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ANTIMICROBIAL RESISTANT ORGANISM (ARO) SURVEILLANCE

Canadian Nosocomial Infection Surveillance Program (CNISP) summary report for ARO data from January 1, 2011 to December 31, 2015


PROTECTING AND EMPOWERING CANADIANS TO IMPROVE THEIR HEALTH

Public Health Agency of Canada
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Canada

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

Updated December 2016

TABLE OF CONTENTS

INTRODUCTION

This report entitled *Canadian Nosocomial Infection Surveillance Program (CNISP) summary report for ARO data from January 1, 2011 To December 31, 2015* 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 Canada and responds to the requests from hospitals to have access to this data in a timely manner.

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 2015, CNISP conducted surveillance in 64 acute-care hospitals in Canada (Appendix A). Of these, 13 are large acute, tertiary care hospitals with more than 500 beds available within the facility; 32 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 33 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.

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 measure of the quality of patient care.

This report provides case counts and rates based on data from January 1, 2011 to December 31, 2015. The report includes rates for healthcare-associated *Clostridium difficile* infection (HA-CDI), methicillin-resistant *Staphylococcus aureus* (MRSA) including healthcare- and community-associated MRSA and MRSA bacteremias, vancomycin-resistant Enterococci (VRE), carbapenemase-producing organisms (CPO) including 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 HA-CDI, MRSA, VRE and CPO.

The 2015 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 2015 are considered preliminary. Results are subject to change as updated data are made available by the participating hospitals. 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

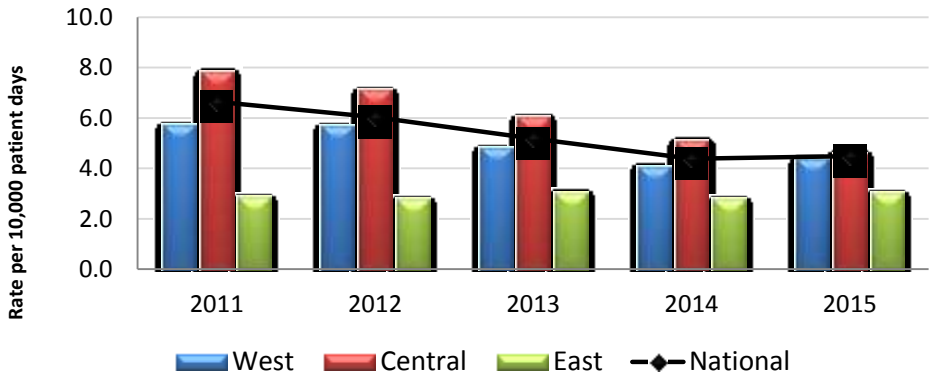
1. Healthcare-associated *Clostridium difficile* Infection (HA-CDI)

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

	2011	2012	2013	2014	2015
National					
No. of HA-CDI cases	3,417	3,482	3,160	2,870	3,028
Rate per 1,000 pt admissions	5.17	4.80	3.99	3.43	3.45
Rate per 10,000 pt days	6.64	6.03	5.19	4.39	4.48
No. of reporting hospitals[a]	54	54	54	60	62
West					
No. of HA-CDI cases	1,241	1,282	1,198	1,121	1,318
Rate per 1,000 pt admissions	4.72	4.76	3.61	3.10	3.35
Rate per 10,000 pt days	5.75	5.70	4.82	4.10	4.41
Central					
No. of HA-CDI cases	2,075	1,997	1,732	1,510	1,356
Rate per 1,000 pt admissions	5.87	5.31	4.56	3.90	3.43
Rate per 10,000 pt days	7.86	7.14	6.08	5.13	4.62
East					
No. of HA-CDI cases	101	203	230	243	256
Rate per 1,000 pt admissions	2.20	2.55	2.86	2.75	2.91
Rate per 10,000 pt days	2.88	2.80	3.07	2.81	3.06

‡ HA-CDI from CNISP reporting hospitals only: includes all cases identified within a CNISP hospital only. 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



‡ HA-CDI from CNISP reporting hospitals only: includes all cases identified within a CNISP hospital only. HA-CDI as per the case definition in Appendix B.

[a] The variation in the number of reporting hospitals each year reflects the changes in the number of participating hospitals, which has increased over time and also reflects only hospitals that submitted both numerator and denominator data which are included in the rate calculations.

Table 1.2 Attributable mortality rate 30 days after date of first positive CDI test in adults with HA-CDI

	Number of deaths*	Mortality rate (%)
2011	36	6.4
2012	24	4.5
2013	21	3.9
2014	22	4.1
2015	16	3.8

**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 (aged 1 year to less than 18 years old). Among pediatric patients, there was no death attributable to HA-CDI.*

Table 1.3 Number and proportion of select healthcare-associated *C. difficile* NAP strain types

Strain Type	***2011***	***2012***	***2013***	***2014***	***2015***
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
NAP1	152 (31.3)	164 (33.3)	152 (29.6)	114 (23.7)	115 (22.9)
NAP4	93 (19.1)	77 (15.7)	90 (17.5)	92 (19.1)	106 (21.1)
NAP11	24 (5.0)	40 (8.1)	33 (6.4)	62 (12.9)	50 (9.9)
Other NAP types*	97 (19.9)	91 (18.5)	91 (17.8)	84 (17.4)	94 (18.7)
Other-not assigned	120 (24.7)	120 (24.4)	147 (28.7)	130 (27.0)	138 (27.4)

**Other NAP strain types include NAP2, NAP3, NAP5, NAP6, NAP7, NAP8, NAP9, NAP10 and NAP12.*
CDI isolates 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 (aged 1 year to less than 18 years old).

Table 1.4 Antimicrobial resistance identified for healthcare-associated *C. difficile* isolates*

Antibiotics	**2011**	***2012***	***2013***	***2014***	***2015***
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Clindamycin	122 (25.1)	80 (16.3)	156 (30.5)	209 (43.4)	125 (24.9)
Moxifloxacin	171 (35.2)	192 (39.0)	166 (32.4)	137 (28.4)	138 (27.4)
Rifampin	3 (0.6)	4 (0.8)	13 (2.5)	5 (1.0)	10 (2.0)

** CDI isolates 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 (aged 1 year to less than 18 years old).*

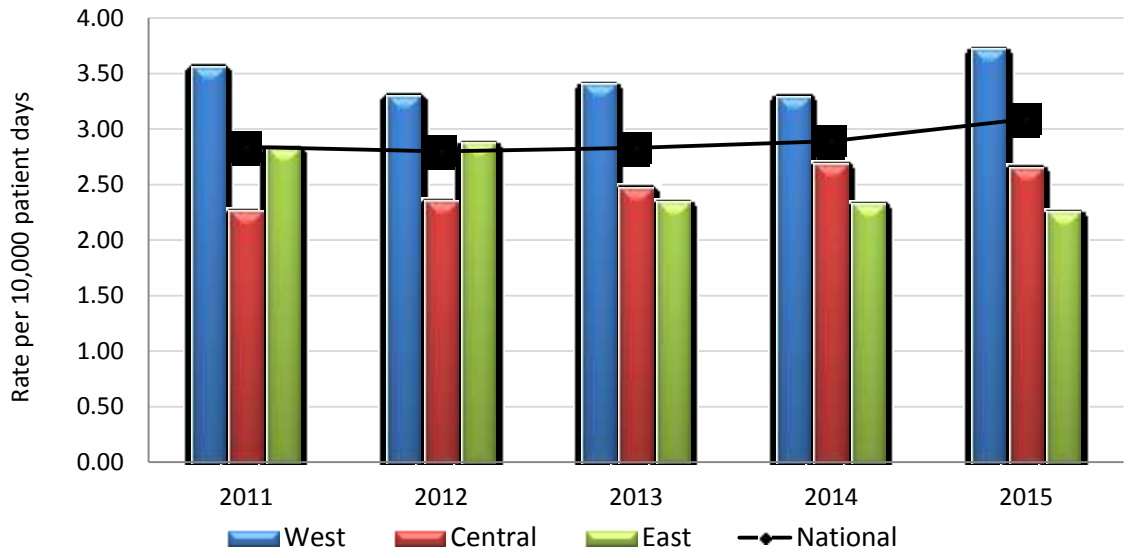
Note: All *C. difficile* strains from 2011 to 2015 submitted to NML were susceptible to metronidazole and tigecycline. Only one isolate had a reduced susceptibility to vancomycin (24 µg/ml) in 2012.

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

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

	2011	2012	2013	2014	2015
National					
No. of MRSA infections	1,857	1,787	1,847	1,969	2,103
Rate per 1,000 pt admissions	2.23	2.17	2.11	2.12	2.23
Rate per 10,000 pt days	2.84	2.80	2.83	2.89	3.09
No. of reporting hospitals[b]	52	51	53	58	59
West					
No. of MRSA infections	891	844	898	949	1,169
Rate per 1,000 pt admissions	2.63	2.42	2.48	2.33	2.74
Rate per 10,000 pt days	3.56	3.30	3.40	3.29	3.72
Central					
No. of MRSA infections	720	703	737	802	733
Rate per 1,000 pt admissions	1.79	1.83	1.78	1.91	1.75
Rate per 10,000 pt days	2.26	2.35	2.47	2.68	2.65
East					
No. of MRSA infections	246	240	212	218	201
Rate per 1,000 pt admissions	2.63	2.63	2.15	2.18	2.04
Rate per 10,000 pt days	2.83	2.87	2.34	2.32	2.25

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



[b] The variation in the number of reporting hospitals each year reflects the changes in the number of participating hospitals, which has increased over time and also reflects only hospitals that submitted both numerator and denominator data which are included in the rate calculations.

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

	2011	2012	2013	2014	2015
National					
No. of HA-MRSA infections	1,261	1,112	1,137	1,172	1,240
Rate per 1,000 pt admissions	1.51	1.35	1.30	1.26	1.31
Rate per 10,000 pt days	1.93	1.74	1.74	1.72	1.82
No. of reporting hospitals[c]	52	51	53	58	59
West					
No. of HA-MRSA infections	558	517	554	535	676
Rate per 1,000 pt admissions	1.65	1.48	1.53	1.31	1.59
Rate per 10,000 pt days	2.23	2.02	2.10	1.86	2.15
Central					
No. of HA-MRSA infections	486	382	400	460	406
Rate per 1,000 pt admissions	1.21	0.99	0.97	1.09	0.97
Rate per 10,000 pt days	1.53	1.28	1.34	1.54	1.47
East					
No. of HA-MRSA infections	217	213	183	177	158
Rate per 1,000 pt admissions	2.32	2.33	1.85	1.77	1.60
Rate per 10,000 pt days	2.50	2.55	2.02	1.89	1.77

** HA-MRSA: includes all cases identified within the CNISP hospitals and 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 from CNISP reporting hospitals only[‡], cases and incidence rates per 1,000 patient admissions and 10,000 patient days

	2011	2012	2013	2014	2015
National					
No. of HA-MRSA infections (CNISP)	914	817	870	869	880
Rate per 1,000 pt admissions	1.10	0.99	1.00	0.94	0.93
Rate per 10,000 pt days	1.40	1.28	1.33	1.28	1.29
No. of reporting hospitals[c]	52	51	53	58	59
West					
No. of HA-MRSA infections (CNISP)	375	377	423	387	483
Rate per 1,000 pt admissions	1.11	1.08	1.17	0.95	1.13
Rate per 10,000 pt days	1.50	1.47	1.60	1.34	1.54
Central					
No. of HA-MRSA infections (CNISP)	357	261	289	331	277
Rate per 1,000 pt admissions	0.89	0.68	0.70	0.79	0.66
Rate per 10,000 pt days	1.12	0.87	0.97	1.11	1.00
East					
No. of HA-MRSA infections (CNISP)	182	179	158	151	120
Rate per 1,000 pt admissions	1.95	1.96	1.60	1.51	1.22
Rate per 10,000 pt days	2.09	2.14	1.75	1.61	1.34

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

[c] The variation in the number of reporting hospitals each year reflects the changes in the number of participating hospitals, which has increased over time and also reflects only hospitals that submitted both numerator and denominator data which are included in the rate calculations.

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

	2011	2012	2013	2014	2015
National					
No. of CA-MRSA infections	468	539	549	654	734
Rate per 1,000 pt admissions	0.56	0.65	0.63	0.70	0.78
Rate per 10,000 pt days	0.71	0.84	0.84	0.96	1.08
No. of reporting hospitals[d]	52	51	53	58	59
West					
No. of CA-MRSA infections	303	309	321	380	455
Rate per 1,000 pt admissions	0.89	0.89	0.89	0.93	1.07
Rate per 10,000 pt days	1.21	1.21	1.21	1.32	1.45
Central					
No. of CA-MRSA infections	150	216	207	243	244
Rate per 1,000 pt admissions	0.37	0.56	0.50	0.58	0.58
Rate per 10,000 pt days	0.47	0.72	0.69	0.81	0.88
East					
No. of CA-MRSA infections	15	14	21	31	35
Rate per 1,000 pt admissions	0.16	0.15	0.21	0.31	0.35
Rate per 10,000 pt days	0.17	0.17	0.23	0.33	0.39

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

	2011	2012	2013	2014	2015
National					
No. of MRSA BSI	370	325	349	439	491
Rate per 1,000 pt admissions	0.44	0.39	0.40	0.47	0.52
Rate per 10,000 pt days	0.56	0.51	0.53	0.64	0.72
No. of reporting hospitals	52	51	53	58	59
West					
No. of MRSA BSI	139	116	128	161	219
Rate per 1,000 pt admissions	0.41	0.33	0.35	0.39	0.51
Rate per 10,000 pt days	0.56	0.45	0.48	0.56	0.70
Central					
No. of MRSA BSI	185	164	179	236	221
Rate per 1,000 pt admissions	0.46	0.43	0.43	0.56	0.53
Rate per 10,000 pt days	0.58	0.55	0.60	0.79	0.80
East					
No. of MRSA BSI	46	45	42	42	51
Rate per 1,000 pt admissions	0.49	0.49	0.43	0.42	0.52
Rate per 10,000 pt days	0.53	0.54	0.46	0.45	0.57

[d] The variation in the number of reporting hospitals each year reflects the changes in the number of participating hospitals, which has increased over time and also reflects only hospitals that submitted both numerator and denominator data which are included in the rate calculations.

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

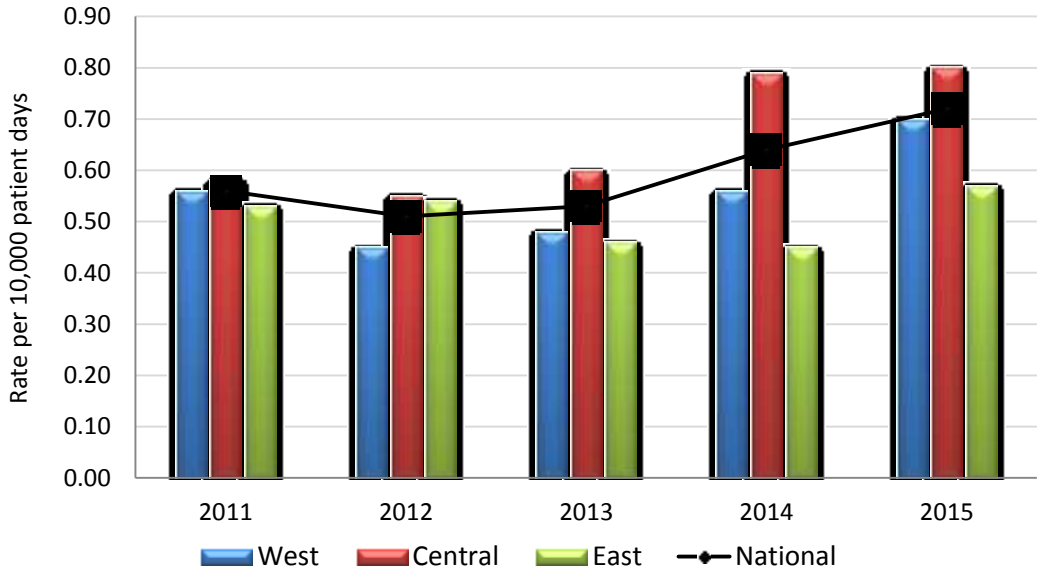


Table 2.6 All-cause mortality rate 30 days after date of positive culture per 100 MRSA-BSI cases

	Number of deaths*	All-cause mortality rate per 100 MRSA-BSI cases
2011	102	27.8
2012	71	22.0
2013	88	25.1
2014	103	24.8
2015	88	19.9

**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	2011	*2012*	*2013*	*2014*	*2015*
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
CMRSA 2	321 (54.5)	271 (50.7)	278 (47.4)	303 (43.9)	205 (36.6)
CMRSA 7	39 (6.6)	28 (5.2)	24 (4.1)	41 (5.9)	44 (7.9)
CMRSA 10	165 (28.0)	179 (33.5)	214 (36.5)	267 (38.7)	233 (41.6)
Other strain types*	56 (9.5)	53 (9.9)	63 (10.7)	71 (10.3)	58 (10.4)
Unassigned	8 (1.4)	4 (0.8)	6 (1.0)	8 (1.2)	20 (3.6)
Total	589	535	587	690	560

**Other strain types include CMRSA 1, CMRSA 3/6, CMRSA 4, CMRSA 5, CMRSA 7, CMRSA 8, ST72, ST88, ST97, ST398, ST772, USA 700, USA 1000, USA 1100 and European.*

MRSA non-blood isolates (urine, respiratory, wound, surgical site) 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	2011	2012	2013	2014	2015
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
	N = 527	N = 517	N = 558	N = 634	N = 496
Clindamycin	341 (89.5)	295 (78.9)	349 (83.5)	374 (65.4)	267 (53.8)
Ciprofloxacin	459 (87.1)	429 (83.0)	479 (85.8)	228 (84.1)	Not tested in
Daptomycin	1 (0.2)	0	2 (0.4)	2 (0.3)	0
Erythromycin	459 (87.1)	432 (83.6)	495 (88.7)	535 (84.4)	400 (80.6)
Fusidic acid	33 (6.3)	32 (6.2)	57 (10.2)	91 (14.4)	76 (15.3)
Mupirocin HLR	34 (6.5)	25 (4.8)	15 (2.7)	30 (4.7)	39 (7.9)
Rifampin	7 (1.3)	0	3 (0.5)	3 (0.5)	2 (0.4)
Tetracycline	19 (3.6)	19 (3.7)	25 (4.5)	34 (5.4)	26 (5.2)
Tigecycline	2 (0.4)	2 (0.4)	25 (4.5)	17 (2.7)	4 (0.8)
TMP/SMX	14 (2.7)	12 (2.3)	25 (4.5)	14 (2.2)	12 (2.4)

Note: 2015 MRSA AMR data considered preliminary
Total isolates tested for Ciprofloxacin= 271 (2014)
Total # isolates tested for clindamycin = 381 (2011), 374 (2012), 418 (2013), 572 (2014)
MRSA non-blood isolates (urine, respiratory, wound, surgical site) collected from January to March of every year and blood isolates are collected year round

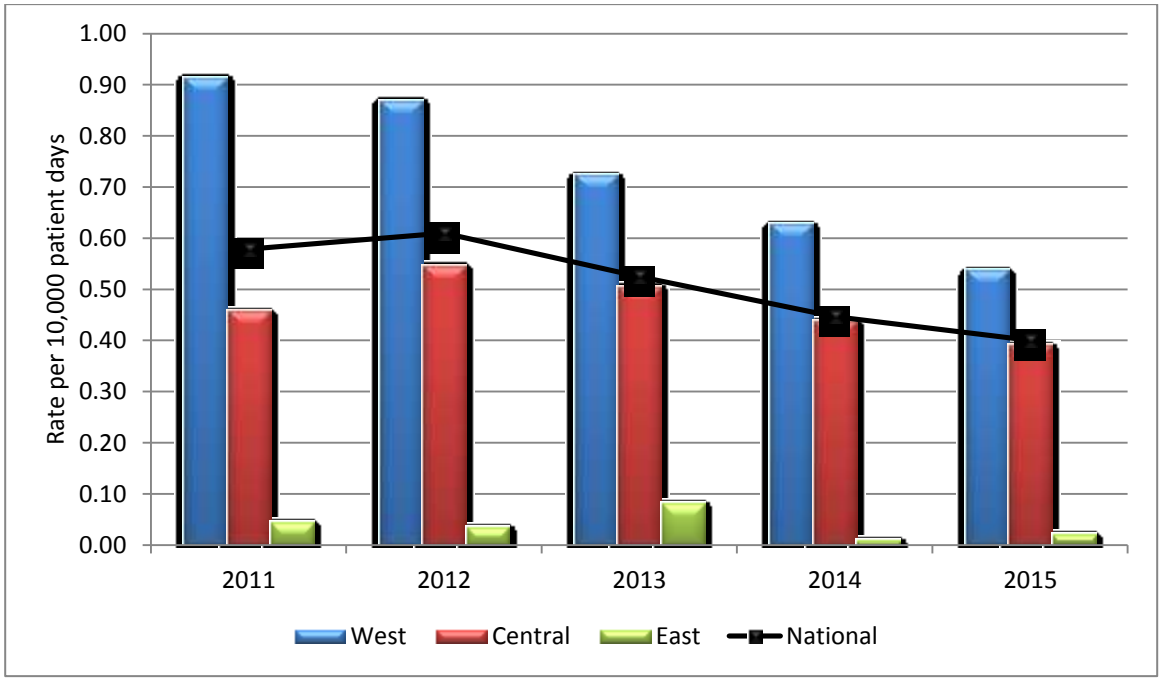
All MRSA isolates from 2011 to 2015 submitted to NML were susceptible to linezolid and vancomycin.

3. Vancomycin-Resistant Enterococci (VRE)

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

	2011	2012	2013	2014	2015
National					
No. of VRE infections	379	394	322	293	271
Rate per 1,000 pt admissions	0.45	0.47	0.39	0.33	0.30
Rate per 10,000 pt days	0.58	0.61	0.52	0.45	0.40
No. of reporting hospitals[e]	52	53	48	54	54
West					
No. of VRE infections	229	223	154	149	142
Rate per 1,000 pt admissions	0.68	0.64	0.52	0.43	0.39
Rate per 10,000 pt days	0.92	0.87	0.72	0.63	0.54
Central					
No. of VRE infections	146	168	161	143	127
Rate per 1,000 pt admissions	0.36	0.43	0.37	0.32	0.28
Rate per 10,000 pt days	0.46	0.55	0.51	0.44	0.39
East					
No. of VRE infections	4	3	7	1	2
Rate per 1,000 pt admissions	0.04	0.03	0.08	0.01	0.02
Rate per 10,000 pt days	0.05	0.04	0.08	0.01	0.02

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



[e] The variation in the number of reporting hospitals each year reflects the changes in the number of participating hospitals, which has increased over time and also reflects only hospitals that submitted both numerator and denominator data which are included in the rate calculations.

Table 3.2 Number of VRE infections from CNISP reporting hospitals only[‡], cases and incidence rates per 1,000 patient admissions and 10,000 patient days

	2011	2012	2013	2014	2015
National					
No. of VRE infections	*	*	*	251	231
Rate per 1,000 pt admissions	*	*	*	0.28	0.25
Rate per 10,000 pt days	*	*	*	0.38	0.34
No. of reporting hospitals[f]	*	*	*	54	54
West					
No. of VRE infections	*	*	*	126	118
Rate per 1,000 pt admissions	*	*	*	0.37	0.32
Rate per 10,000 pt days	*	*	*	0.53	0.45
Central					
No. of VRE infections	*	*	*	124	111
Rate per 1,000 pt admissions	*	*	*	0.27	0.25
Rate per 10,000 pt days	*	*	*	0.38	0.34
East					
No. of VRE infections	*	*	*	1	2
Rate per 1,000 pt admissions	*	*	*	0.01	0.02
Rate per 10,000 pt days	*	*	*	0.01	0.02

**Data of where the VRE infection was acquired was not collected during 2011-2013.*

[‡] *VRE from CNISP reporting hospitals only: includes all cases identified 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

	2011	2012	2013	2014	2015
National					
No. of VRE-BSI infections	74	92	98	93	88
Rate per 1,000 pt admissions	0.09	0.11	0.12	0.10	0.10
Rate per 10,000 pt days	0.11	0.14	0.16	0.14	0.13
No. of reporting hospitals[g]	52	53	48	55	56
West					
No. of VRE-BSI infections	32	38	31	35	35
Rate per 1,000 pt admissions	0.09	0.11	0.11	0.10	0.10
Rate per 10,000 pt days	0.13	0.15	0.15	0.15	0.13
Central					
No. of VRE-BSI infections	40	53	67	58	52
Rate per 1,000 pt admissions	0.10	0.13	0.15	0.13	0.11
Rate per 10,000 pt days	0.13	0.17	0.21	0.18	0.16
East					
No. of VRE-BSI infections	2	1	0	0	1
Rate per 1,000 pt admissions	0.02	0.01	0.00	0.00	0.01
Rate per 10,000 pt days	0.02	0.01	0.00	0.00	0.01

[f] From CNISP reporting hospitals only: includes all cases identified within a CNISP hospital only.
The variation in the number of reporting hospitals each year reflects the changes in the number of participating hospitals, which has increased over time and also reflects only hospitals that submitted both numerator and denominator data which are included in the rate calculations.

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

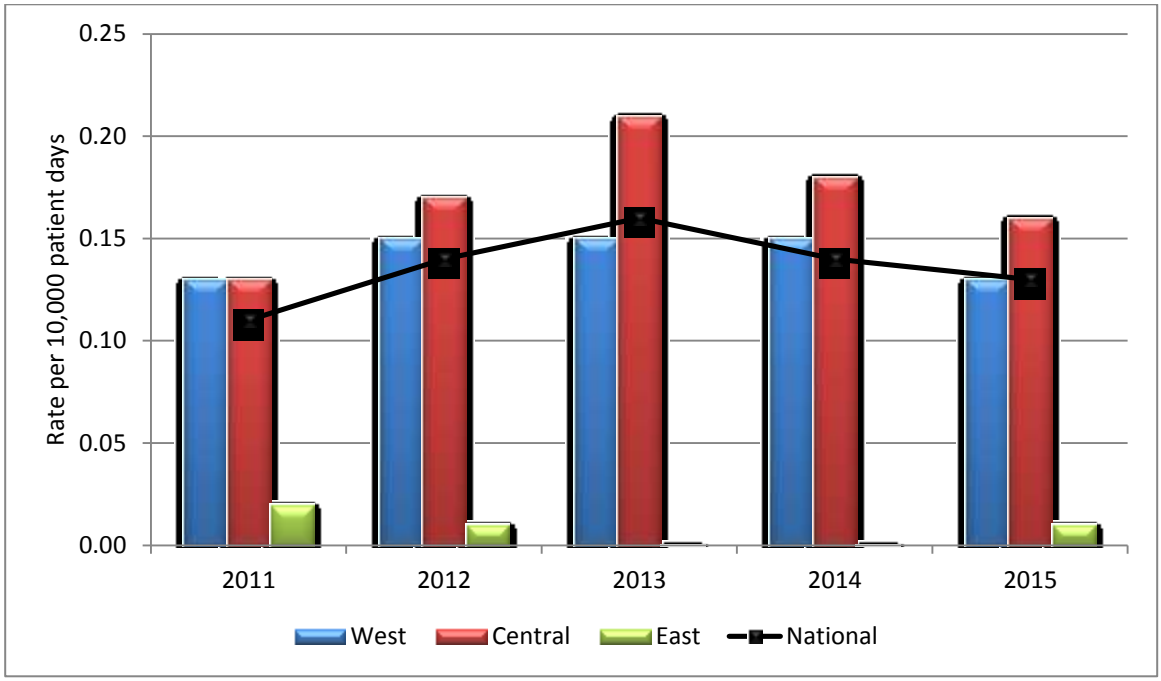


Table 3.4 Number and proportion of main VRE-BSI isolate types identified

	2011 *No. (%)*	*2012 No. (%)*	*2013 No. (%)*	*2014 No. (%)*	*2015 No. (%)*
vanA, vanB, Enterococcus faecium	1 (1.8)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
vanA, Enterococcus faecium	52 (91.2)	65 (90.3)	72 (96.0)	70 (100.0)	75 (100.0)
vanB, Enterococcus faecium	4 (7.0)	7 (9.7)	3 (4.0)	0 (0.0)	0 (0.0)
Total	**57**	**72**	**75**	**70**	**75**

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

	2011 *No. (%)*	*2012 No. (%)*	*2013 No. (%)*	*2014 No. (%)*	*2015 No. (%)*
ST117	18 (32.7)	24 (33.3)	26 (35.6)	16 (22.9)	13 (18.3)
ST18	9 (16.4)	14 (19.4)	15 (20.5)	20 (28.6)	11 (15.5)
ST412	13 (23.6)	10 (13.9)	14 (19.2)	7 (10.0)	12 (16.9)
Others*	15 (27.3)	24 (33.3)	18 (24.7)	27 (38.6)	35 (49.3)
Total	**55**	**72**	**73**	**70**	**71**

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

Table 3.6 Antimicrobial resistance identified for VRE-BSI

	2011 *No. (%)*	*2012* *No. (%)*	*2013* *No. (%)*	*2014* *No. (%)*	*2015* *No. (%)*
Ampicillin	57 (100.0)	71 (98.6)	75 (100.0)	70 (100.0)	75 (100.0)
Penicillin	57 (100.0)	71 (98.6)	75 (100.0)	70 (100.0)	75 (100.0)
Vancomycin	57 (100.0)	71 (98.6)	75 (100.0)	70 (100.0)	75 (100.0)
Total	**57**	**72**	**75**	**70**	**75**

**From 2011-2015, only 1 isolate was resistant to Linezolid and none were resistant to Daptomycin.*

4. Carbapenem-Resistant Gram Negative Bacilli (CRGN)

Please note that CRGN cases and rates were previously reported as organism-based (cases and rates reflected multiple organisms identified in the same patient and included infections, colonizations and those reported from in-patients, out-patients and the ER). Going forward, we will be reporting individual patient-based cases and rates. This means that a patient identified with multiple CRGN organisms is counted only once and only infections (NOT colonizations) from in-patients are reported. This explains the lower incidence rates presented in this report. Consequently, data from previous years included in this report have been adjusted to reflect this change in reporting.

Lastly, this report presents carbapenemase-producing Enterobacteriaceae (CPE) and *Acinetobacter* (CPA) as opposed to carbapenem-resistant Enterobacteriaceae (CRE) and *Acinetobacter* (CRA) as previously reported. Note that CPE and CPA estimates do not add up to the number of CPO cases as one patient can be identified as having both a CPE and a CPA.

4.1 Carbapenemase-Producing Organisms (CPO)

Table 4.1.1 Number of CPO infections and incidence rates per 1,000 patient admissions and 10,000 patient days

	2011	*2012*	*2013*	*2014*	*2015*
National					
No. of CPO infections	16	16	22	27	22
Rate per 1,000 pt admissions	0.031	0.027	0.029	0.030	0.024
Rate per 10,000 pt days	0.039	0.034	0.038	0.041	0.033
No. of reporting hospitals[h]	37	38	45	58	58
West					
No. of CPO infections	2	6	9	12	14
Rate per 1,000 pt admissions	0.014	0.040	0.035	0.032	0.036
Rate per 10,000 pt days	0.017	0.048	0.047	0.044	0.048
Central					
No. of CPO infections	14	10	12	15	7
Rate per 1,000 pt admissions	0.049	0.029	0.029	0.035	0.016
Rate per 10,000 pt days	0.067	0.039	0.040	0.050	0.023
East					
No. of CPO infections	0	0	1	0	1
Rate per 1,000 pt admissions	0.000	0.000	0.011	0.000	0.011
Rate per 10,000 pt days	0.000	0.000	0.012	0.000	0.012

[h] The variation in the number of reporting hospitals each year reflects the changes in the number of participating hospitals, which has increased over time and also reflects only hospitals that submitted both numerator and denominator data which are included in the rate calculations.

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

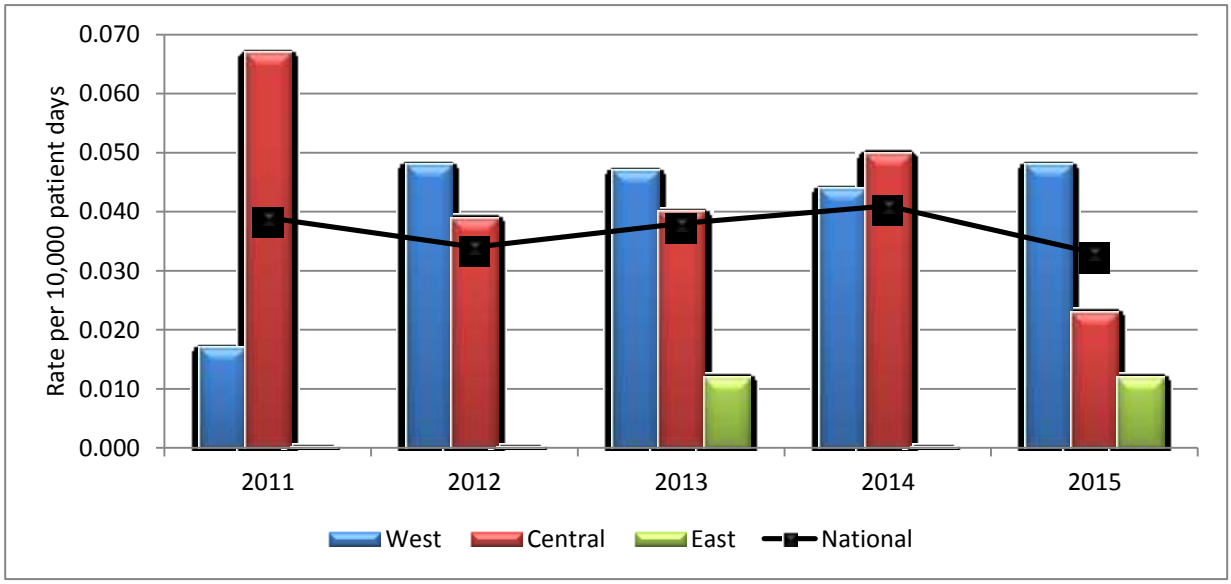


Table 4.1.2 Number of CPO colonizations and incidence rates per 1,000 patient admissions and 10,000 patient days

	2011	*2012*	*2013*	*2014*	*2015*
National					
No. of CPO colonizations	36	22	25	21	35
Rate per 1,000 pt admissions	0.069	0.037	0.033	0.023	0.039
Rate per 10,000 pt days	0.087	0.047	0.043	0.032	0.052
No. of reporting hospitals[i]	37	38	45	58	58
West					
No. of CPO colonizations	1	2	13	1	11
Rate per 1,000 pt admissions	0.007	0.013	0.050	0.003	0.029
Rate per 10,000 pt days	0.008	0.016	0.067	0.004	0.037
Central					
No. of CPO colonizations	35	20	12	20	24
Rate per 1,000 pt admissions	0.123	0.058	0.029	0.046	0.056
Rate per 10,000 pt days	0.167	0.078	0.040	0.066	0.080
East					
No. of CPO colonizations	0	0	0	0	0
Rate per 1,000 pt admissions	0.000	0.000	0.000	0.000	0.000
Rate per 10,000 pt days	0.000	0.000	0.000	0.000	0.000

[i] The variation in the number of reporting hospitals each year reflects the changes in the number of participating hospitals, which has increased over time and also reflects only hospitals that submitted both numerator and denominator data which are included in the rate calculations.

Table 4.1.3 All-cause and attributable mortality rate 30 days after date of positive culture per 100 CPO inpatient infected and colonized cases*

	No. of deaths/No. of CPO inpatients with outcome data	All-cause mortality rate per 100 CPO cases
2011	5/22	22.7
2012	7/56	12.5
2013	6/39	15.4
2014	9/48	18.8
2015	9/33	27.3

**Includes both CPO infections and colonizations.*
Mortality rates are based on CPO cases where outcome data available. This may be less than the number of CPO inpatient infected and colonized cases reported.

Table 4.1.4 Number and proportion of main CPO infection pathogens identified

	2011 ***No. (%)***	***2012*** ***No. (%)***	***2013*** ***No. (%)***	***2014*** ***No. (%)***	***2015*** ***No. (%)***
Klebsiella pneumonia	9 (56.3)	4 (25.0)	9 (40.9)	11 (40.7)	7 (31.8)
Serratia marcescens	0 (0.0)	1 (6.3)	6 (27.3)	6 (22.2)	2 (9.1)
Escherichia coli	1 (6.3)	2 (12.5)	1 (4.5)	2 (7.4)	3 (13.6)
Acinetobacter baumannii	1 (6.3)	1 (6.3)	1 (4.5)	3 (11.1)	2 (9.1)
Enterobacter cloacae	3 (18.8)	1 (6.3)	0 (0.0)	2 (7.4)	2 (9.1)
Others*	1 (6.3)	5 (31.3)	5 (22.7)	2 (7.4)	5 (22.7)
Total	**16**	**16**	**22**	**27**	**22**

**Other includes: Acinetobacter spp., Citrobacter spp., Enterobacter spp., Klebsiella oxytoca, Kluyvera cryocrescens, Morganella morganii, Providencia rettgeri, Raoutella spp., Serratia spp.*

Table 4.1.5 Number and proportion of main CPO colonization pathogens identified

	2011 ***No. (%)***	***2012*** ***No. (%)***	***2013*** ***No. (%)***	***2014*** ***No. (%)***	***2015*** ***No. (%)***
Klebsiella pneumonia	14 (38.9)	3 (13.6)	7 (28.0)	9 (42.9)	12 (34.3)
Enterobacter cloacae	7 (19.4)	5 (22.7)	2 (8.0)	7 (33.3)	3 (8.6)
Escherichia coli	2 (5.6)	2 (9.1)	2 (8.0)	1 (4.8)	12 (34.3)
Serratia marcescens	5 (13.9)	3 (13.6)	3 (12.0)	0 (0.0)	0 (0.0)
Enterobacter spp.	3 (8.3)	2 (9.1)	1 (4.0)	0 (0.0)	2 (5.7)
Others*	5 (13.9)	7 (31.8)	10 (40.0)	4 (19.0)	6 (17.1)
Total	**36**	**22**	**25**	**21**	**35**

**Others include: A. baumannii/calcoaceticus, Acinetobacter baumannii, Citrobacter spp., Enterobacter cloacae complex, Enterobacter spp., Klebsiella oxytoca, Kluyvera spp., Pantoea spp., Raoutella (Klebsiella) terrigena, Raoutella terrigena*

Table 4.1.6 Selected antimicrobial resistance patterns identified for CPO infections

	2011 *No. (%)*	*2012 No. (%)*	*2013 No. (%)*	*2014 No. (%)*	*2015 No. (%)*
Ampicillin	14 (87.5)	12 (75.0)	21 (95.5)	23 (85.2)	20 (90.9)
Piperacillin-Tazobactam	14 (87.5)	16 (100.0)	18 (81.8)	20 (74.1)	20 (90.9)
Cefazolin	14 (87.5)	12 (75.0)	21 (95.5)	23 (85.2)	20 (90.9)
Meropenem	9 (56.3)	15 (93.8)	20 (90.9)	24 (88.9)	18 (81.8)
Ciprofloxacin	9 (6.3)	10 (62.5)	10 (45.5)	18 (66.7)	13 (59.1)
Gentamicin	4 (25.0)	11 (68.8)	11 (50.0)	16 (59.3)	9 (40.9)
Colistin	1 (6.3)	0 (0.0)	2 (9.1)	1 (3.7)	0 (0.0)
Total	**16**	**16**	**22**	**27**	**22**

Table 4.1.7 Selected antimicrobial resistance patterns identified for CPO colonizations

	2011 *No. (%)*	*2012 No. (%)*	*2013 No. (%)*	*2014 No. (%)*	*2015 No. (%)*
Ampicillin	35 (97.2)	21 (95.5)	20 (80.0)	21 (100.0)	32 (91.4)
Cefazolin	35 (97.2)	21 (95.5)	20 (80.0)	21 (100.0)	32 (91.4)
Ceftriaxone	35 (97.2)	20 (90.9)	21 (84.0)	20 (95.2)	34 (97.1)
Ertapenem	33 (91.7)	20 (90.9)	19 (76.0)	20 (95.2)	31 (88.6)
Ciprofloxacin	25 (69.4)	13 (59.1)	13 (52.0)	8 (38.1)	27 (77.1)
Gentamicin	13 (36.1)	6 (27.3)	12 (48.0)	8 (38.1)	27 (54.3)
Colistin	1 (2.8)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Total	**36**	**22**	**25**	**21**	**35**

4.2 Carbapenemase-Producing Enterobacteriaceae (CPE)

Table 4.2.1 Number of CPE infections and incidence rates per 1,000 patient admissions and 10,000 patient days

	2011	2012	2013	2014	2015
National					
No. of CPE infections	15	12	20	24	20
Rate per 1,000 pt admissions	0.029	0.020	0.026	0.027	0.022
Rate per 10,000 pt days	0.036	0.026	0.035	0.036	0.030
No. of reporting hospitals[j]	37	38	45	58	58
West					
No. of CPE infections	1	4	9	15	12
Rate per 1,000 pt admissions	0.007	0.027	0.035	0.039	0.031
Rate per 10,000 pt days	0.008	0.032	0.047	0.055	0.041
Central					
No. of CPE infections	14	8	10	9	7
Rate per 1,000 pt admissions	0.049	0.023	0.024	0.021	0.016
Rate per 10,000 pt days	0.067	0.031	0.033	0.030	0.023
East					
No. of CPE infections	0	0	1	0	1
Rate per 1,000 pt admissions	0.000	0.000	0.011	0.000	0.011
Rate per 10,000 pt days	0.000	0.000	0.012	0.000	0.012

Table 4.2.2 Number of CPE colonizations and incidence rates per 1,000 patient admissions and 10,000 patient days

	2011	2012	2013	2014	2015
National					
No. of CPE colonizations	36	21	22	21	33
Rate per 1,000 pt admissions	0.069	0.036	0.029	0.023	0.036
Rate per 10,000 pt days	0.087	0.045	0.038	0.032	0.049
No. of reporting hospitals	37	38	45	58	58
West					
No. of CPE colonizations	3	1	12	1	11
Rate per 1,000 pt admissions	0.020	0.007	0.046	0.003	0.029
Rate per 10,000 pt days	0.025	0.008	0.062	0.004	0.037
Central					
No. of CPE colonizations	33	20	10	20	22
Rate per 1,000 pt admissions	0.116	0.058	0.024	0.046	0.051
Rate per 10,000 pt days	0.157	0.078	0.033	0.066	0.073
East					
No. of CPE colonizations	0	0	0	0	1
Rate per 1,000 pt admissions	0.000	0.000	0.000	0.000	0.000
Rate per 10,000 pt days	0.000	0.000	0.000	0.000	0.000

[j] The variation in the number of reporting hospitals each year reflects the changes in the number of participating hospitals, which has increased over time and also reflects only hospitals that submitted both numerator and denominator data which are included in the rate calculations.

4.3 Carbapenemase-Producing *Acinetobacter* (CPA)

Table 4.3.1 Number of CPA infections and incidence rates per 1,000 patient admissions and 10,000 patient days

	2011	*2012*	*2013*	*2014*	*2015*
National					
No. of CPA infections	1	4	2	3	2
Rate per 1,000 pt admissions	0.002	0.007	0.003	0.003	0.002
Rate per 10,000 pt days	0.002	0.009	0.003	0.005	0.003
No. of reporting hospitals[k]	37	38	45	58	58

Table 4.3.2 Number of CPA colonizations and incidence rates per 1,000 patient admissions and 10,000 patient days

	2011	*2012*	*2013*	*2014*	*2015*
National					
No. of CPA colonizations	0	1	4	0	2
Rate per 1,000 pt admissions	0.000	0.002	0.005	0.000	0.002
Rate per 10,000 pt days	0.000	0.002	0.007	0.000	0.003
No. of reporting hospitals	37	38	45	58	58

[k] The variation in the number of reporting hospitals each year reflects the changes in the number of participating hospitals, which has increased over time and also reflects only hospitals that submitted both numerator and denominator data which are included in the rate calculations.

Appendix A

Hospitals participating in the Canadian Nosocomial Infection Surveillance Program (CNISP), as of December 2015

Participating hospitals from the Western region

Vancouver General Hospital, Vancouver, BC
Richmond General Hospital, Richmond, BC
UBC Hospital, Vancouver, BC
Lion's 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
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
Sudbury Regional Hospital, 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, Summerside, PEI
QE II Health 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 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: 2015 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[I] and the *best clinical judgment* of the healthcare and/or infection prevention and control practitioner.

[I] 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"***[m] 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)[n]

  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.

[m] 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

[n] 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 **CHEC facility** at the time of hospital admission or identified during hospitalization.

This includes:

- MRSA cases identified for the first time during this hospital admission
- Cases that have been previously identified at other **non**-CHEC sites (since we want newly identified MRSA cases at CHEC sites)
- Cases 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 should be assigned only if it is an MRSA infection, identified as a clinical isolate or bacteremia).

MRSA surveillance exclusion criteria:

- MRSA cases previously identified at other CHEC sites
- Emergency, clinic, or other outpatient cases
- Cases 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[o]

OR

- Patient is on calendar day 3[p] of their hospitalization

[o] 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.

[p] 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 be a case 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 or long-term care admission in the past 12 months[1]

  AND
- Has no reported use of medical devices

MRSA clinical infection

MRSA infection is determined using the 2014 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

[1] *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.*

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 CHEC facility at the time of hospital admission or identified during hospitalization

VRE infection is determined using the January 2015 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 CHEC 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)

4. Carbapenemase-Producing Organisms (CPO), 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.[q]

At least ONE of the following:	**Enterobacteriaceae:**	
	MIC (*µg/ml*)	Disk diffusion* (*mm*)
Imipenem	≥ 2	≤ 22
Meropenem	≥ 2	≤ 22
Doripenem	≥ 2	≤ 22
Ertapenem	≥ 1	≤ 21

At least ONE of the following:	***Acinetobacter:***	
	MIC (*µg/ml*)	Disk diffusion (*mm*)
Imipenem	≥ 4	≤ 21
Meropenem	≥ 4	≤ 17
Doripenem	≥ 4	≤ 17

*Using a 10 µg disk of the appropriate antimicrobial

Carbapenems are a class of broad-spectrum antibiotics 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, the up-regulation of efflux systems that "pump" the antibiotic out of the cell, and more recently due to the hyperproduction of enzymes that break down the carbapenems. This latter subset of carbapenem resistant organisms are called carbapenemase-producing organisms or CPOs and are of particular concern because of their ability to transfer resistance easily across different genus and species of bacteria. They are quickly becoming a public health problem not only because of the ability to cause healthcare-associated infections but because of the potential ease of colonizing both inpatient and outpatient populations creating a reservoir of bacterial resistance.

CPE represents a subset of CRGN bacilli comprised of Enterobacteriaceae and CPA represents a subset of CRGN bacilli comprised of *Acinetobacter* identified as carbapenemase producing. Mechanism may be either by acquisition of a carbapenemase gene e.g. NDM-1, OXA-48, KPC, VIM, IMP or by other cellular mechanisms such as permeability changes (efflux overpression, porin mutations), chromosomal *B*-lactamase up regulation e.g. *E. coli, K. pneumonia, Citrobacter, Enterobacter, Serratia, Morganell, Proteus, Providencia.*

[q] *Clinical and Laboratory Standards Institute. 2014. Performance standards for antimicrobial susceptibility testing; 24th informational supplement, M100- S24 (Jan., 2014). Clinical and Laboratory Standards, Wayne, PA.*