



Canadian Nosocomial Infection Surveillance Program (CNISP) Surveillance Protocol for Carbapenemase-Producing Organisms (CPO)

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BACKGROUND

Carbapenems are a class of beta-lactam antibiotics with broad-spectrum activity recommended as first-line therapy for severe infections caused by certain gram-negative organisms and as directed therapy for organisms that are resistant to narrower spectrum antibiotics. Carbapenem resistance can be due to changes in the permeability of the organism to the antibiotic and/or the up-regulation of efflux systems that “pump” the antibiotic out of the cell, usually concomitant with the presence of an acquired extended-spectrum beta-lactamase (ESBL) or AmpC enzyme or the hyperproduction of intrinsic chromosomally located beta-lactamase(s).

More recently, resistance is increasingly due to the acquisition of enzymes that break down the carbapenems: carbapenemases. These latter subsets of carbapenem-resistant organisms are called carbapenemase-producing organisms (CPOs) and are of particular concern because of their ability to transfer resistance easily across different genera and species of bacteria. They are quickly becoming a public health problem not only because of the ability to cause healthcare acquired infections which have limited treatment options, but because of the potential for colonizing both inpatient and outpatient populations due to their ease of transmissibility, thus, creating a reservoir of bacterial resistance.

The intent of this surveillance is to describe the epidemiology, microbiology and clinical outcomes of patients identified as harbouring a carbapenemase. There is a specific focus on this subset of organisms that are carbapenemase producers because they are associated with transmission and outbreaks in health care facilities. We need to continue to monitor the spread of CPOs across Canadian hospitals to inform infection prevention and control programs and patient treatment strategies.

OBJECTIVES

1. To identify and describe the epidemiology, risk factors and clinical outcomes of patients (inpatients, emergency room (ER) patients and outpatients) infected or colonized with a carbapenemase-producing organism (CPO), specifically carbapenemase-producing *Enterobacteriales* (CPE) and carbapenemase-producing *Acinetobacter* (CPA) in participating CNISP hospitals.
2. To describe the molecular epidemiologic information of the carbapenemase-producing isolates collected, including the resistance genes present and the infecting microorganisms identified.
3. To determine the incidence of patients infected and colonized with a CPO, specifically CPE and CPA in participating CNISP hospitals.
4. To provide national benchmark rates that hospitals may use for external comparison.

METHODS

Site Eligibility

All CNISP hospitals are eligible to participate.

Case Eligibility

- i. Patient admitted to a CNISP participating hospital or presenting to a CNISP hospital emergency department or a CNISP hospital-based outpatient clinic.
- ii. Laboratory confirmation of carbapenem resistance or carbapenemase production in *Enterobacterales* and *Acinetobacter spp* (Appendix 1).



NOTE: Following molecular testing, only isolates determined to be harbouring a carbapenemase will be included in surveillance.

All patient specimens with eligible *Enterobacterales* and/or *Acinetobacter spp* (Appendix 1) will be identified by the hospital microbiology laboratory and sent to the NML with a minimum data set (Appendix 2) for detection or confirmation of carbapenemase production. Laboratories who perform their own molecular testing should submit to the NML only isolates which are confirmed to produce carbapenemases, or which they suspect contain a carbapenemase not detected by their testing.

If there are multiple isolates from one patient:

- where the same gene AND the same organism were identified, please only send one isolate
- for laboratories who are only sending one isolate, please submit the isolate from the most invasive specimen, and otherwise please submit all isolates.

Table 1. Examples of inclusion criteria for patients with multiple samples collected

Patient	Sample	Surveillance Year	Carbapenemase	Species	Site	Inclusion	PID
1	A	2024	NDM	E. coli	Stool	No	99Z-24-001A
	B	2024	NDM	E. coli	Blood	Yes	
2	A	2024	KPC	K.pneumoniae	Stool	Yes	99Z-24-002A
	B	2024	OXA-48	K.pneumoniae	Stool	Yes	99Z-24-002B
3	A	2024	KPC	K. oxytoca	Stool	Yes	99Z-24-003A
	B	2024	KPC	E. cloacae	Urine	Yes	99Z-24-003B
4	A	2024	KPC	K.pneumoniae	Stool	Yes	99Z-24-004A
	B	2024	KPC	K.pneumoniae	Stool	No	-
5	A	2024	KPC	K.pneumoniae	Stool	Yes	99Z-24-005A
	A	2025	KPC	K.pneumoniae	Stool	Yes	99Z-25-001A
6	A	2024	NDM	E.coli	Sputum	Yes	99Z-24-006A
	B	2025	NDM	E.coli	Skin/soft tissue	Yes	99Z-25-002A
7	A	2024	OXA-48	E.coli	Stool	Yes	99Z-24-007A
	B	2024	OXA-48	E.coli	Stool	No	-
	C	2024	OXA-48	E.coli	Blood	Yes	99Z-24-007C
8	A	2024	OXA-51	A.baumannii	Wound	Yes	99Z-24-008A
	B	2024	KPC	E. cloacae	Urine	Yes	99Z-24-008B

Please assign a unique patient identifier as follows: CHEC site number, 2 digit surveillance year, then consecutive number (e.g. 99ZYY001).



NOTE: When multiple isolates are submitted for the same patient in the same surveillance year, please indicate by adding a suffix A or B etc. to the case number (e.g. 99ZYY001A and 99ZYY001B).



NOTE: When the same patient is identified in a different surveillance year, please assign the isolate a new PID (e.g. 99ZYY001) and submit the isolate as per Table 1.

Case Identification and Submission

The NML will email carbapenemase testing results to each hospital which may be used to confirm the hospital's own molecular testing or if the hospital does not do molecular testing this report will indicate for which isolate(s) to submit a patient questionnaire (Appendix 3).

Exposure classification

Once the patient has been identified with a CPO, they will be classified based on the following criteria and in accordance with the best clinical judgement of the healthcare and/or infection control practitioner (ICP).

Days of admission				
Calendar day	1	2	3	4
Time (hours)	0-23	24-47	48-71	72-95

Healthcare-associated acquired in your acute-care facility (HA-YAF)*

- Patient is on or beyond calendar day 3¹ of their hospitalization
- OR
- Has had a healthcare exposure (inpatient or outpatient) at your facility that would have resulted in this infection or colonization (using best clinical judgement)

**If a patient tests positive on or after calendar day 3 but are known to have a recent healthcare exposure out of country in an area with endemic CPO, please use best clinical judgement (e.g., admission screening) when determining HA-YAF or HA-OTHER, OUTSIDE OF CANADA.*

HA-YAF Newborn case definition

- The newborn is on or beyond calendar day 3¹ of their hospitalization **AND**
- The mother was **NOT** known to be CPO positive on admission and there is no epidemiological reason to suspect that the mother was colonized prior to admission, even if the newborn is < 48 hours of age **AND**
- In the case of a newborn transferred from another institution, CPO may be classified as HA-YAF if the organism was **NOT** known to be present and there is no epidemiological reason to suspect that acquisition occurred prior to transfer

Healthcare-associated any other healthcare exposure (HA-OTHER)

Any patient who has an infection or colonization **not** acquired at your facility that is thought to be associated with another healthcare exposure in Canada (e.g. another acute-care facility, long-term care, rehabilitation facility, clinic or exposure to a medical device).

Healthcare-associated acquired from any other healthcare exposure outside of Canada (HA-OTHER, OUTSIDE CANADA)

Any patient who has an infection or colonization **not** acquired at your facility that is thought to be associated with another healthcare exposure **outside of Canada** (e.g. another acute-care facility, long-term care, rehabilitation facility, clinic or exposure to a medical device outside of Canada).

¹ Calendar day 1 is the day of hospital admission

Community-associated (CA)

No exposure to healthcare that would have resulted in this infection or colonization (using best clinical judgement) and does not meet the criteria for a healthcare-associated infection or colonization.

Denominator Data

Denominator data will be collected on the quarterly denominator form and submitted online via the Canadian Network for Public Health Intelligence (CNPHI) at www.cnphi-rcrsp.ca.

The data collected will include:

- 1) total number of patient admissions per year
- 2) total number of inpatient-days per year

In CNPHI, denominator data are entered via the “Profiles and Denominators” page. CPO rates are calculated using the same denominator data as VRE and MRSA/MSSA, so please enter your denominator data under VRE or MRSA/MSSA.

Data Management and Reporting

Case Reporting

All patient questionnaire data (see Appendix 3 – CPO Patient Questionnaire) should be submitted online through the Canadian Network for Public Health Intelligence (CNPHI) at www.cnphi-rcrsp.ca.

Laboratory Reporting

The Appendix 2 must be included with the shipment AND emailed to the NML at **nml.arni-rain.lnm@phac-aspc.gc.ca**. It is important that when isolates are submitted to the NML that they are identified as CNISP isolates otherwise they will not be included in CNISP surveillance. The NML will send the carbapenemase testing results via email to the lead CNISP member and lead ICP for each hospital.

Surveillance Algorithm

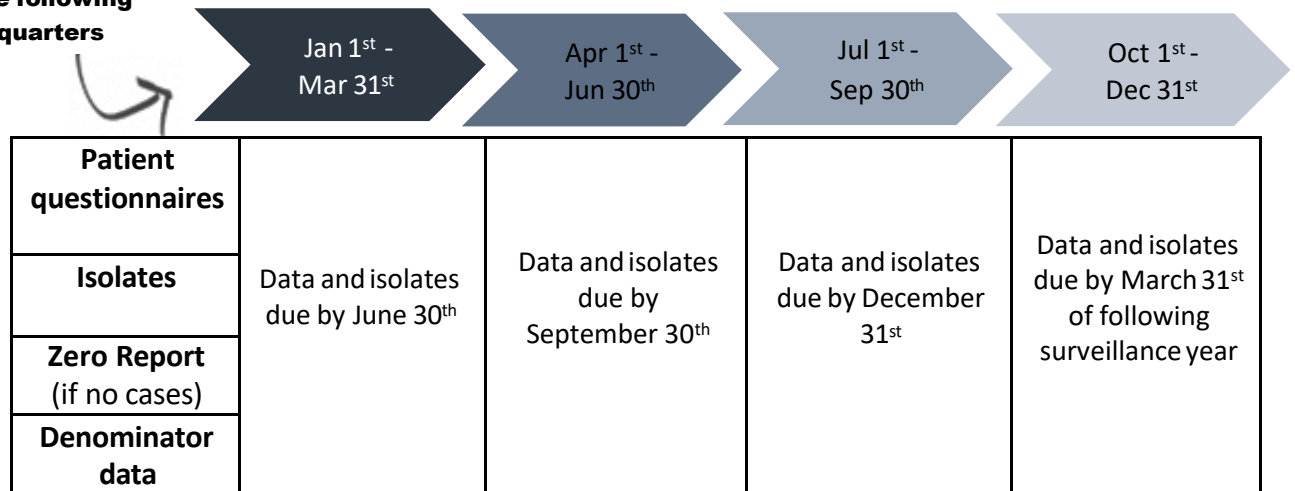
The Appendix 4 has been provided to assist in surveillance activities.

Submission Timeline

Please submit CPO data and isolates according to the following timeline:

CNISP CPO Submission Timeline

Collected in
the following
quarters



Zero Report

For any quarter with no cases at your site, a zero report must be entered in the CNPHI CPO module so that quarters with zero counts can be differentiated from missing data. If no cases are submitted and you are missing zero reports for a surveillance year, your hospital's data will not be included in the rates.

Environmental Sampling



NOTE: Environmental sampling is optional. Sites that wish to continue environmental sampling can continue to do so and notify CNISP.

If possible, please consider screening drains at discharge for CPO positive patients. Please swab all drains in the patient room and bathroom **before** a cleaning protocol is implemented. Please complete and send the [APPENDIX 2 - LABORATORY SHIPPING FORM](#) to the NML along with the CPO positive environmental isolate(s). In the laboratory shipping form, under site of isolation please select environmental (ENV) and indicate site (drain, sink, etc.). Please use the same unique PID assigned to the patient whose room was swabbed and add a suffix E1 or E2 etc. to the case number (e.g. 99ZYY001E1 and 99ZYY001E2).

Analysis

Patients with multiple CPO positive isolates will only be included in the rates once based on the isolate from the most invasive site. E.g. if the patient was initially colonized with a CPO and subsequently develops a CPO infection, within the same surveillance year, the colonization will be excluded from the rates and only the infection will be included.

Rates, descriptive epidemiology, microbiological and resistance data will be calculated annually and available on CNPHI CPO module visual analytics. Data will be reported through surveillance reports, presentations, publications, and published on the PHAC and/or AMMI website.

ETHICS

While this surveillance project does not involve any alteration in patient care and surveillance for healthcare-associated infections is a routine component of quality assurance and patient care in Canadian healthcare facilities, ethics approval may be sought at some hospital sites. A unique identifier linked to patient names will only identify patients at the local CNISP site and is not transmitted to the PHAC. All data submitted to PHAC are kept strictly confidential.

PRIVACY

Any data released by CNISP will be in summary format and will not identify individual hospitals or patients. Hospital administrators should be made aware that national reporting of aggregate data will occur.

Appendix 1 - Laboratory considerations for case eligibility for surveillance

Determining carbapenem resistance and carbapenemase production in gram-negative bacilli: determining eligibility for inclusion of cases in surveillance

All *Enterobacterales* and *Acinetobacter spp.* that meet at least **ONE** of the following criteria should be submitted to the NML:

1. Tested fully resistant to a carbapenem based on the current CLSI M100 guidelines for zone diameters and/or MIC values as listed below:

At least ONE of the following carbapenems:	<i>Enterobacterales:</i>		<i>Acinetobacter:</i>	
	MIC ($\mu\text{g/ml}$)	Disk diffusion (mm)	MIC ($\mu\text{g/ml}$)	Disk diffusion (mm)
Imipenem	≥ 4	≤ 19	≥ 8	<18
Meropenem	≥ 4	≤ 19	≥ 8	≤ 14
Doripenem	≥ 4	≤ 19	≥ 8	≤ 14
Ertapenem	≥ 2	≤ 18	n/a	

2. Tested positive for a carbapenemase in laboratories that conduct molecular testing (PCR) or immunochromatographic lateral flow assay for specific enzymes (e.g. K-SeT).

Laboratories should be aware that commercial tests may include only the most common carbapenemases (i.e. KPC, OXA-48, NDM) and may not include more rare ones (i.e. VIM, IMP, GES, NMC-A/IMI, SME, and others).

If the molecular test is negative but a laboratory suspects the presence of a carbapenemase, the isolate should be further tested by the submitting laboratory, their Provincial Laboratory, or the NML. Isolates then confirmed to harbour a carbapenemase are eligible for inclusion in surveillance.

3. Tested positive for carbapenemase production by a phenotypic test such as the mCIM, Carba-NP or a commercial equivalent. These tests can help determine if a suspected CPO that was negative by molecular testing does in fact harbour a carbapenemase.

Note: these tests can produce false negative results for poorly expressed enzymes (which likely have low MICs), enzymes that only slowly hydrolyze carbapenems (e.g. OXA-48 group, GES-type), or non-specificity of the test for certain enzymes (e.g. SME, NMC-A/IMI, GES-type by Beta-Carba test).

Appendix 2 - Laboratory Shipping Form

Instructions for submitting surveillance data for carbapenemase-producing organisms

1. All fields of this form should be filled out and sent to the NML (care of Dr. Golding) along with the patient specimens. Clearly label each specimen with their unique patient identifier.
2. Please also email this form to nml.arni-rain.lnm@phac-aspc.gc.ca on the day of shipping to allow tracking of the shipment.
3. Send isolates with this form to the following:

Send isolates to:

Dr. George Golding
National Microbiology Laboratory
1015 Arlington St., Winnipeg, Manitoba R3E 3R2
Tel: 204 784 8096
Fax: 204 789 5020

Use FedEx billing number: 6327-8173-3

In addition, please email the shipping form to:

nml.arni-rain.lnm@phac-aspc.gc.ca

Please click on the icon below to access the excel shipping form:



CNISP Laboratory
Shipping Form CPO_2

Appendix 3 – CPO Patient Questionnaire

Please complete the following questionnaire to contribute to surveillance for inpatients, ER and outpatients with Carbapenemase-Producing Enterobacterales (CPE) or Carbapenemase-Producing Acinetobacter (CPA)

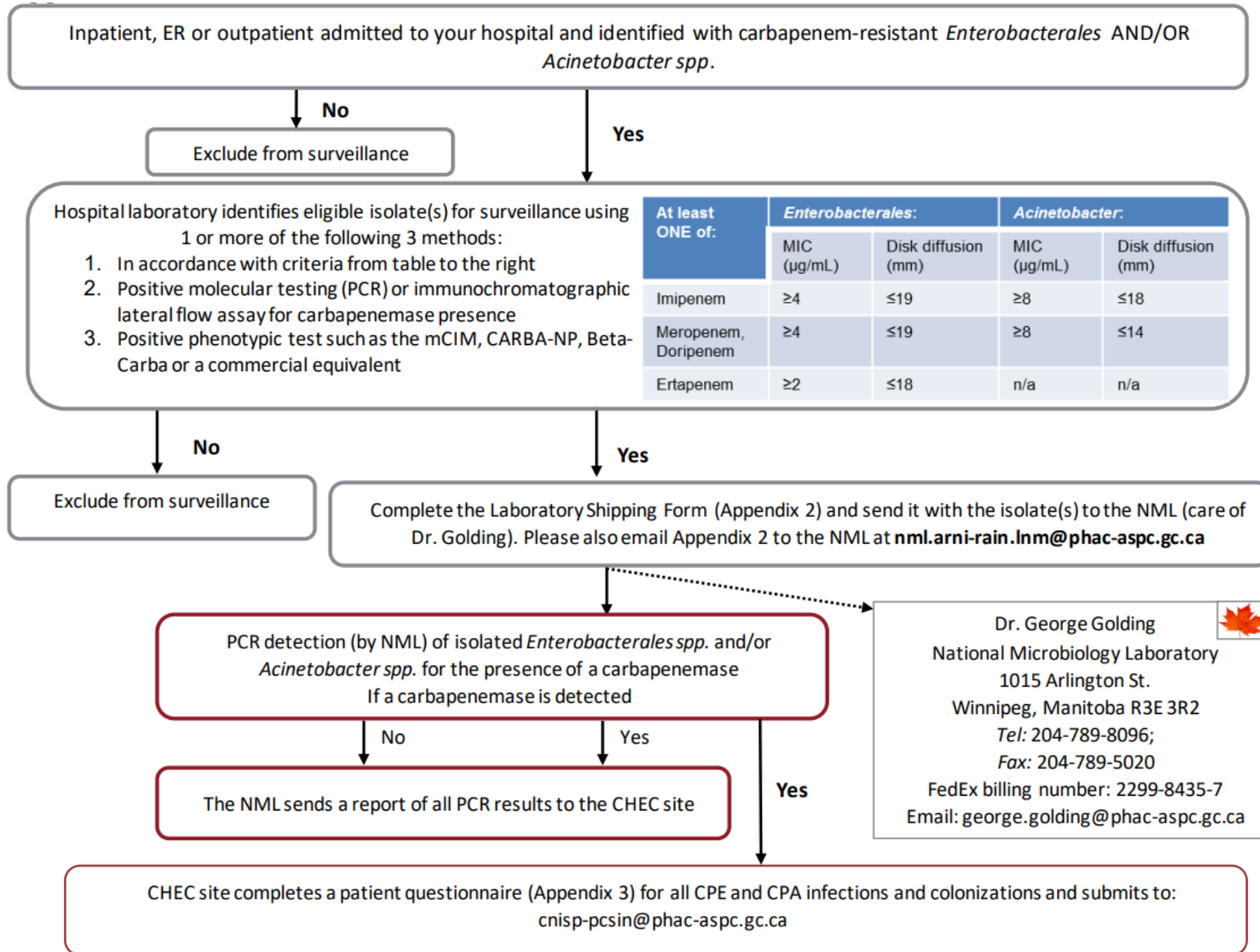
1.	<p>Is this a CPO colonization or infection in a patient previously identified with a CPO in another surveillance year?</p> <p><input type="checkbox"/> Unknown</p> <p><input type="checkbox"/> No</p> <p><input type="checkbox"/> Yes please enter the original/previous unique patient ID:</p> <p>_____ YY _____ (e.g. 99Z23001)</p> <p>(CHEC site #) (year) (case number)</p>
2.	<p>Is this isolate associated with an infection or a colonization?</p> <p><input type="checkbox"/> Infection</p> <p><input type="checkbox"/> Colonization</p>
3.	<p>CHEC Site: _____</p>
4.	<p>Unique Patient Identifier: _____ YY _____ (e.g. 99Z24001)</p> <p>(CHEC site #) (year) (case number)</p>
5.	<p>Patient ward when positive specimen was collected:</p> <p><input type="checkbox"/> Inpatient: If inpatient please check one of the following:</p> <ul style="list-style-type: none"> <input type="checkbox"/> ICU <input type="checkbox"/> NICU <input type="checkbox"/> PICU <input type="checkbox"/> Medical ward <input type="checkbox"/> Surgical ward <input type="checkbox"/> Other inpatient ward (<i>specify</i>): _____ <p><input type="checkbox"/> Emergency Room (ER)</p> <p>If the positive specimen was collected while the patient was in ER, was this patient subsequently admitted? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown</p> <p><input type="checkbox"/> Outpatient</p> <p><input type="checkbox"/> Unknown</p>
6.	<p>Age _____ <input type="checkbox"/> Years <input type="checkbox"/> Months <input type="checkbox"/> Days</p>
7.	<p>Sex: <input type="checkbox"/> Male <input type="checkbox"/> Female <input type="checkbox"/> Unknown</p>
8.	<p>Date of admission: ____/____/____</p> <p>DD MMM YYYY <input type="checkbox"/> Not applicable as patient was not admitted</p>

9.	<p>Type of CPO isolate:</p> <input type="checkbox"/> Screening isolate <input type="checkbox"/> Clinical isolate														
10.	<p>Date of positive culture: <i>(Specimen collection date from which the positive organism was isolated):</i></p> <p>____/____/____ DD MMM YYYY</p>														
11.	<p>Organism isolated:</p> <table border="0"> <tr> <td><input type="checkbox"/> Acinetobacter baumannii</td> <td><input type="checkbox"/> Citrobacter spp.</td> </tr> <tr> <td><input type="checkbox"/> Serratia spp.</td> <td><input type="checkbox"/> Morganella morganii</td> </tr> <tr> <td><input type="checkbox"/> Klebsiella pneumoniae</td> <td><input type="checkbox"/> Enterobacter cloacae</td> </tr> <tr> <td><input type="checkbox"/> Enterobacter spp.</td> <td><input type="checkbox"/> Klebsiella oxytoca</td> </tr> <tr> <td><input type="checkbox"/> Escherichia coli</td> <td><input type="checkbox"/> Citrobacter freundii</td> </tr> <tr> <td><input type="checkbox"/> Proteus spp</td> <td><input type="checkbox"/> Serratia marcescens</td> </tr> <tr> <td colspan="2"><input type="checkbox"/> Other, specify: _____</td> </tr> </table>	<input type="checkbox"/> Acinetobacter baumannii	<input type="checkbox"/> Citrobacter spp.	<input type="checkbox"/> Serratia spp.	<input type="checkbox"/> Morganella morganii	<input type="checkbox"/> Klebsiella pneumoniae	<input type="checkbox"/> Enterobacter cloacae	<input type="checkbox"/> Enterobacter spp.	<input type="checkbox"/> Klebsiella oxytoca	<input type="checkbox"/> Escherichia coli	<input type="checkbox"/> Citrobacter freundii	<input type="checkbox"/> Proteus spp	<input type="checkbox"/> Serratia marcescens	<input type="checkbox"/> Other, specify: _____	
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<input type="checkbox"/> Proteus spp	<input type="checkbox"/> Serratia marcescens														
<input type="checkbox"/> Other, specify: _____															
12.	<p>Site of isolation: (Please select the site of isolation for the isolate that was submitted to the NML)</p> <table border="0"> <tr> <td><input type="checkbox"/> Blood</td> <td><input type="checkbox"/> Skin/soft tissue</td> </tr> <tr> <td><input type="checkbox"/> Urine</td> <td><input type="checkbox"/> Stool/rectal swab</td> </tr> <tr> <td><input type="checkbox"/> Wound</td> <td><input type="checkbox"/> Sputum/Endotracheal secretions/Bronchoalveolar lavage</td> </tr> <tr> <td><input type="checkbox"/> Surgical site</td> <td><input type="checkbox"/> Other, specify: _____</td> </tr> </table>	<input type="checkbox"/> Blood	<input type="checkbox"/> Skin/soft tissue	<input type="checkbox"/> Urine	<input type="checkbox"/> Stool/rectal swab	<input type="checkbox"/> Wound	<input type="checkbox"/> Sputum/Endotracheal secretions/Bronchoalveolar lavage	<input type="checkbox"/> Surgical site	<input type="checkbox"/> Other, specify: _____						
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<input type="checkbox"/> Surgical site	<input type="checkbox"/> Other, specify: _____														
13a.	<p>Where was this CPO acquired?</p> <input type="checkbox"/> Healthcare-associated – acquired in your acute-care facility (HA-YAF) <input type="checkbox"/> Healthcare-associated – acquired from any other healthcare exposure <u>in</u> Canada (HA-Other, Canada) → skip to Q14. <input type="checkbox"/> Healthcare-associated – acquired from any other healthcare exposure <u>outside</u> of Canada (HA-Other, outside Canada) → skip to Q14. <input type="checkbox"/> Community-associated (CA) → skip to Q14. <input type="checkbox"/> Unable to determine → skip to Q14.														
13b.	<p>If healthcare-associated in your facility (HA-YAF), is there evidence of any of the following modes of transmission? Please select all that apply. If unsure, please select unknown.</p> <input type="checkbox"/> N/A (not HA-YACF) <input type="checkbox"/> Sink/drain <input type="checkbox"/> Hemodialysis <input type="checkbox"/> Outbreak/cluster associated <input type="checkbox"/> Device/procedure (e.g. ERCP, endoscopy), specify: <input type="checkbox"/> Another patient (e.g. contact tracing, contact with known CPO positive patient) <input type="checkbox"/> Other exposure, please specify: <input type="checkbox"/> Unknown														

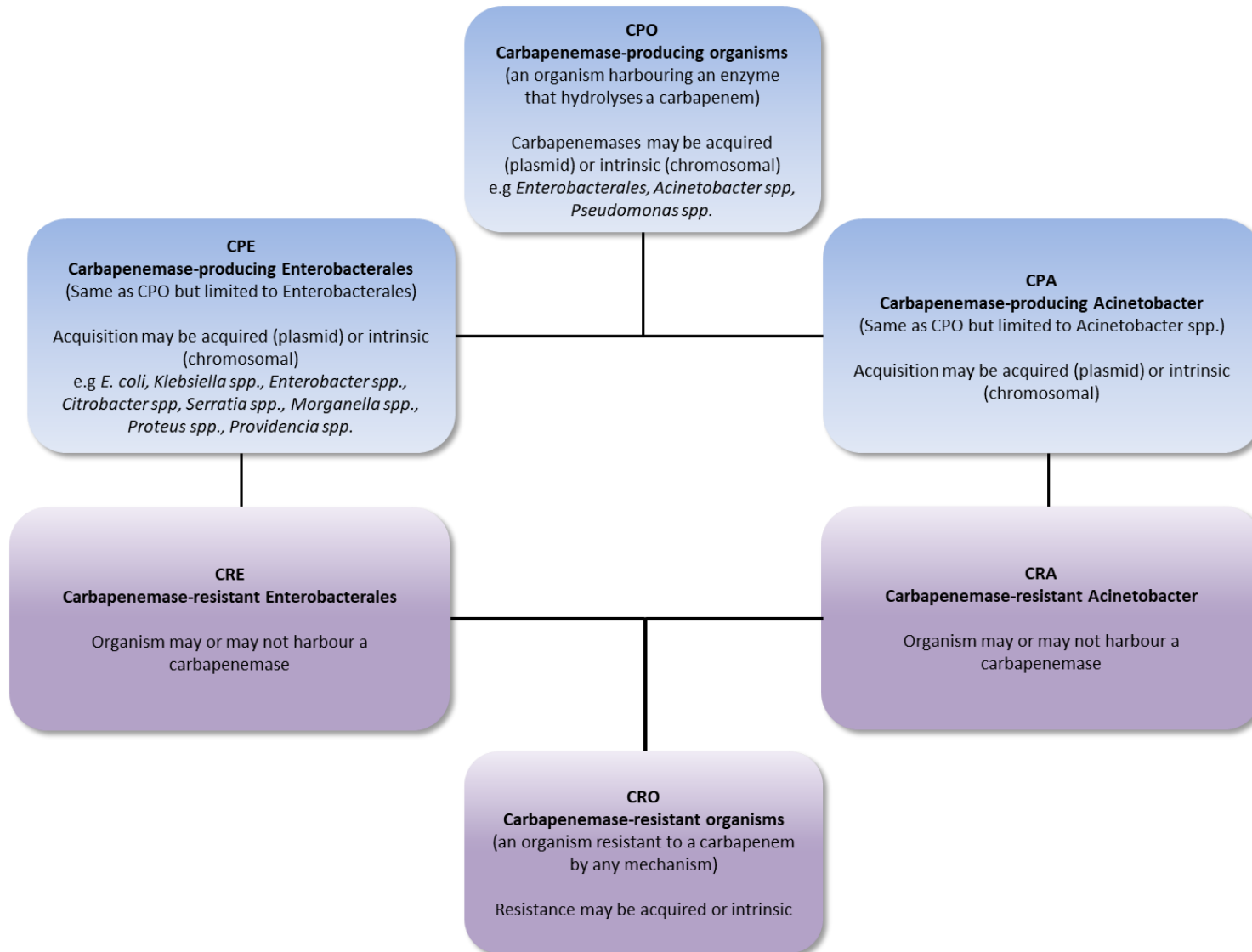
14	<p>If this patient is a newborn (<28 days), was the mother known to be CPO positive?</p> <ul style="list-style-type: none"> <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/> N/A - patient is not a newborn
15a	<p>Is there any evidence of international travel in the 12 months prior to the patient's CPO diagnosis?</p> <ul style="list-style-type: none"> <input type="checkbox"/> No, there is no evidence of international travel. → if NO, skip to Q16. <input type="checkbox"/> Yes, specify where travelled to: _____ <input type="checkbox"/> Unable to determine
15b.	<p>If traveled internationally, is there evidence the patient received medical care where they traveled to?</p> <ul style="list-style-type: none"> <input type="checkbox"/> N/A - no evidence of international travel <input type="checkbox"/> Yes, there is evidence that the patient sought medical care while on international travel <input type="checkbox"/> No, there is no evidence that the patient sought medical care while on international travel <input type="checkbox"/> Unable to determine
16.	<p>Is there evidence the patient has pre-existing comorbidities(s)? Please check all that apply.</p> <ul style="list-style-type: none"> <input type="checkbox"/> No evidence of any pre-existing comorbidity <input type="checkbox"/> Yes (<i>please check all that apply</i>) <ul style="list-style-type: none"> <input type="checkbox"/> Diabetes <input type="checkbox"/> Liver disease <input type="checkbox"/> HIV infection <input type="checkbox"/> Cancer (active) <input type="checkbox"/> Lung disease (e.g., asthma, COPD) <input type="checkbox"/> Kidney disease (include all patients on dialysis) <input type="checkbox"/> Solid organ transplant recipient <input type="checkbox"/> Bone marrow transplant recipient <input type="checkbox"/> Other immunosuppression, specify _____ <input type="checkbox"/> Heart disease <input type="checkbox"/> Other, specify _____ <input type="checkbox"/> Unknown
<p>Q17- Q19 are only to be completed for <u>infected</u> cases</p>	
17.	<p>Was the patient admitted to an ICU within 30 days of positive culture?</p> <ul style="list-style-type: none"> <input type="checkbox"/> N/A - patient was already in an ICU at the time the positive culture was obtained <input type="checkbox"/> Yes, please indicate the date of ICU admission: ____/____/____ <div style="text-align: center; margin-left: 100px;"> DD MMM YYYY </div> <input type="checkbox"/> No <input type="checkbox"/> Unknown

18.	<p>What was the patient outcome 30 days after positive culture?</p> <p><input type="checkbox"/> Patient alive, still in hospital</p> <p><input type="checkbox"/> Patient survived and discharged Date of discharge ____/____/____ DD MMM YYYY</p> <p><input type="checkbox"/> Patient survived and transferred Date of transfer ____/____/____ DD MMM YYYY</p> <p><input type="checkbox"/> Patient died Date of death ____/____/____ DD MMM YYYY</p> <p><input type="checkbox"/> Unknown</p>
19.	<p>If the patient died within 30 days after the positive culture, please indicate the relationship of CPO to the death</p> <p><input type="checkbox"/> CPO was the cause of death</p> <p><input type="checkbox"/> CPO contributed to death</p> <p><input type="checkbox"/> Death is unrelated to CPO</p> <p><input type="checkbox"/> Causality between CPO and death cannot be determined</p>

Appendix 4 - CPO Surveillance Algorithm



Appendix 5 - Key Carbapenem and Carbapenemase Acronyms



Appendix 6 - Data Dictionary

Definitions and notes for Appendix 3 – CPO Patient Questionnaire

1. Is this a CPO colonization or infection in a patient previously identified with a CPO in another surveillance year?

If known, please indicate whether this patient was identified as CPO positive in a previous surveillance year and indicate the PID so that we may link the cases.

2. Is this isolate associated with an infection or colonization?

Based on the isolate submitted, please indicate if this cases is colonized or infected. Infection is determined using the CDC/NHSN surveillance definitions and may be accessed at:

http://www.cdc.gov/nhsn/PDFs/pscManual/17pscNosInfDef_current.pdf

3. CHEC Site #

This will be the **3-character** alphanumeric number assigned to your institution. It will always begin with the two digit number assigned to your CHEC member e.g., 07, 15, and a letter assigned by the CHEC member for that specific institution e.g., A, B, C, etc. The CHEC site # for each institution should always be the same for all the CHEC/CNISP surveillance projects and will always have all three alphanumeric digits reported as the CHEC site #, e.g., 07A, 15A.

4. Unique identifier code

Please assign a unique patient identifier as follows: CHEC site number, surveillance year then consecutive number (e.g., 99ZYY001). Note: When multiple isolates are submitted for the same patient in the same surveillance year, please indicate by adding a suffix A or B etc. to the case number (e.g., 99ZYY001A and 99ZYY001B).

Note: The unique patient identifier assigned to the isolate on Appendix 2 - Laboratory Shipping Form should correspond to the unique patient identifier on the Appendix 3 – CPO Patient Questionnaire

5. Patient ward

Please indicate the ward the patient was on when the positive specimen was collected (e.g., medical, surgical, ICU). If the positive specimen was collected while the patient was in ER, please indicate if this patient was subsequently admitted to hospital.

6. Age

Please enter the patient's age (in years, months or days) at the time of positive culture.

7. Sex

Check male, female or unknown as appropriate.

8. Date of admission

Please indicate the date when the patient was admitted to the hospital using the following format Day (##), Month (May) and Year (2024).

9. Type of CPO isolate

Please indicate whether the isolate was obtained as a result of screening or a clinical isolate (blood, wound, surgical site, respiratory etc.).

10. Date of positive culture

Please indicate when the isolate that tested CPO positive was collected.

11. Organism isolated

Please select the organism isolated as reported by the laboratory.

12. Site of isolation

Please indicate the site of isolation for the isolate that was submitted to the NML.

13. Exposure classification

a. Where was this CPO acquired?

Please indicate whether the infection or colonization was acquired in a healthcare setting (HA) or in the community (CA) according to the following definitions and in accordance with the best clinical judgement of the healthcare and/or infection prevention and control practitioner (IPC). If the site of acquisition cannot be determined, please report as 'unable to determine'.

Healthcare-associated acquired in your acute-care facility (HA-YAF)

- Patient is on or beyond calendar day 3¹ of their hospitalization

OR

- Has had a healthcare exposure at your facility that would have resulted in this infection or colonization (using best clinical judgement)

Healthcare-associated – acquired from any other healthcare exposure in Canada

Any patient who has an infection or colonization not acquired at your facility that is thought to be associated with another healthcare exposure in Canada (e.g. another acute-care facility, long-term care, rehabilitation facility, clinic or exposure to a medical device).

¹ Calendar day 1 is the day of hospital admission

Healthcare-associated – acquired from any other healthcare exposure outside of Canada

Any patient who has an infection or colonization not acquired at your facility that is thought to be associated with another healthcare exposure outside of Canada (e.g. another acute-care facility, long-term care, rehabilitation facility, clinic or exposure to a medical device).

Community-associated (CA):

No exposure to healthcare that would have resulted in this infection or colonization (using best clinical judgement) and does not meet the criteria for healthcare-associated infection or colonization.

b. If healthcare-associated in your facility (HA-YAF), is there evidence of any of the following modes of transmission?

Please indicate whether there is any evidence to suggest that this patient became infected/colonized with this CPO through any of the modes listed (i.e. are any of the modes of transmission suspected as potential sources of exposure?). Please use best clinical judgement when determining the mode of transmission.

14. If this patient is a newborn (<28 days), was the mother known to be CPO positive?

If this patient is a newborn, please indicate whether the mother was known to be CPO positive to help inform the exposure classification of the infant.

15. Patient international travel

a. Is there any evidence of international travel in the 12 months prior to the patient's CPO diagnosis?

Please indicate if the patient has travelled outside of Canada in the 12 months prior to the date of positive culture.

b. If travelled internationally, is there evidence that the patient received medical care where they travelled to?

If answered 'yes' to question 15a, please indicate (if possible) whether the patient received medical care while travelling outside of Canada.

16. Does the patient have any pre-existing comorbidities?

Please indicate whether the patient has any pre-existing comorbidities. Please select all that apply.

Note: Q17-Q19 are only to be completed for infected cases

17. Was the patient admitted to an ICU within 30 days of positive culture?

Please indicate whether the patient was admitted to an ICU within 30 days of positive culture.

18. Patient outcome 30 days after CPO positive culture?

Thirty days after the date of positive culture please select one of the outcome options available.

19. Relationship of CPO to death

If the patient died, please indicate if CPO was the cause of death (i.e. the patient had not other condition that would have caused death during the admission); CPO contributed to death (i.e. CPO exacerbated an existing condition that led to the patient's death), CPO was unrelated to death or unable to determine the causality between CPO and death. Please consult with the most responsible physician (MPR) and/or the CNISP member to conduct an assessment to determine the relationship of CPO to death.

Appendix 7 – Revision History

Date	Revisions Made
June 3, 2014	Added response 'unable to determine' to Q8 "Where CPO acquired?" – now Final v2
June 9, 2014	Corrected numbering of questions – now Final v3
July 15, 2014	Added ER visits to denominator data collection – was already added to separate 'quarterly denominator form' – now Final v4
October 30, 2014	Began making changes to homogenize CNISP protocol formatting
December 15, 2014	Updated the unique patient ID for multiple organisms and/or re-admission to reflect previous nomenclature (i.e. adding suffix A or B).
December 30, 2014	<ol style="list-style-type: none"> 1. Updated Q8 to include 'other Canadian healthcare facility' and 'other healthcare facility outside of Canada' 2. Changed wording of Q13 to clarify evidence of transmission.
2015	Question Q13 "Is there any evidence that this was a nosocomial-acquired case?" was removed in the 2015 protocol.
October 28, 2015	Question 15c related to what medical procedure patients were subjected to if they received medical care abroad has been removed.
November 2017	<ol style="list-style-type: none"> 1. Added Q13b regarding possible sources/modes of transmission 2. Added Q19 - for patients with more than one CPE or CPA infection or colonization in a calendar year, please report the PID of the previous case 3. Project name updated to CPO surveillance. Note: reflected in PID format 4. Update to PID format: For multiple pathogens, infections, colonizations etc. within same the admission use the same PID with suffix A, B, C etc. NEW – use a new PID for a new admission
July 2018	<ol style="list-style-type: none"> 1. Discontinued CPO surveillance of ER and outpatients 2. Updated Appendix 1 to reflect sites that conduct their own molecular testing 3. Removed surveillance year as protocol will no longer be updated annually 4. Added inclusion and exclusion surveillance criteria 5. Removed Q1 from pt questionnaire (Appendix 3) and added a question regarding who/where carbapenemase confirmation is conducted. 6. Updated definitions for healthcare and community associated
Nov 2018	<ol style="list-style-type: none"> 1. Added section on environmental sampling and updated Appendix 2 accordingly 2. Added Q18 – Added question - were any sinks or drains tested for CPO related to this patient 3. Added Q14c – Added question regarding evidence of international travel by a member of the household or caregiver

January 2020	<ol style="list-style-type: none"> 1. ER and outpatients were added back into surveillance 2. Hemodialysis added as a response option to Q13b 3. Question on environmental isolates was moved to Appendix 2 Laboratory Shipping Form 4. Updated Appendix 5 Key Carbapenem and Carbapanemase Acronyms 5. Under Case Identification and Isolate Submission, provided additional details regarding inclusion criteria for patients with multiple samples collected
January 2021	Added new COVID-19 question to patient questionnaire (Q.17)
January 2022	<ol style="list-style-type: none"> 1. Updated the working group member list and email addresses for CNISP and NML 2. Data entry for CPO patient questionnaire available on CNPHI Web Data for 2022 cases
January 2023	<ol style="list-style-type: none"> 1. Updated the working group member list 2. Added question for patients whose positive culture was collected in ER – was this patient subsequently admitted? 3. Added attributable mortality to the pt questionnaire
November 2023	<ol style="list-style-type: none"> 1. Updated the working group member list 2. Updated reporting section for CNPHI module 3. Removed question regarding which laboratory conducted the testing 4. Removed question regarding exposure to a caregiver that traveled in the past 12 months 5. Removed question regarding testing positive for COVID-19 6. Added a question about CPO status of the mother of a newborn case 7. Added outbreak/cluster associated as an option for exposure options 8. Expanded the table on how to handle multiple isolates