



Carbapenemases producer Gram negative bacilli infections Surveillance results: 2014-2015

From April 1, 2014, to March 31, 2015, 67 healthcare facilities (participation rate: 75.2%) took part in the surveillance of carbapenemase-producing Gram negative bacilli (CPGNB) infections, for a total of 3,225,934 patient-days (Table 1).

In total, 9 CPGNB infections were reported among patients who acquired their strain during a current or previous hospital stay in the reporting facility (categories 1a + 1b). The incidence rate of healthcare-associated CPGNB infection (cat. 1a + 1b) was 0.028 / 10,000 patient days. The acquisition rate of healthcare-associated CPGNB colonization (cat. 1a + 1b) was 0.16 / 10,000 patient days. Data was extracted on May 20th, 2015 and updated on June 1, 2015 for complications.

Table 1 - Participation of Healthcare Facilities in the Surveillance of CPGNB Infections, Québec, 2014-2015

	2014-2015
Participating facilities (N)	67
Admissions (N)	432,363
Inpatient-days (N)	3,225,934
Cases of healthcare-associated CPGNB infection (cat. 1a + 1b) (N)	9
Cases of healthcare-associated CPGNB colonization (cat. 1a + 1b) (N)	52
Infected patients (N)	8

Open all

Incidence rate

In 2014–2015, the incidence rate of healthcare-associated CPGNB infection (cat. 1a + 1b) was 0.028/10,000 patient-days (table 2).

Teaching healthcare facilities have a higher incidence rate of healthcare-associated CPGNB infection than non teaching facilities (table 2).

Table 2 - Incidence Rate and Percentile Distribution of Healthcare-Associated CPGNB Infection (Cat. 1a + 1b) by Type of Healthcare Facility, Québec, 2014-2015 (Incidence Rate per 10,000 Patient-Days [95% CI])

Type of Facility	Min.	25 %	50 %	75 %	90 %	Max.	Incidence Rate
Non-teaching (N = 45)	0.057	0.057	0.057	0.057	0.057	0.057	0.007 [0-0.027]
Teaching (N = 22)	0.069	0.091	0.122	0.236	0.558	0.558	0.046 [0.020-0.083]*
Total (N = 67)	0.057	0.069	0.119	0.236	0.558	0.558	0.028 [0.013-0.049]

[I.C. 95 %] : 95% confidence interval.

* Significant statistical difference ($p < 0.05$) between non-teaching and teaching healthcare facilities.

Description of cases

In total, 67 colonizations (including 14 infections) of CPGNB were reported: 54 (80.6%) were identified in patients who acquired their CPGNB during a current hospital stay (9 infections and 51 colonizations), during a previous hospital stay (1 colonization) or in ambulatory care of the reporting facility (1 infection and 2 colonizations) (cat. 1a, 1b and 1c.). A total of 13 colonizations were associated to another facility (2 infections and 6 colonizations), to the community (2 colonizations) or remained unknown (2 infections and 5 colonizations) (cat. 2, 3 and 4) (table 3).

Table 3 - Cases of CPGNB Infections and Colonizations by Presumed Source of Acquisition, Québec, 2014-2015 (N, %)

Category	Source of Acquisition	Infection	Colonization*
1a	Healthcare-associated with a current hospital stay in the reporting facility	9 (64.3 %)	51 (76.1 %)
1b	Healthcare-associated with a previous hospital stay in the reporting facility	0 (0 %)	1 (1.5 %)
1c	Healthcare-associated with ambulatory care in the reporting facility	1 (7.1 %)	2 (3 %)
1d	Healthcare-associated with long-term unit in the reporting facility	0 (0 %)	0 (0 %)
1e	Healthcare-associated with psychiatry unit in the reporting facility	0 (0 %)	0 (0 %)
2	Healthcare-associated with another facility	2 (14.3 %)	6 (9 %)
3	Community	0 (0 %)	2 (3 %)
4	Unknown	2 (14.3 %)	5 (7.5 %)
	Total	14	67

* Colonizations included infections.

In 2014-2015, among 14 infections, no primary bloodstream infection (BSI) was observed. However, two secondary bloodstream infections have been reported (Table 4).

Table 4 - Number of Cases of CPGNB Infections from All Sources by Type of Infection and Number of Complications (Secondary BSIs), Québec, 2014-2015 (N = 14)

Type of Infection	Infections (N)	Secondary Bloodstream Infections (N)
Primary BSI		
CRBSI-MBI	0	-
CRBSI	0	-
Non- CRBSI-MBI	0	-
Non-CRBSI	0	-
HD	0	-
Others		
Surgical site	5	0
Urinary tract	3	0
Abdominal	3	1

Pulmonary	2	1
Skin and soft tissue	1	0
Bones and joints	0	0
Others	0	0
Total	14	2

BSI : bloodstream infection

CRBSI : catheter-related bloodstream infection

MBI : mucosal barrier injury

Non-CRBSI : non-catheter-related primary bloodstream infection

HD: hemodialysis

A total of 5 deaths within 30 days were observed, yielding an all cause case-fatality of 35.7% (Table 5).

Table 5 - Number of Deaths and 30-days all cause case-fatality in Patients Infected by a CPGNB, Québec, 2014-2015

2014-2015	
CPGNB infections (all sources)	14
Number of deaths	5
All cause case-fatality	35.7 %

Table 6 - Risk Factors Associated With CPGNB colonization, Québec, 2014-2015

Risk Factors	New carrier			
	No contact with a known carrier N = 42	Contact with a known carrier N = 9	Known carrier N = 3	Undefined carrier N = 13
Contact with known carrier	-	9	-	7
Healthcare abroad	3	-	-	2
Travel abroad in the last 12 months	8	-	-	-
Other risks				
Carba-3GC*-Fluo	3	1	-	4
No Carba-3GC-Fluo	7	1	-	-
Diabetes	4	-	-	2
Acute renal failure	2	-	1	-
Chronic renal failure	-	-	1	2
Non hematologic active neoplasia	13	2	1	-

Solid organ transplant 3 - - -

* 3GC: 3rd generation cephalosporin.

Carba-3GC-Fluo: Taking a carbapenem / 3rd generation cephalosporin / fluoroquinolone in the last two weeks prior to diagnosis.

Carba-3GC-Fluo: Taking a carbapenem / 3rd generation cephalosporin / fluoroquinolone in the last two weeks prior to diagnosis.

Colonization Screening Protocol

In 2014-2015, the acquisition rate of healthcare-associated CPGNB colonization (cat. 1a + 1b) was 0.16 / 10,000 patient days (table 7).

Table 7 - Change in the Number of Cases and Acquisition Rate of Healthcare-associated CPGNB Colonization (Cat. 1a + 1b) by Type of Healthcare Facility, Québec, 2014-2015 (Acquisition Rate of Healthcare-Associated CPGNB Colonization per 10,000 patient-days)

Type of Facility	2014-2015	
	Number of Colonization	Acquisition Rate of HA-CPGNB Colonization
Non-teaching (N = 45)	33	0.22 [0.15-0.31]
Teaching (N = 22)	19	0.11 [0.07-0.16]
Total (N = 67)	52	0.16 [0.12-0.21]

Table 8 shows the number of non-teaching facilities that identified the type of screening used at admission (29 out of 45) and during hospitalization (26 out of 45). About two-thirds of teaching facilities identified the type of screening used at admission (16 out of 22) and during hospitalization (16 out of 22).

Table 8 - Number of Healthcare Facilities that Identified the type of Screening Procedure Used at Admission and During Hospitalization by Type of Facility, Québec, 2014-2015

Type of Facility	Number of Facilities That Identified the Type of Screening Procedure Used*		
	At admission	During Hospitalization	Total
Non-teaching (N = 45)	29	26	33
Teaching (N = 22)	16	16	17
Total (N = 67)	45	42	50

* The "at admission" and "during hospitalization" categories are not mutually exclusives.

Tables 9 and 10 feature the total number of screening tests performed at admission and during hospitalization, as well as the mean number of CPGNB screening tests per admission.

Table 9 - Total Number of Screening Tests Performed at Admission and During Hospitalization by Type of Healthcare Facility, Québec, 2014-2015

Type of Facility	Total Number of Screening Tests			Total
	At admission	During Hospitalization	Unspecified	
Non-teaching	2,619	8,102	795	11,516
Teaching	10,686	17,417	29	28,132
Total	13,305	25,519	824	39,648

Table 10 - Mean Number of CPGNB Screening Tests by Type of Healthcare Facility, Québec, 2014-2015 (Mean CPGNB Screening Tests per Admission)

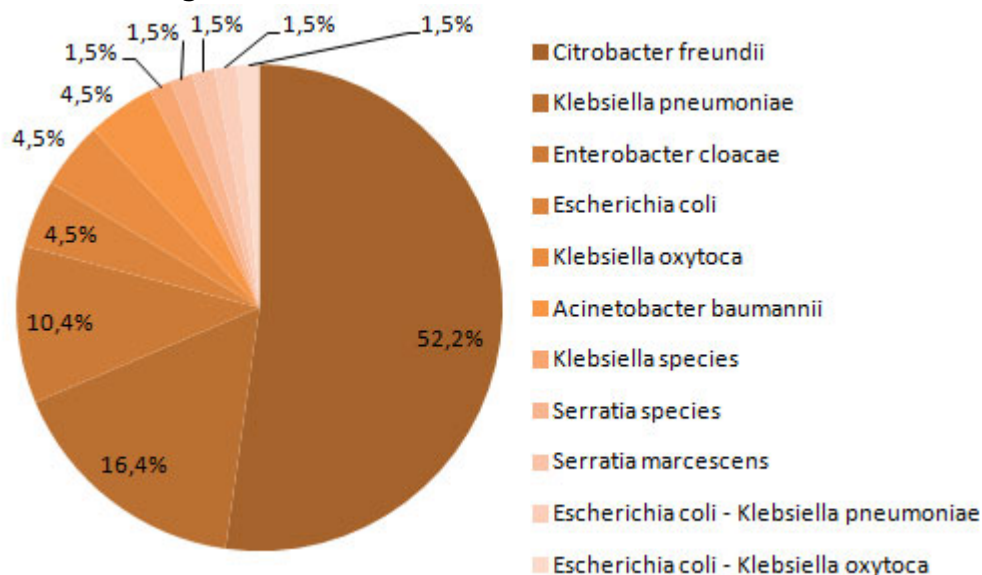
Type of Facility	Mean Number of CPGNB Screening Tests		
	At admission	During Hospitalization	Total (N)
Non-teaching	0.013	0.040	0.057
Teaching	0.046	0.075	0.121
Total	0.031	0.059	0.092

Microbiology

Figure 1 features the distribution of microorganisms isolated from all cases. A total of 35 colonizations were due to *Citrobacter freundii* (52 %), 11 colonizations were due to *Klebsiella pneumoniae* (16 %) and 7 were due to *Enterobacter cloacae* (10 %). Most deaths occurred in patients with KPC-producing *Klebsiella pneumoniae* (n = 5; 62.5%). All 8 deaths occurred in patients with KPC-producing microorganisms.

Figure 1 - Categories of Isolated Microorganisms for all Cases (n = 67) and for Deaths at 30 days (N = 8), Québec, 2014-2015

Isolated Microorganisms - All Cases



Isolated Microorganisms - Deaths at 30 Days (N = 8)

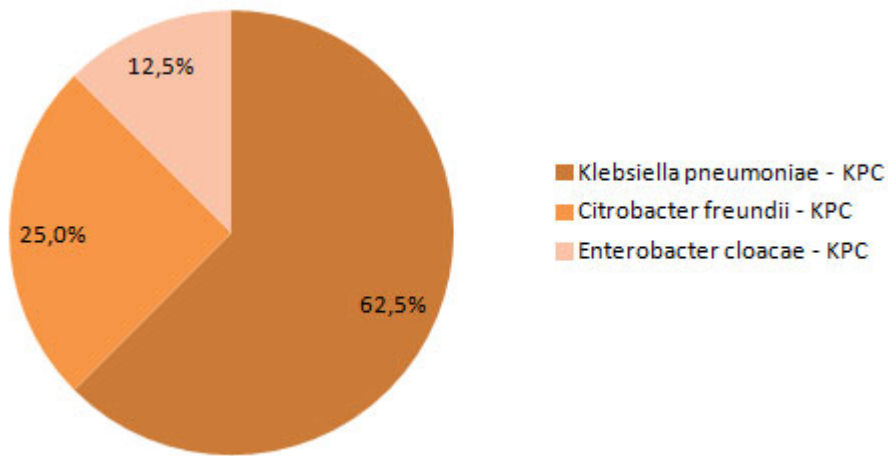


Table 11 presents the resistance profile as reported by the healthcare facilities towards carbapenems of all reported microorganisms (colonization and infection). All the *E. coli*, *K. oxytoca*, *S. marcescens* and *Serratia* spp. were ertapenem resistant (100%). All the *A. baumannii*, *E. cloacae*, *E. coli*, *K. oxytoca*, *Klebsiella* spp, and *Serratia* spp. were meropenem resistant (100%).

Table 11 - Resistance Profile Towards Carbapenem of CPGNB Microorganisms isolated, Québec, 2014-2015

Microorganism	N	Antibiotics	Resistants	
			N	%
<i>Acinetobacter baumannii</i>	3	Doripenem	2	66.7
		Imipenem	3	100.0
		Meropenem	3	100.0
<i>Citrobacter freundii</i>	35	Ertapenem	32	91.4
		Imipenem	12	34.3
		Meropenem	28	80.0
<i>Enterobacter cloacae</i>	7	Ertapenem	4	57.1
		Imipenem	6	85.7
		Meropenem	7	100.0
<i>Escherichia coli</i>	5	Ertapenem	5	100.0
		Imipenem	4	80.0
		Meropenem	5	100.0
<i>Klebsiella oxytoca</i>	4	Ertapenem	4	100.0
		Imipenem	2	50.0
		Meropenem	4	100.0
<i>Klebsiella pneumoniae</i>	12	Ertapenem	11	91.7
		Imipenem	9	75.0

		Meropenem	11	91.7
<i>Klebsiella</i> spp.	1	Ertapenem	1	100.0
		Meropenem	1	100.0
<i>Serratia marcescens</i>	1	Ertapenem	1	100.0
		Imipenem	1	100.0
<i>Serratia</i> spp.	1	Ertapenem	1	100.0
		Imipenem	1	100.0
		Meropenem	1	100.0

Table 12 shows the carbapenemase gene detected for every microorganisms reported during the surveillance period (colonization and infection). Among the 67 cases, one infection was associated with two different CPGNB (1 NDM-producing *Escherichia coli* and 1 OXA-48 producing *Klebsiella pneumoniae*). Also, one patient was colonized by two different CPGNB (1 KPC-producing *Escherichia coli* and 1 KPC-producing *Klebsiella oxytoca*). Finally, one *Klebsiella pneumoniae* strain produced both OXA-48 and NDM.

Table 12 - Distribution of Carbapenemase-encoding Genes from Reported Microorganisms, Québec, 2014-2015

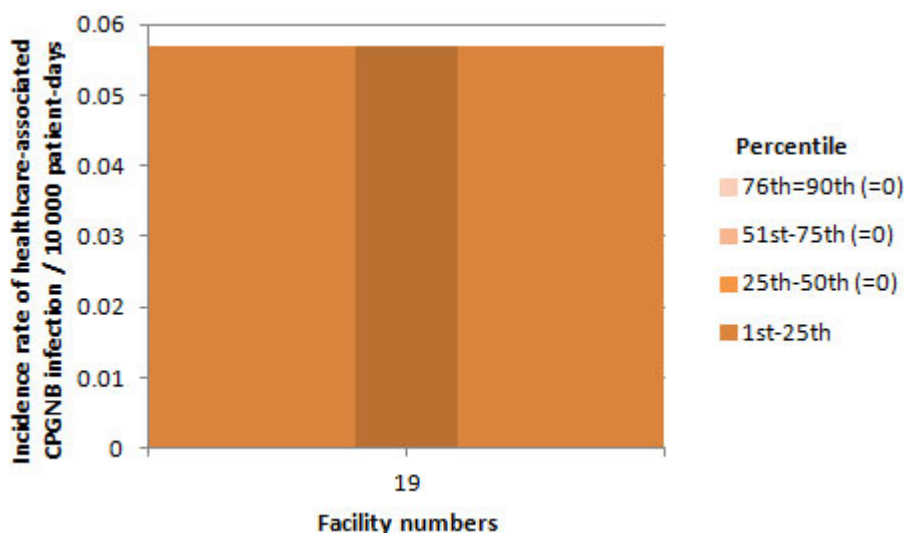
Microorganism	No Isolated	Gene	N	% gene among microorganism
<i>Acinetobacter baumannii</i>	3	OXA-23	3	100.0
<i>Citrobacter freundii</i>	35	KPC	35	100.0
<i>Enterobacter cloacae</i>	7	KPC	6	85.7
		NMC	1	14.3
<i>Escherichia coli</i>	5	KPC	1	20.0
		NDM	3	60.0
		OXA-48	1	20.0
<i>Klebsiella oxytoca</i>	4	KPC	4	100.0
<i>Klebsiella pneumoniae</i>	12	KPC	9	69.2
		OXA-48	1	7.7
		OXA-48/NDM	1	7.7
		VIM	1	7.7
Other <i>Klebsiella</i> spp.	1	OXA-48	1	100.0
<i>Serratia marcescens</i>	1	SME	1	100.0
<i>Serratia</i> spp.	1	SME	1	100.0
Total	69			

KPC: Klebsiella pneumonia carbapenemase (Class A).
 NDM: New-Dehli metallo-β-lactamase (Class B).
 NMC: Not metalloenzyme carbapenemase.
 OXA-23: Oxacillinase-23 (Class D).
 OXA-48: Oxacillinase-48 (Class D).
 SME: Serratia marcescens enzyme.
 VIM: Verona integron-encoded metallo-β-lactamase (Class B).

Data per Facility

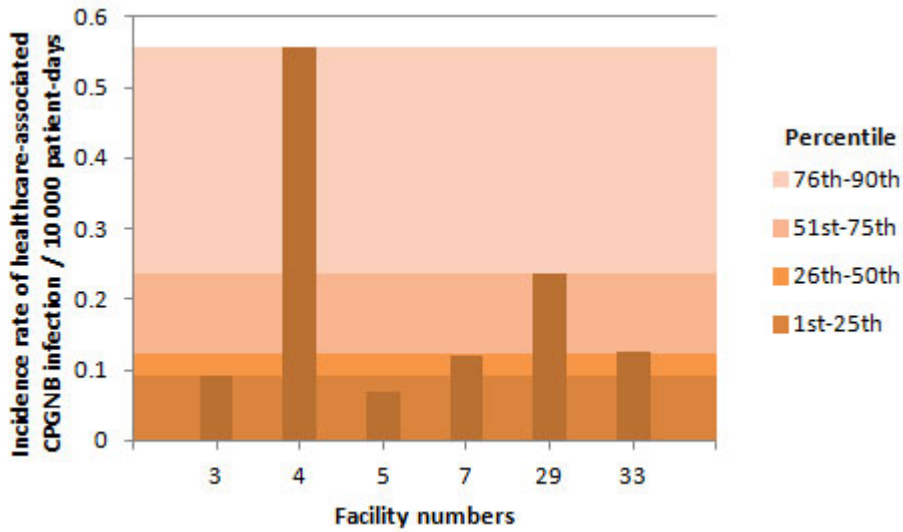
The incidence rate of HA-CPGNB infection and the percentile rankings by type of facility are shown in figure 2 and 3. Figure 4 and 5 present the rate of acquisition of healthcare-associated colonization by type of facility.

Figure 2 - Incidence Rate and Percentile Ranking of Healthcare-Associated CPGNB infection (Cat. 1a + 1b) for Non-Teaching Healthcare Facilities, Québec, 2014-2015 (Incidence Rate per 10,000 Patient-Days)



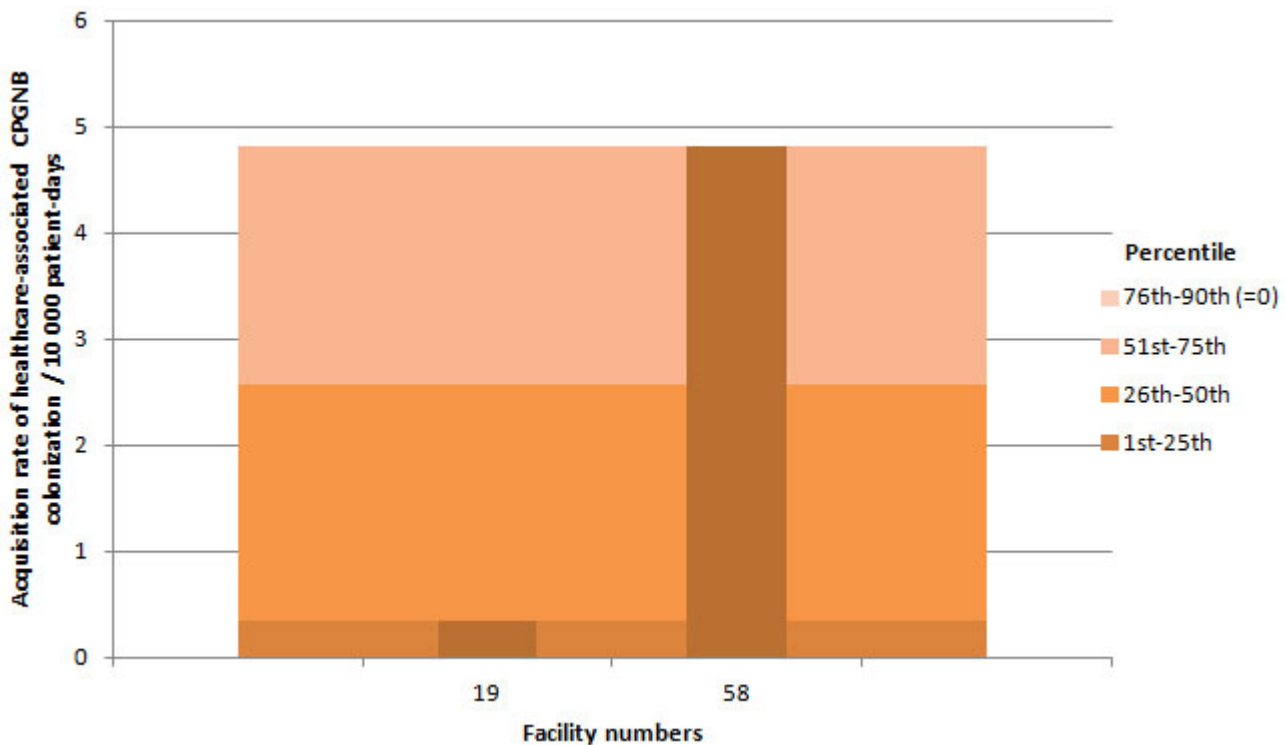
NB: Facilities 9, 11, 16, 23, 26, 32, 34, 35, 36, 37, 40, 42, 45, 46, 47, 49, 52, 53, 56, 58, 61, 63, 64, 65, 67, 71, 74, 75, 77, 81, 82, 83, 84, 85, 88, 89, 91, 97, 100, 103, 107, 109, 113 and 130 did not report any cases of infection in 2014-2015.

Figure 3 - Incidence Rate and Percentile Ranking of Healthcare-Associated CPGNB Infection (Cat. 1a + 1b) for Teaching Healthcare Facilities, Québec, 2014-2015 (Incidence Rate per 10,000 Patient-Days)



NB: Facilities 2, 6, 8, 12, 13, 15, 18, 20, 21, 24, 27, 28, 30, 31, 116 and 118 did not report any cases of infection in 2014-2015.

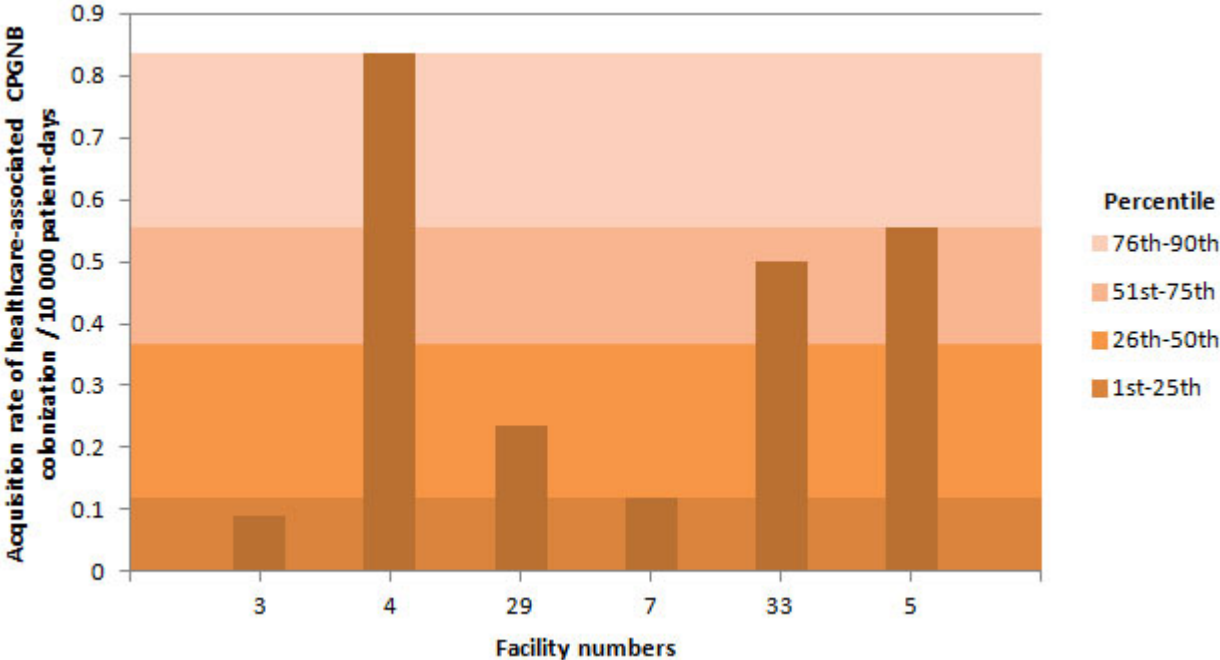
Figure 4 - Acquisition Rate of Healthcare-Associated CPGNB Colonization (Cat.1a + 1b) for Non-Teaching Healthcare Facilities, Québec, 2014-2015 (Acquisition Rate of Healthcare-Associated CPGNB Colonization per 10,000 Patient-Days)



NB: Facilities 9, 11, 16, 23, 26, 32, 34, 35, 36, 37, 40, 42, 45, 46, 47, 49, 52, 53, 56, 61, 63, 64, 65, 67, 71, 74, 75, 77, 81, 82, 83, 84, 85, 88, 89, 91, 97, 100, 103, 107, 109, 113 and 130 did not report any cases of colonization in 2014-2015.

Figure 5 - Acquisition Rate of Healthcare-Associated CPGNB Colonization (Cat.1a + 1b) for

Teaching Healthcare Facilities, Québec, 2014-2015 (Acquisition Rate of Healthcare-Associated CPGNB Colonization per 10,000 Patient-Days)



NB: Facilities 2, 6, 8, 12, 13, 15, 18, 20, 21, 24, 27, 28, 30, 31, 116 et 118 did not report any cases of colonization in 2014-2015.

At the local level, in 2014-2015, the incidence rate of HA-CPGNB infections ranged from 0 to 0.56 / 10,000 patient-days, whereas the acquisition rate of HA-CPGNB colonization ranged from 0 to 4.81 / 10,000 patient-days. A total of 60 facilities (89.6%) did not report any HA-CPGNB infection or colonization in 2014-2015. A detailed summary of the surveillance data for HA-CPGNB infection by healthcare facility can be found in table 13.

Table 13 - Incidence Rate of Healthcare-Associated CPGNB Infection (cat. 1a + 1b), Acquisition Rate of Healthcare-Associated CPGNB Colonization and Mean CPGNB Screening Tests by Admission and by Facility, Québec, 2014-2015 (Incidence Rate per 10,000 Patient-Days [95% CI]; Acquisition Rate of Colonization per 10,000 Patient-Days)

Health Region	Facility		Incidence Rate of HA-CPGNB Infection (cat. 1a + 1b) [95% CI]	Acquisition Rate of HA-CPGNB Colonization (cat. 1a + 1b)	Mean CPGNB Screening Tests per Admission*
	Number	Name			

01	16	HÔPITAL RÉGIONAL DE RIMOUSKI	0	0	0.149
	32	CENTRE HOSPITALIER RÉGIONAL DU GRAND-PORTAGE	0	0	0.016
	61	HÔPITAL NOTRE-DAME-DE-FATIMA	0	0	0.011
	71	HÔPITAL DE MATANE	0	0	0.002
	77	HÔPITAL D'AMQUI	0	0	-
	84	HÔPITAL DE NOTRE-DAME-DU-LAC	0	0	-
		BAS-SAINT-LAURENT	0	0	0.070
02	20	HÔPITAL DE CHICOUTIMI	0	0	0
	67	HÔPITAL ET CENTRE DE RÉADAPTATION DE JONQUIÈRE	0	0	0.137
	74	HÔPITAL DE DOLBEAU-MISTASSINI	0	0	0.002
	88	HÔPITAL, CLSC ET CENTRE D'HÉBERGEMENT DE ROBERVAL	0	0	-
	100	HÔPITAL DE LA BAIE	0	0	-
			SAGUENAY-LAC-SAINT-JEAN	0	0
03	2	HÔPITAL DE L'ENFANT-JÉSUS	0	0	0.066
	7	PAVILLON L'HÔTEL-DIEU DE QUÉBEC	0.12 [0-0.47]	0.12	0.015
	24	HÔPITAL DU SAINT-SACREMENT	0	0	0.021
	27	PAVILLON CENTRE HOSPITALIER DE L'UNIVERSITÉ LAVAL	0	0	0.014
	28	PAVILLON SAINT-FRANÇOIS D'ASSISE	0	0	0.006
	33	INSTITUT UNIVERSITAIRE DE CARDIOLOGIE ET DE PNEUMOLOGIE DE QUÉBEC	0.13 [0-0.49]	0.50	0.184
		CAPITALE-NATIONALE	0.04 [0-0.10]	0.09	0.051
04	23	HÔTEL-DIEU D'ARTHABASKA	0	0	0.007
	31	PAVILLON SAINT-JOSEPH	0	0	0.004
	85	CENTRE DE SANTÉ ET DE SERVICES SOCIAUX DU HAUT-SAINT-AURICE	0	0	-
			MAURICIE ET CENTRE-DU-QUÉBEC	0	0

05	15	HÔPITAL FLEURIMONT	0	0	-
	30	HOTEL-DIEU DE SHERBROOKE	0	0	-
	49	CENTRE DE SANTÉ ET DE SERVICES SOCIAUX MEMPHRÉMAGOG	0	0	-
	75	CENTRE DE SANTÉ ET DE SERVICES SOCIAUX DU GRANIT	0	0	-
		ESTRIE	0	0	0
06	3	HÔPITAL ROYAL VICTORIA	0.09 [0-0.36]	0.09	0.015
	4	HÔPITAL NOTRE-DAME DU CHUM	0.56 [0.05-1.60]	0.84	-
	5	HÔPITAL GÉNÉRAL JUIF	0.07 [0-0.27]	0.56	1.280
	6	L'HÔPITAL DE MONTRÉAL POUR ENFANTS	0	0	0.002
	8	PAVILLON MAISONNEUVE/PAVILLON MARCEL-LAMOUREUX	0	0	0.066
	12	CENTRE HOSPITALIER UNIVERSITAIRE SAINTE-JUSTINE	0	0	-
	13	INSTITUT DE CARDIOLOGIE DE MONTRÉAL	0	0	0.090
	21	HÔPITAL SAINT-LUC DU CHUM	0	0	-
	26	HÔPITAL DE VERDUN	0	0	0.011
	29	HÔPITAL GÉNÉRAL DE MONTRÉAL	0.24 [0.02-0.68]	0.24	0.061
	34	HÔPITAL SANTA CABRINI	0	0	-
	36	HÔPITAL GÉNÉRAL DU LAKESHORE	0	0	0.964
	83	HÔPITAL DE LASALLE	0	0	0.014
	116	INSTITUT THORACIQUE DE MONTRÉAL	0	0	0.024
	118	HÔPITAL NEUROLOGIQUE DE MONTRÉAL	0	0	0.034
	MONTRÉAL	0.07 [0.03-0.14]	0.16	0.257	
07	40	HÔPITAL DE HULL	0	0	0.001
		OUTAOUAIS	0	0	0.001

	47	HÔPITAL DE ROUYN-NORANDA	0	0	0.028
	52	HÔPITAL D'AMOS	0	0	0.001
08	65	HÔPITAL ET CLSC DE VAL-D'OR	0	0	-
	82	PAVILLON SAINTE-FAMILLE	0	0	0.102
		ABITIBI-TÉMISCAMINGUE	0	0	0.019
09	64	HÔPITAL LE ROYER	0	0	0.009
		CÔTE-NORD	0	0	0.009
	53	HÔPITAL DE CHANDLER	0	0	-
	91	HÔPITAL HÔTEL-DIEU DE GASPÉ	0	0	-
	97	HÔPITAL DE MARIA	0	0	0.024
11	107	HÔPITAL DE L'ARCHIPEL	0	0	0.031
	109	HÔPITAL DE SAINTE-ANNE-DES-MONTS	0	0	0.013
		GASPÉSIE-ÎLES-DE-LA-MADELEINE	0	0	0.012
	18	HÔTEL-DIEU DE LÉVIS	0	0	0.009
	63	HÔPITAL DE SAINT-GEORGES	0	0	0.003
12	89	HÔPITAL DE MONTMAGNY	0	0	0.088
	113	HÔPITAL DE THETFORD MINES	0	0	0.013
		CHAUDIÈRE-APPALACHES	0	0	0.017
13	19	HÔPITAL CITÉ DE LA SANTÉ	0.06 [0-0.22]	0.34	0.115
		LAVAL	0.06 [0-0.22]	0.34	0.115
14	11	HÔPITAL PIERRE-LE GARDEUR	0	0	0.020
		LANAUDIÈRE	0	0	0.020
	45	HÔPITAL DE SAINT-EUSTACHE	0	0	0.007
	56	CENTRE DE SANTÉ ET DE SERVICES SOCIAUX D'ARGENTEUIL	0	0	0.043
15	81	HÔPITAL DE MONT-LAURIER	0	0	0.004
	103	HÔPITAL LAURENTIEN	0	0	0.002
		LAURENTIDES	0	0	0.008

	9	HÔPITAL DU HAUT-RICHELIEU	0	0	0
	35	HÔPITAL HONORÉ-MERCIER	0	0	0.027
	37	HÔTEL-DIEU DE SOREL	0	0	0.001
16	42	CENTRE HOSPITALIER ANNA-LABERGE	0	0	0.060
	46	HÔPITAL DE GRANBY	0	0	-
	58	HÔPITAL DU SUROÎT	0	4.81	0.373
	130	HÔPITAL BARRIE MEMORIAL	0	0	0.487
		MONTÉRÉGIE	0	0.70	0.75
	Total	0.03 [0.01-0.05]	0.16	0.092	

* Number of screening test divided by number of admissions.

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