PICNet
PROVINCIAL INFECTION CONTROL NETWORK OF BRITISH COLUMBIA
A program of the Provincial Health Services Authority

Annual surveillance report of healthcare-associated infections in BC health care facilities

Fiscal Year 2017/18
(April 1, 2017 to March 31, 2018)

Prepared by:

Provincial Infection Control Network of British Columbia (PICNet)

December 2018

Interior Health

fraserhealth
Better health. Best in health care.

Vancouver CoastalHealth
Promoting wellness. Ensuring care.

island health

northern health

Provincial Health Services Authority
Province-wide solutions. Better health.

The Provincial Infection Control Network of British Columbia (PICNet) is a provincially supported professional collaborative that provides guidance and advice on healthcare-associated infection prevention and control in British Columbia. Under the aegis and accountability framework of the Provincial Health Services Authority, PICNet connects healthcare professionals from across the province to develop and create guidelines and tools, with a focus on surveillance, education, and evidence-based practice.

Provincial Infection Control Network of BC (PICNet)
1001 West Broadway, Suite 504
Vancouver, BC V6H 4B1
Tel: 604-875-4844 x 22983
Fax: 604-875-4373
Website: www.picnet.ca
Email: picnet@phsa.ca

Table of Contents

Table of Figures and Tables

Acknowledgements

PICNet wishes to thank all participants in each health authority and their affiliated health care facilities for their ongoing support and participation in the provincial HAI surveillance programs. We also thank the infection control practitioners and epidemiologists, and other healthcare providers who collect and report the surveillance data to the health authorities and PICNet.

PICNet recognizes important contributions from the members of PICNet's **Surveillance Steering Committee** on the development of the provincial surveillance program and associated reports, especially Dr. Guanghong Han, PICNet's epidemiologist, for compiling this report.

Surveillance Steering Committee

PICNet's Surveillance Steering Committee consists of representatives from each health authority and related organization, and provides guidance to PICNet's surveillance programs and assists the PICNet Management Office in implementation within the participating health authorities. Following committee members contributed to and reviewed this report:

Joanne Archer	Acting Network Director	PICNet
Dr. Elizabeth Brodkin	Medical Health Officer	FHA
Dr. Elizabeth Bryce	Medical Microbiologist	VCHA
Alison Chant	Infection Control Practitioner	PHSA
June Chen Collet	Epidemiologist	PHSA
Kelly Dillon	Infection Control Practitioner	IHA
Tara Donovan	Network Director	PICNet
Dr. Randall Dumont	Pathologist	NHA
Leslie Forrester	Regional Director, Quality Data Analytics	VCHA
Bruce Gamage	Former Network Director	PICNet
Dr. Dave Goldfarb	Medical Microbiologist	PHSA
Dr. Guanghong Han	Epidemiologist	PICNet
Lisa Harris	Infection Control Practitioner	VCHA
Deanna Hembroff	Infection Control Regional Manager	NHA
Dr. Linda Hoang	Medical Microbiologist	BCCDC
Dr. Pamela Kibsey	Medical Microbiologist	VIHA
Dr. Elisa Lloyd-Smith	Epidemiologist	VCHA
Dr. Christopher Lowe	Medical Microbiologist	PHC
Dr. Neil Mina	Medical Microbiologist	FHA
Dr. Julie Mori	Epidemiologist	IHA
Blair Ranns	Epidemiologist	VIHA
Azra Sharma	Epidemiologist	PHC
Katy Short	Epidemiologist	FHA
Dr. Bing Wang	Medical Microbiologist	IHA
Xuetao Wang	Epidemiologist	FHA
Dr. Titus Wong	Medical Microbiologist	VCHA

Abbreviations

BC	British Columbia
CA	Community-associated
CI	Confidence interval
CDI	*Clostridium difficile* infection
FHA	Fraser Health Authority
FQ	Fiscal quarter
FY	Fiscal year
HA	Health authority
HAI	Healthcare-associated infection
HCA	Healthcare-associated
HCC	Hand cleaning compliance
ICP	Infection control practitioner
IHA	Interior Health Authority
MRSA	Methicillin-resistant *Staphylococcus aureus*
NHA	Northern Health Authority
PHC	Providence Health Care
PHSA	Provincial Health Services Authority
PICNet	Provincial Infection Control Network of British Columbia
PHHWG	Provincial Hand Hygiene Working Group of British Columbia
SSC	PICNet's Surveillance Steering Committee
VCHA	Vancouver Coastal Health Authority
VIHA	Island Health Authority

Executive Summary

Provincial surveillance programs for healthcare-associated infections (HAI) in British Columbia monitor the occurrence and trends of *Clostridium difficile* infection (CDI), methicillin-resistant *Staphylococcus aureus* (MRSA), and carbapenemase-producing organisms (CPO) in acute care facilities, as well as hand cleaning compliance (HCC) among health care providers. The table below summarizes key surveillance results for fiscal year 2017/18, and compares them to previous years.

Highlights of surveillance results in BC healthcare facilities, 2017/18

Indicators	2017/18	2016/17	Five-year trend (2013/14 – 2017/18)
Provincial rate of new CDI associated with the reporting facility per 10,000 inpatient days (and 95% confidence intervals)	3.8 (3.6-4.0)	4.1 (3.9-4.4)	⬇
Provincial rate of new MRSA associated with the reporting facility per 10,000 inpatient days (and 95% confidence intervals)	4.6 (4.4-4.9)	4.9 (4.6-5.1)	⇩
Total number of new cases of CPO identified	134	87	N/A*
Provincial hand cleaning compliance in acute care facilities	84.1%	82.5%	⬆**
Provincial hand cleaning compliance in residential care facilities	86.3%	85.0%	⬆

Notes: ⬆⬇ statistically significant; ⇧⇩ not statistically significant; N/A: not applicable

* Provincial surveillance for CPO, started in July 2014, did not collect denominator data; thus the provincial incidence rate could not be calculated and compared to previous years.

** based on the data from 2014/15 to 2017/18

Key findings in 2017/18

- **CDI**: The provincial annual rate of new CDI associated with the reporting facility did not change significantly in 2017/18 compared with 2016/17. There was a significant downward trend in the provincial rate of CDI from 2013/14 to 2017/18, with the annual rate in 2017/18 being the lowest in this five-year period.
- **MRSA**: The provincial annual rate of MRSA associated with the reporting facility has been relatively stable from 2013/14 to 2017/18. However, the rate of MRSA associated with current admission to the reporting facility decreased significantly during this time period, while the rate of MRSA associated with a previous encounter with the reporting facility increased significantly.
- **CPO**: Of the 134 new cases of CPO identified in acute care facilities in 2017/18, NDM was the predominant carbapenemase resistant gene identified (73.1%). Over half of the cases (58.2%) reported healthcare exposure outside Canada in the prior twelve months.
- **HCC**: Compliance in both acute care facilities and residential care facilities surpassed the target performance of 80% for the fourth consecutive year.

Variations in screening policy, surveillance methods, and patient mix exist among health authorities. The rates of CDI, MRSA, and HCC in this report are not risk-adjusted, therefore, direct comparison between health authorities or healthcare facilities is not recommended.

Introduction

Healthcare-associated infection (HAI) is an infection or colonization that occurred in a patient during the process of care in a hospital or other health care facility, which was not present or incubating at the time of admission [1]. It represents the most frequent adverse event during care delivery [1,2], causing increased morbidity and mortality, prolonged hospital stays, and extra costs. HAI can affect patients in any type of setting where they receive care and can also appear after discharge [1].

Surveillance is a key tool for understanding, measuring and informing actions in the fight against HAI [3]. Since 2009, the Provincial Infection Control Network of British Columbia (PICNet), the health authorities (HAs), and related agencies in British Columbia (BC) have worked together to establish provincial surveillance programs for HAIs in BC acute care facilities. Standard provincial surveillance protocols have been developed for *Clostridium difficile* infection (CDI), methicillin-resistant *Staphylococcus aureus* (MRSA), and carbapenamase-producing organisms (CPOs) over the years (for details of each surveillance protocol, including population under surveillance, case definitions and classification, please visit PICNet's website https://www.picnet.ca/surveillance/). Facility-aggregated data for CDI and MRSA and case-level data for CPO are submitted to PICNet on a quarterly basis. In addition, given the proven effectiveness of hand hygiene in preventing transmission of HAIs [4,5], hand cleaning compliance (HCC) among healthcare providers working in BC healthcare facilities is audited regularly, and the audit results are submitted to PICNet quarterly.

This report summarizes the surveillance data for CDI, MRSA, CPO, and HCC in the fiscal year 2017/18 (April 1, 2017 – March 31, 2018) and compares them to the previous fiscal year of 2016/17. Trend analysis is also presented for CDI, MRSA and HCC, with a focus on the rates over the last five years, from 2013/14 to 2017/18.

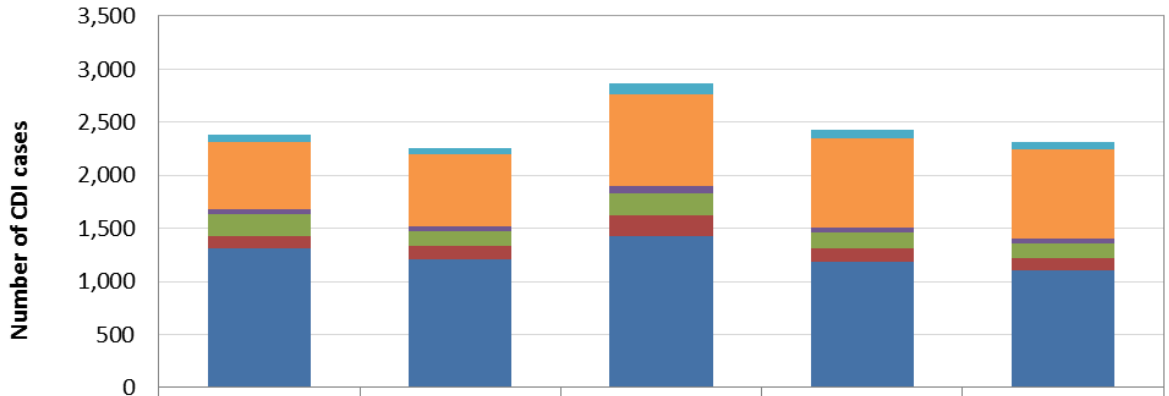
Clostridium difficile infection (CDI)

Overview of CDI cases identified in 2017/18

A total of 2,316 cases of CDI were identified among inpatients in BC acute care facilities in 2017/18. Of these, 1,403 cases (60.6%) were classified as healthcare-associated (HCA), 835 (36.0%) were community-associated (CA), and 78 (3.4%) were of unknown origin. Among 1,403 HCA CDI cases, 1,104 (47.7% of total CDI cases) were new CDI associated with the reporting facility, 116 (5.0%) were new CDI associated with another facility, 136 (5.9%) were relapses of CDI associated with the reporting facility, and 47 cases (2.0%) were relapses of CDI associated with another facility (Figure 1).

Compared with previous years, the numbers of both total CDI cases and new CDI associated with the reporting facility continued to decrease in the last two years after an increase in 2015/16 (Figure 1). The number of new CDI associated with the reporting facility in 2017/18 was the lowest number reported during the last five years.

Figure 1. Number of CDI cases identified in BC acute care facilities by case classification, 2013/14 – 2017/18

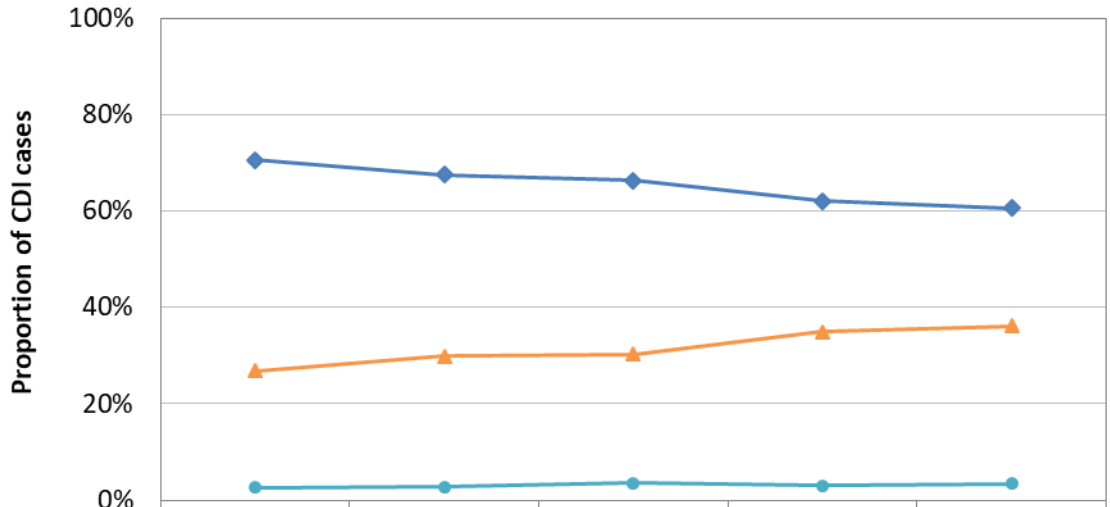


	2013/14	2014/15	2015/16	2016/17	2017/18
Unknown origin	63	62	101	74	78
CA	636	674	866	846	835
HCA with another facility - relapses	46	47	72	42	47
HCA with reporting facility - relapses	201	139	209	145	136
HCA with another facility - new cases	121	132	195	126	116
HCA with reporting facility - new cases	1,309	1,206	1,423	1,190	1,104
Total CDI cases	2,376	2,260	2,866	2,423	2,316

CA: Community-associated; HCA: healthcare-associated

The proportion of HCA CDI cases decreased continuously over the past five years, from 70.6% of all CDI cases in 2013/14 to 60.6% in 2017/18, whereas the proportion of CA CDI increased continuously from 26.8% to 36.8% during the same period (Figure 2). Of HCA CDI, the proportion of new CDI associated with the reporting facility decreased from 55.1% of all CDI cases in 2013/14 to 47.7% in 2017/18.

Figure 2. Proportion of CDI cases identified in BC acute care facilities by case classification, 2013/14 – 2017/18



	2013/14	2014/15	2015/16	2016/17	2017/18
HCA	70.6%	67.4%	66.3%	62.0%	60.6%
CA	26.8%	29.8%	30.2%	34.9%	36.1%
Unknown origin	2.7%	2.7%	3.5%	3.1%	3.4%

CA: Community-associated; HCA: healthcare-associated

Rate of new CDI associated with the reporting facility in 2017/18

The provincial annual rate of new CDI associated with the reporting facility in 2017/18 was 3.8 per 10,000 inpatient days, with a 95% confidence interval (CI) of 3.6 to 4.0. The provincial rate did not change statistically significantly by quarter in 2017/18, with the lowest rate in Q2 (3.5 per 10,000 inpatient days, 95% CI: 3.1 – 4.0) and the highest in Q1 (4.2 per 10,000 inpatient days, 95% CI: 3.7 – 4.7). The CDI rate in Q2 2017/18 was also the lowest quarterly rate since the commencement of the provincial CDI surveillance program in 2009/10.

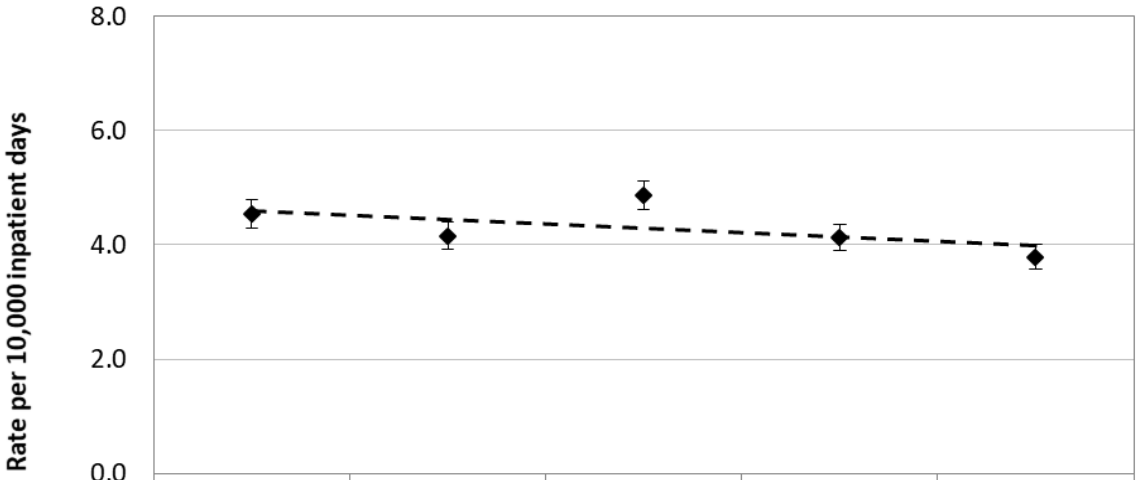
Detailed annual rate of CDI for each health authority and acute care facility in 2017/18 is presented in Appendix D.

Trends of new CDI associated with the reporting facility

The provincial annual rate of CDI associated with the reporting facility in 2017/18 was lower than in the previous year of 2016/17, although the difference was not statistically significant (Figure 3).

Over the last five years from 2013/14 to 2017/18, there has been a downward trend in the provincial rate of CDI, which is statistically significant. The CDI rate in 2017/18 was the lowest during this period and represented a 15.6% decrease compared to 2013/14 (4.5 per 10,000 inpatient days).

Figure 3. Provincial annual rate of new CDI associated with the reporting facility, 2013/14 – 2017/18



	2013/14	2014/15	2015/16	2016/17	2017/18
Rate per 10,000 inpatient days	4.5	4.2	4.9	4.1	3.8
Number of new HCA cases	1,309	1,206	1,443	1,190	1,103

Note: Vertical bars represent the 95% confidence interval of the rates and the dashed line represents the linear trend of rates

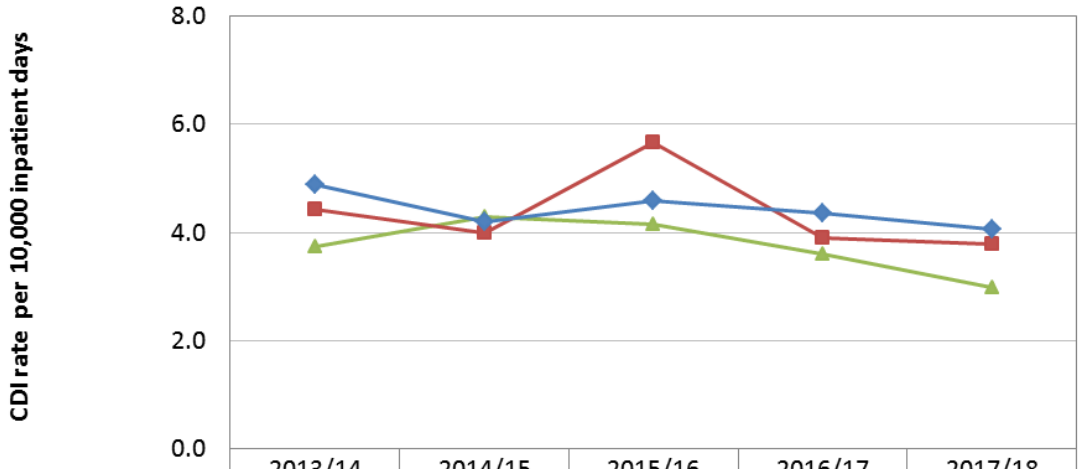
The trend of CDI rates was further analysed by aggregating by: facility type[1] (i.e. tertiary/referral hospital, regional hospital, and community hospital); facility size based on the counts of acute care beds (i.e. 1–50 beds, 51–150 beds, 151–250 beds, and >250 beds); and health authority.

The downward trend was statistically significant for each facility type and the CDI rate in 2017/18 was the lowest over the last five years in each facility type (Figure 4). In 2017/18, the CDI rate in community hospitals was significantly lower than in tertiary/referral hospitals, but the difference in the rates between community hospitals and regional hospitals, and between regional hospitals and tertiary/referral hospitals was not statistically significant.

[1] The classification of hospital types in this report is based on the healthcare services provided and the population served by the hospital, including:

- Tertiary/referral hospital refers to a major hospital that provides a wide range of acute in-patient and out-patient specialist services together with the necessary support systems for the patients across the health authority, and in some cases, across the province. Patients will often be referred from smaller hospitals for major operations, consultations with specialists and sub-specialists, and when sophisticated intensive care facilities are required.
- Regional hospitals typically provide health care services to the patients in its region, with large numbers of beds for intensive care and long-term care, providing specialist and sub-specialist services, such as surgery, plastic surgery, childbirth, bioassay laboratories, and so forth.
- Community hospitals offer an appropriate range of integrated health and social care designed to meet the needs of the local people. Medical care is predominantly provided by general practitioners working with consultant medical colleagues.

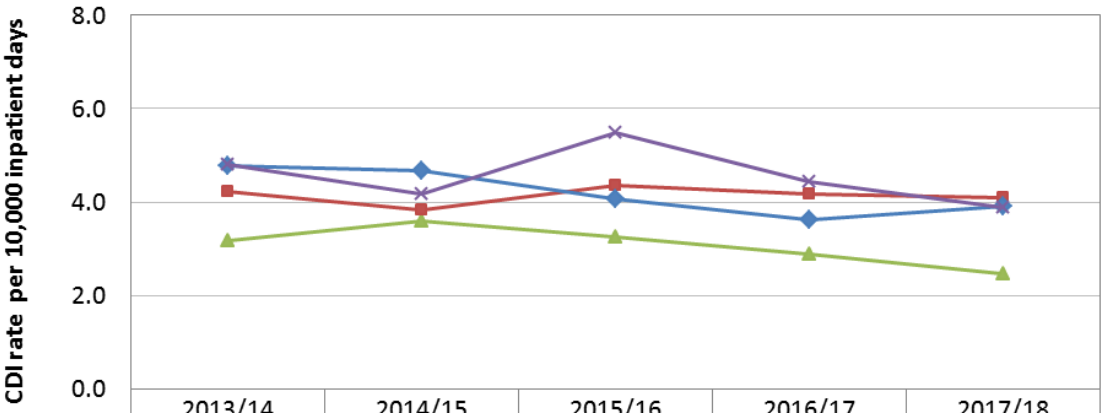
Figure 4. Annual rate of new CDI associated with the reporting facility by facility type, 2013/14 – 2017/18



	2013/14	2014/15	2015/16	2016/17	2017/18
Community hospital	3.7	4.3	4.2	3.6	3.0
Regional hospital	4.4	4.0	5.7	3.9	3.8
Tertiary/Referral hospital	4.9	4.2	4.6	4.3	4.1

Grouping facilities by size shows that CDI rates vary by facility size. The downward trend of CDI rates over the last five years was statistically significantly for each facility size except for facilities with 51-150 beds, which did not change significantly from 2013/14 to 2017/18 (Figure 5). The CDI rate in facilities with 50 beds or less in 2017/18 was significantly lower than larger facilities.

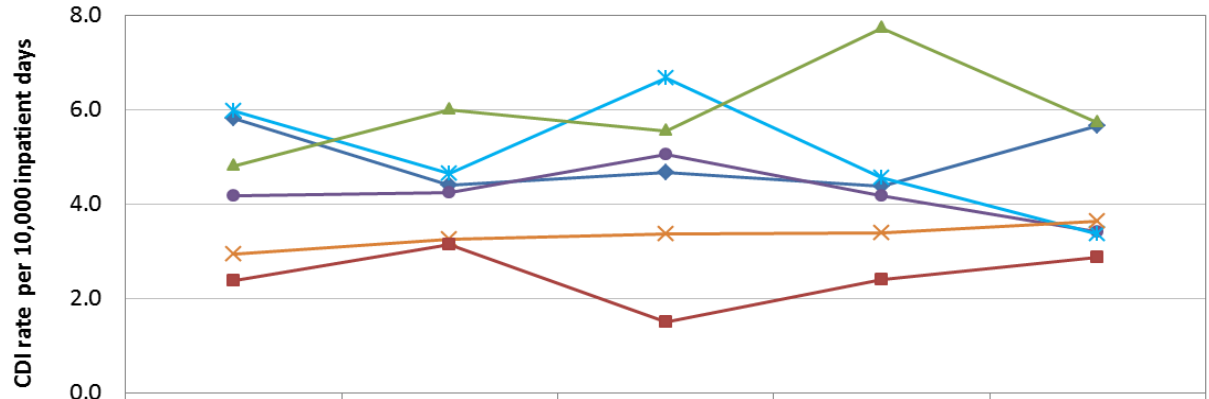
Figure 5. Annual rate of new CDI associated with the reporting facility by facility size, 2013/14 – 2017/18



	2013/14	2014/15	2015/16	2016/17	2017/18
1-50 beds	3.2	3.6	3.3	2.9	2.5
51-150 beds	4.2	3.8	4.4	4.2	4.1
151-250 beds	4.8	4.7	4.1	3.6	3.9
>250 beds	4.8	4.2	5.5	4.4	3.9

Figure 6 presents overall trend of CDI rates in the HAs. There was a significant downward trend among two HAs (FHA and VCHA). A significant upward trend was observed for VIHA[2], which CDI rate was still low compared to the provincial rate. There was no statistically significant trend in the other HAs (IHA, NHA, and PHSA). Please refer to the section on Data Limitations in Appendix A.

Figure 6. Annual rate of new CDI associated with the reporting facility by health authority, 2013/14 – 2017/18



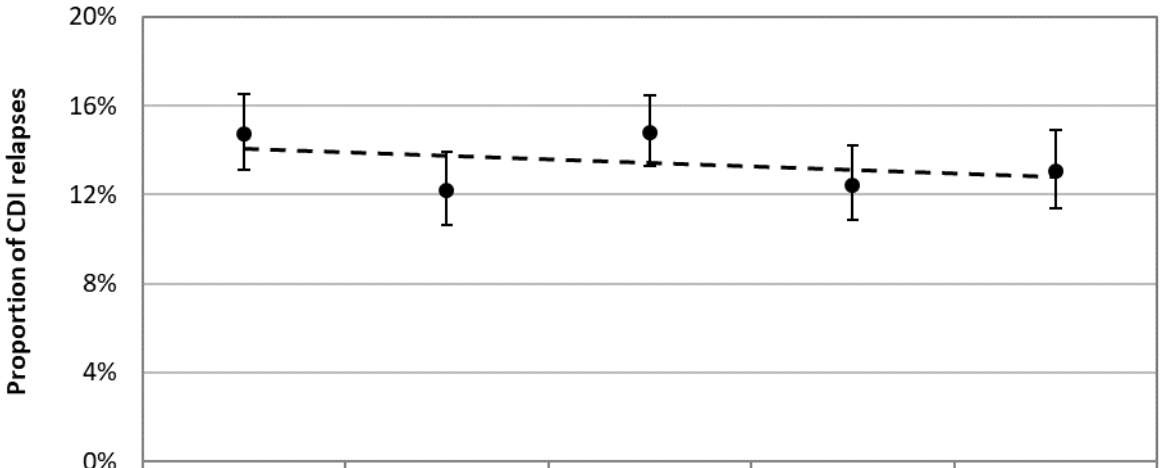
	2013/14	2014/15	2015/16	2016/17	2017/18
IHA	5.8	4.4	4.7	4.4	5.7
FHA	4.2	4.3	5.1	4.2	3.4
VCHA	6.0	4.7	6.7	4.6	3.4
VIHA	2.9	3.3	3.4	3.4	3.6
NHA	2.4	3.1	1.5	2.4	2.9
PHSA	4.8	6.0	5.5	7.7	5.7

Relapse of healthcare-associated CDI

Relapses of CDI were identified among HCA cases if the episode of CDI reoccurred between two and eight weeks after a previous CDI case. Of all 1,403 HCA CDI cases reported in 2017/18, 183 cases were relapses (13.0%, 95% CI: 11.3%–14.7%). The proportion of relapses in 2017/18 was not significantly different from any one of the previous years, although there is a statistically significant downward trend in the proportion of relapses among HCA CDI from 2013/14 to 2017/18 (Figure 7).

[2] VIHA modified its CDI surveillance program in 2017/18, including opening of two new hospitals, closure of two hospitals, and introduction of a new and more sensitive multiplex testing for *C. difficile* from Q3 of 2017/18.

Figure 7. Proportion of relapses among healthcare-associated CDI cases, 2013/14 – 2017/18



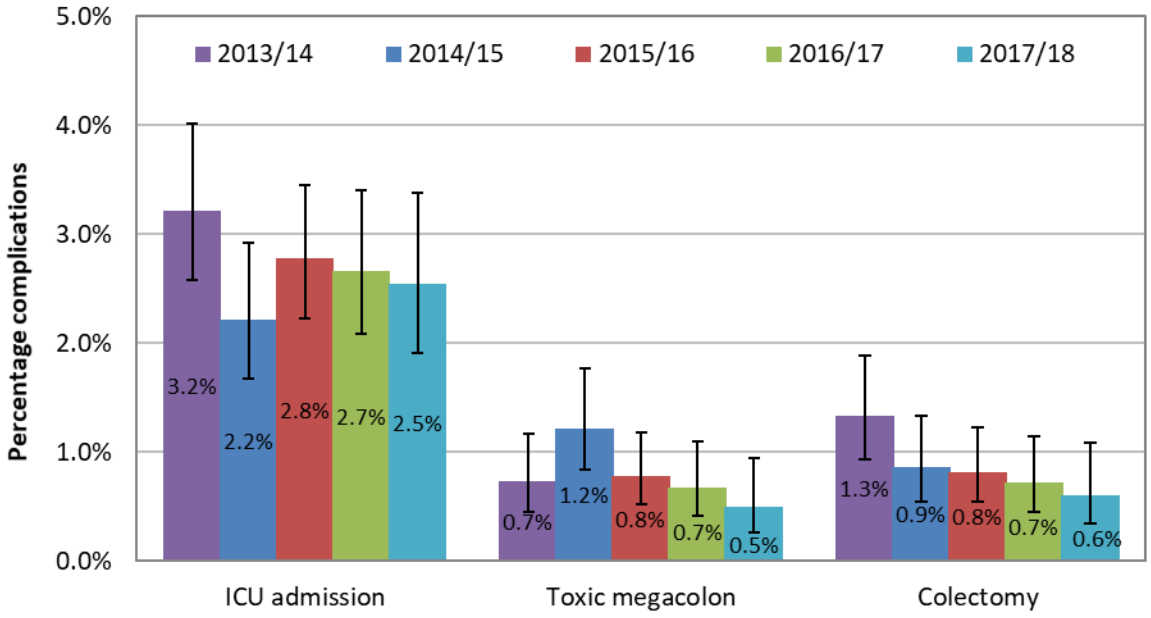
	2013/14	2014/15	2015/16	2016/17	2017/18
Relapse of CDI	14.7%	12.2%	14.8%	12.4%	13.1%

Note: Vertical bars on the line represent the 95% confidence interval of the percentages, and the dashed line represents the linear trend of the percentages

Complications within 30 days of diagnosis

CDI cases were followed up 30 days after diagnosis or up to the point of patient discharge or transfer (whichever comes first) to assess if the patients were admitted to an intensive care unit (ICU), developed toxic megacolon, or required partial or entire colectomy due to CDI. Among the 2,316 CDI cases in 2017/18[3], 46 (2.5%) were admitted to ICU, 9 (0.5%) developed toxic megacolon, and 11 (0.6%) required partial or entire colectomy. The percentage of ICU admissions, toxic megacolon, and colectomy did not change significantly in 2017/18 compared to the previous year of 2016/17 (Figure 8).

Figure 8. CDI-associated complications within 30 days of diagnosis, 2013/14 – 2017/18



Note: Vertical bars on the line represent the 95% confidence interval of the percentage

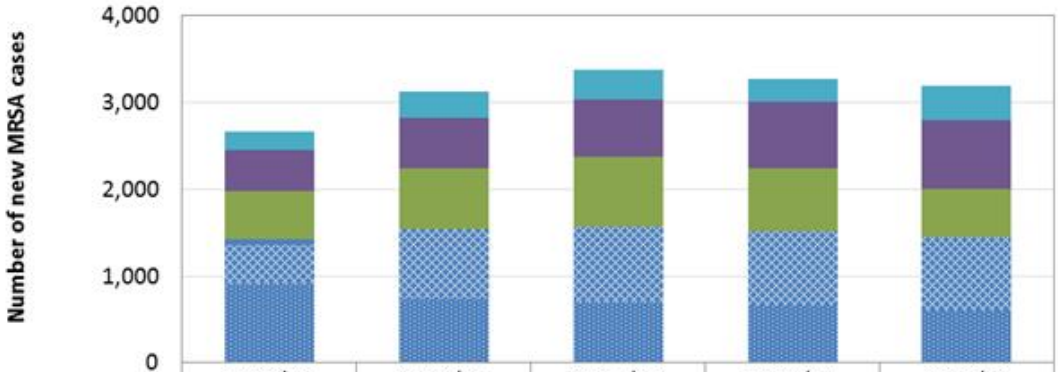
[3] PHSA stopped collecting data on CDI-associated complications from FY 2013/14 and IHA stopped collecting data on CDI-associated complications from FY 2017/18. The CDI cases that were not followed up in both HAs were excluded from this analysis. Variations may exist among HAs in defining complications due to CDI, particularly criteria for ICU admission.

Methicillin-resistant *staphylococcus aureus* (MRSA)

Overview of MRSA cases

There were 3,191 cases of MRSA newly identified among inpatients in BC acute care facilities in 2017/18. Of these, 1,447 (45.3%) were classified as HCA with the reporting facility, 566 (17.7%) were HCA with another facility, 780 (24.5%) were community-associated (CA), and 398 (12.5%) were of unknown origin (Figure 10). All cases of MRSA associated with the reporting facility were further examined for association with the current admission or a previous encounter with the reporting facility in the previous twelve months. Among the 1,447 cases associated with the reporting facility in 2017/18, 613 (19.2% of all MRSA cases) were associated with the current admission to the reporting facility and 834 (26.1%) were associated with a previous encounter with the reporting facility (Figure 9).

Figure 9. Number of newly identified MRSA cases in BC acute care facilities, 2013/14 – 2017/18

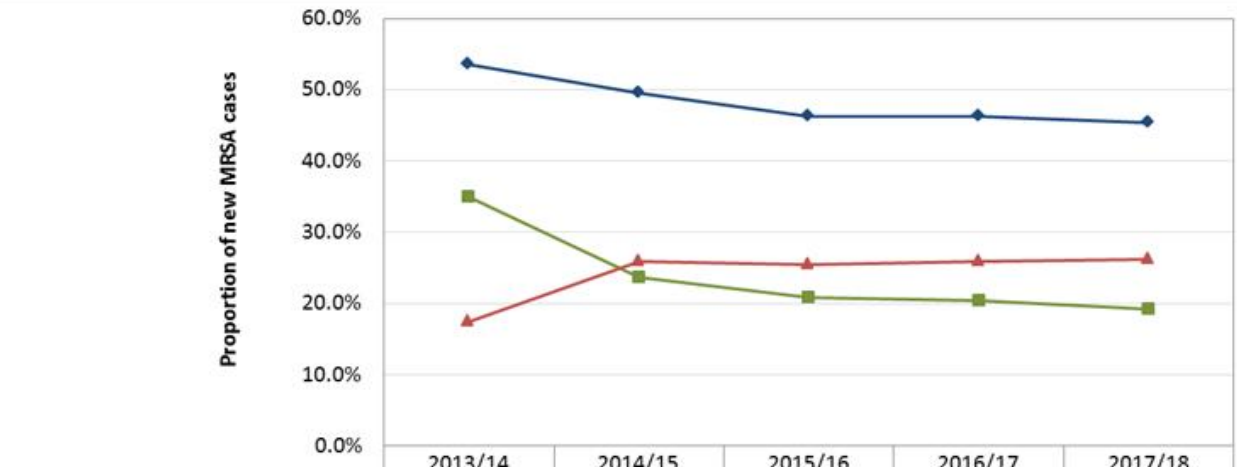


	2013/14	2014/15	2015/16	2016/17	2017/18
Unknown	209	294	349	265	398
CA	477	579	657	764	780
HCA with another facility	553	702	812	729	566
HCA with reporting facility, unspecified	61	0	0	0	0
HCA with a previous encounter with reporting facility	454	809	860	847	834
HCA with current admission to reporting facility	911	740	705	666	613
Total MRSA	2,665	3,124	3,383	3,271	3,191

HCA: healthcare-associated; CA: community-associated

Compared to previous years, the number of both total MRSA cases and cases of MRSA associated with the reporting facility decreased in the last two years, following increases from 2013/14 to 2015/16; however, the proportion of HCA MRSA has decreased continuously from 53.5% in 2013/14 to 45.3% in 2017/18 (Figure 10), with a significant downward trend. Among MRSA cases associated with the reporting facility, there were divergent trends: the proportion of MRSA associated with a previous encounter increased from 17.0% of all MRSA cases in 2013/14 to 26.1% in 2017/18, while the proportion of MRSA associated with current admission decreased from 34.2% to 19.2% during the same period (Figure 11). At the same time, the number and proportion of community-associated MRSA cases increased in BC acute care facilities.

Figure 10. Proportion of new MRSA associated with the reporting in BC acute care facilities, 2013/14 – 2017/18



	2013/14	2014/15	2015/16	2016/17	2017/18
HCA with reporting facility	53.5%	49.6%	46.3%	46.3%	45.3%
HCA with current admission to reporting facility	35.0%	23.7%	20.8%	20.4%	19.2%
HCA with a previous encounter with reporting facility	17.4%	25.9%	25.4%	25.9%	26.1%

Rate of MRSA associated with the reporting facility in 2017/18

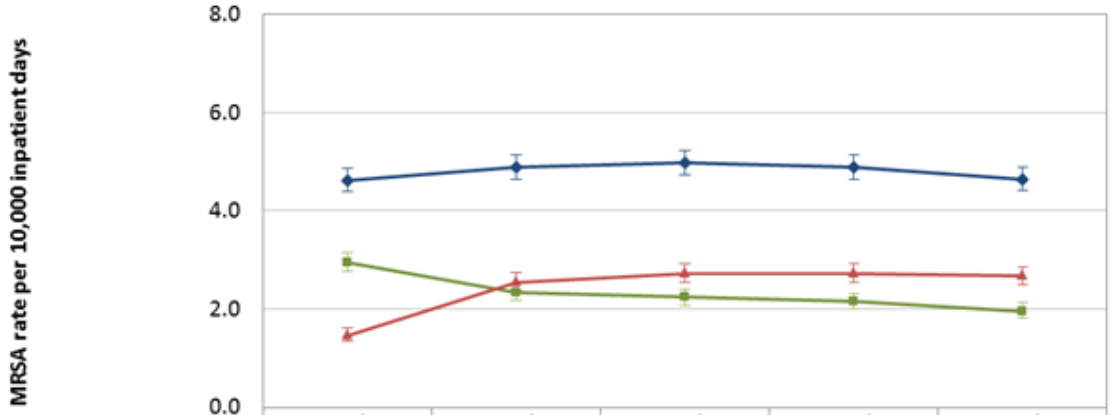
The provincial annual rate of MRSA associated with the reporting facility in 2017/18 was 4.6 per 10,000 inpatient days (95% CI: 4.4 – 4.9). The provincial rate did not change statistically significantly by quarter in 2017/18, with the lowest rate in Q1 (4.3 per 10,000 inpatient days, 95% CI: 3.8 – 4.8) and the highest rate in Q2 (5.1 per 10,000 inpatient days, 95% CI: 4.6 – 5.7).

The annual rate of MRSA in each health authority and acute care facility in 2017/18 is presented in Appendix D.

Trend of new MRSA associated with the reporting facility

The provincial rate of new MRSA associated with the reporting facility has been relatively stable over the last five years (Figure 11). However, the rate of MRSA associated with current admission to the reporting facility decreased significantly from 2013/14 to 2017/18, while the rate of MRSA associated with a previous encounter increased significantly during the same period (Figure 11). The divergent trends in MRSA rates may reflect that current HAI prevention and control strategies, which have mostly focused on acute care facilities, are effective in reducing MRSA transmission in acute care facilities, but may have little impact outside the hospital setting, as would be expected.

Figure 11. Annual rate of new MRSA associated with the reporting facility, 2013/14 – 2017/18

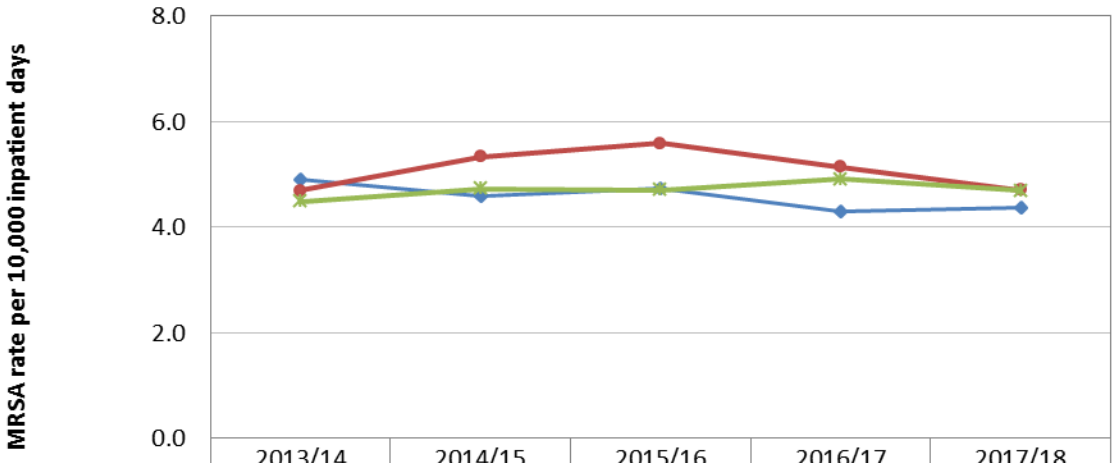


	2013/14	2014/15	2015/16	2016/17	2017/18
Total MRSA associated with the reporting facility	4.6	4.9	5.0	4.9	4.6
MRSA associated with current admission to reporting facility	2.9	2.3	2.2	2.1	2.0
MRSA associated with a previous encounter with reporting facility	1.5	2.6	2.7	2.7	2.7

Further analyses show that there were variations in the trend of MRSA among different facility types and sizes, as well as among the health authorities.

There were no significant trends in MRSA rates by facility type, and the rate in 2017/18 was not significantly different from 2016/17 (Figure 12). The three hospital types had similar MRSA rates in 2017/18.

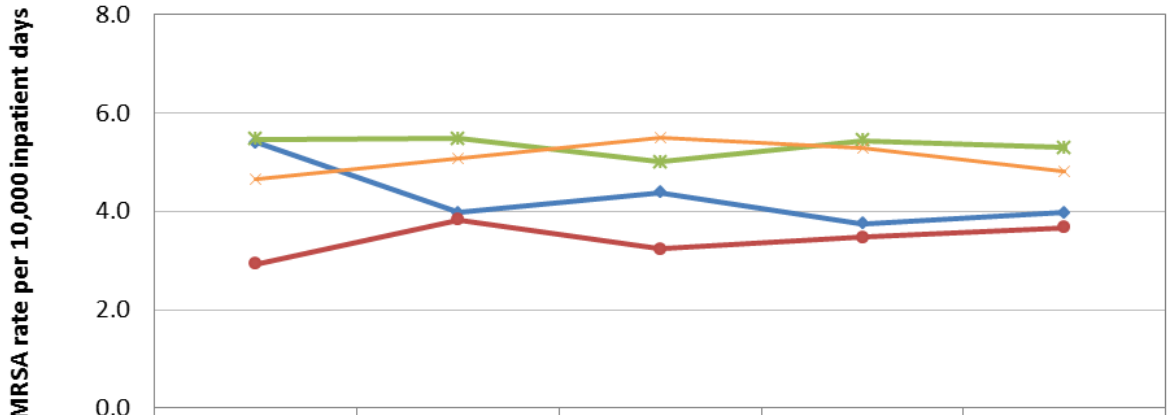
Figure 12. Annual rate of new MRSA associated with the reporting facility by facility type, 2013/14 – 2017/18



	2013/14	2014/15	2015/16	2016/17	2017/18
Community hospital	4.9	4.6	4.7	4.3	4.4
Regional Hospital	4.7	5.3	5.6	5.1	4.7
Tertiary/Referral Hospital	4.5	4.7	4.7	4.9	4.7

While the rate of MRSA varied by facility size, there were no significant trends within each group of facility size in the period from 2013/14 to 2017/18 (Figure 13).

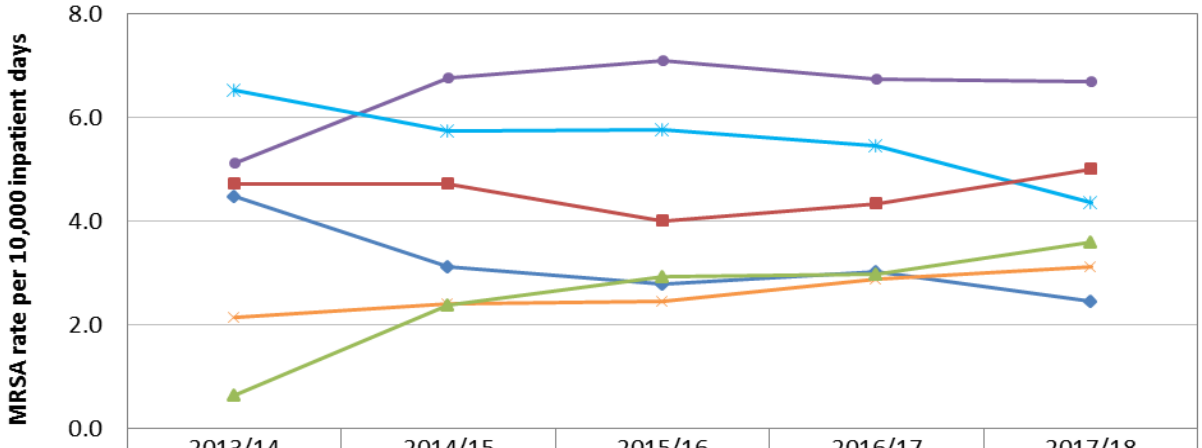
Figure 13. Annual rate of new MRSA associated with the reporting facility by facility size, 2013/14 – 2017/18



	2013/14	2014/15	2015/16	2016/17	2017/18
1-50 Beds	5.4	4.0	4.4	3.7	4.0
51-150 Beds	2.9	3.8	3.2	3.5	3.7
151-250 Beds	5.5	5.5	5.0	5.4	5.3
>250 Beds	4.6	5.1	5.5	5.3	4.8

The rate of MRSA also varied significantly by health authority (see data limitations in Appendix A). The overall trend of MRSA from 2013/14 to 2017/18 was not statistically significant in NHA, significantly downward in IHA and VCHA, and significantly upward in FHA, VIHA, and PHSA (Figure 14).

Figure 14. Annual rate of new MRSA associated with the reporting facility by health authority, 2013/14 – 2017/18



	2013/14	2014/15	2015/16	2016/17	2017/18
IHA	4.5	3.1	2.8	3.0	2.5
FHA	5.1	6.8	7.1	6.7	6.7
VCHA	6.5	5.7	5.8	5.5	4.4
VIHA	2.2	2.4	2.5	2.9	3.1
NHA	4.7	4.7	4.0	4.4	5.0
PHSA	0.6	2.4	2.9	3.0	3.6

Carbapenemase-producing organisms (CPOs)

New cases of CPO identified in 2017/18

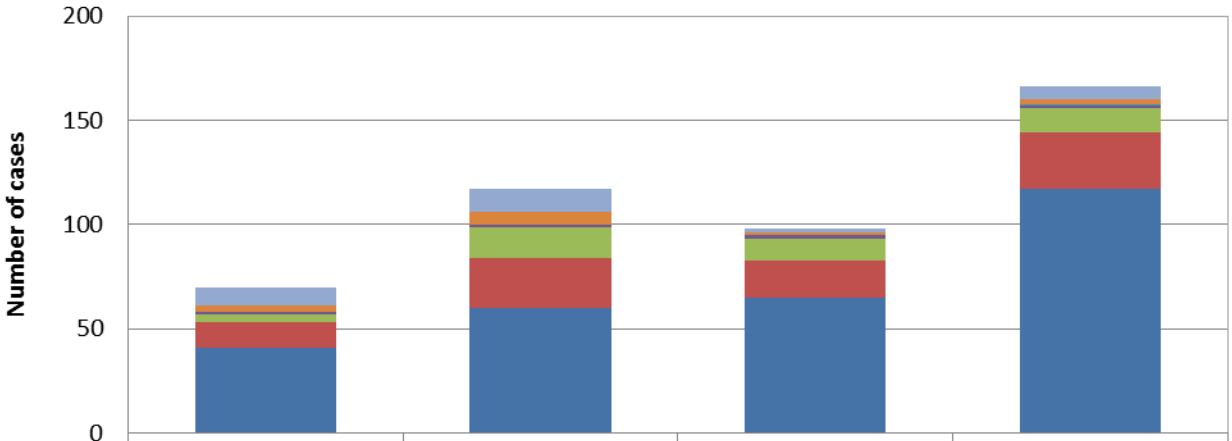
A mandatory provincial CPO surveillance program was introduced to BC acute care facilities in July 2014. CPOs were further made reportable in BC in December 2016, and new cases identified in the community care settings were also required reported to PICNet from December 2017.

During 2017/18, a total of 166 cases of CPO were newly identified from 156 patients in BC. Of the 156 patients, 146 patients harboured a single carbapenemase resistant gene, and ten patients harboured two different carbapenemase resistant genes – each gene identified for the first time in a given patient is counted as a new case of CPO.

Among the new cases of CPO identified in 2017/18, NDM accounted for 70.5% of carbapenemase resistance genes, followed by OXA-48 (16.3%), KPC (7.2%), VIM (0.6%), IMP (0.6%), and SME (1.2%). The 'other' genes identified were OXA-24 and OXA-51 (6 cases, 3.6%) (Figure 15).

New cases of CPO identified in 2017/18[4] was the highest annual number since mandatary CPO surveillance began in July 2014 in BC acute care facilities[5]. NDM has consistently been the predominant carbapenemase resistance gene identified in BC (Figure 15).

Figure 15. Number of cases of CPO newly identified in BC by carbapenemase resistant gene, 2014/15 – 2017/18



	2014/15*	2015/16	2016/17	2017/18
Other	9	11	2	6
SME	3	6	1	2
IMP	0	0	0	1
VIM	1	1	2	1
KPC	4	15	10	12
OXA-48	12	24	18	27
NDM	41	60	65	117
Total	70	117	98	166

* From July 18, 2014 to March 31, 2015 only

[4] One health authority expended CPO screening criteria in 2017/18.

[5] The number of CPO cases includes CPO identified in both healthcare facilities and community care settings; thus, the rate of CPO was not calculated and compared by year.

Surveillance information of new CPO cases

There were 134 new cases reported to PICNet with surveillance information. Of these, 97 (72.4% of reported cases) were identified in acute care facilities in FHA, 30 cases (22.4%) were in VCHA, four cases (3.0%) were in PHSA, and one case (0.7%) was in IHA. No CPO cases were identified in acute care facilities in VIHA and NHA during 2017/18 (Table 1). The remaining two cases (1.5%) were reported from community care settings, including one from the region of NHA, from December 2017.

Table 1. Number of new cases of CPO reported in BC by health care setting, 2017/18

Health care setting	Number of cases	Percent
Acute care facilities	**132**	**98.5%**
IHA	1	0.7%
FHA	97	72.4%
VCHA	30	22.4%
VIHA	0	0.0%
NHA	0	0.0%
PHSA	4	3.0%
Community care settings	**2**	**1.5%**
Total	**134**	**100%**

New CPO cases were investigated for risk factors that may have contributed to CPO acquisition in the previous twelve months, including healthcare encounters outside Canada (e.g. overnight hospitalization, certain medical or surgical procedures); close contact with a CPO patient or their environment; and transfer from a unit or facility which was under investigation for CPO transmission. Of the 134 new cases of CPO, 78 (58.2%) reported a healthcare exposure outside Canada in the previous twelve months, and 21 cases (15.7%) were identified with at least one other risk factor listed in the provincial surveillance protocol. However, there were 36 cases (26.9%) with no known risk factors reported.

Hand cleaning compliance (HCC)

Overall hand cleaning compliance in 2017/18

Overall provincial hand cleaning compliance in 2017/18 was 84.1% in acute care facilities and 86.3% in residential care facilities, respectively, both of which surpassed the target performance of 80% set by the Provincial Hand Hygiene Working Group (PHHWG).

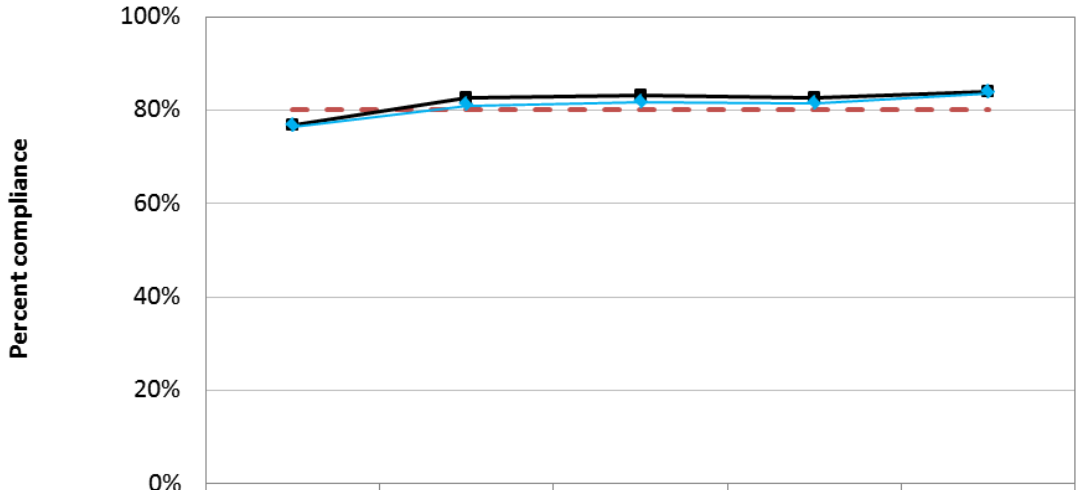
The compliance in each health authority and acute care facilities with more than 200 observations is presented in Appendix D.

Hand cleaning compliance in acute care facilities

To reduce the impact of variation in the number of opportunities observed among HAs, the provincial compliance for acute care facilities was weighted by acute care inpatient days. The weighted provincial compliance for acute care facilities in 2017/18 was 83.7%, which still exceeds the 80% of target performance.

The provincial HCC in acute care facilities in 2017/18, whether un-weighted or weighted, was the highest reported in the last five years, though the provincial overall compliance appeared to plateau from 2014/15 – 2016/17 (Figure 16).

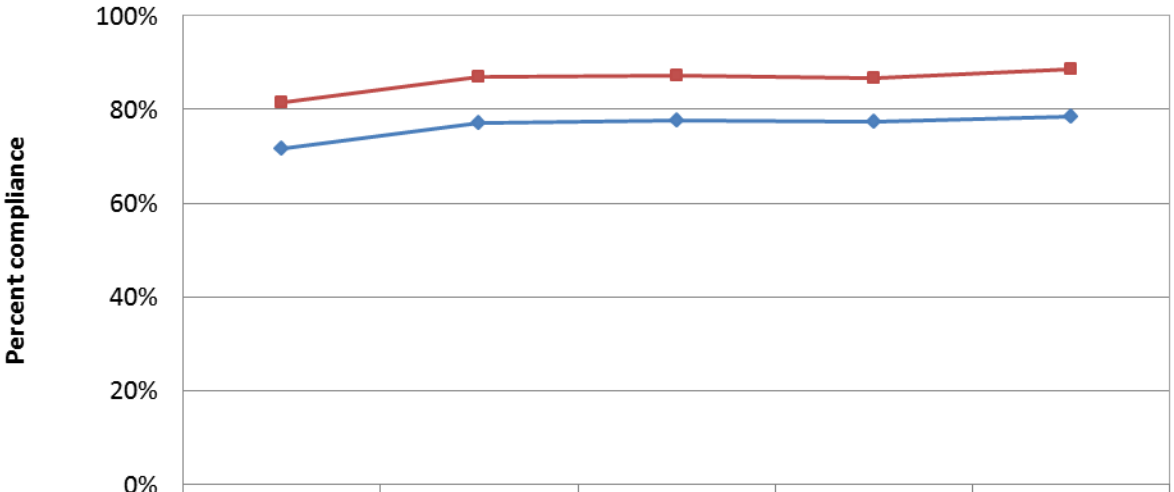
Figure 16. Provincial annual hand cleaning compliance in acute care facilities, 2013/14 – 2017/18



	2013/14	2014/15	2015/16	2016/17	2017/18
Target compliance	80.0%	80.0%	80.0%	80.0%	80.0%
Compliance, unweighted	76.8%	82.6%	83.2%	82.5%	84.1%
Compliance,weighted	76.4%	80.9%	81.7%	81.4%	83.7%

Hand cleaning compliance for acute care facilities was further analysed by moment of contact with a patient or patient's environment and by healthcare provider group. The HCC for both before and after contact was significantly higher in 2017/18 than any previous year and the compliance before contact has consistently been significantly lower than compliance after contact (Figure 17).

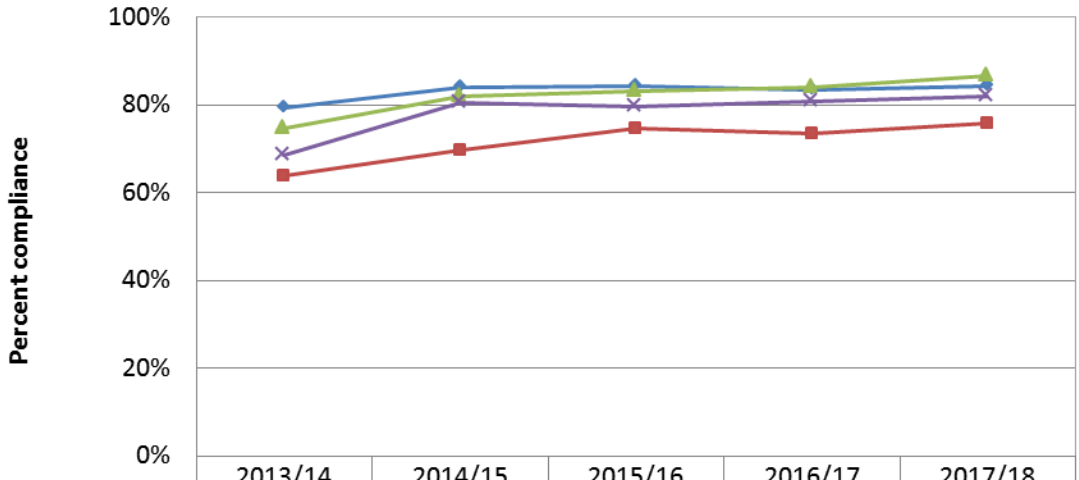
Figure 17. Provincial hand cleaning compliance in acute care facilities by moment of contact, 2013/14 – 2017/18



	2013/14	2014/15	2015/16	2016/17	2017/18
Before contact	71.7%	77.0%	77.8%	77.3%	78.4%
After contact	81.5%	87.0%	87.3%	86.7%	88.6%

HCC has improved among all health care provider groups from 2013/14 to 2017/18. Nursing staff had the highest hand cleaning compliance among all healthcare providers up to 2015/16. In the two years since then, Clinical Support Services staff have had the highest compliance, with 86.6% compliance in 2017/18. Compliance among physicians was lower than in other healthcare provider groups, and has consistently been below the target compliance of 80% (Figure 18).

Figure 18. Provincial hand cleaning compliance in acute care facilities by health care provider group, 2013/14 – 2017/18



	2013/14	2014/15	2015/16	2016/17	2017/18
Nursing staff	79.3%	84.1%	84.3%	83.4%	84.5%
Physician	64.0%	69.7%	74.6%	73.4%	76.0%
Clinical support services	74.6%	81.9%	83.1%	83.9%	86.6%
Other	68.5%	80.6%	79.7%	80.8%	82.0%

Hand cleaning compliance in acute care facilities varied by health authority (see data limitations in Appendix A). Although compliance appeared to have plateaued in most health authorities after significant improvement from 2013/14 to 2014/15, HCC in most health authorities continued to improve in 2017/18, compared to the previous year (Table 4).

Table 2. Hand cleaning compliance in acute care facilities by health authority, 2013/14 – 2017/18

Health authority	2013/14	2014/15	2015/16	2016/17	2017/18
IHA	74.9%	75.4%	77.9%	78.7%	80.1%
FHA	79.2%	84.7%	87.4%	85.9%	87.3%
VCHA	76.4%	78.8%	78.8%	78.5%	87.0%
VIHA	71.4%	81.5%	78.3%	77.6%	76.1%
NHA	74.1%	76.3%	75.9%	78.3%	82.5%
PHSA*	87.8%	88.2%	90.8%	93.8%	93.1%
Province	76.8%	82.6%	83.2%	82.5%	84.1%

* The data for PHSA include observations in BC Children's Hospital, BC Women's Hospital and BC Cancer- Vancouver center.

Hand cleaning compliance in residential care facilities

Hand cleaning compliance data in HA-owned/operated residential care facilities were reported to PICNet from fiscal year 2014/15. The compliance was most commonly assessed by self-auditing, except for facilities in IHA and Providence Health Care (PHC), where infection control practitioners or co-op medical students conducted the audits. Compliance varied significantly by health authority and higher compliance was reported among the health authorities that used self-auditing (Table 5).

Table 3. Hand cleaning compliance in health authority-owned/operated residential care facilities by health authority, 2014/15 – 2017/18

Health authority*	2014/15	2015/16	2016/17	2017/18
IHA	71.4%	77.7%	76.8%	79.8%
FHA	84.2%	85.0%	87.4%	89.4%
VCHA	76.7%	86.0%	88.6%	91.8%
VIHA	90.5%	89.6%	87.6%	84.8%
NHA	77.0%	82.0%	82.4%	80.0%
Province	**80.1%**	**83.6%**	**85.0%**	**86.3%**

* There are no residential care facilities owned or operated by PHSA.

Conclusion

The provincial surveillance programs for HAI were established to monitor the occurrence and trends of HAI in acute care facilities, as well as hand cleaning compliance among health care providers. This report presents the surveillance data in 2017/18 and compares it to the last five years to reflect recent infection prevention and control practice. Overall, there has been a decreasing trend in provincial CDI rates from 2013/14 to 2017/18, with the rate in 2017/18 being the lowest. While the provincial rate of MRSA associated with the reporting facility has been relatively stable, the rate of MRSA associated with current admission to the reporting facility has decreased significantly in the last five years. Increasing spread of CDI and MRSA in the community [6,7,8] poses a great challenge for infection prevention and control programs, which focus on healthcare facilities.

The provincial CPO surveillance program was expanded in 2017/18 to include cases identified in the community. Encounter with the healthcare system in CPO-endemic regions of the world is a major risk factor associated with CPO cases identified in BC. This may also contribute to the variations in CPO cases identified among HAs.

Although the provincial hand cleaning compliance has surpassed the target performance of 80% for the fourth consecutive year, compliance is not evenly achieved among all healthcare providers and moments of contact. There remains work to do to make real, sustainable improvements for hand hygiene in BC healthcare facilities.

It is important to note that variations in screening policy for antibiotic resistant organisms, application of the provincial surveillance protocols, and patient mix may exist among health authorities. The classification of CDI and MRSA cases as either healthcare-associated (HCA), community-associated (CA), or of unknown origin is based on the patient's healthcare encounter history in the patient information system. Classifying a case of CDI or MRSA as healthcare-associated does not necessarily indicate that the patient acquired the bacteria during hospitalization or from medical care. Approximately 2% of the general population are colonized with MRSA [6] and more than 8% of admitted patients are carriers of toxinogenic *C. difficile* without symptoms [7,8]. In addition, the rates of CDI, MRSA, and HCC in this report are not risk-adjusted. They are provided to show the progress of infection prevention and control practice and overall trends over time in the province, rather than for comparison between HAs or between health care facilities.

Appendices

Appendix A. Methods

Surveillance populations

All patients who were admitted to an acute care facility in BC were included in surveillance for CDI, MRSA, and CPO. This included patients admitted to the emergency department awaiting placement (e.g. patients admitted to a service who are waiting for a bed), patients in alternative level of care beds, and patients in labour and delivery beds. Outpatient visits to acute care facilities, patients in extended care, and short-time admissions to emergency departments were excluded from CDI and MRSA. Patients under one year of age were excluded from CDI surveillance because asymptomatic carriage of *C. difficile* is very frequent, and *C. difficile*-associated diarrheal illness is exceedingly rare before twelve months of age [9,10]. In addition, the CPO surveillance also included hemodialysis patients visiting renal clinics in acute care facilities, and other patients that were deemed high risk for CPO by the health authority. After CPO was designated as a reportable condition in December 2016, the provincial CPO surveillance program further expanded to outpatient clinics, residential care facilities, assisted living houses, and other community care settings from December 2017.

For hand cleaning compliance, auditing takes place among all healthcare providers working at both acute care facilities and residential care facilities. The healthcare providers in acute care facilities are grouped into four categories by HA when reporting audit results: 1) nursing staff, including nurses, midwives, care aides, nursing students, etc.; 2) physicians, including medical doctors, residents, and medical students; 3) clinical support services, such as occupational therapists, physiotherapists, respiratory therapists, speech therapists, social workers, dieticians, psychologists, audiologists, porters, pastoral care, radiologists, laboratory and electrocardiogram technicians, etc.; and 4) others, such as housekeeping, food services, clerk, volunteer, security, etc.

Data collection and reporting

CDI and MRSA

Provincial surveillance data for CDI and MRSA were collected according to the provincial surveillance protocols, which were developed by PICNet's Surveillance Steering Committee (SSC) and are reviewed annually. CDI cases include new infections as well as relapses from previous infections. MRSA surveillance focuses on incidence cases, which are newly identified colonizations or infections with MRSA among inpatients. All CDI and MRSA cases were laboratory confirmed and classified as either healthcare-associated (HCA), or community-associated (CA), or unknown origin based on the patient's healthcare encounter in the last four weeks (for CDI) or twelve months (for MRSA) before identification. For detailed case definition and classification for CDI and MRSA, please visit PICNet website: https://www.picnet.ca/surveillance. Information on individual cases of CDI and MRSA were collected daily by infection control practitioners (ICPs) and managed by the respective health authority. After the end of each fiscal quarter, CDI and MRSA cases were aggregated by facility and classification using templates for data submission. These data were then submitted to PICNet. Total acute care admissions and inpatient days (denominators) were collected from the patient information systems by the respective HA.

CPO

The provincial surveillance protocol for CPO was first developed by the provincial CPO Working Group in May 2014 and reviewed and updated annually by SSC. Since July 18, 2014, all microbiology laboratories in BC healthcare facilities or communities are required to submit the isolates suspected of harbouring a

carbapenemase gene to the Public Health Laboratory at the BC Center for Disease Control for confirmatory testing and genotyping analysis. If an isolate is recovered from a patient in an acute care facility and identified with a carbapenemase gene for the first time or with a new carbapenemase gene, regardless of the organism/species identified, it is considered to be a new case of CPO, and reported to PICNet. The ICPs collect surveillance information regarding the new case and submit this information to PICNet via their health authority. From December 2017, new cases of CPO identified in the community care settings were required to report to PICNet by physician or care provider. PICNet further links the new cases to the laboratory testing data and patient information collected by the laboratory for the provincial surveillance report. For the latest provincial surveillance protocol for CPO in BC, please visit https://www.picnet.ca/surveillance.

Hand Cleaning Compliance

The methodology for the provincial hand hygiene audits was adapted by the Provincial Hand Hygiene Working Group (PHHWG) from the World Health Organization's guidelines for hand hygiene, which describe direct observation as the gold standard methodology for assessing hand hygiene [11]. During the auditing process, trained auditors directly observe a sample of healthcare workers in acute care facilities across BC. The auditors record the number of hand cleaning events they observe (i.e., when healthcare workers clean their hands), as well as the number of hand cleaning opportunities (i.e., when healthcare workers should clean their hands). This includes opportunities before contact with a patient or the patient's immediate environment (such as around the patient's bedside) and after contact with a patient or the patient's immediate environment. The minimum requirement is 200 observations per quarterly audit cycle for each facility with 25 or more beds. For facilities with fewer than 25 beds, the audit data are aggregated into the overall health authority data. The audit data are collected and managed by each HA, then aggregated by facility and submitted to PICNet at the end of each quarter.

Data analysis

The quarterly data were verified before data analysis. After the end of each fiscal year, all quarterly submitted data were reviewed with the health authorities and updated if there were any changes.

The CDI and MRSA surveillance data were merged by PICNet into respective databases and then grouped by HA, facility size and type. The rate of HCA CDI or MRSA was calculated using the total number of new cases of HCA CDI or MRSA associated with the reporting facility as numerators divided by the total inpatient days during the same period as denominators, then multiplying by 10,000 to calculate a rate per 10,000 inpatient days. The 95% confidence intervals (CI) of the rates were calculated by the Wilson score method and were used to determine whether the difference between the rates was statistically significant. If the ranges of 95% CI did not overlap, the difference in the two rates was considered statistically significant.

The HCC percentage was the number of compliant opportunities over the total opportunities observed, and further grouped by moment before contact and after contact, and by healthcare worker group. To reduce the impact of variations in the opportunities observed by HA, total inpatient days in each HA was used to weight opportunities observed during the same period and the weighted provincial compliance was calculated for each auditing quarter.

Trend analysis was limited to annual rates of CDI, MRSA, and HCC in the last five years from 2013/14 to 2017/18, with a statistically significant level of $p < 0.05$ using Cochrane-Armitage test for linear trend.

CPO were presented by the number of cases in this report. The rate was not calculated because CPO is still rare in most BC facilities, and therefore only high-risk patients are screened for CPO (including inpatients, hemodialysis patients, and other patients who are deemed at high risk for CPO transmission by each individual HA). The numbers of patients who were screened (denominator) were not collected in a manner that allows the precise calculation of a provincial rate for CPO.

Data limitations

The provincial HAI surveillance programs are collaborations between PICNet and all BC health authorities. Care services provided and patient populations served differed from HA to HA and from facility to facility. HA may extend or end the surveillance in their healthcare facilities over time. FHA merged the data submission from two acute care facilities and included one care center to a facility from 2016/17. FHA extended the CDI and MRSA surveillance to a new acute care site during Q4 2017/18. VIHA included two new hospitals opened during Q3 of 2017/18, with two hospitals closed at the same time.

Although standard provincial surveillance protocols were developed at the beginning of each program and reviewed annually to reflect advances of scientific research and surveillance practice, there are noted variations in how case definitions and inclusion/exclusion criteria were applied by the HAs and healthcare facilities. For example, in defining a CDI case, FHA and PHSA began to apply the frequency of documented diarrheal episodes stringently with chart review since 2012, while other HAs continued to define CDI based on positive laboratory testing from diarrhea specimens. In addition, as of 2012, IHA and FHA require resolution of diarrhea from a previous CDI episode for a period of >24 hours (IHA) or >72 hours (FHA) before applying the period of two to eight weeks for defining a relapse of CDI. No health authorities reported significant changes in the application of the protocol after 2012.

Variation also exists among the HAs in how MRSA case definition and classification is applied. A twelve-month look-back period for healthcare encounter history and >48 hours (or two calendar days, with the day of admission counted as the first day) after admission to classify MRSA associated with the reporting facility is employed by all HAs except PHC and FHA, which use more >72 hours after admission.

Laboratory practice and methodology may vary among the microbiology laboratories and may change over time. From 2008 to 2012, more sensitive and faster testing for detection of *C. difficile* was gradually introduced into the microbiology laboratories across the province, which may result in more specimens being identified positive with *C. difficile* by the laboratory, and thus more CDI cases diagnosed. VIHA introduced a new and more sensitive multiplex testing for C. *difficile* during Q3 of 2017/18 and onwards. There is no evidence that the laboratory testing for MRSA has changed significantly after provincial surveillance started.

Infection prevention and control practices vary across HAs and healthcare facilities, which can also affect identification of MRSA and CDI. For example, facilities that conduct more intense screening of patients (such as universal admission screening, periodic screening of certain units and/or high-risk patients) may identify more MRSA cases than those which screen patients in specific situations only. Intensive testing of diarrheal specimens may result in more CDI reported. In addition, current screening policy for CPO focuses on the patients with a healthcare encounter outside Canada in the last twelve months, accordingly most cases of CPO reported a healthcare encounter history outside Canada. Furthermore, Fraser Health expended CPO screening to all travellers returning from three countries in Southern Asia.

The patient's encounter history with healthcare has been used to determine whether a case of CDI and MRSA was healthcare-associated. Facilities in PHSA and PHC are unable to check patient healthcare history outside their health authority, and thus did not report cases that were associated with another facility.

In hand hygiene audits, auditing might be performed by auditors who work in the same unit or small facility as the healthcare workers they are observing (self-auditing); conversely, it might be performed by external auditors such as infection control practitioners (ICPs), dedicated auditors, medical students, or members of the healthcare quality department of the hospital or HA. Auditors varied by facility and over time. Observer and selection bias are inevitable [12]. Self-auditing tends to report higher compliance than dedicated auditors. The audits in facilities in IHA, PHC, and PHSA were conducted by

ICPs or co-op medical students. FHA, VCHA (except PHC), VIHA, and NHA employed ICPs, or dedicated auditors for auditing large acute care facilities, whereas the compliance in the remaining acute care facilities and all residential care facilities were assessed by self-auditing. In addition, direct observation introduces a phenomenon referred to as the Hawthorne Effect, i.e. the tendency of individuals to change their behavior when they know they are being watched [13,14].

Finally, the rates in this report were not adjusted by any risk factors; therefore, direct comparison of the rates of CDI and MRSA, or the HCC percentage, between HAs or healthcare facilities is not recommended.

Appendix B. Acute care facilities participating in the provincial surveillance program in 2017/18

Summary of acute care facilities participating in the provincial surveillance program, fiscal year 2017/18

Health authority	IHA	FHA[a]	VCHA[b]	VIHA[c]	NHA	PHSA[d]	Total
Total number of facilities	**22**	**14**	**11**	**13**	**18**	**2**	**80**
By facility type							
Community hospital	16	7	6	9	9	0	47
Regional hospital	4	4	3	2	8	0	21
Tertiary/referral hospitals	2	3	2	2	1	2	12
By facility size[d]							
1–50 beds	16	3	6	5	17	0	47
51–150 beds	3	3	1	5	0	2	14
151 – 250 beds	1	4	2	0	1	0	8
>250 beds	2	4	2	3	0	0	11
Acute care beds[e]	**1,369**	**2,824**	**1,812**	**1,670**	**555**	**249**	**8,479**
Total acute care admissions[f]	**76,545**	**145,571**	**86,142**	**80,297**	**29,682**	**27,880**	**446,117**
Total inpatient days[f]	**481,159**	**1,064,590**	**635,978**	**639,885**	**209,167**	**88,520**	**3,119,299**

Notes:

a. FHA expanded provincial surveillance programs to a new acute care site in 2017/18
b. Includes acute care facilities of Providence Health Care (PHC)
c. VIHA opened two new facilities and closed two facilities in 2017/18
d. Excludes BC Cancer Agency, which was not included in the provincial CDI and MRSA surveillance but was included for CPO surveillance and hand cleaning compliance.
e. Based on the counts of acute care beds in quarter 4 of 2017/18. The number of beds may vary by quarter due to temporary closure of acute care beds by facilities.
f. Patients less than one year old were excluded from CDI surveillance

Appendix C. Start and end date for quarters in 2017/18

Start and end date of quarters in 2017/18

Quarter code	Fiscal quarter		Calendar quarter	
	Start date	End date	Start date	End date
Q1	01-Apr-2017	15-Jun-2017	01-Apr-2017	30-Jun-2017
Q2	16-Jun-2017	07-Sep-2017	01-Jul-2017	30-Sep-2017
Q3	08-Sep-2017	01-Novc-2017	01-Oct-2017	31-Dec-2017
Q4	01-Dec-2017	31-Mar-2018	01-Jan-2018	31-Mar-2018

Appendix D. Annual rate of new CDI and MRSA associated with the reporting facility and hand cleaning compliance by acute care facility, 2017/18

Health authority and facility	CDI		MRSA		HCC	
	Number of new cases	Rate (95% CI) [a]	Number of new cases	Rate (95% CI) [a]	Total observations	Percent compliance
Interior Health [b]	**251**	**5.7 (5.0-6.4)**	**118**	**2.5 (2.0-2.9)**	**29,583**	**80.1%**
100 Mile District Hospital	0	0	0	0	296	75.7%
Arrow Lakes Hospital	*	8.0 (1.4-45.0)	0	0	**	**
Boundary Hospital	*	7.1 (2.4-20.8)	*	2.4 (0.4-13.4)	261	77.8%
Cariboo Memorial Hospital and Health Centre	*	2.2 (0.6-8.1)	*	1.1 (0.2-6.2)	439	80.9%
Creston Valley Hospital	*	5.7 (1.9-16.7)	0	0	239	77.0%
Dr. Helmcken Memorial Hospital & Health Centre	0	0	0	0	**	**
East Kootenay Regional Hospital	24	10.3 (6.9-15.3)	*	0.8 (0.2-2.7)	1,816	79.5%
Elk Valley Hospital	*	2.2 (0.4-12.6)	*	2.2 (0.4-12.6)	289	78.2%
Golden & District General Hospital	*	8.7 (2.4-31.8)	0	0	**	**
Invermere & District Hospital	*	4.5 (0.8-25.4)	0	0	**	**
Kelowna General Hospital	88	6.6 (5.4-8.2)	38	2.5 (1.8-3.5)	9,106	79.6%
Kootenay Boundary Regional Hospital	*	2.4 (1.0-5.5)	*	2.4 (1.1-5.2)	1,703	79.4%
Kootenay Lake Hospital	*	5.3 (2.3-12.4)	*	2.1 (0.6-7.7)	963	81.7%
Lillooet Hospital and Health Centre	*	5.4 (0.9-30.3)	0	0	**	**
Nicola Valley Health Centre	0	0	0	0	**	**
Penticton Regional Hospital	22	5.6 (3.7-8.4)	12	2.7 (1.5-4.7)	3,279	80.0%
Princeton General Hospital	0	0	0	0	**	**
Queen Victoria Hospital and Health Centre	*	8.3 (2.3-30.4)	*	4.1 (0.7-23.0)	**	**
Royal Inland Hospital	51	5.4 (4.1-7.2)	38	4.0 (2.9-5.5)	5,253	81.1%
Shuswap Lake General Hospital	*	4.1 (2.0-8.5)	*	2.9 (1.2-6.8)	1,601	84.6%
South Okanagan General Hospital	0	0	*	2.0 (0.3-11.2)	371	83.3%
Vernon Jubilee Hospital	33	5.8 (4.1-8.2)	10	1.6 (0.9-2.9)	3,372	78.8%
Fraser Health [b]	**346**	**3.4 (3.1-3.8)**	**714**	**6.7 (6.2-7.2)**	**85,513**	**87.3%**
Abbotsford Regional Hospital/ Matsqui Sumas Abbotsford [c]	51	4.4 (3.4-5.8)	74	6.0 (4.8-7.6)	11,816	86.2%
Burnaby Hospital	27	2.6 (1.8-3.8)	62	5.8 (4.5-7.5)	12,643	89.6%
Chilliwack General Hospital	37	6.5 (4.7-8.9)	27	4.6 (3.2-6.7)	5,780	86.1%
Delta Hospital	*	0.8 (0.2-2.9)	24	9.6 (6.5-14.3)	4,095	89.2%
Eagle Ridge Hospital	15	2.4 (1.4-3.9)	32	5.1 (3.6-7.2)	4,044	86.2%
Fellburn Care Center [d]	N/A	N/A	N/A	N/A	N/A	N/A
Fraser Canyon Hospital	*	9.7 (3.3-28.6)	*	6.5 (1.8-23.6)	506	96.6%

Health authority and facility	CDI		MRSA		HCC	
	Number of new cases	Rate (95% CI) [a]	Number of new cases	Rate (95% CI) [a]	Total observations	Percent compliance
Langley Memorial Hospital	21	2.9 (1.9-4.5)	35	4.7 (3.4-6.5)	4,503	92.4%
Mission Memorial Hospital	*	2.5 (1.1-5.8)	15	7.4 (4.5-12.2)	3,179	93.6%
Peace Arch Hospital	31	4.5 (3.2-6.4)	42	5.9 (4.4-8.0)	5,912	88.7%
Queen's Park Hospital	*	1.6 (0.7-3.6)	25	7.8 (5.3-11.4)	1,211	90.4%
Ridge Meadows Hospital	25	4.1 (2.8-6.1)	55	8.8 (6.8-11.5)	7,058	88.1%
Royal Columbian Hospital	44	2.9 (2.1-3.8)	81	4.9 (3.9-6.1)	7,771	81.7%
Surrey Memorial Hospital/ Yale Road Centre	80	3.3 (2.7-4.1)	240	9.2 (8.1-10.5)	16,995	85.3%
Vancouver Coastal Health [b]	**214**	**3.4 (2.9-3.8)**	**278**	**4.4 (3.9-4.9)**	**12,011**	**86.9%**
Bella Coola General Hospital	0	0	0	0	**	**
Lions Gate Hospital	29	3.5 (2.4-5.0)	58	7.3 (5.6-9.4)	1,270	90.1%
Mount Saint Joseph Hospital	*	2.4 (1.2-4.7)	11	3.3 (1.8-5.9)	965	82.9%
Powell River General Hospital	*	1.8 (0.5-6.7)	*	1.9 (0.5-6.9)	470	79.6%
Richmond Hospital	21	2.7 (1.8-4.2)	25	3.4 (2.3-5.0)	1,329	91.7%
RW Large Hospital	0	0	0	0	**	**
Sechelt Hospital	*	1.0 (0.3-3.6)	*	4.1 (2.1-8.0)	**	**
Squamish General Hospital	*	4.8 (1.6-14.2)	*	8.9 (3.8-20.8)	**	**
St. Paul's Hospital	58	3.8 (2.9-4.9)	63	4.1 (3.2-5.2)	3,229	79.7%
UBC Hospital	*	1.0 (0.2-5.7)	*	3.0 (1.0-8.9)	343	89.5%
Vancouver General Hospital	90	3.7 (3.0-4.6)	103	4.2 (3.4-5.1)	3,689	92.3%
Island Health [b]	**204**	**3.6 (3.2-4.2)**	**200**	**3.1 (2.7-3.6)**	**25,666**	**76.1%**
Campbell River General Hospital [e]	*	2.6 (1.4-4.9)	10	2.8 (1.5-5.1)	1,017	74.8%
Comox Valley Hospital [f]	16	3.7 (2.3-6.0)	*	1.8 (0.9-3.4)	781	62.1%
Cormorant Island Community Health Centre	0	0	0	0.0	**	**
Cowichan District Hospital	13	2.9 (1.7-4.9)	21	4.1 (2.7-6.2)	2,888	74.6%
Lady Minto Gulf Islands Hospital	*	4.7 (1.6-13.7)	0	0.0	346	88.7%
Nanaimo Regional General Hospital	54	4.8 (3.7-6.2)	67	5.2 (4.1-6.6)	4,224	75.0%
Port Hardy Hospital	*	3.9 (0.7-21.8)	*	3.8 (0.7-21.7)	**	**
Port McNeill and District Hospital	0	0	*	9.9 (1.7-55.6)	**	**
Royal Jubilee Hospital	45	3.1 (2.3-4.1)	51	2.9 (2.2-3.8)	6,543	76.5%
Saanich Peninsula Hospital	*	3.3 (1.7-6.4)	*	0.8 (0.2-3.0)	954	86.5%
Tofino General Hospital	0	0	*	27.1(10.5-69.5)	**	**
Victoria General Hospital	49	4.0 (3.0-5.3)	25	1.8 (1.2-2.7)	7,917	76.2%
West Coast General Hospital	*	3.7 (1.7-8.0)	*	4.7 (2.5-8.9)	913	76.3%

Northern Health [b]	60	2.9 (2.2-3.7)	105	5.0 (4.1-6.1)	19,833	82.5%
Bulkley Valley District Hospital		0	0	0	907	77.1%
Chetwynd General Hospital		0	*	6.6 (1.2-37.6)	**	**
Dawson Creek Hospital	*	1.1 (0.3-4.1)	*	4.5 (2.3-8.9)	256	67.6%
Fort Nelson General Hospital	*	4.4 (0.8-25.0)	*	8.8 (2.4-32.2)	845	82.4%
Fort St. John General Hospital	*	4.9 (2.6-9.3)	*	1.6 (0.6-4.8)	1,220	77.9%
G.R. Baker Memorial Hospital	*	3.2 (1.4-7.6)	*	1.9 (0.7-5.7)	545	68.1%
Kitimat General Hospital		0	*	12.8 (6.5-25.3)	1,597	86.5%
Lakes District Hospital		0	*	2.5 (0.4-14.2)	**	**
Mackenzie and District Hospital		0	*	12.2 (3.3-44.2)	248	73.8%
McBride and District Hospital		0	*	10.5 (1.8-59.0)	200	94.0%
Mills Memorial Hospital	*	0.6 (0.1-3.2)	10	5.7 (3.1-10.5)	938	78.9%
Northern Haida Gwaii Hospital		0	*	8.8 (19.0-124.8)	938	92.9%
Prince Rupert Regional Hospital	*	2.1 (0.6-7.6)	10	10.5 (5.7-19.3)	1,127	78.3%
Queen Charlotte Islands Hospital		0	0	0	738	86.7%
St. John Hospital		0	*	1.4 (0.2-7.9)	697	68.9%
Stuart Lake Hospital		0	*	10.1 (2.8-36.7)	437	92.2%
University Hospital of Northern BC	40	4.4 (3.2-6.0)	48	5.3 (4.0-7.0)	8,775	84.7%
Wrinch Memorial Hospital		0	*	2.4 (0.4-13.6)	286	72.0%
Provincial Health Services Authority [b]	**29**	**5.7 (4.0-8.2)**	**32**	**3.6 (2.6-5.1)**	**4,657** [g]	**93.1%**
BC Children's Hospital	28	10.3 (7.1-14.9)	*	2.7 (1.4-5.1)	2,361	92.7%
BC Women's Hospital	*	0.4 (0.1-2.4)	23	4.2 (2.8-6.3)	1,296	92.9%
Total [b]	**1104**	**3.8 (3.6-4.0)**	**1,447**	**4.6 (4.4-4.9)**	**207,551**	**82.5%**

Notes:

* represents the number of cases of CDI or MRSA that was less than ten

** represents the number of observations that was less than 200 opportunities in 2017/18

a. Per 10,000 inpatient days

b. The total in each health authority includes the numbers masked by * or ** in their facilities

c. Includes data from Matsqui Sumas Abbotsford Hospital

d. A new acute care site participated in the provincial surveillance program during Q4 2017/18

e. Newly opened hospital in Q3 2017/18, including Q1 and Q2 data from Campbell River Hospital

f. Newly opened hospital in Q3 2017/18, including Q1 and Q2 data from St. Josephs General Hospital

g. Includes observations in BC Cancer - Vancouver center

References

1. World Health Organization. The burden of health care-associated infection worldwide. http://www.who.int/gpsc/country_work/burden_hcai/en/. Accessed October 22, 2018.
2. Agency for Healthcare Research and Quality. 2013 annual hospital-acquired condition rate and estimates of cost savings and deaths averted from 2010 to 2013. Rockville, MD; October 2015. AHRQ Publication No. 16-0006-EF. http://www.ahrq.gov/professionals/qualitypatient-safety/pfp/index.html. Accessed August 22, 2016
3. Núñez-Núñez M, Navarro MD, Gkolia P, et al. Surveillance systems from Public Health Institutions and Scientific Societies for antimicrobial resistance and healthcare-associated infections in Europe (SUSPIRE): protocol for a systematic review. BMJ Open 2017;7:e014538. doi:10.1136/bmjopen-2016- 014538
4. Chen YC, Sheng WH, Wang JT, Chang SC, Lin HC, et al. Effectiveness and limitations of hand hygiene promotion on decreasing healthcare-associated infections. PLoS One. 2011;6(11):e27163. doi: 10.1371/journal.pone.0027163.
5. Neo JR, Sagha-Zadeh R, Vielemeyer O, Franklin E. Evidence-based practices to increase hand hygiene compliance in health care facilities: An integrated review. Am J Infect Control 2016; 44:691-704. doi: 10.1016/j.ajic.2015.11.034.
6. MRSA Tracking. last updated: April 13, 2016. http://www.cdc.gov/mrsa/tracking/index.html. Accessed August 22, 2016
7. Zacharioudakis IM, Zervou FN, Pliakos EE, Ziakas PD, Mylonakis E. Colonization with toxinogenic *C. difficile* upon hospital admission, and risk of infection: a systematic review and meta-analysis. Am J Gastroenterol 2015; 110:381.
8. Furuya-Kanamori L, Marquess J, Yakob L, Riley TV, Paterson DL, et al. Asymptomatic Clostridium difficile colonization: epidemiology and clinical implications. BMC Infect Dis. 2015; 15: 516. doi: 10.1186/s12879-015-1258-4
9. Schutze GE and Willoughby RE. Policy statement: *Clostridium difficile* Infection in Infants and Children. Pediatrics 2013;131:196–200
10. Nicholson MR, Thomsen IP and Edwards KM. Controversies Surrounding *Clostridium diff*icile Infection in Infants and Young Children. Children 2014;1:40-47. doi:10.3390/children1010040
11. Clean care is safer care: the first global patient safety challenge. http://www.who.int/gpsc/en/. Accessed May 18, 2011
12. Dhar S, Tansek, R, Toftey E, Dziekan B, Chevalier TC, Bohlinger CG, et al. Observer bias in hand hygiene compliance reporting. Infect Control Hosp Epidemiol 2010; 31:869-70.
13. Niles M, Johnson N. Hawthorne Effect in Hand Hygiene Compliance Rates. Am J Infect Control 2016; 44:S28–S29
14. Srigley JA, Furness CD, Baker GR, and Gardam M. Quantification of the Hawthorne effect in hand hygiene compliance monitoring using an electronic monitoring system: a retrospective cohort study. BMJ Qual Saf 2014;23:974–980. doi:10.1136/bmjqs-2014-003080

PICNet
PROVINCIAL INFECTION CONTROL NETWORK OF BRITISH COLUMBIA
A program of the Provincial Health Services Authority

Provincial Health Services Authority
Province-wide solutions. Better health.