Public Health Agency of Canada | Agence de la santé publique du Canada

Canadian Nosocomial Infection Surveillance Program

Hospital Antibiogram Protocol

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BACKGROUND

Canada, through the Public Health Agency, has a responsibility to contribute data to the World Health Organization (WHO) Global Antimicrobial Resistance Surveillance System (GLASS) initiative. The antibiogram data collected by CNISP forms a portion of the Canadian submission.

While the main focus of CNISP is on the surveillance of healthcare associated infections, it is also of interest to collect antibiogram data from broader populations who seek care at CNISP hospitals. Since not all CNISP sites are equipped to separate outpatients (receiving care in ER) from inpatients, the current protocol supports data collection of three types of populations: inpatient only, outpatient only and mixed inpatient and outpatients.

The antibiogram surveillance program was implemented in phases. Phase I (2015 – 2017) focused on *Escherichia coli* antibiograms. Starting in 2018, antibiograms for *Klebsiella pneumoniae*, *S. aureus* (if possible, broken down by MSSA and MRSA), *Pseudomonas* & *Acinetobacter* were added.

OBJECTIVES

The objective of this CNISP initiative is to collect hospital-wide antibiogram data within the CNISP hospital network (and beyond when possible) and provide national resistance rates that may be used for internal and external comparison.

A secondary objective is to reduce antimicrobial resistance. The literature suggests that the collection and feedback of data to healthcare professionals may result in a reduction in resistance through more appropriate use of antimicrobials. Routine standardized collection of antimicrobial resistance rates also assists individual centres in clinical decision-making, design of infection control interventions, and antimicrobial-resistance containment strategies.

METHODS

Site Eligibility

- ✓ Acute-care Canadian hospitals
- ✓ Able to submit the mandatory elements for annual antibiogram data collection for the target organisms (non-screening specimen isolates). Please see APPENDIX 1 – CNISP ANTIBIOGRAM REQUIREMENTS TABLE for mandatory data elements.

Specimens included in surveillance:

E. coli, *K. pneumoniae, S. aureus* (MRSA and MSSA if able to separate), *Pseudomonas* (optional), *Acinetobacter* (optional) and *Candida* (optional) isolates are to be included in the annual antibiogram data. Submissions should include non-screening specimen isolates with duplicates removed (see below for accepted duplicate removal processes).

Duplicate removal period is 365 days per surveillance period. Types of accepted duplicate removal processes:

a. inclusion of only the first isolate per patient irrespective of specimen type, or
b. inclusion of the first isolate per patient with a hierarchy by specimen type, e.g., blood isolate replace isolate from all other specimen types from the same patient during the period analyzed, or
c. inclusion of the first isolate per patient by specific specimen type in the period analyzed, i.e., including both first blood isolate and first urine isolate from the same patient during the period analyzed
d. inclusion of first isolate per patient per site but has the possibility of duplicated isolates from a patient within the site or hospital network or health authority not differentiated by specimen type

Surveillance period

Data are retrospectively collected for the current surveillance year and include data from January 1st to December 31st of the previous year. Data are due by March 31st of the current surveillance year.

Example: Data from January 1st 2021 to December 31st 2021 are due by March 31st 2022 as part of the 2022 surveillance year.

If you have any questions please do not hesitate to contact us phac.cnisp-pcsin.aspc@canada.ca

Data Elements

A. Mandatory Minimum Data

Please see Appendix 1 – CNISP Antibiogram Requirements Table for a list of the mandatory data collected for *E. coli, K. pneumoniae*, and *S. aureus* (MSSA and MRSA if able to separate).

Summary of mandatory variables

- ✓ **Patient population**
  - Depending on data availability, all patients can be submitted as either:
    a. Inpatients & outpatients combined, **OR**
    b. Inpatients only and/or outpatients only (as separate groups).
  - For hospitals with mixed adults and pediatric patients, ideally data are provided separately for **pediatric** and **adult** groups (See Appendix 1 – CNISP Antibiogram Requirements Table) otherwise 'all patients' will be 'all patients' with no age separation). Please indicate the appropriate descriptor during data entry.
- ✓ **Calendar year**
- ✓ **Does your antibiogram represent more than one CNISP hospital (CHEC site)?**
- ✓ **Does your antibiogram include hospitals that do not participate in CNISP?**
- ✓ **How many hospitals are included in the submission?**
- ✓ **# isolates tested against specified antibiotics**
- ✓ **# isolates susceptible to specified antibiotics**
- ✓ **Specimen type**
  - Note that 'All specimen types' includes clinical (non-blood such as respiratory, skin, soft tissue, surgical sites etc.), blood and urine.
- ✓ **Isolate inclusion criteria**
  - Type of inclusion criteria for isolates included in the antibiogram.
- ✓ **Patient inclusion criteria**
  - Type of inclusion criteria for patient population included in the antibiogram. For example, "Inpatient and outpatient combined (inpatients and patients seen at hospital clinics or emergency department who might or might not have been admitted)".

B. Optional data

Please see APPENDIX 1 – CNISP ANTIBIOGRAM REQUIREMENTS TABLE for a list of the optional data collected for *E. coli, K. pneumoniae, S. aureus, Pseudomonas, Acinetobacter,* and *Candida*.

C. Publicly available antibiogram data

If publicly available antibiogram data from Canadian hospitals are identified which contain the minimum data elements and meet the site eligibility requirements, these data will be added to the surveillance dataset by CNISP staff. Publicly-available data will be indicated in the database so that these data can be removed from analyses as necessary.

Data Submission

All data must be submitted to CNISP by email (phac.cnisp-pcsin.aspc@canada.ca) by **March 31st**.

Submit data using the excel data collection form embedded in APPENDIX 2 – CNISP ANTIBIOGRAM DATA SUBMISSION FORM and available on the CNPHI CNISP collaboration centre www.cnphi-rcrsp.ca (Documents Manager → CNISP Protocols). Each organism has its own worksheet and the data dictionary and notes are in separate tabs in this excel workbook. All completed excel forms are to be submitted to the CNISP generic email account at cnisp-pcsin@phac-aspc.gc.ca. This year, to ease data entry, pop-up forms have been added to the excel data collection form (see the 'Data Entry Forms' tab). Please note that data can continue to be entered directly into the excel tabs for sites that do not wish to use the pop-up forms. To use the pop-up forms, users will have to allow macros to run in the excel workbook (usually this pops up as a grey band in the excel file – click 'enable macros' to allow macros to run).

Please note the CNPHI web form has been discontinued. If another format of data submission would be easier for your site, please contact cnisp-pcsin@phac-aspc.gc.ca to discuss alternatives.

Additional notes

- If you are submitting an antibiogram for more than one hospital, please submit a separate form for each hospital
- If you are submitting antibiogram data for a network of hospitals, please enter all the CHEC sites you are entering data for separated by a comma e.g., 99A, 99B, 99C, 99D, etc
- If you are submitting data for CNISP hospitals and hospitals that do not participate in CNISP, please enter the names of the non-CNISP hospitals

Analysis

Rate Calculation

The rate of non-susceptibility will only be reported when there are 30 or more isolates tested for a specific antibiotic.

$$Proportion\ of\ non\ susceptible\ organisms = \frac{(\#\ isolates\ per\ organism\ reported\ susceptible\ to\ a\ specific\ antibiotic) - (\#\ isolates\ tested\ for\ that\ antibiotic)}{\#\ isolates\ per\ organisms\ tested\ for\ the\ same\ antibiotic}$$

Workload considerations

At many sites, antibiogram surveillance depends on collaboration with the microbiology laboratories that provide antibiogram data for the specific health authority, hospital network, or hospital site. The microbiologists involved in generating the data will be included in the citation or acknowledgement of members of CNISP antibiogram team in publications if requested by the site.

If antibiogram data is not being generated by microbiology laboratories, antibiogram data can be generated by doing case-by-case (isolate-by-isolate) data collection of antibiotic susceptibility data of the target organism for a defined population under surveillance at the health authority, hospital network or hospital site.

ETHICS

This surveillance project is observational and does not involve any alteration in patient care. Surveillance for antimicrobial resistance is a routine component of quality assurance and patient care in Canadian healthcare institutions and therefore informed consent will not be required. All data submitted to the Public Health Agency of Canada are kept strictly confidential. Each aggregate antibiogram will be identified by a unique number and no personal identifiers will be transmitted to the Public Health Agency of Canada. This unique number will be linked to the hospital and will be kept strictly confidential under secure conditions.

Public Access to Individual CNISP Site Data

There is current demand for public disclosure of hospital-associated adverse events. Any data released by CNISP will be in summary format and will not identify individual hospitals. CNISP participants should anticipate that they may be approached to release hospital specific data, especially if the results of this surveillance are published. Hospital administrators should be made aware that national / international reporting will be occurring.

Appendix 1 – CNISP Antibiogram Requirements Table

All results to be reported as number of isolates tested, number of isolates susceptible (i.e., NOT %)

Mandatory	E.coli	K.pneumo	S. aureus ¥ (MSSA+MRSA)	MSSA¥	MRSA¥	Pseudomonas	Acinetobacter	Candida†
Specimen types								
All specimen types*Ŧ	✔	✔	✔	✔	✔			
Patient types								
All Patients Ŧ	✔	✔	✔	✔	✔			
Optional	**E.coli**	**K.pneumo**	**S. aureus ¥ (MSSA+MRSA)**	**MSSA¥**	**MRSA¥**	**Pseudomonas**	**Acinetobacter**	**Candida**
Special Specimen types								
Blood only Ŧ	✓ (GLASS request)	✓ (GLASS request)	✓ (GLASS request)			✔	✔	✔
Urine only Ŧ	✓ (GLASS request)	✓ (GLASS request)						
Location / Patient Types								
Pediatric ICU (PICU) Ŧ	✔	✔	✔			✔	✔	
Adult ICU Ŧ	✔	✔	✔					
Pediatrics <18 yrs.** Ŧ	✔	✔	✔			✔		
Adult ≥ 18 yrs.** Ŧ	✔	✔	✔					

¥ *Depending on your laboratory's capabilities – please submit MSSA and MRSA if able to separate;* ***All specimen types include clinical (non-blood such as respiratory, skin, soft tissue, surgical sites etc.), blood and urine;*** ** *Depending on data availability, all patients can be 1) inpatients & outpatients combined, 2) inpatients only and/or outpatients only (as separate groups). Please indicate the appropriate descriptor during data entry. For hospitals with mixed adults and peds, ideally data to be provided as peds vs. adult separately as optional groups below; otherwise 'all patients' will be all patients with no age separation) Please indicate the appropriate descriptor during data entry. Please note that we recognize some Pediatric only hospitals may have patient's ≥ 18 years of age and some Adult only hospitals may have patients < 18 years of age;* Ŧ *No limit on minimal number of isolates to be reported as data will be reported as national aggregate if > 30 isolates;* † *Please submit each Candida species separately. For species/antifungal combinations where both susceptible (S) and susceptibl-dose dependent (S-DD) breakpoints are available, please submit S. Where S breakpoints are not available (eg. fluconazole/C. glabrata), please submit S-DD results.*

Antimicrobials requested for each organism*	E.coli	K.pneumo	S. aureus (MSSA + MRSA)	MSSA¥	MRSA¥	Pseudomonas	Acinetobacter	Candida†
Amikacin	✔	✔				✔	✔	
Ampicillin	✔	✔						
Amoxicillin/Clavulanate	✔	✔						
Cefuroxime (oral)	✔	✔						
Cefazolin (for systemic use)	✔	✔						
Cefazolin (for detection of oral cephalosporin use)	✔	✔						
Cefoxitin	✔	✔						
Ceftriaxone	✔	✔						
Cefotaxime (Peds)	✔	✔						
Ceftazidime	✔	✔				✔	✔	
Ciprofloxacin	✔	✔				✔	✔	
Clindamycin			✔	✔	✔			
Daptomycin			✔		✔			
Ertapenem	✔	✔						
Erythromycin					✔			
Fosfomycin (urine only)	✔							
Fusidic acid			✔		✔			
Gentamicin	✔	✔				✔	✔	
Imipenem	✔	✔				✔	✔	
Linezolid					✔			
Meropenem	✔	✔				✔	✔	
Mupirocin			✔		✔			
Nitrofurantoin (urine only)	✔	✔						
Oxacillin			✔	✔				
Piperacillin						✔		
Piperacillin-tazobactam	✔	✔				✔	✔	
Tetracycline / Doxycycline			✔	✔				
Tobramycin	✔	✔				✔	✔	
Trimethoprim-sulfamethoxazole	✔	✔	✔	✔	✔			
Vancomycin			✔	✔	✔			
Amphoteracin B								✔
Caspofungin								✔
Fluconazole								✔
Micafungin								✔
Voriconazole								✔

**Please submit all antimicrobials available on your panel of those requested;* ¥*Depending on your laboratory's capabilities – please submit MSSA and MRSA if able to separate;* † *Please submit each Candida species separately. For species/antifungal combinations where both susceptibility (S) and susceptible-dose dependent (S-DD) breakpoints are available, please submit S. Where S breakpoints are not available (eg. fluconazole/C. glabrata), please submit S-DD results.*

Appendix 2 – CNISP Antibiogram Data Submission Form

CNISP 2022
Antibiogram_Data S

Appendix 3 – CNISP Antibiogram Data Submission Form Data Dictionary

	Questions	Options/Dictionary
1.	Calendar year *	Calendar year the antibiogram data represents – Only 2018 available to be chosen from the drop-down list
2.	Does your antibiogram represent more than one hospital (CHEC site)?	□ **No** - If no, please enter your CHEC site number in the field titled 'CHEC_#' e.g., 99A □ **Yes** - If yes, please enter the multiple CHEC site numbers (separated by a comma) in the field titled 'CHEC_#'s' e.g., 99A, 99B, 99C etc. Please also indicate the total number of hospitals that are included in the antibiogram (including CNISP sites and non-CNISP sites).
3.	Does your antibiogram include hospitals that do not participate in CNISP?	□ **No** □ **Yes** - If yes, your antibiogram does include hospitals that do not participate in CNISP. For example, you are reporting antibiogram data for a health authority that includes CNISP and non-CNISP hospitals, please enter the name(s) of the non-CNISP hospital(s), separated by a comma, in the field titled Non-CNISP_hospital(s) 'e.g., Grey General hospital, Blue Hospital, Turquoise Hospital etc.
4.	Patient type *Please note that we recognize some Pediatric only hospitals may have patients ≥ 18 years of age and some Adult only hospitals may have patients < 18 years of age*	Please indicate the type of patient this antibiogram data represents. Drop down list: Inpatient and outpatient combined represents inpatients (admitted patients) and outpatients (patients seen at hospital clinics or the emergency department) – Inpatients represent ONLY admitted patients; Outpatients represent ONLY non-admitted patients (clinics, ER) □ Inpatient and outpatient combined Adult only □ Inpatient and outpatient combined Pediatric only □ Inpatient and outpatient combined Mixed (adult and pediatric) □ Inpatient Adult only □ Outpatient Adult only □ Inpatient Pediatric only □ Outpatient Pediatric only □ Inpatient Mixed (adult & peds) □ Outpatient Mixed (adult & peds) □ Adult ICU □ PICU
5.	Specimen Type	Please indicate the type of specimen/isolates tested from the drop down list. A separate form/row needs to be completed for each 'type' of isolate tested: □ All specimen types □ Urine only □ Blood only
6.	Type of duplicate removal	□ Inclusion of only the first isolate per patient irrespective of specimen type □ Inclusion of the first isolate per patient with a hierarchy by specimen type, e.g., blood isolate replace isolate from all other specimen types from the same patient during the period analyzed □ Inclusion of the first isolate per patient by specific specimen type in the period analyzed, i.e., including both first blood isolate and first urine isolate from the same patient during the period analyzed □ Inclusion of first isolate per patient per site but has the possibility of duplicated isolates from a patient within the site or hospital network or health authority not differentiated by specimen type □ Other, please specify
7.	Does your antibiogram data have any specific	Please describe using free text

limitations that would be important for us to know?

Antibiogram results

E. coli

Number of isolates tested and number of isolates susceptible for the following antibiotics

Antibiotic	# isolates tested	#S
Amikacin		
Ampicillin		
Amoxicillin/Clavulanate		
Cefuroxime (oral)		
Cefazolin (for systemic use)		
Cefazolin (for detection of oral cephalosporin use)		
Cefoxitin		
Ceftriaxone		
Cefotaxime (Peds)		
Ceftazidime		
Ciprofloxacin		
Amikacin		
Ertapenem		
Fosfomycin (urine only)		
Gentamicin		
Imipenem		
Meropenem		
Nitrofurantoin (urine only)		
Piperacillin-tazobactam		
Tobramycin		
Trimethoprim-sulfamethoxazole		

K. pneumo

Number of isolates tested and number of isolates susceptible for the following antibiotics

Antibiotic	# isolates tested	#S
Amikacin		
Ampicillin		
Amoxicillin/Clavulanate		
Cefuroxime (oral)		
Cefazolin (for systemic use)		
Cefazolin (for detection of oral cephalosporin use)		
Cefoxitin		
Ceftriaxone		
Cefotaxime (Peds)		
Ceftazidime		
Ciprofloxacin		
Amikacin		
Ertapenem		
Gentamicin		
Imipenem		
Meropenem		
Nitrofurantoin (urine only)		
Piperacillin-tazobactam		

	Tobramycin		
	Trimethoprim-sulfamethoxazole		

S. aureus
(MSSA + MRSA)

Number of isolates tested and number of isolates susceptible for the following antibiotics

Antibiotic	# isolates tested	#S
Clindamycin		
Daptomycin		
Fusidic acid		
Mupirocin		
Oxacillin		
Tetracycline / Doxycycline		
Trimethoprim-sulfamethoxazole		
Vancomycin		

MSSA

Number of isolates tested and number of isolates susceptible for the following antibiotics

Antibiotic	# isolates tested	#S
Clindamycin		
Oxacillin		
Tetracycline / Doxycycline		
Trimethoprim-sulfamethoxazole		
Vancomycin		

MRSA
Number of isolates tested and number of isolates susceptible for the following antibiotics

Antibiotic	# isolates tested	#S
Clindamycin		
Daptomycin		
Erythromycin		
Fusidic acid		
Linezolid		
Mupirocin		
Trimethoprim-sulfamethoxazole		
Vancomycin		

Pseudomonas

Number of isolates tested and number of isolates susceptible for the following antibiotics

Antibiotic	# isolates tested	#S
Amikacin		
Ceftazidime		
Ciprofloxacin		
Gentamicin		
Imipenem		
Meropenem		
Piperacillin		
Piperacillin-tazobactam		
Tobramycin		

Acinetobacter

Number of isolates tested and number of isolates susceptible for the following antibiotics

Antibiotic	# isolates tested	#S
Amikacin		
Ceftazidime		
Ciprofloxacin		
Gentamicin		
Imipenem		

Meropenem		
Piperacillin-tazobactam		
Tobramycin		

Candida

Number of isolates tested and number of isolates susceptible for the following antibiotics ->

Antifungal	# isolates tested	#S
Amphotericin B		
Caspofungin		
Fluconazole		
Micafungin		
Voriconazole		

Please provide data for each Candida species separately.

*For species/antifungal combinations where both susceptibility (S) and susceptible dose dependent (S-DD) breakpoints are available, please submit only S. Where S breakpoints are not available (*eg. fluconazole/*C. glabrata), please submit S-DD results using the "S" data field on the form.*

References

WHO Step-by-step approach for development and implementation of hospital antibiotic policy and standard treatment guidelines URL: http://apps.who.int/medicinedocs/documents/s19184en/s19184en.pdf

CLSI guidelines URL: https://clsi.org/

WHO/Glass URL: http://www.who.int/glass/en/

Revision History

Date	Revisions Made
November 2017	Protocol and data collection form (on-line at CNPHI and excel data entry form) created
April 2018	Data collection period changed to calendar year or fiscal year Duplicate removal period clarified as 365 days per surveillance period Variable = Type of duplicate removal added Will now accept <30 isolates for certain subpopulations such as ICU, SOT, BMT etc. Will only be reported as aggregate if total number of isolates from all hospitals reporting is >30) if data is available.
February 2019	More organisms added to antibiogram data collection Mandatory = *E.coli, K. pneumo, S. aureus* (MSSA+MRSA), if possible ask to separate *S. aureus* into MSSA & MRSA Optional = *Pseudomonas* and *Acinetobacter* Only 'All specimen types' are mandatory and optional specimen types include blood and urine Patient types (depending data availability can be 1) inpatients & outpatients combined 2) Inpatients only and/or outpatients only (as separate groups). For hospitals with mixed adults and peds, ideally data to be provided as peds vs. adult separately as optional groups otherwise all patients will be all patients with no age separation) Data collection period changed to calendar year Will now accept <30 isolates for any organism. Will only be reported as aggregate if total number of isolates from all hospitals reporting is >30 if data is available.
December 2019	Added section on publicly available data Removed requirement of the hospital being a CNISP site
January 2020	Protocol format updated
Sept 2020	Removed UniqueID and # of antibiogram questions Removed recommendations and microbio contact info questions
Oct 2020	Updated embedded template form
Jan 2022	Added Candida to optional submissions Added question on # of hospitals included in antibiogram Added option to submit data from multiple years in one data entry form