



Central Line–Associated Bloodstream Infections in Intensive Care Units in Québec, Surveillance Results 2012–2013

Healthcare-Associated Infections Provincial Surveillance Program

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From April 1, 2012, to March 31, 2013, 67 intensive care units (ICUs) took part in the surveillance of central line–associated bloodstream infections (CLABSIs), for a combined total of 128,207 central-line days (Table 1). Participating ICUs reported 201 CLABSIs in 197 patients. Incidence rates were 1.13 per 1,000 central-line days in coronary ICUs, 0.84 in teaching adult ICUs, 1.22 in non-teaching adult ICUs, 2.83 in pediatric ICUs and 5.36 in neonatal ICUs. Incidence rates in 2012–2013 were stable compared to 2008–2012 (in ICUs that took part in both surveillance periods), except in adult teaching ICUs, where the pooled mean rate decreased significantly. Two adult non-teaching ICUs with less than 10 beds that did not take part in the 2011–2012 study joined the program in 2012–2013 (one in period 6 and the other in period 9). All participating ICUs in 2011–2012 continued participation in 2012–2013.

TABLE 1 Participation of ICUs in the Surveillance of CLABSIs, Québec, 2008–2009 to 2012–2013

	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013
Participating ICUs (N)	56	61	64	65	67
Inpatient days (N)	235,103	255,604	275,653	287,553	294,438
Central-line days (N)	106,359	115,829	123,899	126,722	128,207
CLABSIs (cat. 1, N)	167	185	194	203	201
Infected patients (N)	161	179	185	191	197

Incidence Rates

In 2012–2013, incidence rates were 1.13 per 1,000 central-line days in coronary ICUs, 0.84 in teaching adult ICUs, 1.22 in non-teaching adult ICUs, 2.83 in pediatric ICUs and 5.36 in neonatal ICUs. The lowest pooled mean rate was found in adult teaching ICUs, despite the fact that these units had the highest use of central lines (Table 2). The CLABSI incidence rate was highest in neonatal ICUs, and this rate was significantly higher than that of adult and pediatric ICUs ($p < 0.05$). The CLABSI incidence rate was significantly higher in pediatric ICUs than in adult ICUs ($p < 0.05$).

TABLE 2 CLABSI Incidence Rate and Catheter Utilization Ratio, by Type of Healthcare Facility and Type of ICU, Québec, 2012–2013 (Incidence Rate per 1,000 Central-Line Days [95% CI])

Type of ICU	ICUs (N)	Incidence Rate	Utilization Ratio
Coronary	3	1.13 [0.21; 2.77]	0.22
Adult, teaching	27	0.84 [0.65; 1.06]	0.63
Adult, non-teaching	26	1.22 [0.85; 1.67]	0.38
Pediatric	4	2.83 [1.70; 4.24]	0.60
Neonatal	7	5.36 [4.26; 6.60]	0.19

95% CI: 95% confidence interval.

Although seven neonatal ICUs took part in the study, only two were able to provide the number of central-line days by birth weight category. As a result, the conclusions that may be drawn from Table 3 are limited. Nevertheless, the incidence rate did tend to increase as birth weight decreased (Table 3).

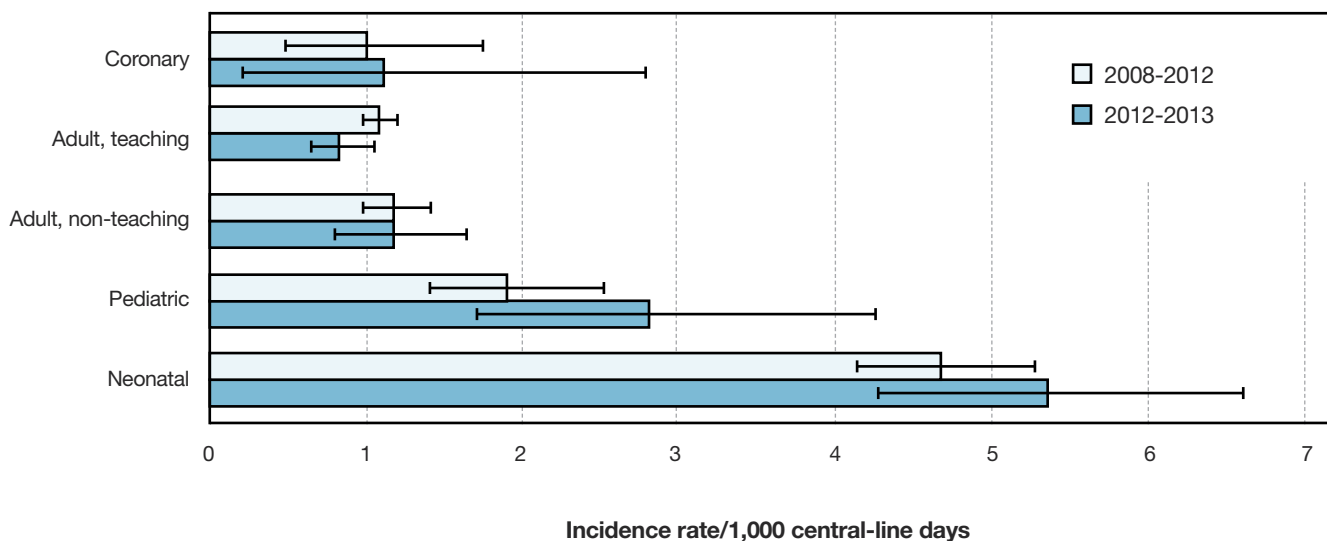
TABLE 3 CLABSI Incidence Rate in Neonatal ICUs, by Birth Weight Category, Québec, 2012–2013 (Incidence Rate per 1,000 Central-Line Days [95% CI])

Birth Weight Category (grams)	Number of Cases	Incidence Rate
≤ 750	5	9.78 [3.09; 20.24]
751-1,000	4	3.57 [0.93; 7.92]
1,001-1,500	6	5.56 [2.00; 10.90]
1,501-2,500	2	2.13 [0.20; 6.09]
> 2,500	3	1.98 [0.37; 4.85]
Total	20	3.87 [2.36; 5.75]

Incidence Rate Trends

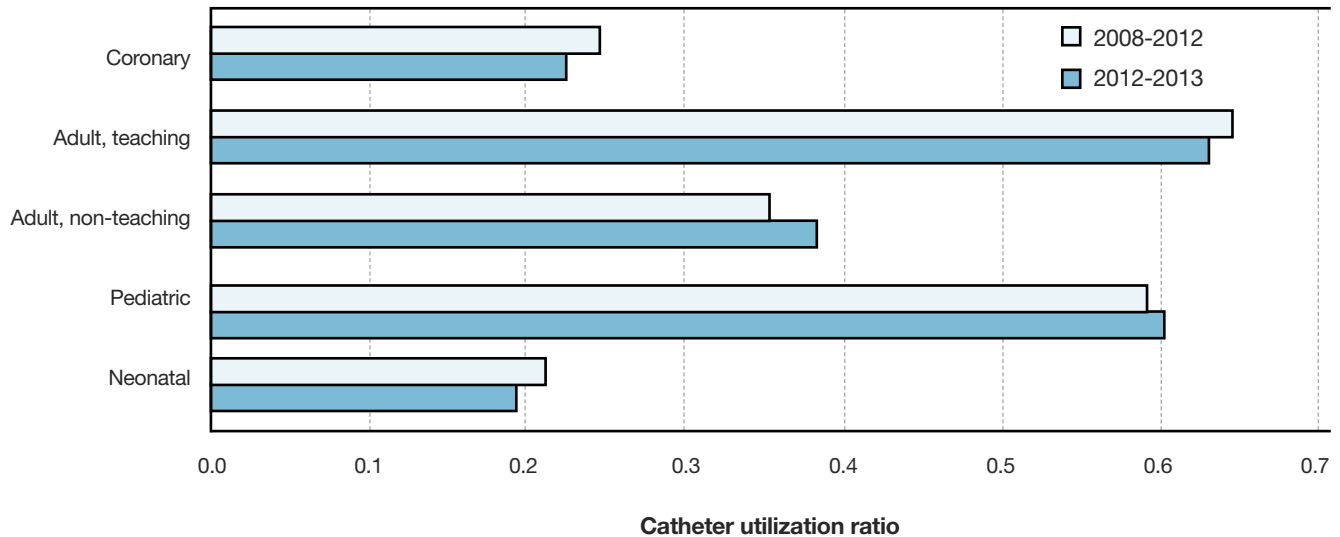
CLABSI incidence rates were stable in 2012–2013 compared to the previous four years (Figure 1), except in adult teaching ICUs, where the pooled mean rate declined significantly ($p = 0.045$). It is interesting to note that the pooled mean incidence rate in neonatal ICUs had not increased significantly compared to the incidence rates in previous years, unlike what had been observed in recent years. Of note, however, the comparison period (background) is obviously not the same as the background rate previously used. The year 2007–2008, when the incidence rate was at its lowest, was included in the background data reported last year but is no longer part of the background rate this year. The increase in incidence rates in subsequent years has thus had an increasing influence on the background rate. The increase observed in 2012–2013 is therefore more difficult to detect statistically.

FIGURE 1 CLABSI Incidence Rate, by Type of Healthcare Facility and Type of ICU, in ICUs that previously participated in SPIN (N = 65), Québec, 2008–2012 and 2012–2013 (Incidence Rate per 1,000 Central-Line Days [I.C. 95%])



Furthermore, catheter utilization ratios increased significantly in adult, non-teaching and pediatric ICUs but decreased significantly in the other ICU types (Figure 2).

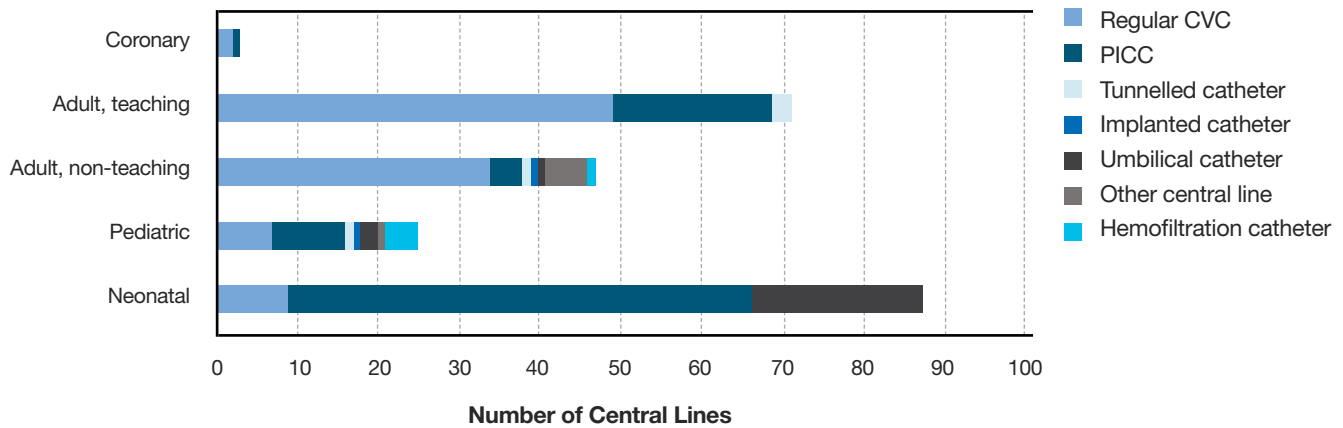
FIGURE 2 Catheter Utilization Ratio, by Type of Healthcare Facility and Type of ICU, in ICUs that Previously Participated in SPIN (N = 65), Québec, 2008–2012 and 2012–2013



Description of Cases

Patients who developed a CLABSI were aged between 0 and 91 years, with a median age of 13 years (65 years in the adult ICUs). In the adult ICUs, the central lines most frequently associated with bloodstream infections were regular central venous catheters (CVCs), followed by peripherally inserted central catheters (PICCs) (Figure 3). In neonatal ICUs, PICCs were in most associated with CLABSI, followed by umbilical catheters.

FIGURE 3 Type of Central Line Used in CLABSI Cases, by Type of Healthcare Facility and Type of ICU, Québec, 2012–2013 (N)



NB: More than one central line may be reported in any given case of CLABSI, which explains why the total number of central lines is higher than the total number of CLABSIs presented earlier in this paper.

In 2012–2013, 23% of CLABSI cases died in the 30 days after the onset of bacteremia (Table 4). Mortality was highest in the adult ICUs ($p < 0.001$; Figure 4). The overall mortality of 23% represents a significant increase compared with 2011–2012 ($p = 0.052$). It is important to bear in mind, however, that this takes into account the total number of deaths irrespective of cause, and therefore includes deaths not necessarily related to a CLABSI.

FIGURE 4 30-Day Case Fatality, by Type of Healthcare Facility and Type of ICU, Québec, 2012–2013 (%)

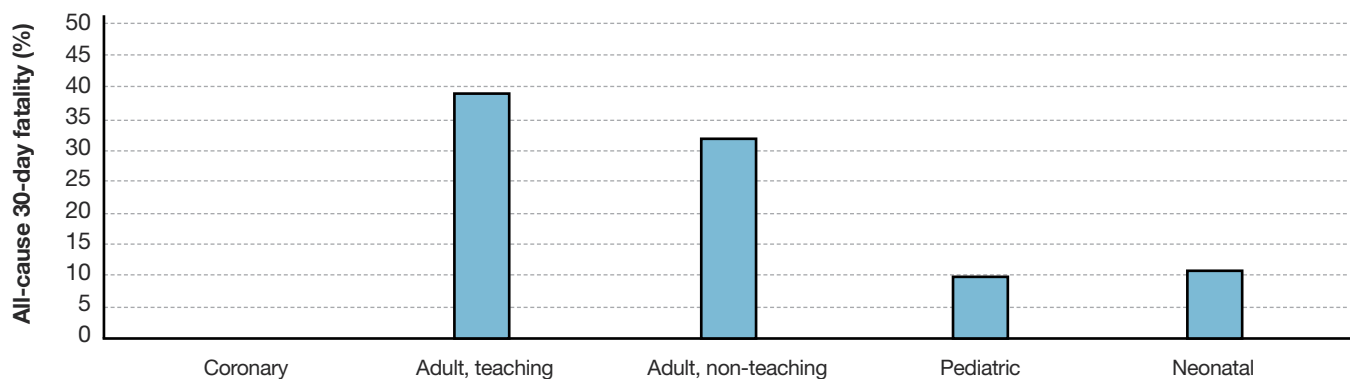


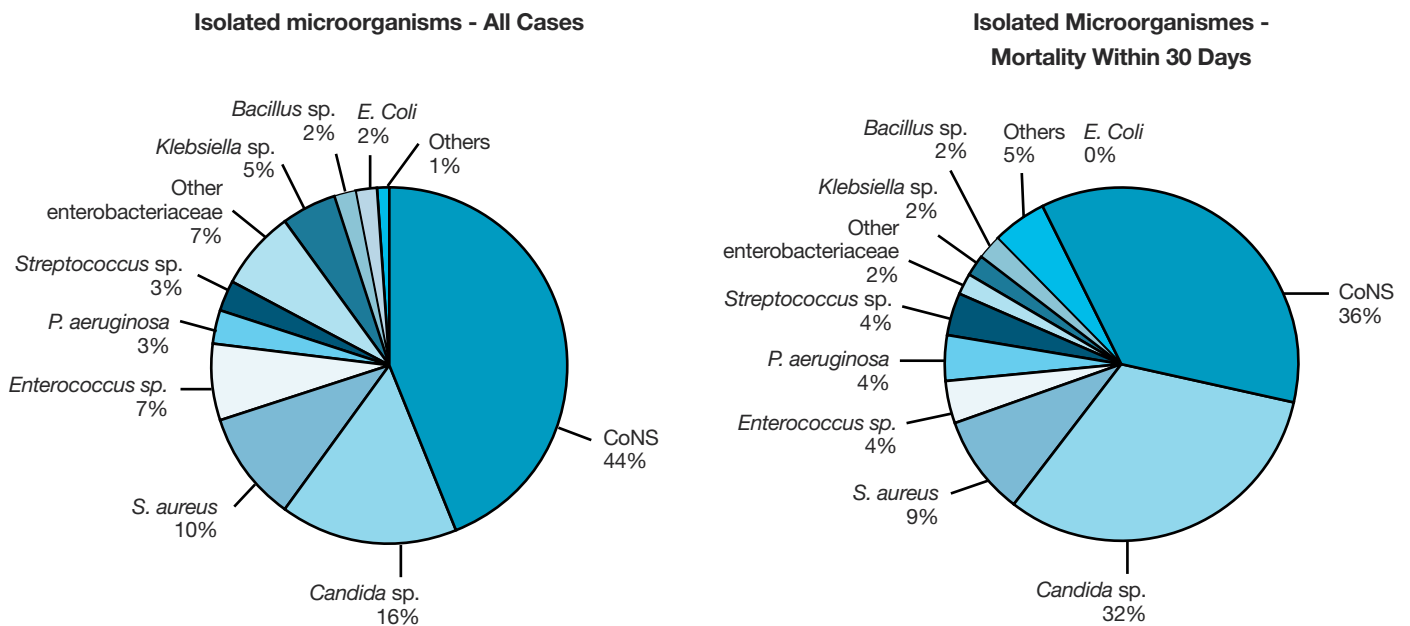
TABLE 4 30-Day Case Fatality, by Type of Healthcare Facility and Type of ICU, Québec, 2012–2013 (N, %)

Type of ICU	CLABSIs		Death in 10 Days		Death in 30 Days	
	N		N	%	N	%
Coronary	3		0	0	0	0
Adult, teaching	64		14	22	25	39
Adult, non-teaching	34		6	18	11	32
Pediatric	19		1	5	2	11
Neonatal	81		7	9	9	11
Total	201		28	14	47	23

Microbiology

Figure 5 shows that the microorganisms most frequently isolated in reported CLABSI cases and in cases resulting in death were coagulase-negative staphylococci (CoNS, at 44% and 36% respectively), followed by *Candida* sp. (16% and 32%) and *Staphylococcus aureus* (10% and 9%).

FIGURE 5 Categories of Isolated Microorganisms in All Cases (N = 221) and Cases of Mortality Within 30 Days (N = 53), Québec, 2012–2013 (%)



In 2012–2013, 23% of *S. aureus* strains were resistant to oxacillin; 19% of Gram-negative bacteria showed resistance to at least one quinolone and 9% were resistant to piperacillin/tazobactam. There was no case of vancomycin-resistant enterococcus infection reported (Table 5 and Figure 6).

TABLE 5 Categories of Isolated Microorganisms in All Cases (N = 221) and Cases of Mortality Within 30 Days (N = 53), Québec, 2012–2013 (%)

Microorganism	Antibiotic	Isolated	Tested		Resistant	
		N	N	%	N	%
<i>Staphylococcus aureus</i>	Oxacillin	22	22	100.0	5	22.7
<i>Enterococcus faecium</i>	Vancomycin	3	3	100.0	0	0.0
<i>Enterococcus faecalis</i>	Vancomycin	10	9	90.0	0	0.0
<i>Klebsiella (pneumoniae/oxytoca)</i>	CSE 4	12	11	91.7	0	0.0
	Imipenem or meropenem	12	0	0.0	–	–
	Multiresistant 1	12	12	100.0	0	0.0
<i>Escherichia coli</i>	CSE 4	4	4	100.0	0	0.0
	Fluoroquinolones 3	4	4	100.0	1	25.0
	Imipenem or meropenem	4	–	–	–	–
	Multiresistant 1	4	4	100.0	0	0.0
<i>Enterobacter sp.</i>	CSE 4	8	8	100.0	0	0.0
	Imipenem or meropenem	8	8	100.0	0	0.0
	Multiresistant 1	8	8	100.0	0	0.0
<i>Pseudomonas sp.</i>	Amikacin, gentamicin or tobramycin	6	5	83.3	0	0.0
	CSE 2	6	6	100.0	3	50.0
	Fluoroquinolones 2	6	6	100.0	4	66.7
	Imipenem or meropenem	6	6	100.0	4	66.7
	Piperacillin/tazobactam	6	6	100.0	2	33.3
	Multiresistant 2	6	6	100.0	3	50.0
<i>Acinetobacter sp.</i>	Imipenem or meropenem	0	–	–	–	–
	Multiresistant 3	0	–	–	–	–

CSE 4: cefepime, cefotaxime, ceftazidime or ceftriaxone; CSE 2: cefepime or ceftazidime.

Fluoroquinolones 2: ciprofloxacin or levofloxacin;

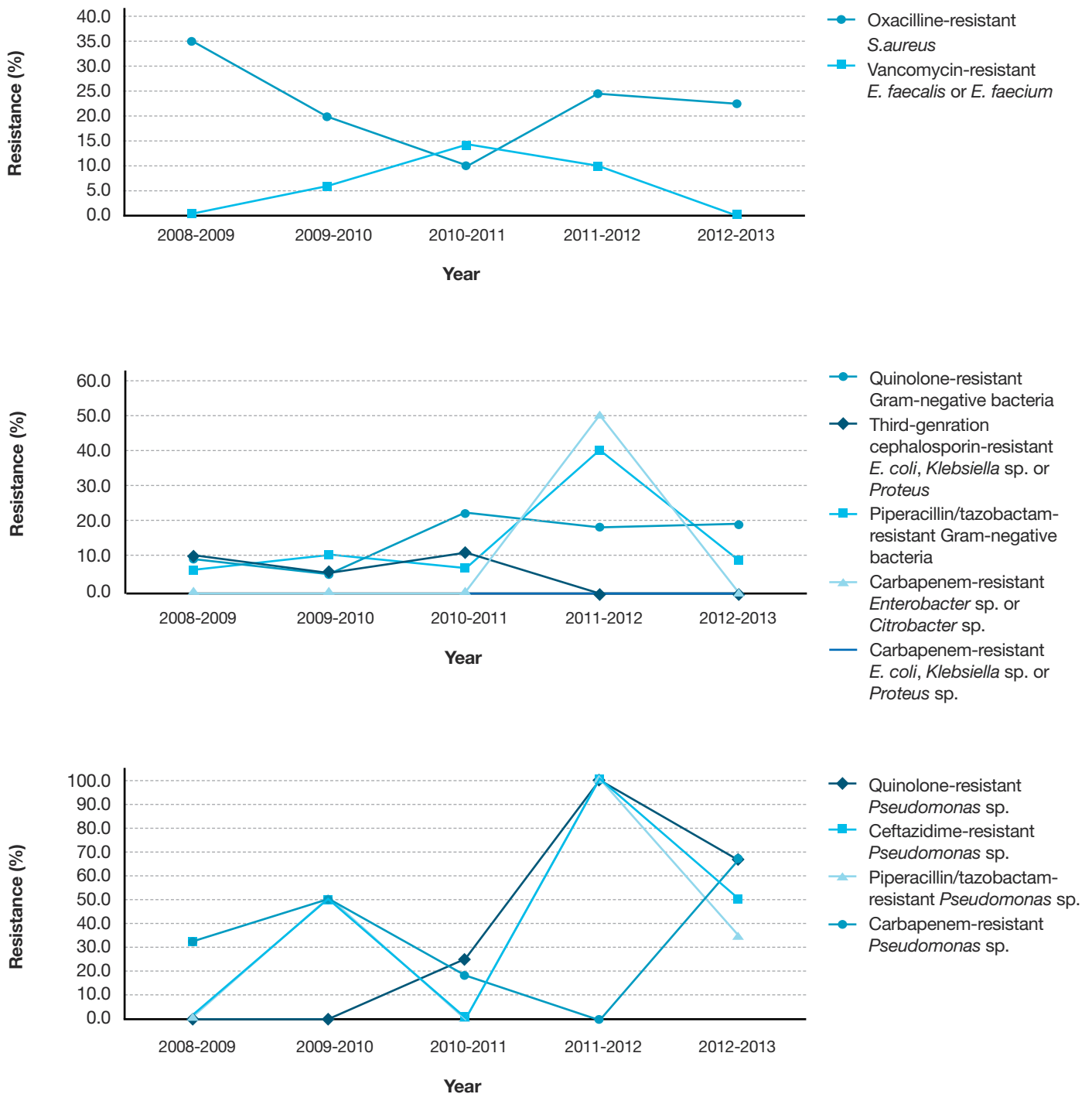
Fluoroquinolones 3: ciprofloxacin, levofloxacin or moxifloxacin;

Multiresistant 1: intermediate or resistant to an agent in three of the following five categories: cephalosporins 4, fluoroquinolones 3, aminoglycosides, carbapenems, piperacillin or piperacillin/tazobactam.

Multiresistant 2: intermediate or resistant to an agent in three of the following five categories: cephalosporins 2, fluoroquinolones 2, aminoglycosides, carbapenems, piperacillin or piperacillin/tazobactam.

Multiresistant 3: intermediate or resistant to an agent in three of the following six categories: cephalosporins 2, fluoroquinolones 2, aminoglycosides, carbapenems, piperacillin or piperacillin/tazobactam, ampicillin/sulbactam.

FIGURE 6 Antibiotic Resistance in Gram-Positive Bacteria, Gram-Negative Bacteria and *Pseudomonas* sp., Québec, 2008–2009 to 2012–2013 (%)



Results per ICU

In 2012–2013, all participating coronary and adult teaching ICUs remained below the 90th percentile compared to 2008–2009 to 2011–2012 rates, which suggests that CLABSI rates have decreased (Figures 7 and 8). The proportion of adult non-teaching and neonatal ICUs above the 90th percentile compared to previous years is roughly 10% (12% and 14%), which is expected (Figures 9 and 11). On the other hand, two of the four pediatric ICUs ranked above the 90th percentile for category, which is higher than anticipated. However, these percentile rankings may be unstable due to the very small number of pediatric ICUs (Figure 10). Tables 6 and 7 present the numerical values that correspond to rates displayed in Figures 7 through 11. Tables 8 and 9 show catheter utilization rates for each ICU.

FIGURE 7 CLABSI Incidence Rate per ICU (2012–2013) and Percentile Ranking (2008–2009 to 2011–2012), Coronary ICUs, Québec, 2012–2013 (Incidence Rate per 1,000 Central-Line Days)

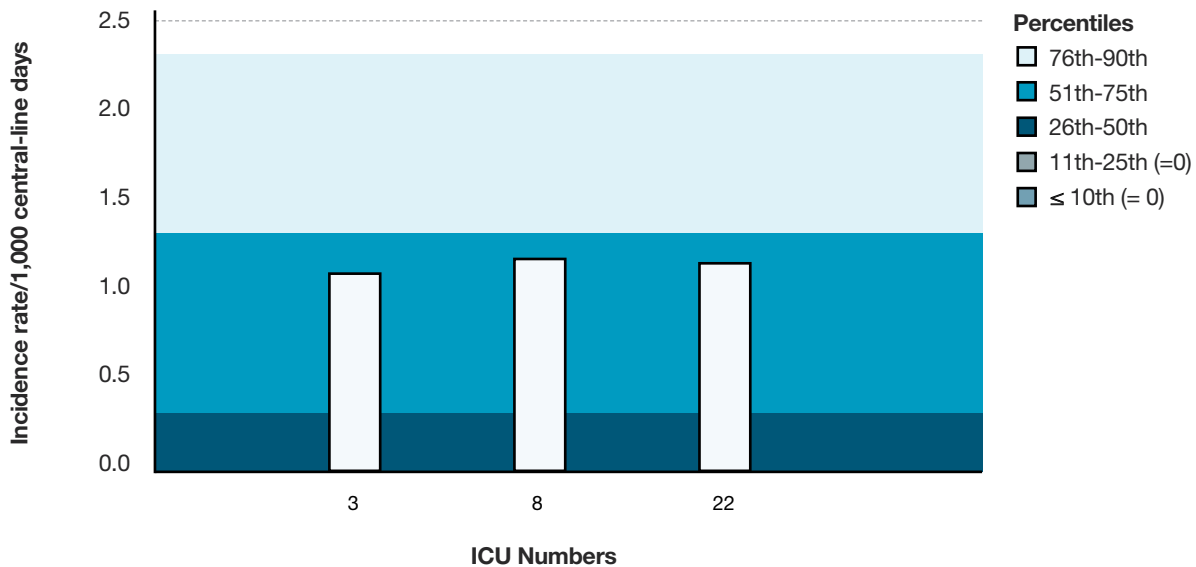


FIGURE 8 CLABSI Incidence Rate per ICU (2012–2013) and Percentile Ranking (2008–2009 to 2011–2012), University Adult ICUs, Québec, 2012–2013 (Incidence Rate per 1,000 Central-Line Days)

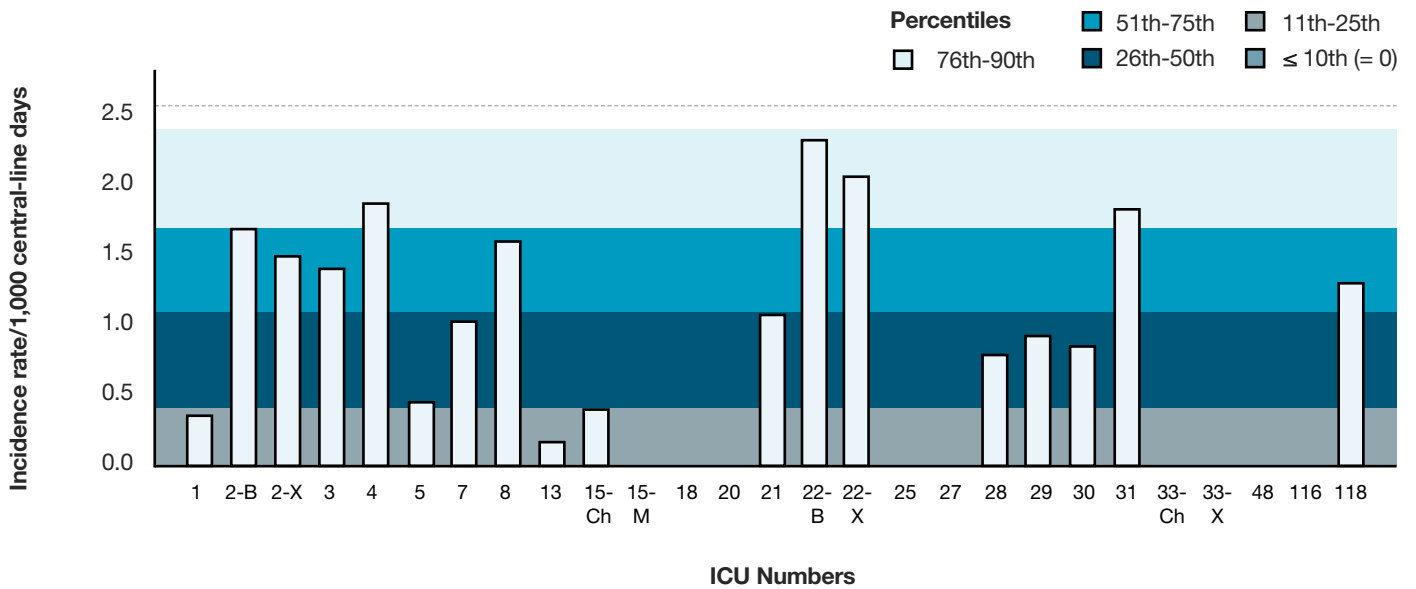


FIGURE 9 CLABSI Incidence Rate per ICU (2012–2013) and Percentile Ranking (2008–2009 to 2011–2012), Non-University Adult ICUs, Québec, 2012–2013 (Incidence Rate per 1,000 Central-Line Days)

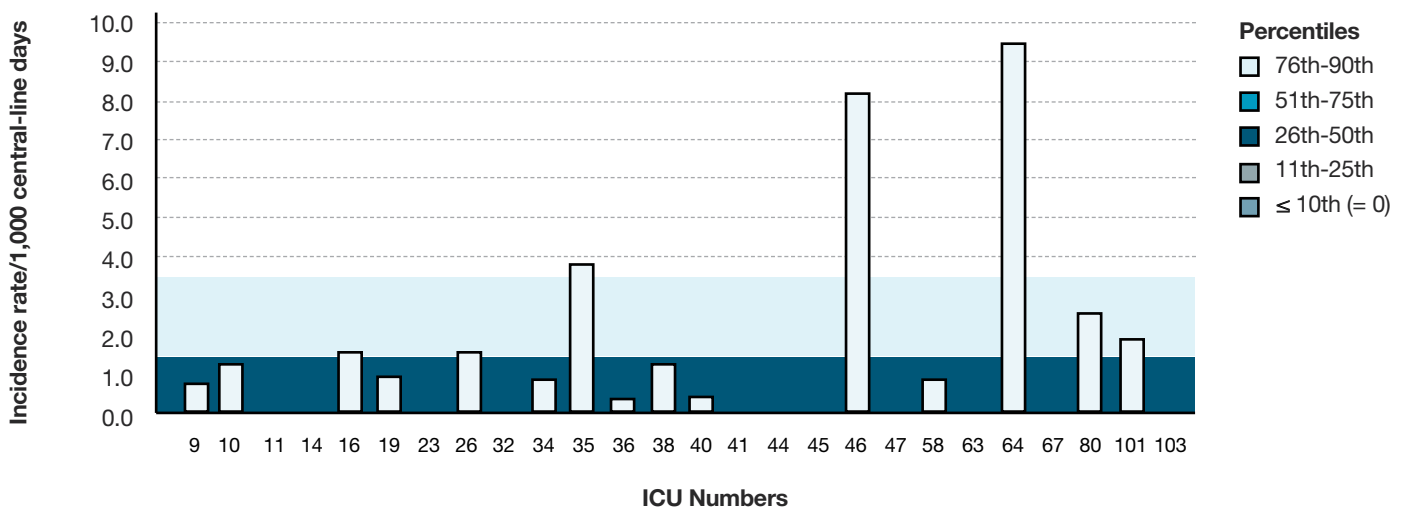


FIGURE 10 CLABSI Incidence Rate (2012–2013) and Percentile Ranking (2008–2009 to 2011–2012) per ICU, Pediatric ICUs, Québec, 2012–2013 (Incidence Rate per 1,000 Central-Line Days)

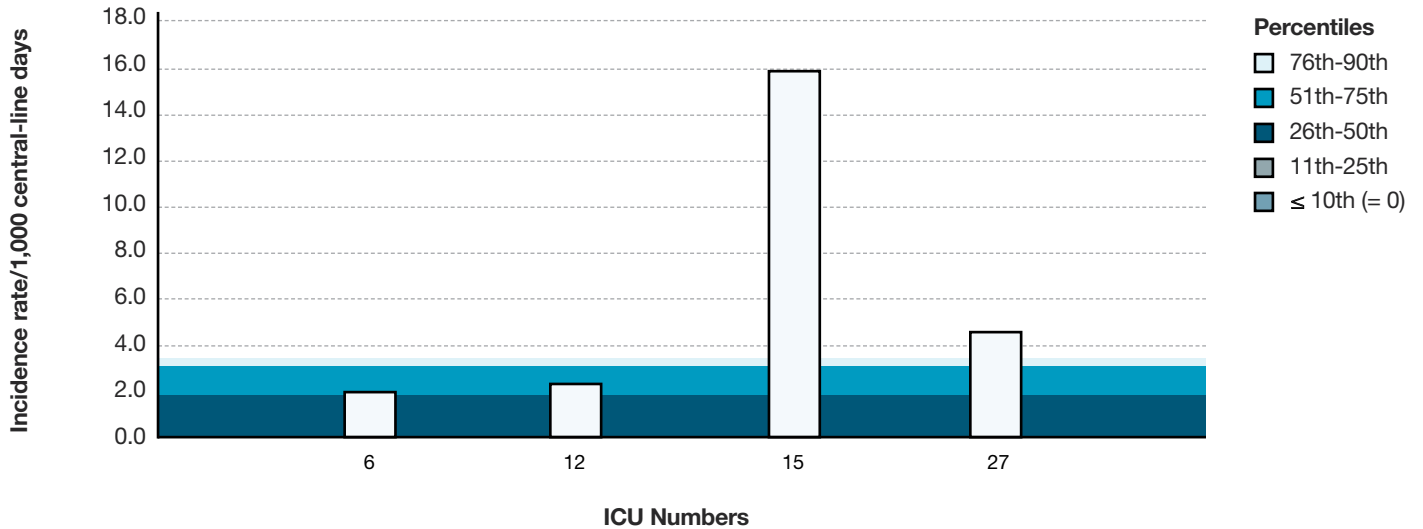
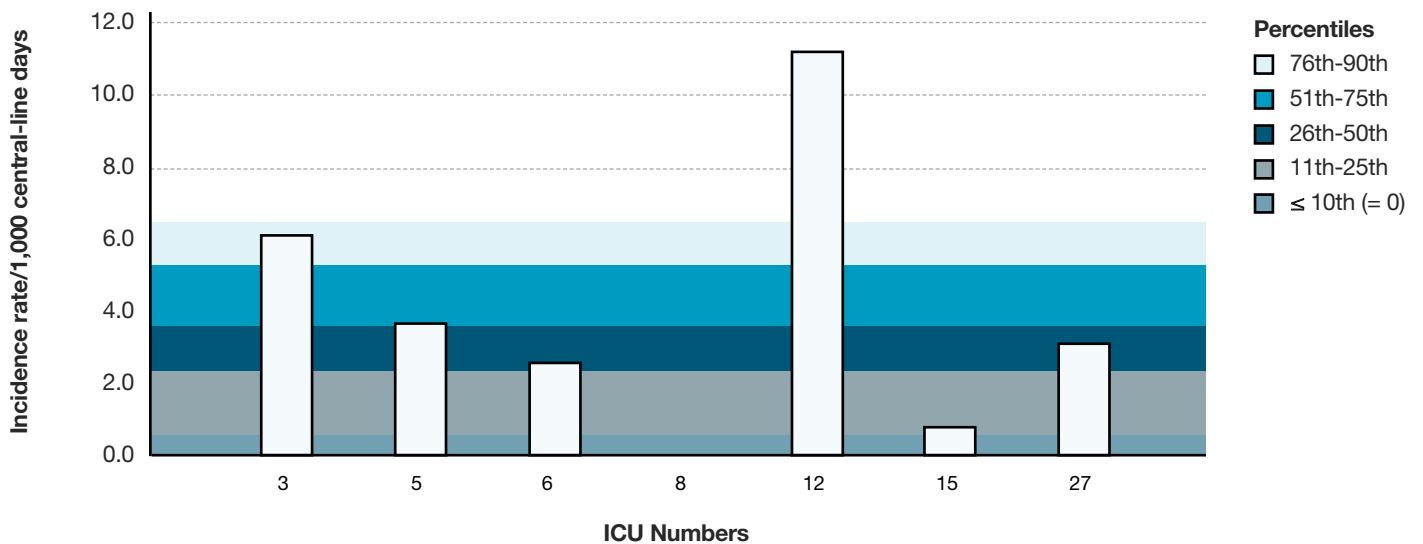


FIGURE 11 CLABSI Incidence Rate (2012–2013) and Percentile Ranking (2008–2009 to 2011–2012), per ICU, Neonatal ICUs, Québec, 2012–2013 (Incidence Rate per 1,000 Central-Line Days)



NB for Figures 7 to 11: In healthcare facilities with more than one type of ICU: S = surgical, M = medical, X = mixed and B = burn trauma.

TABLE 6 CLABSI Incidence Rate per ICU, Distribution of CLABSI rates for 2008–2012 and the Ministry's Strategic Planning Threshold, by ICU Types, for Teaching Healthcare Facilities, Québec, 2012–2013 (Incidence Rate per 1,000 Central-Line Days)

Facility		Adult, teaching*	Coronary	Pediatric	Neonatal
1	HÔPITAL CHARLES-LEMOYNE	0.36			
2	HÔPITAL DE L'ENFANT-JÉSUS	1.47 (X)			
2	HÔPITAL DE L'ENFANT-JÉSUS	1.65 (B)			
3	HÔPITAL ROYAL VICTORIA	1.39	1.09		6.20
4	HÔPITAL NOTRE-DAME DU CHUM	1.85			
5	HÔPITAL GÉNÉRAL JUIF	0.43			3.68
6	HÔPITAL DE MONTRÉAL POUR ENFANTS			2.16	2.65
7	PAVILLON HÔTEL-DIEU DE QUÉBEC	1.03			
8	PAV. MAISONNEUVE / PAV. MARCEL-LAMOUREUX	1.56	1.17		0.00
12	CENTRE HOSPITALIER UNIVERSITAIRE SAINTE-JUSTINE			2.32	11.31
13	INSTITUT DE CARDIOLOGIE DE MONTRÉAL	0.18			
15	HÔPITAL FLEURIMONT	0.41 (S)		15.75	0.76
15	HÔPITAL FLEURIMONT	0.00 (M)			
18	HÔTEL-DIEU DE LÉVIS	0.00			
20	HÔPITAL DE CHICOUTIMI	0.00			
21	HÔPITAL SAINT-LUC DU CHUM	1.07			
22	HÔTEL-DIEU DU CHUM	2.27 (X)	1.14		
22	HÔTEL-DIEU DU CHUM	2.03 (B)			
25	HÔPITAL DU SACRÉ-CŒUR DE MONTRÉAL	0.00			
27	PAVILLON CENTRE HOSPITALIER DE L'UNIVERSITÉ LAVAL	0.00		4.63	3.16
28	PAVILLON SAINT-FRANÇOIS D'ASSISE	0.78			
29	HÔPITAL GÉNÉRAL DE MONTRÉAL	0.93			
30	HÔTEL-DIEU DE SHERBROOKE	0.85			
31	PAVILLON SAINT-JOSEPH	1.79			
33	INSTITUT UNIVERSITAIRE DE CARDIOLOGIE ET DE PNEUMOLOGIE DE QUÉBEC	0.00 (S)			
33	INSTITUT UNIVERSITAIRE DE CARDIOLOGIE ET DE PNEUMOLOGIE DE QUÉBEC	0.00 (X)			
48	CENTRE HOSPITALIER DE ST. MARY	0.00			
116	INSTITUT THORACIQUE DE MONTRÉAL	0.00			
118	HÔPITAL NEUROLOGIQUE DE MONTRÉAL	1.28			
2008-2012 percentile ranking	10th	0.00	0.00	0.00	0.57
	25th	0.40	0.00	0.00	2.33
	50th	1.08	0.00	1.86	3.60
	75th	1.66	1.55	3.06	5.30
	90th	2.34	3.32	3.28	6.49
Strategic planning threshold**		3.15	–	3.32	6.62

* In healthcare facilities with more than one type of adult ICU: S = surgical, M = medical, X = mixed and B = burn trauma.

** This threshold represents the 90th percentile for 2007–2009 rates.

TABLE 7 CLABSI Incidence Rate per ICU, Distribution of CLABSI rates for 2008–2012 and the Ministry’s Strategic Planning Threshold, by ICU Types, for Non-teaching Healthcare Facilities, Québec, 2012–2013 (Incidence Rate per 1,000 Central-Line Days)

Facility		Adult, Non-teaching
9	HÔPITAL DU HAUT-RICHELIEU	0.80
10	HÔPITAL PIERRE-BOUCHER	1.30
11	HÔPITAL PIERRE-LE GARDEUR	0.00
14	CENTRE HOSPITALIER RÉGIONAL DE LANAUDIÈRE	0.00
16	HÔPITAL RÉGIONAL DE RIMOUSKI	1.59
19	HÔPITAL CITÉ DE LA SANTÉ	0.91
23	HÔTEL-DIEU D'ARTHABASKA	0.00
26	HÔPITAL DE VERDUN	1.53
32	CENTRE HOSPITALIER RÉGIONAL DU GRAND-PORTAGE	0.00
34	HÔPITAL SANTA CABRINI	0.83
35	HÔPITAL HONORÉ-MERCIER	3.83
36	HÔPITAL GÉNÉRAL DU LAKESHORE	0.43
38	HÔPITAL JEAN-TALON	1.29
40	HÔPITAL DE HULL	0.39
41	HÔPITAL DU CENTRE-DE-LA-MAURICIE	0.00
44	HÔPITAL SAINTE-CROIX	0.00
45	HÔPITAL DE SAINT-EUSTACHE	0.00
46	HÔPITAL DE GRANBY	8.22
47	HÔPITAL DE ROUYN-NORANDA	0.00
58	HÔPITAL DU SURÔIT	0.86
63	HÔPITAL DE SAINT-GEORGES	0.00
64	HÔPITAL LE ROYER	9.48
67	HÔPITAL ET CENTRE DE RÉADAPTATION DE JONQUIÈRE	0.00
80	HÔPITAL FLEURY	2.59
101	HÔPITAL RÉGIONAL DE SAINT-JÉRÔME	1.86
103	HÔPITAL LAURENTIEN	0.00
2008-2012	10th	0.00
percentile ranking	25th	0.00
	50th	0.00
	75th	1.41
	90th	3.47
Strategic planning threshold*		3.30

*This threshold represents the 90th percentile for 2007–2009 rates.

TABLE 8 Catheter Utilization Ratio per ICU, Distribution of Ratios for 2008–2012, by ICU Types, for Teaching Healthcare Facilities, Québec, 2012–2013

Facility		Adult, teaching*	Coronary	Pediatric	Neonatal
1	HÔPITAL CHARLES-LEMOYNE	0.54			
2	HÔPITAL DE L'ENFANT-JÉSUS	0.49 (X)			
2	HÔPITAL DE L'ENFANT-JÉSUS	0.35 (B)			
3	HÔPITAL ROYAL VICTORIA	0.87	0.14		0.25
4	HÔPITAL NOTRE-DAME DU CHUM	0.84			
5	HÔPITAL GÉNÉRAL JUIF	0.75			0.24
6	HÔPITAL DE MONTRÉAL POUR ENFANTS			0.58	0.41
7	PAVILLON L'HÔTEL-DIEU DE QUÉBEC	0.66			
8	PAV. MAISONNEUVE / PAV. MARCEL-LAMOUREUX	0.52	0.27		0.01
12	CENTRE HOSPITALIER UNIVERSITAIRE SAINTE-JUSTINE			0.74	0.18
13	INSTITUT DE CARDIOLOGIE DE MONTRÉAL	1.00			
15	HÔPITAL FLEURIMONT	0.59 (S)		0.16	0.22
15	HÔPITAL FLEURIMONT	0.35 (M)			
18	HÔTEL-DIEU DE LÉVIS	0.28			
20	HÔPITAL DE CHICOUTIMI	0.66			
21	HÔPITAL SAINT-LUC DU CHUM	0.82			
22	HÔTEL-DIEU DU CHUM	0.98 (X)	0.38		
22	HÔTEL-DIEU DU CHUM	0.58 (B)			
25	HÔPITAL DU SACRÉ-CŒUR DE MONTRÉAL	0.64			
27	PAVILLON CENTRE HOSPITALIER DE L'UNIVERSITÉ LAVAL	0.25		0.46	0.12
28	PAVILLON SAINT-FRANÇOIS D'ASSISE	0.33			
29	HÔPITAL GÉNÉRAL DE MONTRÉAL	0.78			
30	HÔTEL-DIEU DE SHERBROOKE	0.31			
31	PAVILLON SAINT-JOSEPH	0.54			
33	INSTITUT UNIVERSITAIRE DE CARDIOLOGIE ET DE PNEUMOLOGIE DE QUÉBEC	0.99 (S)			
33	INSTITUT UNIVERSITAIRE DE CARDIOLOGIE ET DE PNEUMOLOGIE DE QUÉBEC	0.37 (X)			
48	CENTRE HOSPITALIER DE ST. MARY	0.46			
116	INSTITUT THORACIQUE DE MONTRÉAL	0.51			
118	HÔPITAL NEUROLOGIQUE DE MONTRÉAL	0.22			
<hr/>					
2008-2012	10th	0.30	0.19	0.21	0.04
percentile ranking	25th	0.44	0.21	0.31	0.14
	50th	0.64	0.25	0.47	0.19
	75th	0.83	0.32	0.64	0.30
	90th	0.97	0.41	0.75	0.51

* In healthcare facilities with more than one type of adult ICU: S = surgical, M = medical, X = mixed and B = burn trauma.

TABLE 9 Catheter Utilization Ratio per ICU, Breakdown for 2008–2012, by ICU Types, for Non-teaching Healthcare Facilities, Québec, 2012–2013

Facility		Adult, non-teaching	
9	HÔPITAL DU HAUT-RICHELIEU	0.31	
10	HÔPITAL PIERRE-BOUCHER	0.22	
11	HÔPITAL PIERRE-LE GARDEUR	0.59	
14	CENTRE HOSPITALIER RÉGIONAL DE LANAUDIÈRE	0.29	
16	HÔPITAL RÉGIONAL DE RIMOUSKI	0.22	
19	HÔPITAL CITÉ DE LA SANTÉ	0.42	
23	HÔTEL-DIEU D'ARTHABASKA	0.11	
26	HÔPITAL DE VERDUN	0.55	
32	CENTRE HOSPITALIER RÉGIONAL DU GRAND-PORTAGE	0.37	
34	HÔPITAL SANTA CABRINI	0.38	
35	HÔPITAL HONORÉ-MERCIER	0.47	
36	HÔPITAL GÉNÉRAL DU LAKESHORE	0.64	
38	HÔPITAL JEAN-TALON	0.40	
40	HÔPITAL DE HULL	0.73	
41	HÔPITAL DU CENTRE-DE-LA-MAURICIE	0.15	
44	HÔPITAL SAINTE-CROIX	0.13	
45	HÔPITAL DE SAINT-EUSTACHE	0.26	
46	HÔPITAL DE GRANBY	0.16	
47	HÔPITAL DE ROUYN-NORANDA	0.13	
58	HÔPITAL DU SURÔIT	0.40	
63	HÔPITAL DE SAINT-GEORGES	0.12	
64	HÔPITAL LE ROYER	0.19	
67	HÔPITAL ET CENTRE DE RÉADAPTATION DE JONQUIÈRE	0.22	
80	HÔPITAL FLEURY	0.47	
101	HÔPITAL RÉGIONAL DE SAINT-JÉRÔME	0.67	
103	HÔPITAL LAURENTIEN	0.17	
2008-2012		10th	0.12
percentile ranking		25th	0.17
		50th	0.29
		75th	0.42
		90th	0.59



Central Line–Associated Bloodstream Infections in Intensive Care Units in Québec, Surveillance Results 2012–2013

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