Council of State and Territorial Epidemiologists (CSTE)

Interim Operational Guidance for PS-22-ID-05 (*Candida auris*)

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1. Objectives

This document serves as a complementary, practical guide to the implementation of recommendations for the surveillance of *Candida auris* provided in the Council of State and Territorial Epidemiologists (CSTE) Position Statement 22-ID-05, Update to the Standardized Case Definition and National Notification for *Candida auris* (PDF) (cdn.ymaws.com/www.cste.org/resource/resmgr/ps/ps2022/22-ID-05_C_auris.pdf). The document is targeted at state, territorial, local, and tribal (STLT) public health agencies. Sections addressing clinical or laboratory practices are not intended to provide guidance for those settings and are included to support STLT public health agency staff when collaborating with laboratories and clinicians. The objectives of this document are as follows:

- To provide guidance for applying case definitions, including considerations for testing and data collection
- To provide guidance for reporting case counts and epidemiologic data to Centers for Disease Control and Prevention (CDC)
- To present resources and examples for surveillance and public health response

2. Implementation of the case definition

2.1. Case classification

Confirmed cases of *C. auris* are defined as a person whose specimen contains *C. auris* detected by either culture or a validated culture-independent test (e.g., nucleic acid amplification test [NAAT]). For common examples of *C. auris* tests, see **Section 3** (clinical testing) and **Section 4** (colonization testing). There are no probable or suspect case classifications for *C. auris.*

If multiple test types are conducted (e.g., both PCR and culture) on the same specimen and only one results as positive for *C. auris*, it would be enumerated as a confirmed case. For example, if a specimen is PCR-positive and culture-negative, this would still be indicative of a confirmed *C. auris* case.

2.2. Screening versus clinical case classifications

The *C. auris* case definition distinguishes between confirmed screening and clinical cases. This differentiation is determined by the purpose of the collected specimen: whether collection was performed for screening or for diagnosis and treatment.

A **screening case** is a person with *C. auris* identified in a swab collected **for the purpose of colonization screening** regardless of which site was collected. The most common examples are skin (e.g., axilla, groin, palm, fingertips); however, other examples include nares, rectum, or other external body sites. These specimens are collected for the purpose of surveillance and not to identify source of infection.

A **clinical case** is a person with *C. auris* identified from a clinical specimen collected **for the purpose of diagnosing or treating disease in the normal course of care**. Common examples are blood, wounds, urine, respiratory tract, and tissue. *C. auris* identified in non-sterile sites (e.g., urine) could be an indication for colonization and not true infection; however, when collected during the normal course of care, it would be counted as a clinical case.

2.3. Counting cases

Enumeration criteria

A patient who is colonized or infected with *C. auris* is considered to be colonized indefinitely. A person is counted as a case when *C. auris* is identified for the **first time** in a specimen, whether that be screening or clinical. If the person later has another positive screening specimen, they are not counted again. However, if a person was identified as a screening case first and later had a positive clinical specimen, the individual would be counted twice: once as a screening case and once as a clinical case. Multiple screening positives or multiple clinical positives from the same patient, even if years apart, are not counted again.

The maximum number of times a single patient can be counted as a *C.* auris case is twice: once as a screening case and later, once as a clinical case (see **Table 1**). Note that *C. auris* cases should be counted by jurisdiction residence (as with all other nationally notifiable conditions); however, they should still only be counted once in their lifetime (or twice if first as a screening case, and later as clinical case), regardless of residence at time of *C. auris* identification.

If a person was identified as a screening case on the same day they had a positive clinical specimen, they would be counted as a clinical case, not a screening case.

Table 1. Enumerating *C. auris* cases by initial and subsequent laboratory-confirmed specimen types

Initial laboratory-confirmed *C. auris* specimen	**Additional laboratory-confirmed *C. auris* specimen(s)**	**Number of times counted as a confirmed case**
Screening swab	Clinical specimen	Twice: once as screening, once as clinical
Clinical specimen	Screening swab	Once: clinical at time of first positive specimen
Screening swab	Screening swab	Once: screening at time of first positive specimen
Clinical specimen	Clinical specimen	Once: clinical at time of first positive specimen

Example scenarios
Examples determining type of *C. auris* case (screening or clinical)

Example 1: A local health department conducts a point prevalence survey (PPS) for *C. auris* at a skilled nursing facility. The team collects an axilla/groin composite swab from Patient A that results positive. Patient A would be reported as a *C. auris* screening case.

Example 2: A ventilator-capable skilled nursing facility (vSNF) resident, Patient B is discharged to an acute care hospital (ACH) for signs of a urinary tract infection. Per its protocol to screen high-risk patients, on admission, the hospital does an axilla/groin swab to test for *C. auris.* The swab comes back positive. Patient B would be reported as a *C. auris* screening case.

Example 3: Patient C is admitted to an ACH with pneumonia symptoms. The hospital collects a respiratory specimen that tests positive for *C. auris.* Patient C would be reported as a *C. auris* clinical case.

Examples counting cases when multiple positives specimens per patient are identified
Example 4: Patient D lives is a skilled nursing facility and the local health department conducts a PPS to screen for *C. auris* on 7/1/2022. Patient D's axilla/groin swab tests positive for *C. auris*. On 9/1/2022, Patient D is sent to the hospital due to symptoms of an infection. At the hospital, a urine specimen is collected and tests positive for *C. auris*. Patient D would be counted twice: once as a screening case on 7/1/2022 and once as a clinical case on 9/1/2022.

Example 5: Patient E has prior history of *C. auris* infection from a urine specimen on 1/1/2019. On 7/1/2022, he is hospitalized for an infection, where a blood specimen tests positive for *C. auris*. Even though the specimen sources are different and collected three years apart, Patient E would only be counted once as a *C. auris* clinical case on 1/1/2019.

Example 6: Patient F resides in a SNF. On 4/30/2018, *C. auris* was isolated from a respiratory specimen. As a result, Patient F is already counted as a clinical case for the jurisdiction. On 8/11/2022, the vSNF

conducts a PPS and swabs Patient F despite the known history of *C. auris*. This axilla/groin swab is positive for *C. auris*. Since Patient F has already been included in the official case count for the jurisdiction for a previous clinical specimen, they are not counted again as a screening case.

3. Clinical testing

This section provides information for STLT public health agencies regarding clinical testing. A description of these methods and resources for public health are at CDC Identification of *Candida auris* (www.cdc.gov/fungal/candida-auris/identification.html).

3.1. Misidentification of *C. auris*

Some commonly used phenotypic yeast identification systems can misidentify *C. auris*. For more information on the specifics of *C. auris* misidentification, clinical laboratories should consult CDC Identification of C*andida auris* (www.cdc.gov/fungal/candida-auris/identification.html), which includes a table that summarizes the common misidentifications stratified by identification method. CDC also maintains a helpful algorithm to identify C. *auris b*ased on phenotypic laboratory method and initial species identification (PDF) (www.cdc.gov/fungal/candida-auris/pdf/Testing-algorithm_by-Method_508.pdf).

As more manufacturers have updated their libraries and software to include *C. auris*, the potential to mischaracterize the pathogen has become less of a cause for concern. However, laboratorians and STLT public health agencies should remain aware of these issues and refer to CDC guidance as yeast identification methods continue to change.

3.2. Enhancing *Candida* species identification in clinical specimens

CDC recommends all *Candida* isolated in a normally sterile site, such as blood or cerebrospinal fluid (CSF), be identified to the species level, as this represents an infection that warrants immediate treatment.[1] Public health departments can use the National Healthcare Safety Network (NHSN) annual survey to identify facilities that do not adhere to this recommended practice and can follow up directly to ensure all appropriate testing practices are in place.

In a specimen from a non-sterile site like urine, respiratory tract, or wound, laboratories might not expend the added time and resources to determine the species of *Candida* (e.g., *glabrata*, *albicans*, *auris*, etc.) since this commonly represents colonization, and not an infection requiring treatment. This practice, however, poses challenges for *C. auris* surveillance—it is possible that the first *C. auris* identified in a region would be detected in a urine or respiratory specimen.[2] Expanding species identification to all specimens is a strategy to enhance *C. auris* case detection through clinical specimens. STLT public health agencies can take several steps to improve the possibility that *C. auris* from a non-sterile site would be detected and reported:

[1] CDC Surveillance for Candida auris (www.cdc.gov/fungal/candida-auris/c-auris-surveillance.html)

[2] Karmarkar EN, O'Donnell K, Prestel C, et al. Rapid Assessment and Containment of Candida auris Transmission in Postacute Care Settings-Orange County, California, 2019. *Ann Intern Med*. 2021;174(11):1554-1562. doi:10.7326/M21-2013

- Ensure all healthcare facilities and clinical laboratories in your jurisdiction are aware of CDC recommendations for when species-level identification should be considered for *Candida* isolated from non-sterile sites.[1] Consider recommending species-level identification for isolates from non-sterile sites for laboratories serving high-risk facilities like long-term acute care hospitals (LTACHs) or vSNFs.
- Species identification may need to be targeted based on available resources. In addition to time-limited prospective surveillance recommendations in response to a newly identified case,[3] for more routine surveillance, consider reaching out to (1) large commercial and hospital laboratories that might have the volume and resources to fully identify all *Candida* species and (2) laboratories serving individuals at high risk of *C. auris* acquisition, especially those admitted to LTACHs and vSNFs to recommend identifying a subset of isolates. For example, a laboratory serving:
    - a large academic center might choose to fully identify *Candida* spp. detected Monday-Wednesday each week;
    - a community hospital might choose to fully identify *Candida* spp. in patients admitted to high acuity units (e.g., intensive care unit) or any specimen obtained from a resident of a nearby vSNF that frequently transfers patients; or
    - a network of LTACHs might choose to fully identify *Candida* spp. isolated from urine specimens.
- Discuss with clinical laboratories and healthcare facilities the possibility of submitting all or a subset of non-*albicans Candida* isolates directly to the CDC AR Lab Network for confirmatory organism identification and antifungal susceptibility testing (AFST).
    - View the CDC flyer Send Candida Isolates to Your Public Health Lab (PDF) (www.cdc.gov/drugresistance/pdf/Candida-isolates-508.pdf) for more information on this process.

3.3. Isolate submission requirements

The CSTE *C. auris* position statement does not require isolate submission for case ascertainment or classification. *C. auris* cases could be identified using culture-independent diagnostic methods, and an isolate might not be available. However, isolate submission allows for further testing that can provide added benefit to *C. auris* tracking and response efforts. When isolates are submitted, public health laboratories (PHLs) can perform additional characterization, including AFST and next generation sequencing (NGS), which are often limited or unavailable at clinical or reference laboratories. PHLs have expanded access to species identification and AFST through the AR Lab Network. Isolate submission and case reporting to public health can be compared to check accuracy and enhance data, such as linking epidemiology with laboratory data to examine things like susceptibility trends over time. Without isolate submission requirements, information about characteristics such as antifungal susceptibility or genetic relatedness can be limited.

[3] CDC Novel or Targeted Multidrug-resistant Organisms (MDROs) Containment Strategy Guidelines (www.cdc.gov/hai/containment/guidelines.html)

Isolate submission does require additional resources from submitting laboratories and PHLs to gather, submit, and track data and isolates. The AR Lab Network mitigates this resource use and cost to some extent by providing *Candida* testing at no cost and by accepting direct submissions from facilities (though some states may require submission to their PHL).

STLT public health agencies might choose to limit the type of isolates for submission; for example, asking laboratories to submit *C. auris* isolated only from normally sterile sites (e.g., blood) can reduce the volume, and time and effort necessary for isolate submission. Additionally, since public health testing does not generally inform clinical decision making, STLT public health agencies might provide a longer timeframe for submission (e.g., within 10 working days from date of report). Several examples of STLT public health agency guidance for isolate submission can be found in **Section 5.1** and **Appendix A.**

Public health laboratories in the US have developed substantial capacity to test *C. auris*. In particular, the AR Lab Network can provide isolate confirmation testing, AFST, colonization testing, and NGS.

- **Species confirmation**
  In addition to regional laboratories in the AR Lab Network, STLT public health laboratories (e.g., Connecticut (portal.ct.gov/DPH/Epidemiology-and-Emerging-Infections/Candida_auris), California (www.cdph.ca.gov/Programs/CID/DCDC/Pages/TestOrderFungalIDMoldMALDI.aspx)) may offer *Candida* species identification and confirmation to enhance *C. auris* detection in their jurisdiction.
- **Antifungal susceptibility testing**
  C. auris commonly exhibits reduced susceptibility to azole and polyene antifungal classes, making echinocandins the empiric therapy of choice. However, pan-resistant *C. auris* has been reported in the US, and the AR Lab Network offers AFST that can help monitor trends in resistance over time.
- **Colonization testing**
  The AR Lab Network provides both PCR and culture-based colonization testing services for high-risk patient contacts (see **Section 4** for more information).
- **Next generation sequencing**
  FungiNet (www.cdc.gov/fungal/outbreaks/wgs.html) is a network for molecular surveillance and genomic epidemiology for fungal diseases, launched in partnership with the AR Lab Network. NGS and analysis can help monitor circulating strains and clades, supplement response and control efforts, and identify antifungal resistance mechanisms.

4. Colonization testing (screening)

Individuals with *C. auris* infections represent only a small fraction of total individuals with *C. auris* as many more are colonized. Colonized individuals can still be a source of transmission to others within healthcare settings, particularly when their colonization status is unknown and, as a result, recommended infection prevention and control interventions are not applied. *C. auris* may spread from colonized individuals in a facility or region before the first clinical infection is detected. Prevention-

driven and responsive PPSs as well as admission screening are several strategies that can be used to detect colonized individuals. Early and correct identification of individuals colonized with *C. auris* is critical in containing its spread.

4.1. Types of *C. auris* screening

The different characteristics of each screening type are listed in **Table 2** below.

Table 2. Characteristics of types of *C. auris* screening

Prevention-based PPS	
Definition	Screening everyone in a facility or a specified unit on a specific date and time regardless and possibly prior to the identification of *C. auris*
Screening recommendations	Jurisdictions can find CDC guidance regarding prevention activities including prevention-based PPS here (www.cdc.gov/hai/mdro-guides/prevention-strategy.html).
Considerations/ additional information	• Should be considered for influential facilities (vSNFs and LTACHs) based on testing resources in the jurisdiction • PPS frequency will vary depending on prevalence
Response-based targeted screening	
Definition	Screening conducted on people who are considered close healthcare contacts with someone newly identified with *C. auris* infection or colonization
Screening recommendations	Refer to the following guidance documents for more information on response-based screening: • CDC Containment Strategy Guidelines (www.cdc.gov/hai/containment/guidelines.html) • CDC *C. auris* Screening Guidelines (www.cdc.gov/fungal/candida-auris/c-auris-screening.html) • CORHA *C. auris* Outbreak Guidelines (PDF) (www.corha.org/wp-content/uploads/2021/08/Candida-auris-Recommendations-for-Healthcare-Outbreak-Response.pdf)
Considerations/ additional information	Response-based screenings should be prioritized over prevention-based screening
Response-based PPS	
Definition	A PPS conducted in response to the new identification of a person or multiple people in a facility
Screening Recommendations	Refer to the following guidance documents for more information on response-based screening: • CDC Containment Strategy Guidelines (www.cdc.gov/hai/containment/guidelines.html) • CDC *C. auris* Screening Guidelines (www.cdc.gov/fungal/candida-auris/c-auris-screening.html)

	• CORHA *C. auris* Outbreak Guidelines (PDF) (www.corha.org/wp-content/uploads/2021/08/Candida-auris-Recommendations-for-Healthcare-Outbreak-Response.pdf)
Considerations/ Additional Information	• Might be conducted instead of a response-based targeted screening due to the difficulty or delay in identifying close contacts to an index-case or concern for larger spread due to additional cases being identified or concerns related to infection prevention and control practices at the facility • Frequency of PPS will vary; early on in an outbreak more frequent screening might be necessary but eventually facilities should transition to a "maintenance phase" where PPS might be conducted every 6-12 months
Admission screening	
Definition	Individuals screened upon admission to a facility
Screening recommendations	Will depend based upon laboratory capacity and feasibility. Example approaches to admission screening include: • vSNF screens all admissions to their ventilator unit • LTACH screens all admissions • ACH screens all admissions from certain facilities or facility types • ACH only screens admissions with risk factors for multidrug-resistant organism (MDRO) colonization from certain facilities or facility types • ACH screens all admission to their ICUs • Patients admitted to healthcare facilities after an overnight stay in a healthcare facility outside of the United States in the prior 6 months
Considerations/ additional information	• More useful to facilities that do not already have a lot of cases or spread, where a novel introduction is the chief concern • Consider conducting a proactive PPS beforehand to ensure transmission is not occurring in the facility
Discharge screening	
Definition	Individuals screened prior to discharge to another unit or healthcare facility
Screening recommendations	Will depend on feasibility and laboratory capacity but could include: • Those transferring to other healthcare facilities, especially to units that house many people with risk of MDRO colonization • Those transferring to other units in a healthcare facility, especially to units that house many with risk of MDRO colonization
Considerations/ additional information	Particularly useful during a current outbreak on a unit or if the facility has many people with *C. auris.* Requires a well-thought-out implementation plan that should take into consideration the following: • Laboratory capacity • Turnaround time for results • Timing: screening at discharge vs. right before discharge

	• Results communication: decide who will be responsible for communicating results if patient or resident is discharged prior to results being released Discharge screening results should not be used to determine whether a facility will accept a patient; transfers should be based on clinical need and not MDRO status.

4.2. *C. auris* colonization identification methods

Both culture- and non-culture-based molecular methods for the detection of *C. auris* may be used.[4] Culture-independent methods are preferred due to the faster turnaround time. More information can be found on the CDC Guidance for Detection of Colonization of *Candida auris* website (www.cdc.gov/fungal/candida-auris/c-auris-guidance.html).

4.3. Performing *C. auris* colonization testing

For laboratories interested in performing swab testing in-house, guidance on processing swabs to assess for *C. auris* colonization can be found on the CDC Guidance for Detection of Colonization of *Candida auris* website (www.cdc.gov/fungal/candida-auris/c-auris-guidance.html) which also includes a real-time PCR protocol (PDF) (www.cdc.gov/fungal/candida-auris/pdf/Real-time-PCR-based-Id-C-auris-508.pdf).

4.4. Additional screening resources

- **Procedure for swab collection** (www.cdc.gov/fungal/candida-auris/c-auris-patient-swab.html)
- **Sample consent script and screening FAQs** (www.cdc.gov/fungal/candida-auris/c-auris-screening-info.html)
- **Patient educational materials on colonization** (www.cdc.gov/fungal/candida-auris/fact-sheets/c-auris-colonization.html)
- **AR Lab Network shipping and sample collection guidance examples**:
  - **Central Region**-Minnesota DPH Infectious Disease Laboratory Guidance for *Candida auris* Colonization Test Sampling and Specimen Handling Method (PDF) (www.health.state.mn.us/diseases/idlab/mdhcaurisguidance.pdf)
  - **Mid-Atlantic Region**-Maryland Public Health Laboratory Instructions for Requesting *C. auris* Colonization Screening (PDF) (health.maryland.gov/laboratories/docs/C.auris_Colonization_Instructions.pdf), Instructions for Patient Swab Collection for *C. auris* Colonization (PDF) (www.testmenu.com/UMSJMC/TestDirectory/SiteFile?fileName=sidebar%5CC%20auris%20ESwab%20Visual%20Guide.pdf)
  - **Midwest Region**-Wisconsin State Laboratory of Hygiene Instructions for Colonization Swab Collection (PDF) (www.slh.wisc.edu/wp-content/uploads/2021/10/Instructions-for-colonization-swab-collection.pdf)

[4] Fasciana T, Cortegiani A, Ippolito M, et al. *Candida auris:* An Overview of How to Screen, Detect, Test and Control This Emerging Pathogen. *Antibiotics (Basel). 2021;9(11):778.* doi: 10.3390/antibiotics9110778

- **Mountain Region**-Utah Public Health Laboratory *C. auris* Specimen Collection and Shipping Procedures (PDF) (uphl.utah.gov/wp-content/uploads/RMA-Mountain-Region-Candida-auris-Colonization-Screening-Guidance_1.pdf)
- **Southeast Region**-Tennessee State Public Health Laboratory Shipping Information (PDF) (www.tn.gov/content/dam/tn/health/program-areas/lab/TN_ARLN_Shipping_Information.pdf)
- **West Region**-Washington State Public Health Laboratories Specimen Collection and Submission Instructions: *Candida auris* Colonization Testing (Version 1) (PDF) (doh.wa.gov/sites/default/files/legacy/Documents/5240//SCSI-ARLN-Candida-Screening-V1.pdf)

5. Making *C. auris* reportable

The CSTE Position Statement recommends that STLT public health agencies make *C. auris* reportable and conduct surveillance in their jurisdiction. The addition of *C. auris* screening cases as a nationally notifiable condition and the removal of presumptive laboratory criteria from the overall case definition presents STLT public health agencies with an opportunity to simplify *C. auris* reporting requirements.

5.1. Examples from STLT that have made *C. auris* reportable

While STLT public health agencies that have made *C. auris* reportable in their jurisdiction include both screening and clinical *C. auris* cases, they differ on specific reporting and submission requirements; the time frame for these might range from one to 10 working days, depending on the burden of disease and existing reporting periods defined by STLT regulations. For example, the California Department of Public Health requires provider and laboratory reporting of *C. auris* colonization or infection, and submission of isolates identified from a sterile site (and for which the laboratory has obtained a fungal culture isolate). The Minnesota Department of Health requires case reporting after test results are finalized, and submission of all *C. auris* clinical materials or isolates including any AFST results, as well as isolates from possible *C. auris* misidentifications. The Tennessee Department of Public Health requires case reporting, and isolate submission for *C. auris* and *C. auris* rule-outs (per CDC guidance (www.cdc.gov/fungal/candida-auris/identification.html)). The Virginia Department of Health requires any AFST results accompany the case report, and submission of initial isolate or other testing if *C. haemulonii* is identified. The Washington State Department of Health requires case reporting and isolate submission.

See **Appendix A** for specific language contained on the state example websites.

5.2. Differentiating between screening and clinical cases

STLT public health agencies may choose to have two separate reportable conditions by case type (i.e., *C. auris* – screening, *C. auris* – clinical). In this case, reporters must make the distinction between screening and clinical cases based on specimen source or indication for testing, or both. Per the updated CSTE position statement, these data elements should be included in the initial report to public health. While this reporting method might reduce the burden of case classification by the STLT public health agency, it might also lead to possible misclassification of case type and necessitate confirmation by the STLT public

health agency once reported. The alternative and more common approach is to collapse the condition into an all-inclusive one (i.e., *C. auris*) like the state examples included in **Section 5.1**, and make the distinction once reported. This allows for a more centralized and standardized process for case classification.

Because it can be difficult to differentiate screening specimens from clinical specimens based on microbiology records, one approach STLT public health agencies can use to classify screening and clinical cases is to look at specimen source; *C. auris* identified from any swabs except wound or draining ear swabs can be classified as screening cases, while *C. auris* identified from all other specimens (e.g., respiratory, urine, blood) can be classified as clinical cases unless otherwise specified.

For reports of *C. auris* with unknown specimen source, these can generally be classified as clinical cases unless otherwise indicated (e.g., multiple reports of *C. auris* with unknown specimen source from a single facility and collection date, or PCR-tested).

6. Electronic laboratory reporting (ELR) to STLT and public health communication with laboratories

STLT public health agencies should clearly communicate with laboratories regarding reporting requirements for *C. auris*. This communication should include:

- Their agency's surveillance definition for *C. auris*. Note that this may differ from clinical definitions. See the updated 2022 CSTE position statement definition (PDF) (cdn.ymaws.com/www.cste.org/resource/resmgr/ps/ps2022/22-ID-05_C_auris.pdf).
- When to report *C. auris*
- How to report: see HL7 guidance below
- Whom to contact at the STLT public health agency for questions regarding testing methods and reporting

For examples of written guidance for laboratories, see **Appendix B.**

State health agencies should also be aware of laboratory practices that may impact the quality of ELR messages for *C. auris*. These may include:

- *Differences among laboratories in how C. auris ELR messages are triggered*. If the laboratory is able to automate *C. auris* ELR messaging, this will require less work for the laboratory and reduce opportunities for missed reports. However, some laboratories will need to trigger ELR manually, depending on a jurisdiction's definition of *C. auris* and its complexity.
- *If reporting AFST results, laboratory compliance with current CLSI guidelines for MIC values.* The use of outdated MIC breakpoints can affect the interpretation of test results, especially for qualitative results.
- *Suppression of certain resistance test results according to CLSI guidelines and/or clinical formularies*. This may result in missing test results for some antimicrobials of interest to public health or inability to identify cases and report them to public health.

6.1. Best practices for surveillance of antimicrobial resistance via ELR

- Links to HL7 implementation guides and updates
    - HL7 2.5.1 is the ideal message structure for sending antimicrobial resistance messages, as it allows for the capturing of parent-child relationships in a more complete fashion than using HL7 2.3.1. Culture and susceptibility reporting is outlined in Appendix A of the HL7 Version 2.5.1 ELR Implementation Guide.
        - HL7 Version 2.5.1 Implementation Guide Electronic Laboratory Reporting to Public Health, Release 1 (US Realm) (www.hl7.org/implement/standards/product_brief.cfm?product_id=98)
            - The section(s) of parent/child, culture and susceptibilities should be noted.
        - HL7 Version 2.5.1 Implementation Guide: Laboratory Results Interface (US Realm) (www.hl7.org/implement/standards/product_brief.cfm?product_id=279)
        - Recently published updates to HL7 standards (standups.hl7.org/)
- 2017 CRE ELR Best Practices document (PDF) (cste.confex.com/cste/2017/webprogram/Handout/Session4615/CRE_ELR_Best_Practices_FINALv1.1_20170601.pdf)
- Contact CDC Electronic Data Exchange at edx@cdc.gov for questions on how to build and implement NNDSS HL7 *C. auris* case notification messages, including AFST results.

6.2. Issues with LOINC and SNOMED codes

- *Generic LOINC codes might be used, making it difficult for systems to classify results correctly*. Culture tests where LOINC codes are used are "generic" and require SNOMED codes in order to properly associate the results to the correct condition. Positive culture results cannot be received by systems if generic LOINC codes are used without SNOMED codes.
    - *Recommendation:* Encourage laboratory use of standard specific LOINC and SNOMED codes that can assist in properly identifying *C. auris*, and work with laboratory and epidemiology staff to ensure that the selected codes are correct.
        - LOINC code look-up (search.loinc.org/)
        - SNOMED code look-up: www.snomedbrowser.com/; https://www.nlm.nih.gov/research/umls/Snomed/snomed_browsers.html
        - HAI MMG codes (ndc.services.cdc.gov/mmgpage/healthcare-associated-infections-multidrug-resistant-organisms-hai-mdro-message-mapping-guide/)
- *LOINC codes that do not specify the method used*
    - *Recommendation:* Encourage laboratories to use method-specific LOINC codes.
- For relevant LOINC and SNOMED codes, see **Appendices C and D**.

7. How to submit case notifications to CDC

7.1. Data elements to include for submission per the message mapping guide (MMG)

Report cases of *C. auris* to CDC via the Nationally Notifiable Diseases Surveillance System (NNDSS) in the same way you would for other NNDSS conditions. *C. auris* cases may be submitted using the Generic v2.0 MMG (ndc.services.cdc.gov/mmgpage/generic-v2-0-message-mapping-guide/) and the HAI MDRO MMG (ndc.services.cdc.gov/mmgpage/healthcare-associated-infections-multidrug-resistant-organisms-hai-mdro-message-mapping-guide/). (Condition-specific MMG processes are currently under review; additional information will be forthcoming – see www.cdc.gov/nndss/case-surveillance-modernization/). Specifics on each data element are available in the MMGs. However, there are some general tips to keep in mind.

There are two *C. auris* event codes.

C. auris has two different event codes. Event code **50263 is for clinical cases** and event code **50264 is for screening cases**.

For each case, report the earliest collected confirmed *C. auris* specimen.

As described in **Section 2**, a patient may have up to two cases per lifetime (one screening and one clinical). For each case type, only submit data pertaining to the earliest date of collection. For example, if a patient has a tracheostomy tube (SNOMED CT code: 448621002) at the time of collection of first positive clinical specimen, include this data element in the notification to CDC per the MMG. If, at a later date, the patient has a positive urine specimen collected from an indwelling catheter, do not submit this information to CDC.

When more than one specimen type is collected on the same day for a given case, submit information for all *C. auris* specimens collected that day. For example, if an axilla swab and a groin swab were collected on the same day and both were positive for *C. auris*, submit data for both swabs.

If a patient has a clinical and screening swab collected the same day, count the patient only as a clinical case. However, submit data on both positive specimens for this case.

The reporting jurisdiction for all NNDSS conditions is based on subject residency jurisdiction

In following the national guidance for all NNDSS conditions, reporting for *C. auris* is based on the subject's (i.e., patient's or resident's) usual state of residence at the time of the condition. However, as *C. auris* is a healthcare-associated infection (HAI) and transmission typically occurs within healthcare settings, the jurisdiction of the healthcare facility is often the most relevant jurisdiction for public health responses and investigations. Communication across states is therefore needed when patients are transferred to another state or when a patient is identified as having *C. auris* in a healthcare facility of a state other than their residency state.[5] A minimum set of data elements for inter-jurisdictional reporting can be helpful, and might include: name, date of birth, specimen source, date of collection, and collection facility and facility type. More detailed epidemiologic information such as patient risk factors and prior healthcare exposure, and the context for how the case-patient was identified can be additionally helpful, though

[5] State HAI Program Contacts (www.cdc.gov/hai/state-based/index.html)

not essential.

As many patients with *C. auris* are residents of long-term care facilities, jurisdictions may find it helpful to become familiar with the Revised Guidelines for Determining Residency for Disease Notification Purposes (PDF) (ndc.services.cdc.gov/wp-content/uploads/2021/02/11-SI-04.pdf) which explains that the jurisdiction of usual residency may be a healthcare setting for people living long-term in an institutionalized setting, such as a nursing home.

Jurisdictions who also submit case data directly to CDC's Mycotic Diseases Branch (MDB) via monthly submissions should be aware that NNDSS's reporting by usual residency jurisdiction is different from the reporting jurisdiction for those monthly MDB submissions (which are based on the jurisdiction of healthcare facility of specimen collection). To ensure these data are comparable, residency jurisdiction is a required field on the MDB monthly submissions and the HAI MDRO MMG includes fields for the county (89202-6) and state (68488-6) of specimen collection.

7.2. Additional data elements for public health investigation

In addition to minimum data elements necessary for case reporting to CDC, STLT public health agencies might want to collect more detailed information relevant to an investigation or response. This might include: previous and subsequent healthcare exposure and potential high-risk healthcare contacts to inform screening recommendations; and risk factors such as presence of indwelling devices, being mechanically ventilated, co-colonization or -infection with a carbapenemase-producing organism, and international or out-of-state healthcare exposure. See **Appendix E** for specific examples of STLT case reporting forms.

8. Additional resources

8.1. Resources for surveillance and response

- CORHA *Candida auris*: Recommendations for Healthcare Outbreak Response (www.corha.org/resources/candida-auris-recommendations-for-healthcare-outbreak-response/)
- CLSI M60 Performance Standards for Antifungal Susceptibility Testing of Yeasts (em100.edaptivedocs.net/dashboard.aspx)

The Los Angeles County Department of Public Health (LACDPH) has several laboratory testing resources:

- LACDPH FAQs to Aid Clinical Laboratorians (PDF) (publichealth.lacounty.gov/acd/docs/C.auris_FAQs.pdf)
- LACDPH Monthly *C. auris* Update for Laboratories:
    - Issue #1, Detection & Reporting of *C. auris* (PDF) (publichealth.lacounty.gov/acd/docs/LACDPH_C.aurisUpdateforLabs.pdf)
    - Issue #2, AFST & MALDI-TOF for *C. auris* (PDF) (publichealth.lacounty.gov/acd/docs/LACDPH_C.aurisUpdateforLabs2.pdf)

  - Issue #3, A Team Approach to Containing *C. auris* (PDF) (publichealth.lacounty.gov/acd/docs/LACDPH_C.aurisUpdateforLabs3.pdf)
  - Issue #4, Passive Surveillance for *C. auris* (PDF) (publichealth.lacounty.gov/acd/docs/LACDPH_C.aurisUpdateforLabs4.pdf)
- LACDPH/California Department of Public Health webinar on *C. auris* testing strategies:
  - Slides (PDF) (www.cdph.ca.gov/Programs/CHCQ/HAI/CDPH%20Document%20Library/CDPH_HAIProgram_LAPH_C-aurisWebinar_051922_ADA.pdf_
  - Webinar recording (opens in YouTube) (youtu.be/B5U7hTbqB0U?t=23to)

8.2. CDC resources

- CDC *C. auris* guidance on identification, antifungal susceptibility testing, treatment, laboratory safety, surveillance, and infection control (www.cdc.gov/fungal/candida-auris/health-professionals.html)
- CDC MDRO Prevention and Response Strategies (www.cdc.gov/hai/mdro-guides/index.html)
- CDC Antimicrobial Resistance Laboratory Network (www.cdc.gov/drugresistance/laboratories.html)

9. Appendices

Appendix A. Examples of STLT reporting language

- California Reportable Diseases and Conditions (www.cdph.ca.gov/Programs/CID/DCDC/Pages/Reportable-Disease-and-Conditions.aspx)
- Minnesota Reporting *Candida auris* (www.health.state.mn.us/diseases/candidiasis/auris/hcp/report.html)
- Tennessee Reportable Diseases: Candida auris (including rule-out Candida auris) (www.tn.gov/content/tn/health/cedep/reportable-diseases/candida-auris-including-rule-out-candida-auris.html)
- Virginia *Candida auris* Reporting Requirements (www.vdh.virginia.gov/haiar/diseases-organisms/candida-auris/)
- Washington *Candida auris* Required Reporting (doh.wa.gov/node/9472)

Minnesota

Reporting *Candida auris*

On August 1, 2019, MDH initiated statewide surveillance of *Candida auris* under 4605.7080 of the Communicable Disease Reporting Rule. *Candida auris* includes specimens isolated from any body site. MDH has been requesting voluntary submission of possible *C. auris* isolates since June 2016.

What to report

- *C. auris* must be reported to MDH within one working day after the test result is finalized.

Case definition

- *Candida auris* Information for Health Professionals
  C. auris surveillance case definition and infection prevention guidance.

How to report

- Yellow Disease Report Card
  Confirmed *Candida auris* cases may be reported using the MDH "Yellow Card."
- Phone
  Any reportable infectious disease may be reported by phone to 651-201-5414 or 877-676-5414.
- Laboratories may report through previously established mechanisms.

Submitting clinical materials

- *Candida auris* Isolate Submission and Laboratory Testing
  Submission of clinical materials to MDH is required.
    - *C. auris* can be misidentified as different types of yeast with the phenotypic methods for yeast identification used by most clinical laboratories. More information is provided on identification and the MDH-PHL capacity to rule out *Candida auris*.

Who is required to report

- Health care practitioners (health care facilities, medical laboratories, and in certain circumstances veterinarians and veterinary medical laboratories) are required to report disease to the Minnesota Department of Health (MDH) under Minnesota state law.
    - Unless previously reported, every licensed health care provider who provides care to any patient who has, is suspected of having, or has died from a reportable disease is required to report.
- Any person in charge of any institution, school, child care facility, or camp is also required to report disease to MDH.

Reporting: proposal and notification letters

- Proposal for Conducting Statewide Surveillance for *Candida auris* (*C. auris*) in Minnesota under the Minnesota Communicable Disease Rule (4605.7080) (PDF)
  The proposal explaining the rationale for this change.
  The Commissioner of Health has the authority to require reporting of newly recognized or emerging diseases and syndromes suspected to be of infectious origin per Minn. Rules 4605.7080.
- Commissioner's Letter to Minnesota Hospital and Reference Laboratories Regarding Reporting of *Candida auris* (PDF)
  08/13/2019
- Commissioner's Letter to Minnesota Hospital Infection Preventionists (IPs) Regarding Reporting of *Candida auris* (PDF)
  08/13/2019

Tennessee

Candida auris (including rule-out *Candida auris*) ☎	*Candida auris*, positive by any method for any specimen including detection from including swabs from skin. Please note: *C. auris* can be misidentified when using traditional biochemical methods for yeast identification such as VITEK 2 YST, API 20C, BD Phoenix yeast identification system, and MicroScan. See https://www.cdc.gov/fungal/candida-auris/recommendations.html for greater detail. If species identity cannot be determined or one of the species shown in the table at above URL is identified, please contact HAI team at (615) 741-7247. Such isolates are considered "rule-out C. auris" isolates. If any *Candida auris* or "rule-out *C. auris*" are detected via PCR, perform a culture to obtain the isolate. Submit isolates immediately to the Tennessee Department of Health Laboratory. Contact hai.health@tn.gov for clarification/questions.	Required	L & P

Virginia

The State Board of Health updated the Virginia Regulations for Disease Reporting and Control (12 VAC 5-90-80) effective November 14, 2018. *C. auris* was added to the reportable disease list and conditions reportable by directors of laboratories. Thus, the responsibility for reporting the presence of these organisms rests with physicians, directors of medical care facilities, and directors of laboratories.

Virginia Reportable Disease List

• Report suspected or confirmed *C. auris*, infection or colonization, to your local health department.
  ○ Submit a laboratory report and/or Epi-1 form.
  ○ Include available antifungal susceptibility testing (AFST) results.

Table 1. Virginia Isolate Submission Requirements for Suspect or Confirmed *C. auris* and *C. haemulonii* by Identification Method

Identification Method, Database/Software (if applicable)	Can Identify *C. auris*	Isolates Required to Send to DCLS^
Bruker Biotyper MALDI-TOF, RUO libraries (Versions 2014 [5627] and more recent)	Yes	*C. auris* *C. haemulonii*
Bruker Biotyper MALDI-TOF, CA System library (Version Claim 4)	Yes	*C. auris* *C. haemulonii*
bioMérieux VITEK MS MALDI-TOF, RUO library (with Saramis Version 4.14 database and Saccharomycetaceae update)	Yes	*C. auris* *C. haemulonii*
bioMérieux VITEK MS MALDI-TOF, IVD library (v3.2)	Yes	*C. auris* *C. haemulonii*
bioMérieux VITEK MS MALDI-TOF, Older IVD libraries	No	*C. haemulonii* *C. lusitaniae*
Vitek 2 YST, Software version 8.01	Yes	*C. auris* *C. duobushaemulonii* *C. haemulonii*
Vitek 2 YST, Older versions	No	*C. duobushaemulonii* *C. haemulonii*
API20C	No	*C. haemulonii* *C. sake* *Rhodotorula glutinis* (characteristic red color not present)

BD Phoenix	No	C. *catenulate* C. haemulonii
MicroScan	No	*C. famata, C. guilliermondii, C. haemulonii, C. lusitaniae, C. parapsilosis*
RapID Yeast Plus	No	*C. haemulonii* *C. parapsilosis*
GenMark ePlex BCID-FP Panel		*C. auris* *C. haemulonii*

^In addition to isolates listed, also send any yeast isolates from any specimen source when unable to identify species after identification is attempted per laboratory policies, regardless of identification method.

Public Health Laboratory Testing and Response

Laboratory Testing Goals

1. Identify *C. auris* isolates.

2. Identify early, high-priority results that would require immediate notification to Centers for Disease Control and Prevention (CDC), and be potentially characterized further at the regional antibiotic resistance laboratory or CDC.

3. Facilitate submission of isolates with high-priority results to the regional antibiotic resistance laboratory or CDC for additional testing.

Testing algorithm conducted at DCLS for *Candida auris*

10. Confirm species identification by MALDI-TOF (Bruker Biotyper)
11. Other public health testing may occur as needed and will be facilitated through the CDC Antimicrobial Resistance Laboratory Network

Isolate Submission and Reporting Results

12. Pure yeast isolates should be submitted on a Sabouraud Dextrose agar slant or other appropriate media suitable for the growth of yeast. Ship isolates at room temperature.
13. Submit a completed DCLS Clinical Microbiology/Virology Request Form and AFST results for each isolate.
14. VDH and the submitter will be contacted when *C. auris* is identified.

Contact the HAI/AR Program for questions or discussion.

Last Reviewed: December 2018. VDH will review this interpretive guidance annually at a minimum, and as needed due to regulation changes.

Washington State

Required Reporting (mandated as of Jan 1, 2022)

1. **Laboratories:** lab report to the local health jurisdiction (LHJ) within 24 hours and isolate submission to PHL required (2 business days). If no isolate is available, laboratories should submit any specimen associated with a positive result.

    - Positive result by any method including, but not limited to, culture, nucleic acid detection (NAT or NAAT), or whole genome sequencing;
    - Isolates should be accompanied by a Public Health Laboratories (PHL) Antibiotic Resistance Lab Network (ARLN) Requisition Form. See ARLN Test Menu and Specimen Collection and Submission Instructions for details on isolate submission.

2. **Healthcare facilities and providers:** notifiable to the local health jurisdiction (LHJ) within 24 hours.

    - Positive result by any method including, but not limited to, culture, nucleic acid detection (NAT or NAAT), or whole genome sequencing;

3. **Local health jurisdictions:** notifiable to Washington State Department of Health (DOH) Office of Communicable Disease Epidemiology (CDE) 3 days of receipt of case or lab report.

    - Positive result by any method including, but not limited to, culture, nucleic acid detection (NAT or NAAT), or whole genome sequencing.

Reporting and submission of certain other *Candida* species is *strongly encouraged* but not mandated by law. Some yeast identification assays, including VITEK 2 YST, API 20C, BD Phoenix yeast identification system, and MicroScan, can misidentify *Candida auris* as other *Candida* species, see the *C. auris* reporting and investigation guideline (PDF) for details.

Appendix B. ELR resources

ELR best practices

- Laboratories that report ambiguous ELR messages or are missing key data elements might not be in compliance with reporting requirements.
- All reports should, to the extent possible, include the following:
    - Type of specimen tested (e.g., blood, sputum)
        - If specimen type is an unspecified swab, please provide anatomical site of swab (e.g., axilla/groin)
- Use the most specific SNOMED (browser.ihtsdotools.org/) and LOINC (//search.loinc.org/) codes for all ELR messages.
    - For LOINC codes, send the Long Common Name to accompany the LOINC code in messaging.
    - If using a LOINC code that is non-specific (e.g., 98394-0, Candida sp in Isolate by MS.MALDI-TOF), indicate the genus and species associated with the result, as well as the specimen source.
    - Use LOINC codes that indicate yeast rather than bacterial identification methods (e.g., 601-5, Fungus identified in Blood by Culture rather than 600-7, Bacteria identified in Blood by Culture).
    - If specimen source and genus and species are indicated in the comments, please ensure that these results are also indicated in an OBX segment using the appropriate LOINC or SNOMED code.

Commonly-observed deficiencies in received HL7 ELR messages

- *No utilization of parent/child linking of susceptibility laboratories to the organism(s), or parent/child relationships are used incorrectly.* Without proper parent/child linkages, determining which susceptibility results go with each identified organism may be difficult without the verification of paper laboratory results.
    - *Recommendation*: Make sure facilities are submitting the correct linking values and jurisdictions have the capability to utilize the parent/child result to link the susceptibility test to the organism.
- *Missing specimen information specimen source site (SPM8), specimen type, etc.* Specimen information is needed to determine the timeframe for defining a case as new or recurrent.
    - *Recommendation:* Specimen information should be sent.
- *Results are sent in NTE segments*
    - *Recommendation:* All results should be sent in an OBX segment; quantitative results should be sent in a numeric or structured numeric segment. Qualitative results should be sent in an OBX segment, perhaps using a CE or CWE data type, using national standard vocabulary such as LOINC and/or SNOMED. NTE segments should not be used to communicate important information.

- *Comments are sent in multiple result (OBX) segments*. This can result in potentially important information not being communicated to downstream systems. If the information does come through, use of multiple OBX segments can make reading results difficult.
    - *Example:* OBX|7 “identification and susceptibility,” OBX|8 “Testing to follow”
    - *Recommendation*: Placing comments in NTE segments rather than OBX segments. When there are multiple OBXs, use the OBX|4 (observation sub-id) to group related OBXs

Appendix C. LOINC and SNOMED Codes for Organism Identification

Organism name	LOINC code	LOINC name	SNOMED code	SNOMED name
Candida auris	555-3	Candida XXX Cult	3491000146109	Candida auris
Candida auris	87620-1	Candida auris, Unspecified Specimen by PCR	260373001	Detected
Candida auris	76346-6	Microorganism identified in Isolate by MS.MALDI-TOF	3491000146109	Candida auris
Candida auris	634-6	Microorganism identified : PrId : Pt : xxx : Nom : Aerobic culture	3491000146109	Candida auris
Candida auris	11475-1	Microorganism identified : PrId : Pt : xxx : Nom : Culture	3491000146109	Candida auris
Candida auris	91090-1	Fungal ITS region [Presence] in Specimen by NAA	3491000146109	Candida auris
Candida auris	90002-7	Candida auris [Presence] in Specimen by Organism specific culture	260373001	Detected
Candida auris	15378-3	Fungus identified in Isolate by Culture	3491000146109	Candida auris
Candida auris	18482-0	Yeast [Presence] in Specimen by Organism specific culture	3491000146109	Candida auris

Appendix D. LOINC codes for antifungal susceptibility testing

LOINC code	LOINC name (long common name)
254-3	5-Fluorocytosine [Agar Diffusion]
7014-4	5-Fluorocytosine [Gradient Strip]
253-5	5-Fluorocytosine [Mic]
18855-7	5-Fluorocytosine [Not Specified]
25-7	Amphotericin B [Agar Diffusion]
6978-1	Amphotericin B [Gradient Strip]
24-0	Amphotericin B [Mic]
18863-1	Amphotericin B [Not Specified]
55343-8	Anidulafungin [Mic]
77162-6	Anidulafungin [Gradient Strip]
57095-2	Anidulafungin [Not Specified]
54176-3	Caspofungin [Mic]
54175-5	Caspofungin [Agar Diffusion]
54185-4	Caspofungin [Gradient Strip]
32378-2	Caspofungin [Not Specified]
25637-0	Econazole [Mic]
25595-0	Econazole [Not Specified]
250-1	Fluconazole [Agar Diffusion]
7013-6	Fluconazole [Gradient Strip]
249-3	Fluconazole [Mic]
18924-1	Fluconazole [Not Specified]
7021-9	Itraconazole [Gradient Strip]
25452-4	Itraconazole [Mic]

32603-3	Itraconazole [Not Specified]
296-4	Ketoconazole [Agar Diffusion]
7025-0	Ketoconazole [Gradient Strip]
295-6	Ketoconazole [Mic]
18937-3	Ketoconazole [Not Specified]
53812-4	Micafungin [Mic]
65340-2	Micafungin [Not Specified]
54186-2	Posaconazole [Gradient Strip]
54187-0	Posaconazole [Mic]
54188-8	Posaconazole [Not Specified]
54189-6	Posaconazole [Agar Diffusion]
35862-2	Voriconazole [Gradient Strip]
35863-0	Voriconazole [Mic]
32379-0	Voriconazole [Not Specified]
41200-7	Voriconazole [Agar Diffusion]
85381-2	Isavuconazole [MIC]
88887-5	Isavuconazole [Not Specified]
54202-7	Griseofulvin [Agar Diffusion]
54201-9	Griseofulvin [MIC]
54200-1	Griseofulvin [Not Specified]
55196-0	Terconazole [Not Specified]

Appendix E. Examples of STLT *C. auris* case reporting forms (links)

Los Angeles County: publichealth.lacounty.gov/acd/Diseases/EpiForms/CaurisRep.pdf

New Jersey: nj.gov/health/cd/documents/topics/hai/CAuris-CaseTrackingForm.pdf

Pennsylvania: www.health.pa.gov/topics/Documents/Programs/HAIP-AS/C.%20auris%20Toolkit%20-%20Public%20Health.pdf (see page 18)

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