

Antimicrobial Resistance in Common Hospital Pathogens in Ontario: Annual Laboratory and Hospital Survey Report 2019



Annual Report
December 2021

Public Health Ontario

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Background

Antimicrobial resistance poses a serious threat to patient safety and global public health, as current antimicrobials become less effective at treating resistant organisms. Health care-associated infections contribute to increased length of hospitalization, mortality and use of health care resources. In Canada, it is estimated that antimicrobial resistance causes 5,400 deaths and cost the health care system \$1.4 billion in 2018.¹ Patients colonized with antimicrobial resistant organisms (AROs) are a major reservoir for health care-associated pathogens; screening and surveillance programs further our understanding of the burden of AROs and the impact of infection control programs in health care settings.

For nearly 20 years, the Institute for Quality Management in Healthcare (IQMH), formerly Quality Management Program—Laboratory Services (QMP–LS), administered an annual survey on antimicrobial resistance in common hospital pathogens to all licensed Ontario bacteriology laboratories and summarized the data in an annual report. In 2016, Public Health Ontario (PHO) and IQMH established a partnership to conduct an annual survey of AROs across all laboratories and hospitals for surveillance. As part of this collaboration, IQMH resumed laboratory survey administration, while PHO administered the hospital survey on infection control programs. Questions have evolved each year to capture the changing trends in AROs in Ontario.

The 2019 survey was distributed to all licensed microbiology labs and all public hospitals in Ontario. Participants were surveyed on screening and infection control programs, as well as the prevalence of AROs: methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci (VRE), extended spectrum beta-lactamases (ESBLs), carbapenemase-producing organisms (CPOs) and *Clostridioides difficile* infections (CDI; formerly called *Clostridium difficile* infections). New to this survey is the section on *Candida auris* – an emerging multi-drug resistant fungal pathogen in healthcare settings.

The objective of this report is to summarize the findings of the annual survey on antimicrobial resistance of common hospital pathogens from 2019.

Survey Methods

Information from two surveys was collected for this report: a laboratory survey and an infection control survey. The lab survey was distributed by IQMH to all 51 hospital-based laboratories in Ontario, 11 community-based private laboratories, and 11 PHO reference laboratories across the province. All laboratories surveyed were licensed bacteriology laboratories and able to access the survey via the existing IQMH questionnaire platform in QView. The infection control survey was also appended to the laboratory survey for hospital-based laboratories that were able to provide the infection control survey to onsite infection control staff. The laboratory survey included questions on the number of new patients identified with MRSA, VRE, ESBLs, CPO and CDI. New questions on screening for *Candida auris* from clinical isolates and patients were also included in this survey.

Concurrently, PHO distributed the infection control survey to all hospitals in Ontario using the PHO survey tool, Acuity4 Survey by Voxco. This survey invited infection control professionals to answer questions about their screening programs for MRSA, VRE, ESBLs, CPO, CDI and infection control practices. As with the lab survey, questions about *Candida auris* were also added to this survey.

The surveys were made available on February 24, 2020. Due to the pandemic, the survey deadline was extended from March 31, 2020 to June 30, 2020.

Data from both surveys were extracted and linked on unique identifiers. Duplicates and incomplete data entries were also removed. Data from the Canadian Institute for Health Information - Discharge Abstract Database accessed through IntelliHEALTH on July 2, 2021 was used as the denominator data to calculate MRSA, VRE, and CPO rates.² Population Estimates 2018-2019 from Statistics Canada, also accessed through IntelliHEALTH (received April 22, 2021), was used as denominator data for calculating CDI rates.³ Data were analyzed using SAS 9.3 and Microsoft Excel. ArcMap v10.3.1 software was used to generate the maps, displayed by Local Health Integration Network (LHIN; [Appendix B](#)).

Results

Highlights of the surveys' results have been combined and presented in three sections for majority of the organisms: screening, infection control practices and laboratory data. Aggregated responses to the surveys are available upon request.

Survey Response

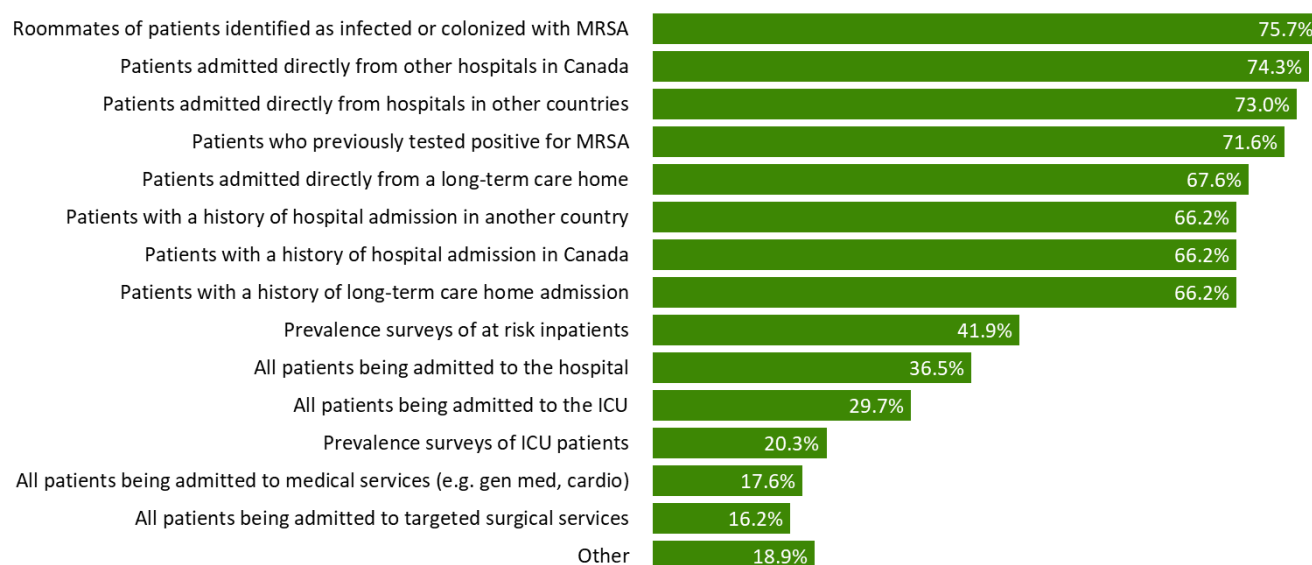
A total of 74/132 (56.1%) hospital corporations responded to the infection control survey questions. Of the currently licensed bacteriology laboratories, 66/73 (90.4%) responded to the survey. This included 44/51 (86.3%) hospital-based laboratories, 11/11 private community-based laboratories and 11/11 PHO laboratory sites.

Methicillin-resistant *Staphylococcus aureus* (MRSA)

Hospital Screening

All 74 hospital corporations responded as having a screening program for MRSA which is consistent with results from 2018. Hospitals were likely to screen patients who were roommates of patients positive for MRSA, patients admitted from other hospitals in Canada or in other countries, and patients previously positive for MRSA (Figure 1).

Figure 1. Criteria used by hospitals for MRSA patient screening, 2019



Infection Control Practices

All hospitals responded that Additional Precautions were used to care for patients with MRSA. Regarding which type of patient with MRSA (i.e., infected, colonized) was placed in Additional Precautions, 73/74 (98.6%) hospitals responded that Additional Precautions were used for all colonized and infected patients and one (1.4%) hospital specified 'other'.

There were 57/73 (78.1%) hospitals that responded Additional Precautions for MRSA may be discontinued once three negative swabs were taken, one week apart. Six (8.2%) hospitals responded that patients with MRSA remain in Additional Precautions for the duration of their hospitalization.

Additionally, 15/74 (20.3%) hospitals responded that decolonization protocols may be applied to patients with MRSA; 51 (68.9%) hospitals responded they do not decolonize patients with MRSA. Seven (9.5%) hospitals decolonize all patients with MRSA, six (8.1%) hospitals decolonize as part of the pre-operative procedure for surgical patients, and two (2.7%) hospitals decolonize to facilitate patient placements. There were 11 (14.9%) hospitals that responded that MRSA decolonization may be considered for a variety of other reasons, including outbreak situations, on a case-by-case basis, and when requested by a primary provider/physician.

Laboratory Data

A total of 11,064 new patients with MRSA isolated from any specimen site (i.e., colonizations or infections) were reported by hospital-based laboratories in 2019 (overall rate: 12.4 per 1,000 patients).

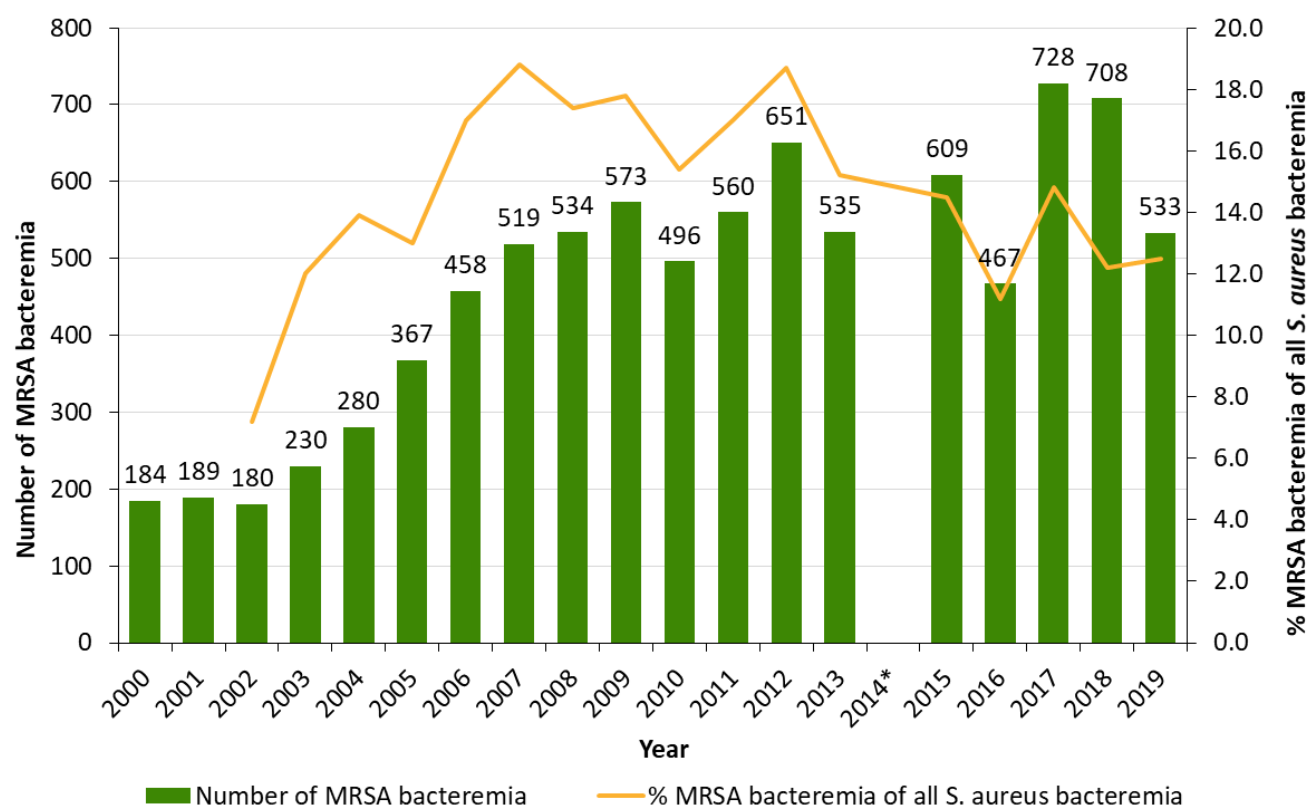
- 533 (4.8%) patient specimens were isolated from blood culture
- 4,358 (39.4%) patients with MRSA had specimens isolated from non-screening sites, excluding blood culture

The total number of new patients with MRSA isolated from any specimen site decreased by 23.0% from 14,371 in 2018 to 11,064 in 2019. The proportion of patients with MRSA from blood culture was similar from 4.9% in 2018 to 4.8% in 2019.

In 2019, the total number of methicillin-susceptible *S. aureus bacteremia* reported was 3,726. Methicillin-resistant *S. aureus bacteremia* as a proportion of all *S. aureus bacteremia* was 12.2% (708/5,809) in 2018 and 12.5% (533/4,259) in 2019 (Figure 2).

North West, North East, Champlain, and Mississauga Halton regions had the highest rates of MRSA isolated from any specimen site in 2019 (Figure 3; see Table 1 for values).

Figure 2. Number of MRSA bacteremia and percentage of all *S. aureus* bacteremia reported from hospital laboratories in Ontario, 2000–2019



*Survey was not conducted in 2014.

Figure 3. Rate of patients with MRSA isolated from any specimen site (colonizations and infections) per 1,000 patients reported from hospital laboratories in Ontario, by LHIN, 2019

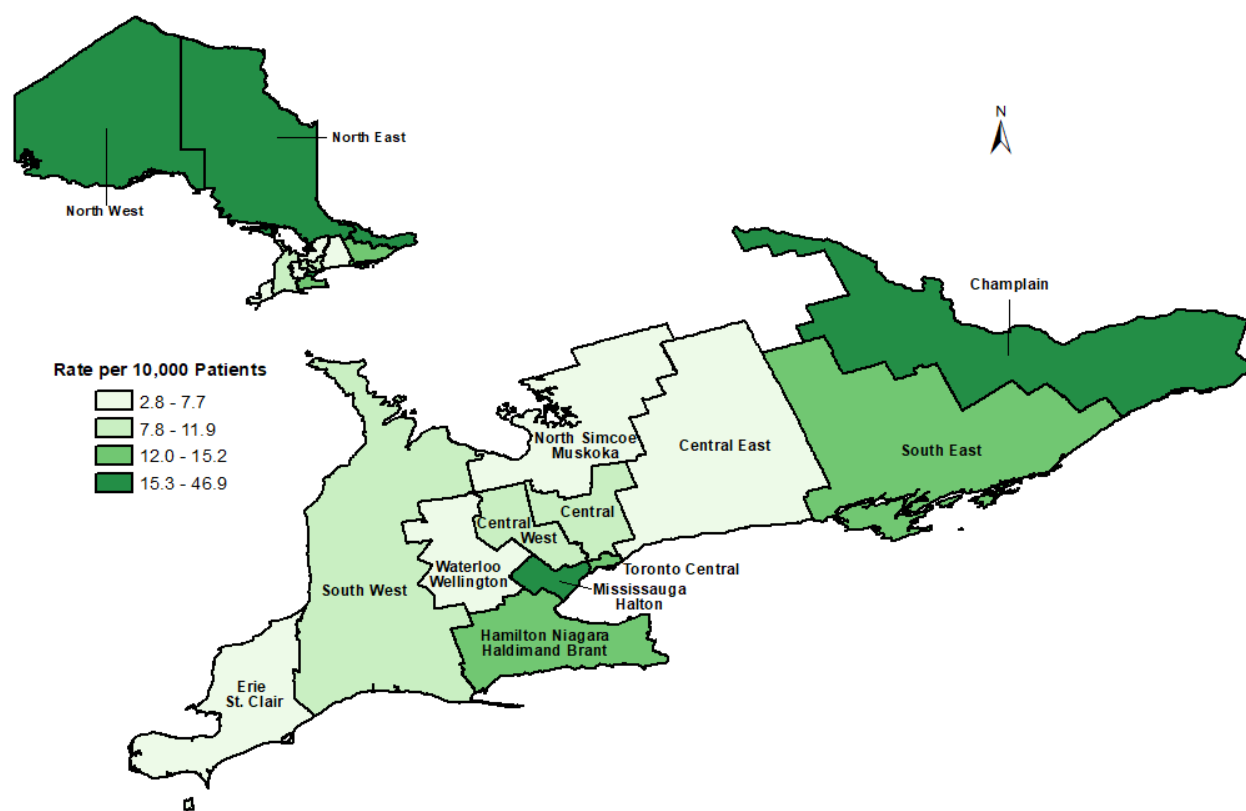


Table 1. Number of patients with MRSA isolated from any specimen site (colonizations and infections) and rate per 1,000 patients reported from hospital laboratories in Ontario, by LHIN, 2018–2019

LHIN	2018 Patients with MRSA from any specimen site	2018 Rate per 1,000 patients	2019 Patients with MRSA from any specimen site	2019 Rate per 1,000 patients
Central	883	7.1	1,284	11.8
Central East	1,399	13.5	682	7.4
Central West	1,412	25.3	43	8.4
Champlain	1,814	16.6	1,592	16.5
Erie St. Clair	884	17.0	132	2.8
Hamilton Niagara Haldimand Brant	1,428	10.9	1,557	13.0
Mississauga Halton	1,026	12.1	826	15.9
North East	838	14.0	770	23.4
North Simcoe Muskoka	335	8.2	116	3.1
North West	498	18.9	1,224	46.9
South East	460	10.1	258	12.8
South West	1,325	13.1	380	8.6

LHIN	2018 Patients with MRSA from any specimen site	2018 Rate per 1,000 patients	2019 Patients with MRSA from any specimen site	2019 Rate per 1,000 patients
Toronto Central	1,774	9.9	1,936	12.1
Waterloo Wellington	295	5.1	264	5.3
Overall	14,371	12.2	11,064	12.4

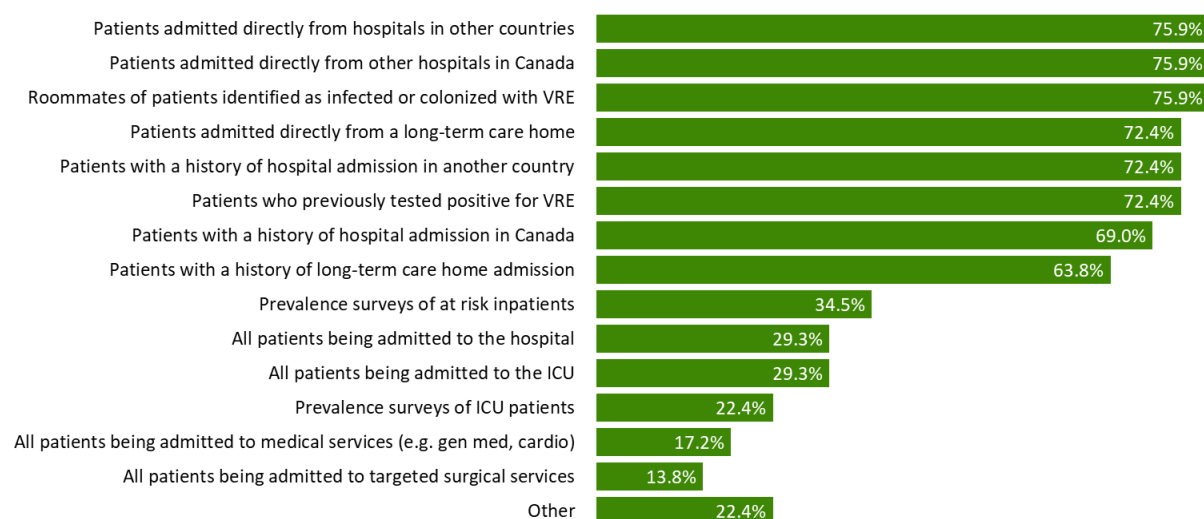
Vancomycin-resistant enterococci (VRE)

Hospital Screening

There were 58/74 (78.4%) hospital corporations that reported having a screening program for VRE in 2019. This was higher than 69.8% of hospital corporations that reported having a screening program for VRE in 2018.

Hospitals with a screening program for VRE were likely to identify patients admitted directly from another hospital in Canada or in other countries, those who were roommates of patients positive for VRE, patients admitted directly from a long-term care home, patients with a history of hospital admission in another country, and patients who previously tested positive for VRE (Figure 4).

Figure 4. Criteria used by hospitals for VRE patient screening, 2019



Infection Control Practices

There were 56/73 (76.7%) hospitals that responded that Additional Precautions were used to care for all patients colonized and infected with VRE; two (2.7%) hospitals responded that Additional Precautions were only used for patients with VRE infections. There were 13 (17.8%) hospitals that reported Additional Precautions were not used for patients with VRE in 2019, compared to 21.6% of hospitals that reported Additional Precautions were not used for patients with VRE in 2018.

Excluding missing responses, 46/71 (64.8%) hospitals reported that Additional Precautions for patients with VRE may be discontinued once three negative swabs for VRE have been taken, one week apart. Eight (11.3%) hospitals reported patients with VRE remain in Additional Precautions for the duration of their hospitalization.

Laboratory Data

A total of 3,916 new patients with VRE isolated from any specimen site (i.e., colonizations and infections) were reported by hospital laboratories in 2019.

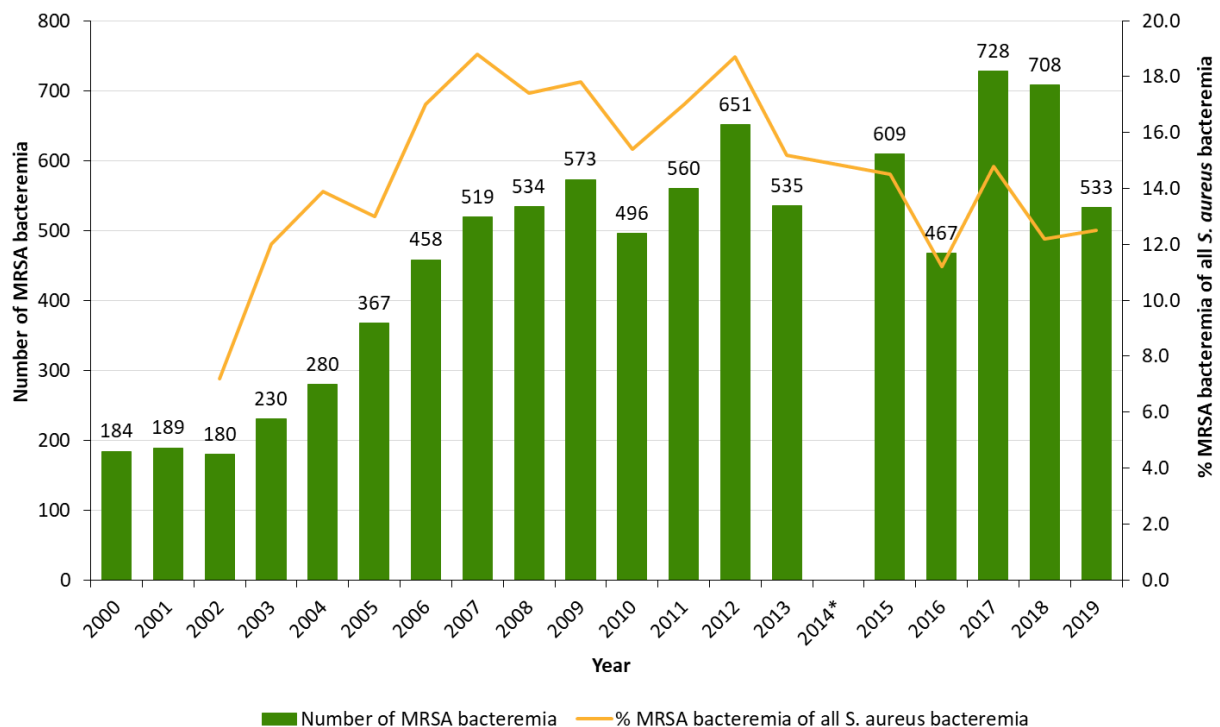
- 133/3,916 (3.4%) patients with VRE had specimens isolated from blood culture
 - *E. faecium*: 129/133 (97.0%)
 - *E. faecalis*: 1/133 (0.8%)
 - Other enterococci: 3/133 (2.3%)

- 475 (12.1%) patients with VRE had specimens isolated from non-screening sites, excluding blood culture
 - *E. faecium*: 427/475 (89.9%)
 - *E. faecalis*: 11/475 (2.3%)
 - Other enterococci: 37/475 (7.8%)

In 2019, the total number of vancomycin-susceptible enterococcal bacteremia was 2,152. The proportion of vancomycin-resistant enterococcal bacteremia of all enterococcal bacteremia was 9.1% (200/2,204) in 2018 and 5.8% (133/2,285) in 2019 (Figure 5).

Hospital laboratories in Champlain, South East and Toronto Central regions reported the highest rates of VRE isolated from all non-screening specimen sites (including blood cultures) in 2019 (Figure 6, see values in Table 2).

Figure 5. Number of VRE bacteremia and percentage of all enterococcal bacteremia reported from hospital laboratories in Ontario, 2001–2019



*Survey was not conducted in 2014

Figure 6. Rate of patients with VRE isolated from all non-screening specimen sites (including blood cultures) per 1,000 patients reported from hospital laboratories in Ontario, by LHIN, 2019

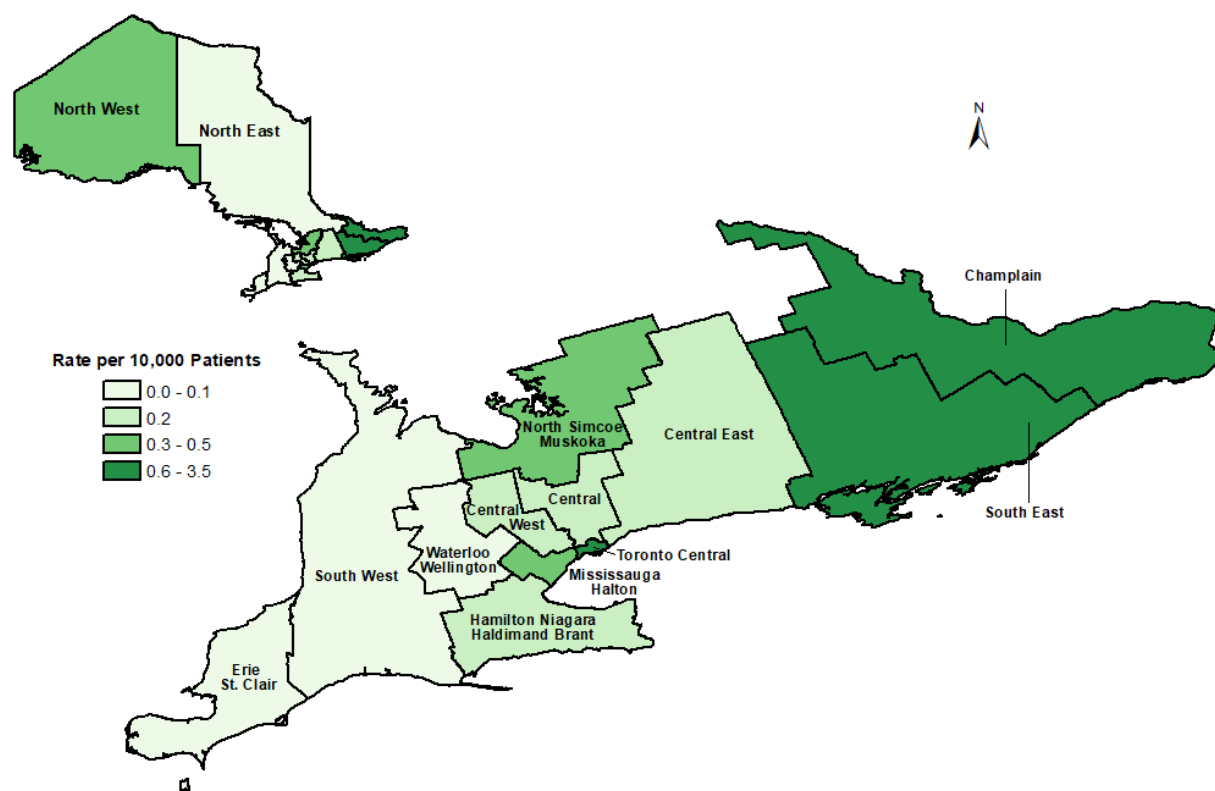


Table 2. Number of patients with VRE isolated from all non-screening specimen sites (including blood cultures) and rate per 1,000 patients reported from hospital laboratories in Ontario, by LHIN, 2018–2019

LHIN	2018 Patients with VRE from non-screening specimen sites*	2018 Rate per 1,000 patients*	2019 Patients with VRE from non-screening specimen sites	2019 Rate per 1,000 patients
Central	3	0.0	26	0.2
Central East	11	0.1	15	0.2
Central West	15	0.3	1	0.2
Champlain	305	2.8	340	3.5
Erie St. Clair	21	0.4	1	0.0

LHIN	2018 Patients with VRE from non-screening specimen sites*	2018 Rate per 1,000 patients*	2019 Patients with VRE from non-screening specimen sites	2019 Rate per 1,000 patients
Hamilton Niagara Haldimand Brant	9	0.1	20	0.2
Mississauga Halton	34	0.4	22	0.4
North East	18	0.3	3	0.1
North Simcoe Muskoka	0	0.0	11	0.3
North West	15	0.6	14	0.5
South East	69	1.5	31	1.5
South West	36	0.4	4	0.1
Toronto Central	126	0.7	114	0.7
Waterloo Wellington	15	0.3	6	0.1
Overall	677	0.6	608	0.7

*Updated to include blood culture specimens

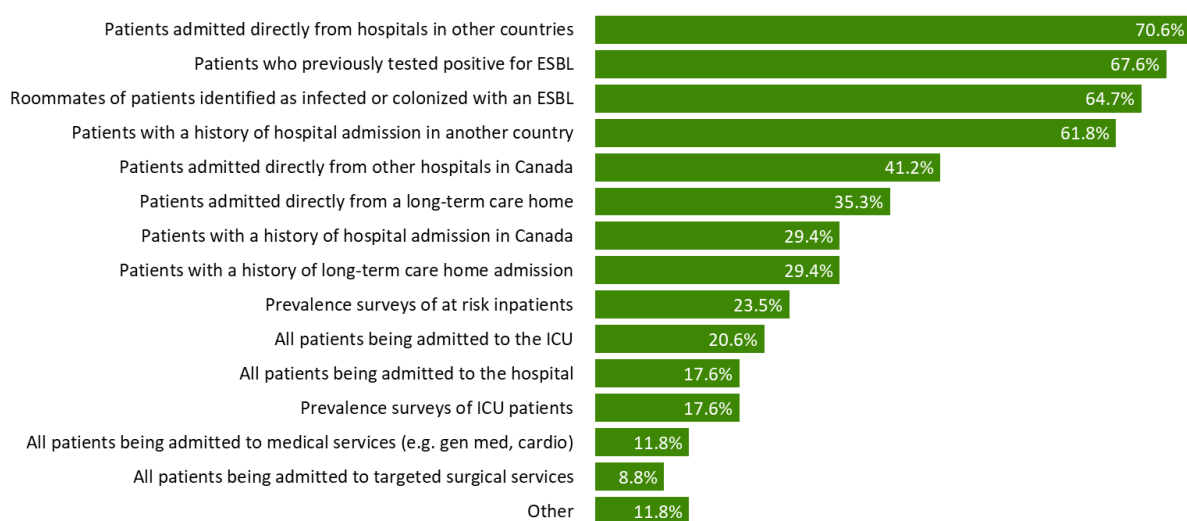
Gram-Negative Bacilli

Extended spectrum beta-lactamases (ESBL) Hospital Screening

Of the 74 hospital corporations, 34 (46.0%) reported having a screening program for extended spectrum beta-lactamases (ESBLs) in 2019. In 2018, 42.7% of hospitals surveyed reported having an ESBL screening program.

Hospitals with a screening program for ESBLs were most likely to screen patients admitted directly from a hospital abroad (Figure 7).

Figure 7. Criteria used by hospitals for ESBL patient screening, 2019



ESBL Infection Control Practices

A total of 40/71 (56.3%) hospitals responded that Additional Precautions were used for all patients colonized and infected patients with ESBLs; four (5.6%) hospitals responded that Additional Precautions were only used for patients infected with ESBLs. There were 19 (26.8%) hospitals that reported Additional Precautions were not used for patients with ESBLs.

Excluding missing responses, 25/41 (61.0%) hospitals responded Additional Precautions may be discontinued once three negative swabs for ESBL were taken, one week apart. Sixteen (39.0%) hospitals reported that patients who test positive for ESBLs remain on Additional Precautions for the duration of their hospitalization.

Laboratory Data

There were 472,249 isolates of *E. coli*, 85,580 isolates of *Klebsiella* spp., 41,718 isolates of *Pseudomonas aeruginosa*, and 2,828 isolates of *Acinetobacter* spp. from any specimen site were reported by laboratories in 2019.

Resistance to third-generation cephalosporin among *E. coli* isolated from all specimen sites has been relatively stable (approximately 10.0% resistant) from 2016 to 2019 (Figure 8). Resistance to cephalosporin among *Klebsiella* spp. isolated from all specimen sites fluctuates between 5.0% and 6.0% from 2016 to 2019 (5.2% in 2016, 4.7% in 2017, 5.9% in 2018, and 5.5% in 2019).

On the other hand, resistance among *E. coli* isolates to ciprofloxacin decreased from 18.2% in 2016 to 14.2% in 2018 and then increased to 17.3% in 2019 (Figure 9). *Klebsiella* spp. resistance to ciprofloxacin has remained stable at approximately 4.0% between 2016 and 2018 and then slightly increased to 4.5% in 2019. Among *P. aeruginosa* isolates, resistance to ciprofloxacin fluctuated from 12.7% in 2016, to 9.0% in 2017, to 10.2% in 2018, and to 12.0% in 2019. Resistance to ciprofloxacin in *Acinetobacter* spp. isolates was 5.6% in 2016, 5.2% in 2017 and 2018, and 8.1% in 2019.

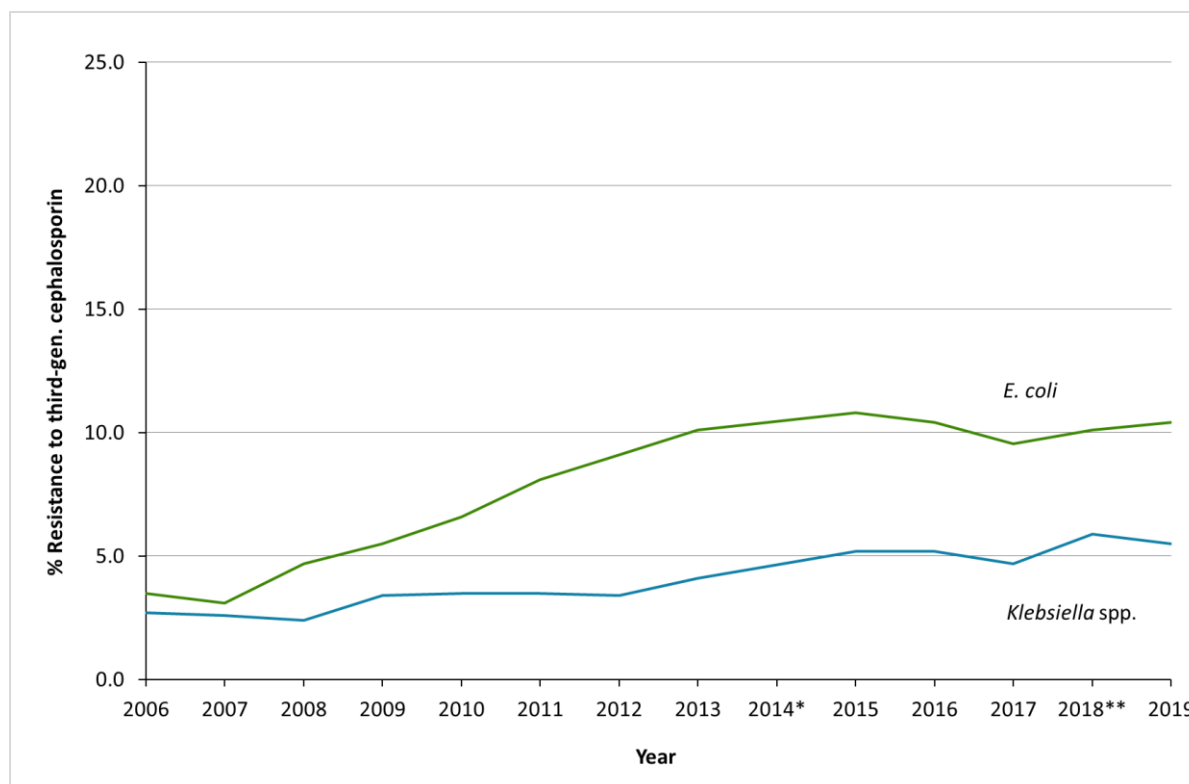
P. aeruginosa resistance from any specimen site to cephalosporin decreased from 9.1% in 2018 to 6.7% in 2019; resistance to meropenem was relatively the same in the past two years at 6.7% in 2018 and 6.5% in 2019 (Figure 10). *Acinetobacter* spp. resistance to cephalosporin decreased from 11.8% in 2018 to 7.2% in 2019; resistance to meropenem increased from 0.8% in 2018 to 3.2% in 2019.

Percent resistance of *P. aeruginosa* from blood to cephalosporin decreased from 10.6% in 2018 to 4.5% in 2019; resistance to meropenem also decreased from 7.9% in 2018 to 4.3% in 2019 (Figure 11). Among *Acinetobacter* spp. isolates, percent resistance from blood to cephalosporin decreased from 19.2% in 2018 to 7.5% in 2019; resistance to meropenem was similar with 4.9% in 2018 and 4.8% in 2019.

E. coli resistance from blood to third-generation cephalosporin and ciprofloxacin both increased from 7.7% and 10.9% in 2018 to 11.6% and 17.4% in 2019, respectively (Figure 11). *Klebsiella* spp. resistance from blood to cephalosporin and to ciprofloxacin was similar in the past two years (5.4% and 4.1% in 2018 to 4.6% and 4.1% in 2019, respectively).

E. coli resistance in urine to cephalosporin decreased from 10.0% in 2018 to 8.9% in 2019 while resistance to ciprofloxacin increased from 14.1% to 17.8% in 2019 (Figure 12). Resistance to cephalosporin among *Klebsiella* spp. isolated from urine slightly decreased from 5.6% in 2018 to 5.3% in 2019; resistance to ciprofloxacin was 3.3% for *Klebsiella* spp. isolated from urine in 2018 and 4.6% in 2019.

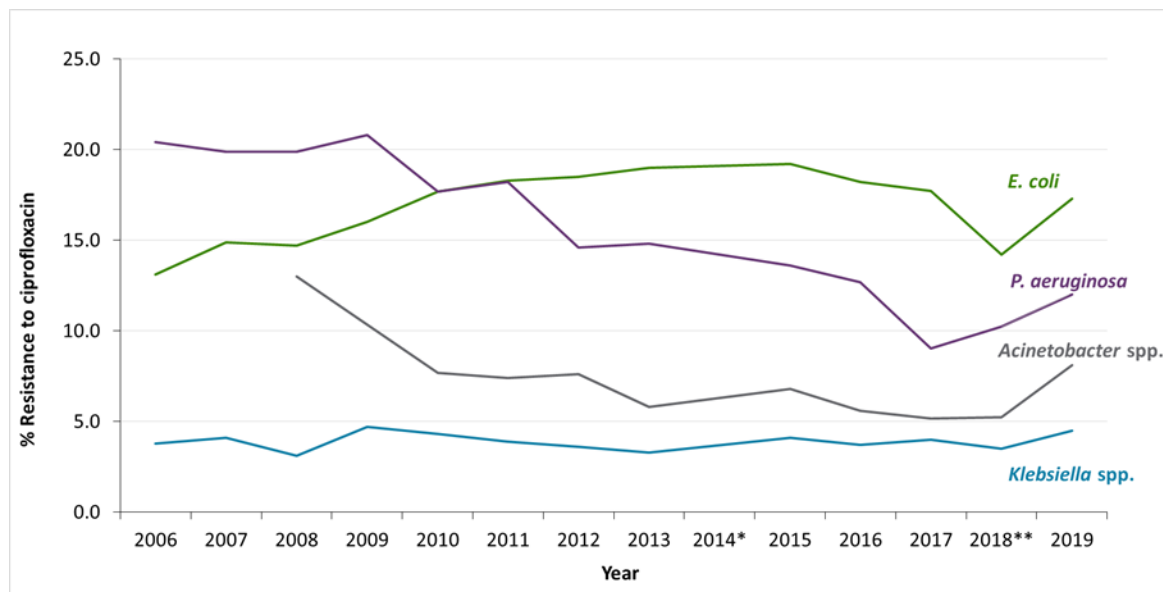
Figure 8. Percent resistance of all isolates of *E. coli* and *Klebsiella* spp. to third generation cephalosporin, 2006–2019



*Survey was not conducted in 2014.

**2018 results were updated based on data cleaning.

Figure 9. Percent resistance of all isolates of *E. coli* and *Klebsiella* spp., *P. aeruginosa*, and *Acinetobacter* spp. to ciprofloxacin, 2006-2019



*Survey was not conducted in 2014. **2018 results were updated based on data cleaning

Figure 10. Percent resistance of all isolates of *E. coli*, *Klebsiella* spp., *Acinetobacter* spp., and *P. aeruginosa* to third-generation cephalosporin, ciprofloxacin and carbapenems, 2019

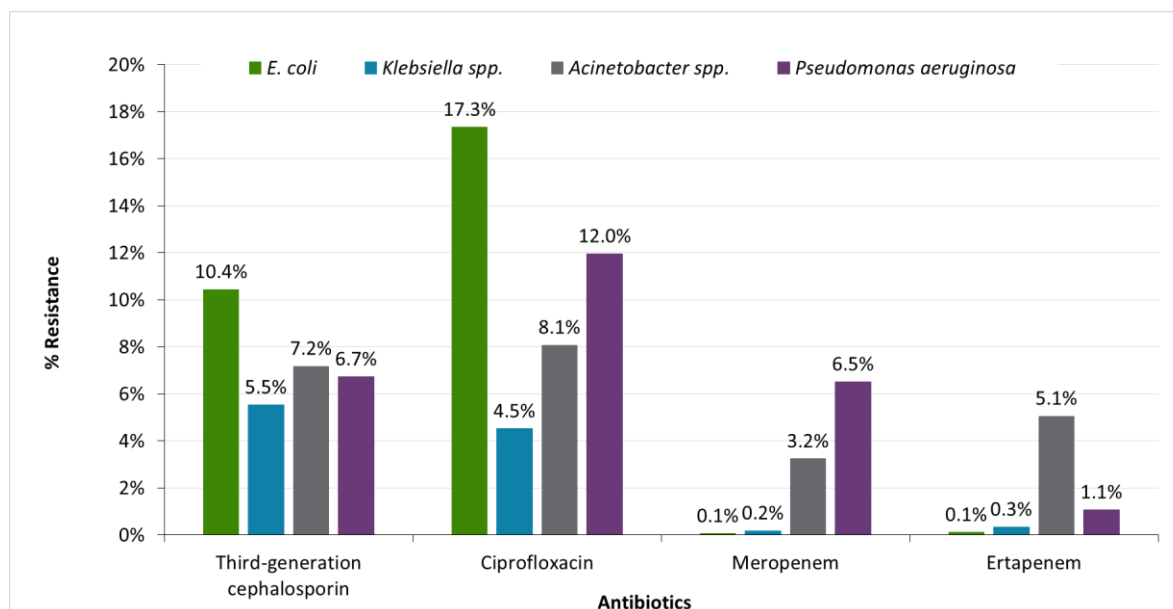
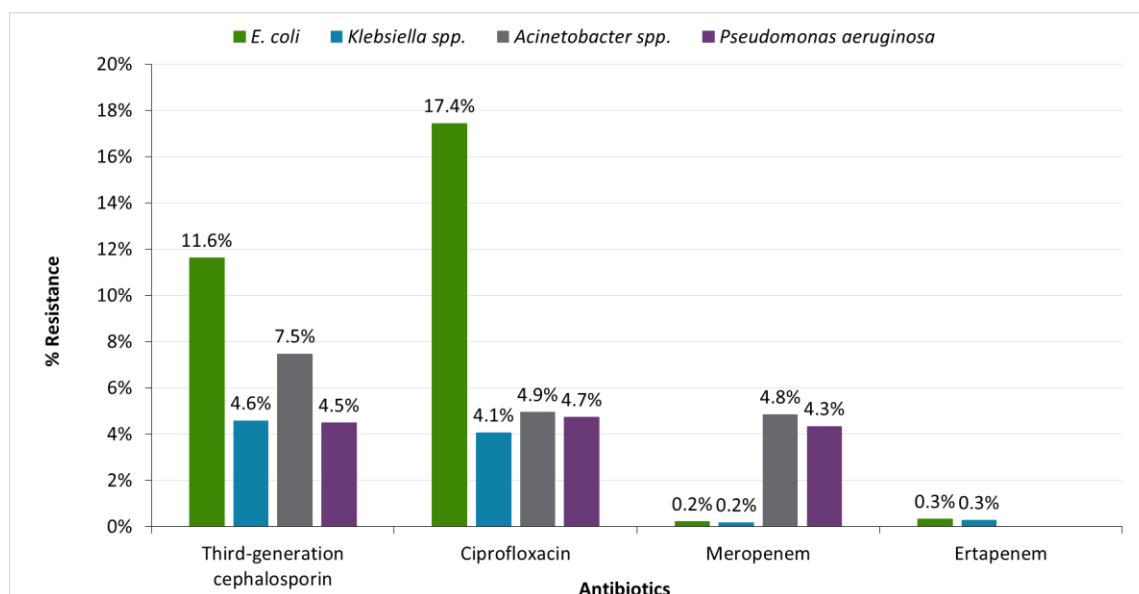
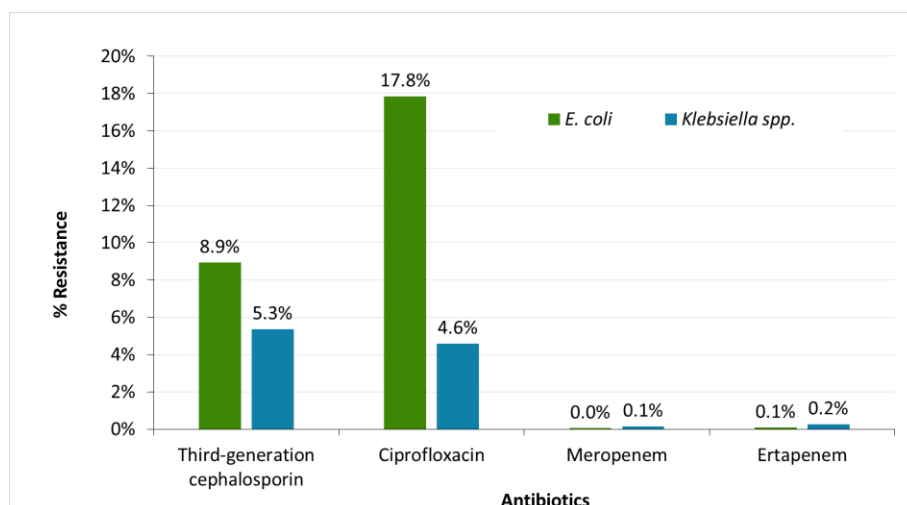


Figure 11. Percent resistance of *E. coli*, *Klebsiella* spp., *Acinetobacter* spp., and *P. aeruginosa* from blood to third-generation cephalosporin, ciprofloxacin and carbapenems, 2019*



*Note: Resistance to ertapenem is shown for *E. coli* and *Klebsiella* spp. only.

Figure 12. Percent resistance of *E. coli* and *Klebsiella* spp. from urine specimens to cephalosporin, ciprofloxacin and carbapenems, 2019



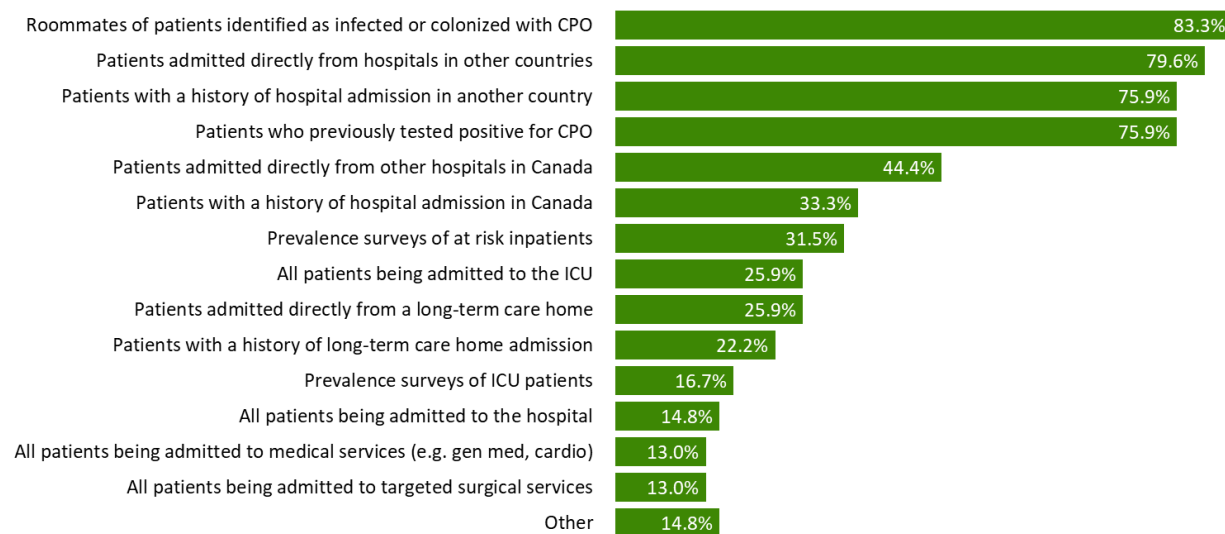
Carbapenemase-producing organisms (CPO)

Hospital Screening

There were 54/74 (73.0%) hospital corporations that reported having a screening program for CPO in 2019. This is slightly higher to the findings from the 2018 survey, where 70.8% of hospitals reported having a screening program for CPOs. Of the 54 hospitals, 12 (22.2%) hospital corporations reported that their screening program for CPO started in 2019.

Hospitals with a screening program for CPOs were likely to identify those who were roommates with patients positive for CPO, patients admitted directly from a hospital in another country, patients with a history of hospital admission in another country, and patients who previously tested positive for CPO (Figure 13).

Figure 13. Criteria used by hospitals for CPO patient screening, 2019



Infection Control Practices

A total of 60/73 (82.2%) hospitals responded that Additional Precautions were used for all patients with CPO colonizations and infections. There were 11 (15.1%) that indicated Additional Precautions do not apply as they have no cases to date. Further, one (1.4%) hospital responded that Additional Precautions were only used for patients with CPO infections and one (1.4%) specified other.

There were 38/74 (51.4%) hospitals that reported that special attention was paid to cleaning sinks and drains, 32 (43.2%) hospitals reported additional cleaning of frequently touched surfaces was done using a hospital-grade disinfectant, and 31 (41.9%) reported that twice-a-day cleaning was used for CPO.

Of the 63 hospitals that provided conditions that must be in place before considering discontinuation of Additional Precautions, 40 (63.5%) hospitals responded patients who tested positive for CPOs remain in Additional Precautions for the duration of their hospitalization. Eleven (17.5%) hospitals reported that Additional Precautions may be discontinued once three negative swabs have been taken, and 12 (19.0%) provided other information such as the absence of a protocol and assessment on a case by case basis.

Laboratory Data

A total of 427 new patients with CPO isolated from any specimen site (colonizations and infections) were reported in 2019.

- 141 (33.0%) patient specimens were identified from non-screening sites
- 20 (4.7%) patient specimens were isolated from blood culture

- 364 (85.2%) patient specimens were reported from hospital laboratories; 62 (14.5%) were submitted from community-based laboratories

The most commonly reported carbapenemase was New Delhi Metallo-beta-lactamase (NDM; 222, 52.0%), followed by Oxacillinase (OXA; 93, 21.8%), *Klebsiella pneumoniae* carbapenemase (KPC; 63, 14.8%); Verona Integron-Encoded Metallo-beta-lactamase (VIM; 18, 4.2%); and, Imipenemase (IMP; 4, 0.9%).

Among hospital-based laboratories, Central, Mississauga Halton, Hamilton Niagara Haldimand Brant, and Toronto Central regions had the highest rates of CPOs per 10,000 patients (Figure 14, see values in Table 3). Overall rates increased from 2.8 per 10,000 patients in 2017 to 4.2 per 10,000 patients in 2019 (Figure 15).

Figure 14. Rate of patients with CPOs isolated from any specimen site (colonizations and infections) per 10,000 patients reported from hospital laboratories in Ontario, by LHIN, 2019

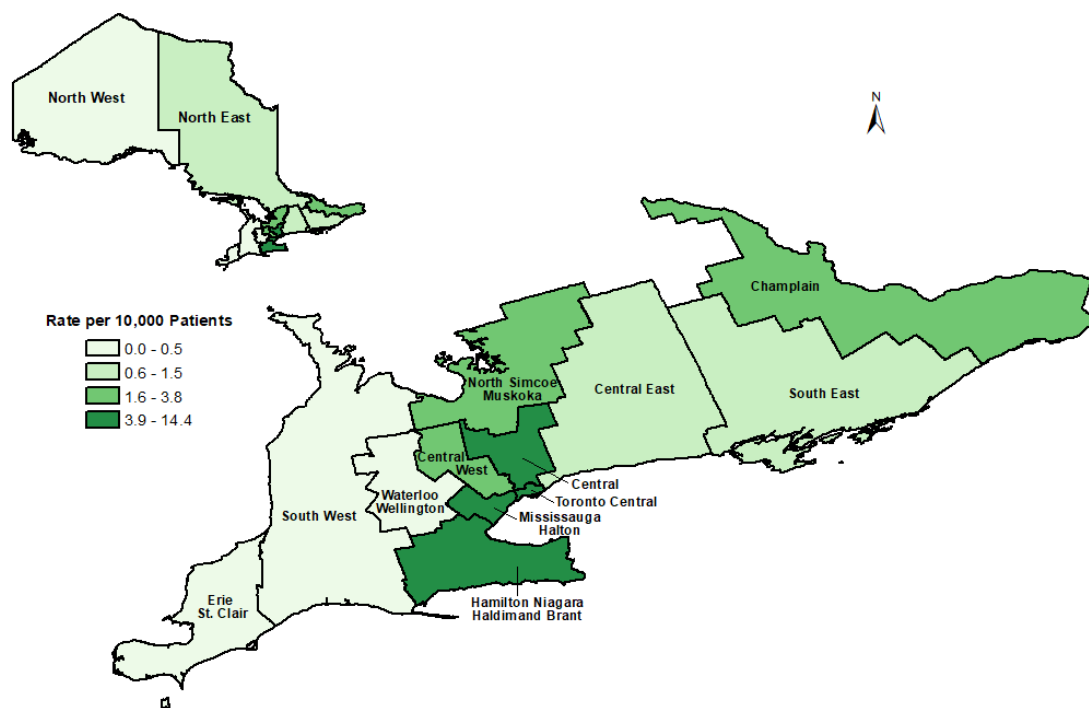
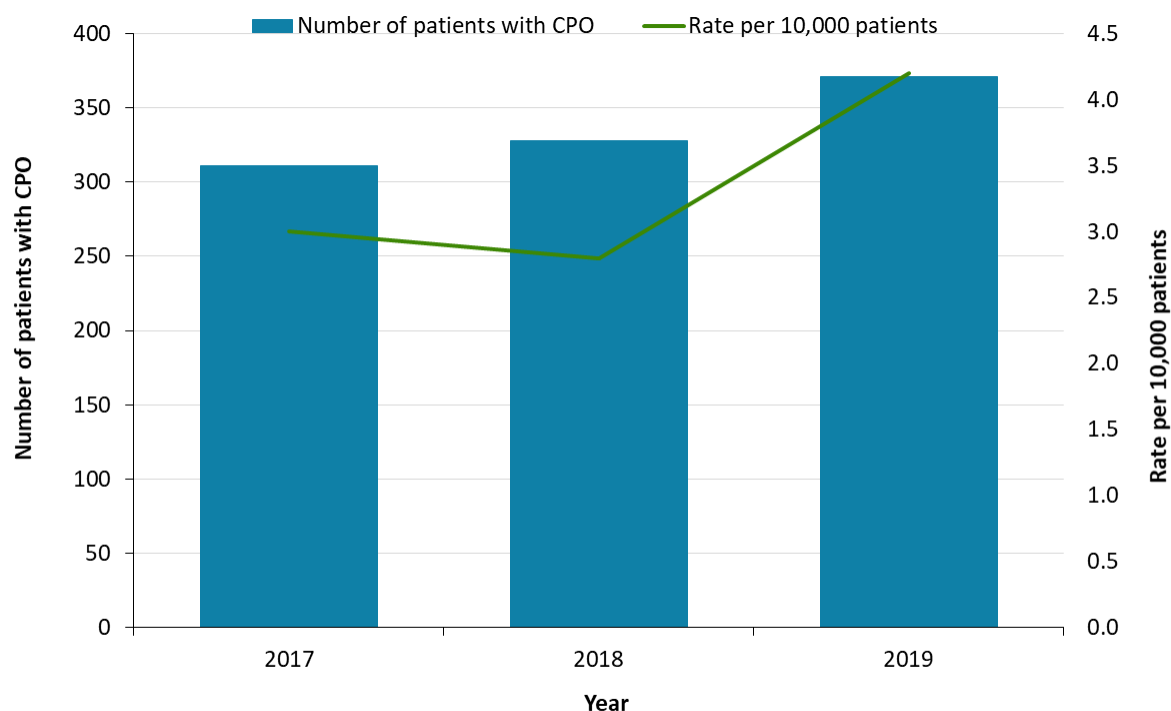


Table 3. Number of patients with CPOs isolated from any specimen site (colonizations and infections) and rate per 10,000 patients reported from hospital laboratories in Ontario, by LHIN, 2018–2019

LHIN	2018 Patients with CPO from any specimen site	2018 Rate per 10,000 patients	2019 Patients with CPO from any specimen site	2019 Rate per 10,000 patients
Central	32	2.6	156	14.4
Central East	6	0.6	7	0.8
Central West	55	9.8	1	2.0
Champlain	17	1.6	27	2.8
Erie St. Clair	9	1.7	2	0.4
Hamilton Niagara Haldimand Brant	58	4.4	49	4.1
Mississauga Halton	26	3.1	47	9.1
North East	1	0.2	2	0.6
North Simcoe Muskoka	3	0.7	10	2.6
North West	1	0.4	0	0.0
South East	9	2.0	2	1.0
South West	11	1.1	1	0.2
Toronto Central	89	5.0	66	4.1
Waterloo Wellington	11	1.9	1	0.2
Overall	328	2.8	371	4.2

Figure 15. Number of patients with CPOs isolated from any specimen site (colonizations and infections) rate per 10,000 patients reported from hospital laboratories in Ontario, 2017-2019



Clostridioides difficile infections (CDI)

Infection Control Practices

All 74/74 (100.0%) hospitals reported that Additional Precautions are used to care for patients with CDI.

A total of 65/74 (87.8%) hospitals reported twice daily cleaning and disinfection of patient rooms using a hospital-grade disinfectant or sporicidal agent. 26 (35.1%) hospitals reported double cleaning of the room and carrying out routine cleaning of patient equipment (dedicated or multi-resident use) while 25 (33.8%) hospitals reported that additional cleaning of frequently touched surfaces is done using a hospital-grade disinfectant.

There were 66/74 (89.2%) hospitals that reported Additional Precautions may be discontinued once the patient has not had diarrhea for ≥ 48 hours and 57 (77.0%) hospitals responded that the room/bedspace and bathroom must receive terminal/discharge CDI cleaning with sporicide prior to discontinuing Additional Precautions. Five (6.8%) hospitals reported that patients positive for CDI remain in Additional Precautions for the duration of their hospitalization.

Laboratory Data

A total of 96,106 specimens were tested for *C. difficile* toxin by Ontario laboratories in 2019.

- 10,397 (10.8%) specimens were positive for *C. difficile* toxin from 9,176 people (overall rate: 6.3 per 10,000 population).

In 2018, 106,439 specimens were tested for *C. difficile*; 12,346 (11.6%) were positive for *C. difficile* toxin. Laboratories in Waterloo, North East, and Central regions reported the highest proportion of specimens positive for *C. difficile* toxin in 2019 (Figure 16). Additionally, Toronto Central, North East, and South West regions reported the highest rates of patients with *C. difficile* toxin in Ontario in 2019 (Figure 17, see values in Table 4).

The Ontario Ministry of Health recommended turnaround time (TAT) from specimen collection to reporting is ≤ 24 hours. In 2019, there were 47/49 (95.9%) laboratories that reported TATs within the recommended time (Figure 18). One (2.0%) laboratory reported TAT between 25-48 hours and one (2.0%) laboratory reported TATs between 49-72 hours. 10/11 (90.9%) PHO laboratories reported TATs of < 24 hours.

Figure 16. *C. difficile* percent specimen test positivity based on laboratory location by LHIN, 2018–2019

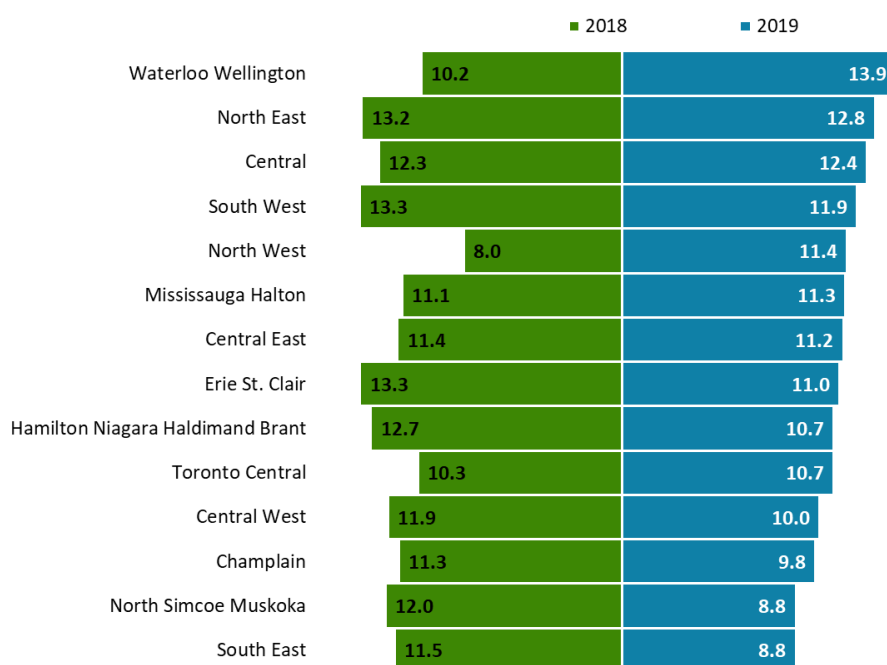


Figure 17. Rate of CDI per 10,000 population reported from all participating laboratories in Ontario, by LHIN, 2019

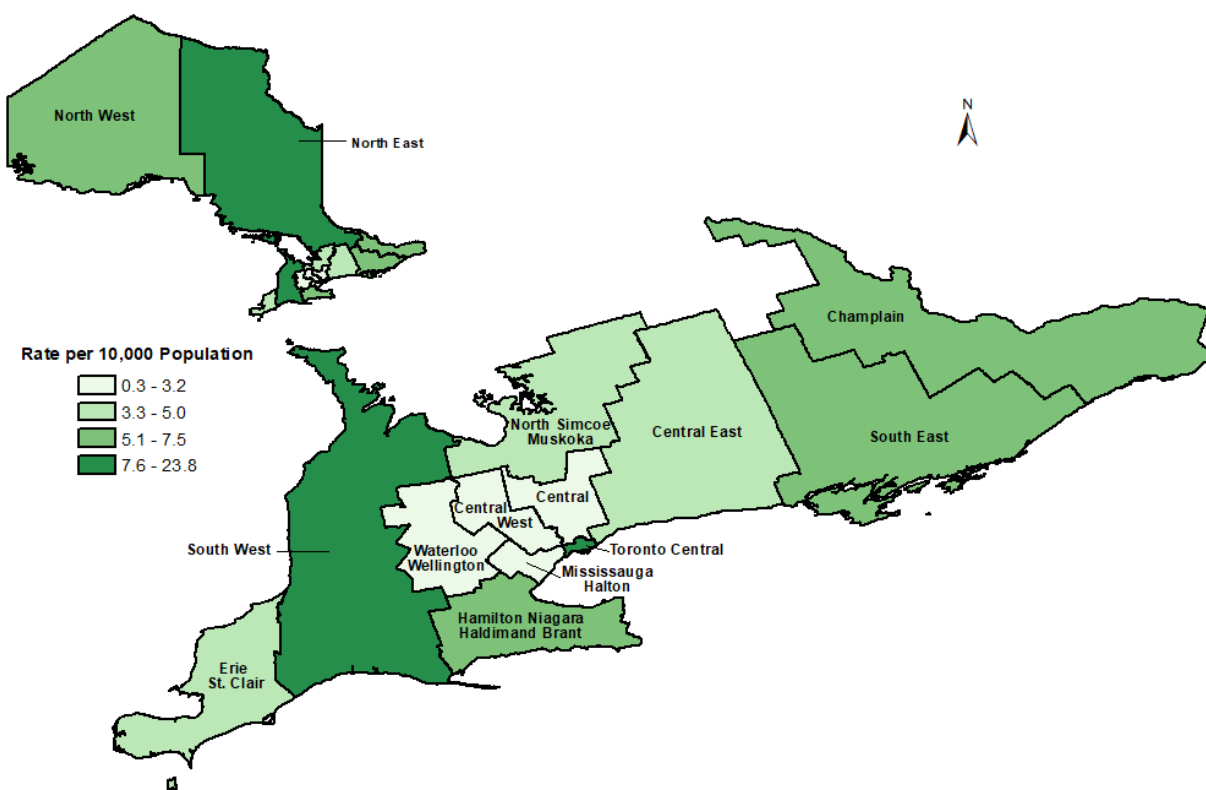
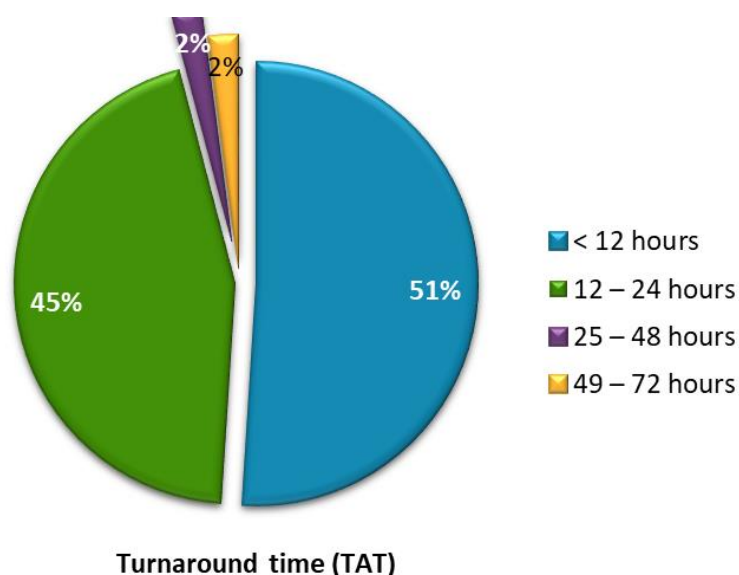


Table 4. Number of CDI and rate per 10,000 population reported from all participating laboratories in Ontario, by LHIN, 2018–2019

LHIN	2018 CDI cases	2018 Rate per 10,000 population	2019 CDI cases	2019 Rate per 10,000 population
Central	572	3.0	600	3.1
Central East	590	3.6	617	3.7
Central West	250	2.5	27	0.3
Champlain	1,105	8.0	1,055	7.5
Erie St. Clair	275	4.2	275	4.1
Hamilton Niagara Haldimand Brant	740	5.0	1,026	6.8
Mississauga Halton	462	3.7	335	2.7
North East	591	10.4	454	7.9
North Simcoe Muskoka	332	6.7	179	3.6
North West	140	5.9	180	7.5
South East	428	8.5	300	5.9
South West	1,018	10.0	806	7.8
Toronto Central	2,442	18.6	3,183	23.8

LHIN	2018 CDI cases	2018 Rate per 10,000 population	2019 CDI cases	2019 Rate per 10,000 population
Waterloo Wellington	145	1.8	139	1.6
Overall	9,090	6.4	9,176	6.3

Figure 18. Percent of laboratories that reported *C. difficile* testing turnaround times between 0 to 72 hours in Ontario, 2019 (n=49)



Candida auris

Infection Control Practices

A section on *Candida auris* was included in the surveys for the first time. For the survey on infection control practices, hospitals were asked if they have an infection prevention and control policy that determines which patients should be screened for colonization with *C. auris*. A total of 16/74 (21.6%) hospitals reported having a screening policy while 58/74 (78.4%) hospitals reported otherwise. Of these 58 hospitals, 29 (50.0%) reported considering it as they believe having a screening policy may be necessary in the future.

Laboratory Data

There were 24/49 (49.0%) laboratories that reported screening for *Candida auris* from clinical isolates. Specimen types collected by these laboratories included respiratory specimens (18/24 or 75.0%) and urine samples (14/24 or 58.3%). Laboratories also reported using matrix-assisted laser desorption ionization-time of flight or MALDI-TOF (12/24 or 50.0%) and VITEK (7/24 or 29.2% labs) to identify *C. auris*.

A total of 7/48 (14.6%) laboratories reported screening for *Candida auris* from patients and of these, 3 (42.9%) labs reported collecting rectal swabs while 6 (85.7%) labs specified collecting from other anatomical sites including nasal, bilateral axillary and groin. All 7 laboratories indicated using culture method to identify *C. auris* from patients.

Data Caveats

Data Collection

The survey was administered in two components. For hospital-based laboratories, instructions were provided to complete the laboratory survey and facilitate completion of the infection control practices with the relevant infection control personnel for the hospital or corporation. The hospital infection control survey was also distributed separately to all hospital corporations in Ontario. Each corporation was requested to complete the survey once on behalf of all corporate sites that followed the same infection control policies. Survey completion was greatest among hospital-based laboratories who were able to facilitate data entry for the infection control portion of the survey into IQMH's QView survey platform.

Different approaches to survey administration have been attempted in previous years. In 2016, we began to provide pre-survey notification and follow-up reminder emails during the survey period. Collection of infection control data through the IQMH platform from hospital-based laboratories was an approach that started in 2018. While efforts were made to ensure dissemination contact lists were up to date, infection control staff may have changed. Additionally, the survey was conducted at the start of the pandemic and some hospital infection control staff may not have participated due to pandemic-related duties. We continue to explore opportunities to strengthen networks between PHO and hospitals, as well as streamline future surveys to encourage infection control personnel to provide important data on the prevalence of AROs.

Laboratory Data

Data on ESBLs and CDIs were requested at the specimen-level, thus duplicate specimens submitted for a single patient may be included.

For MRSA, VRE and CPOs, we assumed that the number of new patients reported by a laboratory was not duplicated by another testing laboratory; however, it is likely there were a number of patients who may have been identified and reported by multiple laboratories due to different hospital visits or admissions within the same year. This would contribute to overestimating the prevalence of AROs.

For both the laboratory and hospital surveys, several assumptions were made during the data cleaning process ([Appendix A](#) provides a detailed list of these assumptions). Additionally, these surveys are dependent on complete and accurate responses in order to provide useful information on AROs that may benefit laboratories practicing bacteriology as well as infection control hospital staff. In most cases, no attempt was made to verify the submitted data therefore, inaccuracies may be present. Finally,

results of this report may not be comparable to other surveillance systems due to different methods employed in collecting data and level of reporting implemented in each of the surveillance systems (i.e., provincial, national level).

Discussion

Health care-associated infections contribute to increased morbidity, mortality and burden on the health care system. From the 2019 survey results, we did not observe substantial changes to the overall prevalence rate of MRSA and VRE in Ontario. Similar to previous years, there was noticeable regional variation across the province among pathogens. Rates of MRSA were highest in the North West, North East, Champlain, and Mississauga Halton regions in 2019, whereas the rates of VRE have been highest in the Champlain and South East regions in 2018 and 2019.

The abundance of travel and migration from the Indian subcontinent to the south central region of Ontario has been reflected in the higher prevalence of CPOs compared to other parts of the province for the last two years.^{4,5} As of May 2018, carbapenemase-producing Enterobacteriaceae (now termed as carbapenemase-producing Enterobacterales) was designated a disease of public health significance in Ontario. Case data are now captured in the integrated Public Health Information System (iPHIS) by all public health units. In 2019, 396 cases were reported by public health units in the [reportable disease data](#)⁶ while 371 cases were reported in the current survey by laboratories. The epidemiological data obtained from Ontario laboratories and hospital infection prevention and control staff helps in understanding the impact of CPO and informs recommendations to prevent the spread of CPO within our province.

While the [hospital-based rates of CDI](#)⁷ were reported to be decreasing since 2012, CDI prevalence rates from this survey were similar from 2018 to 2019. Community-associated cases may have contributed to this relatively stable trend. Different trends in CDI rates were also observed in a study on the [Epidemiology of Clostridioides difficile infection](#)⁸ which reported a decreasing rate of hospital-acquired CDI and an increasing rate of community-acquired CDI in Canada.

Percent resistance varies by antibiotic and by Gram-negative organism. However, an increase in percent resistance to ciprofloxacin was observed across all organisms from 2018 to 2019.

Infection control practices vary widely throughout hospitals in Ontario. Best practice documents by the Provincial Infectious Diseases Advisory Committee on Infection Prevention and Control (PIDAC-IPC) provide guidance on the recommended approaches to infection control. Consistent approaches to MRSA and CDI infection control are more common (e.g., all hospitals responded that they have a screening program for MRSA and all hospitals reported using additional precautions for patients with CDI), whereas screening and infection control of VRE, ESBL and CPOs continue to be inconsistent between hospitals in Ontario. Diverging infection control policies for VRE and changing epidemiology of VRE were observed in the current survey results and highlighted in a study by Johnstone et al. that found increasing rates of VRE bloodstream infections were highly associated with discontinuation of screening programs and Additional Precautions for VRE.⁹

Conclusion

Surveillance programs of AROs in health care are necessary to understand the current landscape of resistance. Identifying regional variation of organisms can inform local decisions regarding the appropriate application of infection control policies. Strengthening the collaborations between public health, health care infection control and laboratories will be instrumental in improving existing surveillance initiatives and developing targeted infection control policies and antimicrobial stewardship programs.

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Appendix A: Assumptions and Data Processing

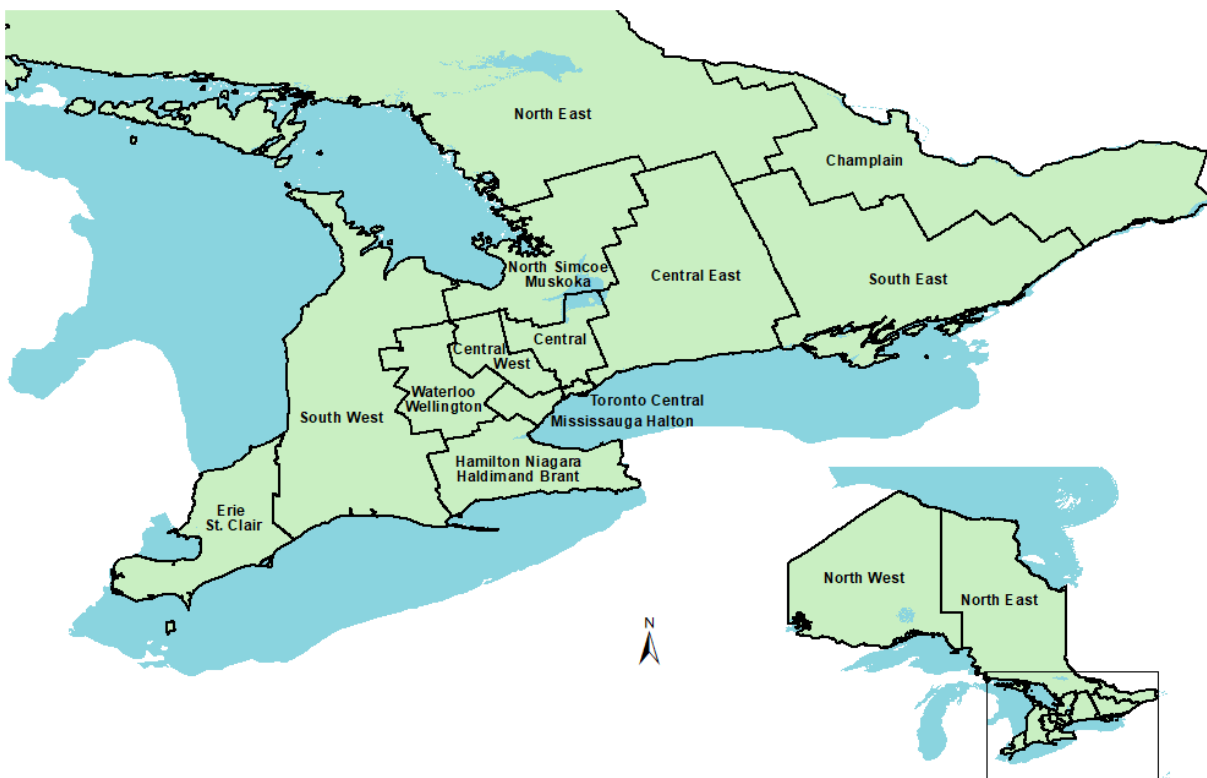
Laboratory Data

1. Counts provided in the survey were assumed to be accurate.
2. Character values in numeric variables were changed to numeric values where possible. Responses such as “NA,” “not available,” “unable to determine” were changed to blanks.
3. For duplicated laboratories grouped with other laboratories, the numbers were assumed to be coming from different laboratories since separating the counts were not feasible.
4. The total number of isolates was used where the subtotals did not match the total number of isolates.
5. Interpretation of questions may vary between laboratories, especially when different laboratory personnel respond to the survey year to year.
6. Regionally stratified data were based on the location of the submitting laboratory.

Hospital Data

1. The hospital was assumed to have a screening program in place if the screening program question was not completed, but follow-up responses were indicative of a positive response.
2. Infection control practices submitted by the corporation were assumed to apply across all institutions under the corporation.

Appendix B: Map of Local Health Integration Networks (LHINs)



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