Carbapenemase-producing Organisms (CPO) Protocol

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Alberta Health Services
Infection Prevention & Control

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Contents

Introduction

Gram-negative bacilli including Enterobacteriaceae and related families, *Pseudomonas* species and *Acinetobacter* species are common pathogens found in some hospitalized patients. These organisms primarily cause urinary tract infections, ventilator-associated pneumonia, and wound infections and may progress to bloodstream infections. Multi-drug resistant gram-negative bacilli are an emerging problem because infections caused by these organisms cannot be treated with usual first-line antibiotics and can cause increased morbidity and mortality in patients.

Carbapenem-resistant organisms are usually resistant to all penicillins, cephalosporins and carbapenems and are prone to spread within healthcare facilities. Their resistance is mediated by a number of mechanisms, one of which is the presence of an inactivating enzyme (a carbapenemase) which is detected using specific gene-detection laboratory tests. Three classes of acquired carbapenemases are found in Enterobacteriaceae and related families, *Pseudomonas* species and *Acinetobacter* species (Gupta, Limbago, Patel, & Kallen, 2011). Factors affecting the emergence and spread of CPOs include cross-border movement of patients due to travel, medical tourism and refugees (Canton et al., 2012).

When using this protocol, each CPO episode (infection or colonization) will be considered separately, and the rules of the protocol will be applied independently for each. Surveillance rates will be reported at the patient-level, e.g., each time the patient is identified with a new CPO episode, the patient will be identified as a separate initial case regardless of the number of new organisms identified at that time.

There are four supporting tools to assist in the interpretation and practical use of the protocol:

- CPO Protocol-Specific and General Surveillance Definitions (Appendix A and Appendix B)
- CPO Case Classification Algorithm (Appendix C)
- CPO User Guide (Alberta Health Services [AHS], 2018).

Goal

To monitor hospital-acquired, hospital-identified and identified on admission CPO cases in Alberta Health Services (AHS) and Covenant Health facilities.

Objectives

1. To determine the incidence of hospital-acquired, hospital-identified, and On Admission CPO colonization and infections in the population under surveillance in AHS and Covenant Health acute and acute tertiary rehabilitation care facilities, and to collect information on patient risk factors to describe the emerging epidemiology of CPO in Alberta.
2. To use surveillance results to develop and evaluate Infection Prevention and Control (IPC) interventions which support safer patient care.
3. To establish quarterly and annual CPO incidence rates for trend analysis over time and to compare with internal and external benchmarks.
4. To establish incidence rates of bloodstream infections (BSI) with CPO.

Methodology

- Cases eligible for surveillance are inpatients with laboratory confirmed CPO.
- Reports of specimens originating from facilities under surveillance will be forwarded by laboratories to site-based IPC programs or designates. Confirmation must be obtained at the reporting facility where the patient is an inpatient, except in the case of admission screening of direct patient transfers within provincial facilities under surveillance where acquisition is being attributed to the sending facility.
- Facility Infection Control Professionals (ICP) receiving CPO laboratory reports will determine if cases are hospital-acquired, hospital-identified, or on admission and compile and record at least the minimum case information. Data from completed CPO surveillance will be entered into the provincial surveillance platform.

Patient population

All individuals admitted to AHS/Covenant Health acute and acute tertiary rehabilitation care facilities where inpatient care is provided 24 hours/day, 7 days a week. Acute and acute tertiary rehabilitation facilities will be referred as the "facilities under surveillance" in this protocol for simplicity. Refer to Appendix B**: General surveillance definitions** (Encounter Types) for facilities that would be included under this term.

Case definition

Each **Initial** case is the presence of one (1) or more new lab confirmed CPO(s) from a body site;

AND

Is identified as positive with a CPO at the time of admission or during hospitalization.

Inclusion criteria

- Patients with lab-confirmed specimen(s) of *Enterobacteriaceae* and related families, *Pseudomonas aeruginosa* or *Acinetobacter* species with acquired carbapenemase meeting the Alberta Health definition and confirmed to have a carbapenemase by molecular methods (Alberta Health, 2021).
- Previously known CPO positive patients with a different organism which produces a carbapenemase (i.e., a new **Initial** case if the patient acquired another CPO with a different organism identified).

A new **Initial** case is based on a patient having a culture positive for a new carbapenemase producing organism, not the same organism previously identified as a CPO which has acquired another carbapenemase producing gene, for example:

- A patient identified with an *E.coli* with a KPC gene and an *Acinetobacter* species with an OXA gene in the same specimen would be a single initial case.
    - If the patient is later identified with an *E.coli* that has both KPC and NDM (i.e., new genes are detected) a follow-up record is created, ***not*** another initial case, because the same organism is identified. i.e. different CPO genes in the same organism are not considered new initial cases.
    - If the same patient is later identified with a *Klebsiella* species that has a KPC gene, this would be a second initial case because a new organism has been identified.

Once a particular CPO has been identified (i.e., there is an **Initial record)**, subsequent data entries for infections or colonizations with that organism would be entered as **Follow-up records** in the provincial surveillance platform.

Exclusion criteria

- Patients with laboratory confirmed CPO who were not admitted at the time of specimen collection or were not subsequently admitted as an inpatient following their emergency department visit are not eligible to be an **Initial** case.

Case classification

Once the patient has been identified as an initial CPO case, they will be classified as hospital-acquired, hospital-identified, or on admission. For all case classifications, additional risk factor information will be collected to better understand the emerging epidemiology for these organisms in Alberta. Case classification is based on the following criteria:

Hospital-acquired

- Initial CPO on **any day of admission** based on an assessment by the ICP believed to be epidemiologically linked to another person(s) with a CPO infection or colonization in the current facility admission (e.g., shared same room, same ward/unit, same caregiver, or same procedure/surgery as a known patient with the same CPO);

OR

- The specimen collection date of the initial CPO occurs during a hospital admission within 12 months of an epidemiological link in a previous admission to any facility under surveillance.

Direct transfers between facilities

- If a patient not known to be CPO positive is transferred directly from one AHS/Covenant Health acute or acute rehabilitation care facility to another and is identified positive by the receiving facility, the sending facility must be notified of the CPO and ICPs from both facilities should discuss and determine the case classification.
- The sending facility records the case as hospital-acquired if there was an epidemiological link to their facility or hospital-identified/on admission if the CPO does not have an epidemiological link to another facility under surveillance within the past 12 months.

Hospital-identified

Initial CPO on or after the 3rd calendar day of admission based on an assessment by the ICP using the following criteria:

- No known CPO colonization or infection at time of admission;

AND

- No established epidemiological link to another person(s) with a CPO infection or colonization for the same organism at the current facility or any facility under surveillance in the 12 months prior to specimen collection date.

On admission

Initial CPO on calendar day one or two of admission based on an assessment by the ICP using the following criteria:

- Does not meet definition for hospital-acquired or hospital-identified;

AND

- No established epidemiological link to another person(s) with a CPO infection or colonization at the current facility or any facility under surveillance in the 12 months prior to specimen collection date.

Other considerations for classification

- Site of positive culture as an **Initial** case - If a patient has multiple body sites positive with the same CPO within one (1) day of each other, use the culture result with the most significant manifestation of the organism (i.e., most clinically relevant specimen) to report as the **Initial** record. If the patient has an infection and colonization within one day of each other, the infection should be captured as the **Initial** case. e.g., if blood and rectal culture specimens are positive within one day of each other, the blood specimen should be used when creating the **Initial** case. If specimens were collected more than 1 day apart, use the specimen with the earliest collection date as the initial case.

Readmissions within 12 months of known epidemiological link and no travel history

- If a patient (not known to be CPO positive) is admitted to a facility under surveillance, has a known epidemiological link to another facility under surveillance (in the last 12 months) and is identified with a CPO infection or colonization on admission (i.e., prior to calendar day 3), the Infection Control Professional at the epidemiological link facility must be notified of the CPO to agree with the interpretation of the case classification. The ICP at the admitted facility creates a **For Info** record using the encounter information of their facility and sends invite to ICP at the epidemiological link facility.
- If the ICP at the epidemiological link facility confirms that there was an epidemiological link at their facility and the case is hospital-acquired to their facility, the ICP will complete the data entry as hospital-acquired at their site.

BSI with CPO surveillance

- All new BSI episodes with a CPO under surveillance are to be entered into the provincial surveillance platform CPO and BSI module.

Note: Each new BSI with CPO episode must be entered in the provincial surveillance platform but not every positive blood culture result from the same BSI episode. Please refer to the provincial BSI protocol for more information (AHS, 2023).

- For BSI with CPO, the case classification for BSI and CPO are determined independently. Classify the CPO based on the CPO protocol and the BSI based on the BSI protocol.
- Any new hospital-acquired BSI where the pathogen is CPO is included in the hospital-acquired BSI with CPO rate. This is regardless of the status of the CPO (either **Initial** or **Follow-up**). The event is reported in the reporting quarter of the BSI event date.

CPO identified in surgical site infections (SSI)

- If a patient has a CPO positive culture from an SSI and is deemed to be an SSI according to the National Healthcare Safety Network Surgical Site Infection definitions (Centers for Disease Control and Prevention [CDC], 2024a), that information should be entered independently in the provincial surveillance platform CPO module and into the SSI module if the surgical procedure is one followed for either provincial or local SSI surveillance and is a deep incisional or organ space SSI within the defined follow-up period.
- If a CPO is identified from a **superficial incisional SSI** (infection is occurring within 30 days of the surgery), the **Initial** CPO case will be classified according to the criteria for case classifications above

and does not require data entry in the SSI module unless followed for local SSI surveillance.

- If a CPO **Initial** case is identified from a **deep incisional or organ-space SSI** it will be classified according to the following criteria:
  - If the surgery resulted in a deep or organ-space SSI, the CPO **Initial** case will be hospital-acquired to the facility where the surgery was done if infection occurs within their National Healthcare Safety Network Surgical Site Infection defined follow-up time. The procedure facility and surgery admission date should be used as the Encounter information for that record and the ICP at that facility should be notified of the CPO to agree with the interpretation of the National Healthcare Safety Network definition.
  - Any SSIs identified outside of the follow-up time and within 12 months will be classified according to the criteria for case classifications above.

    *For procedures performed at a Chartered Surgical Facility, the Initial CPO record will be entered as healthcare associated at the facility where the SSI was found.

Risk factors

The following risk factors must be reported for hospital-identified and on admission CPO cases:

Travel outside Alberta (in past 12 months)

- Healthcare exposures outside Alberta (e.g., medical tourism, unexpected hospitalization, or returning military personnel that received medical care outside Alberta);

or

- Travel/residency outside Alberta with no healthcare exposures.

Epidemiological link in Alberta (in past 12 months)

- Community (e.g., no identified risk factors, or household contact of known CPO positive patient).
- Does not include epidemiological links to AHS/Covenant Health facilities.

AHS/Covenant Health healthcare exposures (in past 12 months)

- Previous admission to an AHS/Covenant Health facility for more than or equal to 3 calendar days with **no known** CPO epidemiological link.
- In the past 12 months was a resident at a Continuing Care Home Type A
- Has indwelling catheter or medical device at the time of culture that is externally exposed and can be manipulated for care on a regular basis.
- In the past 12 months was known to have a surgical procedure, peritoneal dialysis or hemodialysis.

Data collection and data entry

CPO Data entry		
Record Type	**Description**	**Mandatory Entry**
For Info	Non-acute care positive CPO BEFORE the first inpt CPO specimen	No
	Any positive specimen identified by the ARO clearing protocol[1] BEFORE the Initial CPO record	No
	Any negative specimen identified by the ARO clearing protocol[1] BEFORE the Initial CPO record	Yes
Initial	A patient's first CPO positive as an inpatient (either a screening or clinical specimen)* **OR** Previously known CPO positive patient with a different organsims which produces a carbapenemase * Needs case classification (HA, HI, OA) and Case severity (infection or colonization) and Case severity (infection or colonization)	Yes
Follow-up	Clinical specimen from the same ogranism that represents the first episode of infection AFTER an Initial CPO from colonized specimen	No
	Any New BSI with CPO identified AFTER the Initial CPO record	Yes
	Any negative specimen identified by the ARO clearing protocol[1] AFTER the Initial CPO record	Yes
	Any positive specimen identified by the ARO clearing protocol[1] AFTER the Initial CPO record that is the same organism as the initial CPO record, even if a new gene is identified	No
	The first new positive for a patient who was previously cleared	No

[1]Please refer to protocol located here: COMMON>ARO Screening and Flag Clearing>ARO Flag Clearing> Protocol and FAQ

Mandatory data entry

- Initial CPO laboratory episodes of an admitted patient in all AHS/Covenant Health facilities under surveillance.
- Case severity decisions for each case should be noted using National Healthcare Safety Network infection definitions (CDC, 2025a).
- All inpatient blood cultures growing CPO from facilities under surveillance must be evaluated and if determined to be a New BSI episode it must be entered directly in the provincial surveillance platform CPO module and BSI module regardless of the CPO record type (**Initial**, **For Info**, **Follow-up**) (AHS, 2025).

Minimum case information

Basic demographic, facility and microbiological data will be collected on all cases and must include:

- Name (first, middle, last)
- Date of birth
- Gender
- Alberta Personal Healthcare Number (PHN) (or Unique Lifetime Identifier (ULI))
- Connect Care Medical Record Number (MRN)
- Record type and case classification (i.e., hospital-acquired, hospital-identified, on admission)
- Admission date to reporting facility
- Reporting zone and facility name
- Encounter service and area where patient is admitted
- Culture date, laboratory name, accession number, and cultured site
- Case severity (colonization/infection)
- Specimen sampling reason
- Organism(s) and gene(s)
- Risk Factors - Healthcare and Travel Risk Factors (where this information is available in the patient record).

For more information contact ipcsurvstdadmin@ahs.ca

Other considerations for data entry

- Information may be obtained from a variety of sources including inpatient charts (current or archived), nurses' logs, laboratory reports, nursing and medical staff, etc. The data will be collected by the ICP manually or electronically as soon as possible after the lab report of the **Initial** CPO specimen is obtained.
- Each ICP or IPC designate will be responsible for timely entry of the surveillance data into the provincial surveillance platform. It is expected that the minimum data set is collected and entered in a timely manner after factoring in time of collection, to time to reach laboratory, work-up and distribution to ICP and/or IPC offices.
- As a recommendation, data entry should be completed within 1-2 weeks of receiving the laboratory report by an ICP or an IPC designate.
- If the specimen and clinical details do not meet NHSN definition of infection, this would qualify as a colonized record.

Denominator data

Denominators (numbers of inpatient admissions and inpatient days) are provided by AHS Analytics. Denominators are presented by month, which are aggregated for the fiscal quarter of the report. Denominators used for reporting can be accessed on Tableau Workbooks.

Rate calculations

Incidence rates for AHS/Covenant Health hospitalized patients	Calculations
Hospital-acquired CPO	$\frac{\text{Number of hospital-acquired CPO cases}}{\text{Number of patient-days}} \times 10{,}000$
Hospital-identified CPO	$\frac{\text{Number of hospital-identified CPO cases}}{\text{Number of patient-days}} \times 10{,}000$
On admission CPO	$\frac{\text{Number of on admission CPO cases}}{\text{Number of admissions}} \times 1{,}000$
Total CPO	$\frac{\text{Total Number of CPO cases}}{\text{Number of admissions}} \times 1{,}000$

Comparator rates

Internal and external surveillance rates are used as comparators. The internal rates are the historical rates for the province or zone from the previous fiscal year. The external rates are provided by the Canadian Nosocomial Infection Surveillance Program (CNISP) which are created from data submitted by large and tertiary acute care facilities; therefore, may not provide appropriate comparison for smaller acute care facilities.

Reporting

Communication and dissemination of surveillance reports is an integral part of surveillance, to inform IPC practice within AHS/Covenant Health and provide support for interventions that improve the quality of patient care delivered. Responsibility for compiling, reporting, and disseminating data and reports is shared between provincial IPC Surveillance and Standards and the provincial IPC program. Formal reports are generated routinely (usually quarterly) using reconciled and validated data. The reports contain information on the site,

zone and provincial level and are presented to the provincial IPC Surveillance, Evaluation, Quality Improvement and Research Committee for approval (AHS, 2023). Operational reports are created by local ICP or their designate and may or may not consist of reconciled and validated data, as they are often created with real-time, as is, data. Additional BSI with antibiotic-resistant organism information can be accessed on IPC Tableau Workbooks.

Outbreak reporting

Real-time reporting and critical threshold reporting is available to ICP from the provincial surveillance platform for immediate management of detected outbreaks. Since CPO is unusual in Alberta, all CPO cases will be reviewed. Two or more of the same CPO clustered in time or place should be considered an outbreak and should prompt investigation and intervention relative to potential or determined causative factors. Please see Management of CPO Provincial guidelines located COMMON>ARO Screening and Flag Clearing>CPO WG for more information.

Data quality

The purpose of evaluating the quality of data is to ensure that surveillance-related events are monitored efficiently and effectively. The evaluation should involve the assessment of the program (i.e., the protocol and reporting) and system (i.e., electronic data collection tool) attributes, including relevance, simplicity, flexibility, data quality, acceptability, consistency, representativeness, timeliness and stability. Additionally, with increasing use of technology, informatics concerns for surveillance systems need to be addressed. These include evaluating hardware and software, using a standard user interface, applying standard data formatting and coding, performing quality checks and adhering to confidentiality and security standards.

A standardized approach is used to reconcile and validate the data provincially. The first component of data reconciliation and validation of data in the provincial surveillance platform ensures that demographic data are valid and reliable. The second component entails ensuring that the surveillance-related events are entered in a manner that is consistent with the protocol definitions. At this latter stage, outliers are identified, and requests are sent to the ICP to verify that the data was correctly entered, and definitions were consistently applied according to the provincial surveillance protocol. Final designation of cases is a collaborative effort between the facility-based ICP and the epidemiologists/analysts of the IPC Surveillance and Standards team.

Further use of statistical software for validating records is still in development. Algorithms are continuously being updated and added to ensure capture of as many discrepancies as possible. In addition to this current process of data review, there will be data audits using external data sources to determine the validity and reliability of the data in the provincial surveillance platform. The data will also serve to inform decisions made by the IPC Surveillance and Standards team to improve surveillance processes and methodologies.

On-going case-severity decision reviews are conducted to create a supportive environment for the ICP and IPC physicians at the facilities, and to create mentoring relationships between Data Quality Working Group members and ICP at these facilities to support all aspects of surveillance across the participating facilities.

Data quality working group

The IPC Surveillance Data Quality Working Group reports to the IPC Surveillance, Evaluation, Quality Improvement and Research committee and is responsible to develop, review and update indicator protocols to include the precise methodology for data collection to ensure consistency. Decisions from the Data Quality Working Group on specific protocol questions are communicated to provincial ICP through the Data Quality Forum and will be included in the protocol User Guide. These decisions will be supplemental to the protocol and will be incorporated into the protocol when revised.

Protocol revision history

Date	Details
December 2012	Protocol approved by Surveillance Committee.
March 2017	Revised.
March 2018	Revised.
March 2019	Revised HA definition to align with flowchart, protocol style updated, reference style changed to APA).
Spring 2020	Added link to AB Health definition of CPO. Updated to new template and reposted to web page.
April 2021	Updated references.
March 2022	Updated references
Spring 2023	• Updated terminology from incident to initial for clarity • Updated other considerations for data entry – example of multiple sites positive from blood and wound to blood and rectal • Added "and related families" after Enterobacteriaceae to reflect the addition of new families in the Order Enterobacterales that may be a CPO • Risk factor section of algorithm updated for clarity • Added organism(s) and gene(s) to minimum case information • Revised process for direct transfers to include possibility of OA case classification: The sending facility records the case as hospital-acquired if there was an epidemiological link to their facility or hospital-identified/on admission if the CPO does not have an epidemiological link to another AHS/Covenant Health facility within the past 12 months • Removed follow-up data entry from minimum case information • Changed reporting process from IPC Surveillance Committee to IPC Surveillance, Evaluation, Quality Improvement and Research Committee • Updated long term care definition • Updated references.
Spring 2024	• Reference to supporting documentation in the "Introduction" changed to a bulleted list • Removed reference to ProvSurv – used "provincial surveillance platform" • Clarified language for hospital-acquired case classification – removed "using a case" • Added in information about having discussion between sending and receiving facility ICP to determine case classification when there has been a direct transfer between facilities • Updated language for On admission to "Initial CPO on calendar day one or two of admission…" instead of "on the day of admission and/or the day after admission".

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	• Added to "Acquired carbapenemases" definition: CPO surveillance uses the organism as the unit of surveillance, not the CPO gene detected. A surveillance case is the first time an organism is detected with a CPO gene. If the organism has a different CPO gene (either a new one or loses a gene), it is not counted as a new case • This may be reviewed if whole genome sequencing becomes the primary gene detection method • General and specific definitions updated • References updated.
Spring 2025	• Updated definition for patient admissions denominator • Added this statement to "Other considerations for data entry": If the specimen and clinical details do not meet NHSN definition of infection, this would qualify as a colonized record • Removed reference to LTC and replaced with Continuing Care Home Type A – updated definition and added link to continuing care website for source of truth • Included a mandatory data entry table • Changed from "isolate" to "specimen" throughout • Clarified in case definition that different CPO genes in the same organism are not considered new initial cases • Removed "While these are not surveillance cases, they must be recorded as For Info cases" from the exclusion criteria • Clarified when data entry needs to occur in the SSI module when CPOs are identified in SSIs. Also added in case classification information about procedures performed at Chartered Surgical Facilities • Changed risk factor "Acquired-outside Alberta" heading to "Travel outside Alberta to match language in ProvSurv • Added reference to ARO clearing protocol and management of CPO provincial guidelines • Added in "If the specimen and clinical details do not meet NHSN definition of infection, this would qualify as a colonized record" for other considerations for data entry.

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Appendix A: CPO protocol-specific definitions

Terms	Definitions
Carbapenem-producing organism case definition	Laboratory confirmation of a carbapenemase by molecular methods in any carbapenem non-susceptible (includes intermediate and complete resistance to the carbapenems according to the most current clinical and Laboratory Standards Institute interpretive breakpoint guidelines) *Enterobacteriaceae* and related families or *Acinetobacter* (Alberta Health, 2021).
Body or culture sites examples	Abscess, Bronchoalveolar lavage (BAL)-Bronchial Wash (BW), Blood, Burn, CSF Fluid, Device Insertion Site, Groin, Nose, Nose-Groin, Nose-Rectal, Pleural Fluid, Rectal-Stool, Skin, Soft Tissue, Sputum, Stoma, Surgical Site, Synovial Fluid, Throat, Ulcer, Urine, Wound.
Calendar days	Used for determining the timeline of presenting with or acquiring an antibiotic-resistant organism, CDI, BSI, or National Healthcare Safety Network infection definition. Calendar day one is the day of patient admission (see patient admission definition for more information) or day of surgical procedure.
Carbapenems	These include agents such as ertapenem, meropenem, imipenem and doripenem. These are beta-lactam antibiotics (as are penicillins and cephalosporins) that are used to treat serious infections caused by gram negative organisms such as *Enterobacter*iaceae and related families, *Acinetobacter* species and *Pseudomonas* species.
Carbapenemase	These are enzymes that inactivate carbapenem agents and cause those organisms to be non-susceptible (intermediate or resistant), and therefore may result in treatment failure.
Acquired carbapenemases	Additional genes that the organism has obtained through contact with other organisms with these genes: the genes transfer between organisms. There are three classes of acquired carbapenemase in *Enterobacteriaceae*, and related families, *Pseudomonas* species and *Acinetobacter* species (Canton et. al., 2012). Please refer to phenotypic testing definition below. If you have further questions please refer to the Alberta Health definition. • Class A (KPC types, first found in Klebsiella, also see in E.coli) • *KPC: Klebsiella pneumoniae carbapenemase* • Class B (metallo-beta-lactamases such as VIM, IMP in *Pseudomonas* species; and NDM now seen in *Enterobacteriaceae* and related families) • *VIM: Verona-integron coded metallo-beta-lactamase IMP: integron mediated plasmid NDM: New Delhi beta-lactamase* • Class D (oxacilinases – OXA, first seen in *Klebsiella* species) *OXA: oxacillin beta-lactamase.* CPO surveillance uses the organism as the unit of surveillance, not the CPO gene detected. A surveillance case is the first time an organism is detected with a CPO gene. If the organism has a different CPO gene (either a new one or loses a gene), it is not counted as a new case. This may be reviewed if whole genome sequencing becomes the primary gene detection method.

Terms	Definitions
Carbapenemase-producing organisms (CPO)	An organism that is non-susceptible to carbapenem agents because it produces carbapenemase (the enzyme which deactivates carbapenems) due to the presence of acquired gene(s) coding for these enzymes.
Colonization	The presence of microorganisms on skin, on mucous membranes, in open wounds, or in excretions or secretions but are not causing adverse clinical signs or symptoms (CDC, 2025a).
Dialysis	Hemodialysis patients require a vascular access, which can be a catheter or a graft or enlarged blood vessel that can be punctured to remove and replace blood. Peritoneal dialysis works on the same principle as hemodialysis, but the blood is cleaned while still inside the patient's body, rather than in a machine. A catheter is surgically inserted in the abdomen, usually below and to one side of the navel. Because of frequent hospitalizations and receipt of antimicrobial drugs, dialysis patients are also at high risk for infection with antimicrobial-resistant bacteria (CDC, 2025b; The Kidney Foundation of Canada, n.d.).
Enterobacteriaceae	Gram negative coliforms, typically found in the human gastrointestinal system. *E.coli* and *Klebsiella pneumoniae* are the most commonly seen CPO of this family. Other genera include: Citrobacter, Enterobacter, Hafnia, Morganella, Proteus, Providencia, and Serratia. Less common human bacteria are Edwardsiella, Erwinia, Kluyvera, Pantoeae, Raoultella and common food-borne pathogens such as Salmonella, Shigella and Yersinia.
Epidemiological link	A case is thought to be epidemiologically linked to another person(s) or healthcare worker(s) with a CPO infection or colonization in a facility (e.g. shared same room, same ward/unit, same caregiver, and same procedure/surgery as a known patient/resident with the same CPO).
Genotypic testing	Laboratory methods used to test for the presence of a gene. Methods include pulse field gel electrophoresis or polymerase chain reaction. While phenotypic testing would determine if an organism were susceptible or non-susceptible to an antimicrobial agent, genotypic testing can determine if a gene is present which may deactivate the agent, whether it is expressed.
Indwelling catheter	A drainage tube that is inserted into the urinary bladder through the urethra, is left in place, and is connected to a closed collection system. It is also called a Foley catheter. It does not include straight in and out catheters or urinary catheters that are not placed in the urethra (e.g., suprapubic catheter) (CDC, 2025c).
Infection	Presence of micro-organisms from any site with signs and the manifestation of symptoms of a clinical infection. Refer to National Healthcare Safety Network definitions for infection definitions from specific sites. http://www.cdc.gov/nhsn/PDFs/pscManual/17pscNosInfDef_current.pdf (CDC, 2025a).
Infection window period	The 7-days during which all site-specific infection criteria must be met. It includes the day of the first positive diagnostic test (i.e. lab specimen collection, imaging test, procedure or exam, physician diagnosis and initiation of treatment) that is an element of the site-specific infection criterion, was obtained, the 3 calendar days before and the 3 calendar days after. For site-specific infection criteria that do not include a diagnostic test, the first documented localized sign or symptom that is an element of National Healthcare Safety Network infection criterion, excluding

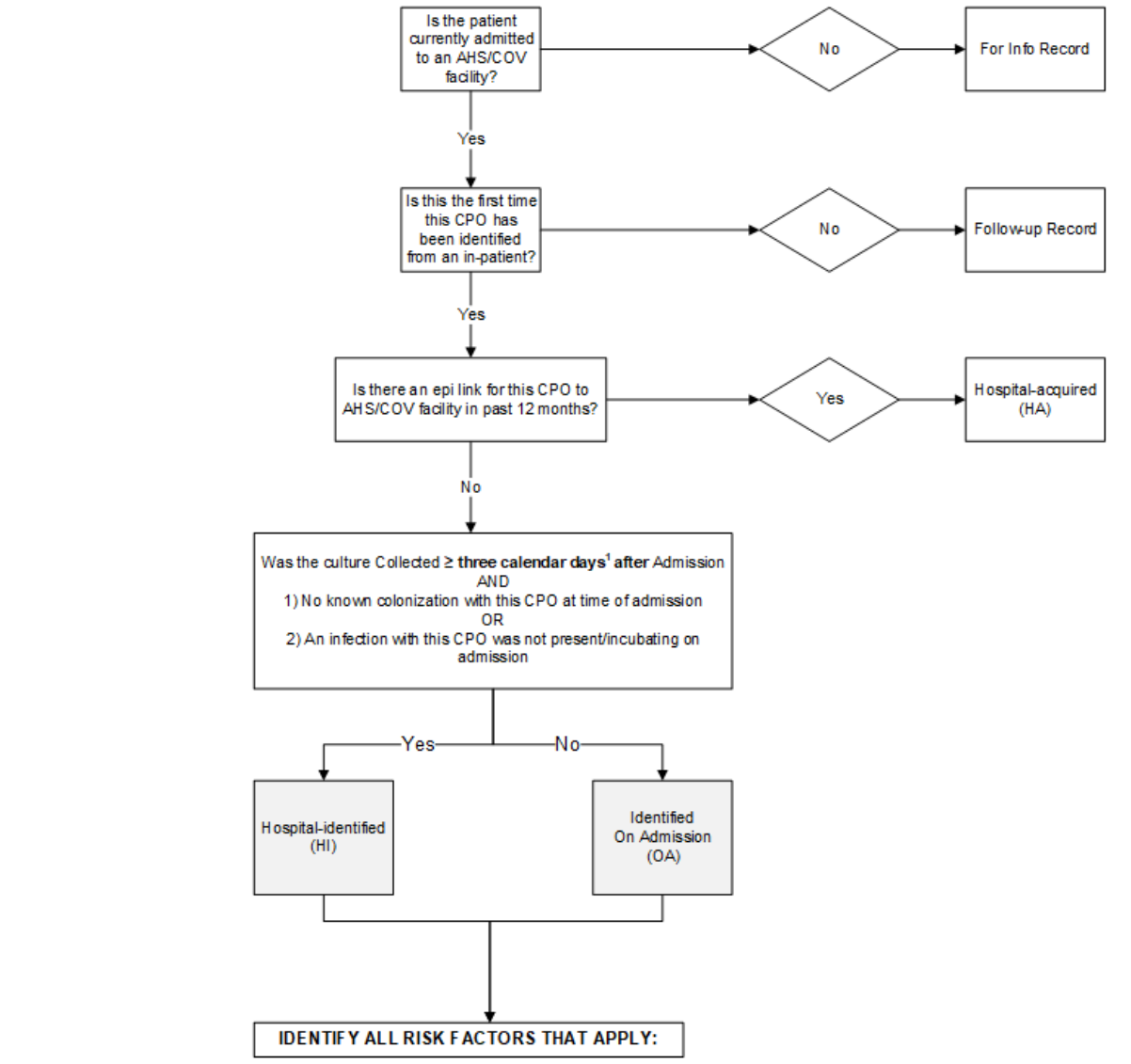
Terms	Definitions
	SSIs, should be used to define the window (i.e., diarrhea, site specific pain, purulent exudate).
Medical device	Covers a wide range of products used in the treatment, mitigation, diagnosis or prevention of a disease or abnormal physical condition (Health Canada, 2022). Examples to consider when determining whether an initial MRSA case is classified as healthcare-associated include central venous catheters (CVCs), intravenous lines, peripheral, umbilical catheters, peripherally inserted central catheter, stoma, and trach.
Molecular methods	Genetic test methods to confirm the presence of a specific gene. One example is genetic testing for the presence of specific genes that produce carbapenemases. For further details, review this specific test method on the Centers for Disease Control website: https://www.cdc.gov/gram-negative-bacteria/php/laboratories/?CDC_AAref_Val=https://www.cdc.gov/HAI/settings/lab/kpc-ndm1-lab-protocol.html (CDC, 2024).
Non-susceptible	Non-susceptible organisms include those which have intermediate or complete resistance to the antimicrobial agent or class of agents (e.g., carbapenems) according to the most current Clinical and Laboratory Standards Institute (CLSI) interpretive breakpoint guidelines. If an organism is non-susceptible to a particular antibiotic class (e.g., aminoglycosides, cephalosporins) then all antibiotics in that class that are tested are non-susceptible or should be considered to be ineffective for treatment if indicated in laboratory reporting comments.
Phenotypic testing	Refers to the observable physical or biochemical characteristics of an organism. One example is antimicrobial susceptibility testing, where an organism is tested against a known concentration of an antimicrobial to determine the Minimum Inhibitory Concentration of the agent required to prevent growth of the organism. Using these concentrations, the laboratory can determine if the organism is susceptible (able to be used for clinical treatment) or non-susceptible (levels of the agent needed to inhibit the organism are higher than therapeutic levels of the agent and may result in treatment failure if used).
Secondary phenotypic testing	Laboratory testing methods using additional lab test methods to screen for the presence of a genotypic characteristic. According to the Alberta Health CPO lab definition, this testing is required to confirm the presence of a CPO in an *Enterobacteriaceae* and related families or *Pseudomonas aeruginosa, e.g.,* lab test for CPO called a modified Hodge Test.

Appendix B: General surveillance definitions

Terms	Definitions
Encounter types	Type of AHS/Covenant Health healthcare location or facility where the patient is located at the time of identification. The following encounter types are referred to in acute care surveillance protocols (Government of Alberta, 2008; Government of Alberta, 2024). • **Inpatient acute care:** Refers to a General Hospital: According to the Hospitals Act, a general hospital is defined as a "hospital providing diagnostic services and facilities for medical or surgical treatment in the acute phase for adults and children and obstetrical care" (Government of Alberta, 2024). General hospitals have several functional centres. Each functional centre is associated with inpatient, outpatient, or diagnostic and therapeutic services. • **Inpatient mental health/rehab**: A designated mental health facility providing diagnosis and treatment for mental illness and addiction in the acute phase for adults and children. Inpatient services refer to a person admitted to and assigned a bed in a facility by order of a physician for provision of diagnostic and/or treatment services. They would have a patient/group room in which inpatient services are provided within the patient's room or within a common group room within the designated mental health facility. AHS facility examples include Glenrose Rehabilitation Hospital, Centennial Centre for Mental Health and Brain Injury.
Infection prevention and control baseline	A comparator rate created for each acute care facility in the IPC Surveillance on-line dashboards and reporting modules, to guide efforts to reduce healthcare-associated infections. The IPC baseline is based on reported monthly rates for the previous fiscal year. The calculation excludes the monthly rates higher than 1 Standard Deviation above the 12-month average but includes all rates where the site had optimal performance. This calculation method biases the IPC baseline rate towards zero, to focus on the best patient safety outcomes.
Continuing Care Home (CCH) Type A (formerly Long Term Care)	This environment provides onsite RN and/or registered psychiatric nurse (RPN) care, assessment and/or treatment 24-hours a day. Licensed practical nurses (LPNs) may also be onsite in addition to onsite personal care and support provided by health care aides (HCAs). CCH Type A may also have a secure space. Some sites may have specialized programs and services available for residents with complex clinical or complex functional care requirements (e.g., rehabilitation) (Alberta Health Services, 2025). To identify if a facility has CCH Type A beds refer to this website: https://www.albertahealthservices.ca/cc/page15328.aspx where you can search by Name and identify what type of beds the facility has.
Patient admission (aka inpatient admission)	A person admitted to and assigned a bed in a hospital by the order of a physician, for the provision of diagnostic or treatment services or both. Includes a person who spends any time in the emergency department if assigned a bed in hospital, regardless of whether the patient was transferred to an inpatient unit and patients who are directly admitted to an inpatient unit. This is the denominator used for non-hospital-acquired rates (see Rate Calculation Section) (Government of Alberta, 2024).
Patient days (aka inpatient days)	As defined by AHS, this is used to create the denominator for hospital-acquired or hospital-identified cases. The total is equal to midnight census with patients admitted and discharged on the same day counted as a one day stay. It includes patients out on a pass. Day of admission is counted but the day of separation (discharge, death or transfer out of hospital) is not counted. Patient-days are included for inpatient encounters where discharge date is not recorded in the

Terms	Definitions
	data source. Inpatient totals exclude the time patients are waiting in the emergency department for an inpatient bed (time from decision to admit to discharge from emergency department).
Emergency department inpatient days (EDIP)	As defined by AHS, denominators for provincial surveillance modules include these figures in the total patient-days. Includes the number of acute care inpatient patient-days utilized in the emergency department during the reporting period. The figures reflect the time from emergency department discharge (i.e. decision to admit) to emergency department departure for patients admitted to an acute care hospital. It is calculated as [(emergency department departure date and time – emergency department discharge date and time) ÷ 60 ÷ 24]. Figures exclude cases where the emergency department discharge date and time or emergency department departure date and time were not provided, or the value has a negative number.

Appendix C: CPO classification algorithm



[1] Calendar day one is the day of hospital admission

[2] Does not include AHS/COV facilities

Alberta Health Services
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