PICNet PROVINCIAL INFECTION CONTROL NETWORK OF BRITISH COLUMBIA

Clostridium difficile Infection (CDI) Surveillance Report

Fiscal Year 2010/2011

(April 1, 2010 – March 31, 2011)

Prepared by:

Provincial Infection Control Network of British Columbia (PICNet)

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Glossary of Acronyms

BC	British Columbia
CA	Community-associated
CDI	*Clostridium difficile* Infection
CI	Confidence Interval
FHA	Fraser Health Authority
FQ	Fiscal quarter
FY	Fiscal year
HA	Health Authority
HCA	Healthcare-associated
ICU	Intensive Care Unit
IHA	Interior Health Authority
NHA	Northern Health Authority
PHC	Providence Health Care
PHSA	Provincial Health Services Authority
PICNet	Provincial Infection Control Network of British Columbia
VCHA	Vancouver Coastal Health Authority
VIHA	Vancouver Island Health Authority

Summary

Clostridium difficile infection (CDI) is a leading cause of healthcare-associated infectious diarrhea. Vancouver Coastal Health and Vancouver Island Health Authorities began to submit data on CDI cases occurring among patients admitted to their acute healthcare facilities from April of 2008. On April 1, 2009, the surveillance system expanded to all 80 acute healthcare facilities in British Columbia (BC). This report focuses on the cases of CDI reported in the fiscal year (FY) 2010/2011 (from April 1, 2010 to March 31, 2011).

A total of 3,095 new infections and 519 relapses of CDI were reported in FY 2010/2011. Of the new infections, 2,353 (76.0%) were healthcare-associated (HCA).

The provincial rate of new infections associated with the reporting facilities was 8.3 [95% confidence intervals (CI): 8.0-8.7] per 10,000 inpatient days in FY 2010/2011. The rate did not change significantly compared to the FY 2009/2010 rate of 8.8 (95% CI: 8.4-9.2) per 10,000 inpatient days.

The number of cases and rate of new infections associated with the reporting facilities varied by Health Authority. There was no significant difference in the rates between FY 2010/2011 and FY 2009/2010 for any of the Health Authorities except Interior Health Authority, whose rate was significantly lower in FY 2010/2011.

The rate of new infections associated with the reporting facilities was lowest in those hospitals with less than 100 beds [5.1 (95% CI: 4.5-5.7) per 10,000 inpatient days] and highest in the hospitals with more than 250 beds [11.0 (95% CI: 10.4-11.6) per 10,000 inpatient days]. The rate increased significantly with hospital size.

About 92.8% of HCA cases in FY 2010/2011 were reported to have used antibiotics in the six weeks prior to CDI diagnosis. There was no significant difference in the antibiotic exposure compared to FY 2009/2010.

Among all CDI cases reported in FY 2010/2011, 160 (4.4%) were admitted to ICU, 47 (1.3%) developed toxic megacolon, and 34 (0.9%) required a total or partial colectomy.

This report aims to increase the understanding of the patterns and characteristics of CDI in BC. The rates of CDI presented are not risk-adjusted, and therefore are not directly comparable between Health Authorities and facilities.

Introduction

Clostridium difficile infection (CDI) is a leading cause of healthcare-associated infectious diarrhea, and is associated with increased healthcare costs, prolonged hospitalization, and patient morbidity. The most common risk factors for CDI include advanced age, antibiotic exposure, and hospitalization in an acute healthcare facility or residency in a long-term care facility.[1] Since 2006, the Provincial Infection Control Network of BC (PICNet), in collaboration with representatives from Interior Heath Authority (IHA), Fraser Health Authority (FHA), Vancouver Costal Heath Authority (VCHA), Vancouver Island Heath Authority (VIHA), Northern Health Authority (NHA), Provincial Health Services Authority (PHSA), and Providence Health Care (PHC), has been developing a standardized provincial surveillance system to monitor the incidence of CDI in BC acute healthcare facilities. VCHA and VIHA began to submit data on CDI cases occurring among patients admitted to their acute healthcare facilities from April of 2008. On April 1, 2009, the surveillance system expanded to all 80 acute healthcare facilities across the province. This report focuses on the cases of CDI reported in the fiscal year (FY) 2010/2011 from **April 1, 2010 to March 31, 2011**.

Please note that the data in this report should be interpreted with caution. Comparison of the numbers of cases and rates among Health Authorities (HA) and healthcare facilities is not recommended. There are many factors that can affect the incidence and rate of CDI, including the size of the facilities, health conditions and medical history of the population served, the complexity of the services offered, the physical layout of the facilities, the proportion of patient population older than 55, the strain of *C. difficile* identified, and the laboratory methods used for detection. Facilities with small numbers of cases may have unstable rates and percentages; slight changes in the number of cases can dramatically affect the rate and percentage, especially in smaller hospitals. To ensure patient confidentiality, facilities reporting case numbers less than 10 are reported as “<10”. In addition, reference to healthcare-associated infections (HAI) should not be interpreted as cases of infection acquired directly through healthcare services provided by the reporting facility or other healthcare facilities. Please see the “About this report” section for other limitations.

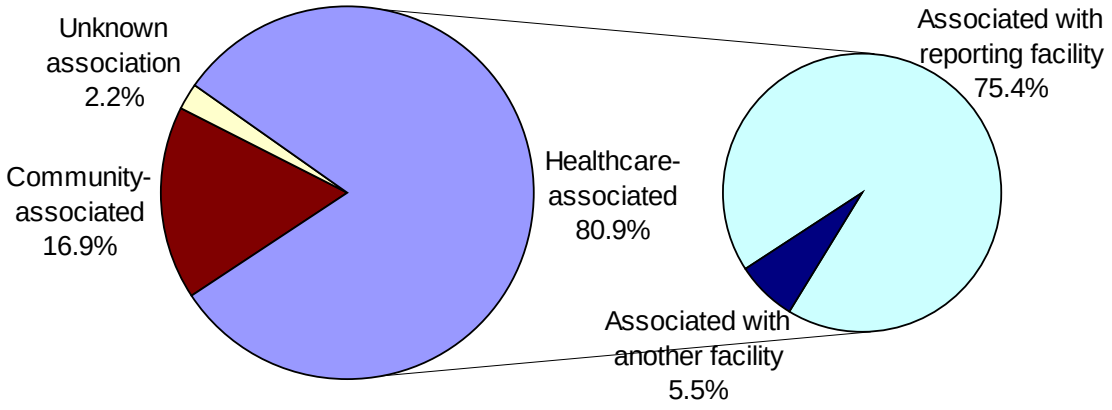
[1] Bartlett JG (2010). Annals of New York Academy of Sciences 1213:62-69

Overview of CDI cases reported from April 1, 2008 to March 31, 2011

The cases of CDI identified in BC acute healthcare facilities include both new infections[2] and relapses. New infections are further classified as either healthcare-associated (HCA) or community-associated (CA) according to the patient's healthcare encounter history. The HCA cases include the infections associated with the reporting facility (nosocomial) and infections associated with another facility.[3]

Of all CDI cases reported from April 1, 2008 to March 31, 2011, 84.4% were new infections and 15.6% were relapses. Among the new infections, 80.9% were HCA, 16.9% were CA, and 2.2% were of unknown association (Figure 1). Of the HCA cases, 75.3% were associated with the reporting facility, and 5.6% were associated with another facility. Given that the population under surveillance is inpatients in acute care hospitals, the data presented in this report do not represent an accurate reflection of the burden of CDI in the community.

Figure 1. Provincial distribution of new cases of CDI by association, April 1, 2008 – March 31, 2011

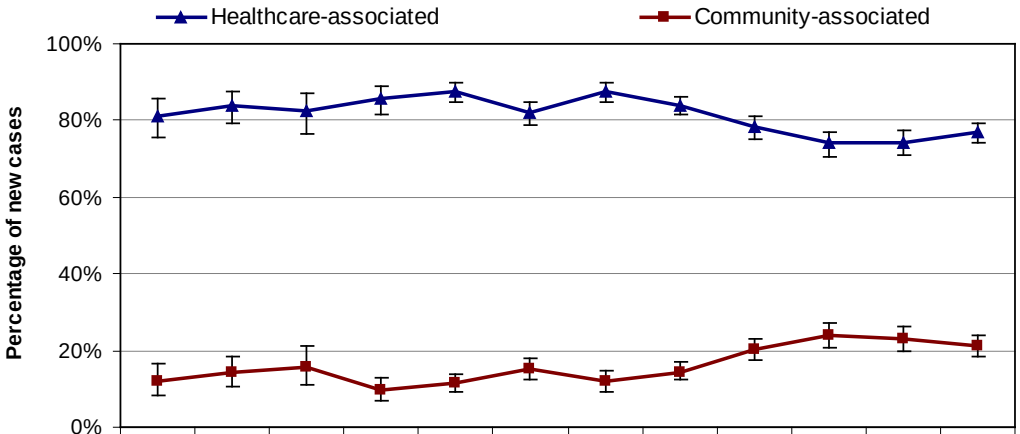


[2] Including reinfection as defined by FHA

[3] See Glossary for definitions

Overall, the proportion of HCA over new CDI cases by fiscal quarter (FQ) decreased slightly by 0.4% since the first FQ of 2008/2009 ($p<0.01$ for trend), and the proportion of CA increased by 0.8% during the same period ($p<0.01$ for trend) (Figure 2).

Figure 2. Percentage and 95% confidence intervals of new CDI cases by association and fiscal quarter and year**



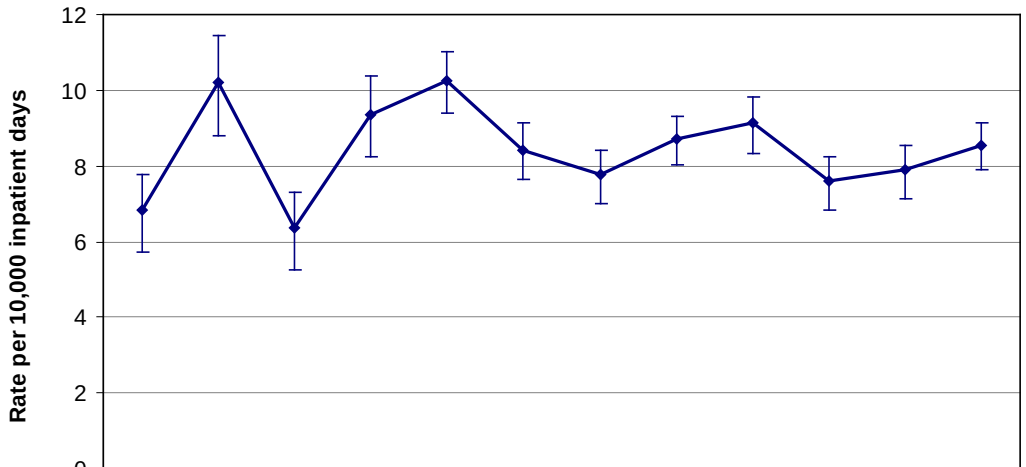
	FQ1	FQ2	FQ3	FQ4	FQ1	FQ2	FQ3	FQ4	FQ1	FQ2	FQ3	FQ4
	2008/2009*				2009/2010				2010/2011			
Healthcare-associated	81.2%	83.8%	82.4%	85.7%	87.5%	82.1%	87.6%	83.9%	78.3%	74.0%	74.3%	76.8%
Community-associated	11.8%	14.1%	15.6%	9.5%	11.3%	15.0%	11.9%	14.4%	20.2%	23.9%	22.8%	21.1%

Fiscal quarter and year

Note: * Includes data from VCHA and VIHA only. ** See Limitations in the "About this report" section.

The average provincial rate of new infections associated with the reporting facilities during the period 2008/2009 to 2010/2011 was 8.5 per 10,000 inpatient days [95% confidence interval (CI): 8.3 – 8.7]. Despite variability of the rate by FQ in 2008/2009, the FQ rates remained relatively stable since the second FQ of 2009/2010 (Figure 3).

Figure 3. Rate and 95% confidence intervals of new infections associated with the reporting facilities per 10,000 inpatient days by fiscal quarter and year**



	FQ1	FQ2	FQ3	FQ4	FQ1	FQ2	FQ3	FQ4	FQ1	FQ2	FQ3	FQ4
	2008/2009*				2009/2010				2010/2011			
Rate/10,000	6.8	10.2	6.3	9.4	10.2	8.4	7.8	8.7	9.1	7.6	7.9	8.5

Fiscal quarter and year

Note: * Includes data from VCHA and VIHA only. ** See Limitations in the "About this report" section.

CDI cases reported in the fiscal year 2010/2011

A total of 3,095 new infections and 519 relapses were reported in FY 2010/2011. Of the new infections, 2,353 (76.0%) cases were HCA, 677 (21.9%) were CA, and 65 (2.1%) were of unknown association. The percentage of new HCA cases decreased from 85.2% in FY 2009/2010 to 76.0% in FY 2010/2011, while the new CA cases increased from 13.2% to 20.9% during the same period.

Among the 2,353 cases of HCA new infections, 2,192 were associated with the reporting facilities. The provincial rate of new infections associated with the reporting facilities was 8.3 (95% CI: 8.0-8.7) per 10,000 inpatient days in FY 2010/2011. There was no significant change when compared to FY 2009/2010; the rate in FY 2009/2010 was 8.8 (95% CI: 8.4-9.2) per 10,000 inpatient days.

CDI cases by Health Authority

The number of each type of CDI case and the rate of new infections associated with the reporting facilities varied by HA (Tables 1 and 2). As illustrated in Table 2 by an overlapping 95% CI, there was no significant difference in the rates of new infections associated with the reporting facilities between FY 2010/2011 and FY 2009/2010 for any of the Health Authorities with the exception of IHA, where the rate was significantly lower in FY 2010/2011 than in FY 2009/2010.

Table 1. Number and percentage of cases of CDI by Health Authority, 2010/2011

Health Authority*	New infection				Relapse
	Healthcare-associated		Community-associated	Unknown	
	New infection associated with reporting facility	New infection associated with another facility			
IHA	272 (41.7%)	0	293 (44.9%)	0	88 (13.5%)
FHA	1032 (70.4%)	86 (5.9%)	113 (7.7%)	<10	233 (15.9%)
VCHA**	605 (57.3%)	62 (5.9%)	186 (17.6%)	63 (6.0%)	139 (13.2%)
VIHA	214 (64.1%)	10 (3.0%)	64 (19.2%)	0	46 (13.8%)
NHA	49 (62.0%)	<10	17 (21.5%)	<10	<10
PHSA	20 (71.4%)	0	<10	0	<10

Note: * See Limitations in the "About this report" section. ** Includes PHC, the same hereinafter.

Table 2. Rate and 95% confidence intervals of new infections associated with the reporting facilities per 10,000 inpatient days by Health Authority

Health Authority*	FY 2010/2011					FY 2009/2010 Annual Rate
	FQ1	FQ2	FQ3	FQ4	Annual Rate	
IHA	9.7 (7.9-11.8)	4.7 (3.6-6.3)	5.1 (3.8-6.8)	6.6 (5.3-8.3)	6.6 (5.8-7.4)	9.2 (8.4-10.2)
FHA	10.3 (9.1-11.8)	10.7 (9.4-12.3)	12.4 (10.9-13.9)	11.4 (10.3-12.7)	11.2 (10.6-11.9)	10.9 (10.2-11.6)
VCHA	10.6 (9.0-12.4)	9.5 (8.0-11.3)	8.6 (7.2-10.3)	10.5 (9.2-12.1)	9.9 (9.1-10.7)	10.0 (9.3-10.9)
VIHA	6.6 (5.2-8.3)	4.4 (3.3-5.9)	2.9 (2.1-4.1)	4.4 (3.5-5.6)	4.6 (4.0-5.2)	5.5 (4.9-6.2)
NHA	4.8 (3.1-7.6)	1.0 (0.4-2.7)	2.5 (1.4-4.7)	2.8 (1.7-4.5)	2.8 (2.1-3.7)	2.1 (1.5-2.8)
PHSA	2.6 (0.9-7.6)	4.3 (1.8-9.9)	4.4 (1.9-10.4)	4.3 (2.1-8.9)	3.9 (2.5-6.1)	6.5 (4.6-9.2)
Total	9.1 (8.4-9.9)	7.6 (6.9-8.3)	7.9 (7.2-8.6)	8.5 (7.9-9.2)	8.3 (8.0-8.7)	8.8 (8.4-9.2)

Note: * See Limitations in the "About this report" section

CDI cases by hospital size

The rate of new infections associated with the reporting facilities was lowest in those hospitals with less than 100 beds [5.1 (95% CI: 4.5-5.7) per 10,000 inpatient days], and highest in those hospitals with more than 250 beds [11.0 (95% CI: 10.4-11.6) per 10,000 inpatient days]. Compared to the annual rate in FY 2009/2010, the rates were not significantly different for those hospitals with less than 100 beds, or more than 250 beds. The rate in the hospitals with 100-250 beds was significantly lower in FY 2010/2011 than FY 2009/2010. The rate increased significantly with hospital size for both years, as demonstrated in Table 3.

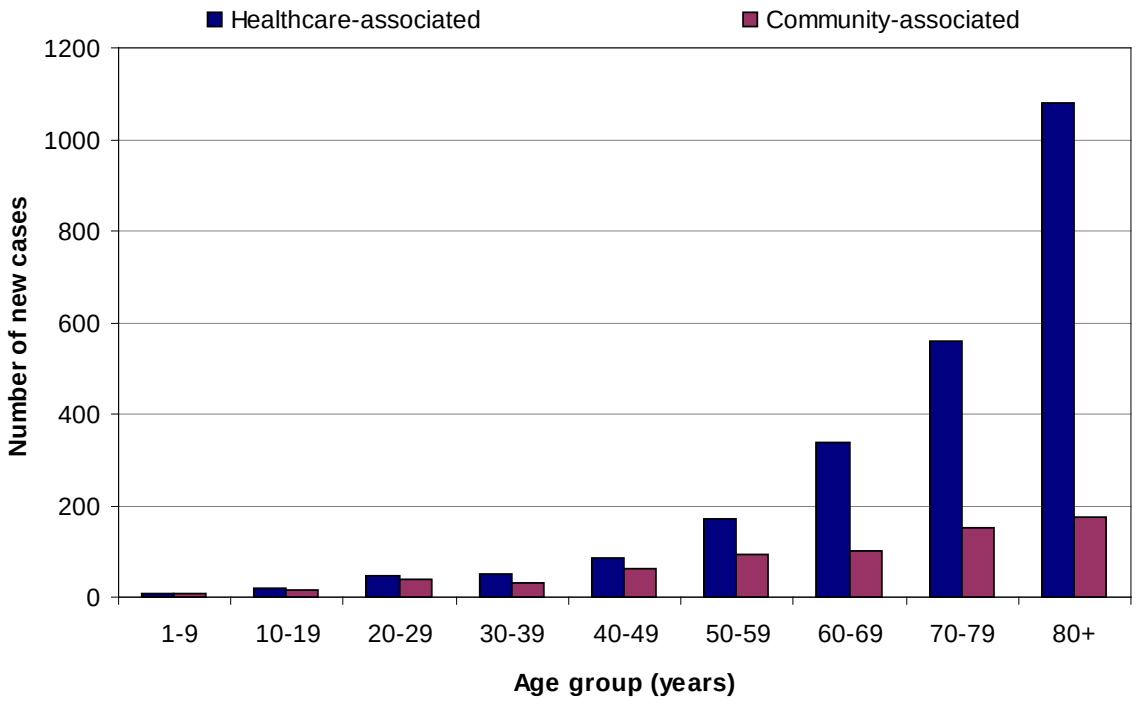
Table 3. Rate and 95% confidence intervals of new infections associated with the reporting facilities per 10,000 inpatient days by hospital size

Hospital Size (Beds)	FY 2010/2011					FY 2009/2010 Annual Rate
	FQ1	FQ2	FQ3	FQ4	Annual Rate	
<100	5.2 (4.1-6.6)	4.1 (3.2-5.4)	5.6 (4.4-7.2)	5.2 (4.2-6.5)	5.1 (4.5-5.7)	5.4 (4.8-6.0)
100-250	8.3 (7.1-9.6)	6.1 (5.2-7.3)	5.3 (4.4-6.4)	6.9 (6.0-8.0)	6.7 (6.2-7.2)	8.2 (7.7-8.9)
>250	11.6 (10.4-12.9)	10.3 (9.2-11.6)	10.9 (9.7-12.2)	11.3 (10.2-12.4)	11.0 (10.4-11.6)	10.6 (10.1-11.2)
Total	9.1 (8.4-9.9)	7.6 (6.9-8.3)	7.9 (7.2-8.6)	8.5 (7.9-9.2)	8.3 (8.0-8.7)	8.8 (8.4-9.2)

CDI cases by age

The number of new cases of CDI increased with patient age for both HCA and CA (Figure 4). Of the HCA infections, 45.9% were patients aged 80 years or older, and 23.7% were between 70-79 years. For CA infections, 25.8% were 80+ years and 22.5% were between 70-79 years. Please note that the senior population may be over-represented as inpatients in the acute healthcare facilities compared to the general population.

Figure 4. Number of new cases of CDI by association and age group, 2010/2011



CDI cases by antibiotic exposure in previous six weeks

Exposure to antibiotics is one of the most common risk factors for CDI. Information about antibiotic use in the previous six weeks is collected by the reporting facilities. About 95.7% of HCA new infections in 2010/2011 had antibiotic exposure history reported. Of these, 92.8% of cases were reported to have used antibiotics in the six weeks prior to CDI diagnosis. The actual exposure to antibiotics may be even higher, as the history of antibiotic use prior to admission is frequently not available in hospital information systems. Compared to FY 2009/2010, there was no significant change in antibiotic use at either the provincial level or for individual HAs (Table 4). Antibiotic exposure data were available for only 58.9% of CA CDI, and are therefore not presented.

Table 4. Antibiotic exposure in the six weeks prior to CDI diagnosis among healthcare-associated new infections by Health Authority

	FY 2010/2011		FY 2009/2010
	Number of cases with antibiotic exposure	Percentage of antibiotic exposure (95% CI)*	Percentage of antibiotic exposure (95% CI)*
IHA	237	96.0% (92.7%-97.8%)	97.3% (95.1%-98.5%)
FHA	1,019	92.8% (91.1%-94.2%)	94.4% (92.8%-95.7%)
VCHA	585	91.8% (89.5%-93.7%)	93.8% (91.6%-95.4%)
VIHA	198	94.7% (90.8%-97.0%)	93.8% (90.1%-96.1%)
NHA	36	80.0% (66.2%-89.1%)	82.9% (67.3%-91.9%)
PHSA	15	100.0% (79.6%-100.0%)	86.2% (69.4%-94.5%)
Total	2,090	92.8% (91.7%-93.8%)	94.4% (93.3%-95.2%)

Note: * Cases with unknown antibiotic exposure were excluded from percentage calculations.

CDI cases by acute healthcare facility

Table 5 displays the annual rate of new cases of CDI associated with the reporting facilities per 10,000 inpatient days in FY 2010/2011 compared to FY 2009/2010. ***The rates in the table are not adjusted by risk factors, and should not be used to make comparisons between the individual facilities.*** Please see the cautionary note in the "Introduction" section and limitations in the "About this report" section. Facilities are listed in alphabetical order.

Table 5. Annual rate and 95% confidence intervals of new cases of CDI associated with reporting facilities per 10,000 in patient days by acute healthcare facility

Acute Healthcare Facility	FY 2010/2011	FY 2009/2010
100 Mile District Hospital	1.5 (0.3-8.7)	-
Abbotsford Regional Hospital	4.2 (3.1-5.7)	4.4 (3.3-6.1)
Arrow Lakes Hospital	- *	28.4 (11.0-72.7)
BC Children's Hospital	7.0 (4.4-11.0)	13.3 (9.4-18.9)
BC Women's Hospital	0.8 (0.2-2.9)	0.4 (0.1-2.2)
Bella Coola General Hospital	-	-
Boundary Hospital	5.2 (0.9-29.5)*	14.1 (6.5-30.8)
Bulkley Valley District Hospital	-	5.4 (1.8-15.8)
Burnaby Hospital	18.5 (16.2-21.2)	22.2 (19.6-25.3)
Campbell River & District General Hospital	1.9 (0.8-4.4)	1.2 (0.4-3.4)
Cariboo Memorial Hospital and Health Centre	6.1 (2.8-13.4)	2.1 (0.6-7.7)
Chetwynd General Hospital	-	-
Chilliwack General Hospital	3.0 (1.9-4.9)	3.7 (2.4-5.7)
Cormorant Island Community Health Centre	-	-
Cowichan District Hospital	4.7 (2.9-7.5)	4.0 (2.3-6.8)
Creston Valley Hospital	6.7 (2.6-17.1)	12.0 (5.5-26.1)
Dawson Creek And District Hospital	-	-
Delta Hospital	8.6 (5.6-13.3)	7.7 (4.9-12.2)
Dr. Helmcken Memorial Hospital & Health Centre	-	8.5 (1.5-47.9)
Eagle Ridge Hospital	11.1 (8.3-14.8)	12.3 (9.3-16.2)
East Kootenay Regional Hospital	7.4 (4.6-11.9)	11.1 (7.5-16.4)
Elk Valley Hospital	15.9 (8.1-31.3)	18.5 (9.7-35.2)
Fort Nelson General Hospital	-	-
Fort St. John General Hospital	2.2 (0.8-6.5)	1.3 (0.4-4.9)
Fraser Canyon Hospital	5.1 (1.4-18.5)	10.0 (3.9-25.6)
Golden & District General Hospital	-	-
GR Baker Memorial Hospital	2.3 (0.8-6.8)	-
Invermere & District Hospital	11.0 (3.7-32.2)	10.8 (3.7-31.6)
Kelowna General Hospital	10.0 (8.4-12.0)	13.7 (11.8-15.9)
Kitimat General Hospital	1.5 (0.3-8.3)	3.1 (0.8-11.1)
Kootenay Boundary Regional Hospital	5.2 (2.2-12.2)*	10.0 (6.7-15.1)
Kootenay Lake Hospital	13.9 (7.0-27.4)*	8.8 (5.0-15.3)
Lady Minto Gulf Islands Hospital	4.9 (1.7-14.4)	3.4 (0.9-12.4)
Lakes District Hospital and Health Centre	-	4.8 (1.3-17.6)
Langley Memorial Hospital	15.8 (13.2-18.9)	17.4 (14.5-20.8)
Lillooet Hospital and Health Centre	-	12.7 (3.5-46.0)
Lion's Gate Hospital	6.8 (5.3-8.7)	9.2 (7.4-11.4)

Table 5 (Cont'd). Annual rate and 95% confidence intervals of new cases of CDI associated with reporting facilities per 10,000 inpatient days by acute healthcare facility

Acute Healthcare Facility	FY 2010/2011	FY 2009/2010
Mackenzie and District Hospital	-	-
Masset Hospital	-	-
Matsqui Sumas Abbotsford	1.2 (0.2-6.6)	-
McBride and District Hospital	-	-
Mills Memorial Hospital	1.3 (0.4-4.7)	0.6 (0.1-3.6)
Mission Memorial Hospital	8.5 (4.1-17.4)	3.5 (1.2-10.3)
Mount Saint Joseph Hospital	19.3 (15.3-24.3)	15.3 (11.9-19.8)
Nanaimo Regional General Hospital	9.3 (7.5-11.5)	7.3 (5.7-9.2)
Nicola Valley Health Centre	-	3.3 (0.6-18.6)
Peace Arch Hospital	6.5 (4.9-8.6)	8.0 (6.1-10.4)
Penticton Regional Hospital	5.6 (3.8-8.1)	4.1 (2.6-6.4)
Port Hardy Hospital	-	-
Port McNeill and District Hospital	-	-
Powell River General Hospital	1.0 (0.2-5.7)	-
Prince George Regional Hospital	4.8 (3.4-6.7)	3.5 (2.4-5.2)
Princeton General Hospital	11.8 (3.2-42.9)	-
Queen Charlotte Islands General Hospital	-	-
Queen Victoria Hospital and Health Centre	3.0 (0.5-16.9)	10.0 (3.4-29.4)
Queen's Park Care Centre	10.7 (7.2-15.9)	9.1 (5.7-14.4)
Richmond Hospital	7.5 (5.6-9.9)	6.5 (4.8-8.9)
Ridge Meadows Hospital	4.3 (2.9-6.4)	4.1 (2.7-6.2)
Royal Columbian Hospital	13.8 (12.1-15.8)	8.3 (7.0-9.9)
Royal Inland Hospital	2.3 (1.5-3.6)	2.5 (1.6-3.9)
Royal Jubilee Hospital	4.3 (3.3-5.7)	7.9 (6.5-9.7)
RW Large Hospital	-	-
Saanich Peninsula Hospital	1.3 (0.5-3.9)	11.2 (7.4-17.0)
Shuswap Lake General Hospital	6.3 (3.4-11.5)	4.0 (1.8-8.7)
South Okanagan General Hospital	6.1 (2.4-15.8)	5.3 (1.8-15.5)
Squamish General Hospital	-	4.4 (1.2-16.0)
St. John Hospital	5.0 (1.7-14.6)	-
St. Joseph's General Hospital	2.6 (1.3-5.0)	5.3 (3.2-8.7)
St. Mary's Hospital	5.4 (2.7-10.6)	3.4 (1.5-8.0)
St. Paul's Hospital	10.2 (8.7-11.9)	9.9 (8.4-11.6)
Stuart Lake Hospital	-	-
Surrey Memorial Hospital	14.0 (12.4-15.8)	13.7 (12.1-15.5)
Tofino General Hospital	-	-
UBC Hospital	2.9 (1.0-8.4)	0.9 (0.2-5.2)
University Hospital of Northern BC**	2.3 (0.6-8.4)	1.2 (0.2-6.6)
Vancouver General Hospital	11.4 (10.1-12.9)	12.1 (10.7-13.6)
Vernon Jubilee Hospital	6.6 (4.7-9.2)	15.5 (12.4-19.4)
Victoria General Hospital	3.0 (2.1-4.2)	3.0 (2.2-4.2)
West Coast General Hospital	4.7 (2.5-9.0)	3.2 (1.5-7.0)
Wrinch Memorial Hospital	3.9 (0.7-21.9)	-

Note: – Represents zero case reported and hence no rate is calculated
* Includes the first and second fiscal quarter of 2010/2011 data only
** Formerly known as Prince George Regional Hospital

Relapse of CDI

There were 519 relapses of CDI reported in FY 2010/2011, accounting for 14.4% of all cases. Compared to FY 2009/2010 (Table 6), the percentages of relapses were significantly lower for IHA, VCHA, and the province as a whole in FY 2010/2011. There was no significant difference for the other HAs.

Table 6. Number and percentage of relapses among healthcare-associated CDI cases by Health Authority, 2010/2011

Health Authority	FY 2010/2011		FY 2009/2010 Percentage of relapses (95% CI)
	Number of Relapses	Percentage of relapses (95% CI)	
IHA	88	13.5% (11.1%-16.3%)	21.2% (18.2%-24.6%)
FHA	233	16.1% (14.3%-18.1%)	15.3% (13.5%-17.3%)
VCHA	139	13.2% (11.3%-15.4%)	18.2% (15.9%-20.7%)
VIHA	46	13.8% (10.5%-17.9%)	15.6% (12.3%-19.6%)
NHA	<10	11.4% (6.1%-20.3%)	13.7% (6.8%-25.7%)
PHSA	<10	14.3% (5.7%-31.5%)	17.8% (9.3%-31.3%)
Total	519	14.4% (13.3%-15.6%)	17.2% (16.0%-18.5%)

Complications and outcomes within 30 days of diagnosis

CDI cases are followed for a period of 30 days post diagnosis or up to the point of patient discharge or transfer (whichever comes first) for CDI-associated complications and outcomes. The complications examined include admission to the intensive care unit (ICU), toxic megacolon, and total or partial colectomy. These complications are not mutually exclusive; it is possible that a patient may experience one or several complications. In addition, complications due to CDI may not be the sole reason for ICU admission.

Follow-up also includes recording mortality from any cause for patients with CDI. In these cases, CDI may or may not have been the cause of death or a contributing factor to the death. It is extremely difficult to determine whether CDI contributes to a patient's death, and the attributable mortality indicators have yet to be developed. The all-cause mortality is potentially open to misinterpretation as the numbers may incorrectly suggest that all deaths reported are due to CDI; this report will therefore not present the mortality data.

Among 3,614 CDI identified cases in FY 2010/2011, 160 (4.4%) were admitted to ICU, 47 (1.3%) developed toxic megacolon, and 34 (0.9%) required a total or partial colectomy (Table 7). The percentage of patients developing toxic megacolon or requiring a total or partial colectomy was higher for the CA CDI cases than HCA CDI or relapsed cases, but the difference was not statistically significant.

Table 7. CDI-associated complications within 30 days of diagnosis, 2010/2011

Complication	Healthcare-associated new infection (n=2,353)	Community-associated new infection (n=677)	Relapse (n=519)	Total*	
				(n=3,614)	(95% CI)
ICU Admission	101 (4.3%)	32 (4.7%)	27 (5.2%)	160 (4.4%)	(2.2%-8.8%)
Toxic Megacolon	24 (1.0%)	15 (2.2%)	8 (1.5%)	47 (1.3%)	(0.2%-9.8%)
Total or Partial Colectomy	18 (0.8%)	11 (1.6%)	5 (1.0%)	34 (0.9%)	(0.1%-11.8%)

Note: * Includes unknown association of new infections

Discussion

This annual surveillance report presents the cases of CDI identified among inpatients admitted to BC acute care facilities in FY 2010/2011. The rate of new infections associated with the reporting facilities did not change significantly for the province or for five of the six HAs compared to the previous fiscal year (FY 2009/2010).

The rate of new infections increased significantly with increasing hospital size. One reason for this may be that the larger hospitals are more likely to offer comprehensive specialty care to patients with greater severity of illness, whereas the smaller hospitals usually transfer the sicker patients to the larger facilities. Severe underlying illness has been determined to be an independent risk factor for CDI[4], which means that the larger hospitals may have more at-high-risk patients of CDI.

Antibiotic exposure has been found to be associated with CDI. Research shows that cumulative dosage, number, and duration of antibiotic exposure are associated with the development of CDI, with higher levels of exposure corresponding to greater risk.[5] The majority of HCA CDI in BC were reported to have used antibiotics in the six weeks prior to CDI diagnosis. Given that antibiotic use is essential in treating many infections, some of which are deadly if not treated. CDI will always be a potential complication associated with antibiotic treatment. It is a challenge for healthcare providers to optimize antibiotic use to minimize the risk of acquiring healthcare-associated CDI.

The CDI surveillance system was established to monitor the patterns and trends of CDI in BC acute healthcare facilities, and to develop appropriate benchmarks for CDI. This report aims to increase the understanding of the patterns and characteristics of CDI in BC. However, the data in this report may not represent the true number of cases of CDI due to the methodologies used for case finding and data collection (see “About this report section”). In addition, the rates of CDI were not adjusted by known risk factors, and therefore comparisons between health authorities and between facilities should not be made.

Acknowledgement

PICNet wishes to thank all participants in each HA and their affiliated healthcare facilities for their ongoing support and participation in our provincial HAI surveillance program.

[4] Poutanen SM and Simor AE. Canadian Medical Association Journal 2004;171(1):51-58

[5] Stevens V, et al. Clinical Infectious Diseases 2011;53(1):42–48

About this report

CDI surveillance system

The provincial HCA CDI surveillance system involves the voluntary participation of all 80 acute healthcare facilities across British Columbia. PICNet, working with each Health Authority, manages the data for CDI cases through a PHSA secure web portal. The objectives of the system are to determine the incidence of HCA CDI, and to describe characteristics of CDI in BC acute care facilities. This report presents the cases of CDI reported in FY 2010/2011 (April 1, 2010 to March 31, 2011).

Population under surveillance

The population under surveillance includes inpatients admitted to BC acute care facilities. This includes 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 healthcare facilities, patients in extended care beds housed in acute healthcare facilities, patients in psychiatric beds, and short-term emergency room admissions are excluded. Infants under one year of age are also excluded from this surveillance.

Data sources

This report incorporates the data collected from all acute care facilities in IHA, FHA, VCHA (including PHC), VIHA, NHA, PHSA, and their affiliated hospitals.

The data are collected daily based on the minimal dataset as defined by the PICNet Surveillance Steering Committee, and submitted quarterly through PICNet's web portal for analysis at the provincial level. Updates and modifications submitted after the data submission due dates may not be reflected in this report, but will be presented in future reports.

Limitations

There are variations in case finding strategies and data collection methodologies across acute healthcare facilities and Health Authorities in BC.

Case definitions: CDI cases are reviewed to identify healthcare encounter history. This information is used to determine whether the infections were healthcare-associated. During FY 2008/2009 to 2009/2010, an eight week "look-back" period was used by all HAs with the exception of PHC, which used a four week period. In FY 2010/2011, the look-back period was modified to four weeks for all HAs, with the exception of IHA and FHA, which continue to use an 8 week period. This modification from eight weeks to four may result in a decrease in the number of healthcare-associated infections reported. In addition, FHA included CDI cases among psychiatric patients in the acute care beds.

Denominator data: Acute care inpatient days are used as the denominator to calculate the CDI rates at the provincial, HA, and healthcare facility level. Participating parties collect inpatient days in each acute care facility by fiscal quarter from their information systems, and

submit the data to PICNet on a quarterly basis. Inclusion of inpatient days varies by HA due to the inability to separate them from their total denominator. VIHA included inpatient days of all acute care admissions without exclusion for FY 2008/2009. FHA and VCHA (except PHC) include patients less than one year of age in their inpatient days. FHA also included psychiatric patient days in their denominator.

Laboratory methodologies: A variety of laboratory methods are used in BC to confirm CDI cases, including Enzyme-linked Immunosorbent Assay (EIA), Toxin Assays, Polymerase Chain Reaction (PCR), etc.[6] The sensitivity and specificity of these methods are different, and vary from site to site. In particular, the PCR testing is more sensitive than traditional method of toxin EIA testing for *C. difficile* by as much as 35%[7], resulting in an increase in identifying CDI cases. The HAs are currently in various stages of implementing molecular testing methods to confirm CDI cases. VCHA implemented PCR testing in FY 2009/2010 and PHC in FY 2010/2011. IHA brought PCR testing into some facilities in FY 2010/2011.

This report is based on the CDI cases reported to PICNet. It is not guaranteed that all CDI among the population under surveillance are identified. Variation in surveillance intensity and case identification methodology affects the number of cases identified. In addition, each healthcare facility has unique challenges and different at-risk populations. Each HA is best situated to respond to the incidence of CDI in their region and the affiliated healthcare facilities.

[6] British Columbia Association of Medical Microbiologists, 2006

[7] Chapin KC et al (2011). Journal of Molecular Diagnosis 13: 395-400

Glossary

Acute healthcare facility

Acute healthcare facilities are care facilities in which patients are treated for brief but severe episodes of illness, for the sequelae of an accident or other trauma, or during recovery from surgery. In this report, acute healthcare facility refers to acute care hospitals in BC.

Age

Age in this report is calculated by the difference between the CDI specimen collection date or case diagnosis date and the birth year of the patient.

Clostridium difficile Infection (CDI)

CDI, under PICNet CDI surveillance, is defined as:

- Acute onset of diarrhea (three or more loose stools within a 24-hour period) without another etiology (loose stool is defined as that which takes the shape of the container that holds it).

  AND one or more of the following:

- Laboratory confirmation (positive toxin, or culture with evidence of toxin production, or detection of toxin genes)

  OR

- Diagnosis of typical pseudo-membranes on sigmoidoscopy or colonoscopy or histological/pathological diagnosis of CDI

  OR

- Diagnosis of toxic megacolon.

Note: It is assumed that any stool sent to the laboratory for *C. difficile* testing is from a patient that has had a least three episodes of loose stools in a 24-hour period. It is accepted that the surveillance protocol may overestimate the number of cases as some patients may have had only one or two loose stools prior to a specimen being collected.

Community-associated (CA) CDI

A CDI case (as defined above) with symptom onset in the community or three calendar days or less after admission to a healthcare facility, provided that symptom onset was more than eight weeks after the last discharge from a healthcare facility.

Complications

Complications under PICNet's CDI surveillance include ICU admission, toxic megacolon, and total or partial colectomy. Other complications associated with CDI are excluded from the surveillance. Relapses are included in the CDI surveillance, but are reported separately.

Confidence Interval (CI)

A confidence interval gives an estimated range of values which is likely to include an unknown population parameter to indicate the reliability of an estimate. The 95% CI of the

rate and proportion in this report are calculated using Wilson score intervals.[8]

Fiscal Quarter (FQ)

A specified period within a budget or financial year. There are four FQs in a fiscal year. Start and end dates of each FQ vary from year to year. Below are the start and end dates of each FQ from 2008/2009 to 2010/2011:

Start and end date of fiscal quarters in BC

Fiscal Quarter	2008/2009		2009/2010		2010/2011	
	Start date	End date	Start date	End date	Start date	End date
Q1	01-Apr-2008	26-Jun-2008	01-Apr-2009	25-Jun-2009	01-Apr-2010	24-Jun-2010
Q2	27-Jun-2008	18-Sep-2008	26-Jun-2009	17-Sep-2009	25-Jun-2010	16-Sep-2010
Q3	19-Sep-2008	11-Dec-2008	18-Sep-2009	10-Dec-2009	17-Sep-2010	09-Dec-2010
Q4	12-Dec-2008	31-Mar-2009	11-Dec-2009	31-Mar-2010	10-Dec-2010	31-Mar-2011

Fiscal Year (FY)

A term used to differentiate a budget or financial year from the calendar year. The Fiscal Year in BC runs from April 1 of the prior year through March 31 of the next year. For example: FY 2010/2011 is from April 1, 2010 to March 31, 2011.

Healthcare-associated (HCA) with reporting facility

A CDI case occurring more than three calendar days after admission to an acute healthcare facility, where the CDI was reported, AND the case has not had CDI in the past eight weeks,

OR

A CDI case with symptom onset in the community or three calendar days or less after admission to an acute healthcare facility where the CDI was reported, provided that symptom onset was less than four weeks after the last discharge from that acute healthcare facility.

Healthcare-associated (HCA) with another healthcare facility

A case with symptom onset three calendar days or less after admission to an acute healthcare facility; AND the case had an encounter with another healthcare facility, either as an inpatient (including Acute Care and Long Term Care), or an outpatient (including emergency care and clinics), within the last four weeks; AND the case has not had CDI in the past eight weeks.

Health Authority (HA)

A Health Authority manages and delivers health care services. There are five regional Health

[8] Agresti A and Coull BA (1998). The American Statistician 52:119-126

Authorities which govern, plan, and coordinate services regionally within 16 health service delivery areas, and a Provincial Health Services Authority which coordinates and/or provides provincial programs and specialized services.

The six HAs in BC are:

- Interior Health Authority (IHA)
- Fraser Health Authority (FHA)
- Northern Health Authority (NHA)
- Vancouver Coastal Health Authority (VCHA)
- Vancouver Island Health Authority (VIHA)
- Provincial Health Services Authority (PHSA)

Inpatient day

An accounting unit used by healthcare facilities and healthcare planners. Each day represents a unit of time during which the services of the institution or facility are used by a patient; thus 50 patients in a hospital for 1 day would represent 50 inpatient days.

New infection

A CDI case without previous history of CDI

OR

A CDI case that has NOT had an episode of CDI in the previous eight weeks

Nosocomial infection

Infection associated with admission to the reporting healthcare facility.

Outcome at 30 days

The patient's status (alive or deceased) at 30 days post diagnosis/culture date.

Percentage

A part or portion relative to the whole quantity expressed in hundredths. It is often denoted using the percent sign, "%".

Rate per 10,000 inpatient days

$$\text{Rate per 10,000 inpatient days} = \frac{\text{Number of CDI cases in a specific period}}{\text{Total inpatient days during the same period}} \times 10{,}000$$

A specific period can be a quarter or several quarters, or a year (annual rate).

Relapse of CDI

A CDI case with recurrence of diarrhea within two to eight weeks of a previous CDI episode (as determined by the date of a previous lab test, chart note or diagnosis by endoscopy or pathological specimen) provided that CDI symptoms from the earlier episode resolved with or without treatment. A relapse is to be attributed to the association of the original infection (i.e., healthcare-associated or community).

Note: A case with recurrence of diarrhea less than two weeks from the previous episode is considered to be a continuation of the previous episode, and not a relapse.

Statistical significance

In statistics, a result is called statistically significant if it is unlikely to have occurred by chance. In this report, the difference is considered as statistically significant if the 95% confidential intervals of the two rates, proportions, percentages, or means are not overlapped (i.e., the lower limit of one confidence interval is greater than the upper limit of the other confidence interval).

Trend test

Trend test is an aspect of statistical analysis that tries to determine whether there is a statistically significant trend upwards or downwards over a period of time or specific ordinal categories. This report uses Mantel-Haenszel Chi-square test for linear trend.

Unknown association

A CDI case where there is insufficient information on healthcare admission and/or discharge to classify whether it is healthcare-associated or not.

Surveillance Steering Committee

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 health care professionals from across the province to develop and create guidelines and tools, with a focus on surveillance, education, and evidence-based practice.

PICNet's **Surveillance Steering Committee** provides guidance to PICNet's surveillance programs and assists the PICNet Management Office in implementation within the participating Health Authorities.

- Jun Chen Collet, Provincial Health Services Authority
- David Crawford, Interior Health Authority
- Tara Donavan, Fraser Health Authority
- Leslie Forrester, Vancouver Coastal Health Authority
- Bruce Gamage (Chair), PICNet
- Dr. Guanghong Han, PICNet
- Deanna Hembroff, Northern Health Authority
- Dr. Bonnie Henry, Provincial Health Services Authority
- Dr. Linda Hoang, Provincial Health Services Authority
- Anthony Leamon, Vancouver Island Health Authority
- Dr. Elisa Lloyd-Smith, Providence Health Care