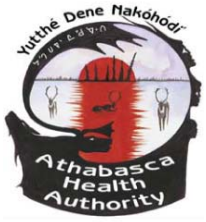
Government of Saskatchewan
Ministry of Health

Clostridium difficile Infection (CDI)
Surveillance Report: Saskatchewan
2012-13

Saskatchewan
Infection Prevention and Control Program

September 2013



Correspondence:

Patient Safety Unit
Saskatchewan Ministry of Health
3475 Albert Street
Regina SK S4S 6X6

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Summary

The Saskatchewan *Clostridium difficile* infection (CDI) surveillance program began on July 1, 2012. This annual report presents the cases of CDI reported in quarter 2 (Q2) through quarter 4 (Q4) of fiscal year (FY) 2012-13 (July 1, 2012 to March 31, 2013), with a focus on new healthcare-associated infections.

A total of 305 CDI cases were reported in the last three quarters of FY 2012-13. Of the total number of reported CDI cases, 241 (79.0%) were deemed to be healthcare-associated *C. difficile* infections (HA-CDI). 224 (92.9%) of the HA-CDI cases were new or *primary* cases, and 17 (7.1%) were relapses. Of the primary HA-CDI cases, 184 (82.1%) were attributed to an acute care (AC) facility and 40 cases (17.9%) were attributed to a long-term care (LTC) facility.

The provincial rate of primary HA-CDI associated with AC facilities was 3.0 (95% confidence interval (CI): 2.4-3.9) per 10,000 patient days in Q2, 2.8 (95% CI: 2.1-3.6) in Q3, and 3.0 (95% CI: 2.5-4.0) in Q4. The provincial rate of primary HA-CDI associated with LTC facilities was 0.1 (95% CI: 0.1-0.3) per 10,000 resident days in Q2, 0.2 (95% CI: 0.1-0.3) in Q3, and 0.2 (95% CI: 0.1-0.4) in Q4. Over the three surveillance quarters, the rates of primary HA-CDI in both acute care and long-term care settings remained relatively stable, with no statistically significant increases or decreases. The combined Q2-Q4 rate was 3.0 (95% CI 2.6-3.4) in acute care, 0.2 (95% CI 0.1-0.2) in long-term care, and 0.8 (95% CI 0.7-0.9) per 10,000 patient days overall.

To provide some context for Saskatchewan's acute care rate, the Canadian Nosocomial Infection Surveillance Program's (CNISP's)[1] 2011 rate of primary HA-CDI associated with AC facilities for the western provinces (British Columbia, Alberta, Saskatchewan and Manitoba) was 6.0 per 10,000 patient days. It is important to note that the CNISP rate is not representative of all healthcare facilities, but only those that participate in the program. These are, for the most part, large tertiary care hospitals.[2] The provincial rates for AC facilities in this report include all Saskatchewan hospitals. It is not known how our rates compare with similar facilities in other provinces.

None of the 241 patients who developed HA-CDI over the surveillance period required admission to an ICU or required a total or partial colectomy. At 30 days following diagnosis, 67 patients (27.8%) were still in a facility, 117 (48.5%) had been discharged, 21 (8.7%) had been transferred, and 31 (12.9%) were deceased.[3] CDI was not deemed to be the primary cause of death in any of these 31 patients.

This report aims to increase the understanding of the patterns and characteristics of CDI in Saskatchewan. The rates of CDI presented are not risk-adjusted, and are therefore not directly comparable across regional health authorities (RHAs).

[1] The Canadian Nosocomial Infection Surveillance Program (CNISP) is a collaborative effort of the Canadian Hospital Epidemiology Committee (CHEC), a subcommittee of the Association of Medical Microbiology and Infectious Disease (AMMI) Canada and the Centre for Communicable Diseases and Infection Control (CCDIC) of the Public Health Agency of Canada (PHAC).

[2] At present, the only Saskatchewan hospitals participating in CNISP are Royal University Hospital and St. Paul's Hospital, both in Saskatoon.

[3] The outcome for 5 patients at 30 days post diagnosis is unknown.

Introduction

Clostridium difficile Infection (CDI), formerly referred to as *Clostridium difficile*-associated disease (CDAD), is a virulent healthcare-associated infection that is easily spread among patients/residents. The severe consequences for those who acquire it demand a reliable surveillance protocol in order to support outbreak investigations, monitor trends, and evaluate interventions aimed at reducing incidence.

Since 2011, the Provincial Infection Control Network of Saskatchewan (PICNS), in collaboration with representatives from the thirteen provincial RHAs,[4] has been developing a standardized provincial surveillance system to monitor the incidence of CDI in Saskatchewan's healthcare facilities. This includes a standard case definition of CDI (see "About This Report"). The cases are then classified as healthcare-associated (HA) or community-associated (CA) according to the patient's healthcare encounter history. HA cases are further split into two categories: those infections associated with the reporting facility (HA-CDI-Y); and those infections associated with another facility, either in the same region or another region (HA-CDI-AF). A CDI case with a previous CDI episode within two to eight weeks is defined as a relapse. Otherwise, it is classified as a primary case of CDI. Primary HA-CDI-Y cases in hospital (not LTC) are essentially consistent with the definition used for reporting by the Canadian Nosocomial Infection Surveillance Program (CNISP).[5] Since July 2012, every RHA has submitted CDI surveillance data to PICNS on a quarterly basis. This annual report presents the cases of CDI reported in quarter 2 (Q2) through quarter 4 (Q4) of fiscal year (FY) 2012-13.

Please note that the data in this report should be interpreted with caution. Comparison of the numbers of cases and rates among RHAs is not recommended. There are many factors that can affect the incidence and rate of CDI, including the health conditions and medical history of the population served, the proportion of the patient population older than 50, the complexity of the services offered, the size and physical layout of the facilities, 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; therefore even slight changes in the number of cases can dramatically affect the rate and percentage. In addition, reference to healthcare-associated infections should not be interpreted as cases of infection acquired directly through healthcare services provided by the reporting facility or other healthcare facilities. Please see "About This Report" for other limitations.

[4] For the purposes of this report, Athabasca Health Authority (AHA) has been included under the classification of a Regional Health Authority (RHA).

[5] Saskatchewan's criteria for HA-CDI-Y in hospitals differ from CNISP's in two ways. First, due to limitations in some regional admissions databases, Saskatchewan includes cases from psychiatric units/wards. Since these patients typically do not have many of the risk factors for CDI (e.g. taking antibiotics) and represent a small fraction of total acute care days, it is unlikely that their inclusion affects regional or provincial rates. Second, although both Saskatchewan and CNISP exclude cases for children under one year of age, Saskatchewan only excludes newborns from its denominators. Since being a newborn is the most likely reason for admission during the first year of life, it is unlikely that this has a major effect on Saskatchewan's CDI rates.

Surveillance Results

Classification of CDI Cases

Of the 305 cases of CDI reported, 241 (79.0%) were classified as HA infections, and 64 (21.0%) were diagnosed in a facility but were deemed to be CA infections. Of the 241 HA-CDI cases, 224 (92.9%) were classified as new or primary infections associated with the reporting RHA, and 17 (7.1%) cases were deemed to be relapses. 184 (82.1%) of the primary HA-CDI cases were attributed to an acute care (AC) facility, while 40 (17.9%) were attributed to a long-term care (LTC) facility (Figure 1).

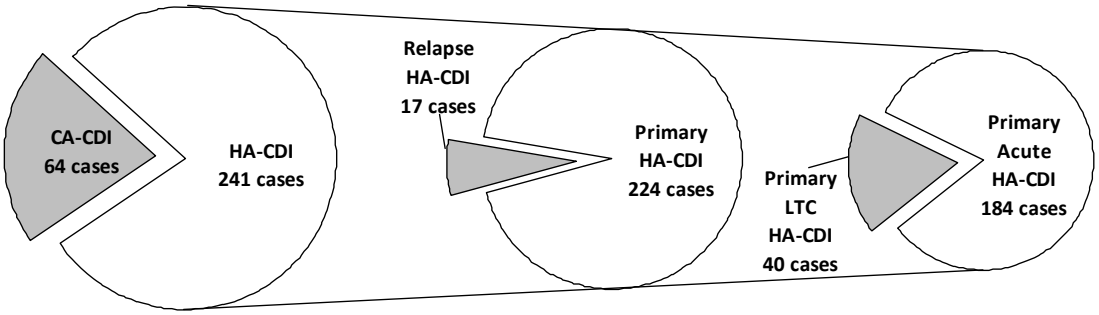

Figure 1: CDI cases by case definition, 2012-13 (Q2-Q4)

Figure 2 shows the proportion of cases by Regional Health Authority (RHA) and exposure definition. **NOTE:** Eight cases were found to be associated with RHAs other than the ones that identified and reported them. In the counts of cases by region and in the analysis of risk factors, these HA-CDI-AF cases are counted in the region to which the case was attributed (Figure 2, and Tables 1-3). However, the treatment and outcomes for the HA-CDI-AF cases were assumed to have occurred, and were therefore counted, in the region in which the case was diagnosed (Figure 6).

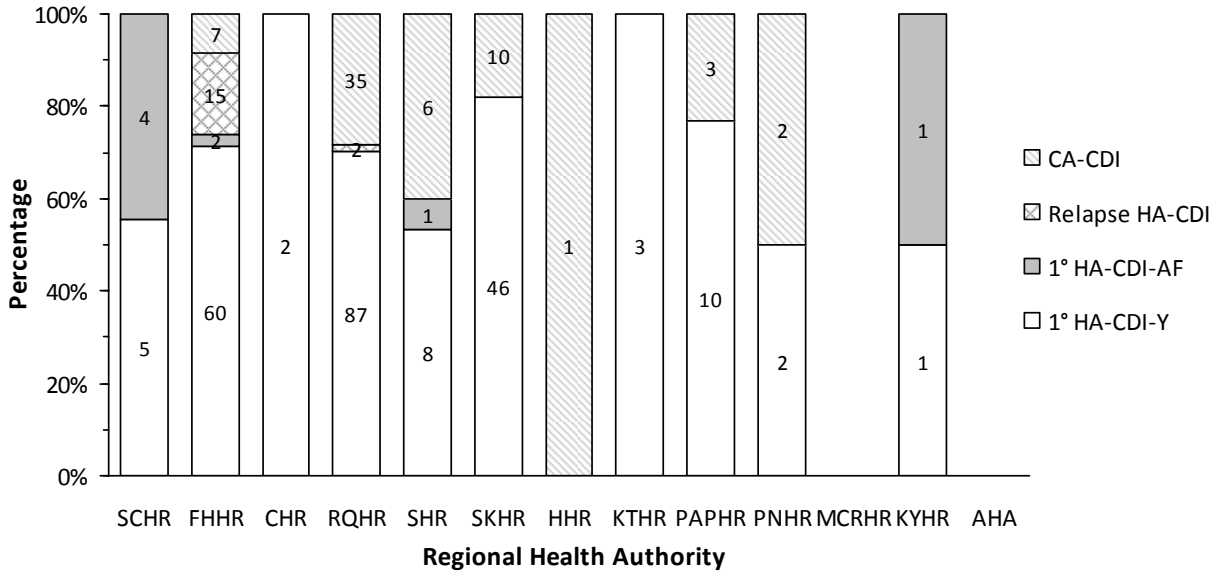

Figure 2: Proportion and number of CDI cases by RHA and exposure definition, 2012-13 (Q2-Q4)

Overview of HA-CDI Cases

A total of 224 primary cases of HA-CDI were reported from Q2 to Q4 of FY 2012-13. The regional rates of HA-CDI per 10,000 patient/resident days in acute care, long-term care and in total are presented in Figure 3, reflecting the variation in population served and healthcare services provided in each RHA.

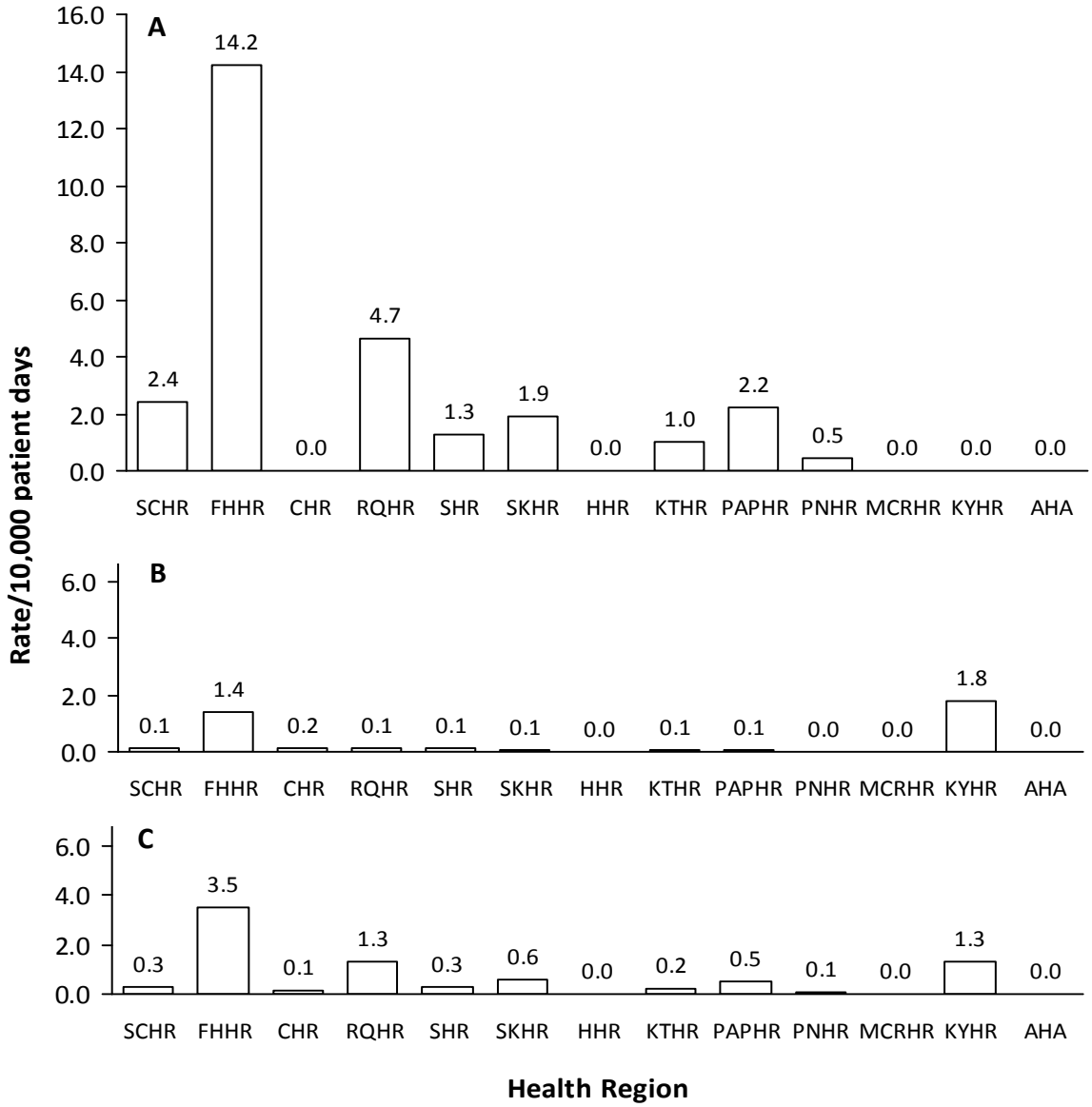

Figure 3: Rate of acute care HA-CDI (A), long-term care HA-CDI (B) and total HA-CDI (C), 2012-13 (Q2-Q4), by RHA

Regional Rates of Primary HA-CDI by Service

The rates of primary HA-CDI cases by RHA for each quarter, and combined Q2-Q4, are given in Tables 1 through 3. In all three quarters, Five Hills Health Region (FHHR) reported a significantly higher rate of acute care *C. difficile* infections than did other regions. Possible explanations for these higher than expected rates are found in the "Discussion" section of this report. The wide 95% confidence intervals for some regions are due to small denominators. Rates in regions with smaller populations and days may vary substantially from reporting period to reporting period, and slight changes in the number of cases (even one case) can considerably affect the rate. Also, rates are not risk-adjusted, and therefore should not be used to make comparisons between regions.

For each RHA, there were no statistically significant changes in the rate of primary HA-CDI cases from quarter to quarter.

Table 1: Rate of primary acute care HA-CDI per 10,000 patient days and 95% confidence interval (CI), by RHA and quarter

RHA	Q2	(95% CI)	Q3	(95% CI)	Q4	(95% CI)	Q2-Q4[1]	(95% CI)
SCHR	2.1	(0.4-12.1)	5.4	(1.5-19.7)	0.0	(0.0-9.3)	2.4	(0.8-7.0)
FHHR	17.1	(10.5-27.7)	10.7	(5.8-19.6)	14.9	(8.9-25.1)	14.2	(10.4-19.4)
CHR	0.0	(0.0-5.7)	0.0	(0.0-5.7)	0.0	(0.0-5.7)	0.0	(0.0-1.9)
RQHR	5.8	(4.1-8.1)	3.9	(2.6-5.9)	4.3	(2.9-6.3)	4.7	(3.8-5.8)
SHR	0.8	(0.1-4.4)	2.3	(0.8-6.8)	0.8	(0.1-4.4)	1.3	(0.5-3.0)
SKHR	1.0	(0.5-2.0)	2.0	(1.2-3.3)	2.7	(1.7-4.1)	1.9	(1.4-2.6)
HHR	0.0	(0.0-7.9)	0.0	(0.0-7.9)	0.0	(0.0-7.9)	0.0	(0.0-2.6)
KTHR	0.0	(0.0-6.0)	3.1	(0.9-11.3)	0.0	(0.0-6.0)	1.0	(0.3-3.8)
PAPHR	2.2	(0.7-6.4)	1.5	(0.4-5.3)	2.9	(1.1-7.5)	2.2	(1.2-4.2)
PNHR	0.0	(0.0-2.6)	0.7	(0.1-3.8)	0.7	(0.1-4.2)	0.5	(0.1-1.7)
MCRHR	0.0	(0.0-42.5)	0.0	(0.0-42.5)	0.0	(0.0-42.5)	0.0	(0.0-14.2)
KYHR	0.0	(0.0-63.6)	0.0	(0.0-63.6)	0.0	(0.0-63.6)	0.0	(0.0-21.3)
AHA	0.0	(0.0-151.3)	0.0	(0.0-151.3)	0.0	(0.0-151.3)	0.0	(0.0-51.0)
TOTAL	**3.0**	**(2.4-3.9)**	**2.8**	**(2.1-3.6)**	**3.0**	**(2.5-4.0)**	**3.0**	**(2.6-3.4)**

[1] Combined value for Q2-Q4

Table 2: Rate of primary long-term care HA-CDI per 10,000 resident days and 95% confidence interval (CI), by RHA and quarter

RHA	Q2	(95% CI)	Q3	(95% CI)	Q4	(95% CI)	Q2-Q4[1]	(95% CI)
SCHR	0.2	(0.0-1.0)	0.0	(0.0-0.7)	0.2	(0.0-1.0)	0.1	(0.0-0.4)
FHHR	0.6	(0.2-1.9)	1.9	(1.0-3.6)	1.7	(0.9-3.3)	1.4	(0.9-2.2)
CHR	0.0	(0.0-0.9)	0.0	(0.0-0.9)	0.5	(0.1-1.7)	0.2	(0.0-0.6)
RQHR	0.1	(0.0-0.4)	0.1	(0.0-0.3)	0.1	(0.0-0.4)	0.1	(0.0-0.2)
SHR	0.1	(0.0-0.8)	0.0	(0.0-0.5)	0.3	(0.1-1.0)	0.1	(0.0-0.4)
SKHR	0.2	(0.1-0.5)	0.1	(0.0-0.3)	0.1	(0.0-0.3)	0.1	(0.0-0.2)
HHR	0.0	(0.0-0.9)	0.0	(0.0-0.9)	0.0	(0.0-0.9)	0.0	(0.0-0.3)
KTHR	0.0	(0.0-0.9)	0.2	(0.0-1.3)	0.0	(0.0-0.9)	0.1	(0.0-0.4)
PAPHR	0.2	(0.0-1.1)	0.0	(0.0-0.8)	0.0	(0.0-0.8)	0.1	(0.0-0.4)
PNHR	0.0	(0.0-0.7)	0.0	(0.0-0.7)	0.0	(0.0-0.7)	0.0	(0.0-0.2)
MCRHR	0.0	(0.0-26.4)	0.0	(0.0-26.4)	0.0	(0.0-26.4)	0.0	(0.0-8.8)
KYHR	0.0	(0.0-20.4)	0.0	(0.0-20.4)	5.3	(0.9-30.1)	1.8	(0.3-10.1)
AHA	0.0	(0.0-126.4)	0.0	(0.0-126.4)	0.0	(0.0-126.4)	0.0	(0.0-42.5)
TOTAL	**0.1**	**(0.1-0.3)**	**0.2**	**(0.1-0.3)**	**0.2**	**(0.1-0.4)**	**0.2**	**(0.1-0.2)**

[1] Combined value for Q2-Q4

Table 3: Rate of total primary HA-CDI per 10,000 patient/resident days and 95% confidence interval (CI), by RHA and quarter

RHA	Q2	(95% CI)	Q3	(95% CI)	Q4	(95% CI)	Q2-Q4[1]	(95% CI)
SCHR	0.3	(0.1-1.1)	0.3	(0.1-1.2)	0.2	(0.0-0.9)	0.3	(0.1-0.6)
FHHR	3.3	(2.1-5.2)	3.3	(2.1-5.2)	3.9	(2.6-5.8)	3.5	(2.7-4.5)
CHR	0.0	(0.0-0.8)	0.0	(0.0-0.8)	0.4	(0.0-0.5)	0.1	(0.0-0.5)
RQHR	1.6	(1.2-2.2)	1.1	(0.7-1.6)	1.2	(0.8-1.7)	1.3	(1.0-1.6)
SHR	0.2	(0.1-0.8)	0.3	(0.1-1.0)	0.3	(0.1-1.0)	0.3	(0.2-0.6)
SKHR	0.4	(0.2-0.7)	0.6	(0.3-0.9)	0.8	(0.5-1.2)	0.6	(0.4-0.8)
HHR	0.0	(0.0-0.8)	0.0	(0.0-0.8)	0.0	(0.0-0.8)	0.0	(0.0-0.3)
KTHR	0.0	(0.0-0.8)	0.6	(0.2-1.8)	0.0	(0.0-0.8)	0.2	(0.1-0.6)
PAPHR	0.6	(0.2-1.6)	0.3	(0.1-1.2)	0.6	(0.2-1.6)	0.5	(0.3-1.0)
PNHR	0.0	(0.0-0.6)	0.1	(0.0-0.8)	0.1	(0.0-0.8)	0.1	(0.0-0.4)
MCRHR	0.0	(0.0-16.3)	0.0	(0.0-16.3)	0.0	(0.0-16.3)	0.0	(0.0-5.4)
KYHR	0.0	(0.0-15.5)	0.0	(0.0-15.5)	4.0	(0.7-22.9)	1.3	(0.3-8.0)
AHA	0.0	(0.0-69.4)	0.0	(0.0-69.4)	0.0	(0.0-69.4)	0.0	(0.0-23.2)
TOTAL	**0.7**	**(0.6-0.9)**	**0.7**	**(0.6-0.9)**	**0.8**	**(0.7-1.0)**	**0.8**	**(0.7-0.9)**

[1] Combined value for Q2-Q4

Provincial Rate of Primary HA-CDI by Service

There were 62 HA-CDI cases reported as primary infections associated with acute care facilities in Q2 of FY 2012-13, 57 cases in Q3 and 65 cases in Q4. There were 11 primary HA-CDI cases associated with a long-term care facility in Q2, 12 cases in Q3 and 17 in Q4. The provincial rate of primary HA-CDI associated with AC facilities was 3.0 (95% confidence interval (CI): 2.4-3.9) per 10,000 patient days in Q2, 2.8 (95% CI: 2.1-3.6) in Q3, and 3.0 (95% CI: 2.5-4.0) in Q4. The provincial rate of primary HA-CDI associated with LTC facilities was 0.1 (95% CI: 0.1-0.3) per 10,000 resident days in Q2, 0.2 (95% CI: 0.1-0.3) in Q3, and 0.2 (95% CI: 0.1-0.4) in Q4. Over the three surveillance quarters, the rates of primary HA-CDI in both the AC and LTC settings remained relatively stable, with no statistically significant increases or decreases in rates (Figure 4). The values shown in Figure 4 are the mean rate/10,000 patient days (95% confidence interval) for each quarter and the combined rate for all quarters. The combined Q2-Q4 rate was 3.0 (95% CI 2.6-3.4) in AC, 0.2 (95% CI 0.1-0.2) in LTC, and 0.8 (95% CI 0.7-0.9) per 10,000 patient/resident days overall.

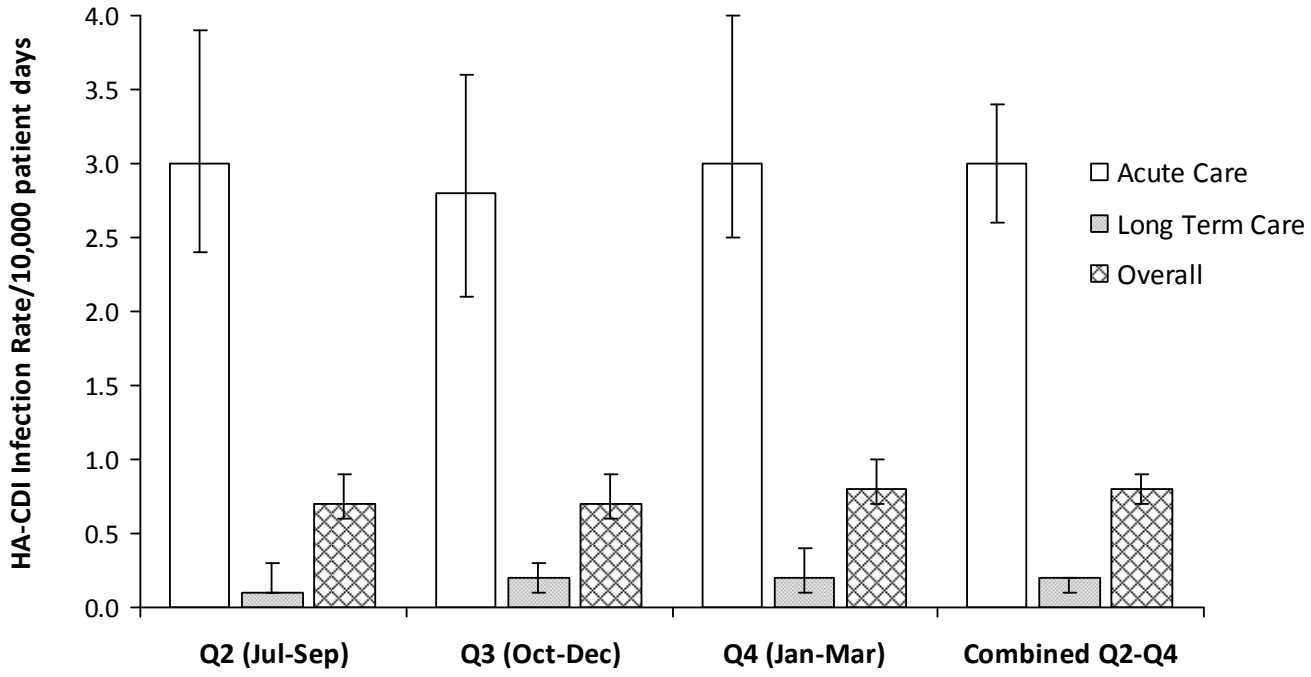

Figure 4: Provincial healthcare-associated CDI rates, by service type and quarter

Provincial Descriptive Statistics

There were a total of 305 cases of CDI reported in Saskatchewan in Q2 through Q4 of FY 2012-13. The breakdown into case and exposure definitions is shown in Table 4.

Table 4: Raw case numbers by case and exposure definition, 2012-13 (Q2-Q4)

Case and Exposure Definitions	Number
Primary acute HA-CDI cases	184
Relapse acute HA-CDI cases	5
Primary LTC HA-CDI cases	40
Relapse LTC HA-CDI cases	12
Primary CA-CDI cases	60
Relapse CA-CDI cases	4

Characteristics of Primary HA-CDI Cases

Of the total 224 primary healthcare-associated CDI cases, 130 (58%) were in female patients and 94 (42%) were in males. In the female patients, the majority of CDI cases were in patients over 75 years of age. However, in the male patients, there was a more even distribution between cases of males 50-75 years of age and males over 75 years of age (Figure 5)[6].

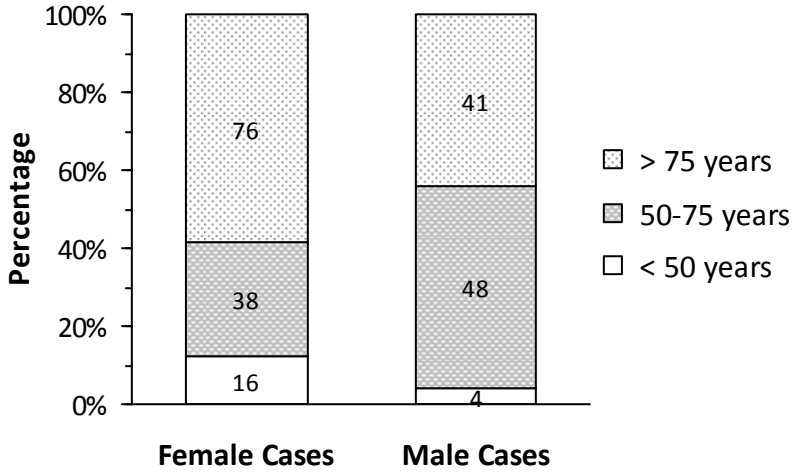

Figure 5: Proportion of primary HA-CDI cases, by age and sex

In the majority of primary HA-CDI cases diagnosed, the infection was first treated either by discontinuation of previous antibiotic or by prescription of oral or IV metronidazole (flagyl) or vancomycin. Most regions reported treatment of the majority of primary cases, with the exception of Prairie North Health Region (PNHR) and Cypress Health Region (CHR) (Figure 6). In all quarters, regions reported that the most common first method of treatment was oral flagyl (Figure 7).

[6] The age of one male patient is unknown.

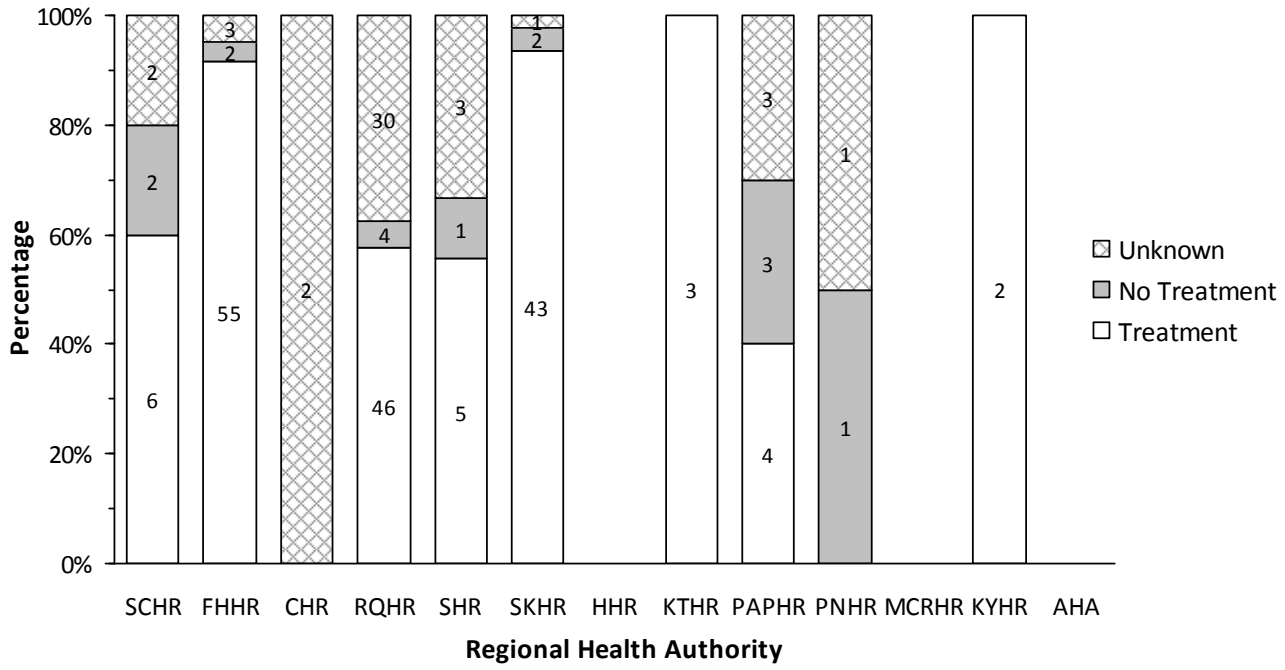

Figure 6: Proportion and number of primary HA-CDI cases receiving treatment following initial diagnosis, by RHA

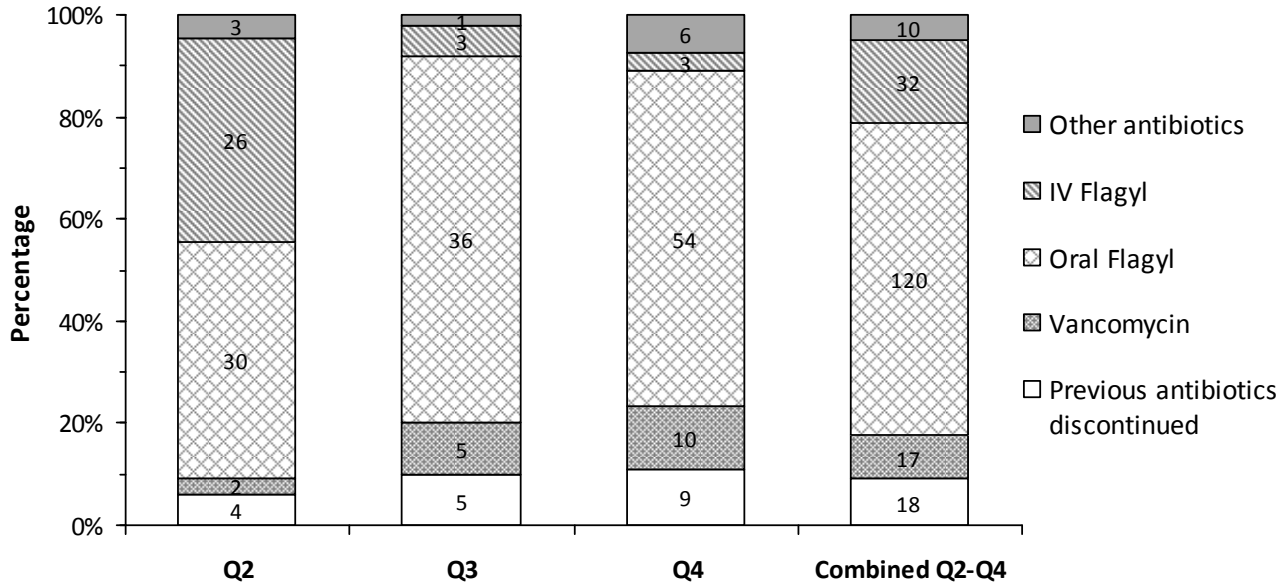

Figure 7: First reported method of treatment following diagnosis of primary HA-CDI case

Patient Risk Factors and Outcomes

Taking antibiotics within 6 weeks prior to their initial diagnosis was the most common risk factor for development of CDI among the reported cases for all quarters combined. The second most common risk factor was the use of proton pump inhibitors (e.g. omeprazole) (Figure 8). Of those patients who had been on antibiotics in the previous 6 weeks, fluoroquinolones, cephalosporins, and a combination

of various other antibiotics (e.g. piperacillin/tazocin) were most commonly reported in all three quarters (Figure 9).

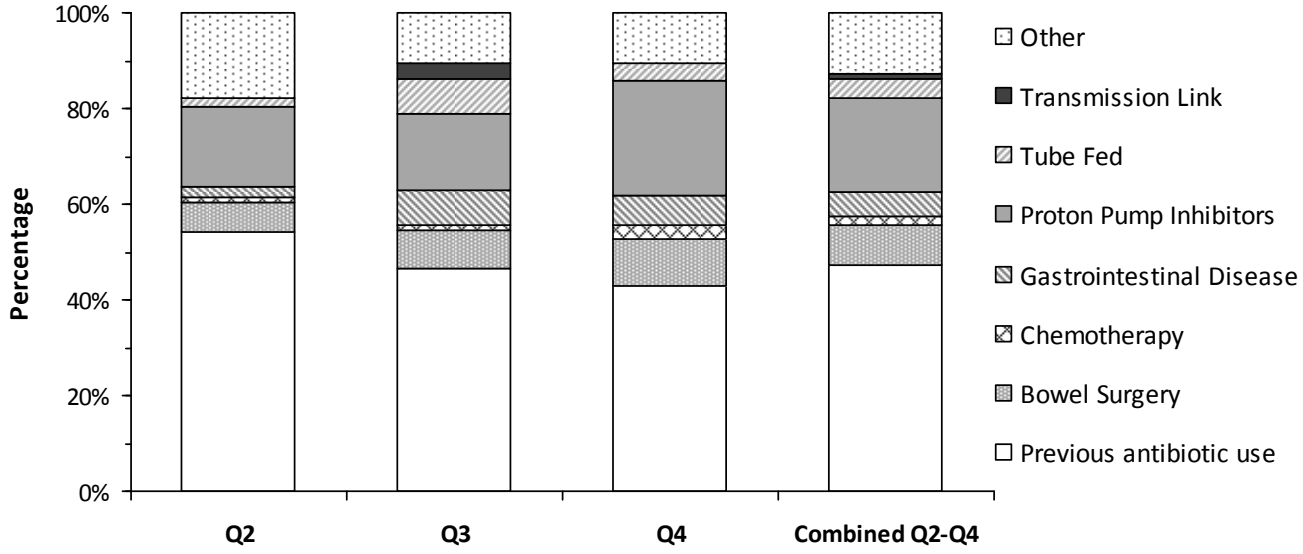

Figure 8: Reported patient risk factors for CDI

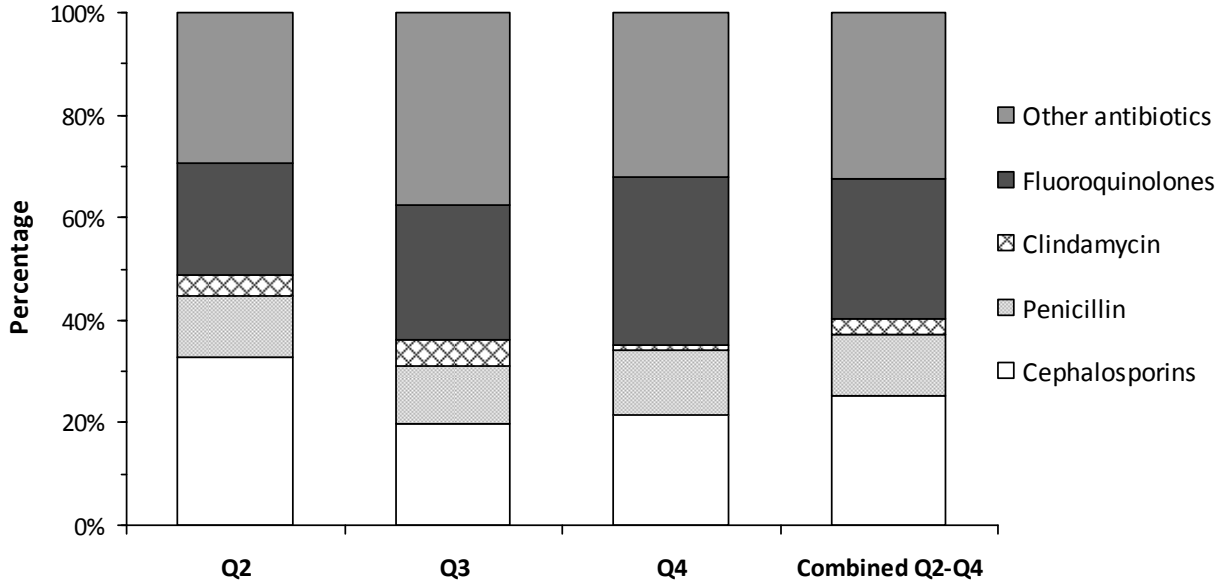

Figure 9: Antibiotics taken within 6 weeks prior to primary HA-CDI diagnosis

The majority (48.5%) of both primary and relapse HA-CDI cases (117 cases) had been discharged at 30 days following initial diagnosis. 67 patients (27.8%) were still in a facility, 21 (8.7%) had been transferred and 31 (12.9%) were deceased. CDI was not deemed to be the primary cause of death in any of these 31 patients (Figure 10).

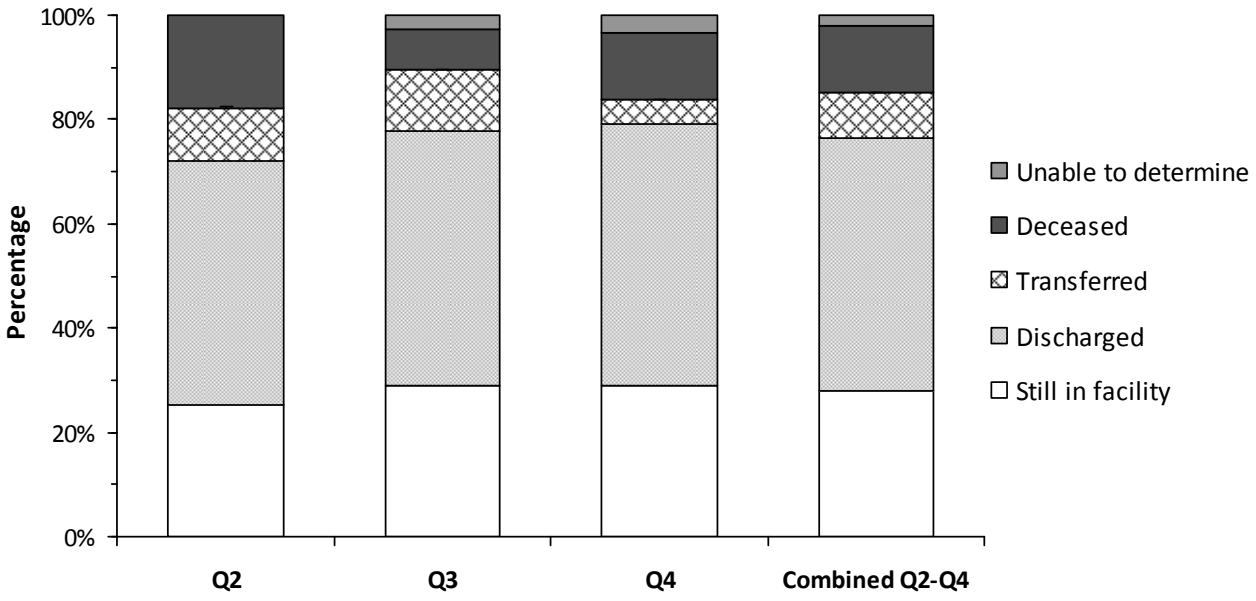

Figure 10: Patient outcome at 30 days, primary and relapse HA-CDI

Discussion

Overall, the provincial rate of primary healthcare-associated CDI remained relatively stable over the three quarters of the first provincial surveillance year 2012-13, with no significant change in rates. This initial report is intended to provide a provincial baseline for CDI in Saskatchewan. Adding subsequent quarterly data submissions, more informative trend analysis will be possible.

Although stable over time, there are large differences in the rates of CDI among health regions, especially in acute care. This is likely based not only on real differences in the numbers of cases of the disease, but also on several factors related to how cases are identified and information about them shared within each region. This report is based on CDI cases reported (usually by laboratories) to regional infection control practitioners (ICPs), who then investigate and submit results to the provincial Infection Control Coordinators (ICCs). Since CDI is not currently a notifiable illness in Saskatchewan, regions vary in their processes for sharing laboratory findings. It is not guaranteed that all cases of CDI in the population under surveillance were reported to the regional ICPs. In addition, variation in surveillance intensity and case identification methodology affects the number of cases identified. While some regions have only passive surveillance programs in their facilities, others are conducting more active infection surveillance (e.g. ICPs visiting the units). This will likely have resulted in underreporting from some regions, and a more accurate representation of the occurrence of the disease from others. Each healthcare facility has unique challenges and different at-risk populations. Thus, each RHA is best positioned to respond to cases of CDI in its healthcare facilities.

With the approval of the Saskatchewan *Clostridium difficile* management guidelines in 2011, the surveillance protocol in 2012 (updated in 2013), and the potential future addition of CDI to the provincial notifiable diseases list, it is hoped that some of the inter-regional discrepancies in testing and reporting will begin to diminish, and a clear picture of the burden of CDI in Saskatchewan will emerge. A better understanding of CDI in Saskatchewan will help us to reduce infection rates.

About This Report

CDI Surveillance System

The provincial HA-CDI surveillance system involves the voluntary participation of all 13 health regions across Saskatchewan. The objectives of the system are to monitor the incidence of healthcare-associated CDI, and to describe characteristics of CDI in Saskatchewan acute and long-term care facilities. Working with each RHA, PICNS collects and manages CDI surveillance data at the provincial level. This report presents the cases of CDI reported in Q2, Q3 and Q4 of FY 2012-13.

1. Population Under Surveillance

Only patients or residents admitted into a hospital or long-term care facility at the time the CDI diagnosis is made are included for surveillance.

Saskatchewan CDI surveillance inclusion criteria include patients:[7]

- one year of age and older;
- admitted to an acute care unit (this includes patients awaiting placement on acute care units, patients admitted to your facility but who remain in the emergency room once admitted, and 'outpatients' in ER who have been there for more than 72 hours);
- in a psychiatry ward/unit; and
- residents in long-term care facilities.

Although the only patients counted for surveillance are those admitted at the time that the positive CDI diagnosis is made, this includes people who are discharged after the date of diagnosis, but before the laboratory results are received. In practice, this will seldom occur if test results are reported in a timely manner. Patients who were discharged in the previous 4 weeks and return to the emergency room or to an outpatient unit with a new onset of CDI without being readmitted are not included.[8]

2. Case Definition for Surveillance and Reporting CDI

A patient is identified as a CDI case if:[9]

- s/he has diarrhea, or fever, abdominal pain and/or ileus, **AND** a laboratory confirmation of a positive toxin assay or PCR positive for *C. difficile*; **OR**
- s/he has a diagnosis of pseudomembranes on sigmoidoscopy or colonoscopy, or has a histological/pathological diagnosis of CDI; **OR**
- s/he has a diagnosis of toxic megacolon.

Diarrhea (watery or unformed stool that takes the shape of the specimen collection container) is defined as one of the following:

- 3 or more unformed stools in a 24-hour period for at least 1 day and new or unusual for the patient;
- 6 or more watery stools in a 36-hour period; or

[7] CNISP, "2011 Surveillance for *Clostridium difficile*-associated infection (CDI) within healthcare institutions", 2.

[8] CNISP, "2011 Surveillance for *Clostridium difficile*-associated infection (CDI) within healthcare institutions", 2.

[9] CNISP, "2010 Surveillance for *Clostridium difficile*-associated infection (CDI) within healthcare institutions", 8-9.

- 8 or more unformed stools over 48 hours.

Note: If the information about the frequency and consistency of diarrhea is not available, a toxin-positive stool is considered as a case.

Primary Case:[10]

- A new CDI diagnosis **OR** a CDI diagnosis > 8 weeks after the first toxin-positive assay.

Relapse CDI:[11]

- A new CDI diagnosis that occurs > 2 weeks and ≤ 8 weeks after being diagnosed with CDI **AND** symptoms from the previous CDI episode completely resolved with or without therapy.[12]

3. Clostridium difficile Infection Defined by Exposure

The following CDI case definitions categorize CDI cases by where they occur.

Note: The term "healthcare" applies to both hospital (acute care) and long-term care facilities.

Healthcare-associated CDI YOUR Facility (HA-CDI-Y):[13]

A CDI case is considered "healthcare-associated, your facility" if it meets the following criteria:

- CDI symptoms began ≥ 72 hours after admission to YOUR healthcare facility; **OR**
- CDI symptoms began in the community (before admission) or < 72 hours after admission to YOUR healthcare facility, **AND** the patient was discharged from YOUR healthcare facility within the previous 4 weeks.

Healthcare-associated CDI ANOTHER Facility (HA-CDI-AF):[14]

- CDI symptoms began in the community or < 72 hours after admission to your healthcare facility, **AND** the patient was discharged from ANOTHER healthcare facility (acute care or long-term care) within the previous 4 weeks.

The purpose of capturing **HA-CDI-AF** is that hospitalization carries an independent risk of acquiring CDI. The use of this definition will help to distinguish true community onset cases from cases discharged from a healthcare facility in the previous 4 weeks.[15] **HA-CDI-AF** cases are attributed to the facility from which the patient was last discharged. This information is captured by the CDI Electronic Report Form (Appendix A) in the 'Patient Information and History' section.

The appropriate follow-up by the ICP with a potential **HA-CDI-AF** case is to contact the ICP from the previous healthcare facility and/or region where the patient was admitted. However, to prevent duplication, data entry into the CDI Electronic Report Form is performed ONLY by the ICP in the facility/health region where the person was diagnosed.

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[10] CNISP, "2010 Surveillance for *Clostridium difficile*-associated infection (CDI) within healthcare institutions", 9.

[11] Cohen, Gerding, Johnson et al., 437.

[12] McDonald, Coignard, Dubberke et al., 141.

[13] CNISP, "2011 Surveillance for *Clostridium difficile*-associated infection (CDI) within healthcare institutions", 3.

[14] Provincial Infection Control Network of British Columbia (PICNet), **"***Clostridium difficile* Infection (CDI) Surveillance Report, Fiscal year 2010/2011", 15.

[15] McDonald, Coignard, Dubberke et al., 144.

Community-associated CDI (CA-CDI):[16]

- CDI symptoms begin in the community or < 72 hours after admission to a healthcare facility, provided that symptom onset was > 4 weeks after the last discharge from a healthcare facility.

Patients seen in an outpatient unit or in the emergency room, but not admitted, are not included.

Data Sources

This report incorporates the data collected from all acute and long-term care facilities in the 13 RHAs in Saskatchewan. The CDI case data are collected daily based on the infection criteria defined in the provincial CDI surveillance protocol, and managed by each RHA using EpiData software that has been installed locally. Six weeks following the end of each quarter, regional ICPs export the data from EpiData to Excel and send it to the ICCs by email. No patient identifiers are provided. Facility-specific denominator data (estimated from other provincial data sources) is provided to regional ICPs. ICPs may change these numbers if they are not reflective of the current situation (e.g. due to bed closures), or if the ICP is able to refine the estimate provided.

Limitations

There are variations in case finding strategies and data collection methodologies across healthcare facilities and RHAs in Saskatchewan.

Case definitions: The patient's healthcare encounter history is reviewed to determine whether the infection is healthcare-associated. The ability to determine healthcare encounter history depends on the patient information system used in each hospital and RHA. Some misclassification of association of CDI is inevitable.

Denominator data: The appropriate denominator used to determine CDI rates is 'patient/resident days'. Denominator data (estimated from other provincial data sources) is provided to regional ICPs. ICPs may change these numbers if they are not reflective of the current situation (e.g. due to bed closures), or if the ICP is able to refine the estimate provided. Some ICPs have submitted exact denominator data for their region and others have allowed the estimated provincial data to be used. However, given that the denominator is based on 10,000 patient days, the discrepancy between the actual denominator and the estimate would have to be fairly large to make a significant difference in the rate.

Laboratory methodologies: A variety of laboratory methods are used in Saskatchewan to confirm CDI cases, including Enzyme-linked Immunosorbent Assay (EIA), Toxin Assays, and Polymerase Chain Reaction (PCR). The sensitivity and specificity of these methods are different, and vary from site to site. PCR testing is up to 35% more sensitive than the traditional method of toxin EIA testing for *C. difficile.*[17]

[16] PICNet, **"***Clostridium difficile* Infection (CDI) Surveillance Report, Fiscal year 2010/2011", 14.

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

Glossary

Acute Care Facility

Acute care 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 care facility refers to acute care hospitals in Saskatchewan.

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.[18]

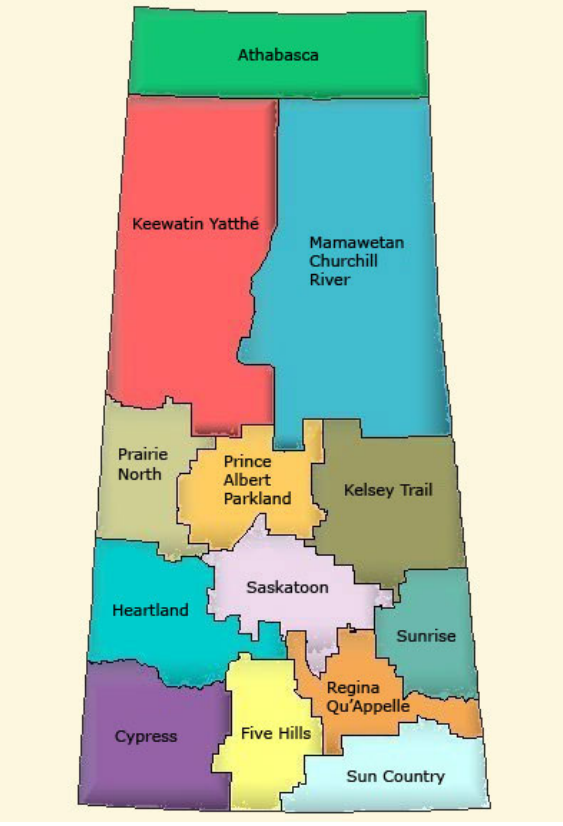
Fiscal Year (FY)

Fiscal year is a term used to differentiate a budget or financial year from the calendar year. Saskatchewan's fiscal year runs from April 1 of the initial year through March 31 of the next year. For example, FY 2012-13 is from April 1, 2012 to March 31, 2013.

Regional Health Authority (RHA) or Health Region (HR)

Regional health authorities manage and deliver healthcare services. For the purposes of this report, Athabasca Health Authority (AHA) has been included as though it were an RHA. The thirteen (13) RHAs in Saskatchewan are:

- Sun Country Health Region (SCHR)
- Five Hills Health Region (FHHR)
- Cypress Health Region (CHR)
- Regina Qu'Appelle Health Region (RQHR)
- Sunrise Health Region (SHR)
- Saskatoon Health Region (SKHR)
- Heartland Health Region (HHR)
- Kelsey Trail Health Region (KTHR)
- Prince Albert Parkland Health Region (PAPHR)
- Prairie North Health Region (PNHR)
- Mamawetan Churchill River Health Region (MCRHR)
- Keewatin Yatthé Health Region (KYHR)
- Athabasca Health Authority (AHA)



[18] Agresti A and Coull BA (1998). The American Statistician 52:119-12.

Patient/Resident Day

A patient/resident day is 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 patient days. This report uses patient days as the denominator to calculate the rate of CDI. This was chosen because increased length of stay has been shown to increase the risk of acquiring *C. difficile* infection.[19]

Nosocomial Infection

A nosocomial (healthcare-associated) infection, or HAI, is one associated with admission to a healthcare facility or service. In other words, it is an infection that was not present or incubating at the time of admission to the hospital or long-term care facility.

Rate per 10,000 patient days

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

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

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% confidence intervals of the two rates, proportions, percentages, or means do not overlap (i.e. the lower limit of one confidence interval is greater than the upper limit of the other confidence interval).

[19] Dubberke, Gerding, Classen et al., S81-S82.