Multidrug-Resistant Organism (MDRO) Webinar 2 – Surveillance and Investigation

Training for Local Health Department Staff

Presented by Division of Patient Safety and Quality, Healthcare-Associated Infections/Antimicrobial Resistance (HAI/AR) Program

2/15/23

Housekeeping

- All attendees in listen-only mode
- Submit questions via Q&A pod to **All Panelists**
- Slides and recording will be made available later

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LHD MDRO Webinar Series

1: MDROs 101 – An Introduction

- Recording: https://illinois.webex.com/illinois/lsr.php?RCID=2640788517bfd715bfad78682b439ee0

2: MDRO Surveillance and Investigation

3: MDRO Response

- Thursday, March 16, 2023, 10 – 11:30 am
- Register here

Webinar recordings and slides will be posted to the IDPH CD SharePoint.

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Today's Agenda

- Laboratory Detection
- Surveillance – Definitions, Tools, Methods
- Overview of CDC MDRO Containment Tiers
- Investigation – Components and Use of INEDSS Modules
- Update to VIM-GES-CRPA Outbreak

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LABORATORY DETECTION

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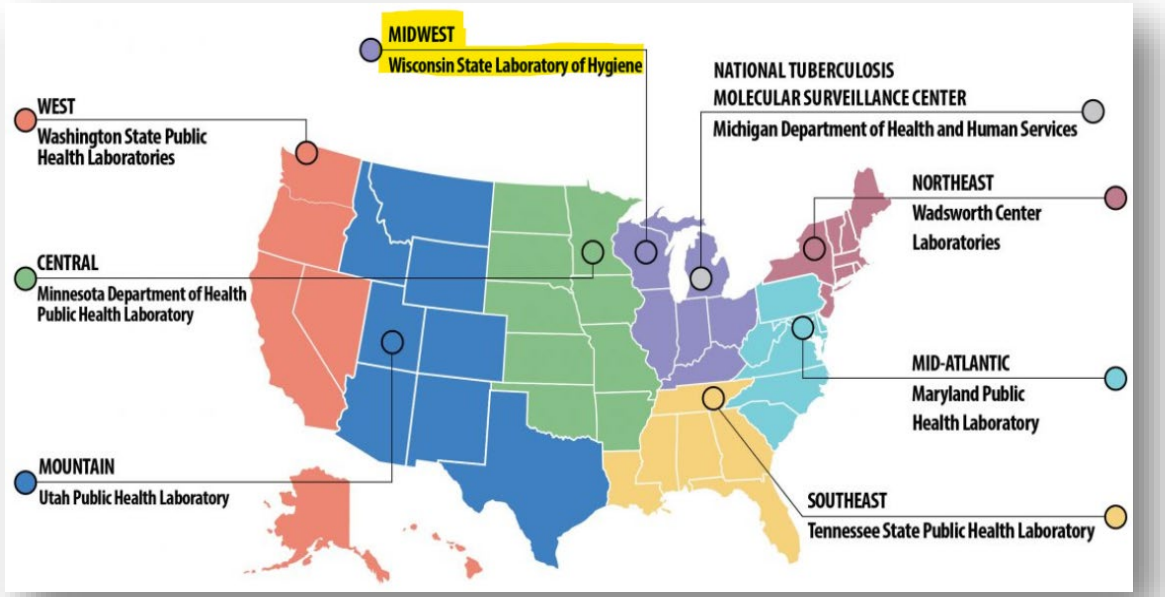
CDC's Antimicrobial Resistance (AR) Lab Network

IDPH – state lab
- Clinical specimen confirmation (CRE, CP-CRPA)

WSLH – regional lab
- Clinical specimen confirmation (CRAB, *C. auris*)
- Colonization screening (*C. auris*, CPOs)

CDC
- Specialized testing, emerging pathogens



https://www.cdc.gov/drugresistance/solutions-initiative/ar-lab-network.html

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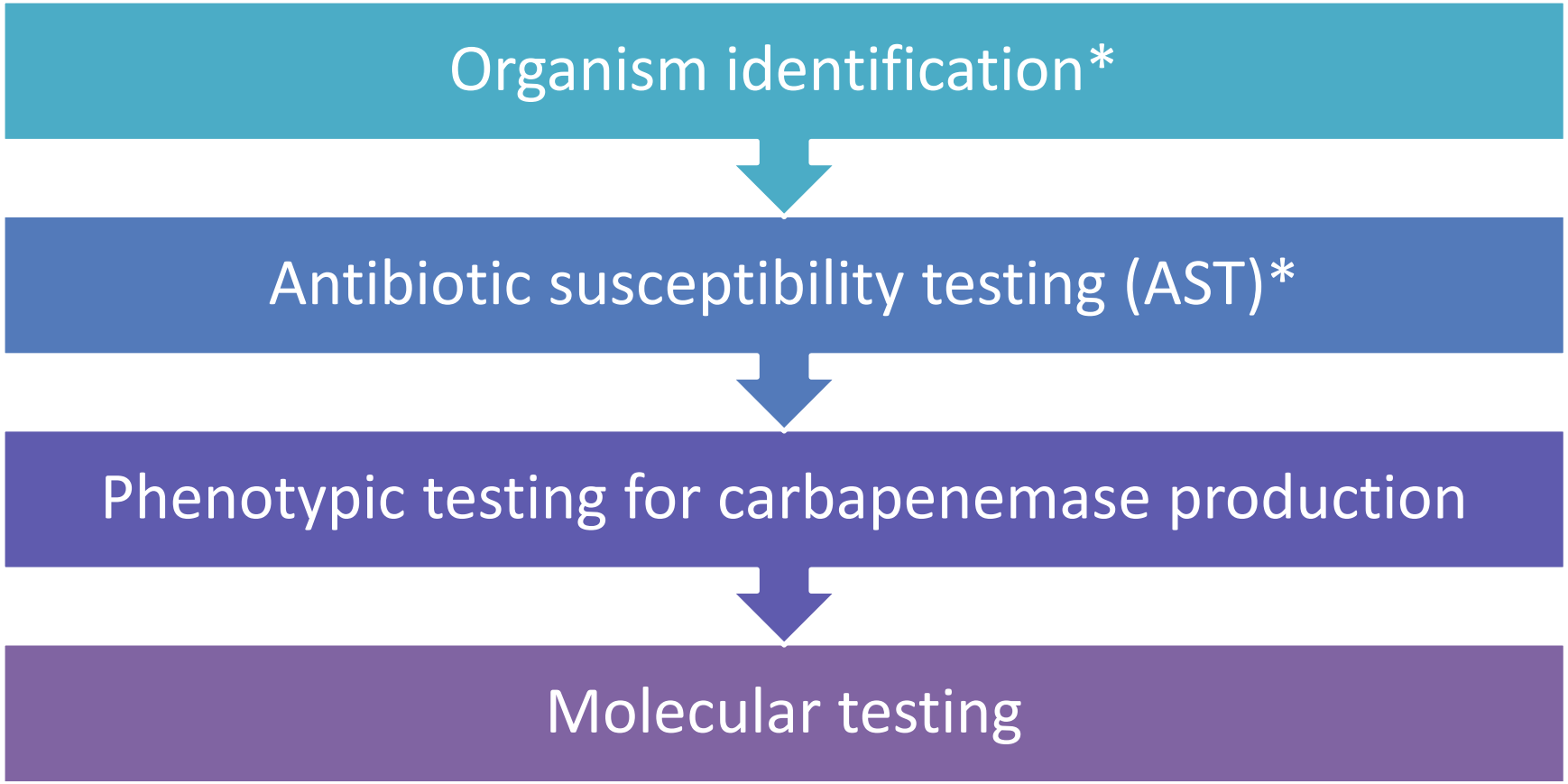
Testing for CROs/CPOs



*Many clinical labs conduct organism ID and AST, but not the confirmatory testing that can identify carbapenemases.

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Antibiotic Susceptibility Testing (AST)

Carbapenem	CLSI M100-ED32 (2022) Breakpoints (ug/ml)		
	Susc	Int	Res
Doripenem	≤1	2	≥4
Ertapenem	≤0.5	1	≥2
Imipenem	≤1	2	≥4
Meropenem	≤1	2	≥4

Clinical and Laboratory Standards Institute. CLSI M100-ED32:2022 Performance Standards for Antimicrobial Susceptibility Testing, 32nd Edition. http://em100.edaptivedocs.net/dashboard.aspx

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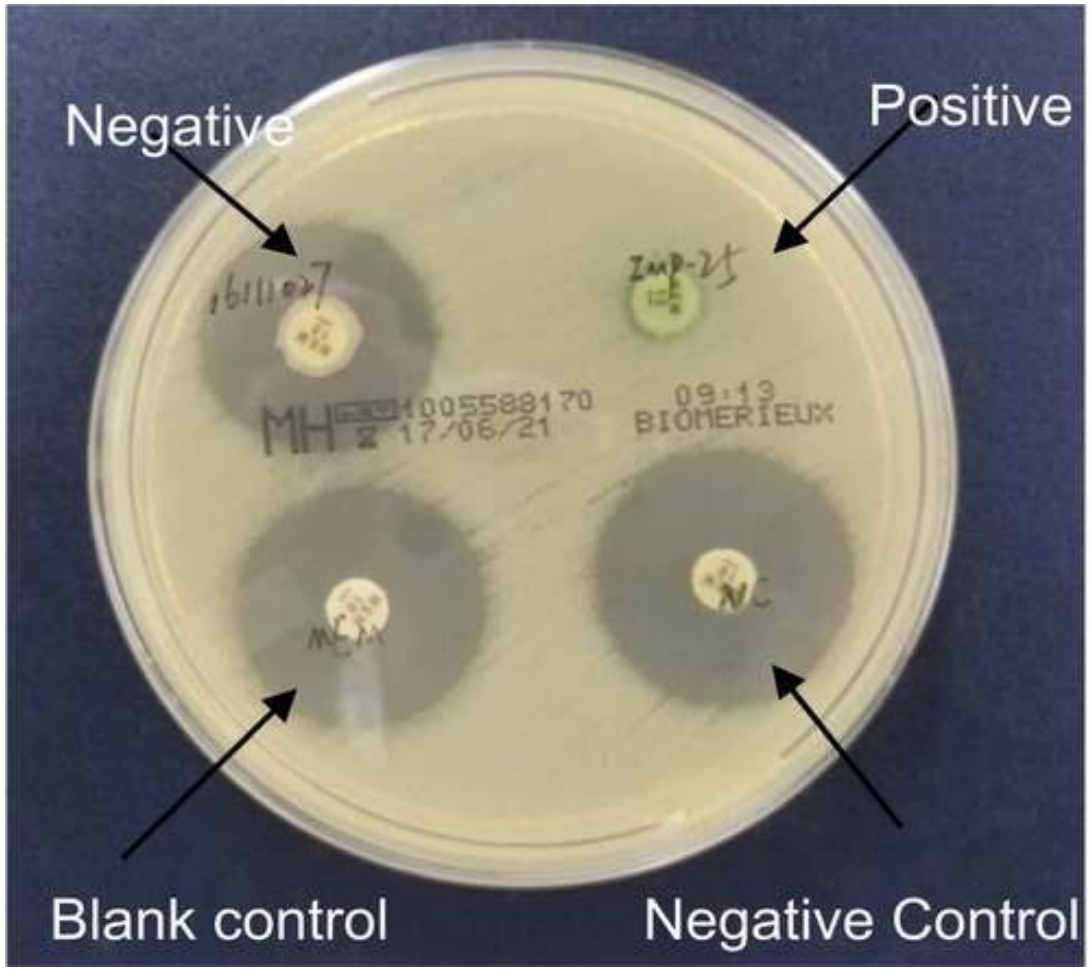
Phenotypic Tests for Carbapenemase Production



Modified carbapenem inactivation method (mCIM) – CDC recommended; AR Lab Network and IDPH Lab use

Photo credit: CDC

Modified Hodge – previous widely used test (shown above)

https://www.tandfonline.com/action/showGraphicalAbstractImage?doi=10.1080%2F21655979.2022.2072601&type=img_lg&id=kbie_a_2072601_uf0001_oc.jpeg

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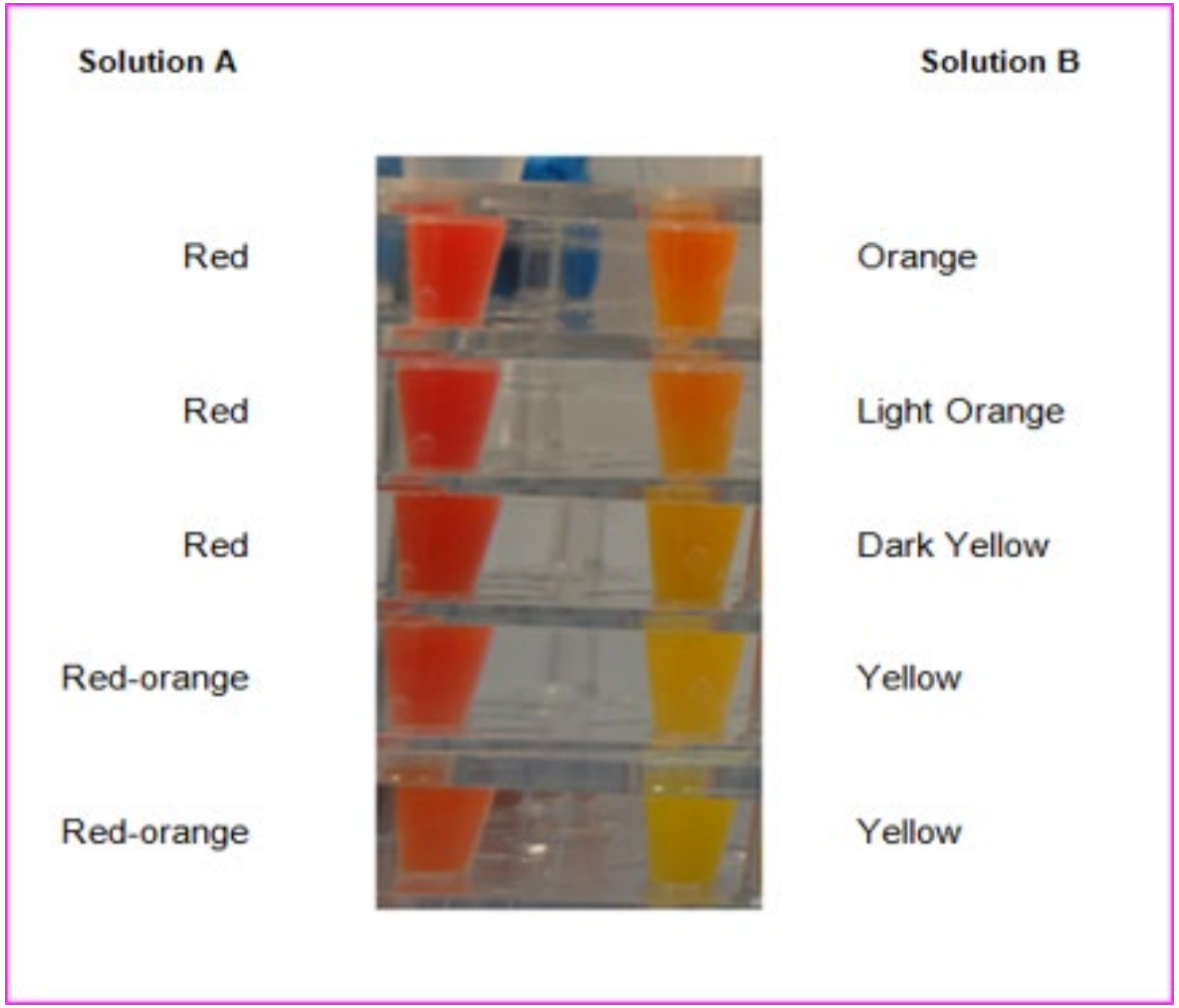
Phenotypic Tests for Carbapenemase Production



CarbaNP

Different growth-inhibition patterns:

Figure 2. Clear cut MBL negative: MP/MPI IC <0.125/<0.032

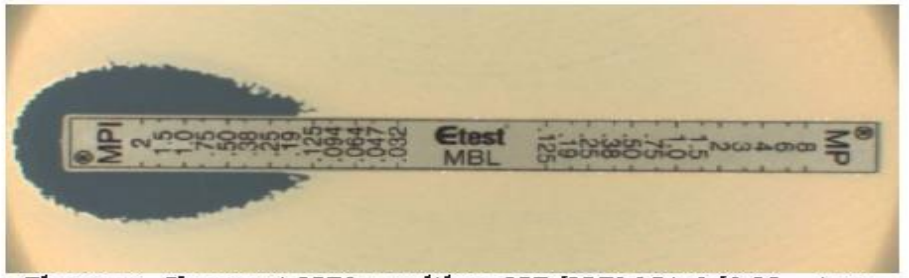


Figure 3. Clear cut MBL positive: MP/MPI IC >8/0.19 = >42

Figure 4. Phantom zone between MP/MPI is indicative of MBL

MBL Etest

https://www.biomerieux-diagnostics.com/sites/clinic/files/metallo-b-lactamase-detection2.jpg

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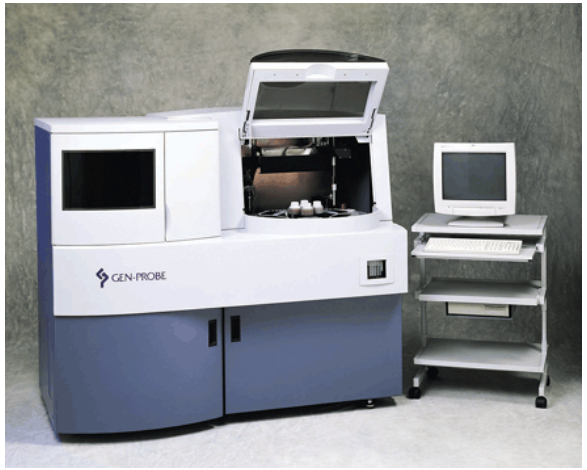
Nucleic acid amplification testing (NAAT)

NAAT is typically performed on pure colonies of a bacteria obtained by culture, which involves growing, isolating and identifying an organism from clinical samples. NAAT testing for resistance markers directly from positive blood culture bottles is also possible. Examples of NAAT include PCR and transcription-mediated amplification (TMA)



https://www.science.org/cms/10.1126/science.294.5546.1553/asset/d49f02c6-87f9-4af2-86a1-f163a8c9ef30/assets/graphic/1553-2.gif

https://globetechcdn.com/labmedica/images/stories/articles/article_images/2019-11-14/RLJ-441A.jpg

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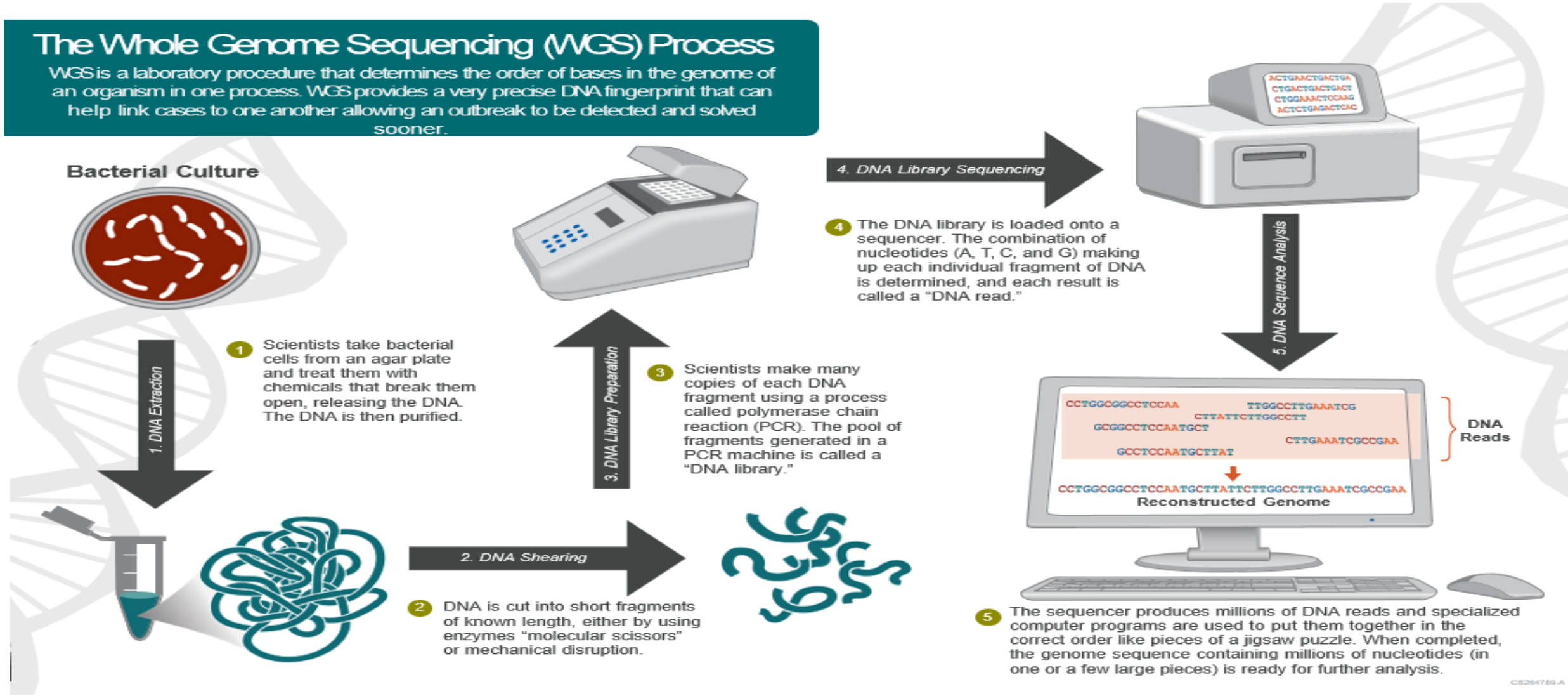
WHOLE GENOME SEQUENCING (WGS)



https://www.cdc.gov/pulsenet/pathogens/wgs.html

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Specimen Submission Guidelines – CRE

- IDPH does not perform routine confirmatory testing for CRE. Laboratories may consider sending isolates to a commercial reference laboratory.

- LHDs may authorize submission to the IDPH Chicago Laboratory for CRE isolates that are:
  - associated with suspected outbreaks, or
  - suspected of exhibiting unusual mechanisms of resistance (e.g., NDM, OXA, IMP, VIM carbapenemases) that meet the conditions below:
    - 1) Must exhibit carbapenem non-susceptibility (I or R to imipenem, doripenem, or meropenem using updated breakpoints) and resistance (R) to all third-generation cephalosporins tested (e.g., ceftriaxone, cefotaxime, and ceftazidime), AND
    - 2) Must have phenotypic testing suggesting presence of metallo-β-lactamase (MBL) (e.g., +MBL Etest or +multi-disk test) OR, if phenotypic testing not done, be isolated from a patient with international travel in the last 6 months or an epidemiologic link to a patient with non-KPC CRE.

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Specimen Submission Guidelines – CRE

- Pure isolate of suspected CRE grown on slant or plate media (such as blood, nutrient, or T-soy agar).

- Only one specimen per patient should be submitted, unless a new organism is identified in subsequent CRE specimens.

- IDPH Communicable Diseases Laboratory Test Requisition
- Copy of submitting clinical laboratory Antimicrobial Susceptibility Testing (AST) results
  - Required for IDPH to confirm that the isolate meets the CRE definition for testing
  - To obtain preliminary indication that isolate may be pan-resistant

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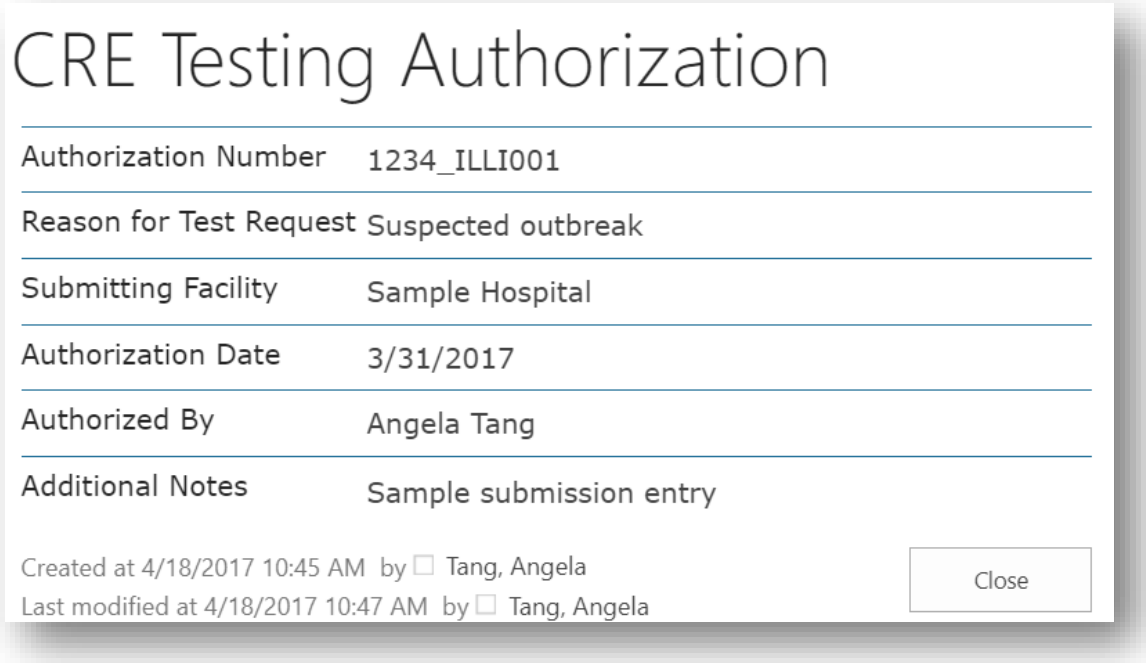
Authorization for CRE Specimen Submission

- LHDs must approve specimen for submission
- Please create authorization number consisting of
  - XDRO registry report identification number (RID; provided by the submitting facility) +
  - first four letters of the LHD name +
  - next consecutive number of CRE specimen submission (e.g., 001, 002, 003, etc.)
- Provide number to submitting lab to put on Test Requisition Form
- Enter info on Testing Authorization Page



https://dph.partner.illinois.gov/communities/communicabledisease/Pages/CRE-Testing-Authorization.aspx

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Specimen Submission – CP-CRPA

- IDPH does not perform routine confirmatory testing for CRPA.
  - If a facility lab is not able to conduct mechanism testing on a clinical specimen and patient is suspected of CP-CRPA, IDPH lab can conduct testing with limited capacity.

- CRPA cases that meet following criteria can be forwarded for testing:
  - Isolates suspected of being pan-resistant
  - From patients with risk factors for CP-CRPA
    - International travel in the last 6 months
    - Exposure to CP-CRPA strains
    - Stay at a long-term acute care hospital or ventilator-capable skilled nursing facility

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Specimen Submission – CP-CRPA

- Pure isolate of suspected CRPA grown on slant or plate media (such as blood, nutrient, or T-soy agar).

- Isolate identified as P. aeruginosa
  - Resistant to at least one carbapenem
  - MIC of >8 µg/mL for imipenem, meropenem, or doripenem

- IDPH Communicable Diseases Laboratory Test Requisition
- Copy of submitting clinical laboratory AST results
  - Required for IDPH to confirm that the isolate meets the CRPA definition for testing
  - To obtain preliminary indication that isolate may be pan-resistant

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Authorization for CRPA Specimen Submission

- Use same form and process as for CRE

- Since there won't be an XDRO RID, use "CRPA"
  - Example: CRPA_ILLI001

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Specimen Submission – CRAB

- Most clinical isolate submissions done through pilot project.
- Point prevalence and admissions screenings may also be performed through ARLN as part of the public health response.
- ARLN performs PCR for the “big 5” carbapenemases and OXA-23-, -24/40-, and -58-like as well as susceptibility testing
  - Susceptibility testing is performed only on clinical isolates

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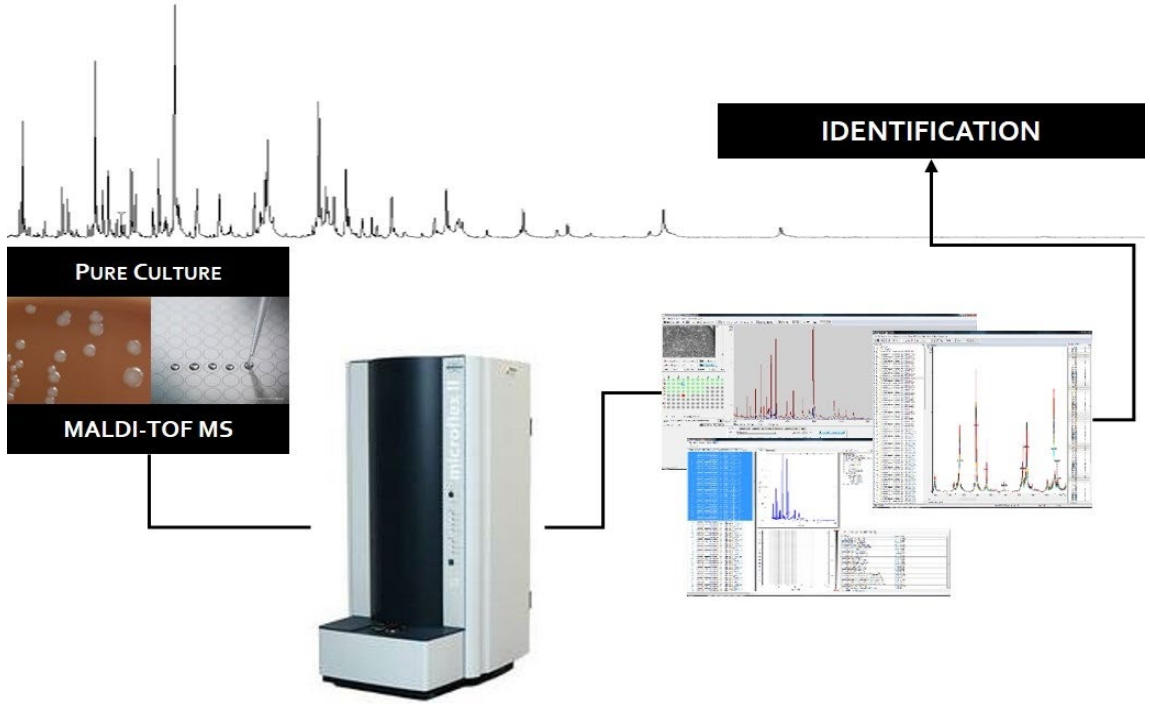
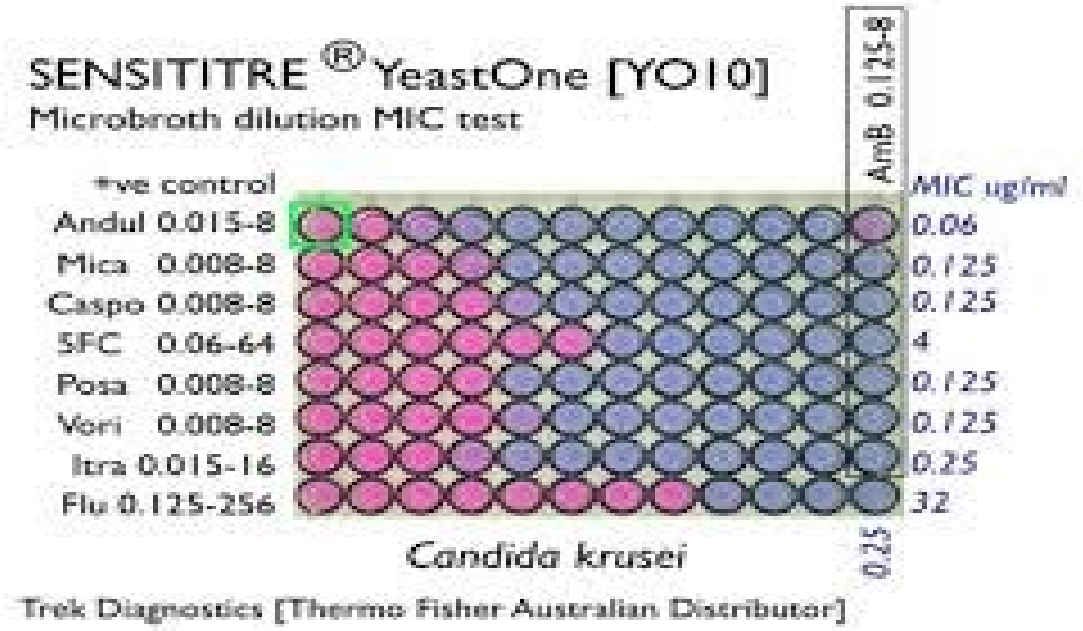
Testing for *C. auris*

- Organism identification



https://bccm.belspo.be/files/pictures/Layout/MALDITOF-LMG.jpg

- Antifungal susceptibility testing (AFST)



https://encyclopedia.pub/media/item_content/202112/61c3ecbeb8cf6diagnostics-09-00049-g002-550.jpg

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Specimen Submission – *C. auris*

- Laboratories should identify all Candida to the species level when identified from sterile sites (e.g., blood). They could also consider speciation of Candida from non-sterile sites (e.g., urine) for high-risk patients or as part of active surveillance after a C. auris case has been identified in their lab.

- Laboratories that can accurately and reliably identify C. auris from clinical specimens no longer need to submit routine isolates to IDPH.

- If laboratories detect isolates that are highly resistant to antifungals or are from patients who are not responsive to treatment, they should submit those specimens to the IDPH Laboratory in Chicago (2121 W Taylor St. Chicago, IL 60612) for further testing.

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TARGETED MDRO SURVEILLANCE DEFINITIONS

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CRE Surveillance Definition in IL

Enterobacterales with one of the following test results:

1. **Molecular test** (e.g., PCR) specific for carbapenemase

OR

2. **Phenotypic test** (e.g., modified carbapenem inactivation method (mCIM)) specific for carbapenemase production

OR

3. **Susceptibility test**, for ***E. coli* and *Klebsiella*** species (except *K. aerogenes*) only:
   - non-susceptible (resistant or intermediate) to ONE of the carbapenems (doripenem, meropenem, or imipenem) AND
   - resistant to ALL third generation cephalosporins tested (ceftriaxone, cefotaxime, and ceftazidime).

https://www.xdro.org/reporting-rule.html

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CRE Identification by Molecular Testing

Example 1

..!
Final Report:
Few Klebsiella oxytoca
Klebsiella oxytoca possessing Klebsiella pneumoniae carbapenemase (KPC) identified. Patients with KPC producing organisms require contact precautions. PCR testing is performed using the Xpert Carba-R assay. This assay has been cleared by the US Food and Drug Administration and its analytical performance characteristics verified by the [redacted] Hospital Microbiology Laboratory.

Example 2

Microbiology**********
Urine Culture Final

1st Report: [redacted] 1445
Greater than 100,000 CFU/mL Gram-negative bacilli
Identification and susceptibility in progress

2nd Report: [redacted], 1414
Gram-negative bacilli identified as
*CRE Klebsiella pneumoniae

Carba-R PCR results:
IMP Not Detected
VIM Not Detected
NDM Not Detected
KPC Not Detected
OXA48 Detected

This assay is intended for use as an aid to infection control in the detection of carbapenem-resistant bacteria that colonize patients in healthcare settings. A negative result does not preclude the presence of other resistance mechanisms.

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CRE Identification by Phenotypic Testing

Example 1

Results:	**Species Identification: KLEBSIELLA PNEUMONIAE** **mCIM: Carbapenemase Activity Detected**

Example 2

Bacterial Identification	**Identification confirmed as:**
	Klebsiella pneumoniae
	Comments: Carbapenemase production detected using Modified Carbapenem Inactivation Method.

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Sample Lab Results in INEDSS – Molecular and Phenotypic

Edit Lab Results

Test Type	Test Result
Bacterial carbapenemase resistance (bla(KPC)) gene	Carbapenem resistant Klebsiella pneumoniae

Lab Report Date:	11/28/2021
Test Type:	Bacterial carbapenemase resistance (bla(KPC)) gene
Other:	
Test Method:	Probe.amp.tar
Other:	
Test Result:	Carbapenem resistant Klebsiella pneumoniae
Other:	
Reference Range:	
Comment:	Numerous. This isolate demonstrates carbapenemase production by positive CarbaNP testing. Additional testing in progress. THIS IS A MULTIPLE DRUG RESISTANT ORGANISM (MDRO). REFER TO INFECTION CONTROL POLICIES FOR ISOLATION PRECAUTIONS.

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CRE Identification by Susceptibility Testing

	What's included?	What's excluded?	Results
Organisms	- *E. coli* - *Klebsiella* spp.	- *K. aerogenes* (formerly *Enterobacter aerogenes*) - Any other genus (e.g., *Proteus, Enterobacter, Morganella*, etc)	--
Carbapenems	- Doripenem - Meropenem - Imipenem	Ertapenem	Resistant or intermediate (May show up as **R** or **I** on lab report)
3rd gen cephalosporins	- Ceftriaxone - Cefotaxime - Ceftazidime		Resistant (if tested)

Note: IL's definition differs from CDC's by the susceptibility testing criterion.

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CRE Identification by Susceptibility Testing

Example 1 – meets IL definition

Susceptibility

	Klebsiella pneumoniae Iso1		
	AR GRAM NEGATIVE SENSITITRE		
Amikacin	>32	mcg/mL	Resistant
Aztreonam	>16	mcg/mL	Resistant
Cefepime	>16	mcg/mL	Resistant
Cefotaxime	>32	mcg/mL	Resistant
Ceftazidime	>16	mcg/mL	Resistant
Ciprofloxacin	>2.0	mcg/mL	Resistant
Colistin	<=0.25	mcg/mL	Intermediate
Doripenem	>2.0	mcg/mL	Resistant
Doxycycline	8.0	mcg/mL	Intermediate
Ertapenem	>4.0	mcg/mL	Resistant
Gentamicin	>8.0	mcg/mL	Resistant
Imipenem	>8.0	mcg/mL	Resistant
Meropenem	>8.0	mcg/mL	Resistant

	What's included?	What's excluded?	Results
Organisms	- *E. coli* - *Klebsiella* spp.	- *K. aerogenes* (formerly *Enterobacter aerogenes*) - Any other genus (e.g., *Proteus, Enterobacter, Morganella*, etc)	--
Carbapenems	- Doripenem - Meropenem - Imipenem	Ertapenem	Resistant or intermediate (May show up as **R** or **I** on lab report)
3rd gen cephalosporins	- Ceftriaxone - Cefotaxime - Ceftazidime		Resistant (if tested)

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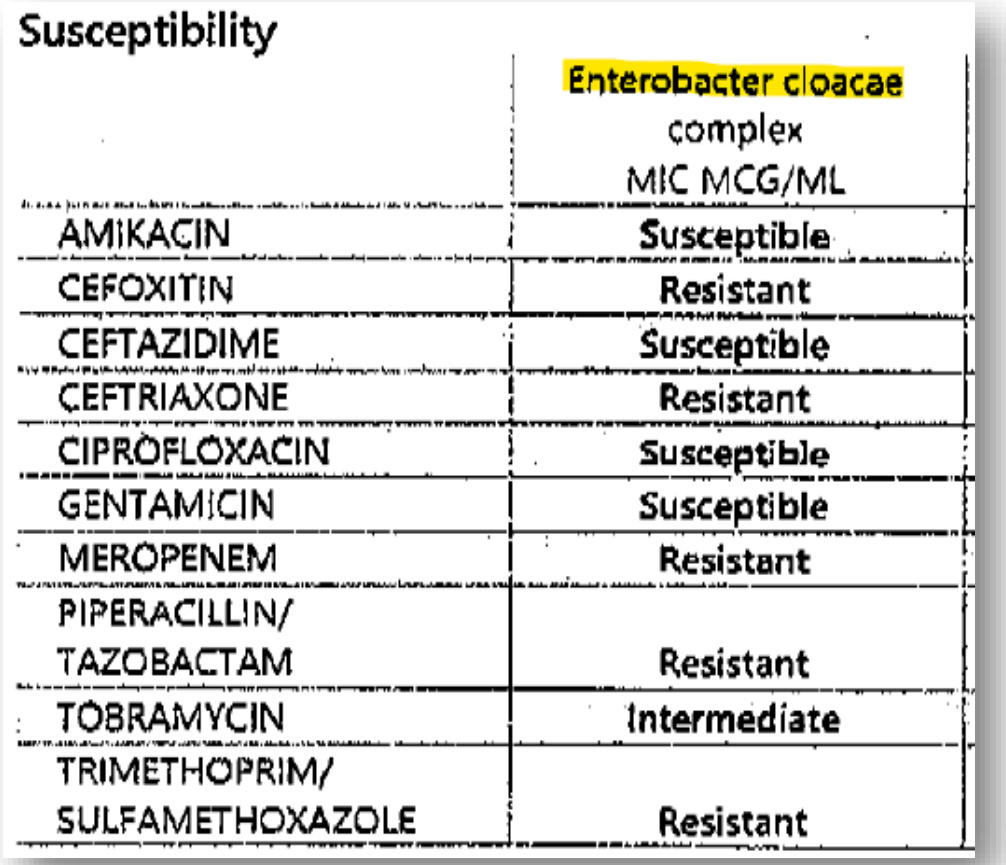
CRE Identification by Susceptibility Testing

Example 2 – does NOT meet IL definition



Susceptibility

	Enterobacter cloacae complex MIC MCG/ML
AMIKACIN	Susceptible
CEFOXITIN	Resistant
CEFTAZIDIME	Susceptible
CEFTRIAXONE	Resistant
CIPROFLOXACIN	Susceptible
GENTAMICIN	Susceptible
MEROPENEM	Resistant
PIPERACILLIN/ TAZOBACTAM	Resistant
TOBRAMYCIN	Intermediate
TRIMETHOPRIM/ SULFAMETHOXAZOLE	Resistant

	What's included?	What's excluded?	Results
Organisms	- *E. coli* - *Klebsiella* spp.	- *K. aerogenes* (formerly *Enterobacter aerogenes*) - Any other genus (e.g., *Proteus, Enterobacter, Morganella*, etc)	--
Carbapenems	- Doripenem - Meropenem - Imipenem	Ertapenem	Resistant or intermediate (May show up as **R** or **I** on lab report)
3rd gen cephalosporins	- Ceftriaxone - Cefotaxime - Ceftazidime		Resistant (if tested)

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Sample Lab Results in INEDSS – Susceptibility Testing

09/25/2021	Urine	Laboratory Name	Ordering Facility Name	
[redacted]				Add Result View Delete
	Bacteria identified		Carbapenem resistant Klebsiella pneumoniae	View Delete
09/25/2021	Isolate	Laboratory Name	Ordering Facility Name	
[redacted] 1				Add Result View Delete
	Amikacin		>32 ug/mL	View Delete
	Amoxicillin+Clavulanate		>16/8 ug/mL	View Delete
	Ampicillin+Sulbactam		>16/8 ug/mL	View Delete
	Cefazolin		>16 ug/mL	View Delete
	Cefepime		>16 ug/mL	View Delete
	Cefoxitin		>32 ug/mL	View Delete
	Ceftazidime		>16 ug/mL	View Delete
	Ceftriaxone		>32 ug/mL	View Delete
	Cefuroxime [Susceptibility] by Minimum inhibitory concentration (MIC)		>16 ug/mL	View Delete
	Ertapenem [Susceptibility] by Minimum inhibitory concentration (MIC)		>1 ug/mL	View Delete
	Imipenem [Susceptibility] by Minimum inhibitory concentration (MIC)		>8 ug/mL	View Delete
	Levofloxacin		>4 ug/mL	View Delete
	Meropenem		>8 ug/mL	View Delete
	Nitrofurantoin		>64 ug/mL	View Delete
	Piperacillin+Tazobactam		>64 ug/mL	View Delete
	Tetracycline		<=4 ug/mL	View Delete
	Tigecycline [Susceptibility] by Minimum inhibitory concentration (MIC)		<=2 ug/mL	View Delete
	Tobramycin		>8 ug/mL	View Delete
	Trimethoprim+Sulfamethoxazole		>2/38 ug/mL	View Delete

Carbapenem	CLSI M100-ED32 (2022) Breakpoints (ug/ml)		
	S	I	R
Doripenem	≤1	2	≥4
Imipenem	≤1	2	≥4
Meropenem	≤1	2	≥4

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CP-CRPA & CRAB Interim Definitions in IL

- **Reminder: CRPA and CRAB not currently reportable in IL**

- **CP-CRPA definition:** *Pseudomonas aeruginosa* with positive molecular test specific for carbapenemase or positive phenotypic test for carbapenemase production.

- **CRAB pilot definition:** *Acinetobacter baumannii* resistant to a carbapenem (imipenem, meropenem, or doripenem).

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CSTE/CDC Definition for CPOs

- Positive phenotypic test result for carbapenemase production in a specimen, **OR**
- Positive molecular test result detecting a carbapenemase gene (with or without organism identification), **OR**
- Detection of carbapenemase gene by next generation sequencing (NGS)

- **Notes:**
  - CPOs may include, but are not limited to, Enterobacterales, *Acinetobacter*, and *Pseudomonas*
  - Organisms that are carbapenem-resistant but not carbapenemase-producing (CROs) are not currently nationally notifiable to CDC

https://cdn.ymaws.com/www.cste.org/resource/resmgr/ps/ps2022/22-ID-04_CPO.pdf

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MDRO Specimen/Case Types

- **Screening** – specimens obtained for the purposes of detecting colonization in an individual
  - Typically, rectal swabs for CPOs and axilla/groin skin swabs for *C. auris*
  - Patient often has no overt symptoms of disease

- **Clinical** – cultures obtained during the course of clinical care
  - Generally, don't know intent of specimen collection. Most sites other than swabs considered clinical (e.g., urine, blood, sputum, wound)

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Counting CPO Cases

- Over their lifetime, a person may have up to one screening and one clinical case for each mechanism-organism combination
  - E.g., a person may have a clinical NDM-*E. coli* and a clinical KPC-*K. pneumoniae* (two cases)

- Order matters for identification of same mechanism-organism:
  - 1. Screening specimen -> 2. Clinical specimen -> Count both cases
  - 1. Clinical specimen -> 2. Screening specimen -> Count clinical case only

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C. auris Surveillance Definition

- **Confirmed case:** Person with confirmatory laboratory evidence of *C. auris* using either culture or a validated culture-independent test (e.g., NAAT)

- **Note:** As of January 1, 2023, there are no probable or suspect case definitions due to improved laboratory detection methods.
  - If a laboratory needs assistance confirming *C. auris*, they can send the isolate to a reference laboratory or IDPH for further testing.

https://cdn.ymaws.com/www.cste.org/resource/resmgr/ps/ps2022/22-ID-05_C_auris.pdf

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C. auris Lab Result & INEDSS Examples

Fungal Characterization (Final result)

ID: [redacted] Type/Src: Fungal Isolate/Blood

Fungal Identification **Identification confirmed as:**

Candida auris (A)

Results apply only to sample tested.
***A**=Abnormal; **AA**=Panic; **H**=High, **L**=Low*

Edit Lab Results

Test Type	Test Result
Candida auris DNA	Detected

Lab Report Date:	[redacted]/2023
Test Type:	Candida auris DNA
Other:	
Test Method:	Non-probe.amp.tar
Other:	
Test Result:	Detected
Other:	
Reference Range:	
Comment:	Implement Contact Precautions Per System Isolation/De-Isolation Protocol

Counting *C. auris* Cases

- Over their lifetime, a person may have up to one screening case and one clinical case

- Order matters (same as CPO):
  - 1. Screening specimen -> 2. Clinical specimen -> Count both cases
  - 1. Clinical specimen -> 2. Screening specimen -> Count clinical case only

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SURVEILLANCE & INVESTIGATION

Acknowledgment: Portions of this section were developed by previous HAI staff and CSTE Fellows (Hannah Doseck, Shelby Daniel-Wayman, Lauren Draftz, Sarah Brister)

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CDC Targeted MDRO Containment Response Tiers
(As of 2019 update, anticipated to change)

Tier 1

- Organisms for which no treatment options exist or have never or only rarely been detected in the US

Tier 2

- Organisms not commonly detected in a geographic area

Tier 3

- Organisms that are known threats in a geographic area but not endemic

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Proposed IL Tiers

(As of 2019, anticipated to change)

Description	Tier 1	Tier 2	Tier 3
MDRO categories by facility characteristics			
Newly or recently identified facility/ low prevalence area	Resistance mechanisms never or very rarely identified in the United States; pan-resistant organisms with the potential for wider spread in a region	CRE/Unknown Organism – NDM, OXA, VIM, IMP CRPA – KPC, NDM, OXA, VIM, IMP CRAB – KPC, OXA-48-like, NDM, VIM, IMP *C. auris*	CRAB with plasmid-mediated OXA (e.g., OXA-23, 24/40, 58-like)
Facility with high prevalence and/or with previous or ongoing, considerable interaction with public health		CRE – VIM CRE/Unknown Organism – OXA, IMP CRPA – KPC, NDM, OXA, IMP CRAB – KPC, OXA-48-like, NDM, VIM, IMP	CRE/Unknown Organism – NDM

In high prevalence areas/facilities, the following may not be in a tier, and prevention may be more beneficial than containment: CRE with KPC or unknown mechanism of resistance; CRAB with OXA-23, 24/40, 58-like; VIM-CRPA; *C. auris*

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Proposed IL Tiers

Action	Tier 1	Tier 2	Tier 3
Healthcare/Case Investigation			
Collect case information via case report form or I-NEDSS. Review the patient's healthcare exposures prior to and after the positive culture.	Always	Always	Always
Ask clinical laboratory to submit isolate to IDPH Chicago Lab. Refer to MDRO isolate submission.	Always	Sometimes	Sometimes
Contact Investigation			
Retrospective lab surveillance	Always	Always	Sometimes

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The Council for Outbreak Response: Healthcare-Associated Infections and Antimicrobial-Resistant Pathogens

Candida auris: Recommendations for Healthcare Outbreak Response (2022)

	ALL HEALTHCARE SETTINGS
Threshold for facility to start investigation	1 *Candida auris* specimen from any source
Threshold for reporting to public health	1 *Candida auris* specimen from any source
Outbreak definition	≥ 2 cases of *Candida auris* including an epidemiologic link

"The actions and considerations outlined…are most applicable when an acute or long-term care facility identifies its first *C. auris* case(s), especially in areas where *C. auris* is uncommon."

https://www.corha.org/resources/candida-auris-recommendations-for-healthcare-outbreak-response/

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MDRO Investigation & Response

- **Rapid identification**
- **Epi investigation**
- **Infection prevention & control assistance**
- **Contact screening/Point prevalence screening**

Webinar 3

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MDRO Identification & Surveillance

- **Rapid identification**
  - Facility/lab reports a case/cluster/outbreak or identified through surveillance
  - If needed, confirmatory testing available at IDPH Chicago Lab (CRE/CRPA) or Wisconsin AR Lab (CRAB/C. auris)

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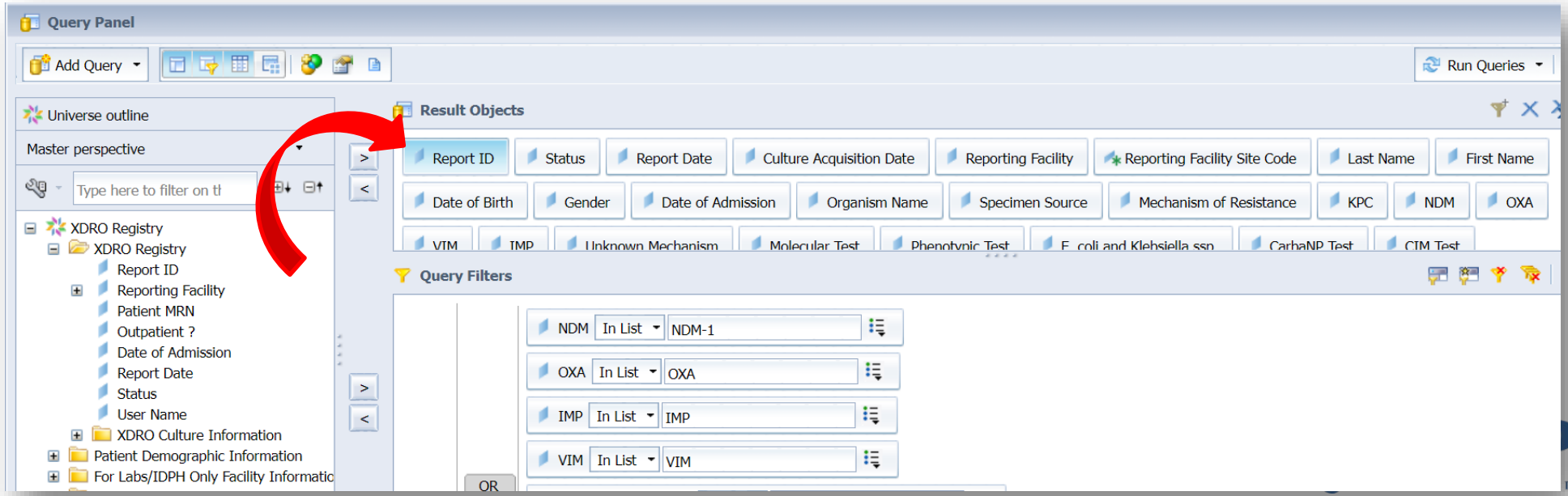
Conducting CRE Surveillance with XDRO Registry Data

- INEDSS training resources
  - How to use BusinessObjects
  - How to set up and schedule reports
- Users who obtain XDRO universe access will get data dictionary and instructions for use
- Consider creating reports to look for
  - Non-KPC CRE
  - Clusters by facility (site code)
  - Clusters by patient address. These addresses may belong to long-term care facilities (LTCF)



Sample BusinessObjects Non-KPC CRE Report

Report ID	Report Date	Status	Organism Name	Specimen Source	KPC	NDM	OXA	IMP
21212	01/06/2023	submitted	Klebsiella pneumoniae	Blood			OXA	
21256	01/02/2023	submitted	Klebsiella oxytoca	Urine		NDM-1		
21267	01/05/2023	submitted	Escherichia coli	Other				
21276	01/06/2023	submitted	Enterobacter cloacae	Other				
21278	01/06/2023	submitted	Klebsiella pneumoniae	Rectal (screening)		NDM-1		
21279	01/06/2023	submitted	Klebsiella pneumoniae	Rectal (screening)	KPC	NDM-1		
21280	01/06/2023	submitted	Klebsiella pneumoniae	Rectal (screening)		NDM-1		
21282	01/06/2023	submitted	Morganella morganii	Rectal (screening)		NDM-1		
21284	01/09/2023	submitted	Proteus mirabilis	Wound		NDM-1		
21353	01/19/2023	submitted	Screen only (organism unknow	Sputum			OXA	
21354	01/19/2023	submitted	Screen only (organism unknow	Sputum			OXA	

- Search XDRO registry: Does the person have prior XDRO history?
- Which facilities reported cases or collected specimen (if lab/IDPH reported for them)?
- Does patient address belong to LTCF?

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SaTScan and Automated CRE Cluster Detection

- SaTScan software paired with XDRO registry CRE data
- Runs weekly to look for clusters based on
  - geography
  - patient sharing networks
- If statistically significant cluster identified, IDPH forwards information to LHD for further investigation

SUMMARY OF DATA

Study period.....: 2015/11/05 to 2017/11/05
Number of locations.....: 768
Total number of cases.....: 930

CLUSTERS DETECTED

1. Location IDs included.: 1001911, 6041
   Coordinates / radius..: (41.__ N, 87.__ W) / 1.26 km
   Time frame.....: 2017/10/23 to 2017/11/5
   Number of cases.....: 7
   Expected cases.....: 0.98
   Observed / expected...: 7.11
   Test statistic.....: 7.738587
   P-value.....: 0.046
   Recurrence interval...: 22 days

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MDRO Investigation

- **Rapid identification**
  - Facility/lab reports a case/cluster/outbreak or identified through surveillance
  - If needed, confirmatory testing available at IDPH Chicago Lab (CRE/CRPA) or Wisconsin AR Lab (CRAB/C. auris)

- **Epi investigation**
  - Collect epi data from facilities using I-NEDSS modules
    - Word case report form available for those without access (typically LTC)
  - Perform micro lab lookback (retrospective lab surveillance) or review of XDRO registry data to identify additional cases
    - If identified, obtaining a map of the facility/floor layout can assist with investigation

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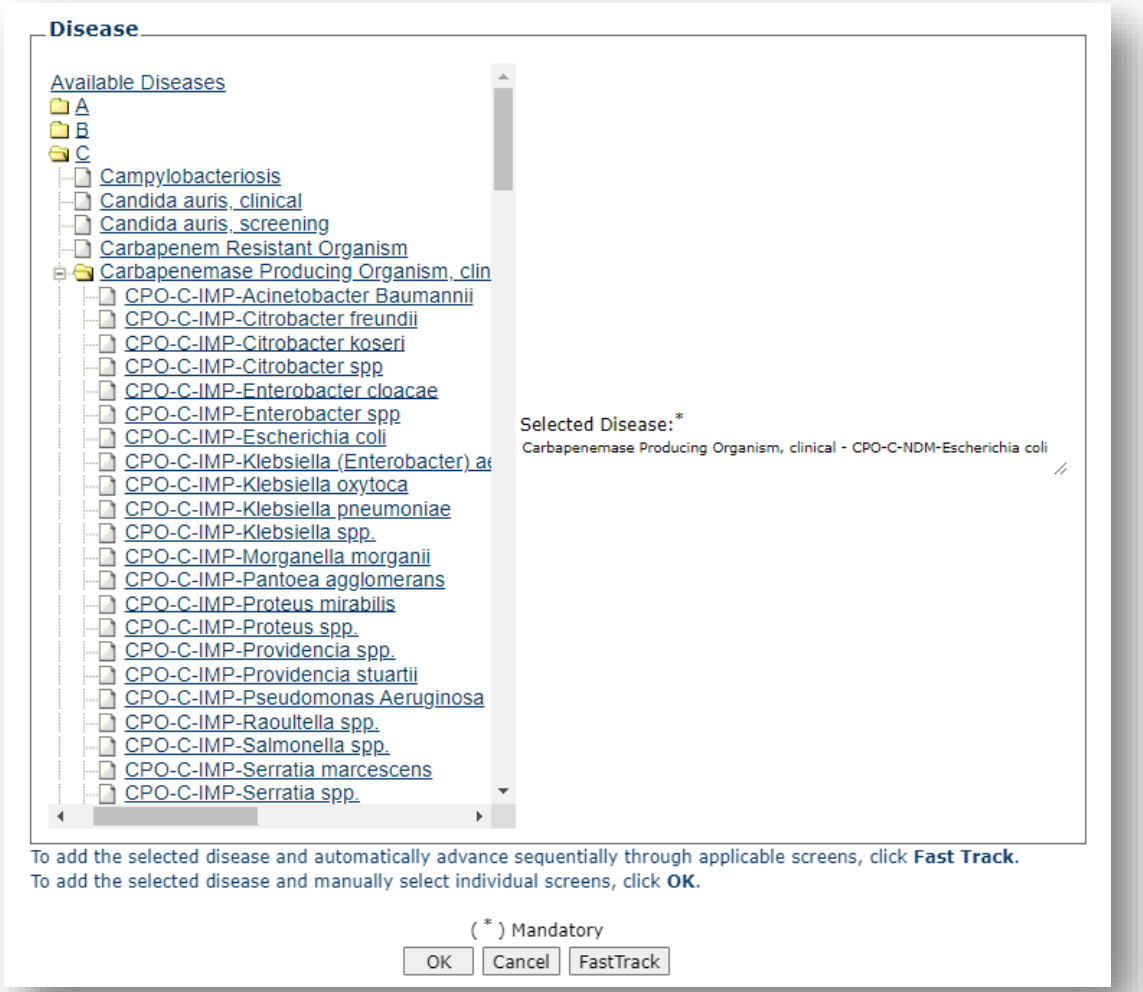
I-NEDSS – MDRO Modules

- Diseases:
  - Candida auris, clinical
  - Candida auris, screening
  - Carbapenemase Producing Organism, clinical
  - Carbapenemase Producing Organism, screening
  - Carbapenem Resistant Organism

Jurisdiction is determined by the location of the facility where specimen was collected



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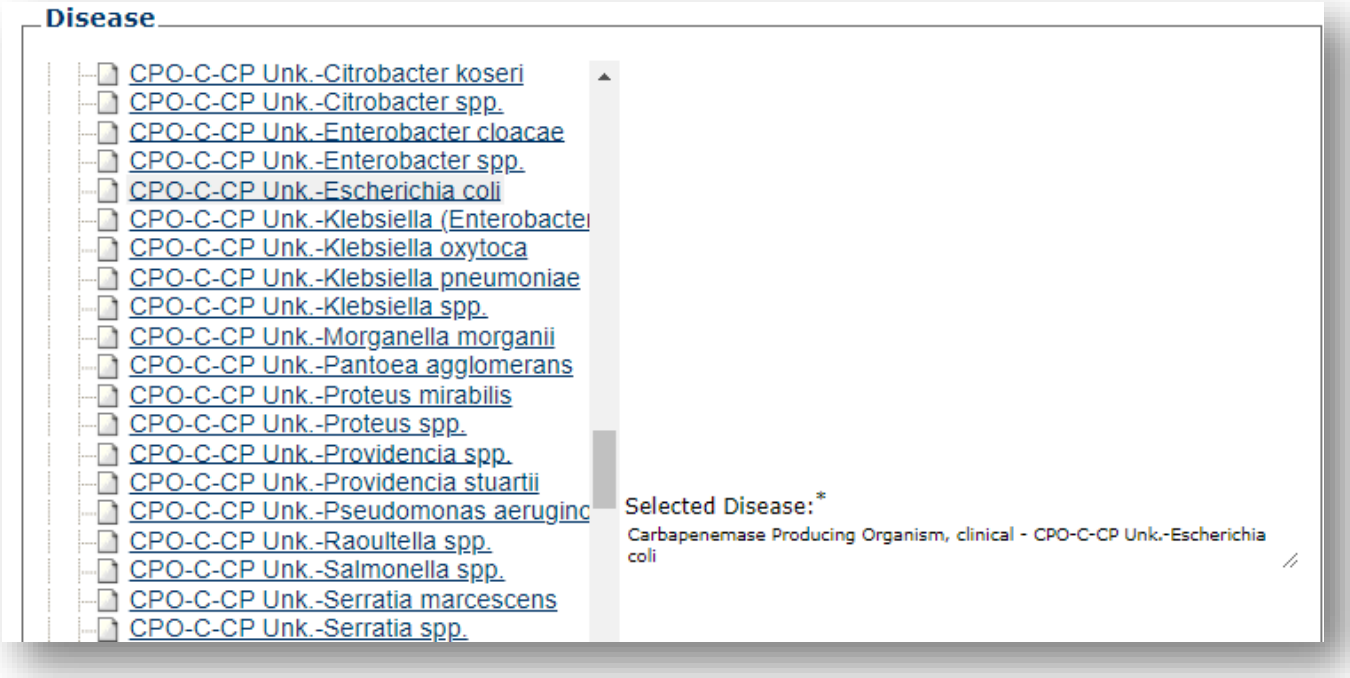
New CPO options

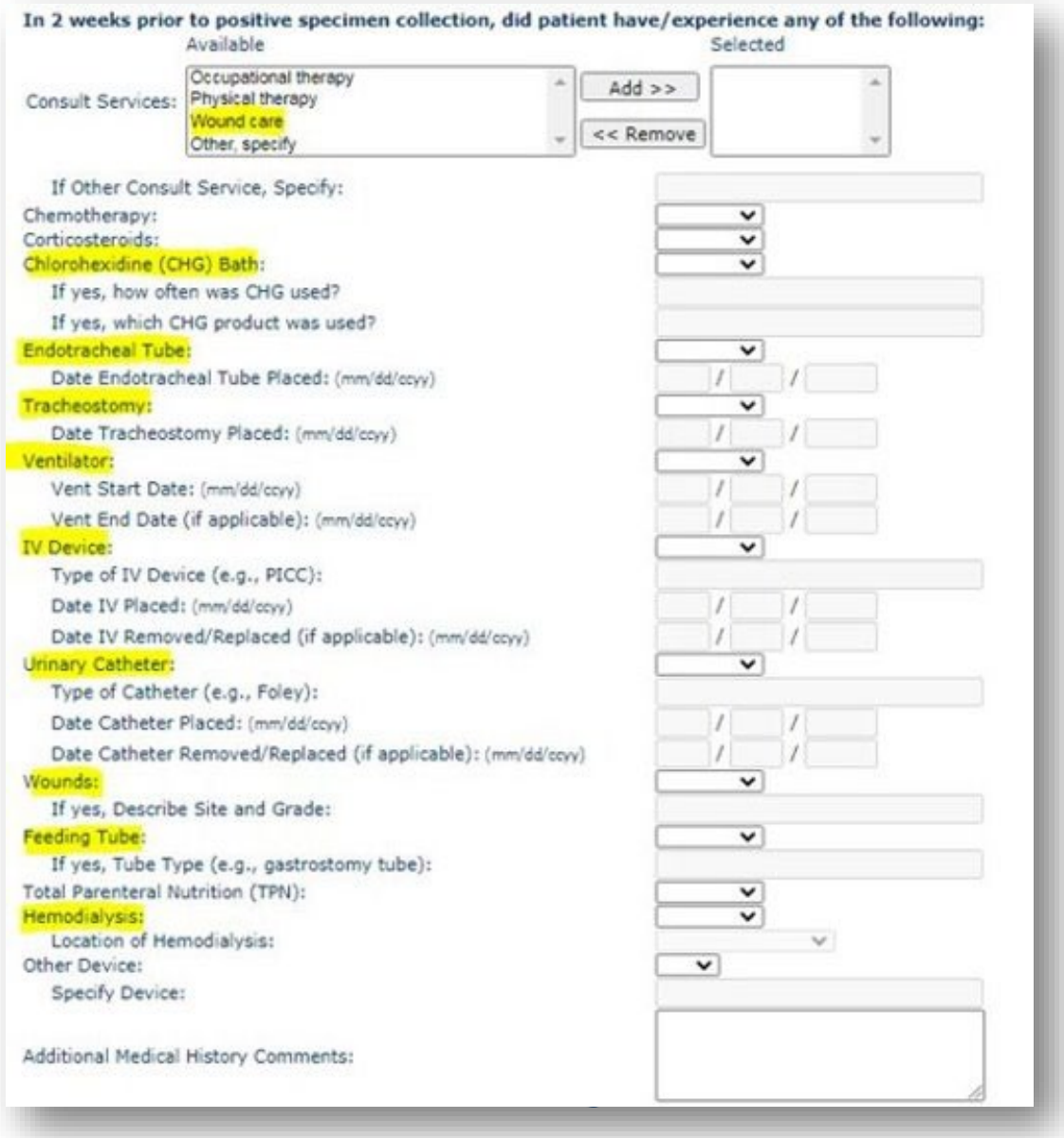
- Previous CRE/CRAB/CRPA fall under CPO/CRO
- New subcategories for CPOs with positive phenotypic tests but no gene identified.
  - CP unk. = carbapenemase unknown



I-NEDSS MDRO Module – Medical History

Particularly interested in:

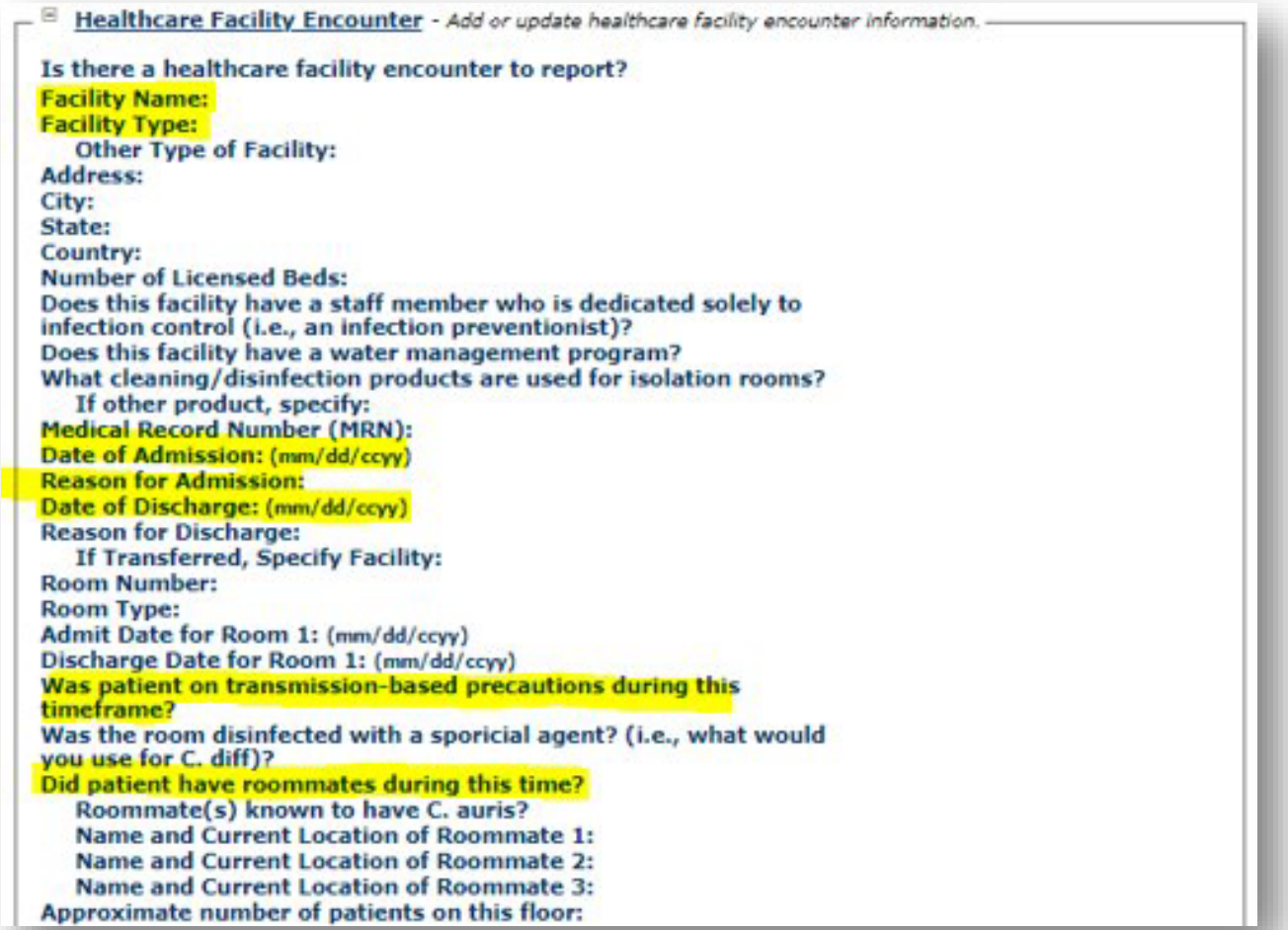
- Vent, trach, IV devices, catheters, procedures, services, other MDROs
- Looking for possible common exposures (e.g., wound care, dialysis)



I-NEDSS MDRO Module – Healthcare Facility Encounters

Particularly interested in:

- where admitted/discharged
- what room/floor/unit
- roommates
- transmission-based precautions
- disinfectant (especially for *C. auris*)



Healthcare Facility Encounter - *Add or update healthcare facility encounter information.*

Is there a healthcare facility encounter to report?
Facility Name:
Facility Type:
Other Type of Facility:
Address:
City:
State:
Country:
Number of Licensed Beds:
Does this facility have a staff member who is dedicated solely to infection control (i.e., an infection preventionist)?
Does this facility have a water management program?
What cleaning/disinfection products are used for isolation rooms?
If other product, specify:
Medical Record Number (MRN):
Date of Admission: (mm/dd/ccyy)
Reason for Admission:
Date of Discharge: (mm/dd/ccyy)
Reason for Discharge:
If Transferred, Specify Facility:
Room Number:
Room Type:
Admit Date for Room 1: (mm/dd/ccyy)
Discharge Date for Room 1: (mm/dd/ccyy)
Was patient on transmission-based precautions during this timeframe?
Was the room disinfected with a sporicial agent? (i.e., what would you use for C. diff)?
Did patient have roommates during this time?
Roommate(s) known to have C. auris?
Name and Current Location of Roommate 1:
Name and Current Location of Roommate 2:
Name and Current Location of Roommate 3:
Approximate number of patients on this floor:

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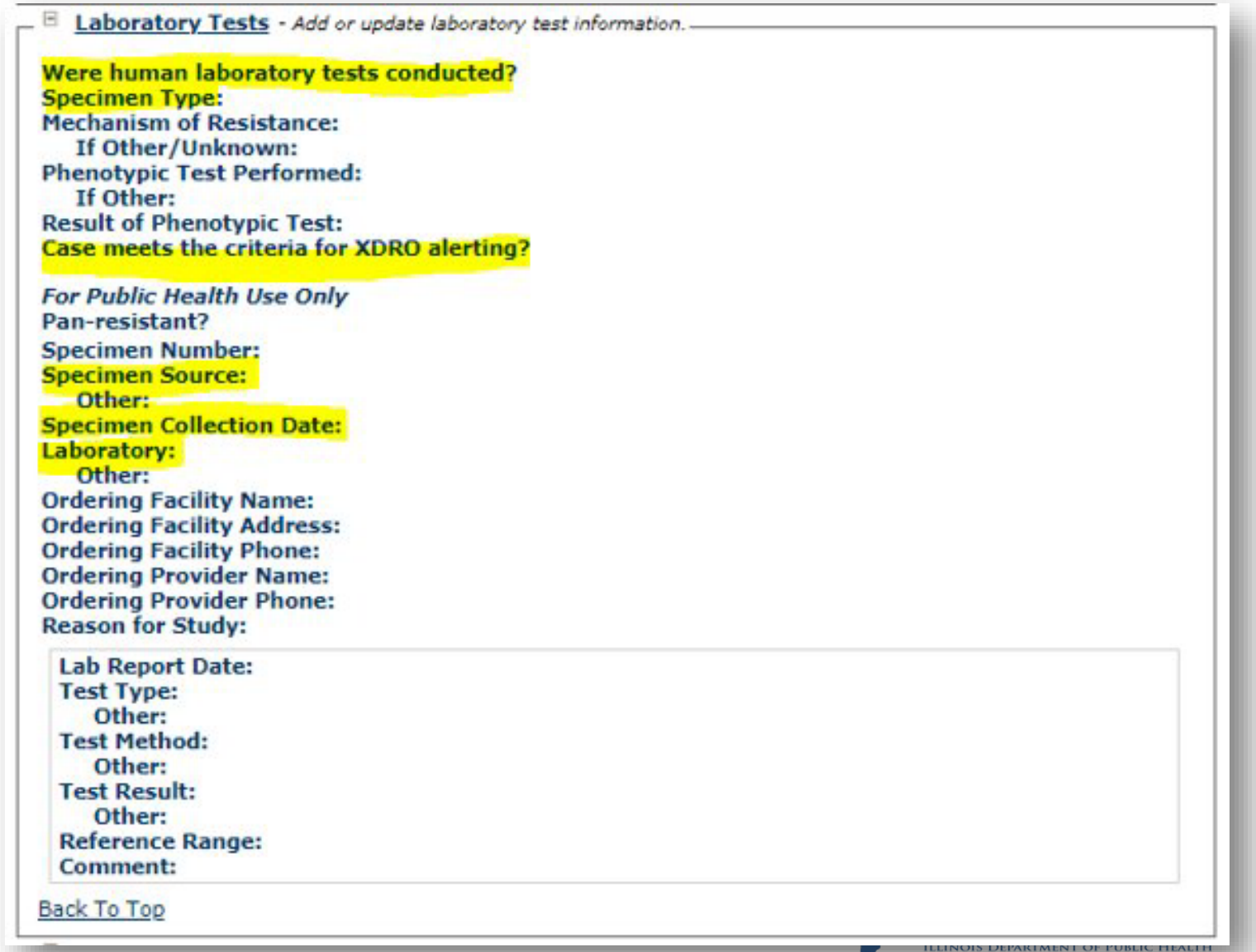
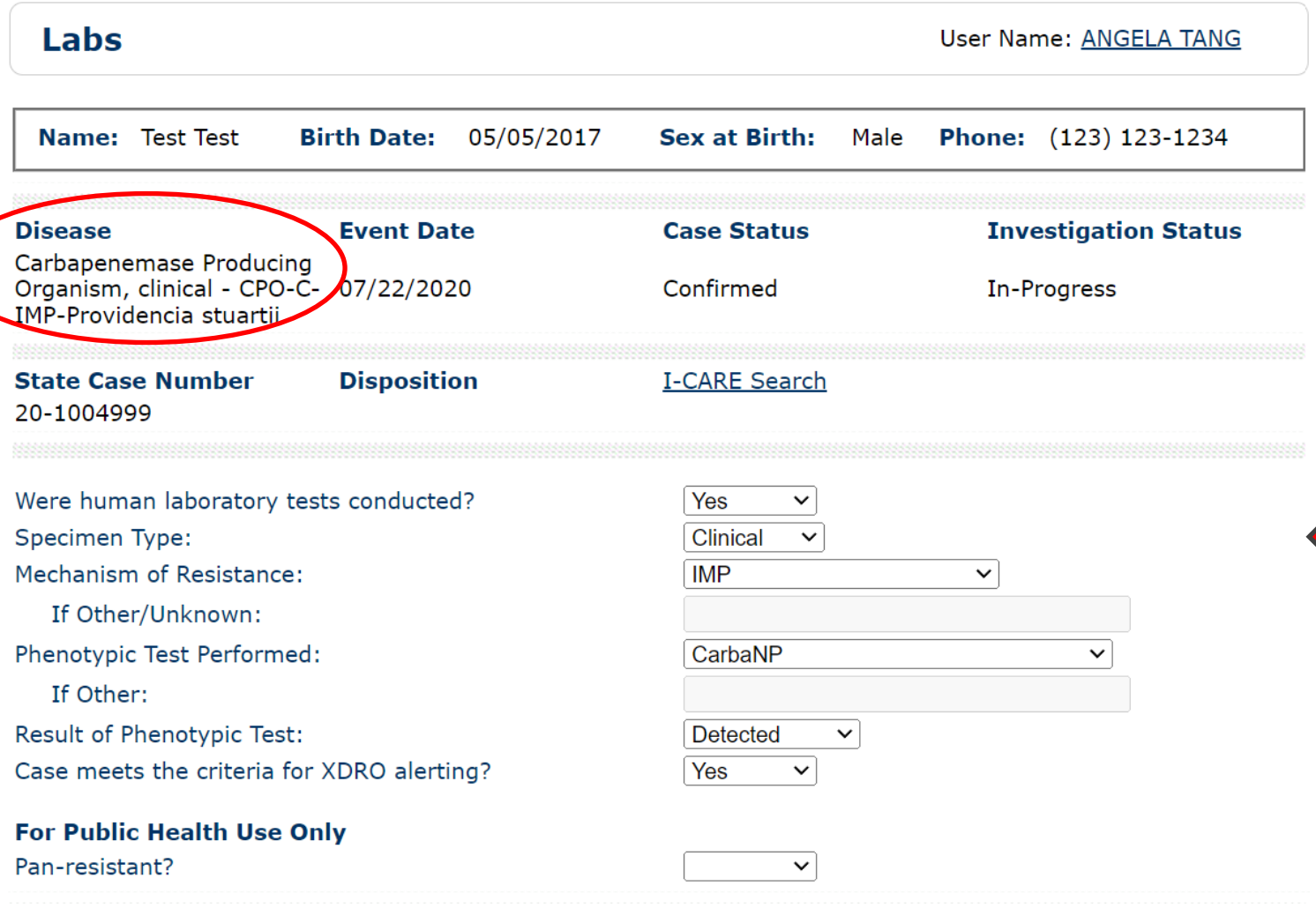
I-NEDSS MDRO Module – Laboratory Tests

Complete as much information as possible.



I-NEDSS MDRO Module – Laboratory Tests (cont.)



Labs User Name: ANGELA TANG

Name: Test Test **Birth Date:** 05/05/2017 **Sex at Birth:** Male **Phone:** (123) 123-1234

Disease	Event Date	Case Status	Investigation Status
Carbapenemase Producing Organism, clinical - CPO-C-IMP-Providencia stuartii	07/22/2020	Confirmed	In-Progress

State Case Number	Disposition	I-CARE Search
20-1004999		

Were human laboratory tests conducted? Yes
Specimen Type: Clinical
Mechanism of Resistance: IMP
If Other/Unknown:
Phenotypic Test Performed: CarbaNP
If Other:
Result of Phenotypic Test: Detected
Case meets the criteria for XDRO alerting? Yes

For Public Health Use Only
Pan-resistant?

Ensure that disease classification and top portion of the Labs section match the lab results

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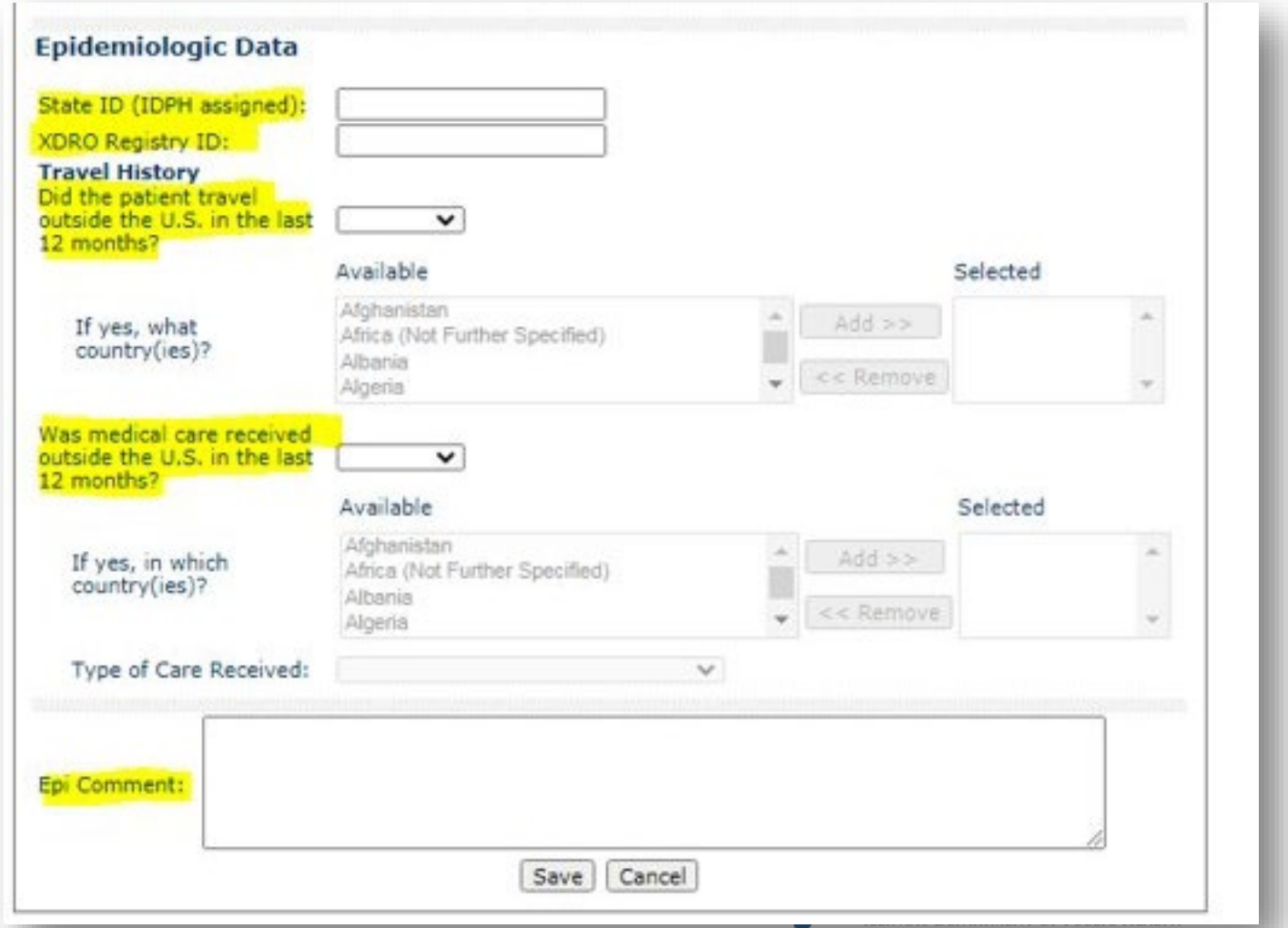
I-NEDSS MDRO Module – Epi Data

Particularly interested in:

- State ID (only for *C auris*)
- XDRO ID (ensure reported correctly)
- Travel and medical care
- Other relevant comments (e.g., exposure to other known cases)



INEDSS WORKFLOW: CPO

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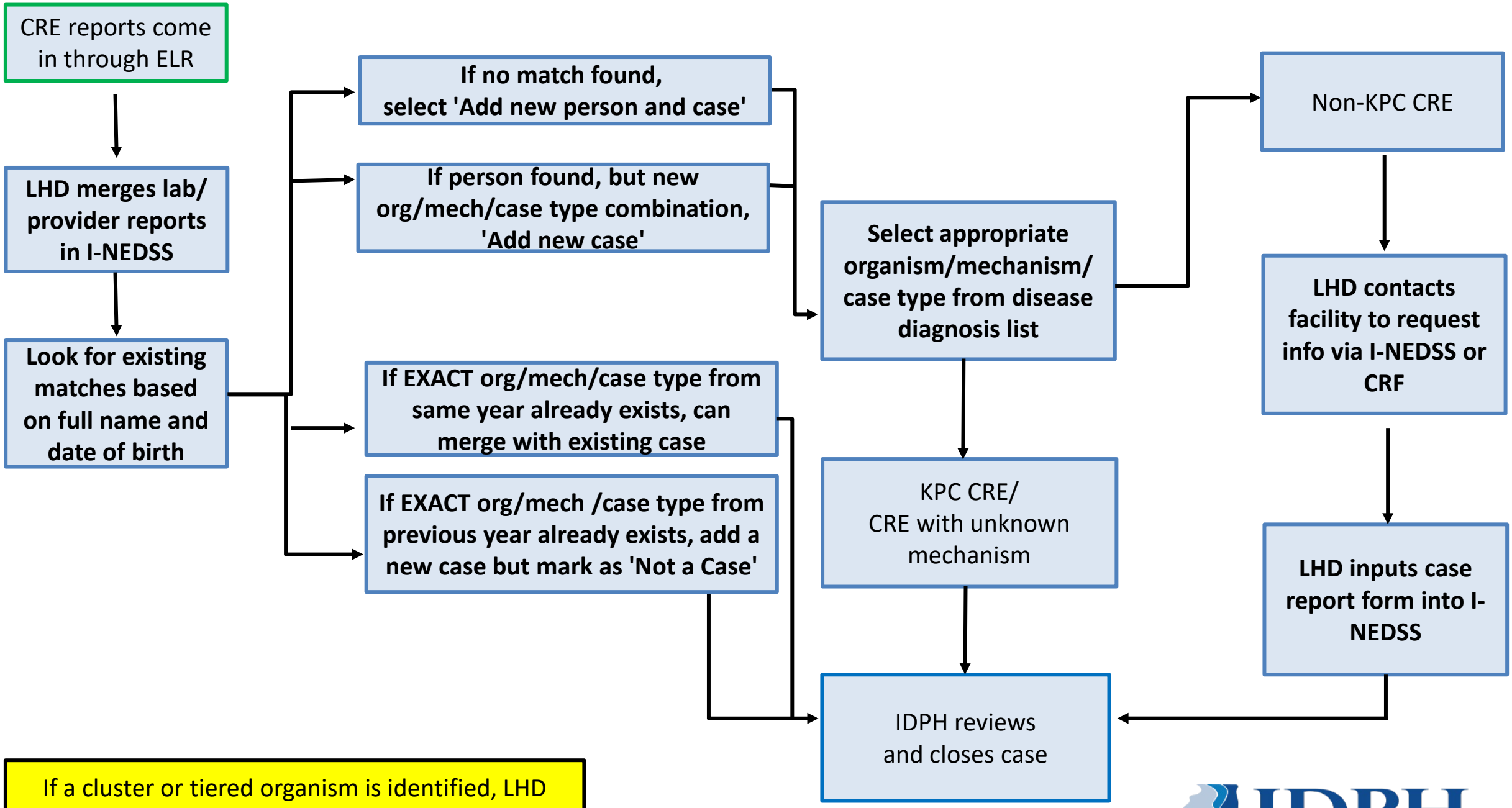
CRE reports come in through ELR
LHD merges lab/ provider reports in I-NEDSS
Look for existing matches based on full name and date of birth
If no match found, select 'Add new person and case'
If person found, but new org/mech/case type combination, 'Add new case'
If EXACT org/mech/case type from same year already exists, can merge with existing case
If EXACT org/mech /case type from previous year already exists, add a new case but mark as 'Not a Case'
Select appropriate organism/mechanism/ case type from disease diagnosis list
KPC CRE/ CRE with unknown mechanism
Non-KPC CRE
LHD contacts facility to request info via I-NEDSS or CRF
LHD inputs case report form into I-NEDSS
IDPH reviews and closes case
If a cluster or tiered organism is identified, LHD organizes a response. IDPH available to assist.
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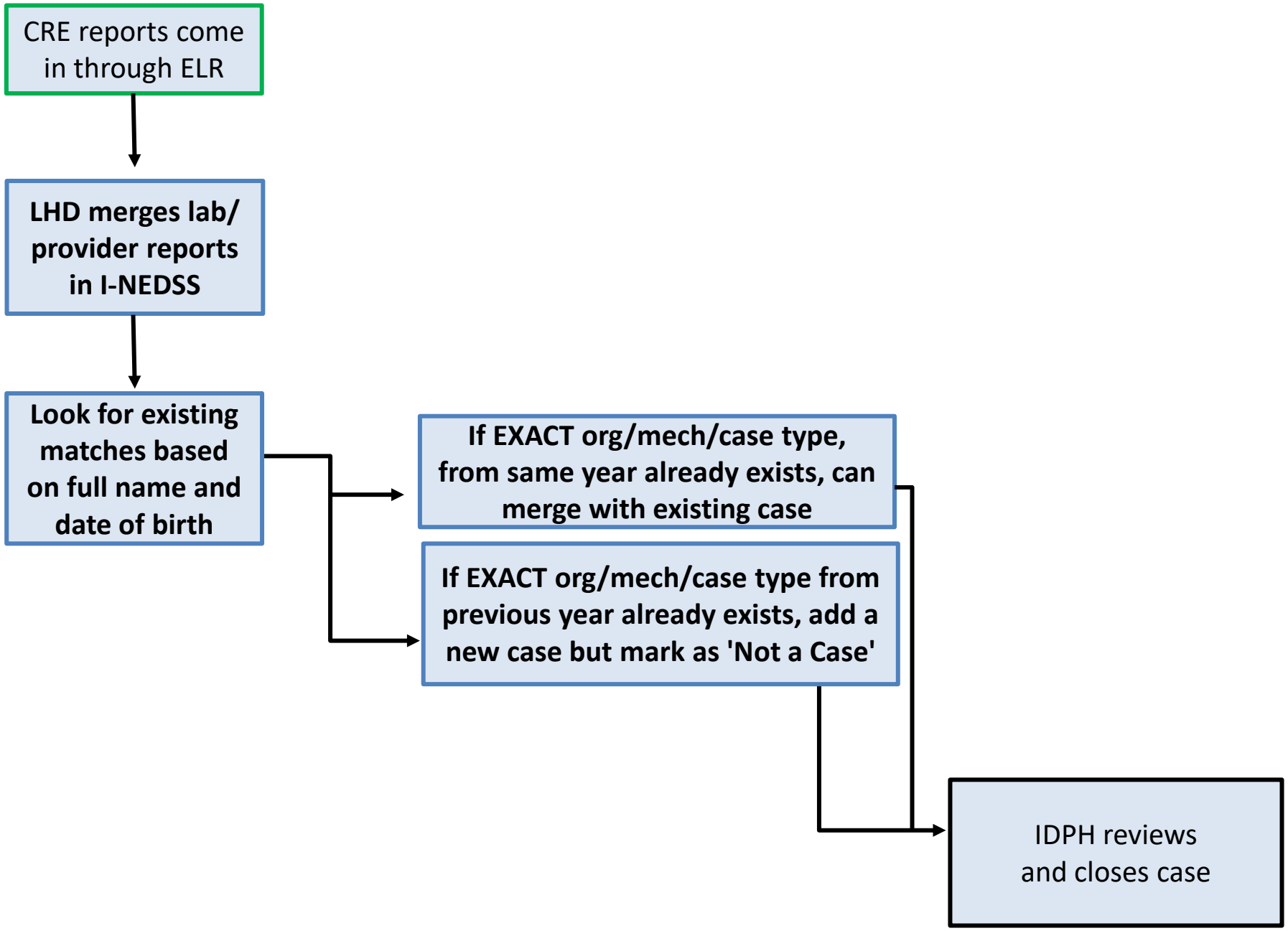

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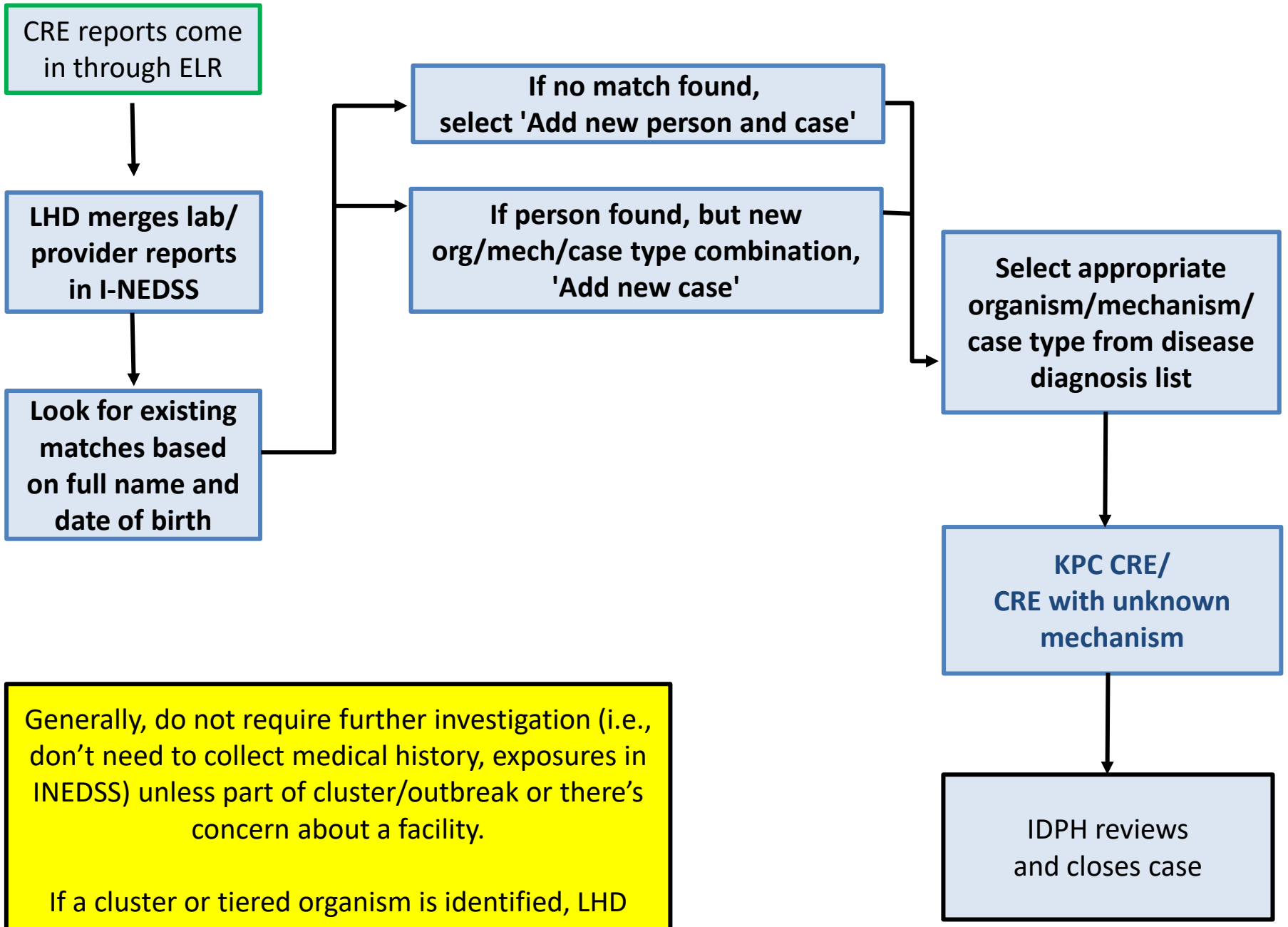

Generally, do not require further investigation (i.e., don't need to collect medical history, exposures in INEDSS) unless part of cluster/outbreak or there's concern about a facility.

If a cluster or tiered organism is identified, LHD organizes a response. IDPH available to assist.

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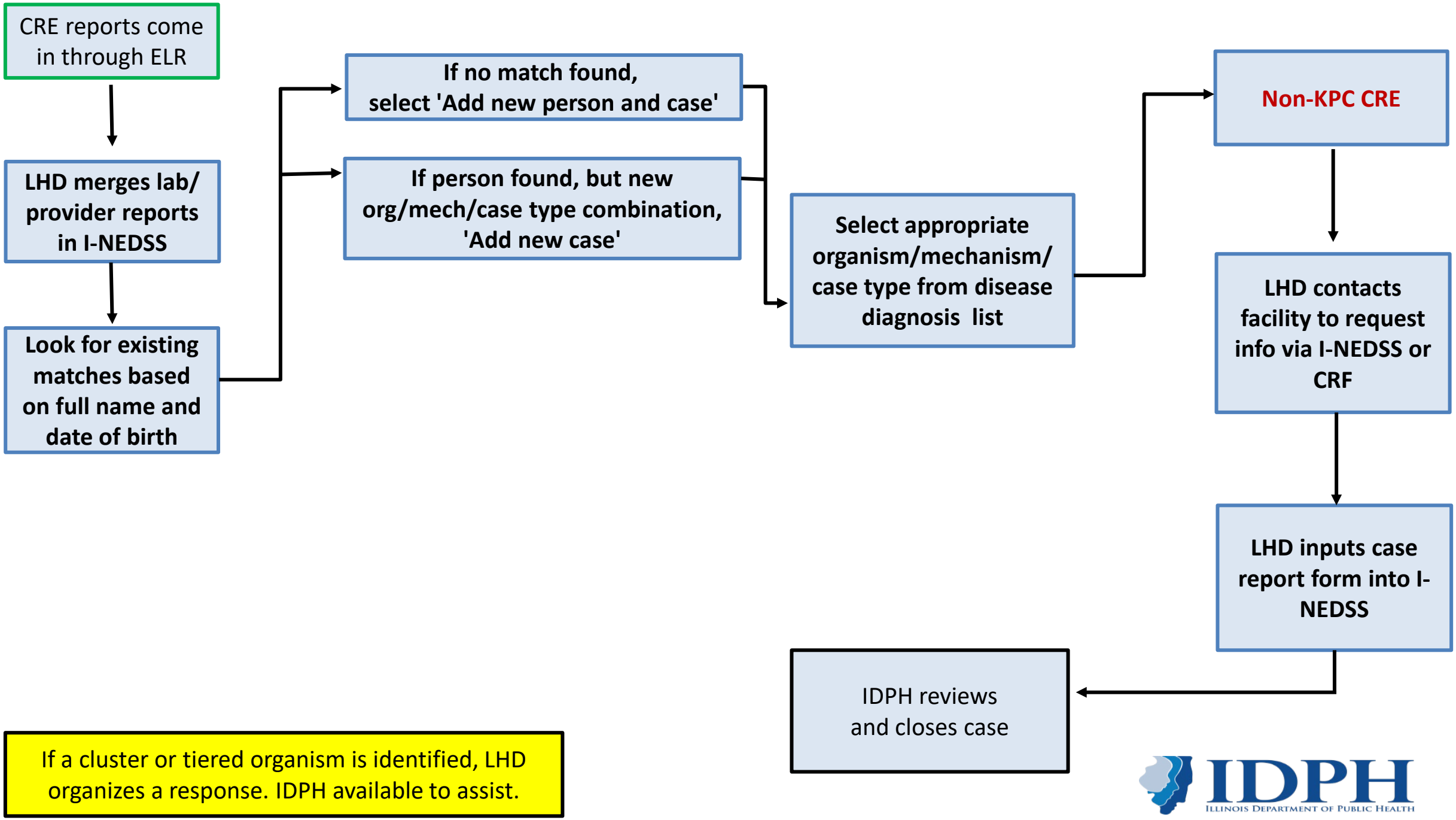
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Select appropriate organism/mechanism/ case type from disease diagnosis list
Non-KPC CRE
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LHD inputs case report form into I-NEDSS
IDPH reviews and closes case
If a cluster or tiered organism is identified, LHD organizes a response. IDPH available to assist.
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CRAB, CP-CRPA Investigation and Response in IL

- Generally, do not require further investigation and response unless part of cluster/outbreak or rare carbapenemase detected
- For CRAB pilot, IDPH has been requesting INEDSS completion from facilities when needed
- CP-CRPA often identified through PPS/screening

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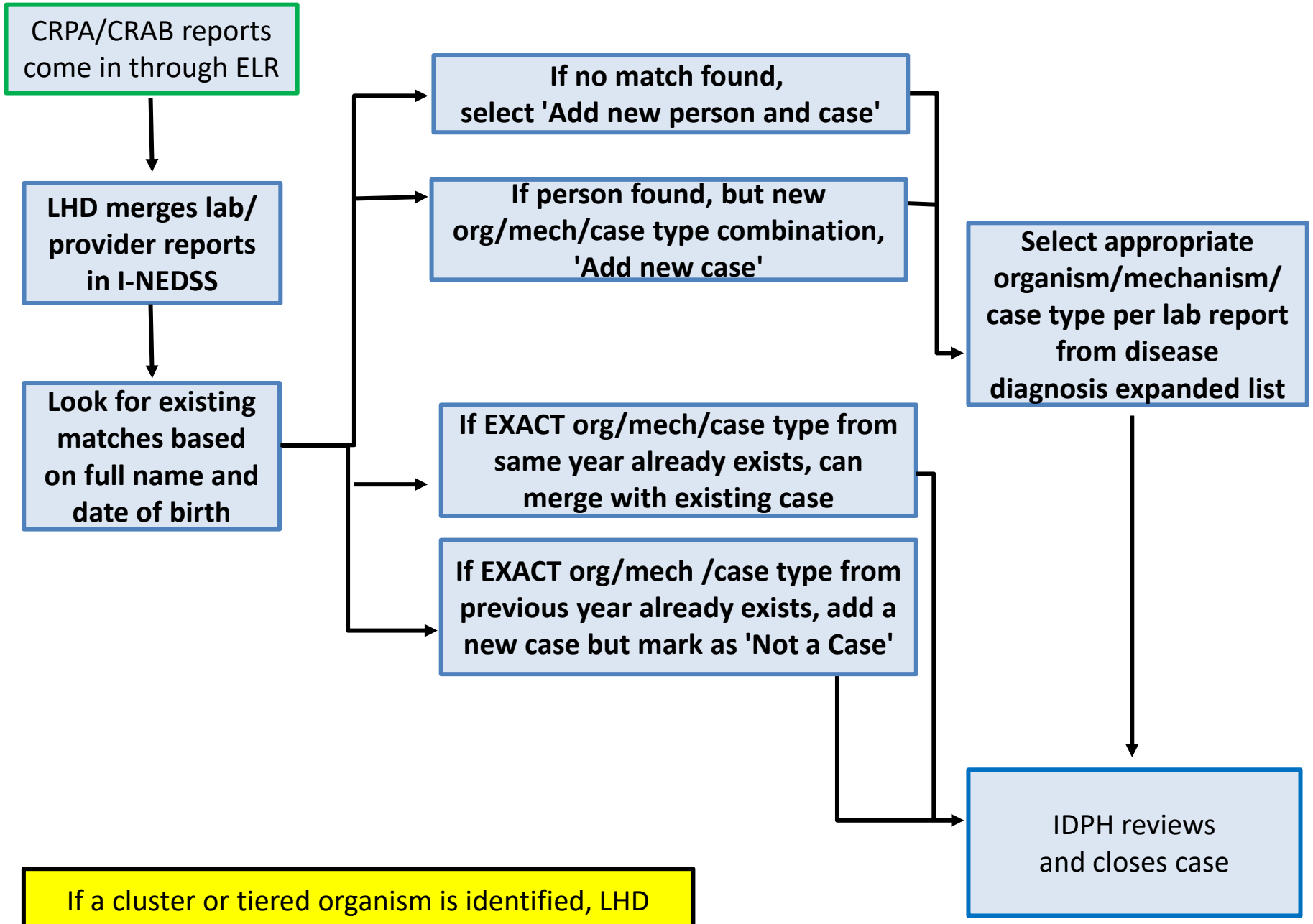

If a cluster or tiered organism is identified, LHD organizes a response. IDPH available to assist.

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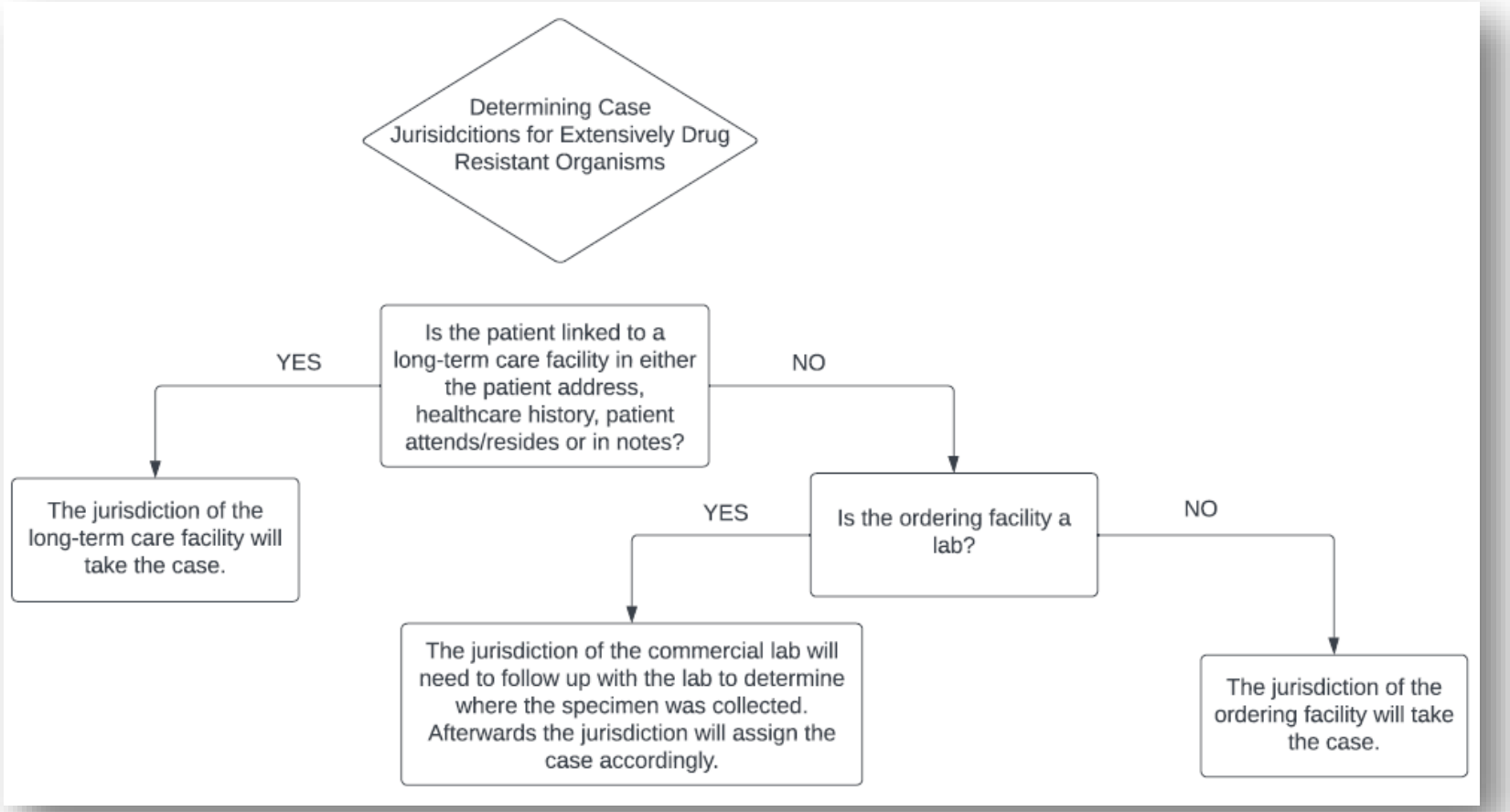
Interim Workflow for Multijurisdictional Cases

- Sometimes cases have had stays or exposures to multiple facilities, in multiple jurisdictions
- Only one jurisdiction can own and edit the case
- No jurisdictional boundaries on viewing cases



Courtesy Chicago Department of Public Health

INEDSS WORKFLOW: C. AURIS

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C. auris Investigation and Response in IL

Screening cases (e.g., axilla/groin skin specimens)

- Facility or LHD should enter into INEDSS with basic lab results info
- Generally do not require further investigation

Clinical cases (e.g., blood, urine, wound specimens)

- At minimum, facility or LHD should enter into INEDSS with basic lab results info
- Further investigation (filling out INEDSS) and response actions depend on whether case falls into a Tier or not

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C. auris REDCap Project

- Project Name: **IL C. auris cases_Master List**
  - Master line list of *C. auris* clinical and colonized cases
  - Primary purposes:
    - Alert IDPH to new cases to enter into XDRO registry
    - Allows for reporting of cases to CDC Mycotics Team
  - Access given to LHDs with cases

- Unique ID for each case "IL___"
  - First case (either colonized or clinical) entered to REDCap as new unique ID (e.g., IL123)
  - If first case was colonized, then has a clinical case, REDCap ID format is "IL____a" (e.g., IL123a)

- Houses attachments such as test requisitions and lab results
- Has section for case investigation notes (used mostly prior to INEDSS module opening)

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C. auris REDCap Master List

IL C. auris cases_Master List

PID 265

Actions: Modify instrument | Download PDF of instrument(s) | VIDEO: Basic data entry

C. auris case list

Adding new State ID **IL1477**

State ID	IL1477
XDRO Report ID	
Case Status * must provide value	○ Confirmed ○ Probable ○ Suspect ○ Screening (reset)
Primary Public Health Jurisdiction	Based on facility where culture1 was obtained
INEDSS ID	
Was a case investigation initiated/completed?	○ Yes ○ No (reset) If yes, fill in investigation questions below Culture1.

Patient Demographics

First Name * must provide value	
Last Name * must provide value	
Gender	
Date of birth * must provide value	Today M-D-Y
Date of Death (if applicable)	Today M-D-Y
Address - Street	
Address - City	
Address - County	
Address - State * must provide value	
Address - ZIP code	

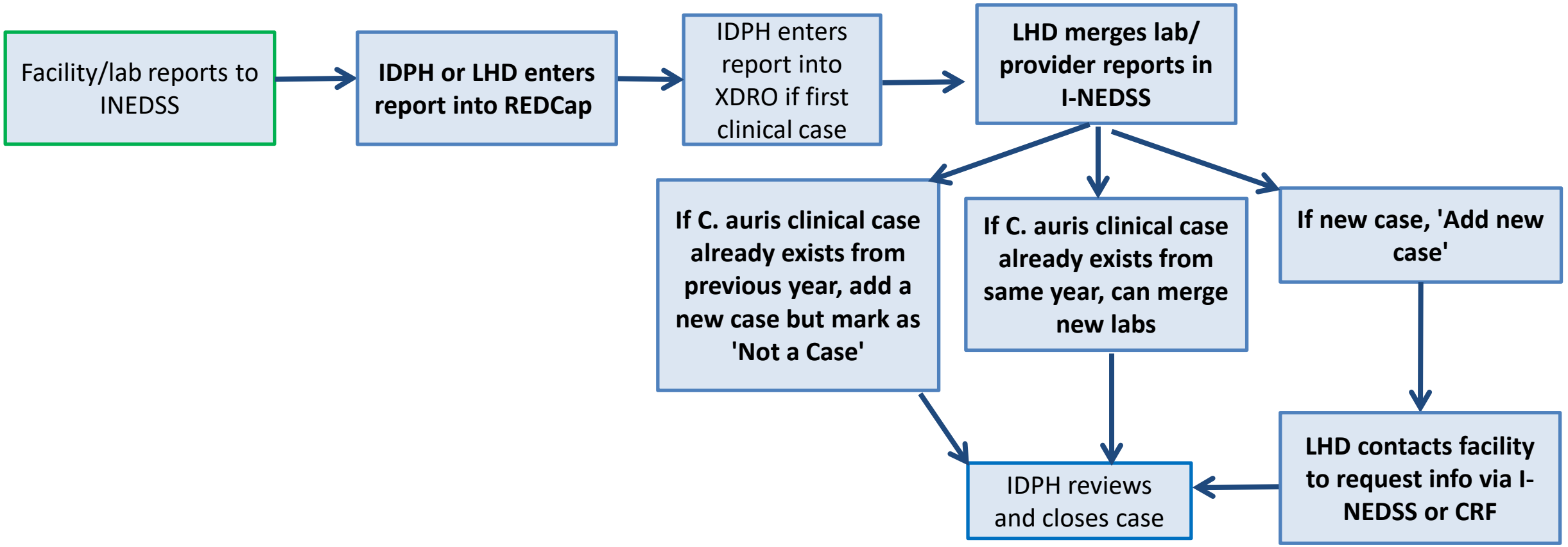
Culture 1

Facility where culture was obtained 1	
Organism Name 1 * must provide value	○ Candida auris ○ Candida haemulonii (reset)
Specimen Source 1 * must provide value	
Culture acquisition date 1 * must provide value	Today M-D-Y
Patient Medical Record Number 1	
Date of Admission 1	Today M-D-Y
Lab that completed the testing	If culture was obtained as part of a PPS
CDC/ARLN lab ID 1	If CDC/ARLN did testing
PPS Patient Identifier	
Was the patient on any of the following:	☐ Vent ☐ Trach ☐ Contact Precautions ☐ Unknown Check all that apply

Case Investigation

Date health department notified of case	Today M-D-Y
Case type	
Brief overview of case	Expand
Completed Steps	Expand
Next steps	Expand
Did health department provide on-site assistance?	○ Yes ○ No (reset)
Number of Screening Cultures (if applicable)	

Workflow: *C. auris* Clinical Cases



If a cluster or tiered organism is identified, LHD organizes a response. IDPH available to assist.

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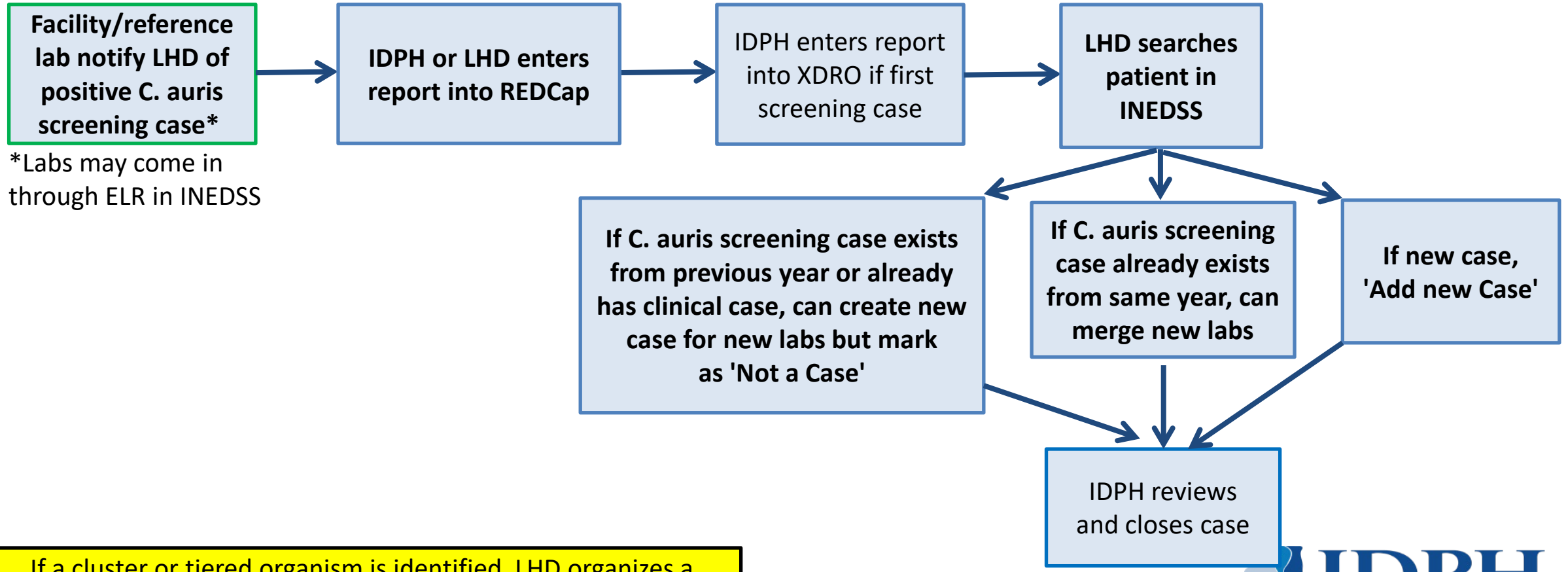
Workflow: *C. auris* Screening Cases



*Labs may come in through ELR in INEDSS

If a cluster or tiered organism is identified, LHD organizes a response. IDPH available to assist.

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UPDATE ON THE VIM-GES –CRPA MULTI-STATE OUTBREAK RELATED TO ARTIFICIAL TEARS PRODUCT

Ezricare NDC 79503-0101-15, UPC 3 79503 10115 7; Delsam Pharma's NDC 72570-121-15, UPC 3 72570 12115 8

Case definitions, updated January 2023

- CONFIRMED
  - VIM CRPA, MLST 1203 with VIM-80 & GES-9 from any specimen source collected on or after Jan 1, 2022.
- PROBABLE
  - VIM-CRPA from an eye specimen OR
  - VIM from any specimen source collected on or after Jan 1, 2022 with epi link to confirmed case OR
  - VIM-CRPA from any specimen source from a patient who reports use of artificial tears.
- POSSIBLE
  - VIM-CRPA from any specimen source collected on or after Jan 1, 2022, with unknown ST type, VIM, & GES (i.e., isolates pending sequencing).

VIM-CRPA OUTBREAK IN ILLINOIS

- As of 02/14/2023: Total of 22 potential cases. 21 so far have not met case definition. 1 probable case is currently undergoing WGS to be confirmed as a case. No results yet.

- Questions can be directed to the IDPH Division of Patient Safety and Quality: dph.dpsq@illinois.gov

Public Talking Points

- Patients may have a lot of questions. CDC has created materials to assist providers when communicating with patients.
    - Provider Talking Points
    - Sample Patient Notification Letter - it is customizable to be distributed via mail or email

If you/your facilities identify VIM-CRPA:

1. Follow Containment Guidance to evaluate for transmission
   - Colonization screening of healthcare contacts of patients with VIM-CRPA
   - Laboratory lookbacks for other CRPA
   - Prospective surveillance
2. Continue to perform WGS on all VIM-CRPA and analyze promptly for outbreak signature (ST1203 with blaVIM-80 and blaGES-9).
   - Contact us (IDPH HAI) if lab cannot perform WGS or molecular testing.
   - Secure email or secure fax us a copy of case lab report. We will advise if isolate should be sent for WGS and/or molecular testing.
   - Send isolate to IDPH lab.
   - Complete CDC CASE REPORT FORM. (We will send you the form)
     - Enter relevant info into INEDSS under CPO.
3. Collect information on eye products, including products used at home, in the 3 months prior to culture collection including NDC code for VIM-CRPA cases

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VIM-GES-CRPA Web Resources

- Outbreak of Extensively Drug-resistant Pseudomonas aeruginosa Associated with Artificial Tears | HAI | CDC https://www.cdc.gov/hai/outbreaks/crpa-artificial-tears.html
- Health Alert Network (HAN) - 00485 | Outbreak of Extensively Drug-resistant Pseudomonas aeruginosa Associated with Artificial Tears (cdc.gov) https://emergency.cdc.gov/han/2023/han00485.asp
- Global Pharma voluntary recall https://global-pharma.com/otc.pdf
- FDA warns consumers not to purchase or use EzriCare Artificial Tears due to potential contamination | FDA https://www.fda.gov/drugs/drug-safety-and-availability/fda-warns-consumers-not-purchase-or-use-ezricare-artificial-tears-due-potential-contamination
- MedWatch: The FDA Safety Information and Adverse Event Reporting Program | FDA https://www.fda.gov/safety/medwatch-fda-safety-information-and-adverse-event-reporting-program

Additional Resources

- Illinois MDRO Surveillance Reports (scroll down to Other State Reports)
- CDC MDRO Containment Strategy
- Council for Outbreak Response: Healthcare-Associated Infections and Antimicrobial-Resistant Pathogens (CORHA) Principles and Practices for Outbreak Response

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Open Q&A

Submit questions via Q&A pod to **All Panelists**

Please do not resubmit a single question multiple times

Slides and recording will be made available on the IDPH CD SharePoint after the session.

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APPENDIX

Clinical and Laboratory Standards Institute (CLSI) Breakpoints for CRE

Carbapenem	Zone Diameter Breakpoints, nearest whole mm			Minimum Inhibitory Concentration (MIC) Breakpoints, µg/mL		
	S	I	R	S	I	R
Doripenem	≥ 23	20–22	≤ 19	≤1	2	≥4
Ertapenem	≥ 22	19–21	≤ 18	≤0.5	1	≥2
Imipenem	≥ 23	20–22	≤ 19	≤1	2	≥4
Meropenem	≥ 23	20–22	≤ 19	≤1	2	≥4

S=Susceptible, I=Intermediate, R=Resistant

Clinical and Laboratory Standards Institute. CLSI M100-ED32:2022 Performance Standards for Antimicrobial Susceptibility Testing, 32nd Edition. http://em100.edaptivedocs.net/dashboard.aspx

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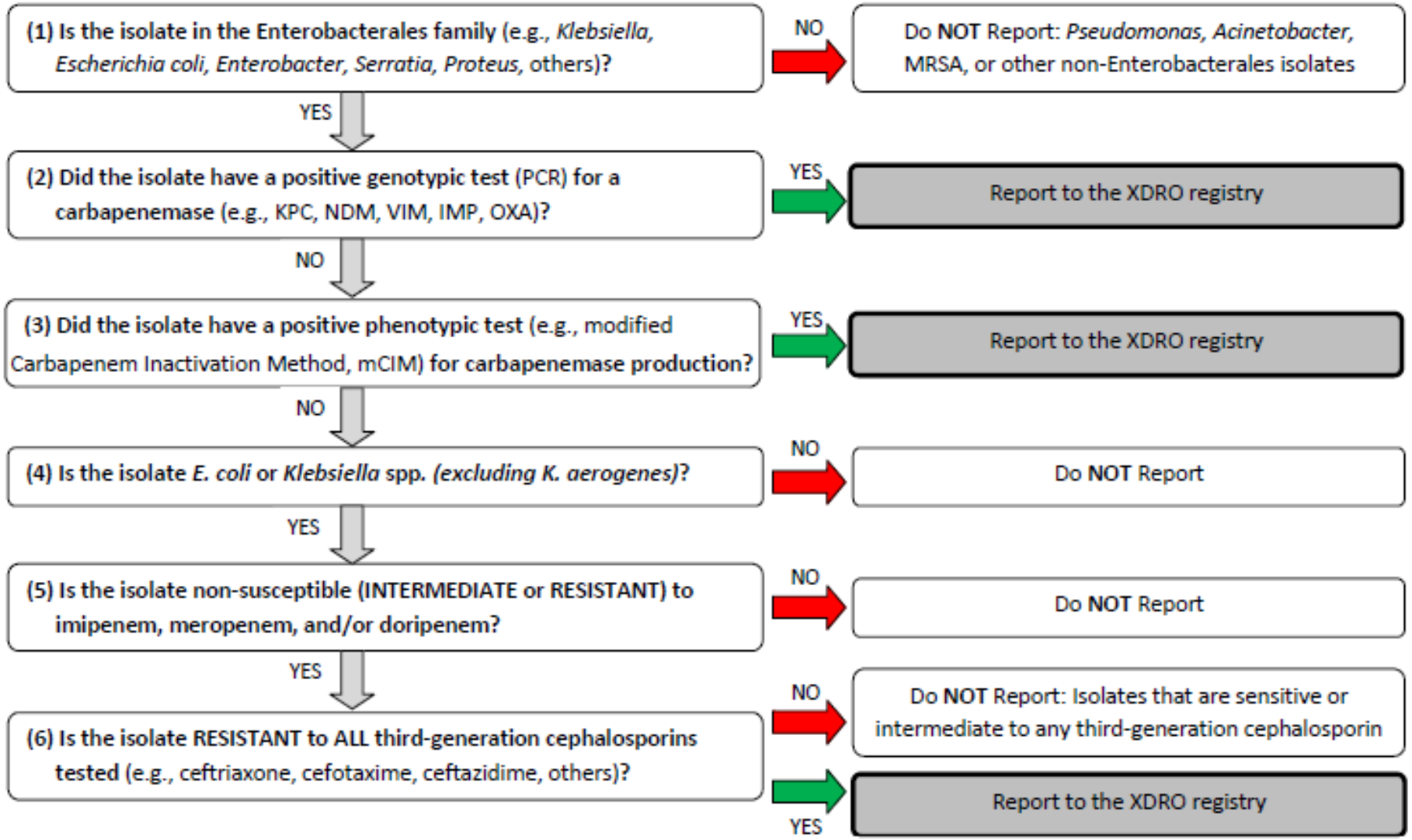
Report Carbapenem-Resistant Enterobacterales (CRE) isolates to the XDRO registry



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CRE Surveillance Definition in IL vs CDC

Illinois

Enterobacterales with one of the following test results:

1. **Molecular test** (e.g., PCR) specific for carbapenemase

OR

2. **Phenotypic test** (e.g., modified carbapenem inactivation method (mCIM)) specific for carbapenemase production

OR

3. **Susceptibility test**, for ***E. coli* and *Klebsiella*** species (except *K. aerogenes*) only:
   - non-susceptible (resistant or intermediate) to ONE of the carbapenems (doripenem, meropenem, or imipenem) AND
   - resistant to ALL third generation cephalosporins tested (ceftriaxone, cefotaxime, and ceftazidime).

CDC

- Enterobacterales that test resistant to at least one of the carbapenem antibiotics (ertapenem, meropenem, doripenem, or imipenem) or produce a carbapenemase
- Some Enterobacterales (e.g., Proteus spp., Morganella spp., Providencia spp.) have intrinsic elevated minimum inhibitory concentrations (MICs) to imipenem and therefore results for meropenem, doripenem, and ertapenem should be used for these organisms to determine if these organisms meet the CRE definition.

CDC's definition differs by the susceptibility criterion (applies to all Enterobacterales and includes ertapenem). It is more sensitive and may capture CRE that are not carbapenemase producers.

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The Council for Outbreak Response: Healthcare-Associated Infections and Antimicrobial-Resistant Pathogens

Healthcare-associated Infections (HAIs) including antimicrobial-resistant (AR) pathogens cause hundreds of thousands of illnesses and deaths among U.S. patients each year. Despite significant progress, patients still experience preventable harms in the context of outbreaks and other adverse events that stem from emerging infectious diseases with potential for healthcare transmission, unsafe healthcare practices, contaminated drugs, and medical devices.

Consistent and coordinated approaches to outbreak detection, response, investigation, and control are needed to speed up detection of new threats, reporting outbreaks to public health, developing tools to support outbreak investigation, stop outbreaks from spreading, and inform prevention activities. To address these needs, CDC's Division of Healthcare Quality Promotion has funded the Association of State and Territorial Health Officials (ASTHO) and the Council of State and Territorial Epidemiologists (CSTE) to co-lead the **Council for Outbreak Response: HAI/AR (CORHA).**

MISSION, VISION, AND MEMBERSHIP

MISSION

To improve practices and policies at the local, state, and national levels for detection, investigation, control, and prevention of HAI/AR outbreaks across the healthcare continuum, including emerging infections and other risks with potential for healthcare transmission.

VISION

Public health and healthcare collaborating effectively to protect patients and prevent harms from HAI/AR outbreaks.

MEMBERSHIP

CORHA is led by a Governance Committee with members from ASTHO, CSTE, CDC, and the National Association of County and City Health Officials (NACCHO). Additional CORHA member organizations include the Association for Professionals in Infection Control and Epidemiology (APIC), the Society for Healthcare Epidemiology of America (SHEA), the U.S. Centers for Medicare and Medicaid Services (CMS), the U.S. Food and Drug Administration (FDA), and the Association of Public Health Laboratories (APHL).

https://www.corha.org/

IDPH
Illinois Department of Public Health

Proposed Investigation/Reporting Thresholds and Outbreak Definition for Carbapenem-Resistant Enterobacteriaceae (CRE), 2019

	Long-Term Care Facilities (LTCFs), Critical Access Hospitals, Dialysis Facilities, and Outpatient Facilities:
Threshold for investigation [by the facility] and public health reporting	1 case CRE (CP, non-CP, or unknown CP)
Outbreak definition	≥ 2 cases CRE with same organism (or mechanism, if mechanism testing performed) in a 4-week period in patients who are epidemiologically-linked or determined to be genetically related by laboratory testing.

As with *C. auris*, these may be most applicable when the facility identifies its first case(s).

https://www.corha.org/wp-content/uploads/2019/06/CORHA-Proposed-CRE-Thresholds-and-Definition-08-19.pdf

VIM-CRPA OUTBREAK

- **Brief outbreak summary:** As of 02/03/2023, there are 61 confirmed isolates from 55 case patients in 12 jurisdictions, and all cases are from specimens collected during May 2022 to present.
- Epidemiological evidence identified artificial tears as a product of interest, and the CDC lab has been testing artificial tears collected from facilities with case patients.
- The cases are in both inpatients and outpatients, and from all specimen collection sites.

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VIM-CRPA is rarely identified in the U.S

- 682 isolates detected in 4-year period from 2017- 2021 (1.2% of CRPA isolates)[1]
- Known risk factors:
  - antibiotic exposure,
  - mechanical ventilation,
  - indwelling medical devices,
  - longer duration of hospitalization
- Mode of transmission:
  - Person-person
  - Environment-person
  - Outbreaks in healthcare settings

IDPH Illinois Department of Public Health

- 1Antibiotic Resistance & Patient Safety Portal: https://arpsp.cdc.gov/profile/arln/crpa