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Canadian Nosocomial Infection Surveillance Program (CNISP)

Surveillance Protocol for Carbapenemase-Producing Organisms (CPO) in CNISP Hospitals

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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 and clinical outcomes of patients (inpatients, emergency room (ER) patients and outpatients) infected or colonized with a carbapenemase-producing organism (CPO), specifically carbapenemase-producing *Enterobacterales* (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 participating CNISP hospitals or presenting to a CNISP hospital emergency department or a CNISP hospital-based outpatient clinic.

ii. Laboratory confirmation of carbapenem resistance or carbapenemase production (SEE APPENDIX 1 - LABORATORY CONSIDERATIONS FOR case eligibility for surveillance in *Enterobacterales* and *Acinetobacter spp*.

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

Numerators

Case Identification and Isolate Submission

All patient specimens with eligible *Enterobacterales* and/or *Acinetobacter spp* (SEE APPENDIX 1 - LABORATORY CONSIDERATIONS FOR case eligibility for surveillance will be identified by the hospital microbiology laboratory and sent to the NML with a minimum data set (SEE APPENDIX 2 - LABORATORY SHIPPING FORM) 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:

- and 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.

Below are examples of inclusion criteria for patients with multiple samples collected:

Patient	Sample	Carbapenemase	Species	Site	Inclusion
1	A	NDM	E. coli	Stool	No
	B	NDM	E. coli	Blood	Yes
2	A	KPC	K.pneumoniae	Stool	Yes
	B	OXA-48	K.pneumonaie	Stool	Yes
3	A	KPC	K. oxytoca	Stool	Yes
	B	KPC	E. cloacae	Urine	Yes
4	A	KPC	K.pneumoniae	Stool	Yes
	B	KPC	K.pneumonaie	Stool	No

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

The carbapenemase testing results 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 – CPO Patient Questionnaire (Appendix 3) should be completed for all carbapenemase-producing *Enterobacterales* and/or *Acinetobacter* spp. For data quality purposes, please ensure that data submitted on Appendix 2 - Laboratory Shipping Form (Appendix 2) matches data submitted on the patient questionnaire (e.g. age, sex, pathogen, site of isolation etc.). The patient questionnaire should be completed based on the isolate submitted to the NML.

Please submit all patient questionnaires by email to CNISP at cnisp-pcsin@phac-aspc.gc.ca or online through CNPHI under **WEB DATA.** Below are the steps to access Web Data:

Under Collaboration > CNISP > Web Data > CPO Patient Questionnaire

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).*

Laboratory Reporting

The Appendix 2 - Laboratory Shipping Form (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 CHEC member and lead ICP for each hospital.

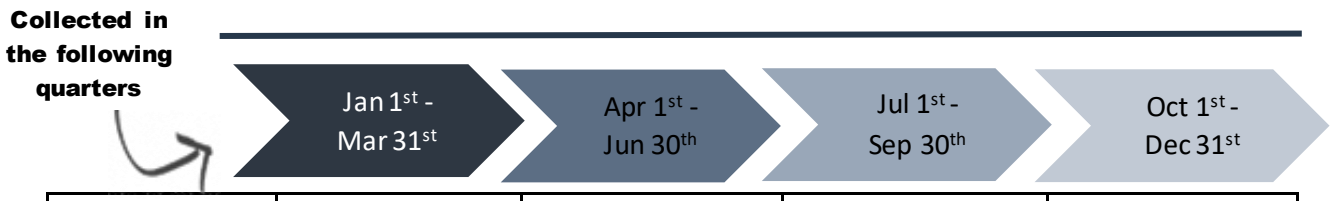
Surveillance Algorithm

The Appendix 4 - CPO Surveillance Algorithm 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



Patient questionnaires	Data and isolates due by June 30th	Data and isolates due by September 30th	Data and isolates due by December 31st	Data and isolates due by March 31st of following surveillance year
Isolates				
Zero Report (if no cases)				
Denominator data				

Zero Report

For any quarter with no cases at your site, a zero report must entered in CNPHI Web Data or emailed to CNISP at cnisp-pcsin@phac-aspc.gc.ca 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

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

The NML will maintain a database of all eligible isolates. This database will include all data submitted on the laboratory shipping form and laboratory testing results. The Ottawa CNISP team will maintain an epi database of all patient questionnaire data. Once the laboratory analysis is complete, the lab and epi data will be merged.

Patients with multiple CPO positive isolates will only be included in the rates once based on the isolate from the most invasive site. 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.

Regional and national rates (per 1,000 admissions and per 10,000 inpatient-days), descriptive epidemiology, microbiology and resistance data will be calculated each year by PHAC and NML staff. Data will be reported through PHAC surveillance reports, presentations, publications, and published on the Agency and/or AMMI website.

ETHICS

While this surveillance project does not involve any alteration in patient care, ethics approval may be sought at some hospital sites. There are no patient identifiers in this data and data is aggregated with the lowest level of aggregation being at the hospital ward. All data submitted to PHAC is kept strictly confidential.

PRIVACY

There is current demand for public disclosure of hospital-associated infections. Any data released by CNISP will be in summary format and will not identify individual hospitals. 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.2020.M100-Ed30 zone diameters and/or MIC values as listed below:

At least ONE of the following carbapenems:	***Enterobacterales:***		***Acinetobacter:***	
	MIC (*µg/ml*)	Disk diffusion (*mm*)	MIC (*µg/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, or Beta-Carba test. These tests can help determine if a suspected CPO that was negative by molecular testing does in fact harbour a carbapenemase.

   Note however, that these tests can produce false negatives for poorly expressed enzymes (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:

Appendix 2 CPO
Laboratory Shipping F

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.	Which laboratory conducted carbapenemase confirmatory testing for this case? □ NML □ Provincial laboratory □ Hospital laboratory	
2.	Is this isolate associated with an infection or a colonization? □ Infection[1] □ Colonization	
3.	CHEC Site: _____	
4.	Unique Patient Identifier: _____ **YY** _____**(**e.g. 99Z23001) *(CHEC site #) (year) (case number)*	
5.	Patient ward when positive specimen was collected: □ Inpatient: If inpatient please check one of the following: □ ICU □ NICU □ Medical ward □ Surgical ward □ Other inpatient ward (*specify):*_____ □ Emergency Room (ER) If the positive specimen was collected while the patient was in ER, was this patient subsequently admitted? □ Yes □ No □ Unknown □ Outpatient □ Other ward, please specify:_____ □ Unknown	
6.	Date of birth: _____ / _____ / _____ DD MMM YYYY	Age _____ □ Years □ Months □ Days
7.	Sex: □ Male □ Female □ Unknown	
8.	Date of admission: _____ / _____ / _____ DD MMM YYYY	

[1] Infection is determined using the 2023 CDC/NHSN surveillance definitions for specific infections, and in accordance with the best judgment of the healthcare practitioner. These criteria can be accessed at www.cdc.gov/nhsn/PDFs/pscManual/17pscNosInfDef_current.pdf

9.	Type of CPO isolate: □ Screening isolate □ Clinical isolate □ Blood
10.	Date of positive culture: (*Specimen collection date from which the positive organism was isolated):* _____/ _____ / _____ DD MMM YYYY
11.	Organism isolated: □ Acinetobacter baumannii □ Serratia spp. □ Klebsiella pneumoniae □ Enterobacter spp. □ Escherichia coli □ Proteus spp □ Other, specify: _____ □ Citrobacter spp. □ Morganella morganii □ Enterobacter cloacae □ Klebsiella oxytoca □ Citrobacter freundii □ Serratia marcescens
12.	Site of isolation: (Please select the site of isolation for the isolate that was submitted to the NML) □ Blood □ Urine □ Wound □ Surgical site □ Skin/soft tissue □ Stool/rectal swab □ Sputum/Endotracheal secretions/BAL □ Other, specify: _____
13a.	Where was this CPO acquired? □ Healthcare-associated – acquired in your acute-care facility (HA-YAF)[2] □ Healthcare-associated – acquired from any other healthcare exposure in Canada (HA-Other, Canada)[3] ➔ skip to Q14a. □ Healthcare-associated – acquired from any other healthcare exposure outside of Canada (HA-Other, outside Canada)[4] ➔ skip to Q14a. □ Community-associated (CA)[5] ➔ skip to Q14a. □ Unable to determine ➔ skip to Q14a.

[2] Patient is on or beyond calendar day 3[2] 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)

[3] 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).

[4] 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).

[5] 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.

13b.	If healthcare-associated in your facility (HA-YACF), is there evidence of any of the following modes of transmission? Please select all that apply. □ N/A (not HA-YACF) □ Sink/drain □ Hemodialysis □ Other environment exposure, specify: _____ □ Device/procedure (e.g. ERCP, endoscopy), specify:_____ □ Another patient (e.g. contact tracing, outbreak investigation). If possible, please specify the PID: _____ □ Other exposure. Specify: _____ □ Unknown
14a	Is there any evidence of international travel in the 12 months prior to the patient's CPO diagnosis? □ No, there is no evidence of international travel. ➔ if NO, skip to Q15. □ Yes, specify where travelled to: _____ □ Unable to determine
14b.	If traveled internationally, is there evidence the patient received medical care where they traveled to? □ N/A - no evidence of international travel □ Yes, there is evidence that the patient sought medical care while on international travel □ No, there is no evidence that the patient sought medical care while on international travel □ Unable to determine
15.	Is there any evidence of international travel by a member of the household or caregiver in the 12 months prior to the patient's CPO diagnosis? □ No, there is no evidence of international travel. □ Yes, specify where travelled to: _____ □ Unable to determine
16	Is there evidence the patient has pre-existing comorbidities(s)? Please check all that apply. □ No evidence of any pre-existing comorbidity □ Yes *(please check all that apply)* □ Diabetes □ Liver disease □ HIV infection □ Cancer (active) □ Lung disease (e.g., asthma, COPD) □ Kidney disease (include all patients on dialysis) □ Solid organ transplant recipient □ Bone marrow transplant recipient □ Other immunosuppression, specify _____ □ Heart disease □ Other, specify _____ □ Unknown

17	During this admission or in the 14 days prior to this admission, did this patient test COVID-19 positive for the first time? □ Yes - if your site participates in VRI surveillance, please provide the PID for the COVID-19 patient questionnaire: _____ □ No □ Unknown
Q18 and Q19 are only to be completed for <u>infected</u> cases	
18	Was the patient admitted to an ICU within 30 days of positive culture? □ N/A - patient was already in an ICU at the time the positive culture was obtained □ Yes, please indicate the date of ICU admission: _____/ _____/ _____ DD MMM YYYY □ No □ Unknown
19	What was the patient outcome 30 days after positive culture? □ Patient alive, still in hospital □ Patient survived and discharged Date of discharge _____/ _____/ _____ DD MMM YYYY □ Patient survived and transferred Date of transfer _____/ _____/ _____ DD MMM YYYY □ Patient died Date of death _____/ _____/ _____ DD MMM YYYY □ Unknown
20	If the patient died within 30 days after the positive culture, please indicate the relationship of CPO to the death □ CPO was the cause of death □ CPO contributed to death □ Death is unrelated to CPO □ Causality between CPO and death cannot be determined

Appendix 4 - CPO Surveillance Algorithm

Inpatient, ER or outpatient admitted to your hospital and identified with carbapenem-resistant *Enterobacterales* AND/OR *Acinetobacter spp*.

No → Exclude from surveillance

Yes

Hospital laboratory identifies eligible isolate(s) for surveillance using 1 or more of the following 3 methods:

1. In accordance with criteria from table to the right
2. Positive molecular testing (PCR) or immunochromatographic lateral flow assay for carbapenemase presence
3. Positive phenotypic test such as the mCIM, CARBA-NP, Beta-Carba or a commercial equivalent

At least ONE of:	*Enterobacterales*:		*Acinetobacter*:	
	MIC (µg/mL)	Disk diffusion (mm)	MIC (µg/mL)	Disk diffusion (mm)
Imipenem	≥4	≤19	≥8	≤18
Meropenem, Doripenem	≥4	≤19	≥8	≤14
Ertapenem	≥2	≤18	n/a	n/a

No → Exclude from surveillance

Yes → Complete the Laboratory Shipping Form (Appendix 2) and send it with the isolate(s) to the NML (care of Dr. Golding). Please also email Appendix 2 to the NML at **nml.arni-rain.lnm@phac-aspc.gc.ca**

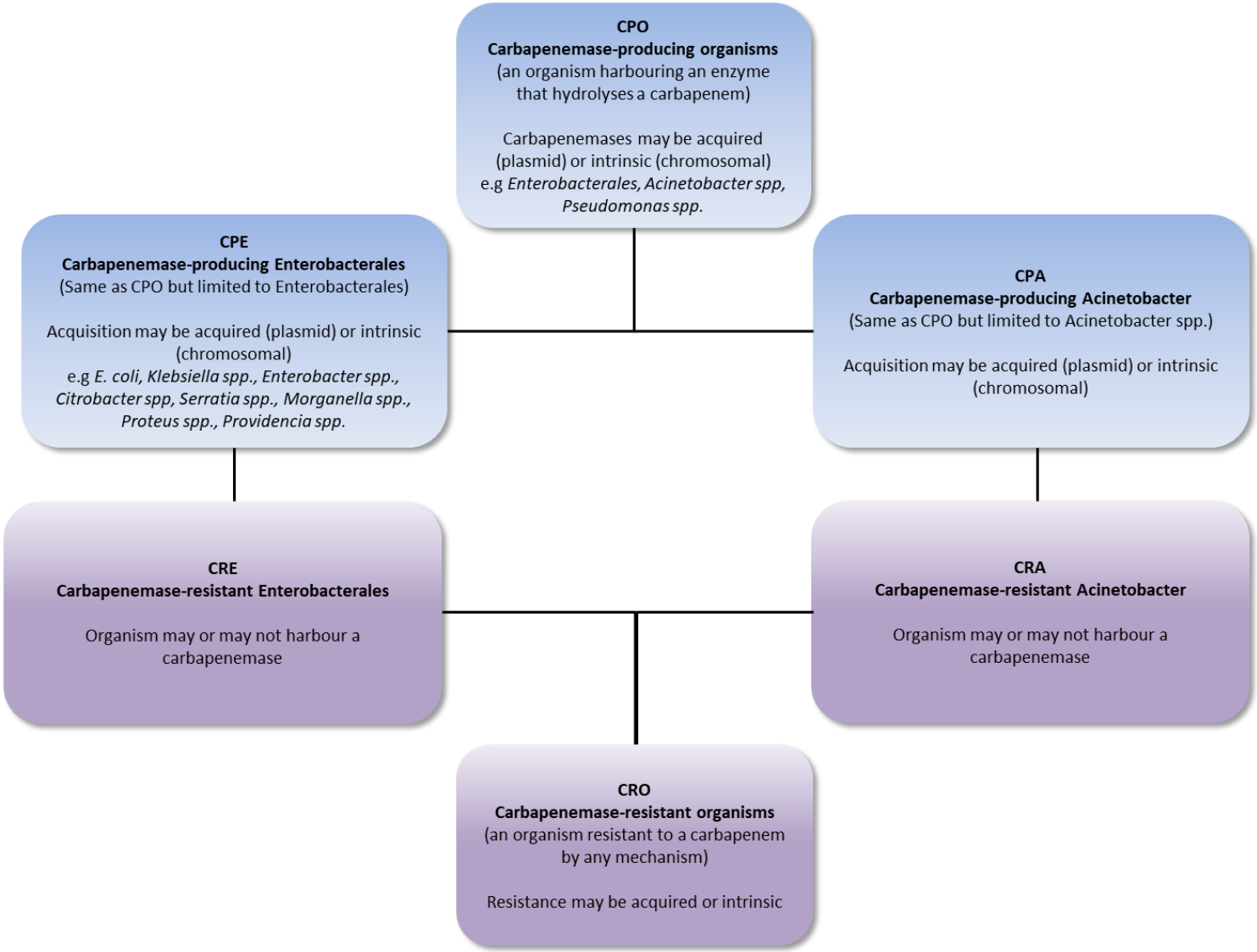
PCR detection (by NML) of isolated *Enterobacterales spp.* and/or *Acinetobacter spp.* for the presence of a carbapenemase
If a carbapenemase is detected

- No → The NML sends a report of all PCR results to the CHEC site
- Yes → **Yes**

Dr. George Golding
National Microbiology Laboratory
1015 Arlington St.
Winnipeg, Manitoba R3E 3R2
Tel: 204-789-8096;
Fax: 204-789-5020
FedEx billing number: 2299-8435-7
Email: george.golding@phac-aspc.gc.ca

CHEC site completes a patient questionnaire (Appendix 3) for all CPE and CPA infections and colonizations and submits to: cnisp-pcsin@phac-aspc.gc.ca

Appendix 5 - Key Carbapenem and Carbapenemase Acronyms



Appendix 6 - Data Dictionary

Definitions and notes for APPENDIX 3 – CPO Patient Questionnaire

1. **Which laboratory conducted confirmatory carbapenemase testing for this case?**

   Please indicate which laboratory confirmed that this case is CPO positive. Please check all that apply.

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

   Based on the isolate submitted, please indicate if this case is colonized or infected. Infection is determined using the CDC/NHSN surveillance definitions for specific interventions AND in accordance with the best judgement of the infection control and/or healthcare practitioner. The CDC/NHSN surveillance definitions can 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 (Appendix 2) 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. **Date of birth**

   Please enter Day (##), Month (May) and Year (1973) in this order. If the date of birth is not available 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 (1973).

9. Type of CPO isolate

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

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 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 3[6] of their hospitalization

OR

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

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

Any patient who has an infection or colonization <u>not</u> 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).

[6] 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 bacteremia (using best clinical judgement) and does not meet the criteria for healthcare-associated BSI

b. If healthcare-associated (your facility), 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. If contact with another patient, please specify the unique patient ID of this patient.

14. 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 14a, please indicate (if possible) whether the patient received medical care while travelling outside of Canada.

15. Is there any evidence of international travel by a member of the household or caregiver in the 12 months prior to the other patient's CPO diagnosis?
Please indicate (if possible) whether there is any evidence of travel outside of Canada by a member of the household and/or a caregiver in the 12 months prior to the patient's CPO diagnosis.

16. Does the patient have any pre-existing comorbidities?
Please indicate whether the patient has any pre-existing comorbidities – if yes, check all that apply.

17. During this admission or in the 14 days prior to this admission, did this patient test COVID-19 positive for the first time?
Please indicate if during this admission or in the 14 days prior to this admission, this patient tested COVID-19 positive for the first time. If yes and your site participates in VRI surveillance, please provide the PID for the COVID-19 patient questionnaire.

Note: Q18 & Q19 are only to be completed for <u>infected</u> cases

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

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

19. Patient outcome 30 days after CPO positive culture?

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

20. Relationship of CPO to death

If the patient died, please indicate if CPO was the cause of death (i.e. the patient had no other condition that would have cause 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 CNISP member to conduct an assessment to determine the relationship of CPO to death.

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	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	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	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	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	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	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	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