INSPQ
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Highlights, Discussions and Orientations 2014–2015

Healthcare-Associated Infections Provincial Surveillance Program

September 2015

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Background

The Institut national de santé publique du Québec (INSPQ) [Québec's public health institute] has been mandated by the Ministère de la Santé et des Services sociaux (MSSS) [Québec's ministry of health and social services] to oversee the provincial surveillance of healthcare-associated (HA) infections. The Comité sur les infections nosocomiales du Québec (CINQ) [Québec healthcare-associated infections committee] and the Comité de surveillance provinciale des infections nosocomiales (SPIN) [Provincial committee for surveillance of healthcare-associated infections] have set up a structured surveillance program to support public health administrations and local infection prevention and control teams in general as well as specialized acute healthcare facilities.

The data for 2014–2015 were retrieved on May 20, 2015, and updated on June 1, 2015, for complications. For *Staphylococcus aureus* bloodstream infections (BSIs), the data were retrieved on August 25, 2015. Surveillance results are available on the INSPQ website. Given the dynamic and continuous nature of the surveillance system, surveillance data are updated on an annual basis for analysis purposes.

The 2014–2015 highlights, discussions and orientations have been drafted by our SPIN committee experts based on this year's findings. The document was then made public following approval by the CINQ and MSSS.

Québec

Carbapenemase-producing gram-negative bacilli infections

The first year of the provincial surveillance program for healthcare-associated infections due to carbapenemase-producing gram-negative bacilli (the SPIN-BGNPC program [provincial surveillance of healthcare-associated MDR-GNB]) ended on March 31, 2015.[1] A total of 67 healthcare facilities within the province participated in this new voluntary program.

In 2014–2015, 14 cases of infection due to carbapenemase-producing gram-negative bacilli (CPGNB) and 67 cases of CPGNB colonization were reported. Most of the infections (64.3%) and colonizations (77.6%)-were linked to a current or previous hospital stay at the reporting facility (categories 1a and 1b). This translates into an incidence rate of healthcare-associated (HA) CPGNB infections of 0.028/10,000 patient-days and an HA CPGNB colonization acquisition rate of 0.16/10,000 patient-days.

Since this was the first year of the program, these incidence rates cannot be compared with those of previous years. However, the data showed that the incidence rate of HA CPGNB infection was higher in teaching hospitals (0.046/10,000 patient-days) than in non-teaching hospitals (0.007/10,000 patient-days). Nevertheless, infections were only reported in one non-teaching facility and in 6 teaching facilities.

There is little comparative data in the existing literature that can be used to compare these infection incidence rates and colonization acquisition rates in other jurisdictions. Most published incidence studies relate to laboratory-based incidence rates, which do not translate into patient-days or are limited to a few facilities in an outbreak situation. The program that most closely resembles SPIN-BGNPC is the Israeli surveillance program for carbapenem-resistant enterobacteriaceae (CRE) implemented in March 2007. However, it is noteworthy to mention that this mandatory country-wide program was launched in response to a country-wide outbreak. At the peak of the outbreak, the monthly incidence rate in the clinical samples provided was approximately 5.5 cases/10,000 patient-days.[2] Following a series of infection prevention and control measures, the annual incidence rate in the clinical samples dropped to 0.48/10,000 patient-days.[3]

Although the methods and screening protocols differed significantly, this incidence rate was still roughly 20 times higher than the incidence of HA CPGNB reported in 2014–2015 in Québec.

Of the 14 infections, there were 5 surgical site infections, 3 urinary tract infections, 3 intra-abdominal infections, 2 pulmonary infections and 1 skin or soft tissue infection. There were no primary CPGNB bloodstream infections (BSIs) during the surveillance period, but two secondary BSIs were reported (1 associated with an intra-abdominal infection and 1 associated with a pulmonary infection). Among these 14 cases, 5 deaths were reported at 30 days, yielding a lethality rate of 35.7%. It is impossible to know whether these deaths were directly attributable to CPGNB infection.

Of the 67 colonization cases, 51 (76.1%) were new carriers, 3 (4.5%) were known carriers and 13 (19.4%) had an undetermined status. Among the new carriers and undetermined cases, 16 (25.0%) were contacts of a known carrier. Among the new carriers without contact with a known carrier, 26.2% were hospitalized in a facility outside Canada or had travelled abroad within the previous 12 months. However, for more than half of the new carriers or undetermined cases, information was not available on the presumed source of the strain. There may have been issues with recording information on the carrier's condition, contacts and other risk factors in the SPIN information system (SI-SPIN). This may provide a partial explanation for the lack of information. Changes will be made to the protocol in 2015–2016 to clarify certain variables. Upgrades to the SI-SPIN platform are also expected in 2016–2017 to improve the situation.

Roughly half of the cases reported in 2014–2015 were colonized with *Citrobacter freundii* (52.2%), each of them carrying the *Klebsiella Producing Carbapenemase (KPC)* gene. The group of cases colonized with *Klebsiella pneumoniae* is the second-largest group in the reported cases (16.4%). Of these, 9 (75.0%) were carrying *KPC*, 1 *OXA-48*, 1 *VIM* and 1 both *OXA-48* and *NDM*. In addition, 3 cases were identified as carriers of *Acinetobacter baumannii – OXA-23*, 1 case was infected with both *E. coli – NDM* and *K. pneumoniae – OXA-48* while one case was colonized with *E. coli – KPC* and *Klebsiella oxytoca – KPC*. Focusing strictly on reported carbapenemases, the SPIN-BGNPC program revealed the presence of 55 strains carrying *KPC*, 4 carrying

NDM, 4 carrying *OXA-48*, 3 carrying *OXA-23*, 2 carrying *SME*, 1 carrying *NMC* and 1 carrying *VIM*.

These data cannot be compared directly with the laboratory surveillance program of the Laboratoire de santé publique du Québec (LSPQ) [Québec's public health laboratory] for several reasons. First, not all Québec facilities are taking part in the SPIN-BGNPC program. Second, the surveillance periods are not exactly the same. Third, it is possible that a strain of carbapenemase-producing enterobacteriaceae was included in the LSPQ program because it was the first strain in the surveillance period, but that it was not reported by the facility as part of the SPIN-BGNPC program as the patient had been identified as a known carrier within the previous 12 months.

About 75% of teaching and non-teaching facilities documented both the number and the type of screening procedures that were done for KPC. Most reported screening patients both upon admission and during hospitalization. However, the mean screening rates at admission remained low, both in non-teaching facilities (5.7/100 admissions) and in teaching facilities (12/100 admissions). It is possible, however, that some laboratories had difficulties in gathering and submitting information on the number of screenings conducted.

In summary, the first year of the SPIN-BGNPC program established the first provincial infection incidence rate and colonization acquisition rate for HA CPGNB. We will be able to use these data to monitor changes over time. Although the purpose of the program is to determine the presumed geographical source of acquisition of CPGNB strains in Québec, this information is missing for more than half of the strains. Finally, the program findings emphasize that CPGNB screening is not a widespread practice in the province.

Recommendations

- Remain highly vigilant and continue CPGNB surveillance to monitor changes in the situation over time;
- Change the SPIN-BGNPC protocol to clarify certain elements related to the carrier state and source of acquisition risk factors;
- Make changes to the SI-SPIN platform to facilitate data entry on carrier state and acquisition risk factors;
- Withdraw *Acinetobacter* from the SPIN-BGNPC program in 2016–2017;
- Implement CINQ's recommendations on CPGNB screening indications in acute care facilities;
- Set up procedural requirements and laboratory methods to effectively screen for CPGNB in hospital laboratories;
- Continue to have the LSPQ confirm CPGNB strains in real time.

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Central line-associated bloodstream infections in intensive care units

The central line-associated bloodstream infections (CLABSIs) surveillance program (SPIN-BACC) has been operating as a mandatory program for eight years. In 2014–2015,[1] 67 intensive care units (ICUs) participated in the program, compared with 66 last year. A slight increase in patient-days (up 0.7%) and central-line days (up 0.6%) was observed, although the absolute number of CLABSIs has decreased by 32%. This drop is due to a significant decrease in incidence rates in ICUs in adult teaching hospitals and neonatal intensive care units (NICUs). The incidence rates for 2014–2015 were 0.52/1,000 central-line days (CI 95%: 0.37; 0.69) in adult teaching hospitals and 2.20/1,000 central-line days (CI 95%: 1.56; 2.94) in neonatal units, whereas in the

period from 2010-2014 the incidence rates were 0.89/1,000 central-line days in adult teaching hospitals (CI 95%: 0.79; 1.00) and 5.07/1,000 central-line days in neonatal units (CI 95%: 4.54; 5.64)

This is the second consecutive year that the incidence rates have dropped (down 22% last year). Quality controls carried out during the past year did not reveal any reporting anomalies. These decreases are therefore multifactorial and real.

NICUs also saw a decrease in their incidence rate (2.20/1,000 central-line days compared with 4.01/1,000 in 2013–2014 and 5.25/1,000 in 2009–2013). NICUs and pediatric intensive care units once again exhibited the highest rates of CLABSIs. Neonatal CLABSI rates broken down by birth weight category once again show that very low birth weight babies (< 1,000 g) are at the greatest risk of contracting a CLABSI.

Babies over 2,500 g at birth are also at risk, only for different reasons—most likely multiple underlying birth defects and the need for multiple surgeries.[2] This year, we observed a significant increase in the central line use ratio in NICUs—a trend to follow. This may either be related to an increase in the number of severe cases admitted in NICUs or to an increase in the misuse of central lines. This higher ratio was not observed in the other types of ICUs.

The only "contemporary" comparison available remains the National Healthcare Safety Network (NHSN) data, whose most recent report was published in 2013.[3] Across all birth weight categories, incidence rates in Québec NICUs are 2 to 3 times higher than those reported in the U.S. in 2013, ranking between the 75th and the 90th percentiles, except for babies 2,500 g or more, where Québec incidence rates exceeded the 90th percentile. As for adult teaching hospital ICUs, Québec ranked under the 25th percentile compared with major teaching ICUs in the U.S., whereas incidence rates in pediatric ICUs were between the 50th and 75th percentile. We nevertheless encourage ICUs to compare their individual findings with incidence rates in the U.S., which are available and broken down into much more specific ICU categories. This would provide ICUs that serve specific types of patients with a more adequate outside benchmark that is better aligned with their clinical activities. Data from the Canadian Nosocomial Infection Surveillance Program (CNISP) have been published up until 2011.[4] Note that this program still uses the SPIN's former definition for bloodstream infection (BSI) with coagulase-negative staphylococci (CNS) and other potential skin contaminants. Definitions used by the NSHN, CNISP and SPIN have been harmonized since April 1, 2011. Table 1 summarizes the data collected from various programs for comparison purposes.

Table 1 CLABSI incidence rate (/1,000 central-line days), including cases involving a mucosal barrier injury—SPIN, NSHN and CNISP programs

Type of ICU	SPIN[a] (2014–2015)	NHSN[b] (2013)	CNISP[g] (2011)
Coronary	0.34 [0.00; 1.34]	1.0 [0.8; 2.6]	Not available
Adult teaching	0.57 [0.41; 0.76]	1.1 [0.9; 2.4][c]	0.94 [0.79; 1.10][h]
Adult non-teaching	0.76 [0.47; 1.12]	0.8 [0.0; 2.4][d]	Not available
Pediatric	2.06 [1.15; 3.23]	1.2 [0.7; 3.2][e]	1.33 [0.85; 1.80]
Neonatal	2.20 [1.56; 2.94]	Not applicable[f]	2.91 [2.37; 5.91]

Abbreviations used: ICU = intensive care unit; SPIN = provincial surveillance of healthcare-associated infections; NHSN = National Healthcare Safety Network; CNISP = Canadian Nosocomial Infection Surveillance Program.

[a] Incidence rate and confidence interval at 95%.

[b] Pooled mean rate and 50th, 90th percentiles.

[c] Medical/surgical ICU—major teaching.

[d] Medical/surgical ICU—15 beds or fewer.

[e] Pediatric medical/surgical ICU.

[f] Rates reported by birth weight category.

[g] Incidence rate and confidence interval at 95%—participating hospitals in 2011.

[h] Adult ICUs include coronary, mixed and cardiovascular, with no distinction made between teaching and non-teaching facilities. Note that teaching hospitals are overrepresented in the CNISP, with very few non-teaching hospitals included in the data.

From a microbiological point of view, CNS continues to be the most frequent pathogen isolated overall as well as the most frequently associated with a 30-day lethality rate. *Enterococcus sp.* remains the second most frequent (38%), followed by *S. aureus* (13%) and *Candida sp.* (13%). The proportion of vancomycin-resistant Enterococcus (VRE) increased from 0% in 2012–2013 to 7% (2 cases of *E. faecium*) in 2013–2014 and 6% (1 case of BSI) in 2014–2015. CLABSIs caused by *S. aureus* represented 13% of the total cases (similar to last year) and the proportion of methicillin-resistant *S. aureus* (MRSA) was 12% (n = 2/17), which is stable compared with last year. No cases of carbapenem-resistant enterobacteriaceae or carbapenem-resistant *Acinetobacter sp.* were reported.

The implementation of best practice bundles in various ICUs likely contributed to lowering the CLABSI incidence rates. Surveillance programs associated with the Campagne québécoise des soins sécuritaires [Québec safe care campaign][10] should help improve the quality of care on an ongoing basis. In addition, many studies have shown the effectiveness of chlorhexidine wipes in preventing nosocomial infections in ICUs, for both multiresistant strains and CLABSIs .[5-9] This is an avenue worth exploring in ICUs whose CLABSI rates remain high even after best practice bundles have been implemented.

To sum up, the drop in CLABSI incidence rates for a second consecutive year is a positive development.

Recommendations

- Implement surveillance for processes in the various ICUs and promote the Campagne québécoise des soins sécuritaires to see if we will be successful in further decreasing our rates, aiming for a zero target;
- Rationalize the use of central venous catheters with special attention to ICUs whose usage ratio has increased;
- Consider other avenues (chlorhexidine baths, etc.) in units where the incidence rate remains high despite the application of best practices.

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Vascular access-related bloodstream infections in hemodialysis patients

- All of Québec's 45 hemodialysis units participate in the SPIN-HD surveillance program for vascular access–related BSIs in hemodialysis patients (VARBSIs).
- The incidence rate in 2014–2015 was 0.28/100 patient-28 day periods,[1] which is the lowest number reported since the surveillance program was launched.
- A total of 156 BSIs were reported out of a mean total of 4,280 patients per period, who received more than 668,000 dialysis sessions.
- Incidence rates were consistently lower when dialysis was performed using an arteriovenous (AV) fistula without the buttonhole technique (0.05/100 patient-periods). With the buttonhole technique in AV fistula, the BSI incidence rate rose to 0.20/100 patient-periods, which is similar to the rate observed with a synthetic fistula. The incidence rate with permanent catheters was 0.37/100 patient-periods compared with 6.73/100 patient-periods with temporary catheters. Incidence rates were therefore lowest when a fistula was used without the buttonhole technique, and much higher when a temporary catheter was involved. SPIN HD incidence rates over the past four years show that the rate of infections with fistula is relatively stable from one year to the next. However, we did observe a significant decrease in BSI incidence rates associated with a permanent catheter (overall average incidence rate of 0.53/100 patient-periods in 2010–2014).
- Corresponding incidence rates per 1,000 central-line days are 0.13 for permanent catheters, compared with 2.39 for temporary catheters.

Types of vascular access

- A total of 57% patients received dialysis through a catheter, and this proportion has grown steadily over the past eight years. However, despite the increase in the use of catheters, the proportion of patients with a temporary catheter fell slightly. Once again this year, most (85%) of the BSIs encountered were associated with catheters.
- Only 4.6% of patients had a synthetic fistula and 9.1% of patients were treated using the buttonhole technique. Despite the steady increase in patients, the absolute number of those who receive their dialysis through a fistula has remained relatively stable.

Case description

- 156 BSIs were reported in 142 patients.
- Median patient age was 68 years.
- 30-day lethality rate was 12%.
- 88% of BSIs occurred in outpatient services, but more than half of them (55%) resulted in hospitalization.
- Admission to intensive care was required for 20 patients (13%).

Microbiology

- Staphylococcus aureus continues to be the predominant pathogen, representing 55% of the microorganisms isolated. MRSA cases accounted for 14.6% of them.
- Coagulase-negative staphylococci (CNS) were responsible for 14% of cases.
- Enterobacteriaceae represented 14% of cases and enterococci 5% of cases. This is similar to previous years' results. Among the enterococci cases, a sole incidence of VRE was reported.

Data per facility and inter-hospital comparisons

- Units varied widely in terms of the number of patients they care for.
- There were significant differences in the proportion of fistulas used in the various units, ranging from 10% to 87%. Incidence rates were therefore as low as 0/100 patient-periods or as high as 1.22/100 patient-periods. The median was 0.19/100 patient-periods, with the 75th percentile at 0.51/100 patient-periods and the 90th percentile at 0.70/100 patient-periods. This median was significantly lower than that of previous years. Overall, 17 units did not report any cases and 5 units reported more than 9 cases.
- Despite these differences, an attempt to break down these units by number of patients followed did not yield any comparable groups.

Analysis and interpretation

Despite the more widespread use of catheters in hemodialysis patients, infection incidence rates were lower than they had ever been and remained relatively stable between this year and last. The biggest decrease was observed in 2013–2014 when the portal was changed and the definitions and validation process became more stringent. Nevertheless, we have continued to see a significant amount of variability in infection incidence rates and proportion of fistula use between hospitals. *Staphylococcus aureus* was once again the most frequently encountered pathogen, with the proportion of MRSA cases reflecting the provincial BSI profile.

International benchmarking

The Réseau de surveillance des infections vasculaires en hémodialyse (DIALIN) of the Centre de coordination de la lutte contre les infections associées aux soins (CCLIN) du Sud-Est de la France [the Hemodialysis-related vascular infections surveillance network of the French Southeast coordinating centre for the fight against healthcare-associated infections] reported an overall hemodialysis-related BSI incidence rate of 0.57 BSIs per month in dialysis, but an incidence rate of only 0.11/100 patient-months associated with vascular access.[2] This very low rate can be explained by the high proportion of fistulas used for 68% of their patients in 2013. The infection incidence rate was 0.14/1,000 central-line days, which is similar to our results. Infection incidence rates by type of access stood at 0.03/100 patient-months for AV fistulas, 0.19 for synthetic fistulas and 0.45 for catheters. They have also observed a decline over the past eight years of surveillance. The Dialysis Surveillance Network (DSN) reports 62.8% fistula use in 2015[3] which is much higher than current use in Québec (43.3%).

Recommendations

- Continue and deepen this surveillance program to reduce complications associated with hemodialysis;
- Complete the BSI data validation study as part of this surveillance program to ensure findings are accurate and that inter-hospital comparisons and selected indicators correspond to reality;
- Establish a link with the Campagne québécoise des soins sécuritaires,[4] which specifically aims to prevent VARBSIs in hemodialysis patients. A study to document specific prevention measures, such as the topical decolonization of *Staphylococcus aureus*, the type of dressings and catheter care procedures could be conducted again using a more precise framework based on the previously-published survey.[5]
- Promote the use of AV fistulas:
  - Ensure the broad dissemination of these findings to various stakeholders;
  - Explore the possibility of developing a strategy to promote fistula use;
  - Itemize the reasons why many patients do not have a fistula to round out general information compiled through a previous study involving healthcare teams.[4]

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Vancomycin-resistant Enterococcus infections

In 2014–2015[1], 87 healthcare-associated vancomycin-resistant Enterococcus (HA VRE) infections were reported, yielding an incidence rate of 0.18/10,000 patient-days. This is identical to the incidence rate reported in 2013–2014. HA VRE infections were concentrated in the metropolitan area (region 06), especially in teaching hospitals in Montréal, where the incidence rate was 0.54/10,000 patient-days. However, we noted a downward trend in the incidence rate for HA infections in teaching facilities and the opposite in non-teaching facilities.

The total number of VRE infections was stable for the third year in a row, with 103 infections versus 107 in 2013–2014.

A total of 36 VRE BSIs was reported in 2014–2015 (23 primary BSIs and 13 secondary BSIs), compared with 39 in 2013–2014 (20 primary BSIs and 19 secondary BSIs), representing a decrease of 8%.

Overall VRE infection lethality within 30 days was 17.5%, which was stable compared with 2013–2014.

The acquisition incidence rate of HA VRE colonization (colonization and infection) was 10.99/10,000 patient-days in 2014–2015, compared with 10.85/10,000 patient-days in 2013–2014. This rate therefore appears to be stabilizing.

The average number of VRE screening tests performed in 2014–2015 was 1.16 per admission which is also stable compared with 2013–2014.

There were no major methodological changes in 2014-2015, although a new hospital stratification approach was adopted to analyze incidence rates and the screening tests' frequency. This stratification takes into account the greater Montréal region versus the rest of the province and the academic nature of the facility (teaching versus non-teaching). This process showed that that the problem of HA VRE infections concerns primarily the Montréal area and teaching hospitals.

We also noted that certain facilities that had scaled back their VRE control measures have subsequently experienced an increase in the number of VRE infections. For example, a teaching hospital in the Montréal area amended its VRE infection control policy in 2010. Under the new policy, screening operations were limited to patients admitted to high-risk units (ICUs, oncology) and to those who had been in direct contact with a confirmed nosocomial case. The number of infections subsequently rose considerably. The number of VRE BSIs increased from 1 per year on average between 2000 and 2010 to 10 per year on average between 2010 and 2013, including 12 cases in 2012 alone. The VRE infection control policy is currently being reviewed in this hospital.

National and international benchmarks

The latest NHSN report on the resistance of healthcare-associated infections, published in 2013, analyzed data from 2009–2010. This published report shows that the proportion of Enterococcus and VRE in overall HA infections seems to be growing. Enterococcus was then

the second most prevalent HA pathogen (14%), just behind *S. aureus* (16%), while in 2006–2007, Enterococcus and VRE infections ranked third at 12%. In 2009-10 VRE made up 37% of all HA enterococcal infections, up from 33% in 2006–2007. In Québec, VRE's share in terms of all healthcare-associated enterococcal BSIs was 6.4% in 2014–2015 and 12.5% in healthcare-associated Enterococcus catheter-related BSIs, compared with the NHSN rate of 42%.

The Canadian Nosocomial Infection Surveillance Program (CNISP) reports new cases of clinical VRE infection and colonization for all patients admitted in a participating Canadian hospital. Unfortunately, since January 2011, a subgroup of CNISP hospitals stopped compiling data on VRE colonization, making comparisons very difficult. However, 2014 infection-related data reported an incidence rate of 0.45/10,000 patient-days on a Canada-wide basis (n = 54 facilities).[2] The data varied greatly from one region to the next, with an incidence rate of 0.65/10,000 patient-days in the west of the country, 0.44 in central Canada and 0.01 in the eastern provinces. Overall, there has been a 22% drop in the incidence rate since 2011. In Québec, the rate of HA VRE infection was 0.18/10,000 patient-days in 2014–2015. It is essential to note here that the vast majority of the facilities covered by the CNISP are teaching hospitals.

In Ontario, resistance surveillance falls under the purview of the Institute for Quality Management in Healthcare (IQMH). Data are collected using a questionnaire sent to provincial government–subsidized laboratories. VRE colonization data are no longer reliable in that 18 of the 194 hospitals have discontinued their VRE screening program. The number of VRE BSIs increased from 70 in 2012 to 84 in 2013, a 20% increase.[3] It is noted that 4.6% of enterococcal BSIs were VRE although their program includes both HA and non-HA cases. More specifically the percentage of enterococcal BSIs attributable to VRE quickly rose from 6.6% in 2012 to 11.2% in 2013 in hospitals without a VRE screening program, while in facilities with such a program in place, the percentage decreased from 3.5% to 2.1%

Ontario hospitals are required to report all cases of HA VRE bacteremias. These VRE bacteremia incidence rates are available online for each hospital. Readers can also find the overall incidence rate for the province. In 2014, the average incidence rate was 0.006 BSIs per 1,000 patient-days. In Québec, the incidence rate of HA VRE bacteremias calculated using BACTOT data was 0.004 per 1,000 patient-days in 2014–2015. On a per-capita basis, Ontario reported 84 BSIs (HA and non-HA) for a population of 13,677,700[4] or 0.614 VRE infections per 100,000 people versus 36 BSIs for a population of 8,214,885[5] or 0.438 VRE infections per 100,000 people in Québec.

Conclusion

In conclusion, the data for 2014–2015 seemed to indicate a slight improvement in the incidence rate for HA VRE infections, the total number of BSIs and total infections (HA and non-HA) and a certain stabilization in the acquisition rate of HA VRE colonization. Furthermore, a large majority of the facilities are very active in their VRE prevention programs through active screening upon admission and during hospitalization.

The Québec situation therefore seems to be enviable at this time when compared side by side with data from the U.S., CNISP and Ontario. It will be important to follow the situation in hospitals that have decreased VRE screening practices in Ontario. Already, a trend seems to be emerging, with VRE infections now a much more prevalent cause of enterococcal BSIs in these hospitals. Similarly, it will be interesting to monitor the impact of restoring VRE infection control measures in the Montréal-area hospital referred to earlier in this section.

Recommendations

- Continue VRE surveillance;
- Continue efforts to control VRE (targeted screening upon admission and during hospitalization, along with other prevention measures), given the worrisome situation regarding hospitals in Ontario and the U.S. that have abandoned VRE screening programs;
- Promote and monitor the Campagne québécoise de soins sécuritaires.

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Methicillin-resistant *staphylococcus aureus* bloodstream infections

In 2014–2015,[1] the incidence rate of healthcare-associated methicillin-resistant *Staphylococcus aureus* (MRSA) bloodstream infections remained stable compared to last year, at 0.20/10,000 patient-days for the 88 centres participating in the surveillance program.

A data entry issue for BSIs that fall into categories other than 1a, 1b and 1c occurred in periods 12 and 13. The results initially reported in June 2015 using the data retrieved on May 20, 2015, were therefore incomplete. For this reason, the information the information in the highlights for non-HA categories related to the facility were extracted from the INSPQ Infocentre on August 25, 2015, after correction of the cited problem.

In summary, the following results were observed for 2014–2015:

- The incidence rate for HA MRSA BSIs was 0.20/10,000 patient-days, down from 0.54/10,000 patient-days in 2006, the first year of the surveillance program when denominators were available(2);
- 1,888 Staphylococcus aureus BSIs were reported including 262 MRSA BSIs; in 2013-14, these numbers were respectively 1,774 and 253;
- The overall percentage of MRSA BSIs, all categories combined, was 13.8%, compared with 31.6% in 2003(2);
- For HA infections (categories 1a and 1b), 529 Staphylococcus aureus BSIs were reported, 97 of which were resistant to methicillin (18.3%);
- By contrast to HA BSIs in categories 1a and 1b, the proportion of MRSA bacteremias was 15% in outpatient services (categories 1c) and 9.4% amongst cases of community-onset bacteremia (category 3);
- Community-onset MRSA BSIs represented 34% of all MRSA BSIs, although the MRSA strain itself might have been contracted at the healthcare facility;
- There were no substantial differences in the incidence rates of HA MRSA BSIs for specific groups of facilities;
- The highest incidence rate was found in teaching hospitals with fewer than 250 beds; however, only 6 centres matched this description, 3 of which reported no cases in 2014–2015;
- Primary BSIs related to intravascular catheters and vascular access for hemodialysis remained the most frequently encountered of the HA MRSA BSIs;
- The most common causes of secondary BSIs were pulmonary infection, surgical site infection and skin and soft tissue infection; surgical site infections ranked first in 2013–2014;(4)
- A total of 34 deaths within 30 days were reported in 124 cases of HA MRSA BSIs (categories 1a, 1b and 1c), yielding a lethality rate of 27.4%;
- Only one region, Chaudière-Appalaches, saw a significant decline in its incidence of HA MRSA BSIs, after several years of high rates;

- Seven regions continue to have over 20% MRSA amongst their S. aureus HA BSIs, although most did not report a high number of cases.

In 2013–2014, we observed a greater decrease in the incidence of HA MRSA BSIs. This year, the rate remained fairly stable. The lower number of cases was attributable partly to a change in definition designed to harmonize operations with BACTOT. We noticed the same phenomenon in 2011–2012 and 2012–2013, when the incidence rates stood at 0.28 and 0.29/10,000 patient-days respectively. Whether this downward trend continues in the coming years needs to be followed. Taking the difference in methodology and definitions into account, the MRSA BSI incidence rate in Québec is comparable or lower to that of other surveillance programs in the world, including France, where the BMR-Raisin network obtained an incidence rate of 0.38/10,000 hospitalization days in 2013.[5] In the United Kingdom, the incidence rate was 0.23/10,000 bed-days for the 2014–2015 fiscal year, for selected establishments (Acute Trust)[6]. In Canada, preliminary data for 2014 showed an incidence rate of MRSA BSIs of 0.62/10,000 patient-days. This incidence rate was 0.79 for participating centres in Ontario and Québec, including 8 facilities in Québec, 7 in Montréal and 1 in Québec City. The incidence rates in 2014 remained at 0.57/10,000 patient-days at the national level and 0.66 for central Canada (Ontario and Québec).[7]

The majority of MRSA BSIs occur in healthcare facilities. They have the highest percentage of MRSA BSIs of *S. aureus* BSIs. Furthermore, community-onset BSIs may have been contracted in the hospital environment prior to a patient's release. In a 2013–2014, molecular analysis and typing of strains showed that community-onset MRSA strains, especially CMRSA-10, are responsible for 23.7% of BSIs acquired in the community and 11.5% of BSI acquired in a healthcare facility.[8] This differs in the U.S., where the strain of community-onset MRSA is gradually supplanting the hospital-acquired strain in HA BSIs.[9] The hospital strain therefore remains the main cause of MRSA BSIs in Québec, regardless of where they occur. Specific measures to prevent and control the transmission of MRSA are key to reducing the number of MRSA BSIs, in addition to general measures aimed at preventing BSIs and other healthcare-associated infections. It would be interesting to compare the origins of infection of methicillin-susceptible *Staphylococcus aureus* (MSSA) with that of MRSA. *S. aureus* remains a widespread pathogen, and BSIs are the most severe manifestation of these infections.

The proportional incidence rate of MRSA BSIs, compared with other *S. aureus* BSIs, has been easing off from year to year. It was 13.8% in 2014–2015, 14.2% in 2013–2014 and 15.3% in 2012–2013. In comparison, the European Centre for Disease Prevention and Control (ECDC) found that, in 2013, MRSA was responsible for 18.0% of invasive infections on average, ranging from 0% in Iceland to 64.5% in Romania.[10] Some areas in Québec have seen a steady drop in the percentage of MRSA-associated BSIs, compared with all HA BSIs, since the surveillance program began in 2006, in particular the Montréal area, which fell from 31% in 2006 to 18.4% in 2014–2015, and in Chaudière-Appalaches, which went from 40% to 0% over the same time span.[2]

To sum up, although the incidence rate of MRSA BSIs was stable in 2014–2015, the gradual decline in recent years underscores the relevance of and need for measures to prevent and control healthcare-associated infections, especially measures designed to reduce the transmission of MRSA in Québec healthcare facilities.

Recommendations

- Ensure ongoing surveillance of BSIs due to *Staphylococcus aureus* and methicillin-resistant *S. aureus* (MRSA), including categories other than healthcare-associated infections related to the reporting facility, with a separate analysis of total healthcare-associated BSIs;
- Continue to collect aggregate surveillance data on *Staphylococcus aureus* BSIs, other than those related to the reporting healthcare facility;
- Conduct a more detailed analysis of the incidence rate and source of HA methicillin-susceptible *S. aureus* (MSSA);
- Continue regular typing of MRSA strains derived from blood cultures;
- Expand the MRSA surveillance program to include all new MRSA colonization;
- Promote and monitor the Campagne québécoise des soins sécuritaires; all of its facets will have an impact on MRSA BSIs.

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Hospital-wide healthcare-associated bloodstream infections

During the 2014–2015 surveillance period for hospital-wide healthcare-associated bloodstream infections (SPIN-BACTOT),[1] 3,035 HA BSIs were reported in hospitalized patients, for an overall incidence rate of 5.3 cases per 10,000 patient-days. This is a significant decrease in the incidence rate in 2014–2015 as compared with the rate of 2010–2014. This drop was even more noticeable and significant for catheter-related primary BSIs, which may reflect the efforts undertaken by hospitals to minimize incidence rates, thorough application of best practices when inserting a central line.

Lower incidence rates were actually observed for all BSI sources, excluding non-catheter-related primary BSIs. The decrease was significant for hemodialysis-related BSIs and secondary BSIs caused by a surgical site infection. Increased participation by healthcare centres and the dissemination of BSI incidence rates through various channels may help to bring the BSI incidence rate down even further. The initiation of the Campagne québécoise des soins sécuritaires in the fall of 2014 may help decrease the incidence of BSIs associated with infections targeted by the campaign which are surgical site infections, catheter-related urinary tract infections and ventilator-associated pneumonia.[2]

A new surveillance category was introduced in 2014–2015: bloodstream infections in patients with a mucosal barrier injury (MBI). These BSIs are observed in patients with central lines, in many cases neutropenic patients undergoing chemotherapy. This category separates catheter-related BSIs that can be prevented

using best practice bundles from MBIs more likely to originate from the GI tract, which are more difficult to prevent.[3]

We also observed a significant decrease in BSIs associated with surgical site infections (SSIs). One of the contributing factors may have been the change in the duration of follow-up after surgery to define SSI, now limited to 30 or 90 days following the surgery, depending on the type of procedure. If we look retrospectively at the 2013–2014 data, we observe that 102 of the 266 BSIs associated with SSIs occurred more than 90 days after the corresponding surgery. Of these, 42 involved patients with an implant. However, 60 BSIs emerged after the 90-day mark, but in non-implant patients. These data would have been rejected by the new definitions. In validating our data we found no BSIs reported past 90 days post-op in 2015. It follows that the lower incidence rates seem to be attributable in part to the new definitions that were adopted to align our systems with that of the NHSN, as well as an improved validation process. The majority of BSIs associated with SSIs are still caused by *S. aureus.* In this context, it is worth pointing out that, for facilities with an abnormally high incidence of *S. aureus* SSIs, screening and decolonization can be considered for certain types of surgery.[4]

BSIs secondary to urinary tract infection continue to exhibit the highest incidence rate among nosocomial BSIs. This may be explained by the previously mentioned decrease in catheter-related BSIs as well as by their predominance in non-teaching hospitals. This relative rise in BSIs secondary to urinary tract infection over the past three years reflects the greater decrease in catheter-related BSIs, as a result of the efforts by many Québec facilities to promote best practices to lower their incidence rate. Because the majority of these cases involve the use of a urinary tract catheter,[5] it would be helpful to introduce procedures designed to ensure the actual need for a catheter and re-evaluate its necessity after a predetermined amount of time. This could feasibly lead to a similar decrease in the rate of BSI secondary to urinary tract infection. To support this concept, a new section in the Campagne québécoise des soins sécuritaires focusing on the prevention of catheter-related urinary tract infections was released in fall 2014. The purpose of this program is to reduce nosocomial infections using best practice bundles.[2] Once implemented on a larger scale, it may be worthwhile to pair the information gathered from this campaign with SPIN-BACTOT data to determine the impact of the various recommended measures for healthcare facilities that participated in the campaign compared with non-participating centres.

BSI incidence rates are three times higher in adult intensive care units (ICUs) than non-ICU settings. In addition incidence rates in adult teaching hospital ICUs are double those in their non-teaching counterparts. These differences may reflect the more complex population and greater prevalence of underlying medical conditions in a teaching hospital. However, although incidence rates outside of ICUs are lower, the absolute number of catheter-related BSIs remains significant.

For the past three years, BSIs associated with invasive procedures have been reported when they occur within 7 days following the procedure. Prior to this change, events were only followed for 48 hours after procedures. This extended follow-up period has enabled us to have a clearer understanding of BSIs associated with these procedures, the two main causes being transrectal prostate biopsies and endoscopic retrograde cholangiopancreatography (ERCP). BSIs that occurred between 3 and 7 days after a procedure represented 40% (65/162) of all procedure-related BSIs. The absolute number of post-procedure BSIs appears to have slightly decreased between 2013–2014 (201 BSIs) and 2014–2015 (162 BSIs). It is nevertheless difficult to gain an overall picture of post-procedure BSIs as we do not have denominators for each of these procedures , and some of these BSI may be classified in other categories (e.g., urinary, digestive).

The most frequently isolated pathogens were enterobacteriaceae and *S. aureus*. *S. aureus* is mostly associated with patients with catheter-related or hemodialysis-related BSI. It is also the micro-organism with the highest associated mortality. 18% of isolated *S. aureus* was resistant to methicillin (MRSA) and nearly 17% of the isolated *E. faecium* was resistant to vancomycin. Although there are no programs in the U.S. devoted to the study of hospital-wide BSIs, it is still interesting to compare data on the proportions of resistant bacteria observed in Québec with NHSN data (U.S.), which presents higher rates of resistance. Data from the 2009–2010 NHSN surveillance network on

catheter-related BSIs show 54.6% MRSA and 82.8% VRE for *E. faecium*.[6] The CNISP reported an incidence rate of MRSA BSIs of 0.62 BSIs per 10,000 patient-days in 2014. In comparison, the incidence rate for healthcare-associated MRSA BSIs documented in our program is 0.2 BSIs per 10,000 patient-days, although the Québec program does not include BSIs contracted by patients who have been in contact with healthcare services over the past 12 months as does CNISP.[7]

MRSA control measures implemented throughout Québec hospitals[8] have definitely contributed to the relatively steady drop and stabilization of the proportion of MRSA BSIs since the program started. The overall proportion of VRE BSIs continued to be fairly stable at 6.4%, lower than the 8.0% recorded in 2013–2014. This result is encouraging, following the 2012 publication of Québec guidelines on VRE infection control.[9] It may be interesting to determine the proportion of hospitals that have been successful in applying screening and other recommended measures in the current context of limited resources. BSIs caused by carbapenem-resistant enterobacteriaceae remain a rare event in Québec. This surveillance program makes it possible to track their progress, considering their emergence in North America.

The reported 30-day mortality rate, whether attributable to BSI or not, was 18% overall. This is lower than the rate observed in a similar surveillance program in the U.S., which reported a 27% mortality rate for all BSIs.[10] It is important to note, however, that this surveillance program covered an earlier period than ours (1995–2002) and did not include BSIs related to catheter use and outpatient procedures. Half of BSIs in this program therefore implicated hospitalized ICU patients, compared with only 11% in our program. This could easily explain the higher mortality rate in the U.S. hospitals.

HA BSIs are responsible for significant morbidity and mortality in acute care facilities in Québec. Recent data shows that surveillance in and of itself reduces the incidence of catheter-related BSIs in intensive care units.[11, 12] Current data suggest that a similar impact can also be observed for hospital-wide BSIs. The surveillance program for hospital-wide healthcare-associated BSIs allows facilities that do not have a hospital-wide surveillance program to establish a comprehensive profile of the most serious infections, determine the source (e.g., surgical site infections, catheter-associated urinary tract infections, post-procedure infections) and set infection prevention and control program priorities at the local level.

Recommendations

- Continue surveillance of HA BSIs;
- Analyze the impact of introducing new definitions of HA BSIs (BSIs associated with mucosal barrier injury, etc.);
- Hold ongoing training sessions to ensure definitions are applied in a standardized way and ensure case validation, especially in the context of using new provincial definitions;
- Continue to monitor for primary BSIs associated with a procedure for 7 days following this procedure. Obtain denominators for prostate biopsy and ERCP to establish infection proportions for these procedures, as part of a pilot project;
- Ensure a link between the SPIN-BACTOT program and the Campagne québécoise des soins sécuritaires in order to evaluate the campaign's impact on health outcomes by determining whether there is a correlation between improvements in certain practices and changes in incidence rates for certain infections (e.g., urinary tract infections, surgical site infections, ventilator-associated pneumonia).

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Clostridium difficile-associated diarrhea

The provincial surveillance program for Clostridium difficile-associated diarrhea (CDAD) completed its 11th year of surveillance this year.(1) In total, 95 facilities, including 2 pediatric facilities and 6 rehabilitation facilities, participated in the program.

At the provincial level, the number of HA CDAD cases and the provincial incidence rate dropped significantly compared with the previous year, achieving its lowest point since 2010–2011. A total of 3,453 cases in categories 1a and 1b were reported, for an annual incidence rate of 6.8/10,000 patient-days. There were roughly 200 fewer cases this year compared with last, taking the incidence rate below the mark of 7.0/10,000 patient-days for the first time in five years.

Comparing provincial incidence rates with other provinces or countries is not easy. Methodological differences between the various surveillance programs can have enormous repercussions on incidence rates and make it difficult to draw valid comparisons. It therefore seems more prudent to compare current and previous incidence rates in Québec rather than make haphazard comparisons with other jurisdictions.

The incidence rate remained below the threshold value for all 13 periods in the year. The winter peak was not as dramatic in 2015 (8.5 cases/10,000 patient-days) as it was in 2014 (8.9 cases/10,000 patient-days) despite poor vaccine efficacy against the main strain of influenza circulating.

More than 80% of CDAD cases were found in acute care, rehabilitation and long-term care facilities. Community-onset cases represented a mere 14.7% of the total number of cases reported. The proportion of deaths, colectomies and transfers to an intensive care unit remained stable.

As far as groups of facilities are concerned, we observed a narrowing of the gap between incidence rates in facilities where the proportion of patients aged 65 and older is higher than 35% versus those where it is lower. This characteristic has been a good predictor of incidence rates in the past, but this year is an exception. For example, the proportion of patients 65 and older explained 20% of the variation in the incidence rates in 2010–2011. It is unclear why this has changed. We plan to update these predictive variables in 2015–2016.

Compared with last year, 17 facilities experienced a significant drop in their incidence rates, while 8 others went in the opposite direction. The proportion of facilities that observed a significant loss is greater than in previous years (11 significant improvements in 2013–2014).

The SPIN-CD group performed related studies on *C. difficile*, some of which are still underway. An overview of the *C. difficile* prevention measures undertaken in acute care facilities in Québec was published in 2015.[2] Ongoing work was done in conjunction with the strain study, the findings of which will be available soon.

The impact of various types of laboratory tests on incidence rates is also being carefully monitored by the SPIN-CD group. Preliminary data suggest that an increasing proportion of hospitals are using nucleic acid amplification tests (NAATs), including PCR (polymerase chain reaction) tests, to diagnose *C. difficile*. The number of facilities using NAATs nearly tripled between 2010 and 2014, going from 12 to 34. Since these tests are more sensitive than traditional models (ELISA toxin tests and cytotoxin assays), the incidence rate usually increases as a result of the change. Given the growing popularity of NAATs, it is surprising that provincial incidence rates have remained so low.

A few improvements could be made, notably to optimize the analysis by type of diagnostic tests used to detect *C. difficile*, but any such modifications should not have a major impact on surveillance. Plans are in place for 2015–2016 to update the variables used to stratify various facilities. Three variables are currently being used to compare facilities, namely the proportion of patients aged 65 or older, the number of beds and the academic mission. Some of these variables may be adapted or eliminated to make way for others.

Efforts to monitor *C. difficile* strains will also be ongoing, and typing techniques will be adapted to incorporate ribotyping, the standard technique used worldwide.

Because the number of HA CDAD cases has stabilized at between 3,100 and 3,900 cases per year since the end of the 2007 outbreak, it would suggest that a lower bound might have been achieved. However, breakthroughs in *C. difficile* prevention measures may still occur and make it possible to further improve our rates. Antibiotic stewardship is also a promising avenue that should be explored. Improvements in the use of antibiotics could also help reduce the number of CDAD cases. The maintenance of housekeeping resources is also recommended to ensure adequate environmental control and to reduce the likelihood of outbreaks.

The SPIN-CD program will also be called upon to work with the Campagne québécoise des soins sécuritaires to evaluate the correlation between certain practices (hand-washing hygiene) and infection incidence rates.

In conclusion, this year represented Québec's lowest rate of CDAD in five years, with 18% of facilities observing a considerable improvement in their incidence rate. This is a remarkable performance considering the poor influenza vaccine efficacy in 2014–2015 and the growing use of NAAT tests. The SPIN-CD program is now well-established in Québec and provides the province with key facts and figures. The SPIN-CD group will continue its work next year, with the goal of improving and refining the surveillance program.

Recommendations

- Continue surveillance program for *C. difficile*-associated diarrhea;
- Continue annual strain monitoring program;
- Follow trends in the types of tests used to diagnose CDAD;
- Promote antibiotic stewardship;
- Promote and monitor the Campagne québécoise des soins sécuritaires;
- Ensure a sufficient quantity and quality of resources (both human and material) in housekeeping to ensure adequate cleaning and disinfection of facilities.

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