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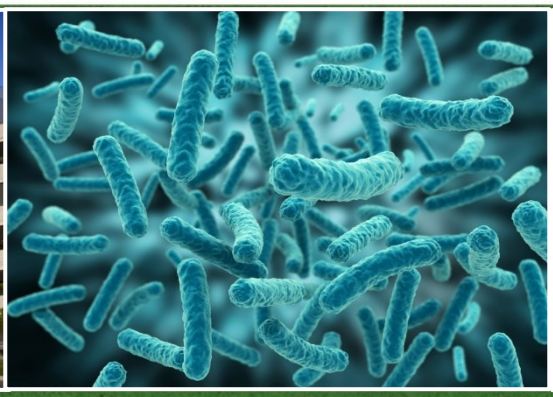
CANADIAN NOSOCOMIAL INFECTION SURVEILLANCE PROGRAM (CNISP):

Summary Report on Antimicrobial Resistant Organism (ARO) Surveillance Data from January 1, 2012 to December 31, 2016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Canada

The Canadian Nosocomial Infection Surveillance Program (CNISP) Antimicrobial Resistant Organism (ARO) Surveillance Report

Updated December 2017

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INTRODUCTION

This report entitled *Canadian Nosocomial Infection Surveillance Program (CNISP): Summary Report on ARO Surveillance Data from January 1, 2012 to December 31, 2016,* was produced by the Centre for Communicable Diseases and Infection Control of the Public Health Agency of Canada (PHAC). The report provides a review of available ARO data in the healthcare setting in Canada.

The Centre for Communicable Diseases and Infection Control (CCDIC) coordinates the data collection and is responsible for the data management, analysis and report production related to this summary report. CCDIC supports the use of these data to inform public health and policy action. In addition, PHAC is committed to improving data quality, as well as defining and setting surveillance standards.

PHAC collects national data on various healthcare-associated infections, including AROs through the Canadian Nosocomial Infection Surveillance Program (CNISP), a collaborative effort of CCDIC, the National Microbiology Laboratory (NML) and sentinel hospitals across Canada who participate as members of the Canadian Hospital Epidemiology Committee (CHEC), a subcommittee of the Association of Medical Microbiology and Infectious Disease (AMMI) Canada. Their ongoing contributions to national ARO surveillance are gratefully acknowledged.

As of December 2016, CNISP conducted surveillance in 65 acute-care hospitals in Canada (Appendix A). Of these, 12 are large acute, tertiary care hospitals with more than 500 beds available within the facility; 34 hospitals are of intermediate size (201 to 500 beds), while the remaining 19 hospitals are smaller facilities with less than 200 beds. Acute tertiary care hospitals are major hospitals that offer a range of specialist services such as burn units, transplant units, trauma centres, specialized cardiac surgery etc. to which patients are referred from smaller hospitals. General urban acute-care hospitals provide overall medical and surgical services but do not always have specialised sub-specialities. There are 34 adult-only hospitals, 23 hospitals which treat both adult and children, and the remaining 8 hospitals are stand-alone pediatric facilities (Appendix A). Surveillance of AROs at participating hospitals is considered to be within the mandate of hospital infection prevention and control programs and does not constitute human research. The ability for a hospital to participate in CNISP ARO surveillance is based on the site capacity for data collection, access to hospital laboratory services and their operational capacity to participate in a given year. Therefore, the variation in the number of reporting hospitals each year reflects the changes in the number of participating hospitals, which has generally increased over time.

CNISP surveillance provides key information that informs the development of federal, provincial, territorial and local infection prevention and control programs and policies. When carried out in a uniform manner, surveillance provides a measure of the burden of illness, establishes benchmark rates for internal and external comparison, identifies potential risk factors, and allows assessment of

specific interventions. Surveillance for AROs is considered an important component of the quality of patient care.

This report provides case counts and rates based on data from January 1, 2012 to December 31, 2016. All rates presented in this report represent infections and/or colonizations identified in patients admitted (inpatients) to CNISP hospitals. The report includes rates for *Clostridium difficile* infection (CDI) including healthcare- and community associated CDI, methicillin-resistant *Staphylococcus aureus* (MRSA) including healthcare- and community-associated MRSA and MRSA bacteremias, vancomycin-resistant Enterococci (VRE), carbapenemase-producing Enterobacteriaceae (CPE) and carbapenemase-producing *Acinetobacter* (CPA).

Where possible, rates are provided by region and include Western (British Columbia, Alberta, Saskatchewan and Manitoba), Central (Ontario and Quebec), and Eastern Regions (Nova Scotia, New Brunswick, Prince Edward Island and Newfoundland and Labrador). The territories do not currently submit data to PHAC.

National and regional infection rates are based on the total number of cases reported divided by the total number of patient admissions (multiplied by 1,000) or patient days (multiplied by 10,000). This report also provides strain type and antimicrobial resistance data for CDI, MRSA, VRE, CPE and CPA.

The 2016 case definitions and eligibility criteria for these surveillance programs are provided in Appendix B. Case definitions and eligibility criteria are reviewed each year prior to the start of the surveillance year by the CNISP working group responsible for overseeing each ARO surveillance activity. CNISP working groups are comprised of members of CHEC and PHAC technical experts from CCDIC and NML. Case definitions and eligibility criteria may vary from one surveillance year to another as the surveillance protocols are reviewed and updated by the applicable CNISP working group.

This report supersedes the data in previous ARO reports. The most current report should be considered the most accurate. Data from 2016 are considered preliminary. Surveillance data are dynamic and results are subject to change as more updated data are made available by the participating hospitals. Data from previous ARO and Canadian Antimicrobial Resistance Surveillance System (CARSS) reports may vary slightly based on criteria used to analyze and report the data, but the overall reported trends remain similar. Note that for all years, only hospitals that submitted both numerator and denominator data are included in the rate calculations.

For questions or more information on these rates or for a copy of the most recent PHAC surveillance report, please contact the Centre for Communicable Diseases and Infection Control, Public Health Agency of Canada by sending an email to ccdic-clmti@phac-aspc.gc.ca.

RESULTS

1. *Clostridium difficile* Infection (CDI)

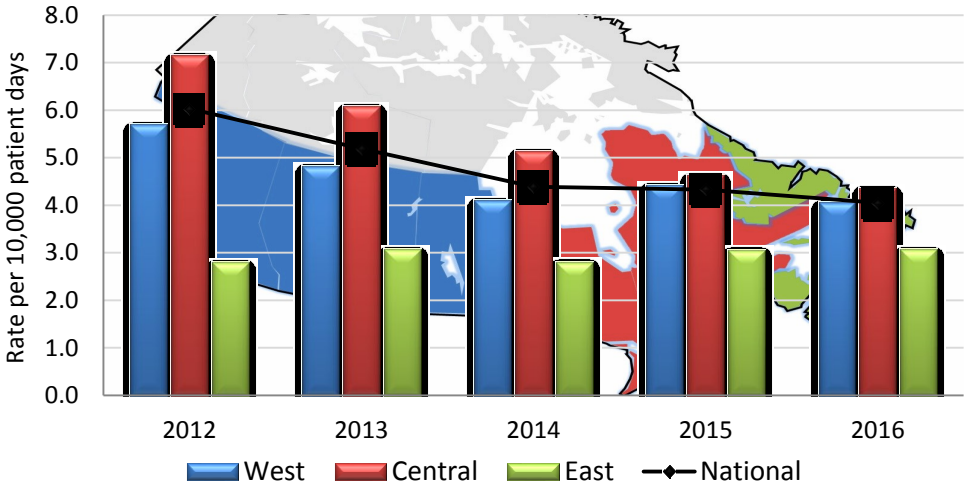
1a. Healthcare-associated *Clostridium difficile* Infection (HA-CDI)

Table 1.1 Number of HA-CDI from CNISP reporting hospitals only[‡], cases and incidence rates per 1,000 patient admissions and 10,000 patient days

	2012	2013	2014	2015	2016
National					
No. of HA-CDI cases	3,482	3,160	2,870	2,930	2,814
Rate per 1,000 pt admissions	4.80	3.99	3.43	3.34	3.13
Rate per 10,000 pt days	6.03	5.19	4.39	4.33	4.05
No. of reporting hospitals	54	54	60	62	63
West					
No. of HA-CDI cases	1,282	1,198	1,121	1,318	1,254
Rate per 1,000 pt admissions	4.76	3.61	3.10	3.35	3.10
Rate per 10,000 pt days	5.70	4.82	4.10	4.41	4.05
Central					
No. of HA-CDI cases	1,997	1,732	1,510	1,356	1,290
Rate per 1,000 pt admissions	5.31	4.56	3.90	3.43	3.22
Rate per 10,000 pt days	7.14	6.08	5.13	4.62	4.35
East					
No. of HA-CDI cases	203	230	243	256	270
Rate per 1,000 pt admissions	2.55	2.86	2.75	2.91	2.90
Rate per 10,000 pt days	2.80	3.07	2.81	3.06	3.07

[‡]*HA-CDI from CNISP reporting hospitals only: includes all cases identified and have potentially been acquired only within a CNISP hospital. HA-CDI as per the case definition in Appendix B.*

Graph 1.1 HA-CDI from CNISP reporting hospitals only, national and regional incidence rates per 10,000 patient days



1 b. Community-associated *Clostridium difficile* Infection (CA-CDI)

Table 1.2 Number of CA-CDI cases and incidence rates per 1,000 patient admissions and 10,000 patient days

	2012	2013	2014	2015	2016
National					
No. of CA-CDI cases	*	*	*	1,036	937
Rate per 1,000 pt admissions	*	*	*	1.56	1.35
Rate per 10,000 pt days	*	*	*	2.03	1.76
No. of reporting hospitals	*	*	*	49	50
West					
No. of CA-CDI cases	*	*	*	254	238
Rate per 1,000 pt admissions	*	*	*	1.15	1.05
Rate per 10,000 pt days	*	*	*	1.55	1.41
Central					
No. of CA-CDI cases	*	*	*	676	598
Rate per 1,000 pt admissions	*	*	*	1.91	1.60
Rate per 10,000 pt days	*	*	*	2.57	2.17
East					
No. of CA-CDI cases	*	*	*	106	101
Rate per 1,000 pt admissions	*	*	*	1.20	1.10
Rate per 10,000 pt days	*	*	*	1.27	1.15

CA-CDI includes all cases identified among admitted patients within a CNISP hospital. CA-CDI as per the case definition in Appendix B. Data collection for CA-CDI started only in 2015.

Table 1.3 Attributable mortality rate 30 days after date of first positive CDI test in adults with HA-CDI

	Number of deaths*	Mortality rate (%)
2012	24	4.6
2013	21	3.9
2014	22	4.3
2015	16	3.8
2016	12	3.0

**Deaths directly and indirectly related to HA-CDI 30 days after the date of the first positive lab specimen or positive histopathology specimen. Mortality data are collected during the two-month period (March and April of each year) for adults (age 18 years and older) and year-round for children (age 1 year to less than 18 years old). Among pediatric patients, there was no death attributable to HA-CDI.*

Table 1.4 Number and proportion of select healthcare-associated *C. difficile* NAP strain types[ǂ]

Strain Type	2012	2013	2014	2015	2016
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
NAP1	164 (33.3)	152 (29.6)	114 (23.6)	115 (22.9)	53 (11.8)
NAP4	77 (15.7)	90 (17.5)	92 (19.1)	106 (21.1)	91 (20.1)
NAP11	40 (8.1)	33 (6.4)	62 (12.9)	50 (9.9)	73 (16.2)
Other NAP types*	91 (18.5)	91 (17.8)	84 (17.4)	94 (18.7)	72 (16.0)
Other-not assigned	120 (24.4)	147 (28.7)	130 (27.0)	138 (27.4)	162 (35.9)

[ǂ] *CDI isolates are collected for NAP typing during the two-month period (March and April of each year) for adults (age 18 years and older) and year-round for children (age 1 year to less than 18 years old from admitted patients only). *Other NAP strain types include NAP2, NAP3, NAP5, NAP6, NAP7, NAP8, NAP9, NAP10 and NAP12.*

Table 1.5 Antimicrobial resistance identified for healthcare-associated *C. difficile* isolates[ǂ]

Antibiotics	2012	2013	2014	2015	2016
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Clindamycin	80 (16.3)	156 (30.5)	209 (43.4)	125 (24.9)	99 (22.0)
Moxifloxacin	192 (39.0)	166 (32.4)	137 (28.4)	138 (27.4)	72 (16.0)
Rifampin	4 (0.8)	13 (2.5)	5 (1.0)	10 (2.0)	7 (1.6)
Total isolates tested	**492**	**512**	**482**	**503**	**451**

[ǂ] *CDI isolates are collected for resistance testing during the two-month period (March and April of each year) for adults (age 18 years and older) and year-round for children (age 1 year to less than 18 years old) from admitted patients only*

Note: All *C. difficile* strains from 2012 to 2016 submitted to NML were susceptible to metronidazole and tigecycline. Only one isolate had a reduced susceptibility to vancomycin (24 µg/ml) in 2012.

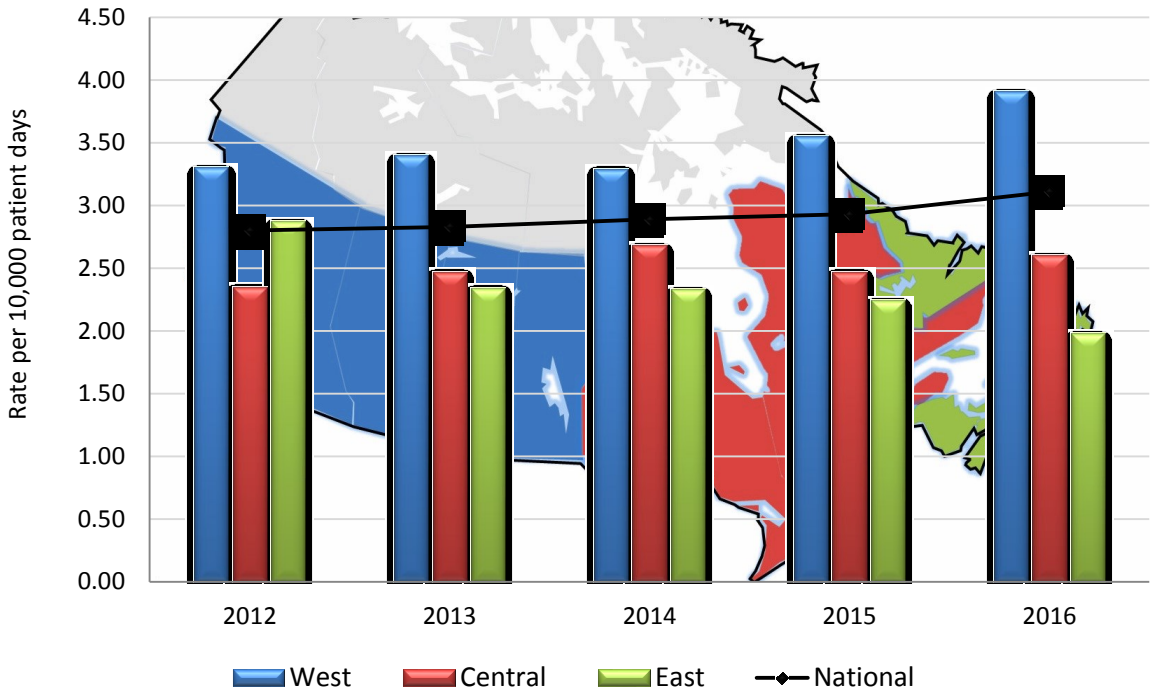
2. Methicillin-Resistant *Staphylococcus aureus* (MRSA)

Table 2.1 Number of total* MRSA infections and incidence rates per 1,000 patient admissions and 10,000 patient days

	2012	2013	2014	2015	2016
National					
No. of MRSA infections	1,787	1,847	1,969	2,049	2,241
Rate per 1,000 pt admissions	2.17	2.11	2.12	2.16	2.30
Rate per 10,000 pt days	2.80	2.83	2.89	2.93	3.11
No. of reporting hospitals	51	53	58	59	61
West					
No. of MRSA infections	844	898	949	1,117	1,272
Rate per 1,000 pt admissions	2.43	2.48	2.33	2.59	2.90
Rate per 10,000 pt days	3.30	3.40	3.29	3.55	3.91
Central					
No. of MRSA infections	703	737	801	732	784
Rate per 1,000 pt admissions	1.83	1.78	1.91	1.75	1.82
Rate per 10,000 pt days	2.35	2.47	2.68	2.47	2.60
East					
No. of MRSA infections	240	212	219	200	185
Rate per 1,000 pt admissions	2.63	2.15	2.19	2.03	1.77
Rate per 10,000 pt days	2.87	2.34	2.33	2.24	1.98

*Includes infections identified from blood AND clinical isolates as well as healthcare and community associated cases identified in admitted patients.

Graph 2.1 Total* MRSA national and regional incidence rates per 10,000 patient days



*Includes infections identified from blood AND clinical isolates as well as healthcare and community associated cases identified in admitted patients.

Table 2.2 Number of Healthcare-associated (HA) MRSA* infections and incidence rates per 1,000 patient admissions and 10,000 patient days

	2012	2013	2014	2015	2016
National					
No. of HA-MRSA infections	1,112	1,137	1,172	1,192	1,206
Rate per 1,000 pt admissions	1.35	1.30	1.26	1.26	1.24
Rate per 10,000 pt days	1.74	1.74	1.72	1.70	1.67
No. of reporting hospitals	51	53	58	59	61
West					
No. of HA-MRSA infections	517	554	535	630	676
Rate per 1,000 pt admissions	1.49	1.53	1.31	1.46	1.54
Rate per 10,000 pt days	2.02	2.10	1.86	2.00	2.08
Central					
No. of HA-MRSA infections	382	400	460	405	381
Rate per 1,000 pt admissions	0.99	0.97	1.09	0.97	0.89
Rate per 10,000 pt days	1.28	1.34	1.54	1.37	1.26
East					
No. of HA-MRSA infections	213	183	177	157	149
Rate per 1,000 pt admissions	2.33	1.85	1.77	1.59	1.43
Rate per 10,000 pt days	2.55	2.02	1.89	1.76	1.59

** HA-MRSA: includes all cases identified and have potentially been acquired within CNISP hospitals and/or from any other healthcare exposure (non-CNISP hospitals, clinics, long-term care facility, etc.) as per the case definition in Appendix B.*

Table 2.3 Number of HA-MRSA infections identified only at CNISP hospitals ‡ and incidence rates per 1,000 patient admissions and 10,000 patient days

	2012	2013	2014	2015	2016
National					
No. of HA-MRSA infections (CNISP)	817	870	869	850	873
Rate per 1,000 pt admissions	0.99	1.00	0.94	0.90	0.90
Rate per 10,000 pt days	1.28	1.33	1.28	1.21	1.21
No. of reporting hospitals	51	53	58	59	61
West					
No. of HA-MRSA infections (CNISP)	377	423	387	455	486
Rate per 1,000 pt admissions	1.08	1.17	0.95	1.05	1.11
Rate per 10,000 pt days	1.47	1.60	1.34	1.44	1.49
Central					
No. of HA-MRSA infections (CNISP)	261	289	331	276	269
Rate per 1,000 pt admissions	0.68	0.70	0.79	0.66	0.63
Rate per 10,000 pt days	0.87	0.97	1.11	0.93	0.89
East					
No. of HA-MRSA infections (CNISP)	179	158	151	119	118
Rate per 1,000 pt admissions	1.96	1.60	1.51	1.21	1.13
Rate per 10,000 pt days	2.14	1.75	1.61	1.33	1.26

‡ *HA-MRSA from CNISP reporting hospitals only: includes all cases identified and have potentially been acquired only within a CNISP hospital. HA-MRSA as per the case definition in Appendix B.*

Table 2.4 Number of community-associated (CA) MRSA infections and incidence rates per 1,000 patient admissions and 10,000 patient days

	2012	2013	2014	2015	2016
National					
No. of CA-MRSA infections	539	549	654	729	921
Rate per 1,000 pt admissions	0.65	0.63	0.70	0.77	0.95
Rate per 10,000 pt days	0.84	0.84	0.96	1.04	1.28
No. of reporting hospitals	51	53	58	59	61
West					
No. of CA-MRSA infections	309	321	380	449	569
Rate per 1,000 pt admissions	0.89	0.89	0.93	1.04	1.30
Rate per 10,000 pt days	1.21	1.21	1.32	1.43	1.75
Central					
No. of CA-MRSA infections	216	207	243	245	322
Rate per 1,000 pt admissions	0.56	0.50	0.58	0.59	0.75
Rate per 10,000 pt days	0.72	0.69	0.81	0.83	1.07
East					
No. of CA-MRSA infections	14	21	31	35	30
Rate per 1,000 pt admissions	0.15	0.21	0.31	0.35	0.29
Rate per 10,000 pt days	0.17	0.23	0.33	0.39	0.32

Table 2.5 Number of MRSA bloodstream infections (MRSA-BSI) and incidence rates per 1,000 patient admissions and 10,000 patient days

	2012	2013	2014	2015	2016
National					
No. of MRSA BSI	324	349	439	491	606
Rate per 1,000 pt admissions	0.39	0.40	0.47	0.52	0.62
Rate per 10,000 pt days	0.51	0.53	0.64	0.70	0.84
No. of reporting hospitals	51	53	58	59	61
West					
No. of MRSA BSI	115	128	161	215	279
Rate per 1,000 pt admissions	0.33	0.35	0.39	0.50	0.64
Rate per 10,000 pt days	0.45	0.48	0.56	0.68	0.86
Central					
No. of MRSA BSI	164	179	236	225	281
Rate per 1,000 pt admissions	0.43	0.43	0.56	0.54	0.65
Rate per 10,000 pt days	0.55	0.60	0.79	0.76	0.93
East					
No. of MRSA BSI	45	42	42	51	46
Rate per 1,000 pt admissions	0.49	0.43	0.42	0.52	0.44
Rate per 10,000 pt days	0.54	0.46	0.45	0.57	0.49

Graph 2.2 MRSA-BSI National and regional incidence rates per 10,000 patient days

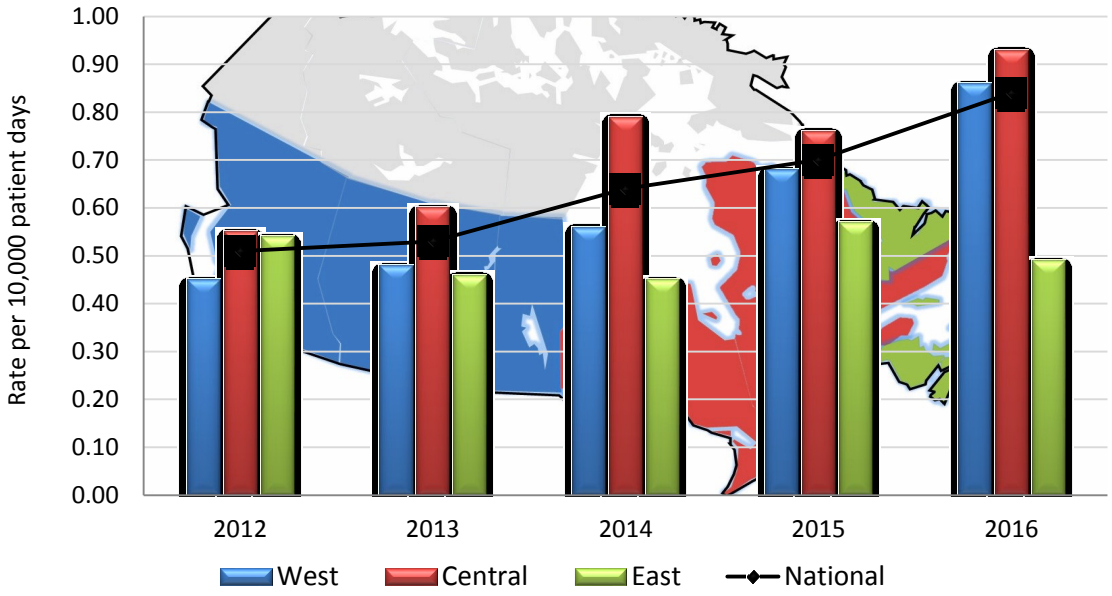


Table 2.6 All-cause mortality rate 30 days after date of positive culture per 100 MRSA-BSI cases

	Number of deaths*	All-cause mortality rate per 100 MRSA-BSI cases
2012	71	22.0
2013	92	25.3
2014	103	24.4
2015	96	20.5
2016	111	19.0

**All-cause mortality rate based on the number of cases with associated 30-day outcome data.*

Table 2.7 Number and proportion of select MRSA strain types identified

Strain Type	2012	2013	2014	2015	2016
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
CMRSA 2	271 (50.7)	278 (47.4)	302 (43.9)	266 (37.2)	279 (31.6)
CMRSA 7	28 (5.2)	24 (4.1)	41 (6.0)	48 (6.7)	72 (8.1)
CMRSA 10	179 (33.5)	214 (36.5)	266 (38.7)	303 (42.3)	408 (46.2)
Other strain types*	52 (9.9)	65 (11.1)	70 (10.2)	76 (10.6)	92 (10.4)
Unassigned	4 (0.7)	6 (1.0)	9 (1.3)	23 (3.2)	33 (3.7)
Total	534	587	688	716	884

**Other strain types from 2012 to 2016 include CMRSA 1, CMRSA 3/6, CMRSA 4, CMRSA 5, CMRSA 8, ST88, ST97, ST398, ST772, USA 700, USA 1000, USA 1100 and European.*

MRSA non-blood isolates (urine, respiratory, wound, surgical site) are collected from January to March of every year and blood isolates are collected year round.

Table 2.8 Antimicrobial resistance identified for MRSA isolates

Antibiotics	2012	2013	2014	2015	2016
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Clindamycin	295 (78.9)	349 (83.5)	374 (65.4)	385 (54.1)	296 (42.7)
Ciprofloxacin	429 (83.0)	479 (85.8)	228 (84.1)	85 (81.7)	520 (74.9)
Daptomycin	0	2 (0.4)	2 (0.3)	5 (0.7)	0
Erythromycin	432 (83.6)	495 (88.7)	535 (84.4)	576 (80.9)	538 (77.5)
Fusidic acid	32 (6.2)	57 (10.2)	91 (14.4)	126 (17.7)	121 (17.4)
Mupirocin HLR	25 (4.8)	15 (2.7)	30 (4.7)	40 (6.6)	Not tested
Rifampin	0	3 (0.5)	3 (0.5)	3 (0.4)	9 (1.3)
Tetracycline	19 (3.7)	25 (4.5)	34 (5.4)	37 (5.2)	48 (6.9)
Tigecycline	2 (0.4)	25 (4.5)	17 (2.7)	6 (0.8)	0
TMP/SMX	12 (2.3)	25 (4.5)	14 (2.2)	14 (2.0)	18 (2.6)
Total isolates tested	517	558	634	712	694

Total # isolates tested for clindamycin =374 (2012), 418 (2013), 572 (2014)
Total # isolates tested for Ciprofloxacin= 271 (2014) 104 (2015)
Total # isolates tested for Mupirocin HLR = 608 (2015)
MRSA non-blood isolates (urine, respiratory, wound, surgical site) are collected from January to March of every year and blood isolates are collected year round

All MRSA isolates from 2012 to 2016 submitted to NML were susceptible to linezolid and vancomycin.

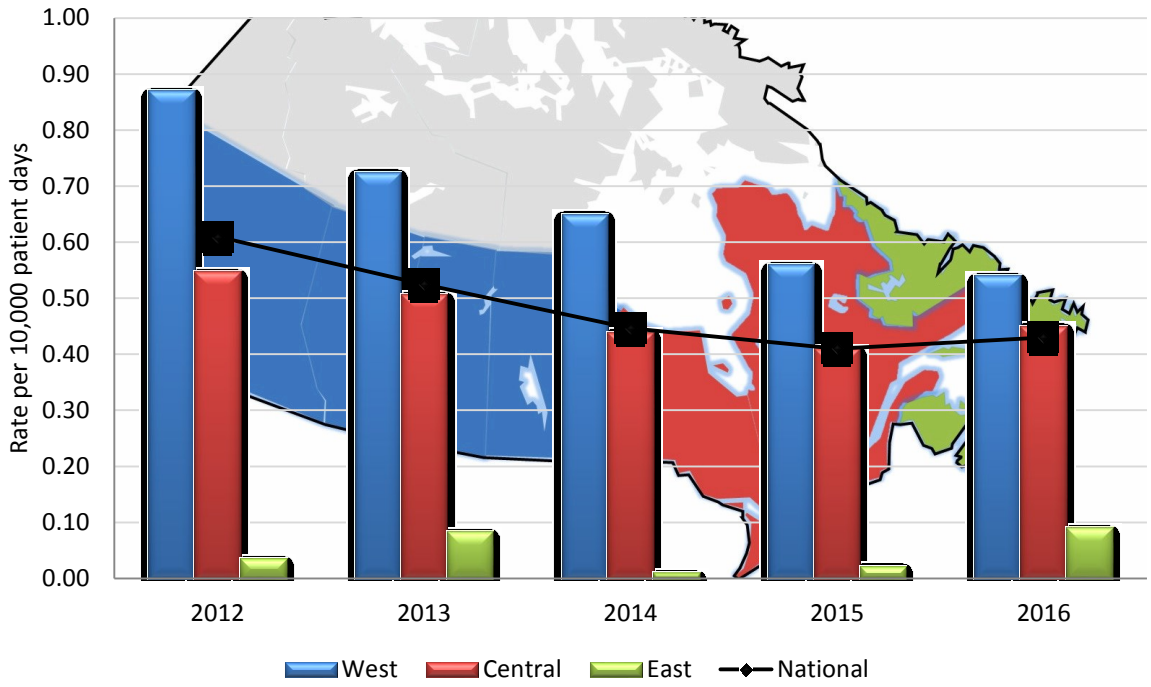
3. Vancomycin-Resistant Enterococci (VRE)

Table 3.1 Number of total* VRE infections and incidence rates per 1,000 patient admissions and 10,000 patient days

	2012	2013	2014	2015	2016
National					
No. of VRE infections	394	322	293	271	299
Rate per 1,000 pt admissions	0.47	0.39	0.33	0.30	0.32
Rate per 10,000 pt days	0.61	0.52	0.45	0.41	0.43
No. of reporting hospitals	53	48	54	53	56
West					
No. of VRE infections	223	154	149	142	146
Rate per 1,000 pt admissions	0.64	0.52	0.45	0.40	0.40
Rate per 10,000 pt days	0.87	0.72	0.65	0.56	0.54
Central					
No. of VRE infections	168	161	143	127	145
Rate per 1,000 pt admissions	0.43	0.37	0.32	0.29	0.32
Rate per 10,000 pt days	0.55	0.51	0.44	0.41	0.45
East					
No. of VRE infections	3	7	1	2	8
Rate per 1,000 pt admissions	0.03	0.08	0.01	0.02	0.08
Rate per 10,000 pt days	0.04	0.08	0.01	0.02	0.09

*Includes infections identified from blood AND clinical isolates.

Graph 3.1 Total* VRE infections national and regional incidence rates per 10,000 patient days



*Includes infections identified from blood AND clinical isolates.

Table 3.2 Number of VRE infections identified only at CNISP hospitals ‡ and incidence rates per 1,000 patient admissions and 10,000 patient days

	2012	2013	2014	2015	2016
National					
No. of VRE infections	*	*	251	231	257
Rate per 1,000 pt admissions	*	*	0.28	0.26	0.28
Rate per 10,000 pt days	*	*	0.39	0.35	0.37
No. of reporting hospitals	*	*	54	53	56
West					
No. of VRE infections	*	*	126	118	121
Rate per 1,000 pt admissions	*	*	0.38	0.33	0.33
Rate per 10,000 pt days	*	*	0.55	0.46	0.45
Central					
No. of VRE infections	*	*	124	111	129
Rate per 1,000 pt admissions	*	*	0.27	0.25	0.28
Rate per 10,000 pt days	*	*	0.38	0.36	0.40
East					
No. of VRE infections	*	*	1	2	7
Rate per 1,000 pt admissions	*	*	0.01	0.02	0.07
Rate per 10,000 pt days	*	*	0.01	0.02	0.07

**Data of where the VRE infection was acquired was not collected in 2012 and 2013.*

‡ *VRE from CNISP reporting hospitals only: includes all cases identified and have potentially been acquired only within a CNISP hospital. VRE as per the case definition in Appendix B.*

Table 3.3 Number of VRE bloodstream infections (VRE-BSI) and incidence rates per 1,000 patient admissions and 10,000 patient days

	2012	2013	2014	2015	2016
National					
No. of VRE-BSI infections	92	98	93	89	121
Rate per 1,000 pt admissions	0.11	0.12	0.11	0.10	0.13
Rate per 10,000 pt days	0.14	0.16	0.14	0.14	0.18
No. of reporting hospitals	53	48	54	53	56
West					
No. of VRE-BSI infections	38	31	35	35	45
Rate per 1,000 pt admissions	0.11	0.11	0.11	0.10	0.12
Rate per 10,000 pt days	0.15	0.15	0.15	0.14	0.17
Central					
No. of VRE-BSI infections	53	67	58	53	75
Rate per 1,000 pt admissions	0.13	0.15	0.13	0.12	0.16
Rate per 10,000 pt days	0.17	0.21	0.18	0.17	0.23
East					
No. of VRE-BSI infections	1	0	0	1	1
Rate per 1,000 pt admissions	0.01	0.00	0.00	0.01	0.01
Rate per 10,000 pt days	0.01	0.00	0.00	0.01	0.01

Graph 3.2 VRE-BSI national and regional incidence rates per 10,000 patient days

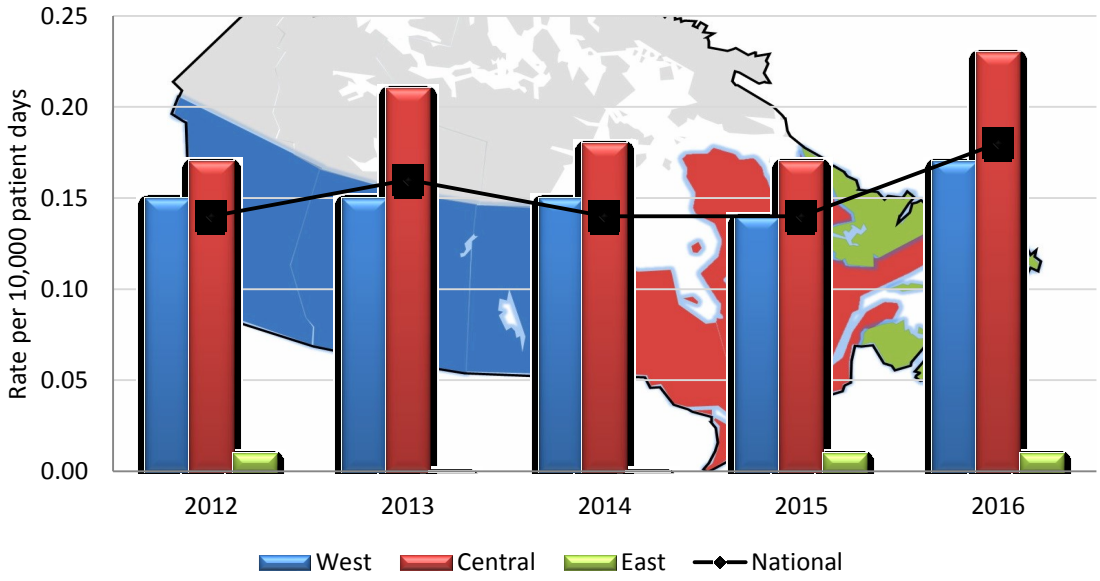


Table 3.4 Number and proportion of main VRE-BSI isolate types identified

Isolate Type	2012	2013	2014	2015	2016
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
vanA, Enterococcus faecium	65 (90.3)	72 (96.0)	70 (100.0)	75 (100.0)	88 (96.7)
vanB, Enterococcus faecium	7 (9.7)	3 (4.0)	0 (0.0)	0 (0.0)	3 (3.3)
Total	**72**	**75**	**70**	**75**	**91**

Table 3.5 Number and proportion of main VRE-BSI multi-locus sequence types (MLST) identified

Sequence Type	2012	2013	2014	2015	2016
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
ST117	24 (33.3)	26 (34.7)	16 (22.9)	13 (17.3)	21 (23.1)
ST18	14 (19.4)	14 (18.7)	20 (28.6)	11 (14.7)	14 (15.4)
ST412	10 (13.9)	14 (18.7)	7 (10.0)	12 (16.0)	13 (14.3)
Others*	24 (33.3)	19 (25.3)	27 (38.6)	35 (46.7)	33 (36.3)
Total	**72**	**75**[a]	**70**	**75**[b]	**91**[c]

**Others include ST17, ST78, ST80, ST203, ST252, ST262, ST265, ST282, ST414, ST494, ST584, ST612, ST664, ST665, ST721, ST734, ST736, ST772, ST787, ST802, ST835, ST836, ST912, ST982, ST983, ST984, ST992, ST1032, ST1112, ST1113.*

[a] 2 samples were untypeable.

[b] 4 samples were untypeable.

[c] 10 samples were untypeable.

Table 3.6 Antimicrobial resistance identified for VRE-BSI isolates

Antibiotics	2012	2013	2014	2015	2016
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Ampicillin	71 (98.6)	75 (100)	70 (100)	75 (100)	91 (100)
Chloramphenicol	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (2.2)
Daptomycin[a]	2 (2.8)	5 (6.7)	0 (0.0)	0 (0.0)	7 (7.7)
HL-Gentamicin	16 (22.2)	13 (17.3)	7 (10.0)	6 (8.0)	13 (14.3)
HL- Streptomycin	29 (40.3)	28 (37.3)	29 (41.4)	27 (36.0)	32 (35.2)
Levofloxacin	72 (100)	75 (100)	70 (100)	75 (100)	91 (100)
Linezolid	0 (0.0)	1 (1.3)	0 (0.0)	0 (0.0)	1 (1.1)
Nitrofurantoin	11 (15.3)	14 (18.7)	15 (21.4)	25 (33.3)	35 (38.5)
Penicillin	71 (98.6)	75 (100)	70 (100)	75 (100)	91 (100)
Tigecycline	1 (1.4)	0 (0.0)	2 (2.9)	0 (0.0)	0 (0.0)
Vancomycin[b]	71 (98.6)	75 (100)	70 (100)	74 (98.7)	88 (96.7)
Total isolates tested	**72**	**75**	**70**	**75**	**91**

[a] Daptomycin does not have breakpoints for intermediate or resistant. Therefore, these are non-susceptible.
[b] Some isolates were susceptible or intermediate to vancomycin, but all harboured VanA or VanB.

4. Carbapenemase-Producing Enterobacteriaceae (CPE) and Carbapenemase-Producing *Acinetobacter* (CPA)

This report presents data on Carbapenemase-Producing Enterobacteriaceae (CPE) and *Acinetobacter* (CPA). CPE and CPA rates are based on inpatients only and include both colonized and infected cases, with the exception of mortality data which includes only infected cases. Rates are based on individual patient data. This means that a patient identified with multiple organisms during the same admission is only included once in the rates. If they are re-admitted and identified as CPE or CPA, they are included in the rates again as their subsequent admission contributes to the denominator. This explains the higher incidence rates presented in this report compared to previous reports. Consequently, data from previous years included in this report have been adjusted to reflect this change in reporting.

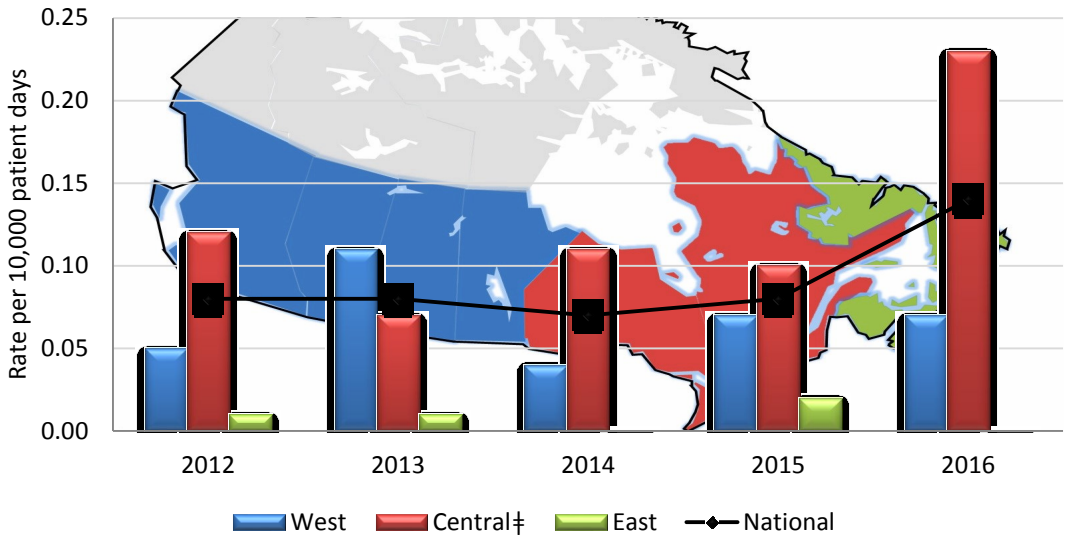
Table 4.1 Number of CPE cases* and incidence rates per 1,000 patient admissions and 10,000 patient days

	2012	2013	2014	2015	2016
National					
No. of CPE cases	39	45	44	54	93
Rate per 1,000 pt admissions	0.07	0.06	0.05	0.06	0.10
Rate per 10,000 pt days	0.08	0.08	0.07	0.08	0.14
No. of reporting hospitals	38	45	58	58	58
West					
No. of CPE cases	6	22	12	21	22
Rate per 1,000 pt admissions	0.04	0.08	0.03	0.05	0.06
Rate per 10,000 pt days	0.05	0.11	0.04	0.07	0.07
Central‡					
No. of CPE cases	32	22	32	31	71
Rate per 1,000 pt admissions	0.09	0.05	0.07	0.07	0.16
Rate per 10,000 pt days	0.12	0.07	0.11	0.10	0.23
East					
No. of CPE cases	1	1	0	2	0
Rate per 1,000 pt admissions	0.01	0.01	0.00	0.02	0.00
Rate per 10,000 pt days	0.01	0.01	0.00	0.02	0.00

**Includes both CPE infections and colonizations*

‡The greater number of cases reported in the Central region is largely attributed to one hospital

Graph 4.1 CPE national and regional incidence rates per 10,000 patient days



‡The greater number of cases reported in the Central region is largely attributed to one hospital

Table 4.2 Number of CPA cases* and incidence rates per 1,000 patient admissions and 10,000 patient days

	2012	2013	2014	2015	2016
National					
No. of CPA cases	9	32	4	5	13
Rate per 1,000 pt admissions	0.02	0.04	0.004	0.01	0.01
Rate per 10,000 pt days	0.02	0.06	0.01	0.01	0.02
No. of reporting hospitals	38	45	58	58	58
West					
No. of CPA cases	4	1	1	4	2
Rate per 1,000 pt admissions	0.03	0.004	0.003	0.01	0.01
Rate per 10,000 pt days	0.03	0.01	0.004	0.01	0.01
Central‡					
No. of CPA cases	5	31	3	1	11
Rate per 1,000 pt admissions	0.01	0.07	0.01	0.002	0.02
Rate per 10,000 pt days	0.02	0.10	0.01	0.003	0.04
East					
No. of CPA cases	0	0	0	0	0
Rate per 1,000 pt admissions	0.00	0.00	0.00	0.00	0.00
Rate per 10,000 pt days	0.00	0.00	0.00	0.00	0.00

**Includes both CPE infections and colonizations*

‡The greater number of cases reported in the Central region is largely attributed to one hospital in 2013 and another hospital in 2016.

Table 4.3 All-cause mortality rate 30 days after date of positive culture per 100 CPE and CPA inpatient infected cases*

	No. of deaths/No. of CPE and CPA infected inpatients with outcome data	All-cause mortality rate per 100 infected cases
2012	2/18	11.1
2013	4/25	16.0
2014	5/24	20.8
2015	3/17	17.6
2016	3/28	10.7

**Includes only CPE and CPA infections*
Mortality rates are based on infected cases where outcome and classification data are available.

Table 4.4 Number and proportion of main CPE and CPA pathogens identified[a]

Pathogen	2012	2013	2014	2015	2016
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Klebsiella pneumoniae	19 (31.2)	27 (28.4)	27 (38)	30 (35.7)	49 (35.8)
Escherichia coli	10 (16.4)	5 (5.3)	11(15.5)	22 (26.2)	24 (17.5)
Serratia marcescens	5 (8.2)	11 (11.6)	6 (8.5)	3 (3.6)	3 (2.2)
Enterobacter cloacae complex[b]	11 (18)	4 (4.2)	12 (17)	10 (11.9)	23 (16.8)
Acinetobacter baumannii	8 (13.1)	37 (39)	8 (11.3)	9 (10.7)	17 (12.4)
Others[c]	8 (13.1)	11 (11.6)	7 (9.9)	10 (11.9)	21 (15.3)
Total	**61**	**95**	**71**	**84**	**137**

[a]Includes both infections and colonizations
[b]*Enterobacter cloacae* complex includes *Enterobacter cloacae* and other *Enterobacter* spp., excluding *E. aerogenes*
[c]Others includes: *Acinetobacter* spp*., Citrobacter* spp., *Klebsiella* oxytoca, *Kluyvera cryocrescens, Morganella morganii, Providencia rettgeri, Raoutella spp.*

Table 4.5.1 Number and proportion of resistance to specific antimicrobials identified for CPE

Antibiotics	2012	2013	2014	2015	2016
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Piperacillin-Tazobactam	49 (96.1)	52 (91.2)	56 (88.9)	69 (92)	91 (76.5)
Cefotaxime	47 (92.2)	46 (80.1)	56 (88.9)	68 (90.1)	113 (95)
Ceftazidime	44 (86.3)	46 (80.1)	56 (88.9)	66 ((88)	109 (91.6)
Meropenem	46 (90.2)	53 (93)	59 (93.7)	66 (88)	106 (89.1)
Ciprofloxacin	28 (54.9)	29 (50.1)	35 (55.6)	49 (65.3)	75 (63)
Amikacin	14 (27.5)	18 (31.6)	17 (27)	23 (30.7)	44 (37)
Gentamicin	23 (45.1)	26 (45.6)	32 (50.8)	39 (53.4)	51 (42.9)
Tobramycin	27 (53)	29 (50.9)	40(63.5)	41 (54.7)	62 (52.1)
Trimethoprim-sulfamethoxazole	29 (56.9)	39 (68.4)	42 (66.7)	57 (76)	79 (66.4)
Tigecycline	11 (21.6)	10 (17.5)	11 (17.5)	13 (17.3)	28 (23.5)
Total isolates tested	**51**	**57**	**63**	**75**	**119**

All isolates were resistant to Ampicillin, and all but one to Cefazolin

Table 4.5.2 Number and proportion of resistance to specific antimicrobials identified for CPA

Antibiotics	2012	2013	2014	2015	2016
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Piperacillin-Tazobactam	10 (100)	37 (97.4)	8 (100)	9 (100)	18 (100)
Cefotaxime	7 (70)	35 (92.1)	8 (100)	9 (100)	16 (88.9)
Ceftazidime	10 (100)	36 (94.7)	8 (100)	9 (100)	16 (88.9)
Meropenem	9 (90)	36 (94.7)	8 (100)	9 (100)	18 (100)
Ciprofloxacin	10 (100)	36 (94.7)	8 (100)	9 (100)	16 (88.9)
Amikacin	5 (50)	5 (13.1)	0 (0)	3 (33.3)	12 (66.7)
Gentamicin	5 (50)	34 (89.5)	8 (100)	7 (77.8)	14 (77.8)
Tobramycin	7 (70)	32 (84.2)	5 (62.5)	7 (77.8)	12 (66.7)
Trimethoprim-sulfamethoxazole	9 (90)	35 (92.1)	8 (100)	7 (77.8)	15 (83.3)
Tigecycline	3 (30)	0 (0)	0 (0)	0 (0)	0 (0)
Total isolates tested	**10**	**38**	**8**	**9**	**18**

All isolates were resistant to Ampicillin, Amoxicillin/Clavulanic Acid, Cefazolin, Cefoxitin

Table 4.6.1 Number and proportion of carbapenemase types identified for CPE

Strain Type	2012	2013	2014	2015	2016
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
KPC	33 (64.7)	30 (52.6)	31 (49.2)	26 (34.7)	62 (52.1)
NDM	5 (9.8)	14 (24.6)	17 (27)	29 (38.7)	38 (31.9)
OXA-48	8 (15.7)	6 (10.5)	7 (11.1)	14 (18.7)	17 (14.3)
VIM	1 (2)	0 (0)	1 (1.6)	1 (1.3)	1 (0.8)
SME*	3 (5.8)	6 (10.5)	5 (7.9)	3 (4)	1 (0.8)
GES-5	1 (2)	1 (1.8)	1 (1.6)	3 (4)	0 (0)
NMC/IMI	0 (0)	1 (1.8)	2 (3.2)	0 (0)	2 (1.6)
IMP	0 (0)	0 (0)	1 (1.6)	0 (0)	0 (0)
Total isolates tested	**51**	**57****	**63****	**75****	**119****

** Only found in Serratia marcescens*

*** 1 isolate in 2013, 2 isolates in 2014, 1 isolate in 2015, and 2 isolates in 2016 harboured both NDM and OXA-48*

Table 4.6.2 Number and proportion of carbapenemase types identified for CPA

Strain Type	2012	2013	2014	2015	2016
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
OXA-23	5 (50)	5 (13.2)	5 (62.5)	8 (88.9)	6 (33.3)
OXA-24	1 (10)	4 (10.5)	0 (0)	0 (0)	3 (16.7)
OXA-58	1 (10)	0 (0)	0 (0)	111.1)	0 (0)
OXA-237	4 (40)	29 (76.3)	3 (37.5)	0 (0)	0 (0)
OXA-235	0 (0)	0 (0)	0 (0)	0 (0)	9 (50)
IMP	1 (10)	0 (0)	0 (0)	0 (0)	0 (0)
NDM	0 (0)	0 (0)	0 (0)	1 (11.1)	0 (0)
Total isolates tested	**10***	**38**	**8**	**9****	**18**

** 1 isolate in 2012 harboured OXA-23, OXA-58, and IMP*

*** 1 isolate in 2015 harboured OXA-58 and NDM*

Appendix A

Hospitals participating in the Canadian Nosocomial Infection Surveillance Program (CNISP), as of December 2016

Participating hospitals from the Western region

Vancouver General Hospital, Vancouver, BC
Richmond General Hospital, Richmond, BC
UBC Hospital, Vancouver, BC
Lions Gate Hospital, Vancouver, BC
Powell River Hospital, Powell River, BC
Sechelt Hospital, Sechelt, BC
Squamish Hospital, Squamish, BC
Children's and Women's Health Centre, Vancouver, BC
Royal Jubilee, Victoria, BC
Nanaimo Regional General Hospital, Nanaimo, BC
Victoria General Hospital, Victoria, BC
Kelowna Hospital, Kelowna, BC
University of Northern BC, Prince George, BC
Peter Lougheed Hospital, Calgary, AB
Rockyview General Hospital, Calgary, AB
Foothills Hospital, Calgary, AB
South Health Campus, Calgary, AB
Alberta Children's Hospital, Calgary, AB
University of Alberta Hospital, Edmonton, AB
Stollery Children's Hospital, Edmonton, AB
Royal University Hospital, Saskatoon, SK
St. Paul's Hospital, Saskatoon, SK
Regina General Hospital, Regina, SK
Pasqua Hospital, Regina, SK
Health Sciences Centre, Winnipeg, MB
Children's Hospital, Winnipeg, MB

Participating hospitals from the Central region

Children's Hospital of Western Ontario, London, ON
Victoria Hospital, London, ON
University Hospital, London, ON
Toronto Western Hospital, Toronto, ON
Toronto General Hospital, Toronto, ON
Princess Margaret Hospital, Toronto, ON
North York General Hospital, Toronto, ON

The Hospital for Sick Children, Toronto, ON
Mount Sinai Hospital, Toronto, ON
Sunnybrook Health Sciences Centre, Toronto, ON
Kingston General Hospital, Kingston, ON
Hamilton Health Sciences Centre, McMaster, Hamilton, ON
Hamilton Health Sciences Centre, Juravinski Site, Hamilton, ON
Hamilton Health Sciences Centre, General Site, Hamilton, ON
St Joseph's Healthcare, Hamilton, ON
The Ottawa Hospital, Civic Campus, Ottawa, ON
The Ottawa Hospital, General Site, Ottawa, ON
The Ottawa Hospital, Heart Institute, Ottawa, ON
Children's Hospital of Eastern Ontario, Ottawa, ON
Health Sciences North, Sudbury, ON
Jewish General Hospital, Montréal, QC
Montréal Children's Hospital, Montréal, QC
Maisonneuve-Rosemont Hospital, Montréal, QC
Montréal General Hospital, Montréal, QC
Royal Victoria Hospital, Montréal, QC
Montréal Neurological Hospital, Montréal, QC
Hôtel-Dieu de Québec de CHUQ, Québec, QC

Participating hospitals from the Eastern region

The Moncton Hospital, Moncton, NB
Queen Elizabeth Hospital, Charlottetown, PEI
Prince County Hospital, PEI
QE II Health Sciences Centre, Halifax, NS
IWK Health Centre, Halifax, NS
Health Sciences Centre General Hospital, St. John's, NL
Janeway Children's Health and Rehabilitation Centre, St. John's, NL
St. Clare's Mercy Hospital, St. John's, NL
Burin Peninsula Health Centre, Burin, NL
Carbonear General Hospital, Carbonear, NL
Dr. G.B. Cross Memorial Hospital, Clarenville, NL
Western Memorial Regional Hospital, NL

We gratefully acknowledge the contribution of the physicians, epidemiologists, infection control practitioners and laboratory staff at each participating hospital and the Public Health Agency staff within the Centre for Communicable Diseases and Infection Control and the National Microbiology Laboratory, Winnipeg.

Appendix B: 2016 Surveillance Case Definitions and Eligibility Criteria

1. *Clostridium difficile* Infection (CDI)

To be included in the surveillance, a CDI patient must be:

- **ONE** year of age and older

Surveillance case definition for primary episodes of CDI

- A "primary" episode of CDI is defined as either the first episode of CDI ever experienced by the patient or a new episode of CDI which occurs greater than eight (8) weeks after the previous confirmed case of CDI in the same patient, i.e. after the first *C. difficile* toxin-positive assay or PCR test.

A patient is identified as having CDI if:

- they have diarrhea* or fever, abdominal pain and/or ileus **AND** a laboratory confirmation of a positive toxin assay or positive polymerase chain reaction (PCR) for *C. difficile* (without reasonable evidence of another cause of diarrhea).

OR

- they have a diagnosis of pseudomembranes on sigmoidoscopy or colonoscopy (or after colectomy) or histological/pathological diagnosis of CDI.

OR

- the patient is diagnosed with toxic megacolon (in adult patients only)

*Diarrhea is defined as one of the following:

- 6 or more watery stools in a 36-hour period
- 3 or more unformed stools in a 24-hour period and this is new or unusual for the patient (in adult patients only)

NOTE: If the information about the frequency and consistency of diarrhea is not available, a toxin-positive stool or positive PCR will be considered as a case.

Once the patient has been identified with CDI, they will be classified as HA or CA based on the following criteria[a] and the *best clinical judgment* of the healthcare and/or infection prevention and control practitioner.

[a] Adapted from SHEA/IDSA practice recommendations 'Strategies to Prevent Clostridium difficile Infections in Acute Care Hospitals: 2014 Update' – available at URL http://www.jstor.org/stable/10.1086/676023?origin=JSTOR-pdf

CDI is considered ***"healthcare-associated from your facility"***[b] if it meets the following criteria:

- The patient's CDI symptoms occur in your healthcare facility 3 or more days after admission, with day of admission being day 1.

OR

- The patient's CDI symptoms occur less than three (3) days after admission and are seen in a patient who had been hospitalized at your healthcare facility and discharged within the previous 4 weeks.

CDI is considered "***healthcare-associated, another facility***" if it meets the following criteria:

- The patient's CDI symptoms occur less than three (3) days after admission and are seen in a patient who is known to have been hospitalized at another healthcare facility and discharged within the previous four (4) weeks.

CDI is considered "***community-associated***" if it meets the following criteria:

- Patients seen in the Emergency Department, clinic, or other outpatient areas with positive test results for CDI are included (if possible at your facility)[c]

  OR

- Patient's CDI symptoms occur three (3) days or less after admission to a healthcare facility (your facility or another), with the date of admission being day 1;

AND

- The symptom onset was more than twelve (12) weeks after the patient was discharged from any healthcare facility

CDI is considered "***indeterminate***" if it meets the following criteria:

- The patient with CDI does not meet any of the definitions listed above for HA- or CA-CDI**.** The symptom onset was more than four weeks but less than 12 weeks after the patient was discharged from any healthcare facility.

[b] Patients seen in ER or outpatients within 4 weeks of discharge from your or another healthcare facility who meet the criteria for CDI would be considered HA-CDI even if not admitted

[c] Cases identified in the ER (non -admitted patients) or outpatient areas will NOT be included in the calculation of infection rates

2. Methicillin-Resistant *Staphylococcus aureus* (MRSA)

MRSA surveillance inclusion criteria

MRSA case definition:

- isolation of *Staphylococcus aureus* from any body site

AND

- resistance of isolate to oxacillin

AND

- patient must be admitted to the hospital

AND

- is a "newly identified MRSA case" at a **CNISP hospital** at the time of hospital admission or identified during hospitalization.

This includes:

- MRSA infections identified for the first time during this hospital admission
- Infections that have been previously identified at other **non**-CNISP hospitals (since we want newly identified MRSA cases at CNISP hospitals)
- Infections that have already been identified at your site but are new cases. This can only be identified if the previously identified case has another strain. This means the person was exposed again to MRSA and acquired another strain of it from another source (a new patient identifier is assigned only if confirmed with a different strain type)

AND

- meets the criteria for MRSA infection as determined using the April 2015 CDC/NHSN surveillance definitions for specific infections, and in accordance with the best judgment of the healthcare and/or IPC practitioner.

MRSA surveillance exclusion criteria:

- MRSA infections previously identified at other CNISP sites
- Emergency, clinic, or other outpatient cases who are not admitted to the hospital.
- Infections re-admitted with MRSA (unless it is a different strain)

Healthcare-associated (HA) case definition:

Once the patient has been identified with MRSA, they will be classified as HA based on the following criteria and the best clinical judgement of the healthcare and/or infection prevention and control practitioner (IPC):

- Exposure to any healthcare setting (including long-term care facilities or clinics) in the previous 12 months[d]
  OR
- Patient is on calendar day 3[e] of their hospitalization

[d] Consideration should be given to the frequency and nature of exposure to a healthcare setting. For example, pediatric patients with clinic visits in the previous 12 months may or may not be considered as HA.
[e] Calendar day 1 is the day of hospital admission.

Newborn healthcare-associated (HA) case definition:

A MRSA case in a newborn may be considered as HA if:

- The newborn is on calendar day 3 of their hospitalization
- The mother was not known to have MRSA on admission and there is no epidemiological reason to suspect that the mother was colonized prior to admission, even if the newborn is < 48 hours of age.

In the case of a newborn transferred from another institution, MRSA may be classified as HA if the organism was not known to be present and there is no epidemiological reason to suspect that acquisition occurred prior to transfer.

Community-associated case definition:

- MRSA identified on admission to hospital (Calendar Day 1 = day of hospital admission) and/or the day after admission (day 2).
  AND
- Has no previous history of the organism.
  AND
- Has no prior hospital, long-term care admission or other exposure to a healthcare setting (rehab, clinics)[4] in the past 12 months[1].
  AND
- Has no reported use of medical devices.

MRSA clinical infection

MRSA infection is determined using the 2016 CDC/NHSN surveillance definitions www.cdc.gov/nhsn/pdfs/pscmanual/17pscnosinfdef_current.pdf for specific infections, and in accordance with the best judgment of the healthcare and/or IPC practitioner.

The MRSA infection would be considered HA if all elements of a CDC/NHSN site-specific infection criterion were present on or after the 3rd calendar day of admission to the facility (the day of hospital admission is calendar day 1). The MRSA infection would be considered CA if all elements of a CDC/NHSN site-specific infection criterion were present during the two calendar days before the day of admission, the first day of admission (day 1) and/or the day after admission (day 2) and are documented in the medical record.

MRSA Bloodstream infection (bacteremia)

To be considered a MRSA bloodstream infection the patient must have MRSA cultured (lab-confirmed) from at least one blood culture

To classify the MRSA bloodstream infection as HA or CA, the following criteria taken from Friedman et al, Ann Intern Med 2002 will be used. The MRSA infection would be considered:

HA – your facility MRSA BSI: if the first positive blood culture for MRSA was obtained ≥ 48 hours after admission to your hospital

HA – MRSA BSI: if the first positive blood culture for MRSA was obtained ≥ 48 hours after hospital admission
OR
if the first positive blood culture for MRSA was obtained within 48 hours of admission, the patient meets one of the following criteria:

(i) healthcare exposure in the previous 90 days (such as receipt of IV medications, IV chemotherapy, hemodialysis, etc);
(ii) was hospitalized in the previous 90 days; or
(iii) resides in a long-term care facility or nursing home.

CA – MRSA BSI: if the first positive blood culture for MRSA was obtained prior to hospital admission, or within 48 hours of admission, **AND** did not meet criteria for HA-BSI.

3. Vancomycin-Resistant Enterococci (VRE)

VRE infection case definition:

- Isolation of *Enterococcus faecalis or faecium*

AND

- Vancomycin MIC ≥ 8 ug/ml

AND

- Patient is admitted to the hospital

AND

- Is a "newly" identified VRE-infection at a CNISP facility at the time of hospital admission or identified during hospitalization

VRE infection is determined using the January 2016 Centers for Disease Control and Prevention (CDC) National Healthcare Safety Network (NHSN) definitions/criteria for infections, and in accordance with the best judgment of the ICP. These criteria should be met at the time of the culture that yielded VRE, or within 72 hours of the culture.

www.cdc.gov/**nhsn**/pdfs/pscmanual/17pscnosinfdef_current.pdf

Exclusion criteria:

- Previously identified at other CNISP sites (to avoid duplicate reporting to CNISP)
- Identified through emergency, clinic, or other outpatient areas
- Re-admitted with VRE (**UNLESS** it is a different strain)

Healthcare-associated, from your facility (e.g. infection from CNISP reporting hospital) is defined as an inpatient who meets the following criteria:

- Exposure to any healthcare setting (including long-term care facilities or clinics) in the previous 12 months

OR

- Has been hospitalized for greater than 48 hours

4. Carbapenemase-Producing Enterobacteriaceae (CPE) and Carbapenem-Producing *Acinetobacter* (CPA)

Any patient admitted to participating CNISP hospitals with a hospital laboratory confirmation (and subsequent confirmation by the NML) that tested/screened positive for a least one potential carbapenem-reduced susceptible Enterobacteriaceae and *Acinetobacter spp*., from any body site that meets the following CLSI criteria.[f]

At least ONE of the following:	**Enterobacteriaceae:**	
	MIC (*µg/ml*)	Disk diffusion* (*mm*)
Imipenem	≥ 4	≤ 19
Meropenem	≥ 4	≤ 19
Doripenem	≥ 4	≤ 19
Ertapenem	≥ 2	≤ 18

At least ONE of the following:	***Acinetobacter:***	
	MIC (*µg/ml*)	Disk diffusion (*mm*)
Imipenem	≥ 8	≤ 18
Meropenem	≥ 8	≤ 14
Doripenem	≥ 8	≤ 14

*Using a 10 µg disk of the appropriate antimicrobial

Carbapenems are a class of beta-lactam antibiotics with broad-spectrum activity recommended as first-line therapy for severe infections caused by certain gram negative organisms and as directed therapy for organisms that are resistant to narrower spectrum antibiotics.

Carbapenem resistance can be due to changes in the permeability of the organism to the antibiotic and/or the up-regulation of efflux systems that "pump" the antibiotic out of the cell, usually concomitant with the presence of an acquired extended-spectrum beta-lactamase (ESBL) or AmpC enzyme or the hyperproduction of intrinsic chromosomally –located beta-lactamase(s). More recently, resistance is increasingly due to the acquisition of enzymes that break down the carbapenems: carbapenemases (e.g. NDM-1, OXA-48, KPC, VIM, IMP etc). These latter subsets of carbapenem-resistant organisms are called carbapenemase-producing organisms (CPOs) and are of particular concern because of their ability to transfer resistance easily across different genera and species of bacteria. They are quickly becoming a public health problem not only because of the ability to cause healthcare acquired infections which have

[f] Clinical and Laboratory Standards Institute. 2015. Performance standards for antimicrobial susceptibility testing; 25th informational supplement, M100-S25 (Jan., 2015). Clinical and Laboratory Standards, Wayne, PA.

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limited treatment options, but because of the potential for colonizing both inpatient and outpatient populations due to their ease of transmissibility, thus, creating a reservoir of bacterial resistance.