,439

Figure S1: Trends of multi-drug resistant *Neisseria gonorrhoeae* in Canada, 2017–2021^a



^a Percentage based on the total number of isolates tested nationally: 2017=5,290; 2018=5,607; 2019=4,859; 2020=3,130; 2021=3,349

Figure S2: Trends of extensively drug-resistant *Neisseria gonorrhoeae* in Canada, 2017–2021^a



^a Percentage based on the total number of isolates tested nationally: 2017=5,290; 2018=5,607; 2019=4,859; 2020=3,130; 2021=3,349

Table S5: All extensively resistant *Neisseria gonorrhoeae* isolated in Canada

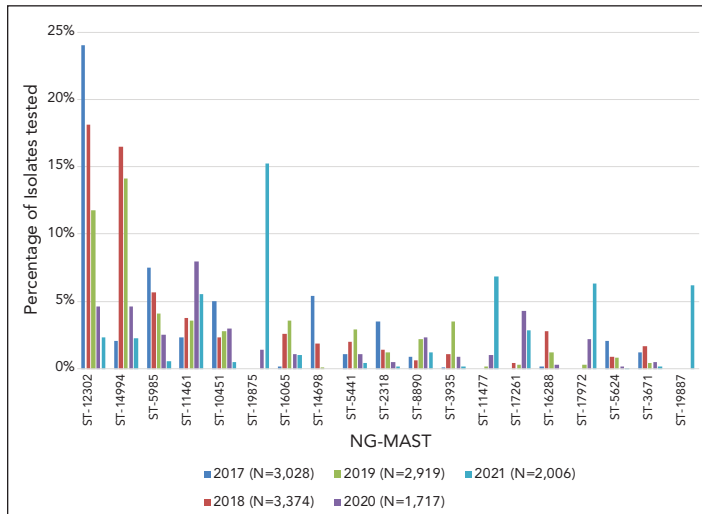
Year	AziR isolates		AziR isolates with CeDS and/or CxDS				Provinces (n)
	n	% ^a	n	% ^a	Isolation sites	NG-MAST	
2012	26	0.9	7	0.2	Penis/urethra (n=5); rectum (n=1); throat (n=1)	ST-3158 (n=6); ST-1407 (n=1)	BC (n=1), ON (n=6)
2013	37	1.2	8	0.3	Penis/urethra (n=5); rectum (n=1); throat (n=1); cervix (n=1)	ST-3158 (n=6); ST-1407 (n=1); ST-9427 (n=1)	BC (n=2), SK (n=1), ON (n=5)
2014	127	3.3	1	0.03	Penis/urethra	ST-1407	QC
2015	198	4.7	2	0.05	Penis/urethra (n=1); cervix (n=1)	ST-11765, ST-2400	ON, QC
2016	326	7.2	1	0.02	Rectum	ST-2318	BC
2017	624	11.7	0	0	N/A	N/A	N/A
2018	427	7.6	7	0.12	Throat (n=4); penis/urethra (n=2); cervix (n=1)	ST-5308	BC (n=5), QC (n=2)
2019	567	11.7	1	0.02	Penis/urethra	ST-20344	ON
2020	191	6.1	2	0.06	Throat (n=1); penis/urethra (n=1)	ST-19857, ST-3356	BC, QC
2021	262	7.6	0	0	N/A	N/A	N/A

Abbreviations: AziR, azithromycin-resistant; BC, British Columbia; CeDS, cefixime decreased susceptibility; CxDS, ceftriaxone susceptibility; N/A, not applicable; NG-MAST, *Neisseria gonorrhoeae* multi-antigen sequence type; ON, Ontario; QC, Québec; SK, Saskatchewan; ST, sequence type

^a Percentage based on the total number of isolates tested nationally: 2017=5,290; 2018=5,607; 2019=4,859; 2020=3,130; 2021=3,349

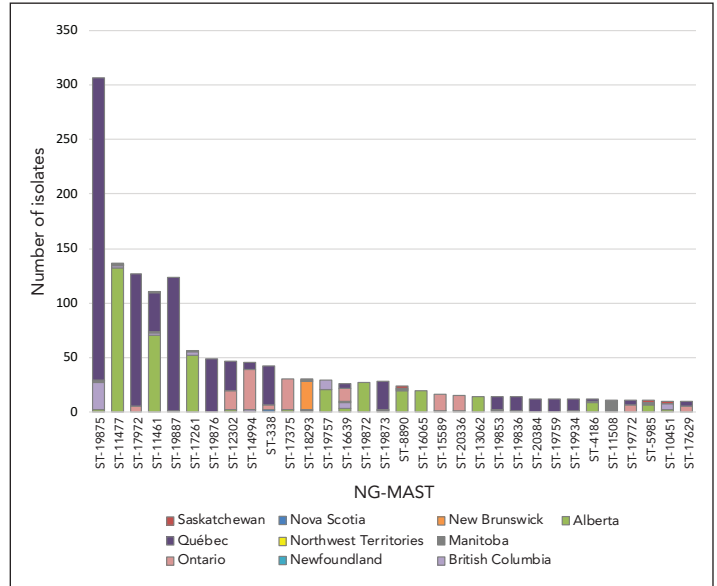


Figure S3: Trends of prevalent *Neisseria gonorrhoeae* multi-antigen sequence types of isolates tested by the National Microbiology Laboratory, 2017–2021



Abbreviations: NG-MAST, *Neisseria gonorrhoeae* multi-antigen sequence types, ST, sequence type

Figure S4: Provincial distribution within *Neisseria gonorrhoeae* multi-antigen sequence types, 2021 (N=2,006)^a



Abbreviations: NG-MAST, *Neisseria gonorrhoeae* multi-antigen sequence types, ST, sequence type

^a Figure does not include 33 isolates that were non-typeable. This graph represents 1,439 isolates. The remaining 534 isolates are dispersed among 252 sequence types containing 1–9 isolates each

Table S6: Ceftriaxone-resistant *Neisseria gonorrhoeae* identified in Canada, 2017–2021

NML #	Province	Year	Gender	Age (years)	Resistance profile	MIC (ug/mL)										NG-MAST	NG-STAR	MLST	penA
						PEN	SPE	TET	ERY	CX	CE	CIP	AZ	G	ET				
47707	Québec	2017	Female	N/A	CeR/CxR/CipR/EryR/PenR/TetR	>=256	16	4	2	1	2	32	0.25	8	0.125	ST-1614	233	1903	60.001
51742	Alberta	2018	Male	36	CeR/CxDS/CipR/EryR/PenR/TetR	2	16	2	2	0.5	2	32	0.25	8	0.125	ST-3435	233	1903	60.001
55486	Ontario	2018	Female	45	CeR/CxDS/CipR/EryR/PenI/TetR	1	16	4	2	0.5	2	32	0.25	16	0.25	ST-18042	3865	1901	121.002
55487	Ontario	2018	Male	46	CeR/CxR/CipR/EryR/PenR/TetR	2	16	4	4	1	2	32	0.5	8	0.5	ST-18042	3865	1901	121.002
61829	British Columbia	2021	Female	26	CeR/CxR/CipR/EryR/PenR/TetR	2	16	4	2	1	2	32	0.5	4	0.063	ST-19937	3903	7365	60.001

Abbreviations: AZ, azithromycin; CE, cefixime; CeR, cefixime-resistant; CIP, ciprofloxacin; CipR, ciprofloxacin-resistant; CX, ceftriaxone; CxDS, ceftriaxone decreased susceptibility; CxR, ceftriaxone-resistant; ERY, erythromycin; EryR, erythromycin-resistant; ET, ertapenem; G, gentamicin; MLST, multi-locus sequence type; NG-MAST, *Neisseria gonorrhoeae* multi-antigen sequence types; NG-STAR, *Neisseria gonorrhoeae* antimicrobial resistance sequence type; NLM, National Microbiology Laboratory; PEN, penicillin; PenI, penicillin intermediate; PenR, penicillin-resistant; SPE, spectinomycin; ST, sequence type; TET, tetracycline; TetR, tetracycline-resistant



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