

# Antimicrobial Resistance in Common Hospital Pathogens in Ontario: Annual Laboratory and Hospital Survey Report 2023



Annual Report  
February 2025

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# Executive Summary

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Antimicrobial resistance (AMR) continues to present significant challenges in Ontario, impacting patient safety and the effectiveness of treatments for common hospital pathogens. This report, based on 2023 data collected through a collaborative effort by Public Health Ontario (PHO) and the Institute for Quality Management in Healthcare (IQMH), highlights key trends and findings from laboratory and infection control surveys across the province. These surveys provide a comprehensive view of the prevalence of antimicrobial-resistant organisms (AROs) and the infection control practices implemented in Ontario hospitals.

**Methicillin-resistant *Staphylococcus aureus* (MRSA)** remains a concern, with 15,119 new cases reported in 2023, including 980 cases of MRSA bacteremia. While the total number of MRSA cases decreased compared to 2022, the proportion of MRSA bacteremia cases increased to 6.5% from 4.5% in 2022. Consistent screening practices were implemented across hospitals, but significant regional variations in MRSA rates were observed, with the East and North East regions recording the highest incidence.

**Vancomycin-resistant enterococci (VRE)** rates remained stable, with 4,425 new cases reported, including 226 cases of VRE bacteremia. Two thirds of hospitals reported having screening programs for VRE, and a similar proportion implemented additional precautions. Hospitals in East region continued to report the highest rates of cases from non-screening isolates.

**Gram-negative bacilli**, including *Escherichia coli* (*E. coli*) and *Klebsiella* spp., showed increasing resistance in 2023. Over one third of hospitals reported screening programs for **extended-spectrum beta-lactamases (ESBLs)**, while more than half implemented additional precautions.

**Carbapenemase-producing organism (CPO)** colonization and infections are increasing, with the incidence rate nearly doubling between 2022 to 2023. Over two thirds of the hospitals had a screening program for CPE, and the majority implemented additional precautions. The highest rates of CPOs continue to be seen in the Toronto and Central Ontario regions.

***Clostridioides difficile* infections (CDI)** positivity rate has decreased from 12.1% in 2022 to 10.1% in 2023. The highest positivity rates in 2023 were reported in the North East and Central Ontario regions.

***Candida auris* (C.auris)** incidence remained rare, with 3 cases reported from the laboratory survey in 2023 and 4 cases reported in 2022. Sixty one percent of the hospitals reported not having a *C. auris* screening program in place at the time of the survey. Fifty two percent of laboratories reported having procedures to identify *C. auris* from routine clinical specimens, while 28% of laboratories had processes to identify *C. auris* from specimens collected as part of an antibiotic resistant organism surveillance programs.

# Background

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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.<sup>1</sup> In Ontario, this translates to an estimated 6 lives lost due to AMR.<sup>2</sup> Recent evidence suggests the SARS-COV-19 pandemic may have accelerated the emergence and transmission of AMR.<sup>3,4</sup> 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.

A survey to capture information about 2023 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), *Clostridioides difficile* infections (*C. difficile*, CDI) and *Candida auris* (*C. auris*). The survey also included questions regarding the consistency of IPAC practices across hospital sites within the same corporation.

The objective of this report is to summarize the findings of the annual survey on antimicrobial resistance of common hospital pathogens from 2023.

# Survey Methods

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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 was administered to collect data from 2023. Surveys included questions on the number of new patients identified with MRSA, VRE, ESBLs, CPO and CDI and *C. auris*. In addition, questions were included to understand the consistency of IPAC practices across hospital sites within the same corporation.

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 *C. auris* and infection control practices in 2023.

The surveys were made available from February 21, 2024 to June 30, 2024.

Data from both surveys were extracted and linked on unique identifiers. Duplicates and incomplete data entries were removed. Data from the Canadian Institute for Health Information - Discharge Abstract Database accessed through IntelliHEALTH were used as denominator data to calculate MRSA, VRE, and CPO rates.<sup>5</sup> Population Estimates 2023 from Statistics Canada, also accessed through IntelliHEALTH, were used as denominator data for calculating CDI rates.<sup>6</sup> Ontario Health Region boundaries were assigned based on the location of the laboratories. Data were analyzed using SAS 9.4 and Microsoft Excel. ArcGIS Pro v3.3.2 software was used to generate the maps, displayed by Ontario Health Region.



# Results

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Highlights of the surveys' results have been combined and presented in three sections for a 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 98/133 (73.6%) hospital corporations responded to the infection control survey questions. The response rate for 2023 hospital survey was lower than that of the 2022 survey (87.2%) but higher than the rates from 2016 to 2021.

Of the currently licensed bacteriology laboratories, 65/73 (89.0%) responded to the 2023 survey. This included 45/51 (88.2%) hospital-based laboratories, 9/11 (81.8%) private community-based and 11/11 PHO laboratory sites. The laboratory survey response rate in 2023 was lower than it (95.9%) in 2022. Historically, the laboratory survey response rates have been between 96%-100%, except for the surveys conducted in the pandemic years.

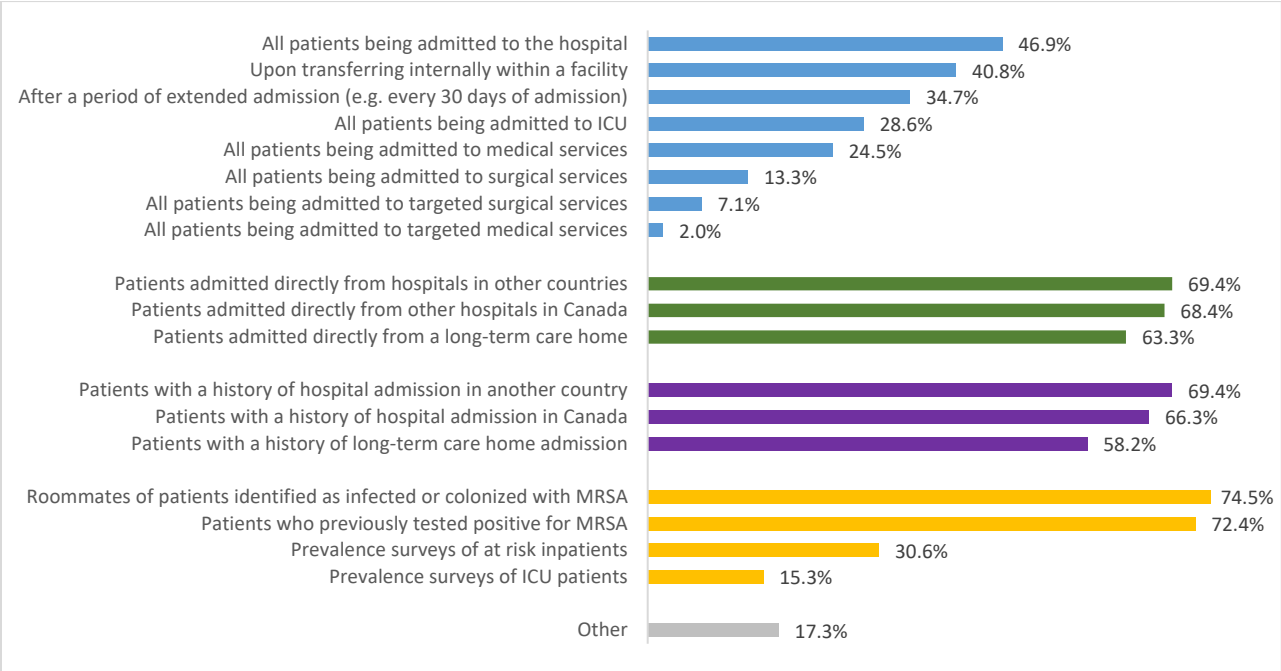
Due to the variabilities of the hospitals and laboratories that respond year over year, the data need to be interpreted with caution.

# Methicillin-resistant *Staphylococcus aureus* (MRSA)

## Hospital Screening

All 98 hospital corporations responded as having a screening program for MRSA in 2023 which is consistent with past results. Hospitals were most likely to screen patients who were roommates of patients positive for MRSA, patients previously positive for MRSA, patients admitted from other hospitals in Canada or other countries, and patients with a history of hospital admission in other countries (Figure 1).

**Figure 1. Criteria used by hospitals for MRSA patient screening, 2023**



## Infection Control Practices

Almost all hospitals (97/98; 99.0%) reported that Additional Precautions were used to care for all patients identified (infected or colonized) with MRSA. Most 80/98 (81.6%) hospitals indicated that Additional Precautions for MRSA are discontinued once three negative swabs were taken, one week apart in the absence of antibiotic therapy. Eleven (11.2%) hospitals responded that patients with MRSA remain in Additional Precautions for the duration of their hospitalization.

The majority (71/98; 72.4%) of hospitals responded that their institutions do not decolonize patients with MRSA; with 9 (9.2%) hospitals responding that decolonization protocols are applied to all MRSA positive patients. There were 15 (15.3%) hospitals that indicated they may consider MRSA decolonization on a case-by-case basis. Of these, five (5.1%) hospitals decolonize to facilitate patient placement (e.g. long term care), four (4.1%) hospitals decolonize as part of the pre-operative procedure for surgical patients, four (4.1%) hospitals decolonize upon physician or IPAC request, and one (1.0%) hospital considers decolonization during outbreak. (Note: Multiple reasons for decolonization could be reported.)

## Laboratory Data

A total of 15,119 new patients with MRSA isolated from any specimen site (i.e., colonizations or infections) were reported by hospital-based laboratories in 2023, with an overall rate of 13.4 per 1,000 patients.

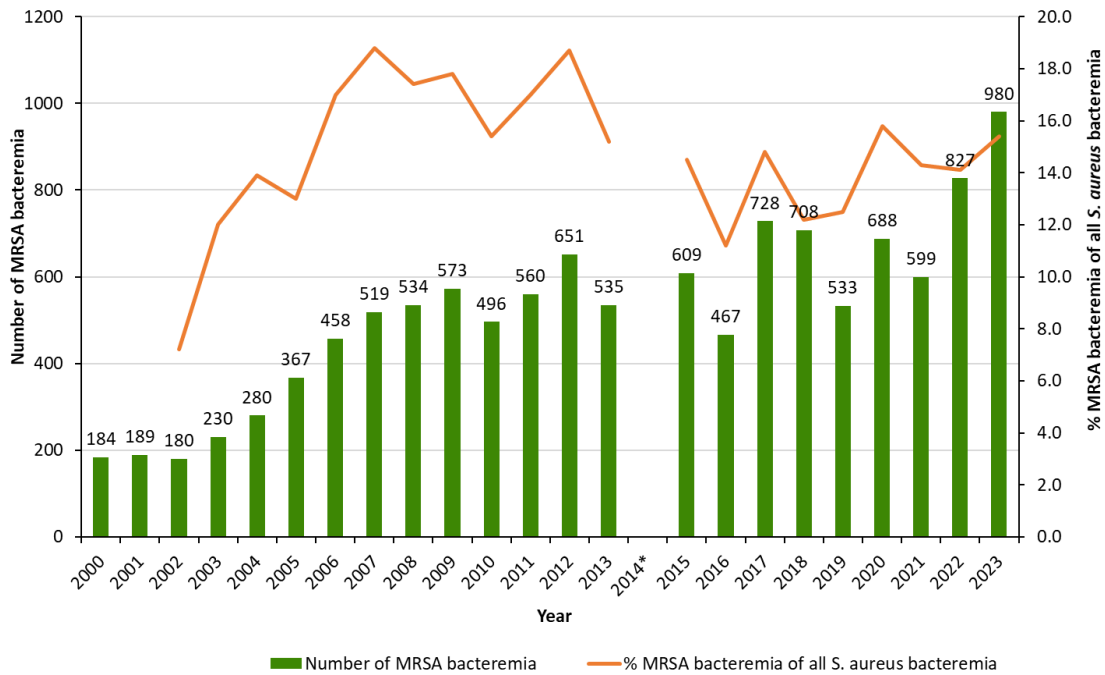
- 980 (6.5%) patient specimens were isolated from blood culture in 2023.
- 5,113 (33.8%) patients with MRSA had specimens isolated from non-screening sites, excluding blood culture in 2023.

The total number of new patients with MRSA isolated from any specimen site decreased by 17.5% from 18,332 in 2022 to 15,119 in 2023. This decrease might be partially attributable to the lower number of responding hospital laboratories in 2023 (45) compared to 2022 (48). The proportion of patients with MRSA from blood culture in 2023 (980/15,119; 6.5%) was higher than the proportion in 2022 (827/18,332; 4.5%).

In 2023, the total number of methicillin-susceptible *S. aureus bacteremia* reported was 5,392. Methicillin-resistant *S. aureus bacteremia* as a proportion of all *S. aureus bacteremia* was 15.4% (980/6,372) in 2023, slightly higher than the proportion in 2022 (14.1%) (Figure 2).

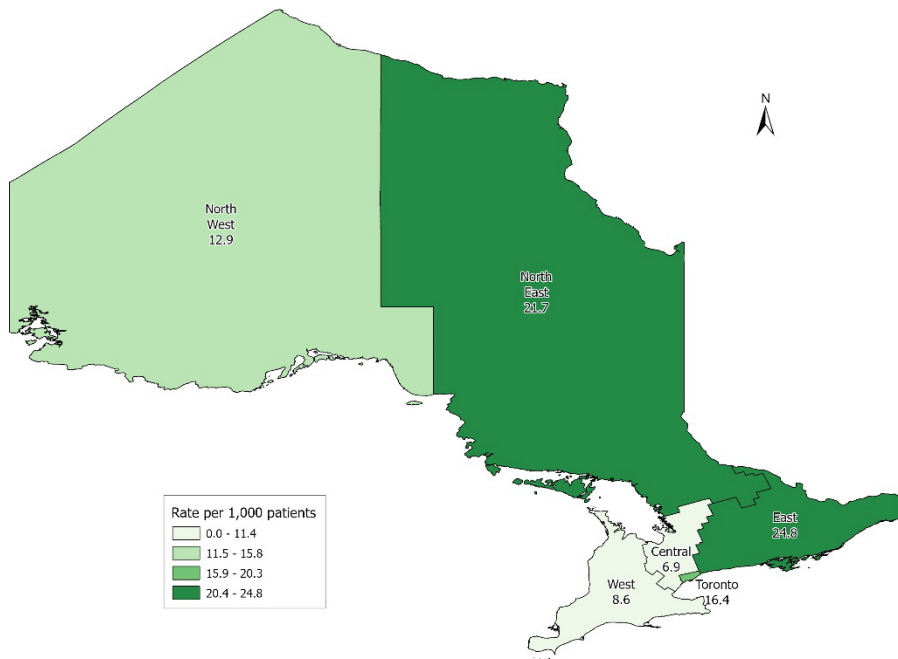
The East, North East and Toronto regions had the highest rates of new patients with MRSA isolated from any specimen site in 2023 (Figure 3, Appendix A).

**Figure 2. Number of MRSA bacteremia and percentage of all *S. aureus* bacteremia reported from hospital laboratories in Ontario, 2000–2023**



\*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 Ontario Health Region, 2023**

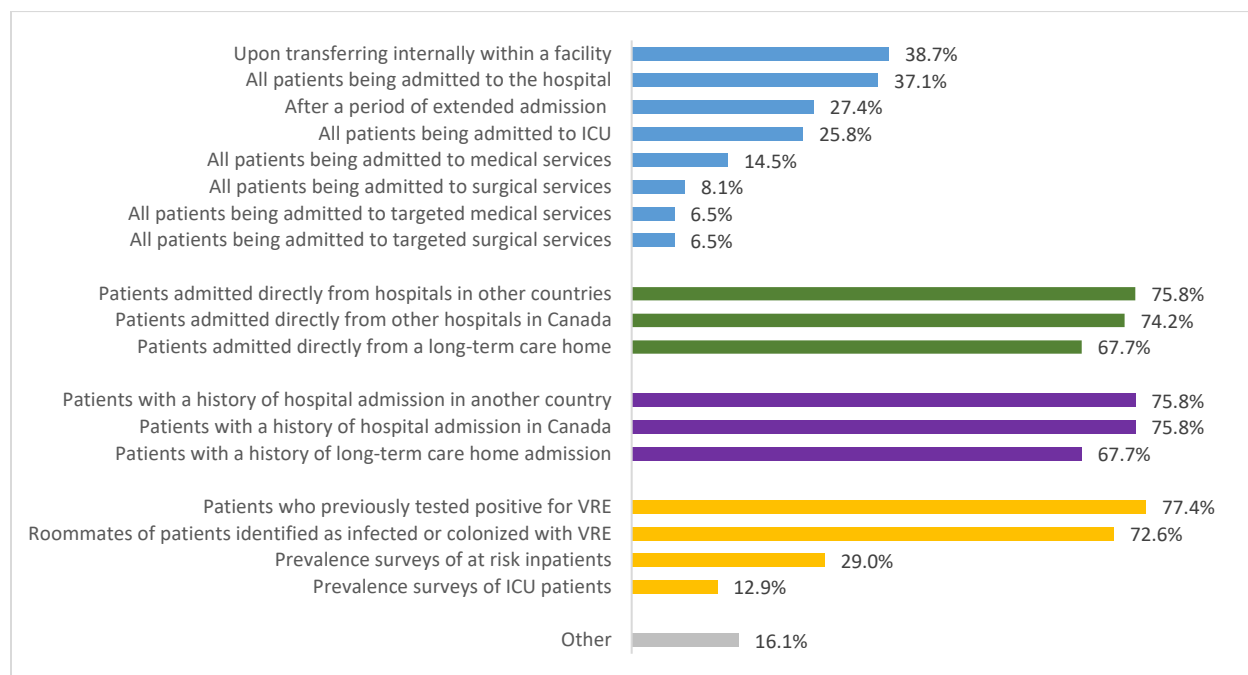


# Vancomycin-resistant Enterococci (VRE)

## Hospital Screening

In 2023, 63.2% (62/98) of the responding hospital corporations reported having a screening program for VRE, compared to 68.9% in 2022. Hospitals were most likely to screen patients who previously tested positive for VRE, patients with a history of hospital admission in Canada or another country, patients admitted directly from hospitals in other countries or from other hospitals in Canada, and those who were roommates of patients identified as infected or colonized with VRE (Figure 4).

**Figure 4. Criteria used by hospitals for VRE patient screening, 2023**



## Infection Control Practices

There were 64/98 (65.3%) hospitals that responded that Additional Precautions were used to care for all patients colonized and infected with VRE; four (4.1%) hospitals responded that Additional Precautions were only used for patients with VRE infections; two (2.0%) hospitals responded that Additional Precautions were only used in high risk units. There were 27 (27.6%) hospitals that reported Additional Precautions were not used for patients with VRE in 2023. One hospital did not respond to the questions on Additional Precautions.

In hospitals reporting the use of Additional precautions for VRE, 57/70 (81.4%) reported Additional precautions are discontinued once three negative swabs for VRE have been taken, with at least one taken three months after the last positive, and in the absence of antibiotic therapy. Hospitals also indicated discontinuation of precautions also requires the three negative swabs to be one week apart, and one negative swab from stool. Ten (14.3%) hospitals reported patients with VRE remain in Additional Precautions for the duration of their hospitalization.

## Laboratory Data

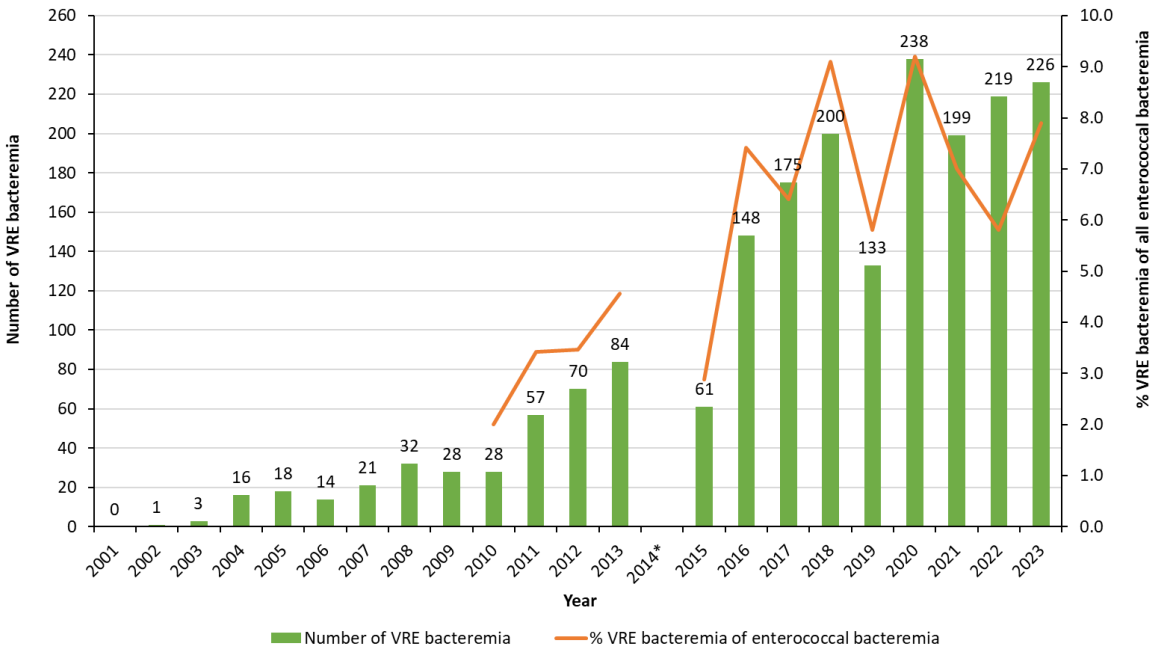
A total of 4,425 new patients with VRE isolated from any specimen site (i.e., colonizations and infections) were reported by hospital laboratories in 2023.

- In 2023, 226/4,425 (5.1%) patients with VRE had specimens isolated from blood culture:
  - *E. faecium*: 198/226 (87.6%)
  - *E. faecalis*: 4/226 (1.8%)
  - Other enterococci: 24/226 (10.6%)
- In 2023, 855/4,425 (19.3%) patients with VRE had specimens isolated from non-screening sites, excluding blood culture:
  - *E. faecium*: 803/855 (93.9%)
  - *E. faecalis*: 16/855 (1.9%)
  - Other enterococci: 36/855 (4.2%)

The total number of vancomycin-susceptible enterococcal bacteremia was 2,648 in 2023. The proportion of vancomycin-resistant enterococcal bacteremia of all enterococcal bacteremia was 7.9% (226/2,874) in 2023 (Figure 5).

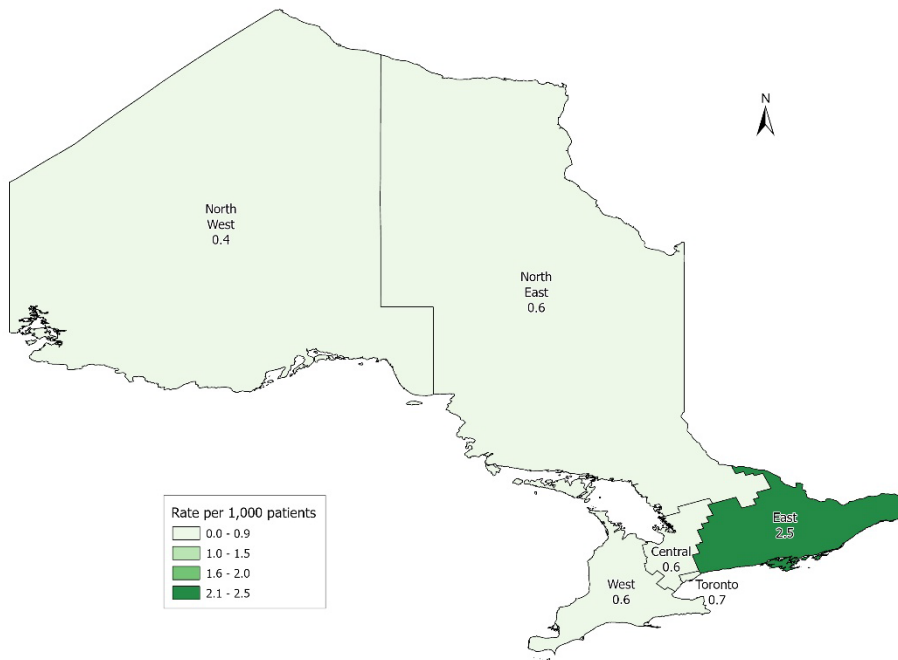
Hospital laboratories in the Ontario East region reported the highest rate of new patients with VRE isolated from all non-screening specimen sites (including blood cultures) in 2023 (Figures 6, Appendix A).

**Figure 5. Number of VRE bacteremia and percentage of all enterococcal bacteremia reported from hospital laboratories in Ontario, 2001–2023**



\*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 Ontario Health Region, 2023**



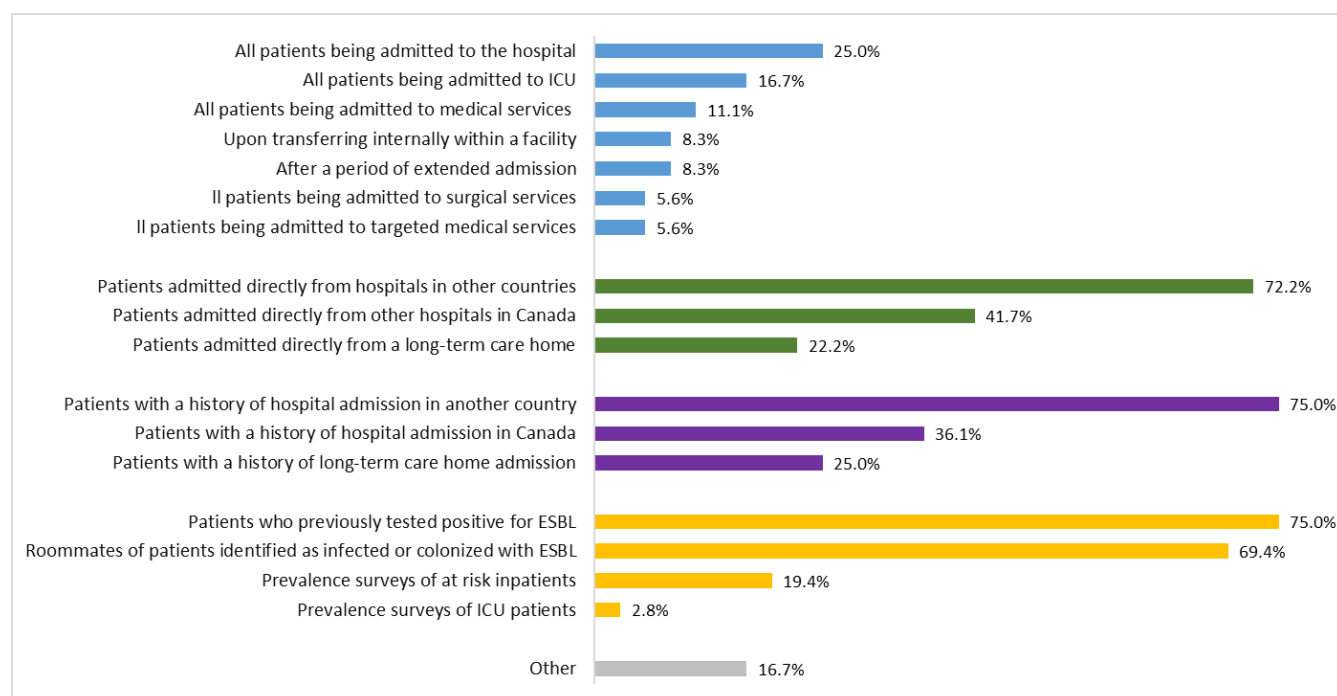
## Gram-Negative Bacilli

### Extended spectrum beta-lactamases (ESBL) Hospital Screening

Of the 98 responding hospital corporations, 36 (36.7%) reported having a screening program for extended spectrum beta-lactamases (ESBLs) in 2023, which is slightly lower than proportion in 2022 (39.7%).

Hospitals with a screening program for ESBLs were most likely to screen patients who previously tested positive for ESBL, patients with a history of hospital admission in another country, and patients admitted directly from a hospital abroad (Figure 7).

**Figure 7. Criteria used by hospitals for ESBL patient screening, 2023**



### ESBL Infection Control Practices

A total of 51 out of 98 (52.0%) hospitals responded that Additional Precautions were used for all patients colonized and infected patients with ESBLs. Seven (7.1%) hospitals indicated that Additional Precautions were only used for patients infected with ESBLs. Eight (8.2%) hospitals provided open-text responses including that Additional Precautions were only used in certain units. There were 31 (31.6%) hospitals that reported Additional Precautions were not used for patients with ESBLs. One hospital did not respond to the questions regarding Additional Precautions for ESBLs.

In hospitals reporting the use of Additional Precautions for ESBL, 33/66 (50.0%) reported Additional Precautions are discontinued once three negative swabs for ESBL have been taken, one week apart in the absence of antibiotic therapy. Twenty nine (43.9%) hospitals reported that patients who test positive for ESBLs remain on Additional Precautions for the duration of their hospitalization.



## Laboratory Data

In 2023, 301,587 isolates of *E. coli*, 75,525 isolates of *Klebsiella* spp., 42,219 isolates of *Pseudomonas aeruginosa*, and 2,834 isolates of *Acinetobacter* spp. from any specimen site were reported by laboratories.

Resistance to third-generation cephalosporins among *E. coli* isolated from all specimen sites has increased from 9.6% in 2017 to 12.8% in 2023 (Figure 8). Resistance to third-generation cephalosporins among *Klebsiella* spp. isolated from all specimen sites has increased from 4.7% in 2017 to 9.2% in 2023.

Resistance among *E. coli* isolates to ciprofloxacin showed an overall increasing trend with some fluctuations throughout the observation period. In 2023, the resistance rate reached 22.3%, the highest resistances level reported to date (Figure 9). Resistance among *P. aeruginosa* isolates to ciprofloxacin showed a decreasing trend from 18.0% in 2020 to 12.0% in 2023. *Klebsiella* spp. resistance to ciprofloxacin also showed an increasing trend and reached the highest rate of 9.3% in 2023. Resistance to ciprofloxacin in *Acinetobacter* spp. isolates decreased from 8.1% in 2019 to 4.0% in 2023.

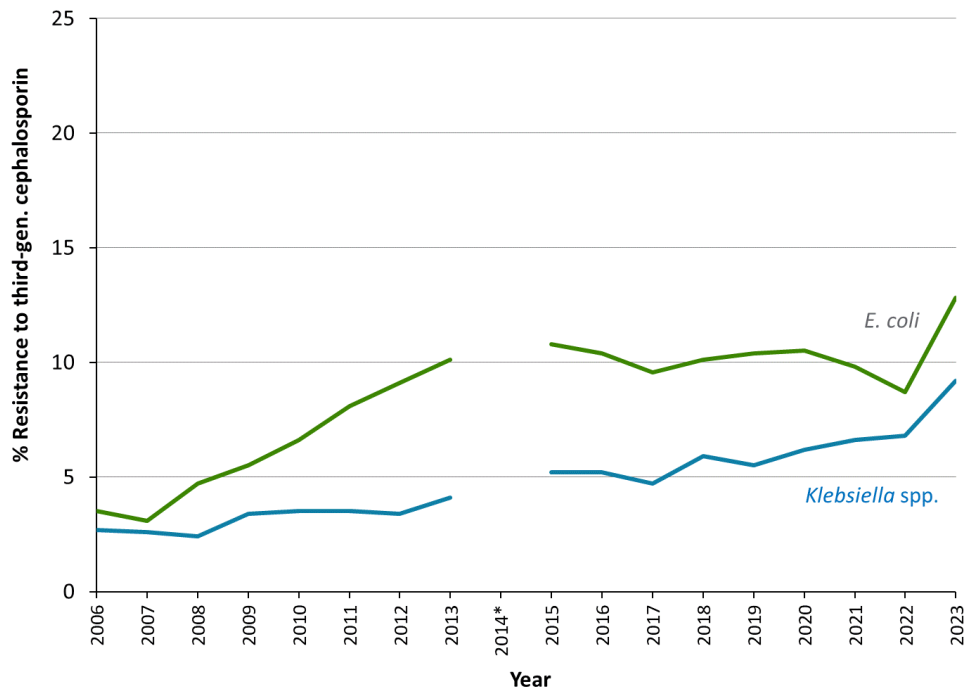
*P. aeruginosa* resistance from any specimen site to third-generation cephalosporins has remained mostly the same in recent years, from 7.8% in 2020 to 7.7% in 2023; resistance to meropenem increased slightly from 6.5% in 2019 to 7.5% in 2023 (Figure 10). *Acinetobacter* spp. resistance to third-generation cephalosporins fluctuated slightly in recent years, being 8.2% in 2023; resistance to meropenem decreased from 6.0% in 2020 to 3.4% in 2023.

Percent resistance of *P. aeruginosa* from blood to third-generation cephalosporins has increased from 4.5% in 2019 to 8.9% in both 2022 and 2023; resistance to meropenem also increased from 4.3% 2019 to approximately 9% in both 2022 and 2023 (Figure 11a). Among *Acinetobacter* spp. isolates, percent resistance from blood to third-generation cephalosporins increased steadily from 7.5% in 2019 to 18.7% in 2023.

*E. coli* resistance from blood to third-generation cephalosporins and ciprofloxacin fluctuated between 2019 to 2023, and reached the highest rates in 2023 at 18.8% and 25.8%, respectively (Figure 11a). *Klebsiella* spp. resistance from blood to cephalosporin and to ciprofloxacin increased from 4.6% and 4.1% in 2019 to 12.4% and 11.1% in 2023, respectively.

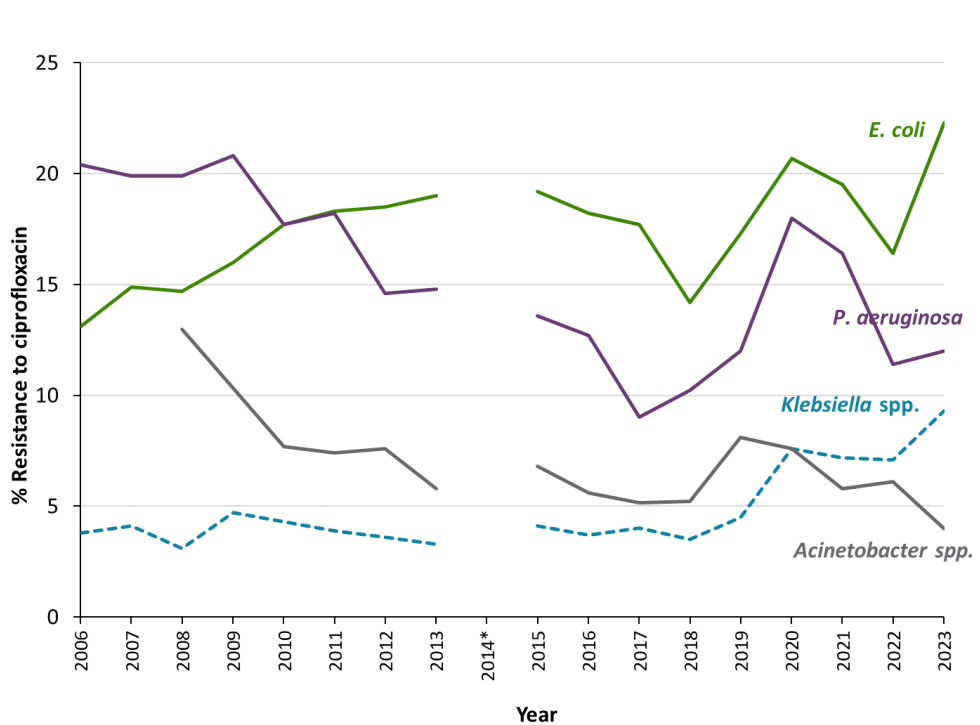
*E. coli* resistance in urine to third-generation cephalosporins and ciprofloxacin increased from 8.9% and 17.8% in 2019 to 12.2% and 21.9% in 2023 (Figure 11b), respectively. Similarly, resistance to third-generation cephalosporins and ciprofloxacin among *Klebsiella* spp. isolated from urine increased from 5.3% and 4.6% in 2019 to 7.8% and 8.9% in 2023, respectively.

**Figure 8. Percent resistance of all isolates of *E. coli* and *Klebsiella* spp. to third generation cephalosporins, 2006–2023**



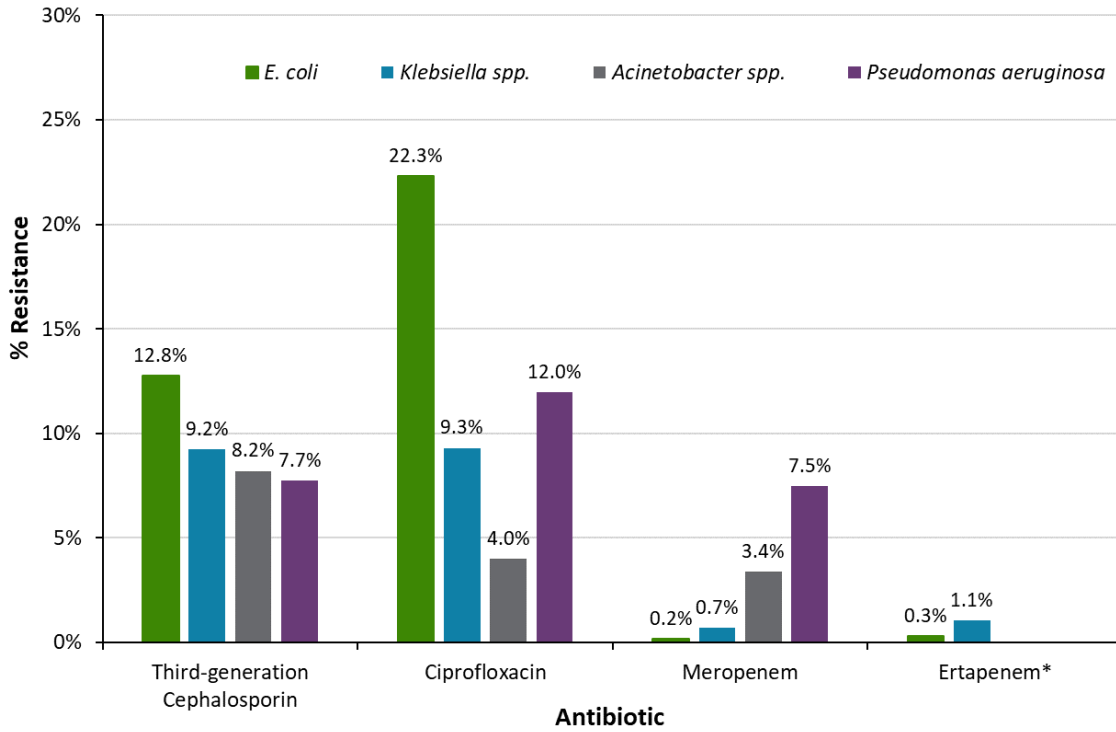
\*Survey was not conducted in 2014.

**Figure 9. Percent resistance of all isolates of *E. coli* and *Klebsiella* spp., *P. aeruginosa*, and *Acinetobacter* spp. to ciprofloxacin, 2006–2023**



\*Survey was not conducted in 2014.

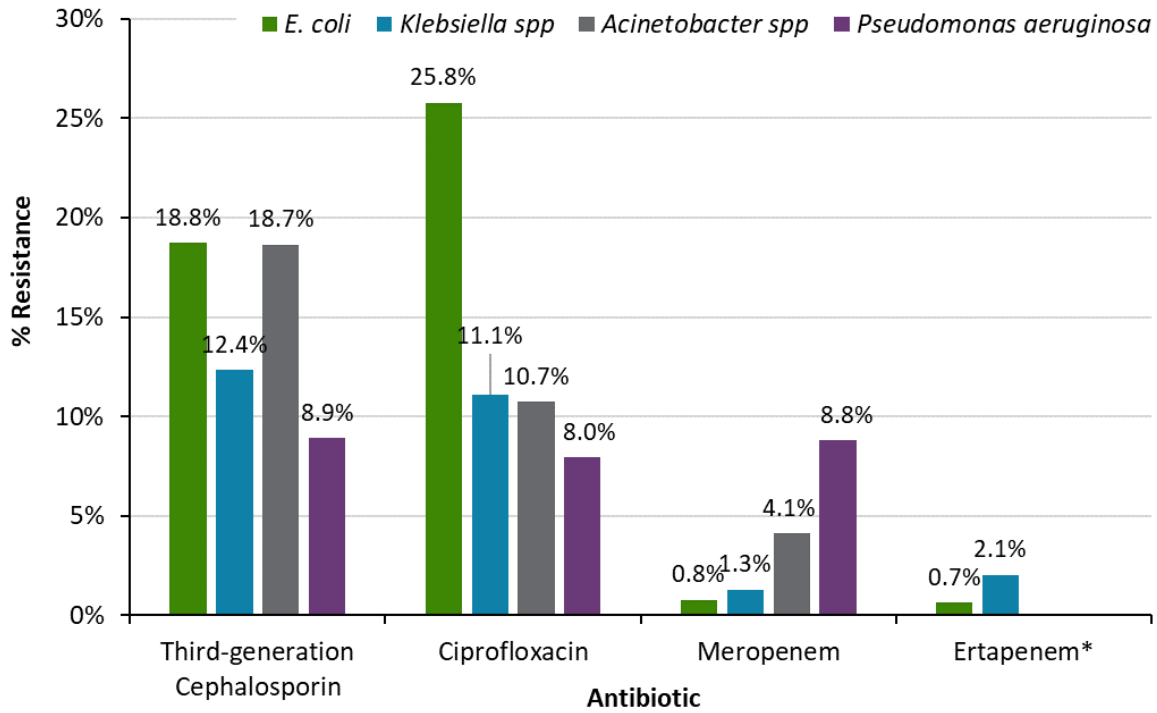
**Figure 10. Percent resistance of all isolates of *E. coli*, *Klebsiella* spp., *Acinetobacter* spp., and *P. aeruginosa* to third-generation cephalosporins, ciprofloxacin and carbapenems, 2023**



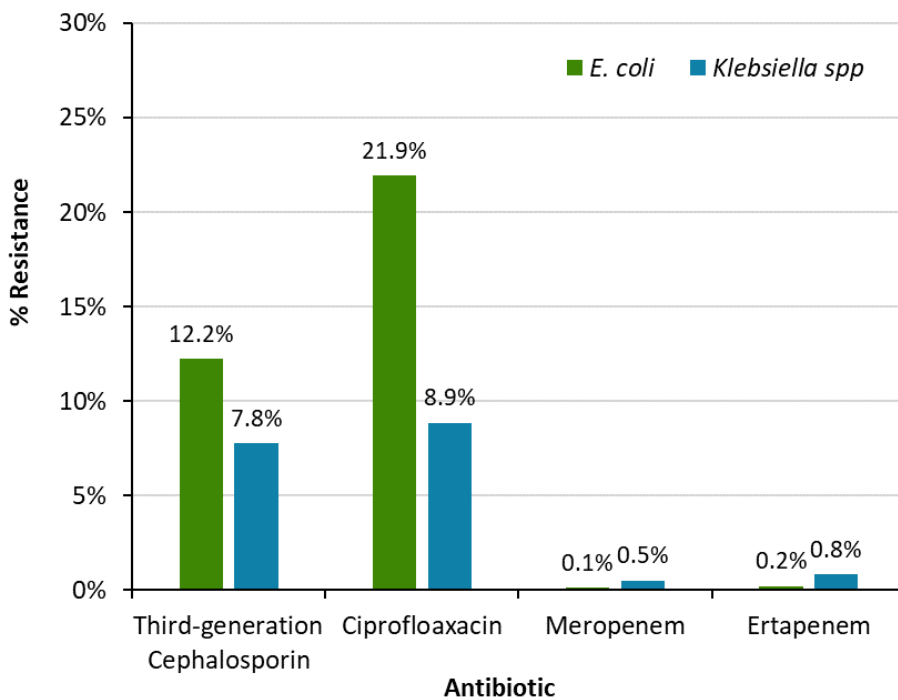
\*Note: Resistance to ertapenem is shown for *E. coli* and *Klebsiella* spp. only.

**Figures 11. Percent resistance of *E. coli*, *Klebsiella* spp., *Acinetobacter* spp., and *P. aeruginosa* from blood and urine to third-generation cephalosporins, ciprofloxacin and carbapenems, 2023\***

**A. Isolates from blood**



**B. Isolates from urine**



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

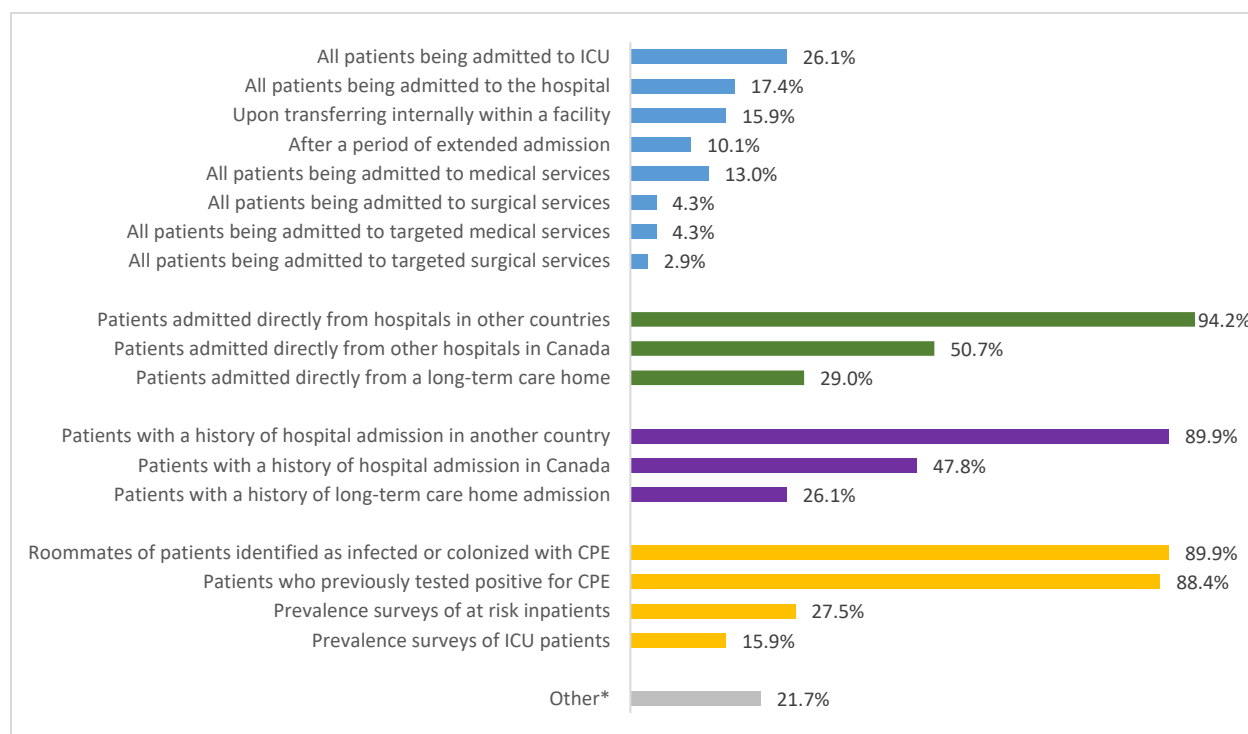
# Carbapenemase-producing organisms (CPO)

## Hospital Screening

Of the 98 responding hospital corporations, there were 69 (70.4%) that reported having a screening program for Carbapenemase-producing *Enterobacteriaceae* (CPE) in 2023, similar to 70.9% in 2022. Most (55/69; 79.7%) hospitals with screening programs indicated that they manage all CPO colonizations/infections the same, even if they are not from the *Enterobacteriaceae* family (CPE). There were 14/69 (20.3%) hospitals that replied they only apply Additional Precautions for CPE cases.

Hospitals were most likely to screen patients admitted directly from hospitals in other countries, patients with a history of hospital admission in another country, roommates of known CPE cases, and patients who previously tested positive for CPE (Figure 12).

**Figure 12. Criteria used by hospitals for CPE patient screening, 2023**



\*In the 'other' category, three hospitals indicated they screen patients reporting history of travel to the Indian subcontinent.

## Infection Control Practices

A total of 92 out of 98 (93.9%) hospitals responded that Additional Precautions were used for all patients with CPE colonizations and infections. One (1.0%) hospital responded that Additional Precautions were only used for patients with CPE infections. There were three (3.1%) hospitals that reported Additional Precautions were not used for patients with CPE. One (1.0%) hospital reported not seen CPE in their hospitals often, and another hospital did not respond to the questions regarding Additional Precautions for CPE.

Most hospitals (77/98; 78.6%) using Additional Precautions for CPE positive patients reported that these patients remain in Additional Precautions for the duration of their hospitalization. Eleven (11.2%) reported that Additional Precautions may be discontinued once three negative swabs have been taken in the absence of antibiotic therapy and 4 (4.1%) provided other information such as after consulting with IPAC professionals or physicians and for long-term patients only.

There were 77/98 (72.4%) hospitals reported that special attention was paid to cleaning sinks and drains used by patients with CPE. Fifty three (54.1%) reported twice-a-day cleaning, and 47 (48.0%) reported double cleaning of rooms on CPE patient discharge/transfer or discontinuation of precautions.

## Laboratory Data

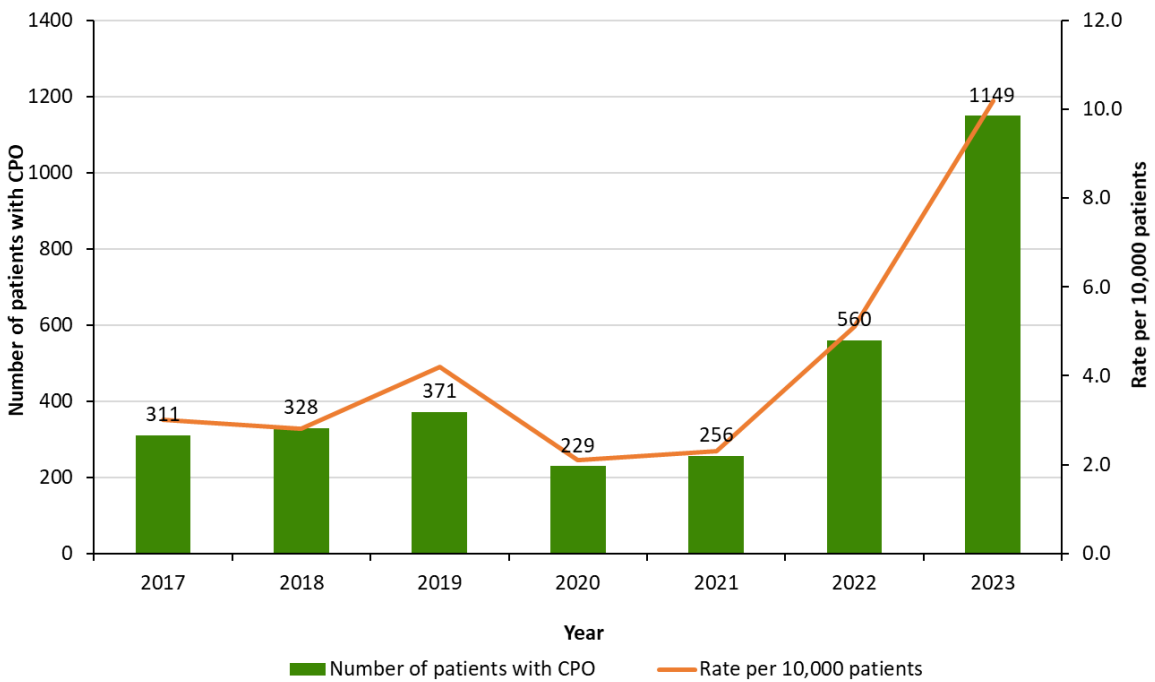
A total of 1,229 new patients with CPO isolated from any specimen site (colonizations and infections) were reported in 2023. Of these new CPO patients, 1,207 (98.2%) were associated with *Enterobacteriaceae* organisms.

- 319/1,229 (26.0%) specimens were identified from non-screening sites
- 48/1,229 (3.9%) specimens were isolated from blood culture
- 1,149/1,229 (93.5%) specimens were reported from hospital laboratories (Figure 13)

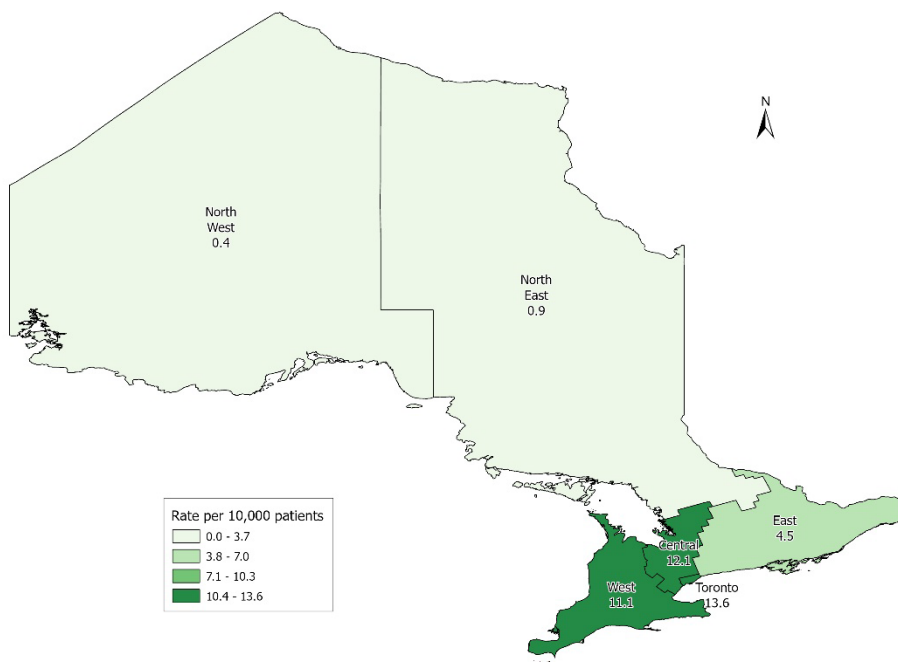
Among hospital-based laboratories, Toronto and Central regions had the highest rates of new patients with CPOs per 10,000 patients in 2023 (Figure 14, Appendix A). The overall rate increased from 5.1 per 10,000 patients in 2022 to 10.2 per 10,000 patients in 2023 (Figure 13).

The most commonly reported carbapenemase in 2023 was New Delhi Metallo-beta-lactamase (NDM; 678, 55.2%), followed by Oxacillinase (OXA; 320, 26.0%), *Klebsiella pneumoniae* carbapenemase (KPC; 168, 13.7%); Verona Integron-Encoded Metallo-beta-lactamase (VIM; 39, 3.2%); and, Imipenemase (IMP; 14, 1.1%) (Figure 15).

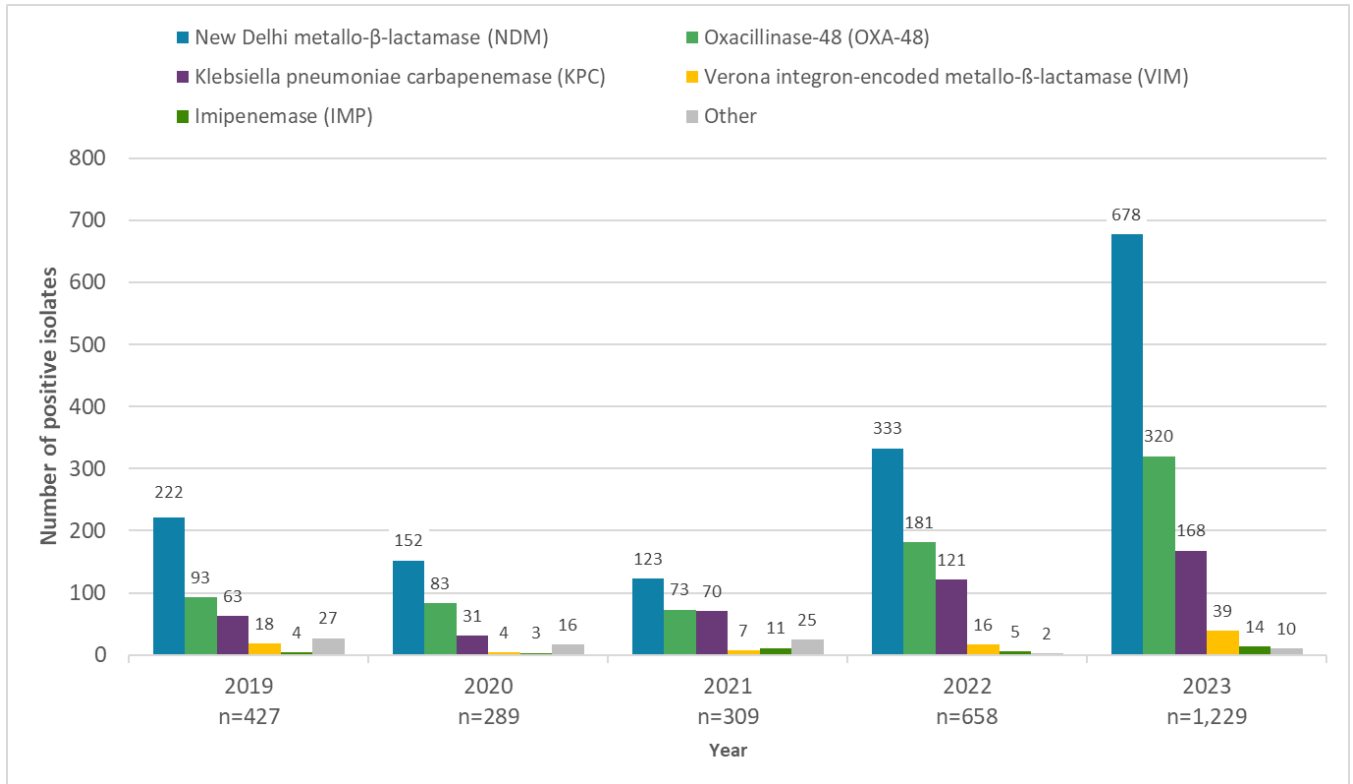
**Figure 13. Number of patients with CPOs isolated from any specimen site (colonizations and infections) and rate per 10,000 patients reported from hospital laboratories in Ontario, 2017–2023**



**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 Ontario Health Region, 2023**



**Figure 15. Number and proportion of CPO isolated from any specimen site (colonizations and infections) by carbapenemase and year, 2019–2023**





# *Clostridioides difficile* infections (CDI)

## Infection Control Practices

Most hospitals 69/98 (70.4%) hospitals responded that Additional Precautions were used for patients identified with symptomatic CDI infections. Twenty eight (28.6%) hospitals responded that Additional Precautions were used for all colonized as well as symptomatically infected patients.

There were 76/98 (77.6%) hospitals that reported Additional Precautions for CDI are discontinued when patients have had at least 48 hours of return to baseline stool pattern and 1 (1.0%) reporting that CDI patients remain in precautions for the duration of their hospitalization. Twenty (20.4%) provided other information such as waiting  $\geq 72$  after the patient returns to baseline stool patterns or waiting  $\geq 48$  hours following the completion of treatment to remove additional precautions.

A total of 82/98 (83.7%) hospitals reported daily double cleaning of CDI patient rooms using a sporicidal agent. Sixty six (67.3%) also reported double cleaning with a sporicidal agent after terminal/discharge or discontinuation of precautions. Half (49; 50.0%) of the hospitals also reported additional cleaning of patient equipment using a sporicidal disinfectant.

## Laboratory Data

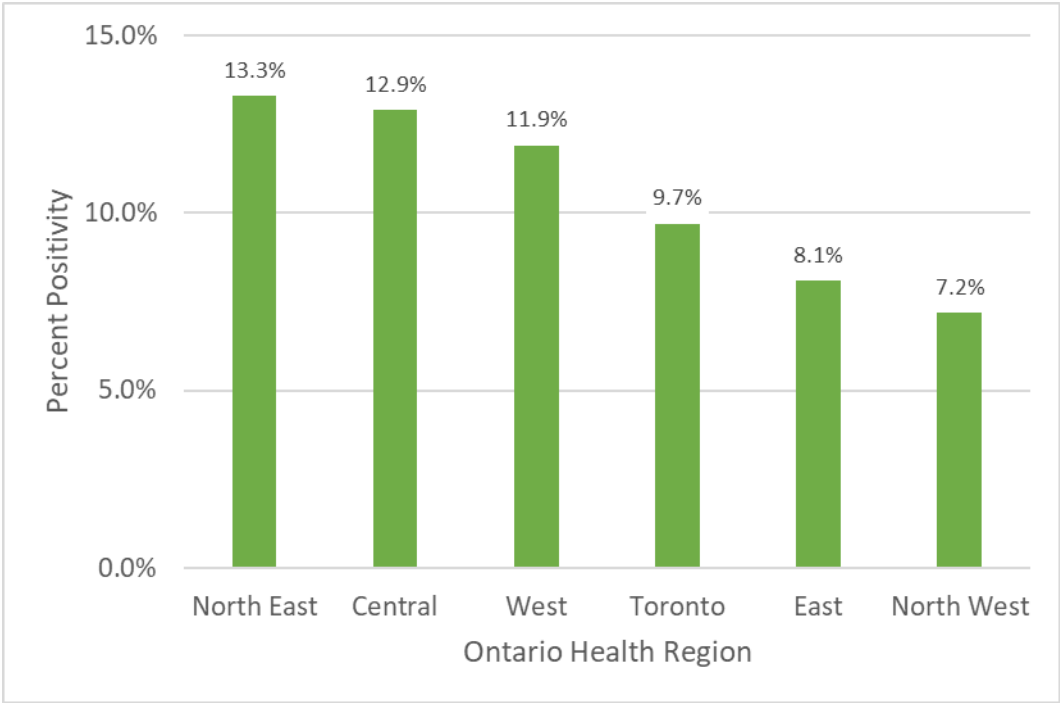
A total of 99,498 specimens were tested for *C. difficile* toxin by Ontario laboratories in 2023.

- 10,048 (10.1%) specimens were positive for *C. difficile* toxin from 7,108 people (overall rate 4.7 per 10,000 population).
- The *C. difficile* percent specimen positivity rate has decreased from 12.1% in 2022 to 10.1% in 2023.

Laboratories in North East, Central and West regions reported the highest proportion of specimens positive for *C. difficile* toxin in 2023 (Figure 16, Appendix A).

The Ontario Ministry of Health recommends turnaround time (TAT) from specimen collection to reporting is  $\leq 24$  hours. Due to limitations in understanding the interval between specimen collection and receipt at the laboratory, the survey asks laboratories about their average TAT from the time specimens are received to reporting test results. There were 49/51 (96.1%) laboratories that reported average TATs from specimen receipt at the laboratory to reporting  $< 24$  hours in 2023. Two (3.9%) laboratories reported an average TAT between 25–48 hours.

Figure 16. *C. difficile* percent specimen test positivity based on laboratory location by Ontario Health Region, 2023



# Candida auris

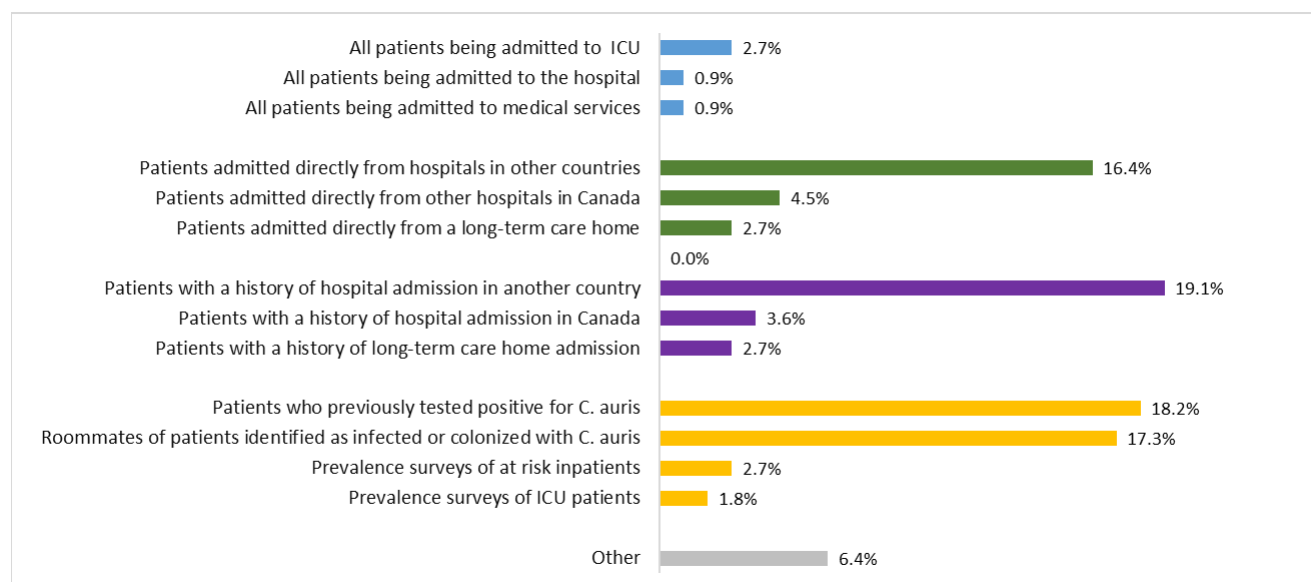
## Infection Control Practices

Of the 98 responding hospital corporations, 60 (61.2%) reported they did not have a *Candida auris* screening program at the time of the survey. Twenty-four (24.5%) hospitals reported they did have a screening program in place with 13 (13.3%) more reporting they were planning to implement a program. One hospital did not respond to this question.

The main reasons reported by hospitals for not having a *Candida auris* screening program were that they had yet to see a case (31/60; 51.7%), and there are too many competing priorities and/or insufficient resources to implement testing (31/60; 51.7%). Other reasons for not having a screening program for *C. auris* include 23 (38.3%) hospitals perceiving the risk level in their geographic area did not yet warrant a screening program, and 21 (35.0%) hospitals reporting that they did not yet have access to laboratory testing for *Candida auris*.

Hospitals were most likely to screen patients with a history of hospital admission in another country, patients who had previously tested positive for *Candida auris*, roommates of known *Candida auris* cases, and patients admitted directly from hospitals outside of Canada (Figure 17).

**Figure 17. Criteria used by hospitals for *Candida auris* patient screening, 2023**



## Laboratory Data

There were 34/65 (52.3%) laboratories that reported having procedures in place to identify *Candida auris* from routine clinical specimens at the time of the survey. Eighteen (27.7%) laboratories indicated they had procedures to identify *Candida auris* from surveillance specimens.

A total of three new patients with *Candida auris* isolated from any specimen site (colonizations and infections) were reported in 2023. All three specimens were identified from hospital screening with two cases reported from hospital(s) in the Central region and 1 from the West region (Appendix A).

# Discussion

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Health care-associated infections contribute to increased morbidity, mortality and burden on the health care system. This report summarized the findings of the annual survey on antimicrobial resistance of common hospital pathogens from 2023. Data need to be interpreted with caution due to the year-to-year variations in the laboratory survey response rate and the variability of hospitals that participate in the survey.

In 2023, the MRSA incidence rate in Ontario decreased compared to 2022. The proportion of MRSA isolates from blood cultures increased between 2023 and 2022. In recent years, the Canadian Nosocomial Infection Surveillance Program (CNISP) has observed a decrease in MRSA bloodstream infection (BSI) rates in Canadian acute care hospitals.<sup>7</sup> Similar to previous years, there was noticeable regional variation in MRSA rates in Ontario. The highest MRSA rates were observed in the East and North East Regions in 2023.

The VRE incidence rate remained stable between 2023 and 2022. The proportion of VRE isolates from blood cultures remained stable as well. While CNISP has observed an increase in VRE BSI rates in acute care hospitals.<sup>7</sup> The VRE rate remained highest in East Region in 2023.

The rate of CPO in Ontario hospitals is increasing, with rates nearly doubling year over year – from 2.8 per 10,000 patients in 2021 to 5.1 in 2022, and reaching 10.2 per 10,000 patients in 2023. An increase in CPE infection rates has also been observed by CNISP in recent years.<sup>7</sup> 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.<sup>8,9</sup> As of May 2018, carbapenemase-producing *Enterobacteriaceae* 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 2023, 847 cases were reported by public health units in the [reportable disease data](#)<sup>10</sup> while 1229 cases were reported in 2023 in the current survey by laboratories. The discrepancy may be attributable to laboratory survey data being reported as counts that can not be validated, potential duplicate reporting of the same CPO case by laboratories, and possible underreporting of cases in iPHIS.

While hospital-based rates of CDI have been decreasing since 2012 and remained relatively stable in recent years<sup>11</sup>, CDI prevalence rates from this survey peaked at 8.6 per 10,000 population in 2022, and decreased to 4.7 per 10,000 population in 2023. CNISP has observed fluctuating CDI rates in recent years.<sup>7</sup> Differential trends in CDI rates were also observed in a study on the epidemiology of *Clostridioides difficile* infection in pre-pandemic years.<sup>12</sup>

Percent resistance varies by antibiotic and by Gram-negative organism. Notably, in 2023, the resistance rates of *E. coli* and *Klebsiella* spp. to third generation cephalosporins, as well as *E. coli* resistance to ciprofloxacin, reached their highest levels since 2006.

There has been exponential growth in colonizations and infections of *Candida auris* in the United States and in Europe.<sup>13-15</sup> Given Canada's proximity to the US, *Candida auris* infections across Canada are expected to increase. Ontario laboratories are encouraged to submit all *Candida auris* isolates to the Public Health Ontario (PHO) laboratory for confirmation and susceptibility testing.<sup>16</sup> Since 2014, 23 cases

of *C. auris* have been found from isolates which have been voluntarily submitted to PHO laboratory for testing (2024 email from PHO Microbiologist, J Kus; unreferenced). Understanding the true incidence of *Candida auris* in Ontario is difficult as only half of the responding laboratories reported established processes for identification and only about 25% of responding hospitals indicated they had screening programs in 2023. Despite this, 3 positive isolates were reported by responding laboratories in 2023, and all of which were identified through screening programs.

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, CPO and *C. auris* continue to be inconsistent among 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. (2020) that found increasing rates of VRE bloodstream infections were highly associated with discontinuation of screening programs and Additional Precautions for VRE.<sup>17</sup>

## Conclusion

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The epidemiological data obtained from Ontario laboratories and hospital infection prevention and control programs helps in understanding the impact of AROs and informs recommendations to prevent spread within our province. Continued and improved surveillance of AROs are necessary to understand the current landscape of resistance. Identifying regional variation in incidence of organisms can inform provincial and local decisions regarding appropriate application of infection control policies.

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## Appendix A: Number of new patients and Rates by Ontario Health Region, 2023

Ontario Health Region	MRSA Number of new patients*	MRSA Rate per 1,000 patients*	VRE Number of new patients*	VRE Rate per 1,000 patients*	CPO Number of new patients*	CPO Rate per 10,000 patients*	<i>C. auris</i> Number of new patients*	<i>C. auris</i> Rate per 10,000 patients*
Central	1,835	6.9	162	0.6	321	12.1	2	0.1
East	4,948	24.8	504	2.5	89	4.5	0	0.0
North East	695	21.7	20	0.6	3	0.9	0	0.0
North West	347	12.9	11	0.4	1	0.4	0	0.0
Toronto	4,458	16.4	187	0.7	369	13.6	0	0.0
West	2,836	8.6	197	0.6	366	11.1	1	0.0
Total	15,119	13.4	1,081	1	1,149	10.2	3	0.0

\*Reported from hospital laboratories



# Appendix B: Data Caveats and Assumptions

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## 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. The data in this report has assigned Ontario Health Region boundaries based on postal codes of the laboratories, which potentially impacts comparisons to previous reports. In addition, rates by Ontario Health Region were calculated excluding patient discharges from hospitals served by laboratories that did not respond to the laboratory survey. 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 during 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. Not all laboratories responded fully to each question in the survey, which may have resulted in underestimating AROs.

For both the laboratory and hospital surveys, several assumptions were made during the data cleaning process. The assumptions listed below 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).

## Assumptions

### Laboratory Data

1. Counts provided in the survey were assumed to be accurate.
2. The total number of isolates was used where the subtotals did not match the total number of isolates.
3. Interpretation of questions may vary between laboratories, especially when different laboratory personnel respond to the survey year to year.
4. Regionally stratified data were based on the location of the submitting laboratory.

### Hospital Data

1. Infection control practices submitted by the corporation were assumed to apply across all institutions under the corporation.
2. Reinstatement of disruptions to screening and management practices due to the pandemic were assumed if respondents indicated an end date or 'unknown' to questions asking if practices were later reinstated.

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